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SOP for Sampling of Intertidal Invertebrates and Algae on Sheltered Rocky Shores – Version 4.6

Southwest Alaska Inventory and Monitoring Network

Natural Resource Report NPS/SWAN/NRR—2011/397

ON THE COVER
Rocky intertidal sampling
Photograph: Katmai National Park and Preserve

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Southwest Alaska Inventory and Monitoring Network

Natural Resource Report NPS/SWAN/NRR—2011/397

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Revision History Log

All edits and amendments made to this document since its inception should be recorded in the table below. Users of this protocol should promptly notify the project leader of the marine nearshore monitoring program of recommended edits or changes. The project leader will review and incorporate suggested changes as necessary, record these changes in the revision history log, and modify the date and version number on the title page of this document to reflect these changes.

Revision History Log:

Previous Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
Version 1	2/7/07	Dean	Change sampling - Size of transect reduced to 50 m for percent cover of sessile inverts/algae - added flow chart	.	2
Version 2	5/1/08	Dean	Change sampling schedule for photo quads. - reduce number of points used in percent cover estimates from 49 to 25, eliminate counts of small inverts	.	3
Version 3	03/08/2011	Dean	Add rev table and header/footer; Update addresses	.	4
Version 4	2/15/10	Dean	Removed provision for quadrat photos	.	4.4
Version 4.4	6/6/10	Dean	Minor edits to text, update limpet sampling and site photo procedures	.	4.5
Version 4.5	1/6/11	Dean	Made edits to text in response to reviews from Saupe and Lindeberg	.	4.6
Add rows as needed for each change or set of changes associated with each version.					

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1 Background and Objectives

1.1 Introduction

Intertidal invertebrates and algal communities provide an important source of primary production and are an important conduit of energy, nutrients, and pollutants between terrestrial and marine environments. Intertidal plants and animals are harvested and provide resources for subsistence, sport, and commercial harvests. The intertidal zone is also important as a site of recreational activities such as camping, fishing, and hiking. In addition, the intertidal zone is an important interface that is dependent on environmental conditions in both the nearshore marine and the terrestrial environment. The intertidal is particularly susceptible to human disturbance including oil spills; trampling by recreational visitors; harvesting activities; pollutants from terrestrial, airborne and marine sources; and shoreline development. Changes in the structure of the intertidal community serve as valuable indicators of disturbance, both natural (e.g. Dayton 1971, Sousa 1979) and human induced (e.g. Barry et al. 1995, Keough and Quinn 1998, Jamieson et al. 1998, Shiel and Taylor 1999, Sagarin et al. 1999, Peterson 2001, Peterson et al. 2003).

The intertidal community on sheltered rocky shorelines throughout the Gulf of Alaska is generally divided into three or four relatively distinct vertical zones characterized by different plant and invertebrate assemblages (Nybakken 1969, Feder and Keiser 1980, O'Clair and Zimmerman 1986, Highsmith et al. 1994, 1996). The vertical extent, position with respect to tidal elevation, and species composition of each zone varies with physical characteristics of the site (e.g. substrate composition, slope, tidal range, and relative exposure) but can generally be characterized as follows.

The upper zone is dominated by barnacles and generally occurs over a tidal range extending from about the mean tide level to mean high water (approximately from plus 1.5 to plus 2.5 m, relative to MLLW). It is usually bounded at the upper elevation by a thin crust of the black lichen *Verrucaria* spp. This zone generally has lower cover and number of species than the lower zones. Dominant organisms include barnacles (*Chtamalus dalli, Semibalanus balanoides*, and *Balanus glandula*), littorine snails (*Littorina scutulata* and *Littorina sitkana*), limpets (*Lottia pelta* and *Lottia persona*), and mussels (*Mytilus trossulus*). The next lower zone is dominated by *Fucus distichus subsp. evanescens* and generally extends from the mean tide level to just above mean lower-low- water (approximately plus 1.5 to plus 0.2 m, MLLW). The zone is dominated by various algae (brown algae, *Fucus distichus subsp. evanescens* and *Pylaiella littoralis*; green algae, *Ulva* and *Cladophora* spp.; red algae *Palmaria* and *Neorhodomela* spp.) as well as many of the same invertebrates as observed as dominant in the barnacle zone (e.g. barnacles, mussels, littorine snails, and limpets). On slightly more exposed sites, a narrow red algal zone is often seen just below the *Fucus* zone. This zone is dominated by various types of red algae, although it may not occur at more sheltered sites where there is little wave action. The lower intertidal zone (generally below plus 0.2m MLLW) is often dominated by kelps (e.g. *Alaria marginata*). The above are given as broad generalities as there is a high degree of variation among sites. For example, at many less exposed sites in Prince William Sound, *Fucus* distributions peak in the range of 1 to 2 m above MLLW (Feder and Keiser 1980, Highsmith et al. 1996).

Our sampling will focus primarily on the upper and mid intertidal zones. We have chosen not to sample the lower intertidal because of the limited time afforded for sampling, even during spring tides.

The purpose of this task is to assess change in intertidal invertebrate and algal communities in sheltered rocky habitats. Specifically, the objectives are to assess changes in: 1) the relative abundance of algae and invertebrates in the intertidal zone, 2) the diversity of algae and invertebrates, 3) the size distribution of limpets (*Lottia persona*, 4) the concentration of contaminants in mussel tissue, 5) changes in temperature (either sea or air depending on tidal stage), and 6) changes in salinity. We will sample sizes of limpets because these are potentially sensitive indicators of change and because limpets are important prey species for other nearshore species of interest, especially for black oystercatchers and sea ducks. Sampling of contaminants focuses on mussel tissue because mussels are important prey, they integrate contaminants that tend to be more variable in both water and sediments than in tissue, and because mussel tissue is widely used to characterize contaminants in marine environments. Additional sampling of density and size of mussels is described elsewhere (Bodkin et al. 2010). Sampling will be conducted in sheltered rocky habitats within the Katmai (KATM) and Kenai Fjords (KEFJ) National Parks (Figure 1).

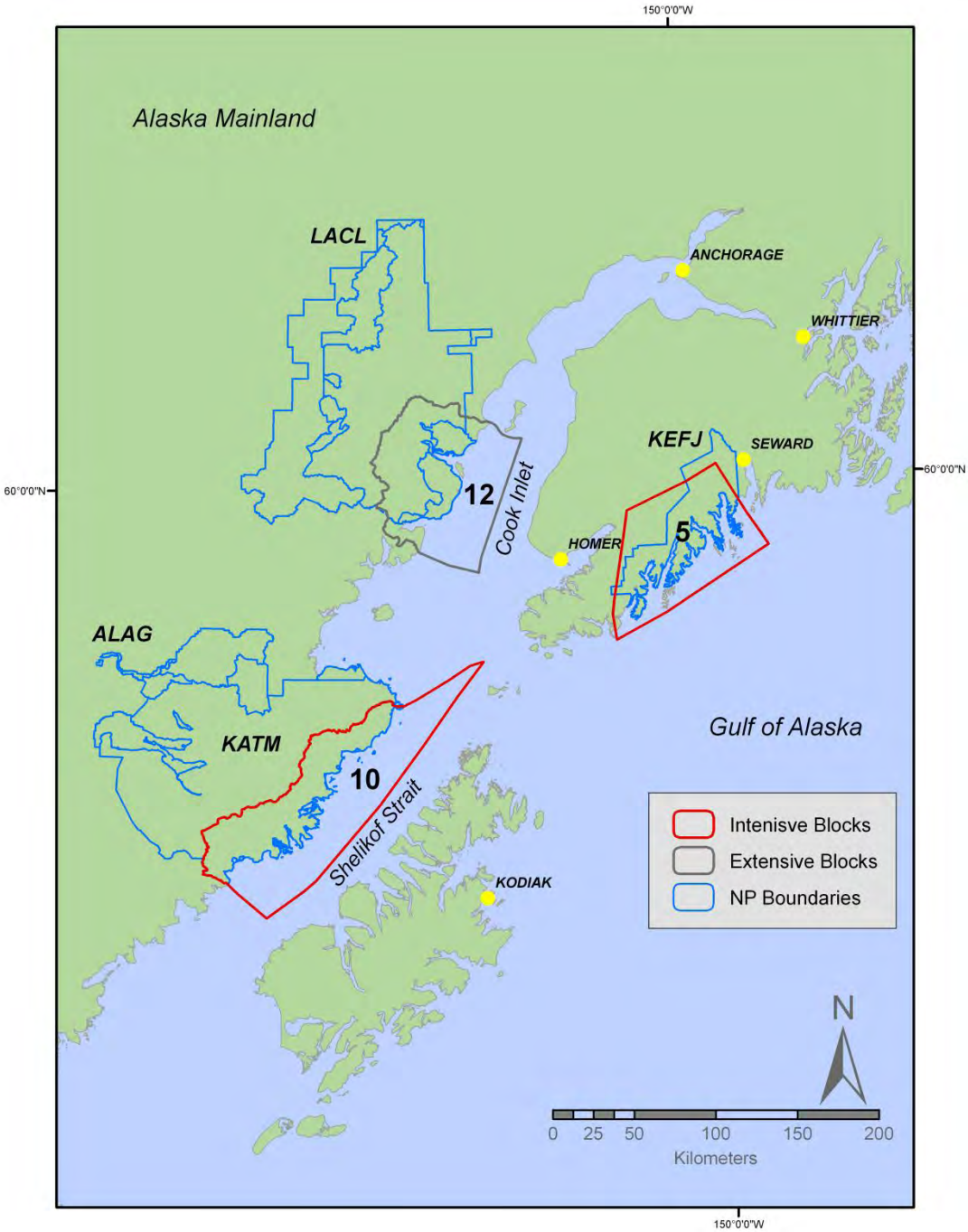

Figure 1.
Areas for sampling within the KATM (Block 10) and KEFJ (Block 5).

2 Sampling design

2.1 Rationale and overview

Intertidal communities were selected as a vital sign because they are sensitive indicators of change in the nearshore ecosystem, provide an important source of primary production, and provide an important prey base for other nearshore species. We specifically elected to sample the sheltered rocky intertidal habitat because it makes up a relatively high proportion of the available rocky habitat in the region, is tractable to sample, and has a wealth of historical data relative to other habitats. Sampling will focus on estimating percent cover of algae and sessile invertebrates; the density of black katy chitons (*Katharina tunicata*), dogwinkles (*Nucella* spp.), the density of sea stars; the sizes of mask limpets (*Lottia persona*). We focus on these because they are important representatives of the nearshore food web. We elected not to sample smaller motile species (e.g. littorine snails) because preliminary sampling suggested that we would be unable to detect reasonable levels of change for these species without an unrealistic increase in sampling effort. Additional rationale for sampling in the sheltered rocky intertidal habitats and the selection of specific metrics of interest are given in the Protocol Narrative (Dean and Bodkin 2011).

Sampling for the various parameters will be conducted at intervals ranging from once every year to once every ten years. A stratified random sampling design will be employed, with sampling locations stratified by geographic location, geomorphologic shoreline type, and tidal elevation. A summary of the design and the rationale for it are given in the Protocol Narrative (Dean and Bodkin 2011). Surveys will be conducted at KATM and KEFJ. A total of 10 intensive sites are to be sampled, 5 in KATM and 5 in KEFJ. These sites were selected using a generalized random tessellation stratified (GRTS) sampling scheme (see Protocol Narrative section 2.6 for details). This provided a list of spatially balanced - randomly selected sites for sampling. The stratified random design is supplemented by additional sampling at one selected site in KATM as time permits. This site was placed on Ninagiak Island, a location of particular biological interest (e.g. nesting areas for birds and haul-out sites for sea otters) or perceived as at high risk to human induced impacts such as eco-tourism. Additional sites were selected using the GRTS protocol such that sites could be added to the design in the future if necessary (see Protocol Narrative section 2.7).

2.2 Metrics

At each site we will measure the abundance (either percent cover or number of individuals per unit area) of algae and invertebrates. These data will be used to examine changes in abundance patterns for numerically dominant taxa as well as changes in both algal and invertebrate diversity. Specific metrics to be evaluated include (but are not necessarily limited to) percent cover of bare substrate, barnacles (*Balanus* spp., *Semibalanaus* spp., and *Chthamalus dalii*), mussels (*Mytilus trossulus*), rockweed (*Fucus distichus subsp. evanescens*), ribbon kelp (*Alaria marginata*), and red algae (*Neorhodomela and Odonthalia* spp.); and density of slender arm sea stars (*Evasterias troschelii*), ochre sea stars (*Pisaster ochraceus*), black katy chitons (*Katharina tunicata*), and dogwinkles (*Nucella* spp.). In addition, we will measure the size distribution of limpets (*Lottia persona*) at each site. Mussels will also be collected from each site to obtain concentrations of contaminants (metals, hydrocarbons, and persistent organic pollutants) in mussel tissue. A complete listing of contaminants to be measured is given in Appendix A.

Mussels used for contaminant analysis will be collected and analyzed using methods of the NOAA National Status and Trends Program (O'Connor 2001) and will become part of the national database. Ancillary physical data from each site will include estimates of slope and substrate size distribution. Temperature (either air or water as determined by tidal stage) will be measured at each site and salinity will be measured at selected sites.

2.3 Sampling at each site

2.3.1 Sizes and number of sampling units per site

The abundance of algae and invertebrates will be measured in quadrats or belt transects at each site. The sizes of the sampling units employed vary depending on the size and anticipated density of organisms. Percent cover of algae and sessile invertebrates will be determined in 0.25 sq.m quadrats. Densities of intermediate size motile invertebrates (*Nucella* spp. and *Katharina tunicata*) will be measured in 2 sq. m. quadrats and densities of sea stars will be measured in belt transects of 200 sq. m. Sizes of sampling quadrats or transects were originally selected so that dominant species would be expected to be present in more than two-thirds of the samples and that the average abundance for motile species would be greater than 5 individuals per sampling unit based on historical data from the Gulf of Alaska (GOA) (Nybakken 1969, Feder and Keiser 1980, Highsmith et al. 1996). Preliminary analysis of data from KATM and KEFJ suggested that sizes of the sampling units generally provided data that fit these criteria (Coletti et al. 2009).

A total of twelve quadrats will be sampled for invertebrate and algae abundances and diversity at each of two tidal elevations. The determination of the number of quadrats to be sampled per site was guided by power analyses and on logistical considerations (the estimated time required to sample at given site within one low-tide window). Simulations using data from prior intertidal sampling in Prince William Sound (Highsmith et al. 1994) indicated that sampling within 12 quadrats per site should provide sufficient power (80% or greater) to detect 50% changes in abundance between intensive blocks (with 5 sites sampled per block) for several of the dominant taxa (L. McDonald and T. Dean, unpublished data). The simulations also suggested that increasing the number of quadrats sampled beyond 12 per site would not appreciably increase power relative to the increase in effort required. A sample size of six quadrats per site was found to have reasonable power (generally greater than 80% to detect 50% changes with a sample size of 5 or more sites) to detect differences in the abundance of numerically dominant species between oiled and unoiled sites following the Exxon Valdez oil spill (Peterson et al. 2001).

A single 4-m x 50-m transect will be sampled at each site to estimate the abundance of sea stars.

A total of 120 limpets will be sampled from each site for estimation of size distribution. Duplicate samples of 60 large mussels each will be collected to provide tissue for determination of contaminants (either metals or organics).

2.3.2 Vertical stratification

Sampling of algae, sessile invertebrates, and intermediate size motile invertebrates will be sampled in each of two vertical strata at each site: 0.5 m and 1.5 m above MLLW. These elevations were selected to represent mid and upper intertidal zones represented by different assemblages of organisms. The vertical distribution of species varies greatly from site to site depending on slope, exposure, and substrate type. However, sampling at these tidal elevations

should capture peaks in relative abundance of several key taxa (e.g. *Fucus* and mussels,) that generally have maximal abundances at tidal elevations ranging from 0.5 to 1.5 m above MLLW (Nybakken 1969, Feder and Keiser 1980, Highsmith et al. 1996).

Sampling of larger, more motile invertebrates will be conducted at a single tidal elevation. Four meter wide sampling transects will be used that stretch parallel to shore and have their lower boundary at MLLW. Many larger, more abundant sea stars (especially *Pycnopodia helianthoides*) are highly motile and tend to congregate near the low tide level as the water recedes during an ebbing tide. Thus, sampling at MLLW should provide near maximal estimates of abundance of larger invertebrates at a site and provide a reasonable index of relative density.

Limpets and mussels used for determination of size distributions and concentrations of contaminants in tissue respectively are to be sampled at a single tidal elevation at each site. In each case, these will be from a tidal elevation where densities of limpets or mussels are highest. At some sheltered rocky sampling sites there may not be sufficient numbers of larger mussels needed for contaminants analysis. In these instances, mussels should be collected from nearby sites where larger mussels are available.

Temperature will be measured at 0.5 m MLLW, approximately 1.0 m below the mean tide level at each site. This should provide a range of air/water temperatures indicative of the intertidal region at the site. Salinity will be measured at 0 m MLLW.

2.4 Sampling frequency and replication

2.4.1 Number and location of sampling sites

A total of ten to eleven sites will be sampled. These include 5 randomly selected sites at both KATM and KEFJ (Figure 1). (Geographic coordinates for these sites are given in Appendix B). These sites were selected using a GRTS sampling method that provided an ordered list of spatially balanced, randomly selected sites within sheltered rocky habitat. The habitat designations were as described in an Environmental Sensitivity Index (ESI) database (RPI 1983a, 1983b, 1985, 1986). The shoreline classification system in the ESI database has known errors (Sundberg et al. 1996) and in some instances, the sites originally selected were not appropriate for sampling. If these cases, inappropriate sites were replaced by a nearby sites (within the same bay) that is next site on the list provided by the GRTS sampling (see Protocol Narrative section 2.7 for details).

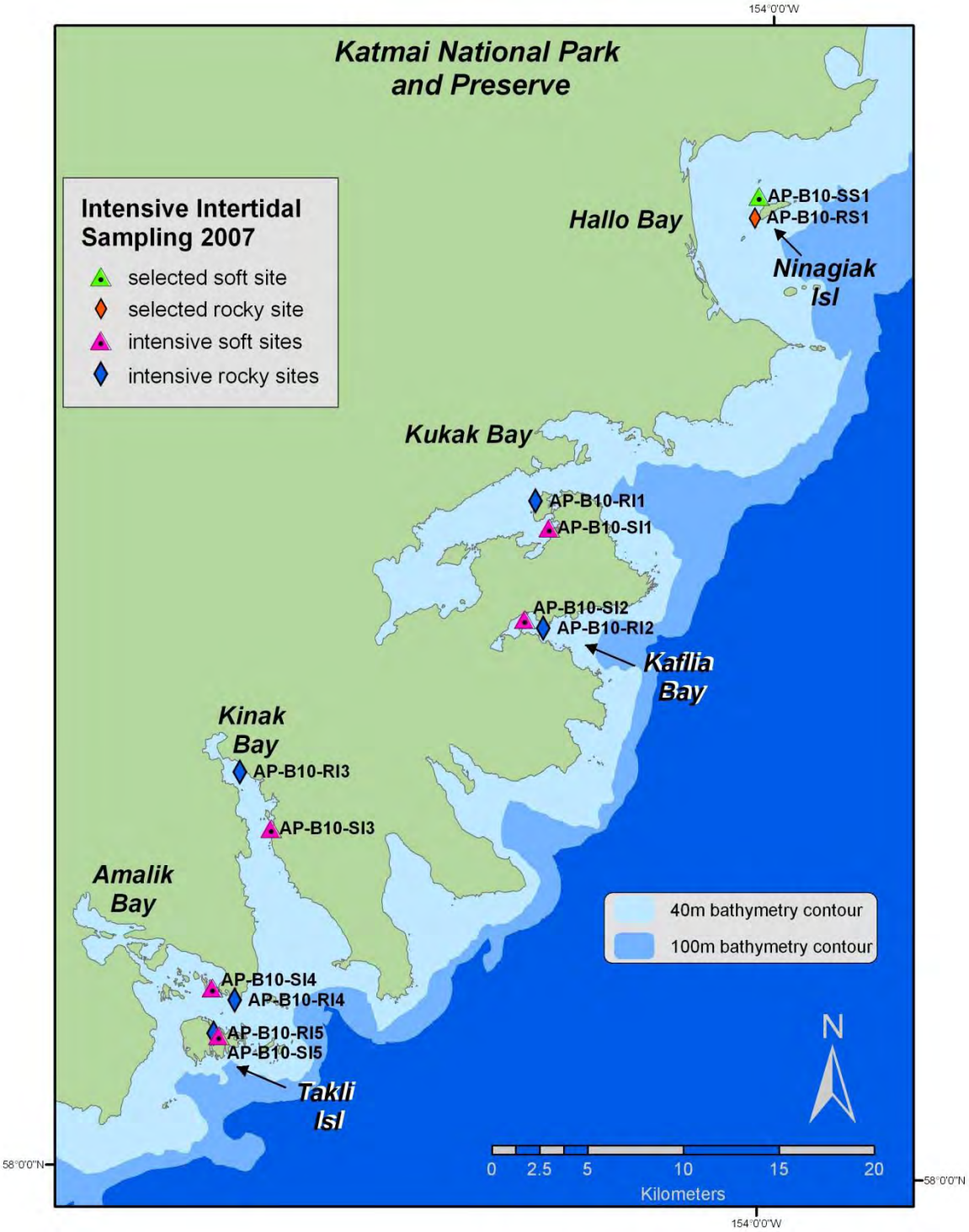

Figure 2. Locations of intertidal sampling sites in KATM.

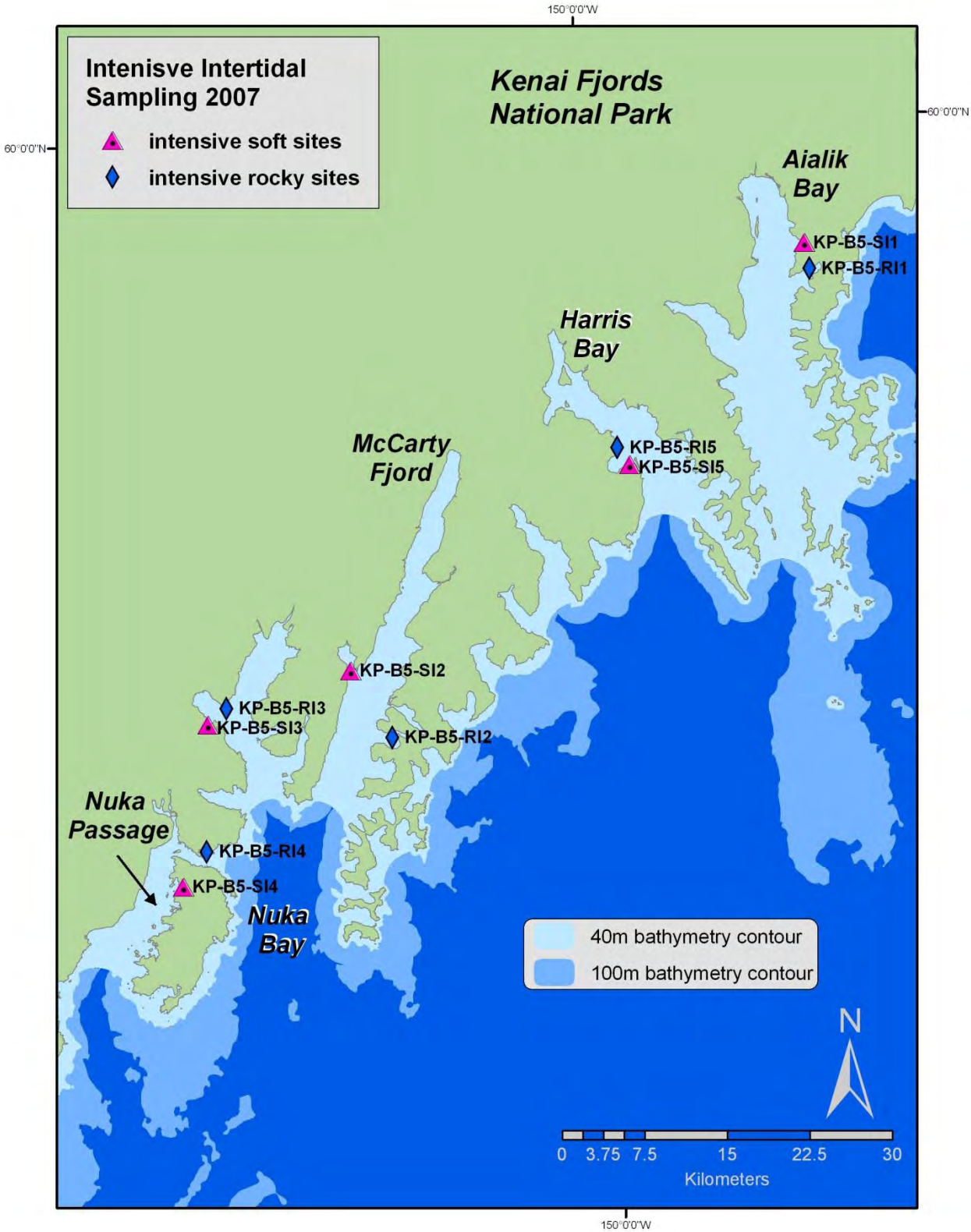

Figure 3. Locations of intertidal sampling sites in KEFJ.

Algal and invertebrate abundance, limpet size distribution, contaminant concentrations in mussel tissue, temperature will be measured at each site. Salinity will be measured at a minimum of two sites within each park.

2.4.2 Frequency and times of sampling

In the initial years of sampling, visits will be made annually to each site. It is anticipated that this frequency may be reduced to bi-annual after the first 5 years of sampling. During each year we will estimate the abundance of dominant algal and sessile invertebrates, species composition of algae and invertebrates, densities of *Nucella* spp., *Katharina tunicata*, and sea stars, and size distributions of *Lottia persona* (Table 1). Temperature and salinity will be measured year round and recorded at a frequency of once every 20 minutes to once per hour. The recording of temperature and salinity at these frequencies will allow us to monitor intra-day fluctuations as well as longer term trends. Other metrics are to be measured either annually or every five to ten years according to the schedule outlined in Table 1. Less frequent measures of contaminant concentrations are required because it is anticipated that the inter-annual variation in these metrics will be relatively small. Slope will be determined for each site during the initial site visit and ten year intervals thereafter. Slope is also to be measured during intervening visits if changes in slope (due to earthquakes or slides) are observed.

Table 1. Sampling frequency for various metrics.

Metric	Sampling frequency
Algal/Invertebrate abundance and species composition	Annual
Limpet size distribution	Annual
Contaminants in mussels	Every 5 years
Temperature and salinity	Continuous
Slope	Every 10 years

Sampling is to be conducted during spring tide series from May through July. Tidal series should be selected such that there are at least 7 consecutive days of minus tides occurring during daylight hours.

2.4.3 Levels of change to be detected

It is the goal of the sampling to detect a 50% increase or a doubling of abundance of most abundant intertidal taxa within a five year period. Trends over time at each site as well as time by location interactions will be examined (see Protocol Narrative section 4.2). At present, there is insufficient information on the extent of variation between sites and times to conduct appropriate power analyses. However, power analyses conducted using data gathered using a similar (and probably less powerful) design following the Exxon Valdez oil spill (Highsmith et al. 1996) found that, for the most abundant taxa (e.g. *Fucus* and mussels) differences on the order

of 50% could be detected between 5 pairs of oiled and unoiled sites (in a given year) with greater than 50% power. As with other metrics, it is recommended that power analyses be conducted after the initial five years of sampling and sampling effort be adjusted accordingly to maximize power and sampling efficiency.

Detectable changes with respect to contaminant concentrations are to be viewed somewhat differently. During initial sampling (Coletti 2009) contaminant concentrations at KATM and KEFJ were generally low. Therefore the focus will be on examining long-term temporal trends toward increasing contaminant concentrations, and on identifying ―outlier" sites where contaminant levels are above those considered threatening to wildlife.

3 Field Methods

3.1 Overview and general methods

Sampling sites are defined as 50-m stretches of coastline with contiguous sheltered rocky habitat. The approximate location of each site is pre-determined using the protocol described in Protocol Narrative section 2.6. However, there are known inaccuracies in the ESI shoreline classification data (Sundberg et al. 1996) due largely to the coarse scale at which the classifications were made. Therefore, on the initial visit to each pre-selected location, the sites will be evaluated and new sites substituted if the habitat classification proves to be incorrect. Sampling of invertebrates and algae is to be conducted within transects or quadrats placed within the appropriate vertical zone within each site. The horizontal positions of transects or quadrats will be selected systematically with a random start point. The systematic placement of subsampling units will ensure relative equal distribution of sampling effort within the site. The location of the site and the vertical elevations chosen for sampling will be fixed after the initial survey, but new subsampling locations (based on a randomly selected start point chosen before each survey) will be used for each survey. Random, rather than fixed, subsampling units are to be used because of the difficulty in ensuring that fixed sites could be relocated over extended periods of time, and because of the statistical design problems created if the location of a given fixed subsampling unit changes with time.

The bulk of the sampling is to be conducted within the mid and upper intertidal zones at 0.5 and 1.5 m above MLLW.

Abundance estimates will be made based on counts of the number of individuals (for motile species) or percent cover (for algae and sessile invertebrates). Special sampling techniques are described for measurement of limpet size distribution and collection of mussels for the determination of contaminant concentration in tissue.

Identifications will be made to the species level, or in the case of some algae and sessile invertebrates, species will be lumped into higher taxonomic groupings because of difficulties in making positive species identifications in the field. For example, species of barnacles are difficult to distinguish in the field, especially newly settled juveniles. As a result all barnacle species are grouped together as barnacles. In all cases in which we have lumped species, the higher groups include species that occupy similar ecological niches. A list of sessile invertebrate and algal taxa found and higher order groups of taxa is given in Appendix C. Species identifications are to be made based on available field guides (O‘Clair and O‘Clair 1998, O‘Clair and Lindstrom 2000, Lindeberg and Lindstrom 2010).

Surveys will conducted by crews of two to three people and are designed such that a single site can be set up within a tidal cycle, and after initial setup, sampled in a single tidal cycle. A schematic of sampling procedures at each site is given in figure 3 and described in detail below.

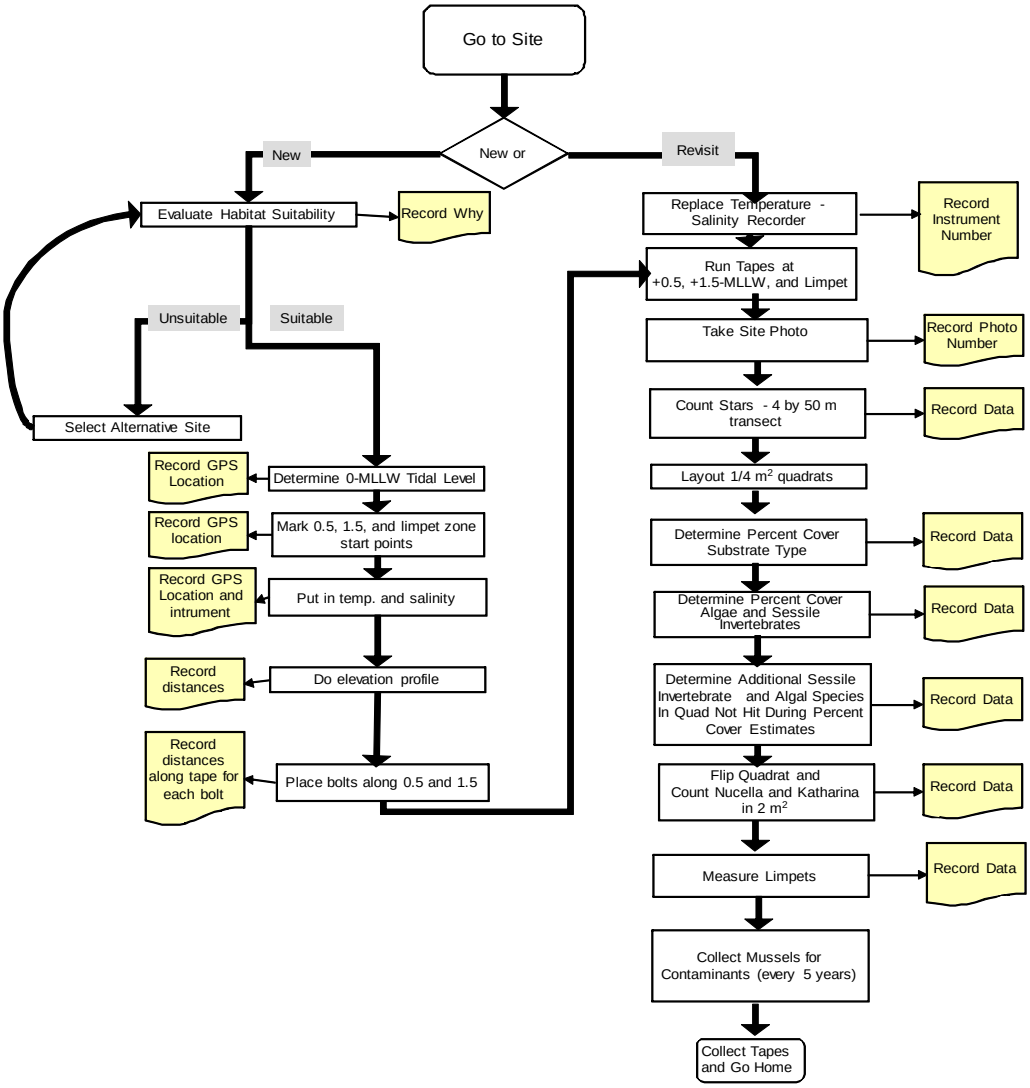

Figure 4. Flow chart describing procedures to be conducted at sheltered-rocky intertidal sampling sites.

3.2 Initial site layout

The geographic coordinates for the approximate position of the site to be sampled will be determined using existing maps and habitat descriptions. On the initial visit to the site, a sampling team will go to these coordinates and evaluate the site to determine if the habitat is as described. If necessary, an alternative site will be selected. This is to be the next site within the ordered list of GRTS sites within close proximity to the rejected sites. Once a suitable site is found, the sampling team will go to shore at this site and locate the start of the sampling area. This is approximately 25 m to the left (while facing shore) of the given coordinates provided using the GRTS procedure. Determine the tidal elevation corresponding to MLLW by consulting a tide table to determine the time of MLLW and marking the waters edge at that time. Then, mark the position of 0.5m and 1.5 m above MLLW, and at one additional elevation corresponding to the zone of highest density for *Lottia persona* (generally at the top of the *Fucus* zone at approximately 2.5 m above MLLW). Elevations above MLLW are to be determined using a stadia rod and a site level as described below. The markers will be metal tags affixed to

the rock using stainless steel screw and anchors. Secure a Hobo temperature logger near the 0.5 m marker and a salinity logger near 0.0 m just below the marker. Secure instruments using stainless steel bolts and cable ties. Also, place steel bars at the high water mark above the transect start points, approximately 10 m to the left and right of a line directly upslope of the transect start points. Positions and distances from these markers to transect start points will be noted. The positions and distances will be used to relocate transect start points in the event that tags are lost. The coordinates of all marker positions are to be noted using a GPS. Record positions of the markers and instrument numbers directly into a filed computer (Appendix D) or onto a data sheet (Appendix E).

A tape is then stretched along the shoreline parallel to the waters edge at each of the 3 transect locations (+0.5m, +1.5m, and limpet zone). The vertical positions of the tape relative to vertical distance above MLLW is to be maintained by using a mason twine with a line level stretched from the marker at the start of the transect and between strategic points along the tape. The tape and mason twine should approximately follow the contour along the site. Place stainless steel bolts at points along the tape (at approximately 6.25-m intervals) that will allow the tape to be placed at the same elevation during future sampling events. Make sure that the bolts are not limited to only projections on the beach. It is important that bolts be placed where the beach contours in, as well. Otherwise, when the tape is stretched tight along the bolts, it will make it difficult to lay quadrats in beach pockets. Place bolts in large, presumably immovable boulders. Use a hammer drill to drill holes in the rock, place a stainless steel drop anchors into the hole, and screw the stainless steel bolts into the anchors. Note the position of the bolts along the tape and make a rough sketch of the site and tape layout.

3.3 Details of data collection

3.3.1 Measurement of slope

The team will determine the slope profile at the site as follows: At the start and at 12.5-m intervals along a tape stretched parallel to shore at the 0.5 m tidal level, stretch another tape perpendicular to shore running from 0 m MLLW to the high tide line. The high tide line is to be determined visually based on either the presence of wrack or the lower limit of the *Verucaria* zone. MLLW is to be determined as the water level at the time of MLLW as estimated from tide charts. Place a stadia rod (a 2-m long, 3/4 inch PVC pipe marked off in 0.5-m increments) at MLLW. Place a site level or laser level at the 1-m mark of the rod and locate the positions of the 1-m vertical elevation along the tape (the one running perpendicular to shore). Note the distance between the low tide mark and this position and record. Move up the tape and repeat this up to the high tide mark noting the distance corresponding to each 1-m vertical rise. Repeat this process at 12.5 - m intervals along the shoreline. This will produce five vertical profiles of the beach at the sampling site. Record slope measurements directly into a field computer (Appendix D) or onto a data sheet (Appendix E).

3.3.2 Temperature and salinity measurement

Temperature will be measured using a Hobo Pro v2 ® (or equivalent) temperature logger (Onset, Cape Cod, MA) and salinity will be measured using a Star Oddi DST-CT ® salinity logger (Star-Oddi, Reykjavik
Iceland). Specifics on the use of these instruments are given in separate operational manuals provided by the manufacturers.

3.3.3 Transect and quadrat counts

On each visit to the site, teams will locate the makers at 0.5 and 1.5 m above MLLW on the left hand boundary (as determined while facing the shore from the water) and stretch 50- m tapes from these locations running parallel to shore as described in 3.2 above. At time of the zero tide level, count the number of sea stars within a 4 m- wide band along the entire length of the 50-m long transect. The band should extend 4 m upslope from MLLW. Use the 2- m stadia rod to determine the transect width. Count individuals that are visible after moving overlying algae but do not move substrates.

Once the tapes have been stretched along the permanent transects, quadrats will be sampled at random start points along the tape during each visit. Note that the quadrats are not permanently marked and will be randomly placed along the tape during each visit. Quarter sq. m. sampling quadrats are placed at a random start points between 0- and 4.12-m along the 50-m tapes and at 4.09-m intervals thereafter. This will result in 12 evenly spaced quadrats being placed along the tape. Quadrat frames should be positioned such that the lower left corner of the frame (as determined while facing the shoreline) is placed at the desired start point on the tape.

Working in teams of two, samplers will then begin sampling within quadrats. One person will determine percent cover and count while the other person is to record data. First, note the substrate type within the quadrat. Classify substrate type according to the wentworth scale (Table 3). Visually estimate and record the percent cover of each substrate type within each quadrat. Next, estimate the percent cover of algae, sessile invertebrates, and bare substrate within each quadrat. Use a frame with monofilament line stretched across the frame starting at 5 cm from the perimeter and at 10 cm intervals thereafter. This creates a frame with 25 crosshair points. Determine the percent cover of each species within the frame by noting the species under each crosshair. Start with the crosshair in the upper left of the quadrat. Using a knitting needle, gently move the top layer and record the next species observed. Repeat this process until rock substrate is reached. Repeat this process for each crosshair. It is very important that a ―hit" is only recorded if it falls exactly under the cross-hairs. The tendency is to record a hit if the algae or invertebrate lands near the cross-hairs. This will over-estimate the percent cover of that taxonomic group. Enter percent cover data onto a data sheet or directly into a toughbook computer that is loaded with data entry software. Instructions on data entry using this software are given in C.

In some cases, it will be impossible to identify individuals to the species level. In these cases, taxa names are to be recorded to the lowest possible taxonomic level. After completing point counts, note as present any macroalgal or invertebrate species that were observed in the quadrat but did not fall under a crosshair.

Table 2. Classification of substrate types.

Substrate classification	**Range in diameter of substrate size**
Mud/Sand	<1 mm
Gravel	1 mm to <50 mm
Cobble	50 mm to <300 mm
Boulder	300 mm to <1 m
Rock	1 m diameter or greater

Next observers are to count the number of individuals of *Nucella* spp. *and Katharina tunicata* within a 2 sq. m area. Flip the quadrat to the right and count the number in a one sq. m area (four quadrats) above the tape and one sq. m (four quadrats) below the tape.

In some cases, individual plants or animals will recognized as discrete species, but will be impossible to identify on site. In these instances, assign a descriptive name to the organism (e.g. small white snail A, or small red algal blade A), record the cover estimates under this name, and collect a small number of specimens for later identification. Change the name on the data sheets and in databases if and when a positive identification is made.

3.3.4 Sampling limpets for size distribution and density

On each visit to the site, teams will locate the marker corresponding to elevations of maximum *Lottia persona* density and stretch a 50- m tape from this locations running parallel to shore as described in 3.2 above. Sampling will be conducted within six circular sampling areas centered at a random start point 0- and 4.12-m along the 50-m tapes at 8.18-m intervals thereafter. This will result in six evenly spaced areas being placed along the tape. The size of the sampling area will be adjusted to obtain a sample size of 20 limpets at each point along the tape. The first 20 individual limpets encountered at each sampling location will be measured in place using calipers and the radius of the sampling area noted. Record limpet sizes and sampling radius directly into a field computer (D) or onto a data sheet (Appendix E).

3.3.5 Site photos

Next, a digital photograph should be taken at the site. This is to be taken from a location that allows for a photo to include the zone between 0.5 and 3 m MLLW, has some identifiable feature(s) within (a large boulder) that will allow replication of the photo over time, and from an angle that eliminates shadows and has the sun from behind. The coordinates for the location from which the photo is taken is to be noted and marked with a stainless steel bolt.

3.3.6 Collection of mussels for contaminants

Every 5 years, collect mussels for contaminant analysis from an area approximately 1.25 m above the 1.5 m tape running parallel to the shoreline. Collect duplicate pooled samples of 60 mussels from each site by collecting 10 mussels from a location just to the right of the location where mussels were collected for size distribution. All mussels collected should be 25 mm in length or larger. Collections are to be made by hand by collectors wearing contaminant free rubber gloves. Sixty mussels from each location are to be used for hydrocarbon analyses. These are to be placed in hexane rinsed aluminum foil envelopes (double layered, with shinny side out) or pre-cleaned Teflon bags then into labeled Ziploc bags. Sixty other mussels of a similar size are to be used for analysis of metals, and are to be placed into Ziploc bags (double bagged). Methods for collection and handling of these two fractions (organic and metals) are given in Lauenstein and Cantillo 1993a-d, 1998 (http://www.ccma.nos.noaa.gov/publications/tm71v1.pdf). Label the collection bags with the date, site number, collectors name, and replicate number. All mussels collected are to be frozen immediately after collection.

3.4 Equipment list

Site Set up
GPS with provisional site location entered
Tide tables
Site tags with anchor and stainless steel screws
Sledge hammer and rebar
Hammer drill with ¼ inch bit
Drill with Phillips bit
Hobo (in protective PVC tube with anchoring device)
Star Oddi salinity logger (in protective PVC tube with anchoring device)
Cable ties
Stainless anchors and eye bolts
Hammer and anchor setting tool (nail punch)
Ratchet wrench with ¼ inch driver
Phillips screw driver
Four 50-m tapes
Stadia rod
Site level
Mason line
Line levels
Data sheet for site set up
Digital camera

Annual sampling
GPS with site coordinates entered
Hobo (in protective PVC tube with anchoring device)
Star Oddi salinity logger (in protective PVC tube with anchoring device)
Stadia rod
Four 50-m tapes
Quadrat frame with grid
Knitting needles
Computer with software for data entry
Data sheet for site information and counts
Calipers
Magnifying loop
Bags for algal collection
Marking pen
Digital camera

3.5 Field season preparation and equipment set

Prior to each field season, the following tasks are to be performed.

- Review the master field schedule and prepare a list of tasks to be performed and set the field schedule

- Review personnel requirements, train personnel as needed, and make personnel assignments
- Arrange for vessel charters
- Prepare an itinerary and emergency contact list
- Arrange for travel of personnel to the departure site
- Prepare smaller boats (inflatable and/or other skiffs) for use
- Review sampling procedures
- Gather equipment and supplies (see above)
- Ensure that electronics have fresh batteries and are in good working

3.6 Post collection processing of data and samples collected

3.6.1 General procedures for post field processing of samples and data

After each field day, the following tasks are to be completed:

- Field personnel are to review data sheets and edit as necessary to improve legibility and resolve any discrepancies.
- Make identifications (if possible) of any taxa for which field identifications were in question and revise taxa names on data sheets accordingly.
- Make sure that samples collected for use in later analyses or species identification are appropriately labeled and stored. All samples for contaminant analyses should be kept frozen.
- Enter data from data sheets into computer files. Verify the data entry.
- Download files from digital cameras, GPS‘s, and temperature recording devices. Store these and provide additional documentation as needed.
-Make a backup copy (cd or other removable media) of all data collected.
- Check and replace batteries in electronic equipment as needed.
- Provide a summary of activities and observations for the day including any problems, suggestions for modifications in procedures, and unusual occurrences or observations.
-Prepare field sheets and equipment for the following day‘s use.

After each field trip or cruise, the following are to be completed:

-Catalogue and prepare to ship samples as required for analyses of contaminants.
-Produce a summary of the cruise based on summaries of daily activities and observations

After each field season, the following are to be done:

- Clean and check all electronic equipment and field gear for needed repair and store appropriately.
- Make repairs or obtain replacements for damaged or lost equipment or supplies.
- Ship samples to appropriate laboratories for analyses of growth of and contaminants in mussels.
- Ship any temperature logging devices recovered to the manufacturer for replacement of batteries.
- Produce a field season summary report based on daily and cruise reports. This should be completed within on week of completion of the seasons.

3.6.2 Laboratory analyses of contaminants in mussels

Mussel tissue is to be analyzed for contaminants including various metals, persistent organic pollutants, and petroleum hydrocarbons as described for the NOAA National Status and Trends Program (O,Connor 2005). Specific methods for conducting these analyses in mussel tissue are given in Lauenstein, G.G., and A.Y. Cantillo (1993a-d, 1998; http://www.ccma.nos.noaa.gov/publications/tm71v1.pdf).

3.7 End of season procedures

At the end of each field season all equipment should be cleaned, serviced, and batteries removed for storage. Optics, and other equipment and field gear should be assessed for repair or replacement needs. Skiff and engines should be winterized and prepared for seasonal storage.

After each field season, the following are to be done:

- Clean and check all mechanical and electronic equipment and field gear for needed repair and store appropriately.
- Make repairs or obtain replacements for damaged or lost equipment or supplies.
- Produce a summary of the survey based on summaries of daily activities and observations. This should be completed within on week of completion of the seasons.

4 Data handling, analyses, and reporting

See Protocol Narrative section 4.0

4.1 Metadata

See Protocol Narrative section 4.0)

4.2 Overview of database design

A schematic indicating databases associated with this task and there linkages are given in Figure 4. This is a preliminary version consisting of an access database with various lookup tables (LU) containing possible entries for each field in the database. All of the data collected are linked to a descriptor of the site and transect or quadrat within that site. The data management system for this project is under development and this SOP is to be updated when the task is completed.

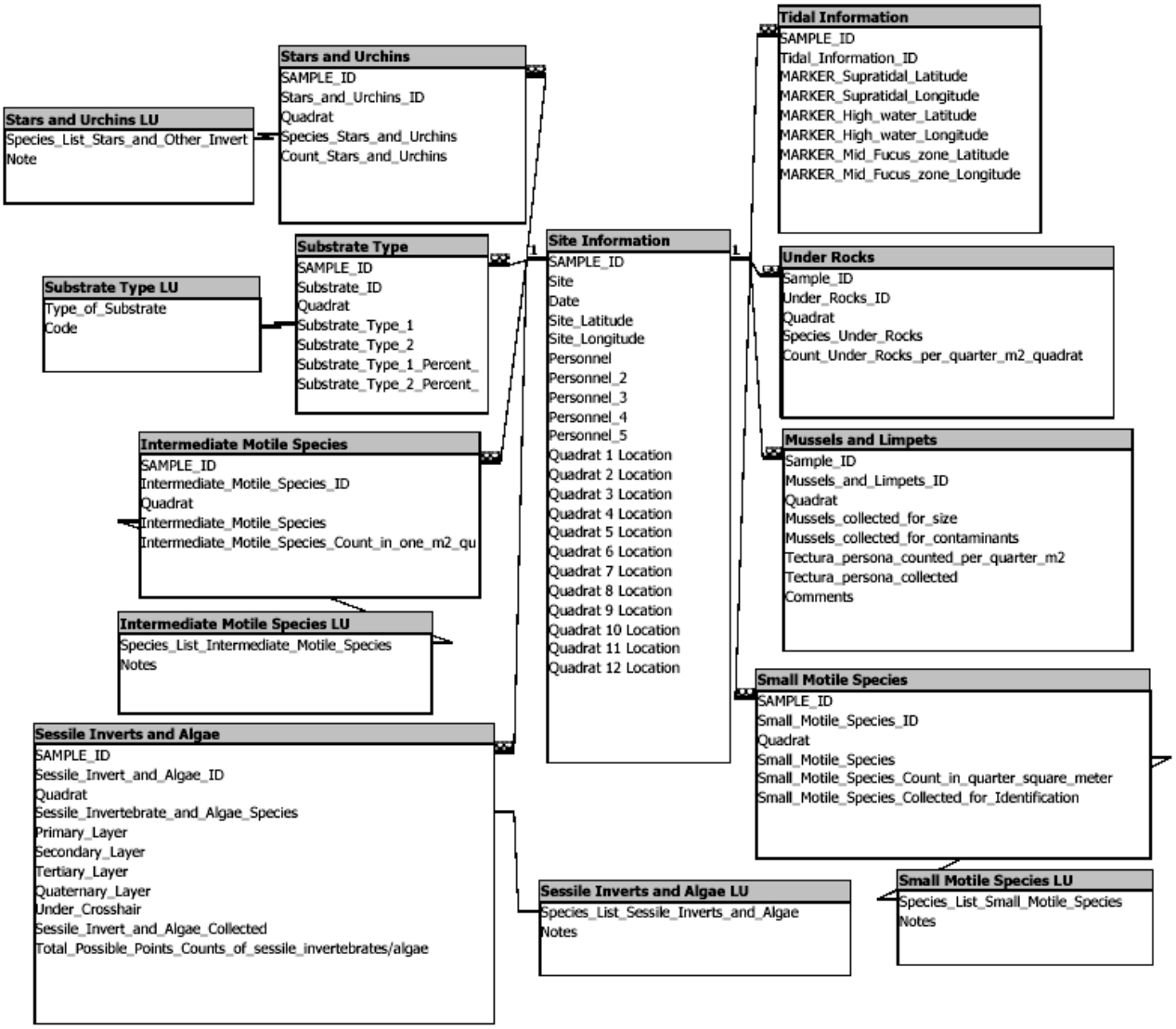

Figure 5. Schematic indicating structure of the database for data collected under the SOP for sampling of intertidal invertebrates and algae on rocky shores.

4.3 Data entry, verification, editing, and archival

A draft manual for entry of data into toughbook computers is given in Appendix C. General procedures for data entry, verification, editing, and archival of the data are to be as described in data management plan.

4.4 Data analysis and reporting

See Protocol Narrative section 4.0 for a general discussion

4.4.1 Routine Data Summaries and Analyses

Analyses to be performed and data summaries to be produced are as follows:

Upon completion of the initial site visit:
-Plot out the beach profile for each site and compute the average slope based on the average of 5 slope estimates made from distances and average elevation gain from MLLW to +3m MLLW.

Annually:
-Provide a master list of all sites visited, dates of sampling, and sampling conducted.
-Produce a list of all samples that were collected for further analyses (i.e. mussels for determination of contaminants, mussels for determination of growth, and limpets for determination of size distribution) and the current status of those samples and analyses.
-Produce derived variables including total number of species and percent cover per subsampling unit (quadrat or transect) and site (a combined list of species from quadrats and transects) for each tidal elevation. Percent cover is to be calculated as [(the sum of all tallies for a given species / 25) x100].
-Provide a list of taxa observed by tidal elevation for sites, blocks, regions, and over all regions and indicate any deletions or additions to the list from the previous year.
-Calculate means and variances for each metric at each tidal elevation at the scales of site, block, region, and over all regions. Metrics to be included are:

- \Percent cover or density for each species and size category
- Limpet size
- Concentrations of each contaminant in mussels

-Provide summaries of temperature and salinity data including yearly and monthly mean, minimum, maximum, and variance for each site. Use these to compute averages for blocks, regions, and over all regions.

4.4.2 Reporting schedule

Summary reports should be produced annually. More comprehensive reports should be produced after the first five years of sampling and every four years thereafter.

4.4.3 Report format

Annual reports should include the summary tables described in 4.4 above. Also, reports should include plots of means of each metric of interest vs. time and vs. location. Plots for percent cover and density of algae and invertebrates should be limited to those species (or higher order taxa) that are relatively abundant as determined after viewing summary tables. A process for determining what additional analyses may be appropriate for inclusion in comprehensive reports

produced every four years and suggested formats for these are presented in the Protocol Narrative

4.4.4 Long-term trend analysis

Procedures for long-term trend analyses are presented in the Protocol Narrative.

5 Personnel requirements and training

5.1 Roles and responsibilities

The roles and responsibilities of personnel are here described as responsibilities regarding the overall project, particular cruises, or particular field sampling teams as a given site. A single person may fill several of these roles. For example, a project leader may also serve as a cruise leader and field team leader or field assistant. The roles of these persons area as follows:

Project Leader – Organizes the schedule and personnel assignments, takes part in field sampling, oversees all activities, and is responsible for preparation of reports.

Cruise Leader – Organizes daily schedules, makes sure all daily and cruise reports are completed, takes part in sampling, and reviews all data collected on a given cruise. Identifies daily field team or task leaders and assistants, depending on the sampling needs for that particular day

Field task leader – Is responsible for on site activities on a daily basis and for the review and entry of all data collected by that crew.

Field assistant - Assists in site layout, data entry, and data collection at a site.

5.2 Qualifications

Project Leader – Five or more years experience in similar projects with a background and experience in project management, nearshore marine ecological field studies, data analysis, and report preparation.

Cruise Leader – Experience in nearshore marine ecological field studies and leading field teams. Expertise in sampling and taxonomy of marine algae and invertebrates.

Field Team Leader – Expertise in sampling and taxonomy of marine algae and invertebrates.

Field Assistant – Competent boat handler and field crew member with ability to identify common marine algae and invertebrates.

5.3 Training procedures

All field team leaders are to be trained and show proficiency in small boat handling, algal and invertebrate taxonomy, and the specific procedures for sampling outlined here. All field team members should be accompanied by personnel that have carried out sampling under this procedure in the past. All personnel must be current with applicable safety training.

6 Operational Considerations

6.1 Personnel requirements

A minimum of two crew members are required to conduct surveys in each region.

6.2 Annual workload and field schedule

Field surveys are to be conducted in the summer of each year (see Protocol Narrative). It is anticipated that field sampling will require a crew of 2 to 3 working approximately 6 hours per day for 5 to 7 days per region (KATM or KEFJ). Crews used for field sampling will share duties with those persons conducting surveys including sea otter diet, summer bird and mammal surveys, eelgrass surveys, and oystercatcher surveys. Approximately 1 month‘s time will be required for field preparation, coordination, and data entry. Approximately 1.5 months per year will be required for each of three staff (principal investigator, data analyst, and technician) in order to prepare for the field season, prepare specimens collected for analysis, conduct analyses, and report the results.

6.3 Facility and equipment needs

A charter vessel that accommodates at least six field crew members will be required. The vessel will be equipped with skiffs for accessing the beach. Three GPS units are required per each field crew.

6.4 Startup costs and budget considerations

Startup costs include the completion of the database structure. It is anticipated that the startup costs for this task will be approximately $15,000. After the startup, the annual budget for this task is estimated at $62,000. This includes costs of analysis for contaminants.

7 Procedures for Revising the Protocol

All edits and amendments made to the protocol narrative and/or SOPs should be recorded in the revision history log table at the beginning of this document. Users of this protocol should promptly notify the project leader of the marine nearshore monitoring program of recommended edits or changes. The project leader will review and incorporate suggested changes as necessary, record these changes in the revision history log, and modify the date and version number on the title page of this document to reflect these changes.

It is anticipated that following at least five years of annual data collection it will be important to evaluate, in terms of power and sensitivity, the ability of the sampling design to detect change in the data derived from marine bird and mammals surveys. Following such analyses it may be appropriate to consider revising sampling design or data collection protocols.

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9.Appendices

Appendix A. Analytes examined in tissues of mussels

PAH Tissue
Decalin
C1-Decalin
C2-Decalin
C3-Decalin
C4-Decalin
Naphthalene
C1-Naphthalenes
C2-Naphthalenes
C3-Naphthalenes
C4-Naphthalenes
Benzothiophene
C1-Benzothiophene
C2-Benzothiophene
C3-Benzothiophene
Biphenyl
Acenaphthylene
Acenaphthene
Dibenzofuran
Fluorene
C1-Fluorenes
C2-Fluorenes
C3-Fluorenes
Anthracene
Phenanthrene
C1-Phenanthrenes/Anthracenes
C2-Phenanthrenes/Anthracenes
C3-Phenanthrenes/Anthracenes
C4-Phenanthrenes/Anthracenes
Dibenzothiophene
C1-Dibenzothiophenes
C2-Dibenzothiophenes
C3-Dibenzothiophenes
Fluoranthene
Pyrene
C1-Fluoranthenes/Pyrenes
C1-Fluoranthenes/Pyrenes
C1-Fluoranthenes/Pyrenes
Naphthobenzothiophene
C1-Naphthobenzothiophene
C2-Naphthobenzothiophene
C3-Naphthobenzothiophene

Benz(a)anthracene
Chrysene
C1-Chrysenes
C2-Chrysenes
C3-Chrysenes
C4-Chrysenes
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(e)pyrene
Benzo(a)pyrene
Perylene
Indeno(1,2,3-c,d)pyrene
Dibenzo(a,h)anthracene
C1-Dibenzo(a,h)anthracene
C2-Dibenzo(a,h)anthracene
C3-Dibenzo(a,h)anthracene
Benzo(g,h,i)perylene
2-Methylnaphthalene
1-Methylnaphthalene
2,6-Dimethylnaphthalene
1,6,7-Trimethylnaphthalene
1-Methylphenanthrene
C29-Hopane
18a-Oleanane
C30-Hopane

Pesticides Tissue
Aldrin
Dieldrin
Endrin
Heptachlor
Heptachlor-Epoxide
Oxychlordane
Alpha-Chlordane
Gamma-Chlordane
Trans-Nonachlor
Cis-Nonachlor
Alpha-HCH
Beta-HCH
Delta-HCH
Gamma-HCH
DDMU
2,4'-DDD
4,4'-DDD
2,4'-DDE
4,4'-DDE

2,4'-DDT
4,4'-DDT
1,2,3,4-Tetrachlorobenzene
1,2,4,5-Tetrachlorobenzene
Hexachlorobenzene
Pentachloroanisole
Pentachlorobenzene
Endosulfan II
Endosulfan I
Endosulfan Sulfate
Mirex
Chlorpyrifos

PCBs Tissue
PCB8/5
PCB18
PCB28
PCB29
PCB31
PCB44
PCB45
PCB49
PCB52
PCB56/60
PCB66
PCB70
PCB74/61
PCB87/115
PCB95
PCB99
PCB101/90
PCB105
PCB110/77
PCB118
PCB128
PCB138/160
PCB146
PCB149/123
PCB151
PCB153/132
PCB156/171/202
PCB158
PCB170/190
PCB174
PCB180
PCB183

PCB187
PCB194
PCB195/208
PCB199
PCB201/157/173
PCB206
PCB209

Metals Tissue
Ag
Pb
Se
Sn
Al
As
Cd
Cr
Cu
Fe
Mn
Ni
Si
Zn

Appendix B. Coordinates (WGS83) for 0.5 m MLLW markers at established sheltered rocky intertidal sites at KATM and KEFJ

Site ID	Common_Name	Latitude	Longitude
AP_B10_R_01_I	Kukak Bay	58.31658	-154.20658
AP_B10_R_02_I	Kaflia Bay	58.25708	-154.19769
AP_B10_R_03_I	Kinak Bay	58.18656	-154.46575
AP_B10_R_04_I	Amalik Bay	58.07922	-154.46600
AP_B10_R_05_I	Takli Island	58.06350	-154.48406
KP_B5_R_01_I	Aialik Bay	59.87664	-149.63289
KP_B5_R_04_I	Nuka Passage	59.42071	-150.64696
KP_B5_R_05_I	Harris Bay	59.73766	-149.95837
KP_B5_R_02_I	McCarty Fjord	59.50853	-150.34178
KP_B5_R_03_I	Nuka Bay	59.53723	-150.60713
AP_B10_R_01_S	Nanagiak Island	59.39204	-150.68874

Appendix C. Sessile invertebrate and algal taxa identified on rocky intertidal sites at KATM and KEFJ and groupings of taxa used in rocky intertidal sampling and analyses.

Taxa name	**Lumped taxa name**
Acrosiphonia sp.	*Acrosiphonia sp.*
Ahnfeltiopsis gigartinoides	*Ahnfeltiopsis gigartinoides*
Alaria marginata	*Alaria marginata*
Analipus japonicus	*Analipus japonicus*
Anthopleura elegantissima	*Anthopleura elegantissima*
Balanus / Semibalanus sp.	barnacle
Balanus glandula	barnacle
bare substrate	bare substrate
barnacle	barnacle
barnacle spat	barnacle
Blidingia minima	*Blidingia minima*
Chaetomorpha melagonium	*Chaetomorpha melagonium*
Chthamalus dalli	barnacle
Cladophora / Chaetomorpha sp.	*Cladophora / Chaetomorpha sp.*
Constantinia subulifera	*Constantinia subulifera*
Corallina sp.	foliose coralline alga
Cryptochiton stelleri	*Cryptochiton stelleri*
Cryptosiphonia woodii	*Cryptosiphonia woodii*
Desmarestia aculeata	*Desmarestia aculeata*
Dictyosophon foeniculaceus	*Dictyosophon foeniculaceus*
Ectocarpus sp.	*Ectocarpus sp.*
Elachista sp.	*Elachista sp.*
encrusting bryozoan	encrusitng bryozoan
encrusting coralline alga	encrusting coralline alga
Endocladia muricata	*Endocladia muricata*
Epiactis sp.	*Epiactis sp.*
erect coralline alga	erect coralline alga
Eurystomella bilabiata	foliose bryozoan
foliose bryozoan	foliose bryozoan
foliose coralline alga	foliose coralline alga
Fucus distichus subsp. evanescens	*Fucus distichus subsp. evanescens*
Gloiopeltis furcata	*Gloiopeltis furcata*
Gracilaria pacifica	*Gracilaria pacifica*
Halosaccion glandiforme	*Halosaccion glandiforme*
Hiatella arctica	*Hiatella arctica*
Hildenbrandia sp.	non-coralline algal crust
Leathesia difformis	*Leathesia difformis*
Mastocarpus papillatus	*Mastocarpus papillatus*
Mazzaella parksii	*Mazzaella sp.*

Taxa name	**Lumped taxa name**
Mazzaella phyllocarpa	*Mazzaella sp.*
Mazzaella sp.	*Mazzaella sp.*
Melanosiphon / Scytosiphon sp.	*Melanosiphon / Scytosiphon sp.*
Melanosiphon intestinalis	*Melanosiphon / Scytosiphon sp.*
Metridium senile	*Metridium senile*
Microcladia borealis	*Microcladia borealis*
Modiolus modiolus	*Modiolus modiolus*
Mya truncata	*Mya truncata*
Mytilus trossulus	*Mytilus trossulus*
Neoptilota / Ptilota sp.	*Neoptilota / Ptilota sp.*
Neorhodomela larix	*Odonthalia / Neorhodemela sp.*
Neorhodomela oregona	*Odonthalia / Neorhodemela sp.*
non-coralline algal crust	non-coralline algal crust
Odonthalia / Neorhodomela sp.	*Odonthalia / Neorhodemela sp.*
Odonthalia floccosa	*Odonthalia / Neorhodemela sp.*
Palmaria callophylloides	*Palmaria sp.*
Palmaria hecatensis	*Palmaria sp.*
Palmaria hecatensis/mollis	*Palmaria sp.*
Palmaria mollis	*Palmaria sp.*
Palmaria sp.	*Palmaria sp.*
Petalonia fascia	*Petalonia fascia*
Phycodrys / Tokidadendron sp.	*Phycodrys / Tokidadendron sp.*
Phycodrys serrata	*Phycodrys / Tokidadendron sp.*
Plocamium cartilageneum	*Plocamium cartilageneum*
Polysiphonia sp.	*Pterosiphonia / Polysiphonia sp.*
Porphyra sp.	*Porphyra sp.*
Pterosiphonia / Polysiphonia sp.	*Pterosiphonia / Polysiphonia sp.*
Pterosiphonia bipinnata	*Pterosiphonia / Polysiphonia sp.*
Pylaiella littoralis	*Pylaiella littoralis*
Ralfsia sp.	non-coralline algal crust
Rhodochorton purpureum	non-coralline algal crust
Saccharina latissima	*Saccharina latissima*
Scytosiphon lomentaria	*Melanosiphon / Scytosiphon sp.*
Semibalanus balanoides	*barnacle*
Semibalanus cariosus	*barnacle*
Soranthera ulvoidea	*Soranthera ulvoidea*
spirorbidae	spirorbidae
unidentified sponge	unidentified sponge
Stomachetosella cruenta	encrusitng bryozoan
Tokidadendron bullatum	*Phycodrys / Tokidadendron sp.*
Ulothrix flacca	*Ulothrix flacca*
Ulva / Monostroma sp.	*Ulva / Monostroma sp.*
Ulva sp.	*Ulva / Monostroma sp.*
unidentified anemone	unidentified anemone

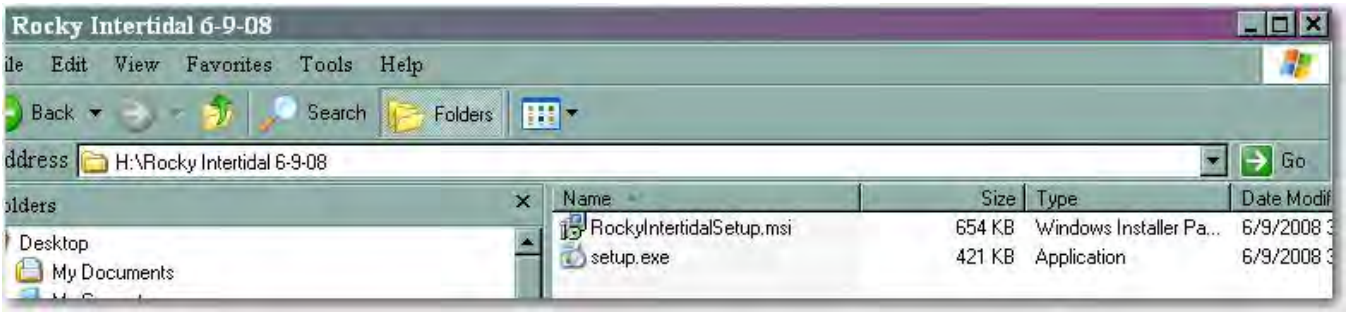
Taxa name	**Lumped taxa name**
unidentified brown alga	unidentified brown alga
unidentified filamentous red alga	unidentified filamentous red alga
unidentified green alga	unidentified green alga
unidentified hydrozoan	unidentified hydrozoan
unidentified tunicate	unidentified tunicate
Urticina crassicornis	*Urticina crassicornis*

Appendix D. Data entry of rocky intertidal data

This draft data entry manual describes how to use the electronic data entry forms for real-time data entry or data-entry from paper data sheets for sampling of intertidal invertebrates and algae on sheltered rocky shores.

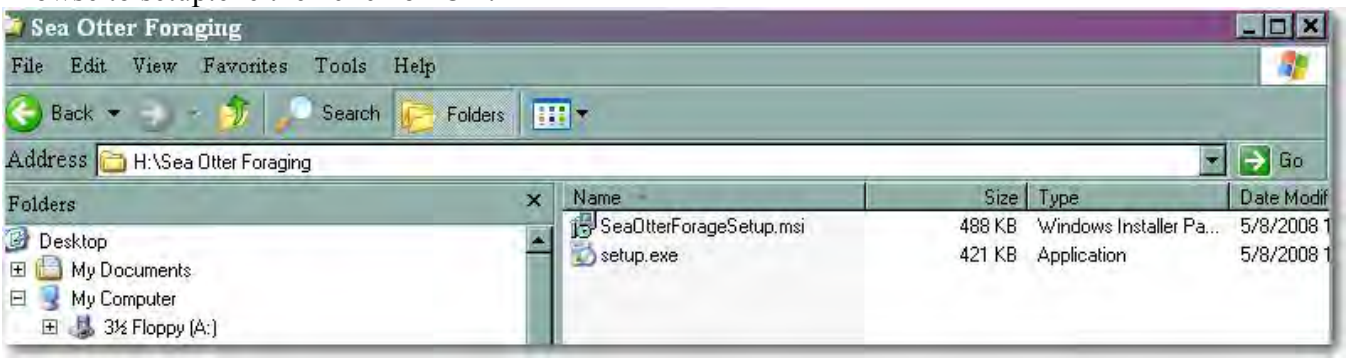
1 Installation: (incomplete 9june2008)

1. From a flash drive containing the setup packages, install the rocky intertidal and sea otter foraging data entry packages (and associated back-end database) by navigating in Windows explorer to the respective *.exe files and double clicking on them (it doesn‘t matter which you install first) or by clicking on Start/Run and browsing to the *.exe files and installing.



Double click on set-up.exe.

Browse to setup.exe then click on OK.

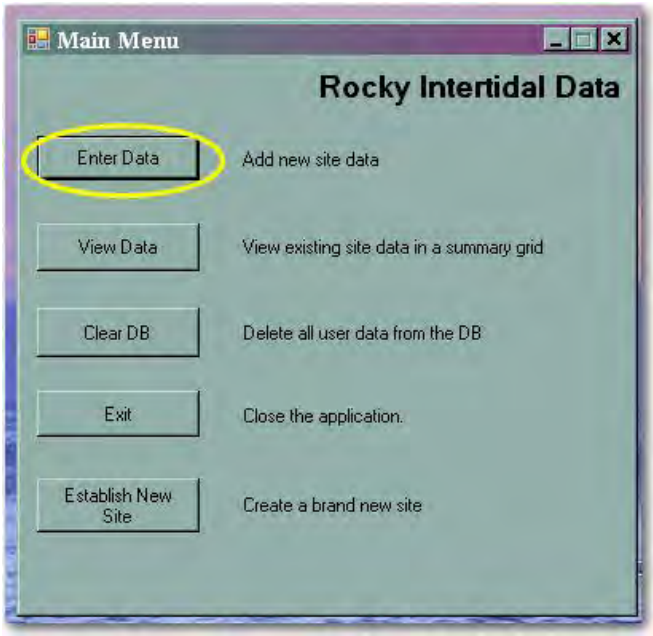


Double click on set-up.exe.

Browse to setup.exe then click on OK.

2. Rocky Intertidal Data Entry

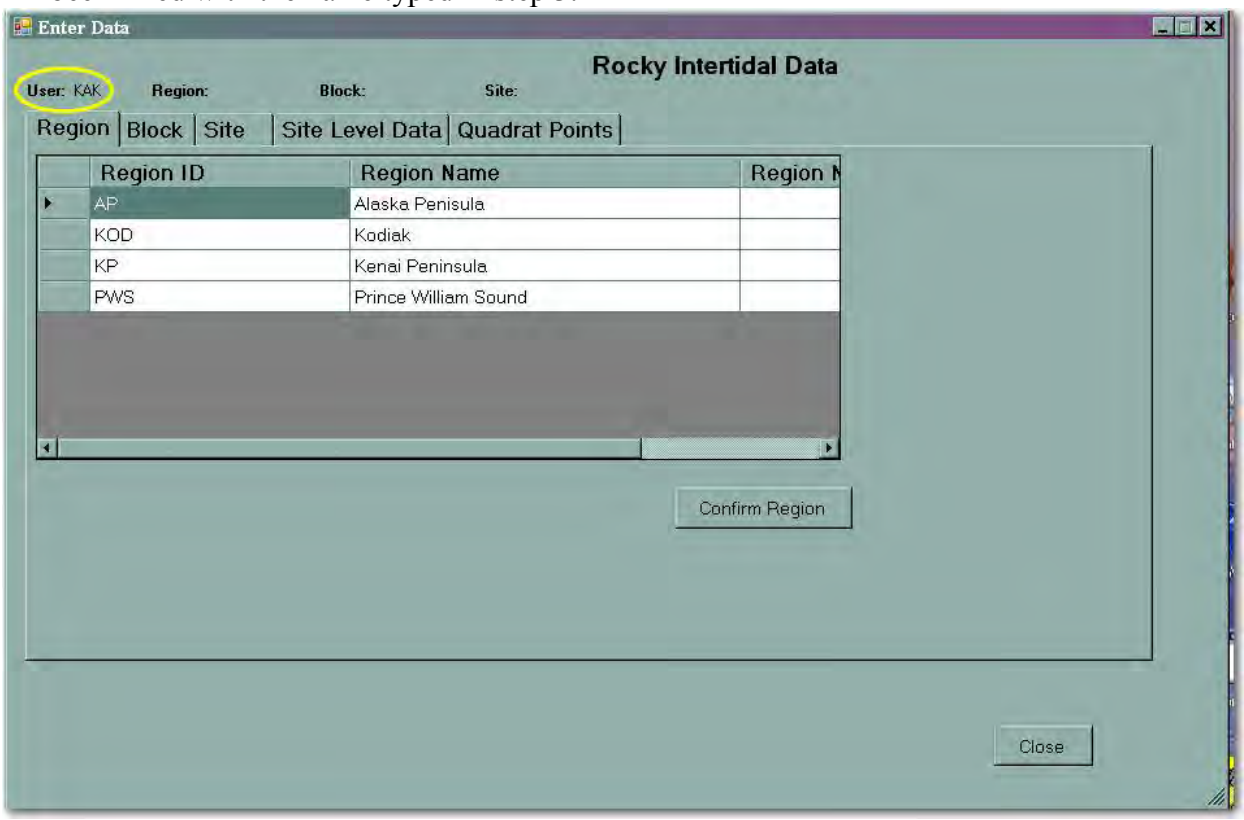
1



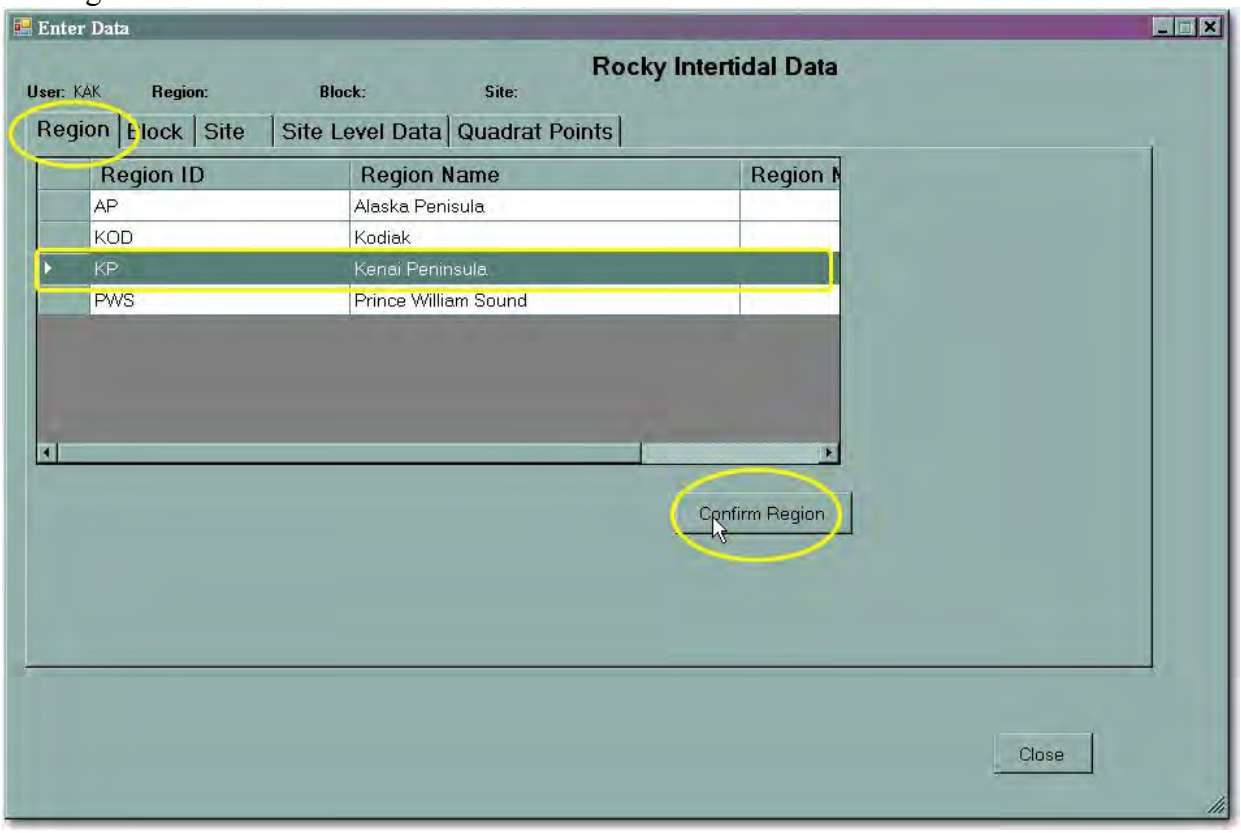
2

3

1. Double click on the Rocky Intertidal Icon that is on the desktop.
2. Click on the Enter Data button (see page ?? for other main menu options, including death threats)
3. Enter the name of the data entry person—this can be initials, full name, all caps, all smalls—as long as we can determine who entered the data by what you type here. There will be places later for choosing observers from a drop-down list. After typing in your name, click on the OK button or hit the enter key on the keyboard.
4. The following data entry screen will now appear. Note that the –User" summary field has been filled with the name typed in step 3.

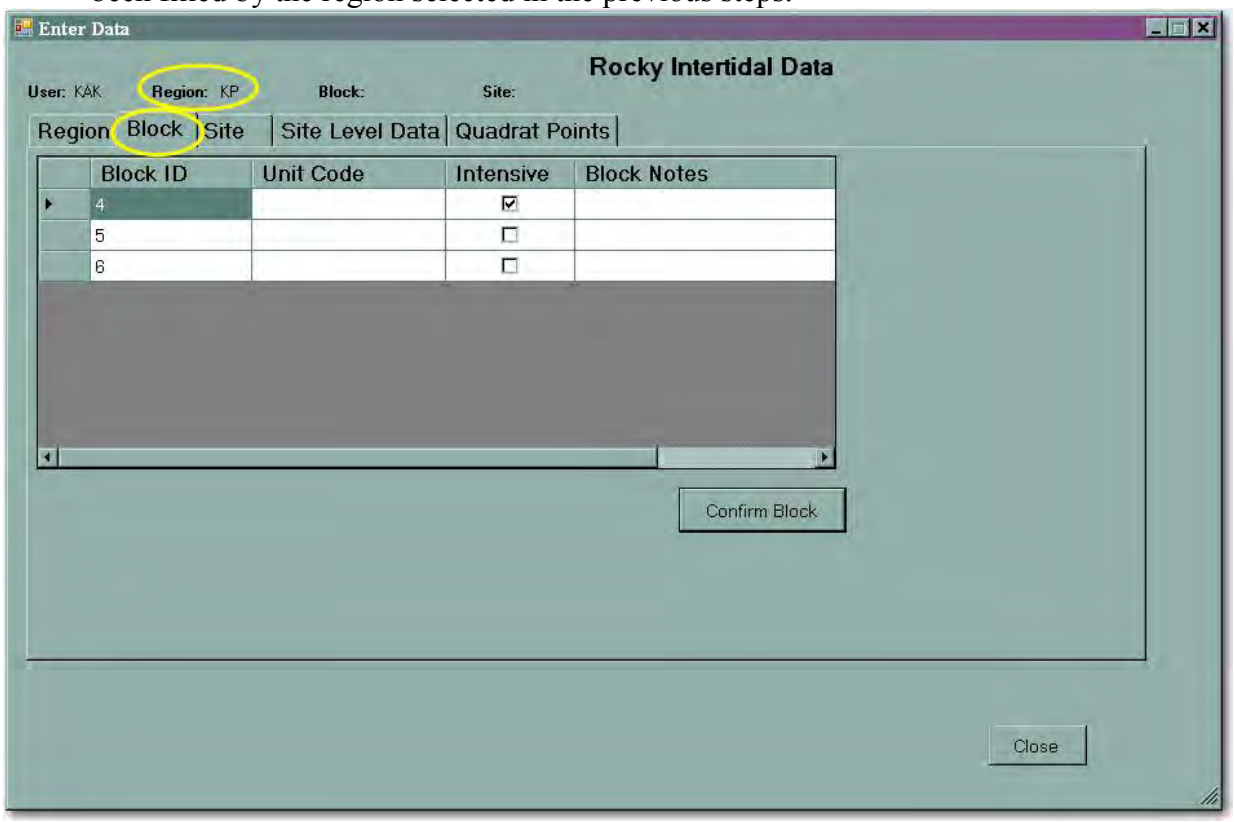


5. The data entry screen opens defaulted on the –Region" tab. Select the region by single clicking anywhere within the row you want to choose. Then single click on the Confirm Region button.

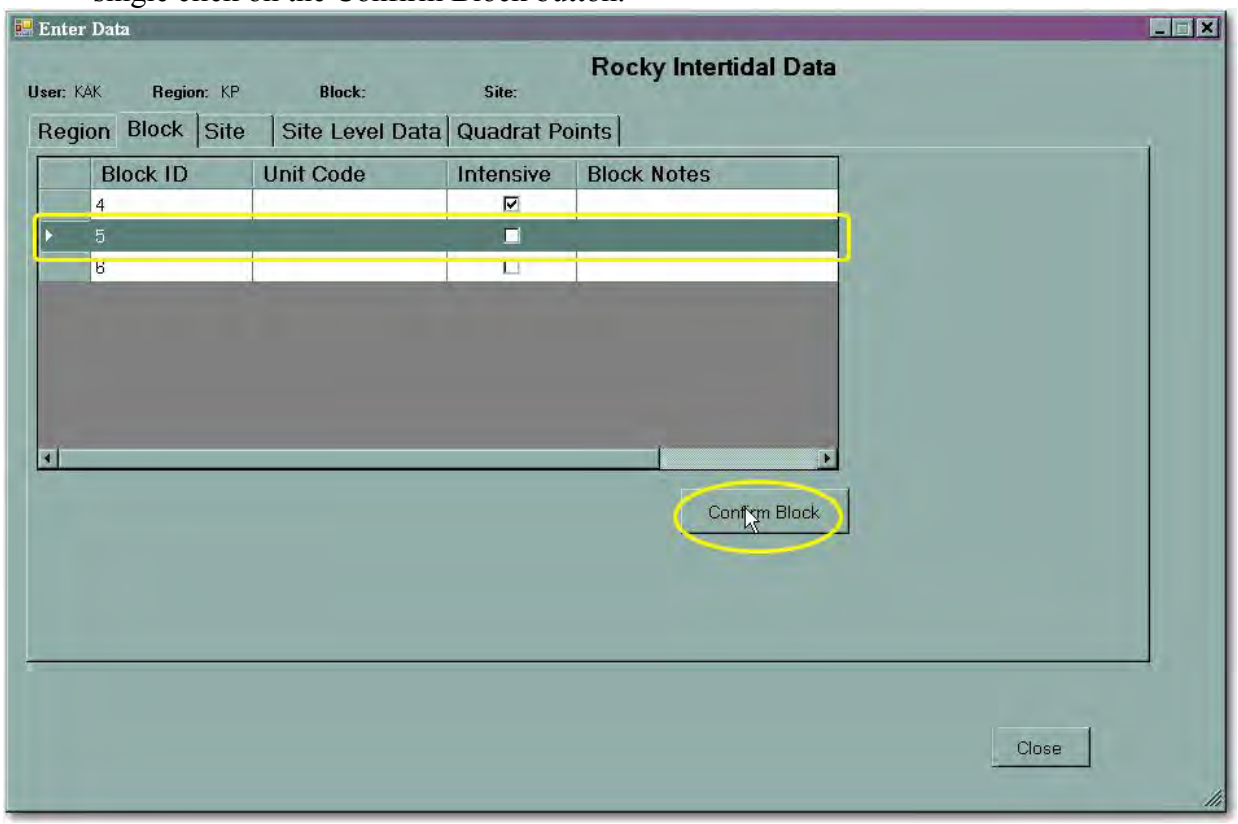


6. A Confirm Region confirmation box will appear, if you have selected the correct region, single click on the OK button, or hit the enter key on the keyboard.

7. The data form will advance to the Block tab, and now the —Region— summary field has been filled by the region selected in the previous steps.

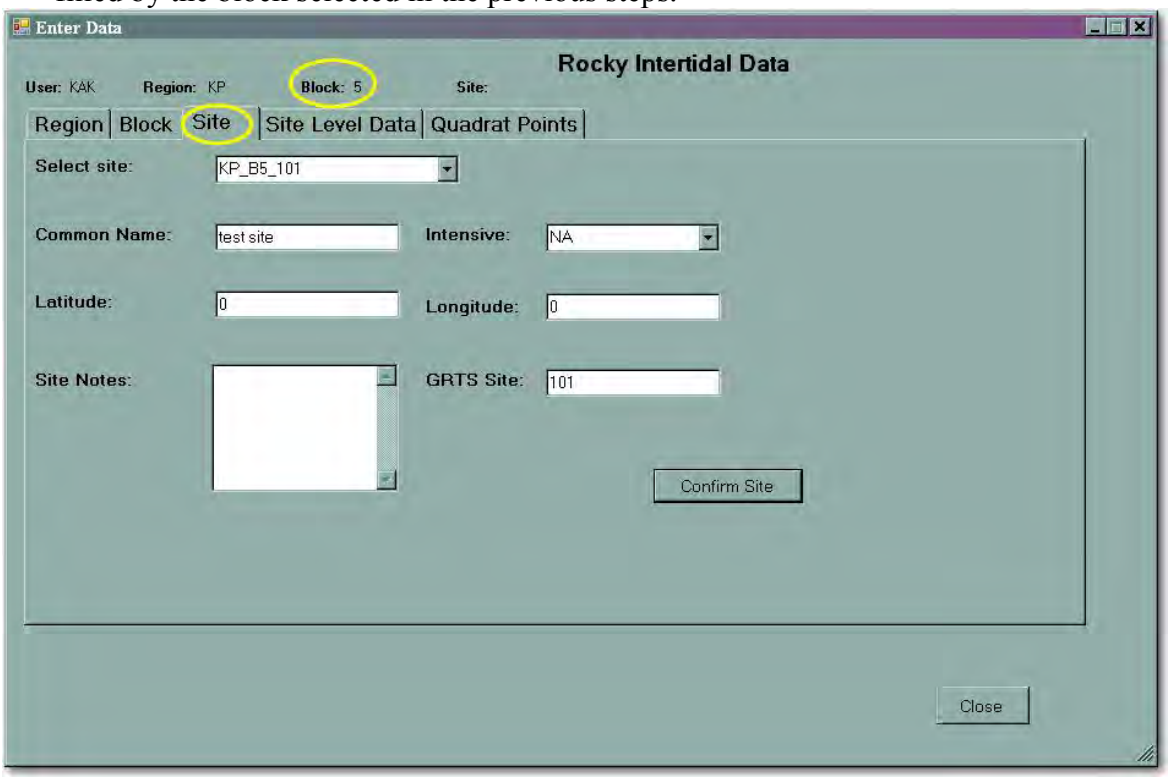


8. Select the block by single clicking anywhere within the row you want to choose. Then single click on the Confirm Block button.

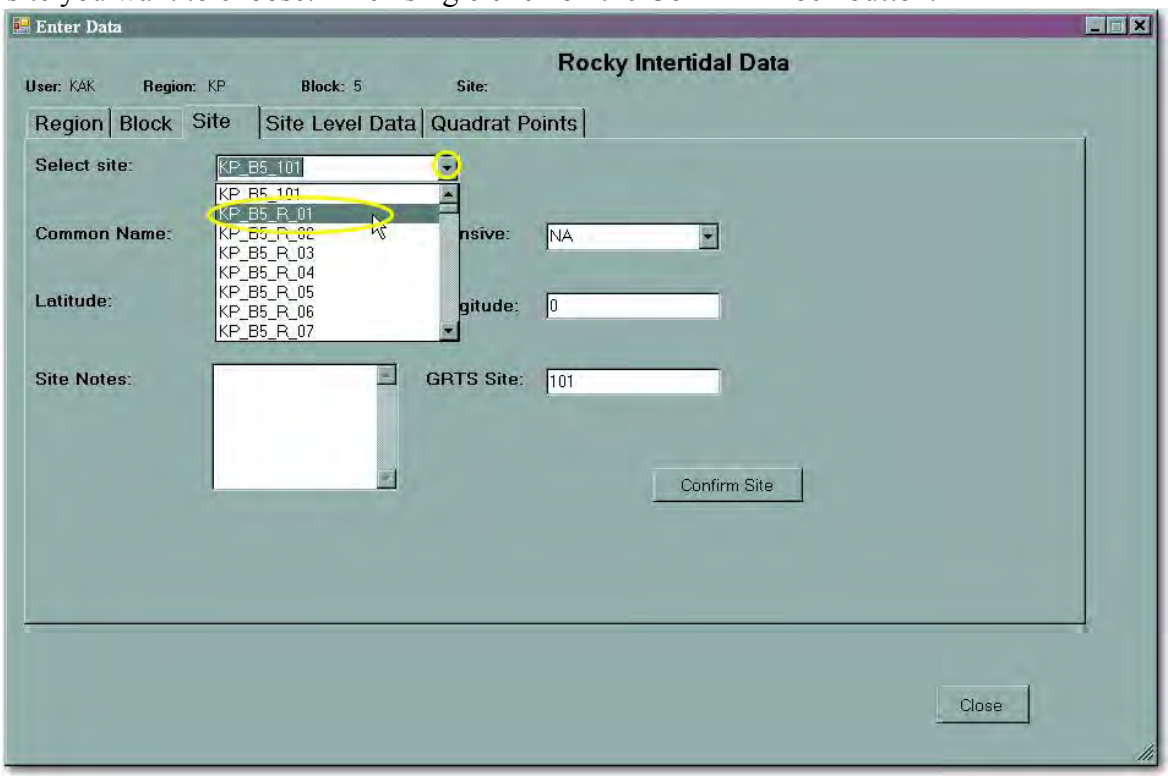


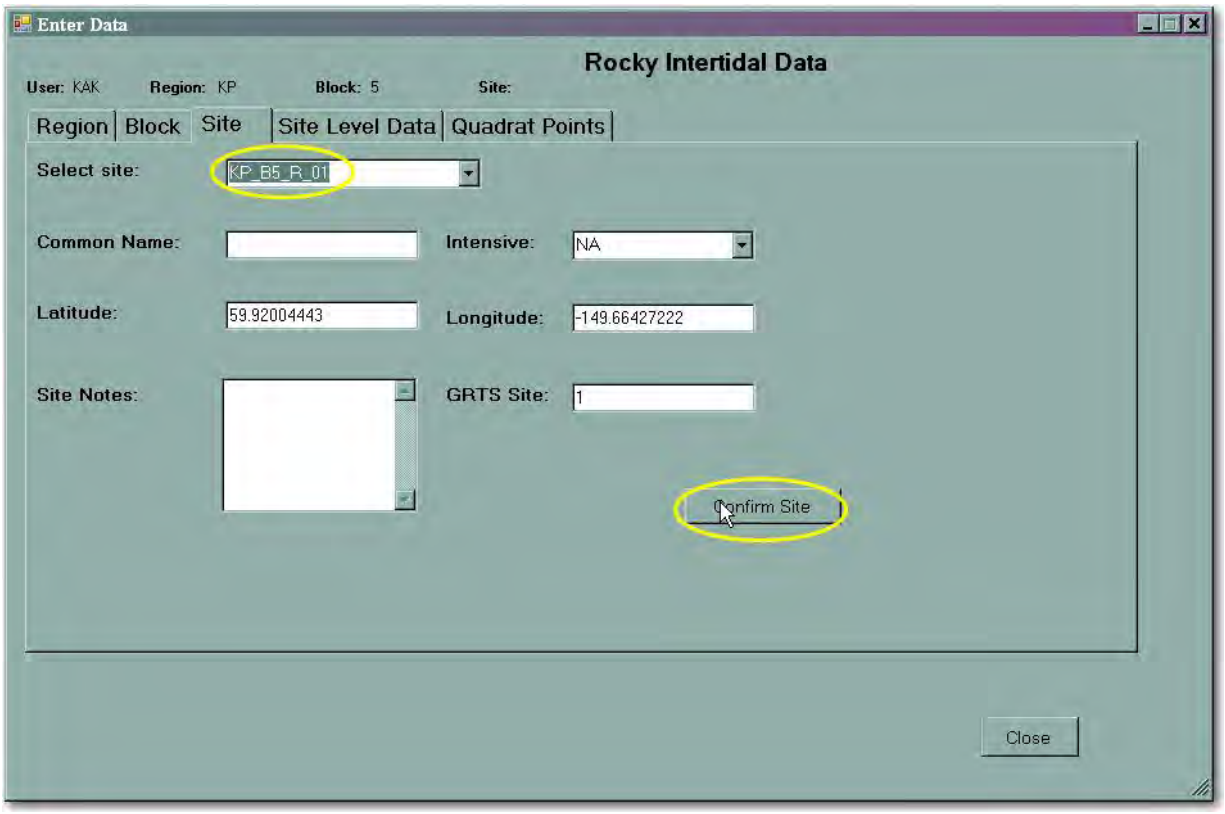
9. A Confirm Block confirmation box will appear, if you have selected the correct block, single click on the OK button, or hit the enter key on the keyboard.

10. The data form will advance to the Site tab, and now the –Block–summary field has been filled by the block selected in the previous steps.



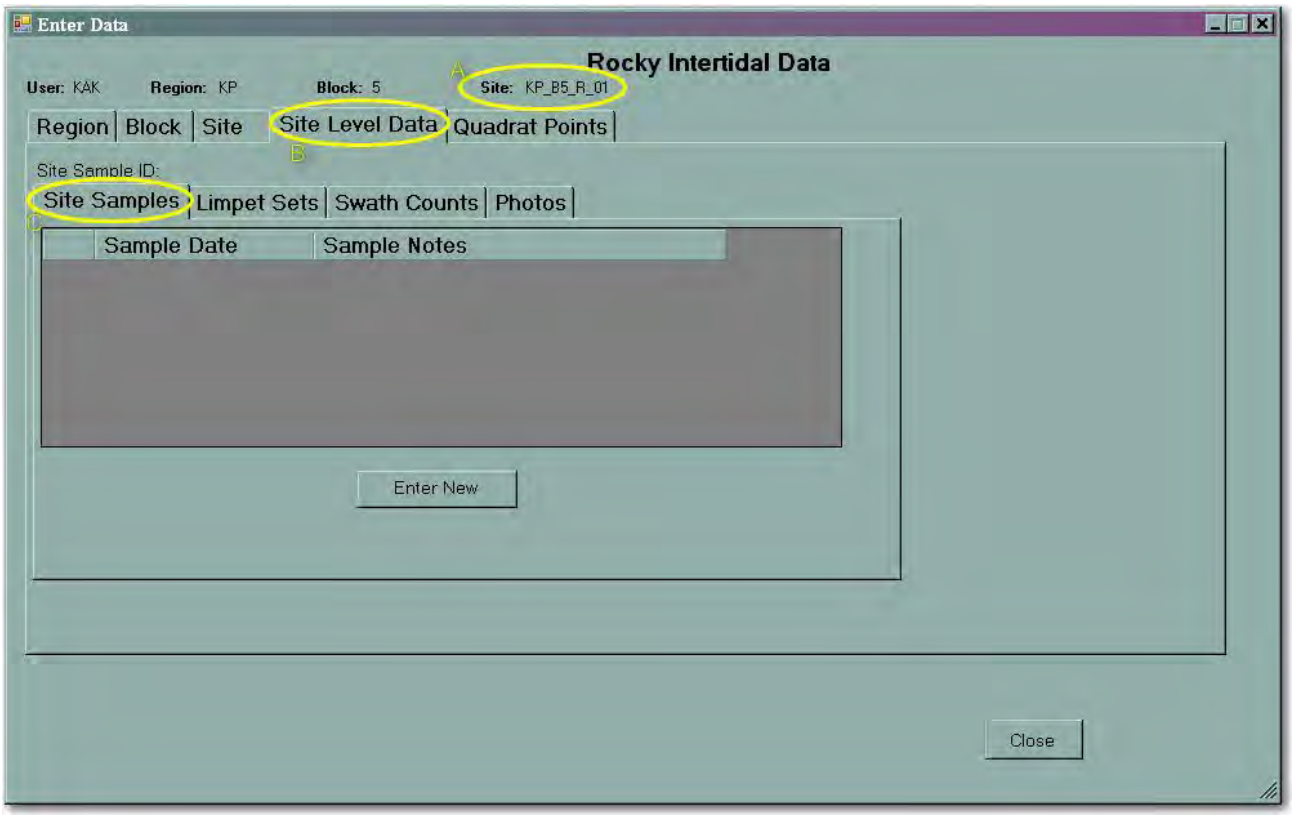
11. Select the site by single clicking on the drop-down list arrow, and scrolling to highlight the site you want to choose. Then single click on the Confirm Block button.



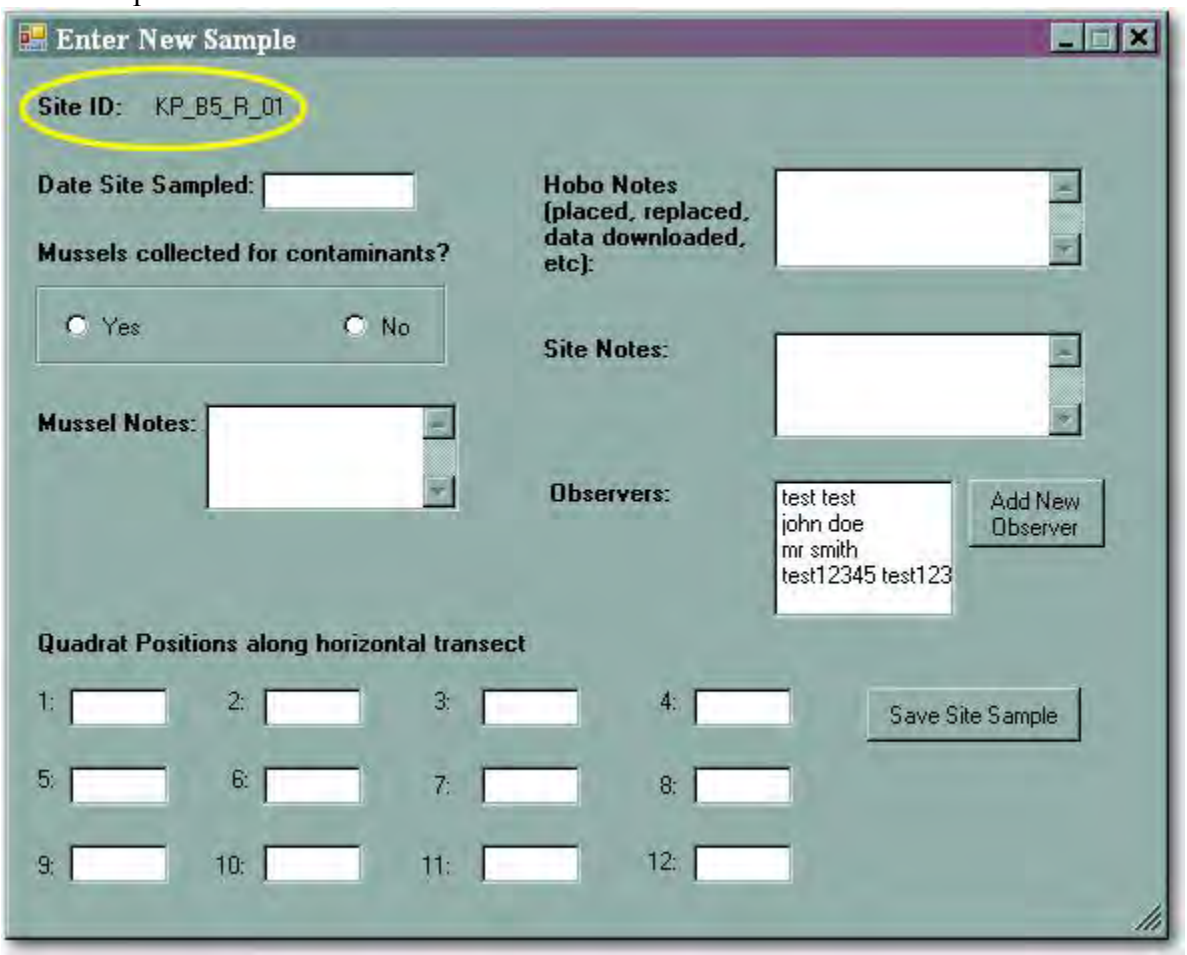


12. A Confirm Site confirmation box will appear (except there's a mistake and it still reads ―Confirm Block". This will be corrected before Katmai), if you have selected the correct site, single click on the OK button, or hit the enter key on the keyboard.

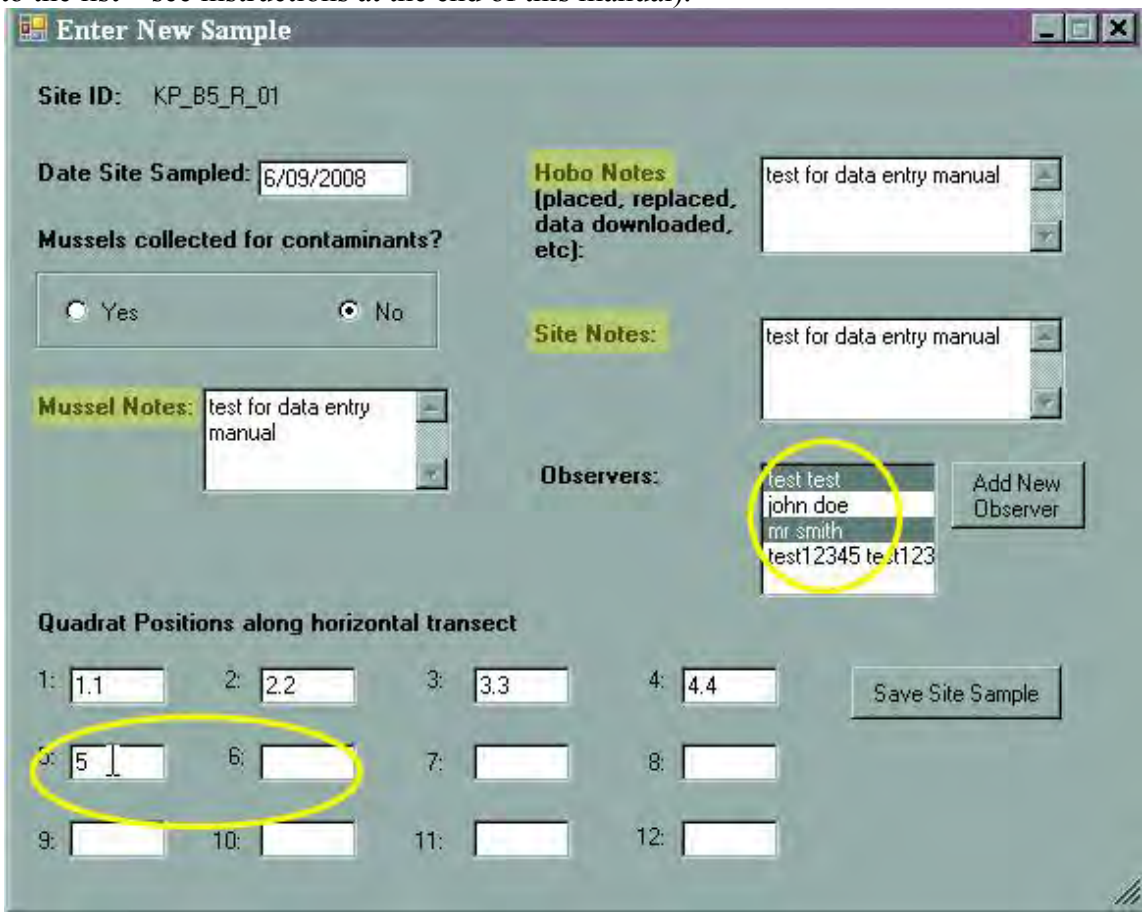
13. The data form will advance to the Site Level Data tab (B in the following figure), and now the ~~Site~~ summary field has been filled by the site selected in the previous steps (A, in the following figure). This is the first place data will actually be entered, as opposed to choosing items from pick lists. Notice that a sub-form has appeared, with the Site Samples tab selected (C in the following figure). At this point you can advance straight to the quadrat points tab if you wish and begin entering point count data, skip to page ??? of this manual for instructions.



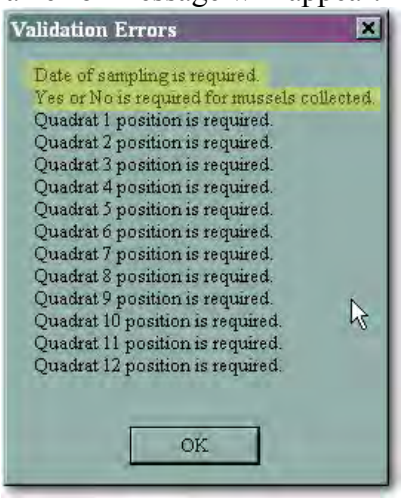
14. Single click on the Enter New button to begin data entry. The following data entry screen will appear. Note that the –site ID" summary field shows what site you've entered in steps 11-12.



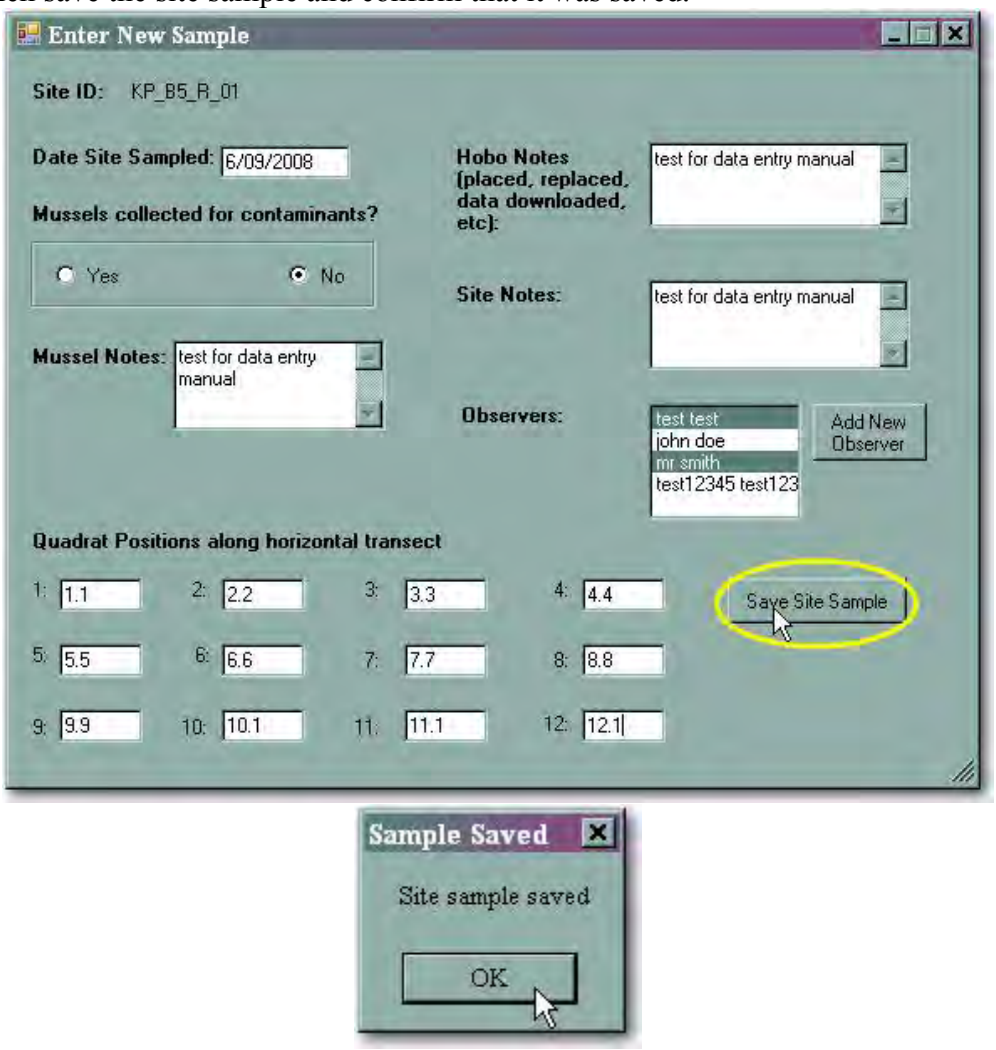
15. Use the stylus, mouse, or Tab button to navigate through the form and enter data. Use MM/DD/YYYY for the date field. Hobo, site, and mussel notes are all text fields. To enter observers, simply single click on their name from the pick-list and highlight as many as were present (if necessary click on the Add New Observer button to add a name to the list—see instructions at the end of this manual).



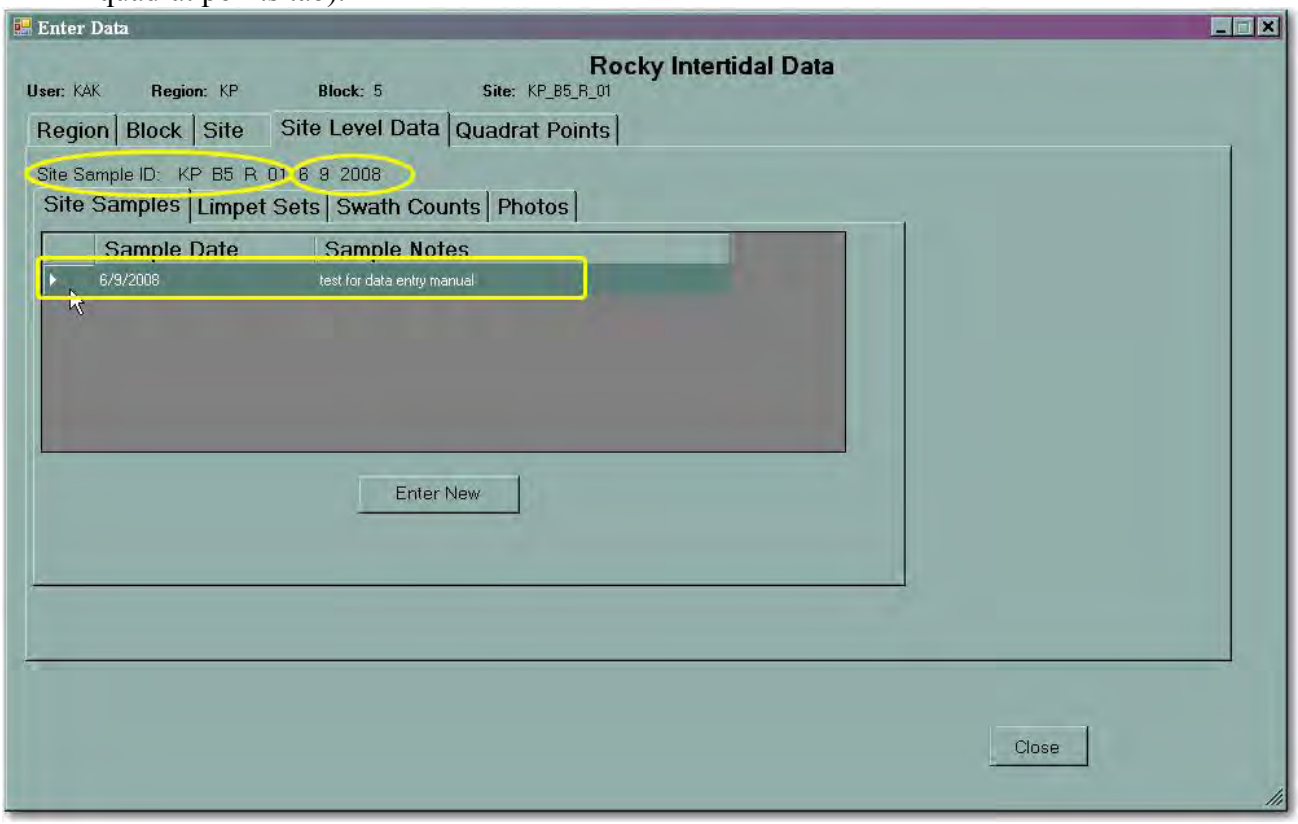
16. Date, mussel collection yes/no button, and all quadrat positions must be filled in before saving the site sample, or an error message will appear:



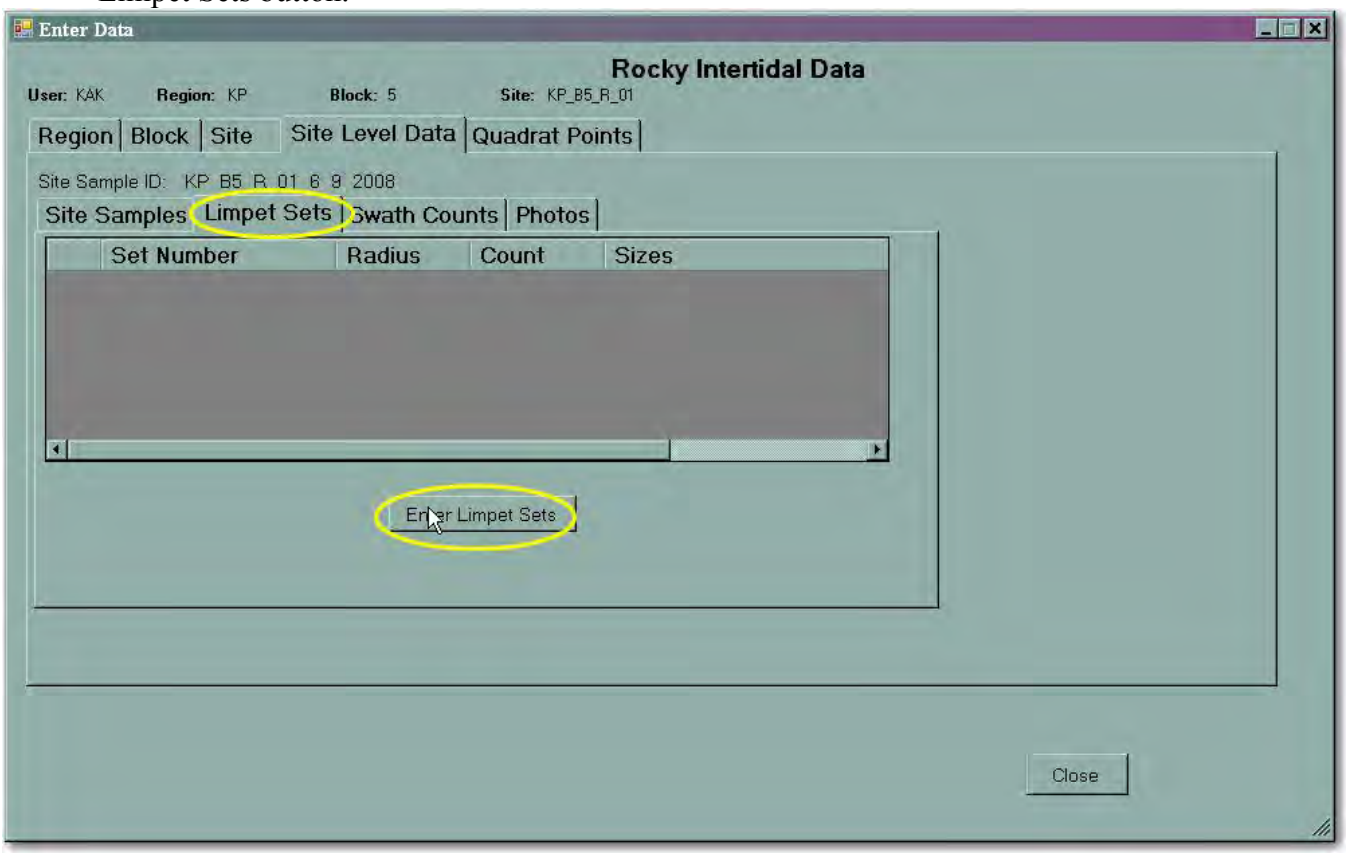
17. If you get this error message, single click on the OK button and fill in the missing data. Then save the site sample and confirm that it was saved.



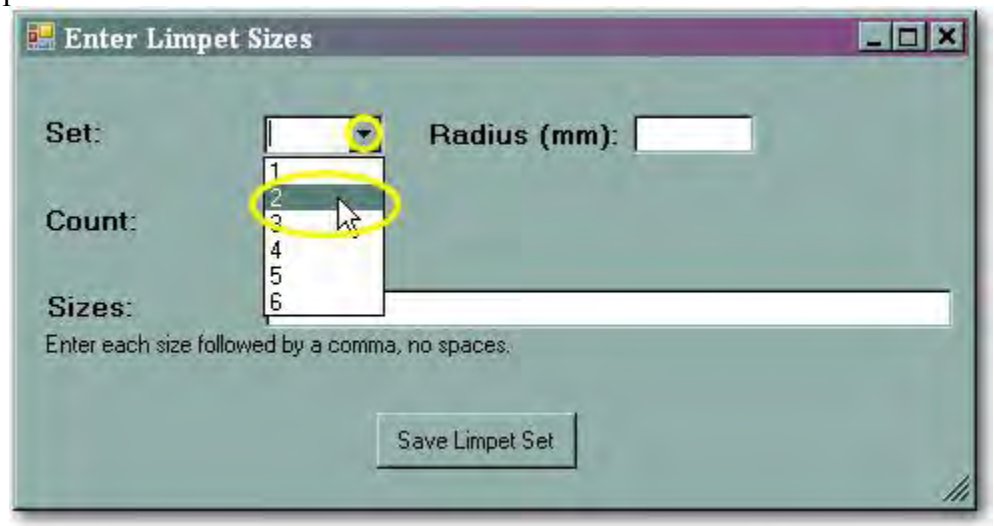
18. After confirming that the site sample was saved, you'll be back on the Site Level Data tab. Note that now the Site ID consisting of the Site Name (eg KP B5 R 01) and the sampling date have appeared in the Site Sample ID summary field. Select the site sample you wish to continue entering data for by single clicking on the row, then choose the data tab you wish to continue with (Limpet sets, Swath Counts, or Photos—or jump to the quadrat points tab).



19. Limpet Sets Tab. Single click on the limpet sets tab, then single click on the Enter Limpet Sets button.

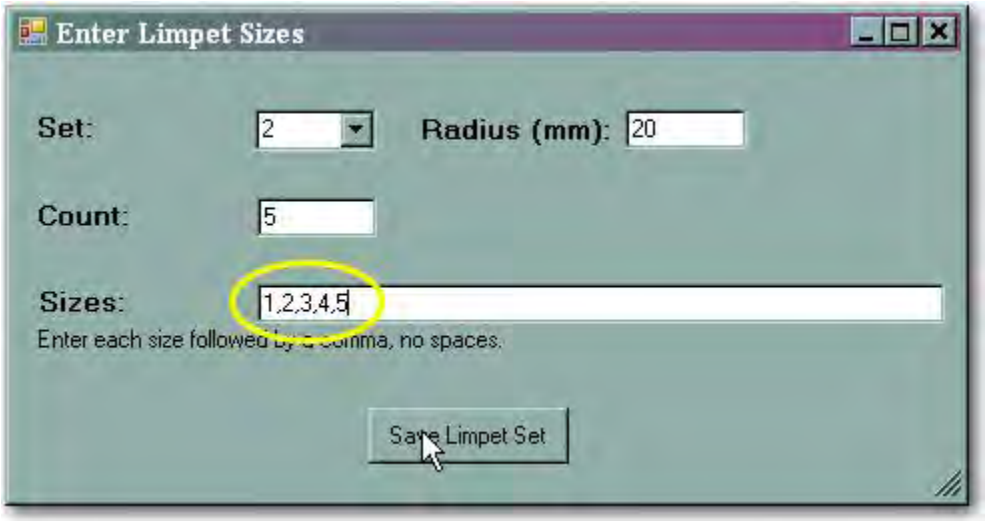


20. After clicking on the Enter Limpet Sets button, the following data entry screen will appear:

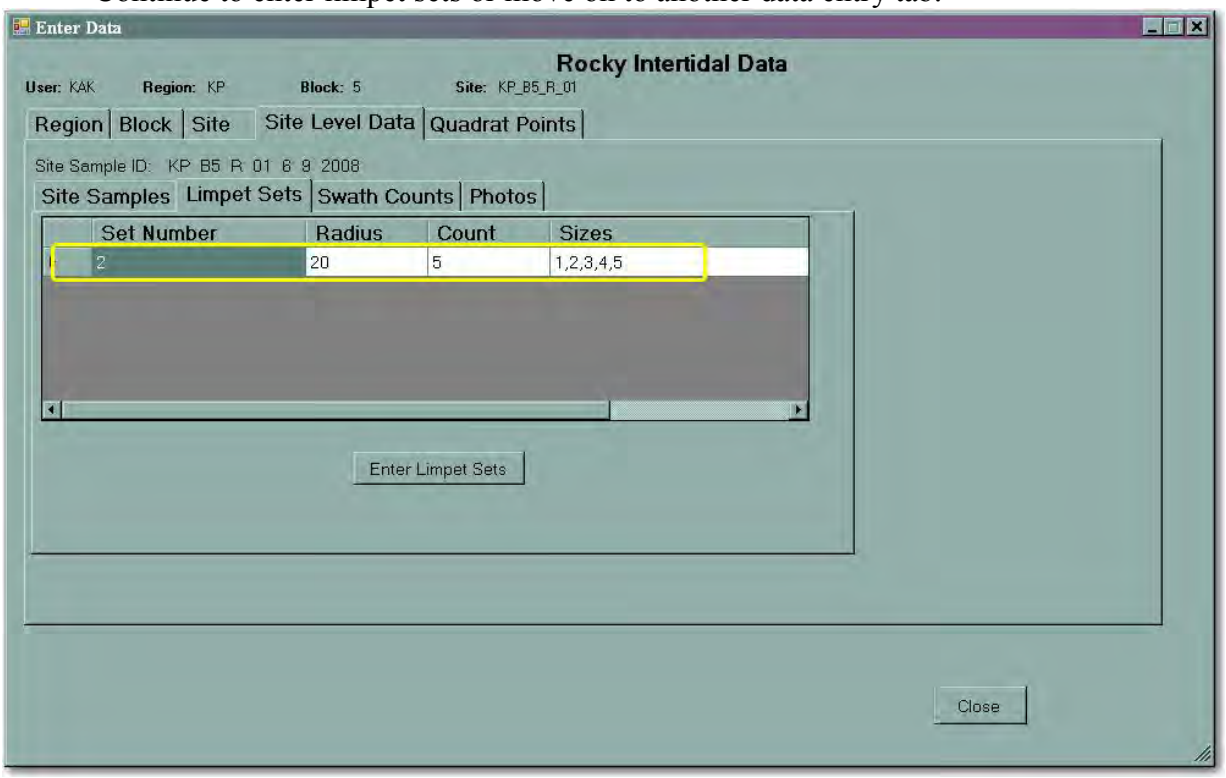


Using the mouse or stylus, single click on the drop down arrow next to the Set field and scroll to the set you'll be entering.

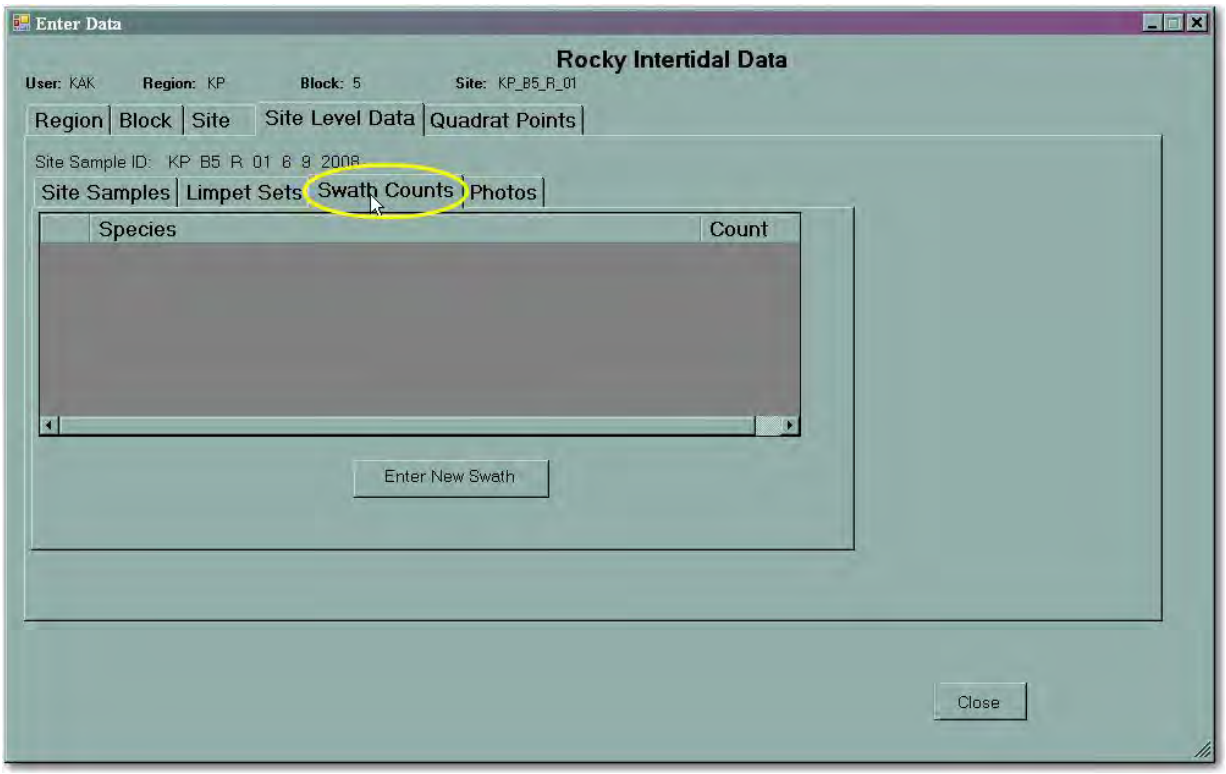
21. After selecting the set, type in the radius and count, and the sizes (as instructed on the screen). Then single click on the save limpet set button, and click OK on the confirmation button.



22. After confirming the limpet set entry, you'll see a summary of what has been entered. Continue to enter limpet sets or move on to another data entry tab.



23. Swath Counts Tab. Single click on the Swath Counts tab, then single click on the Enter New Swath button.

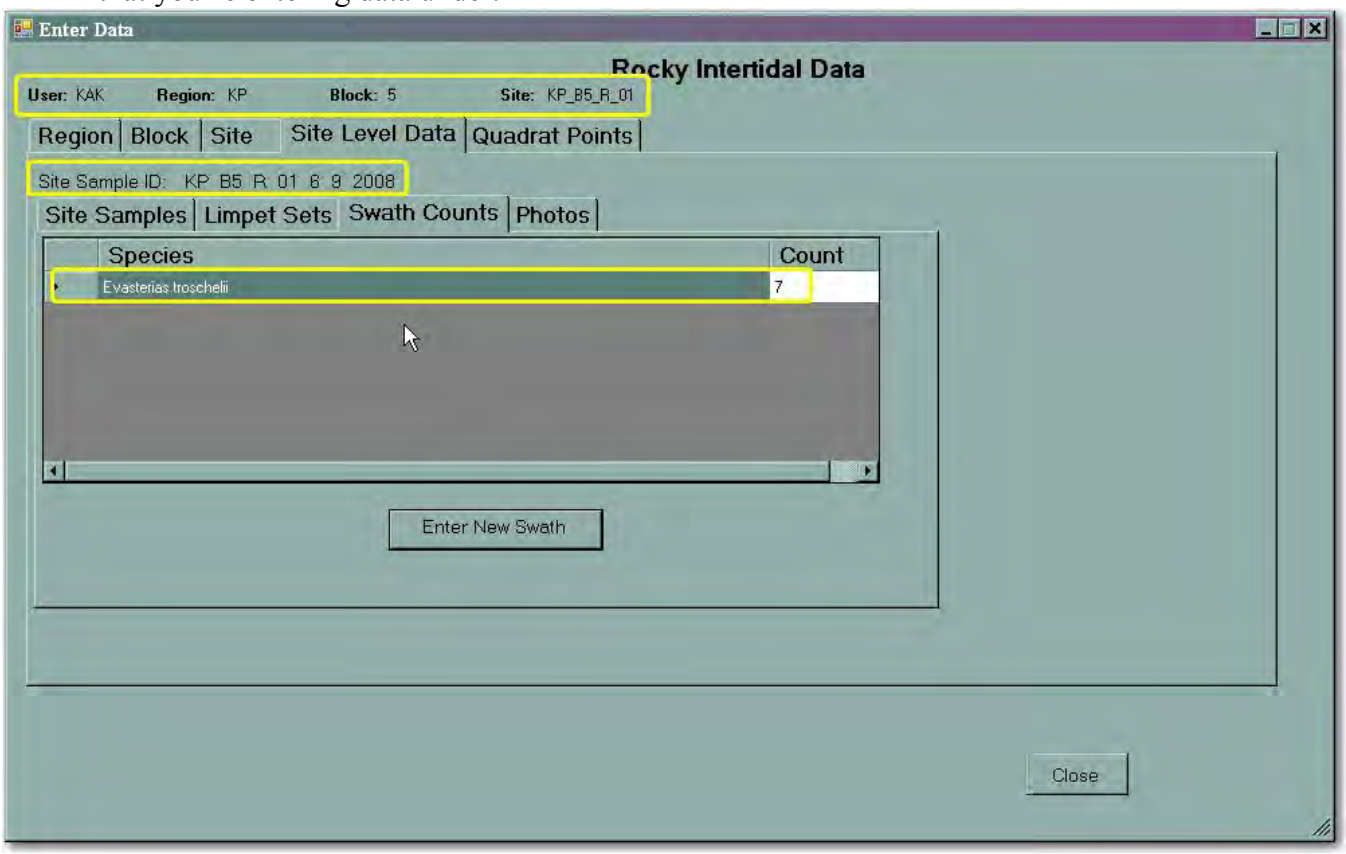


24. After clicking on the Enter new swath button, the following data entry screen will appear:

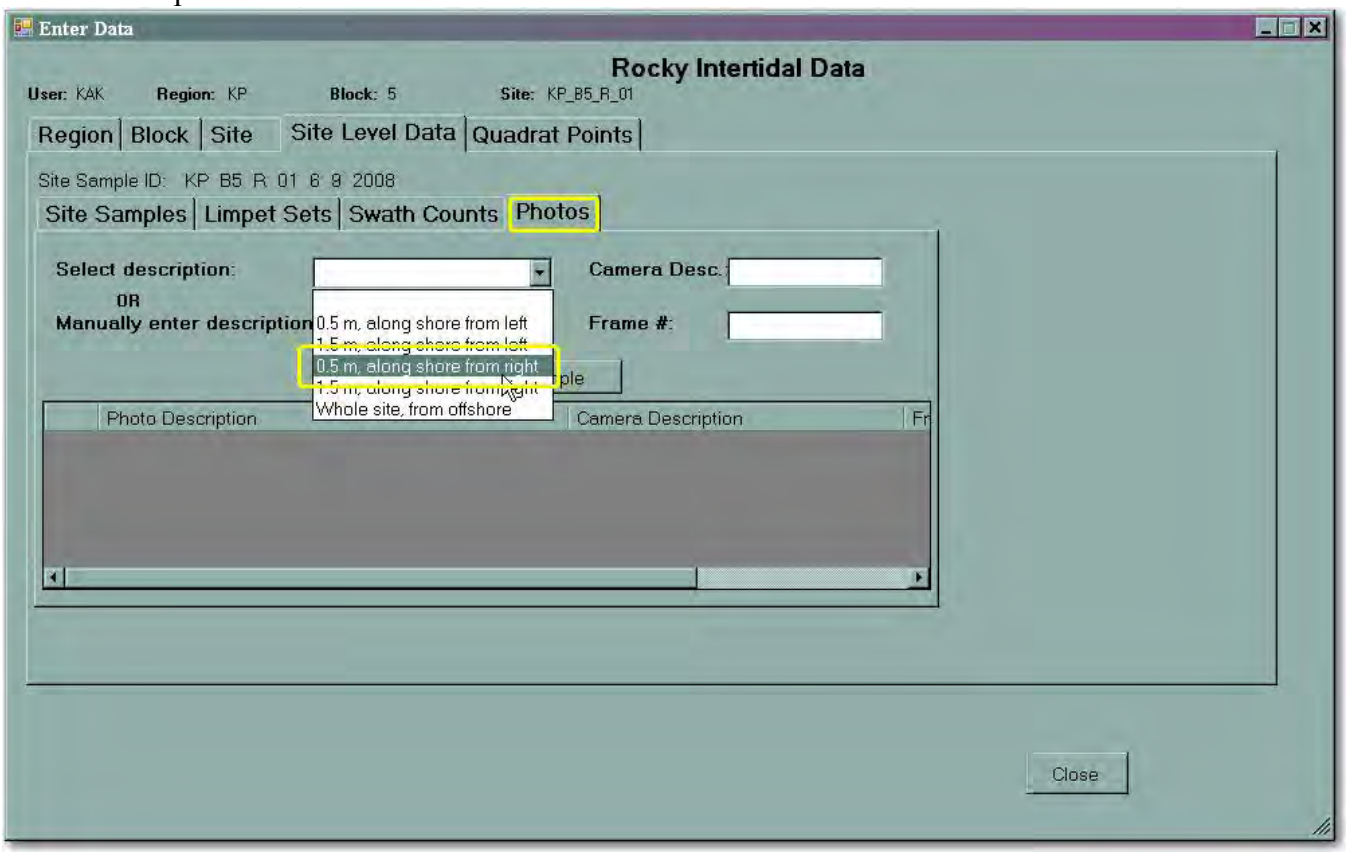
Using the mouse or stylus, single click on the drop down arrow next to the Set field and scroll to select the species you'll be entering.

After selecting the species, type in the count and single click on the save swath count button, and click OK on the confirmation button.

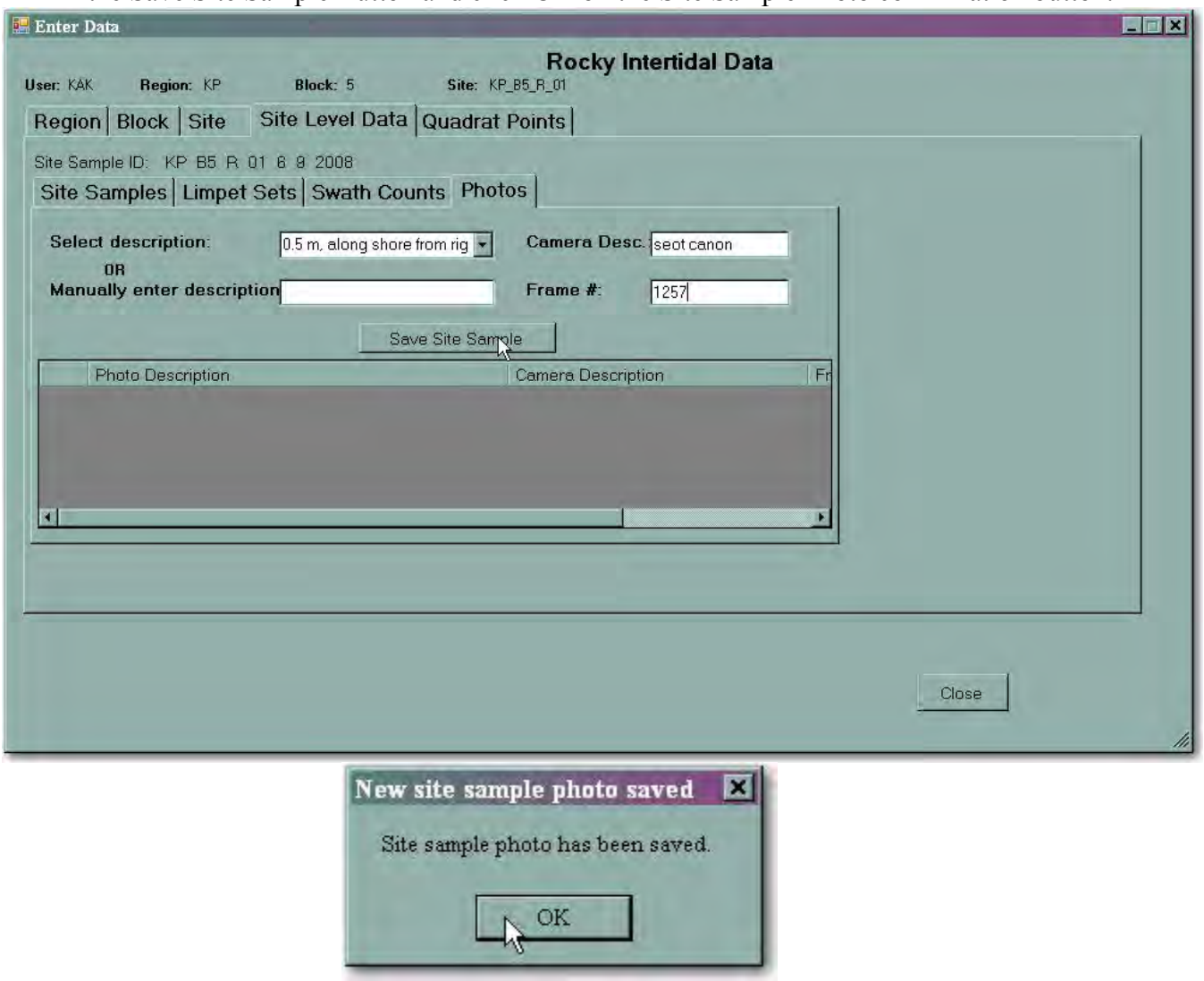
25. After confirming the swath count entry, you'll see a summary of what has been entered. Continue to enter additional species counts or move on to another data entry tab. Note that for Limpet Sets, Swath Counts, and Photos, you can verify the site and sampling date that you're entering data under.



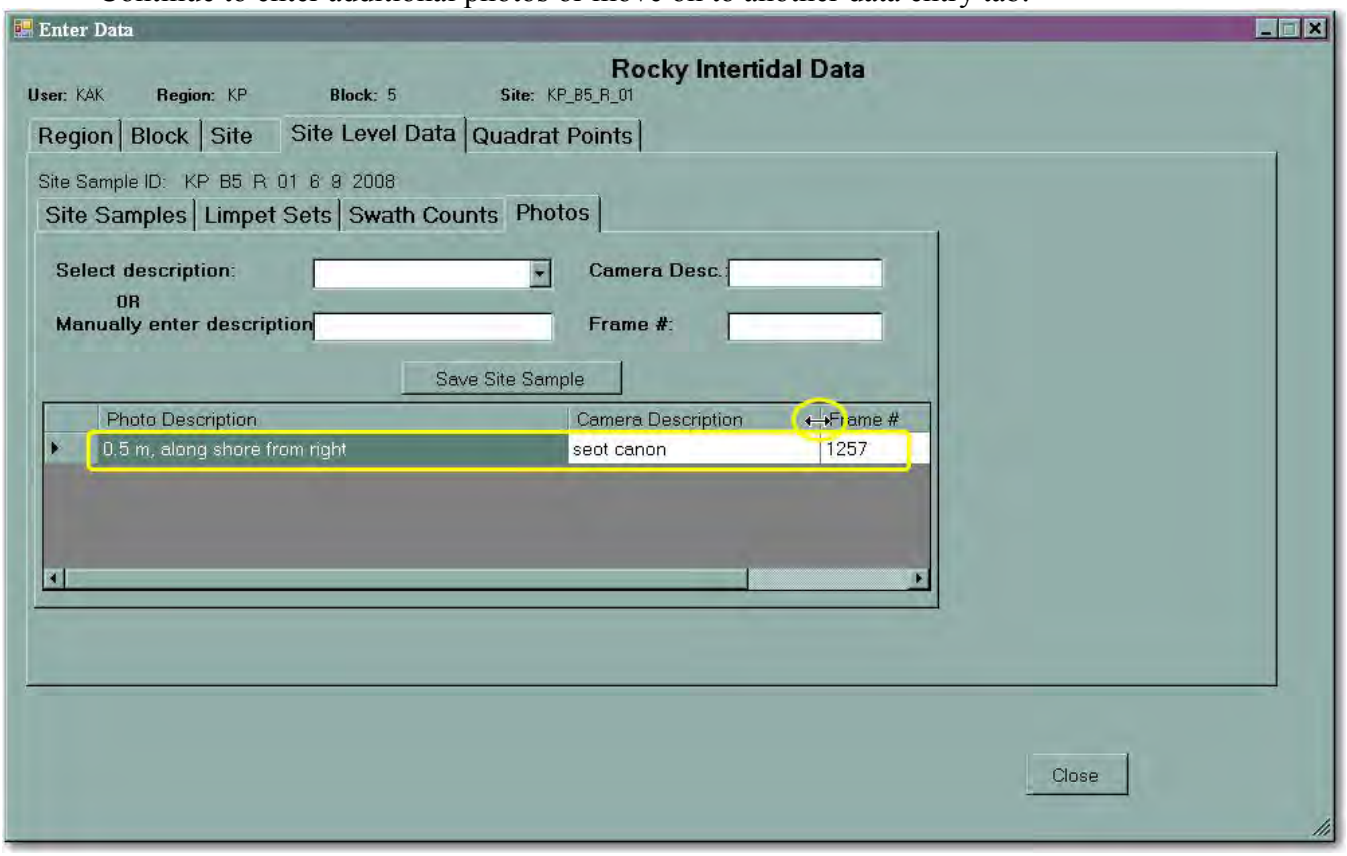
26. PhotosTab. Single click on the photos tab, then single click on the arrow next to the select description to find a standard description to choose, or enter your own photo description.



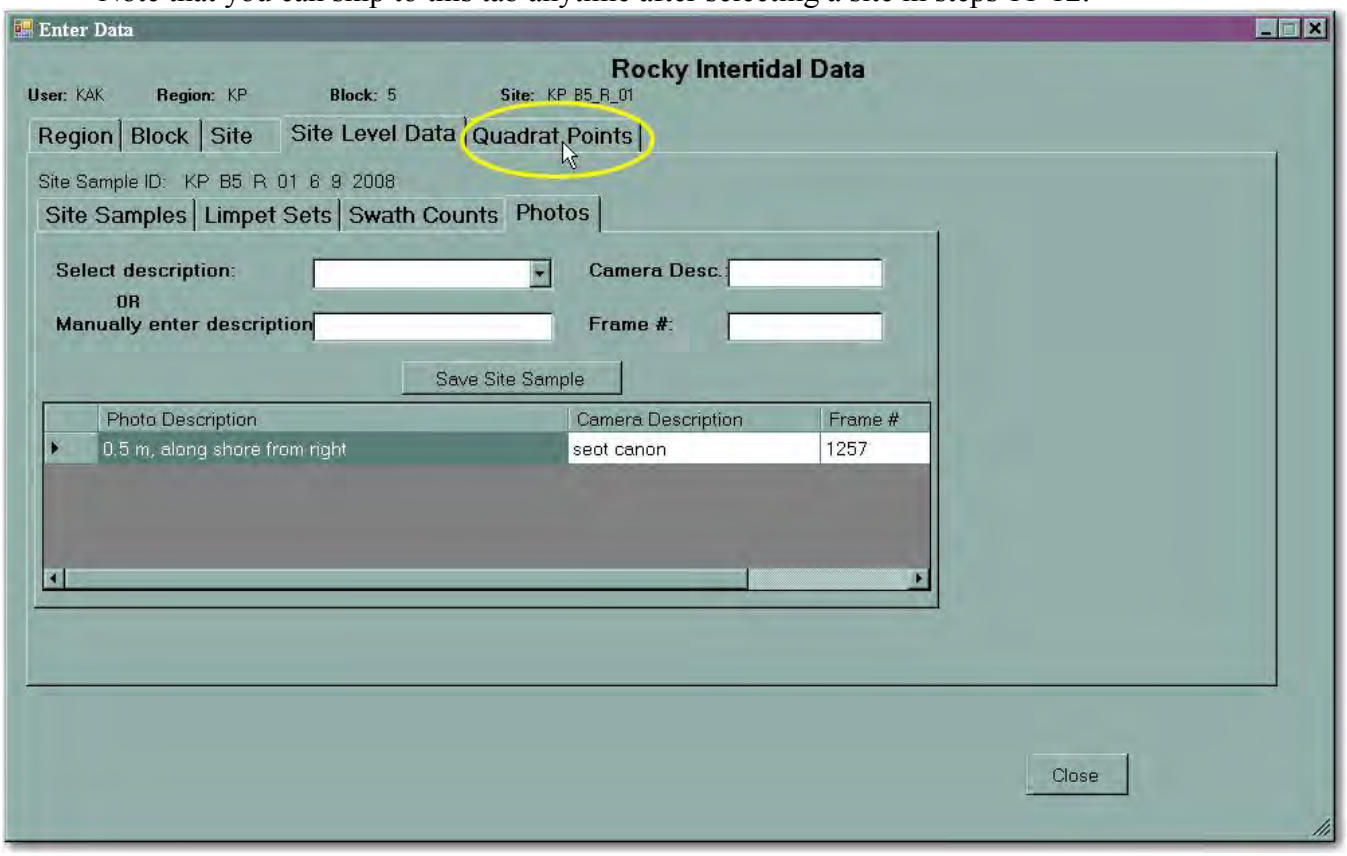
27. Type in a camera description and frame number. Examples of camera descriptions are: sea otter project canon = seot canon, sea otter project Nikon = seot Nikon, personal cameras = LastName_camera brand. After entering the photo information, single click the Save Site Sample Button and click OK on the Site Sample Photo confirmation button.



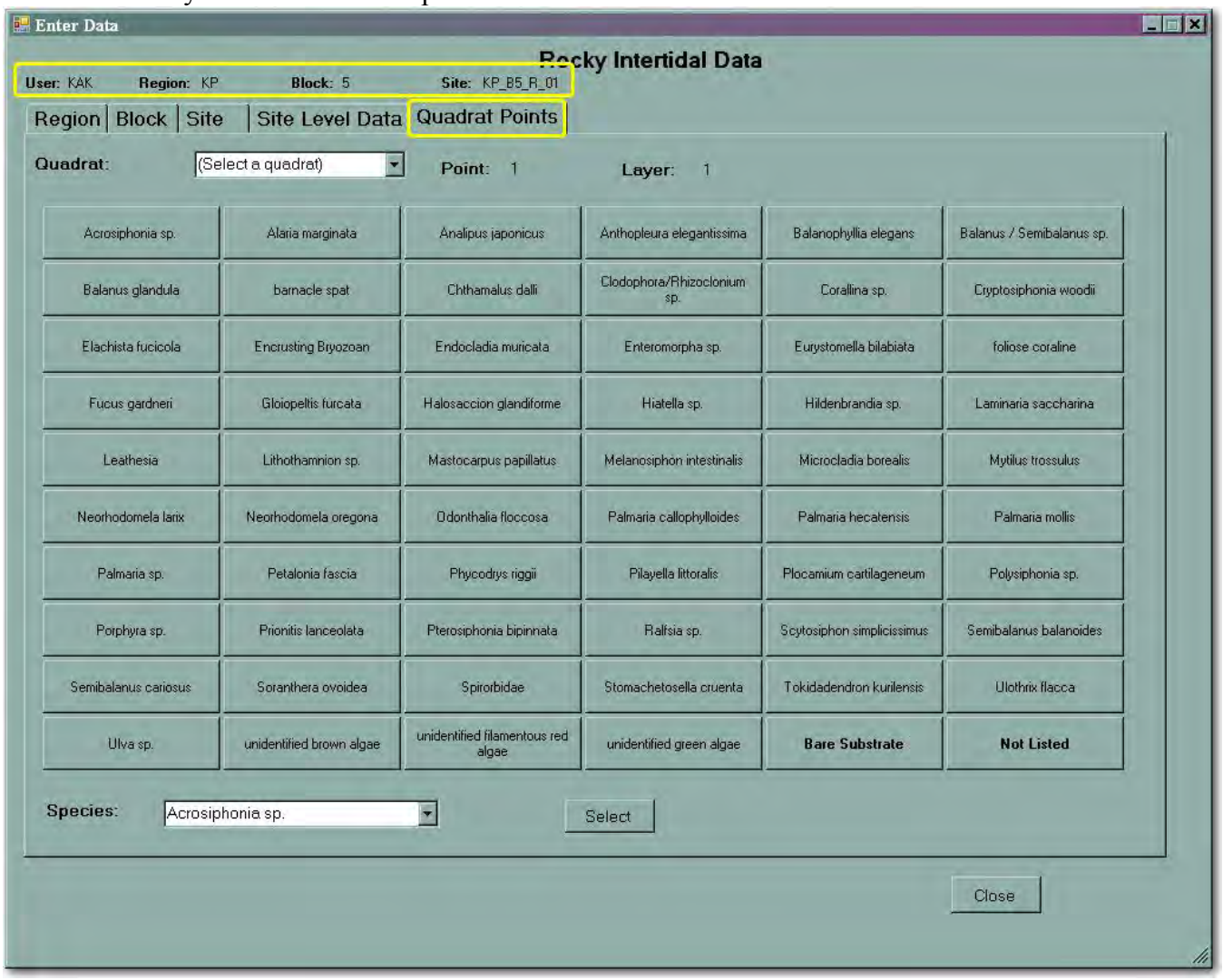
28. After confirming the photo entry, you'll see a summary of what has been entered. Continue to enter additional photos or move on to another data entry tab.



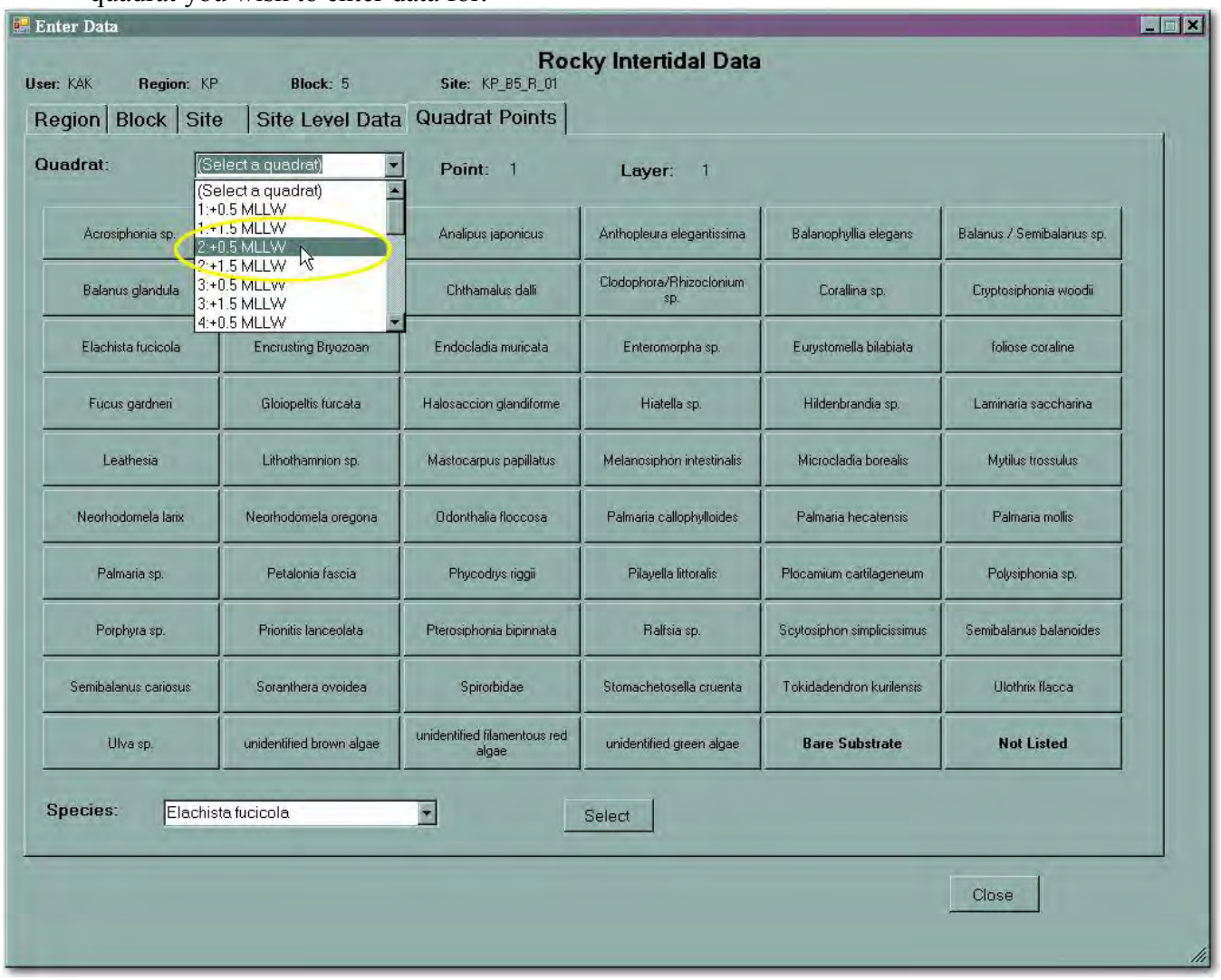
29. Quadrat Points Tab. Using the mouse or stylus, single click on the quadrat points tab. Note that you can skip to this tab anytime after selecting a site in steps 11-12.



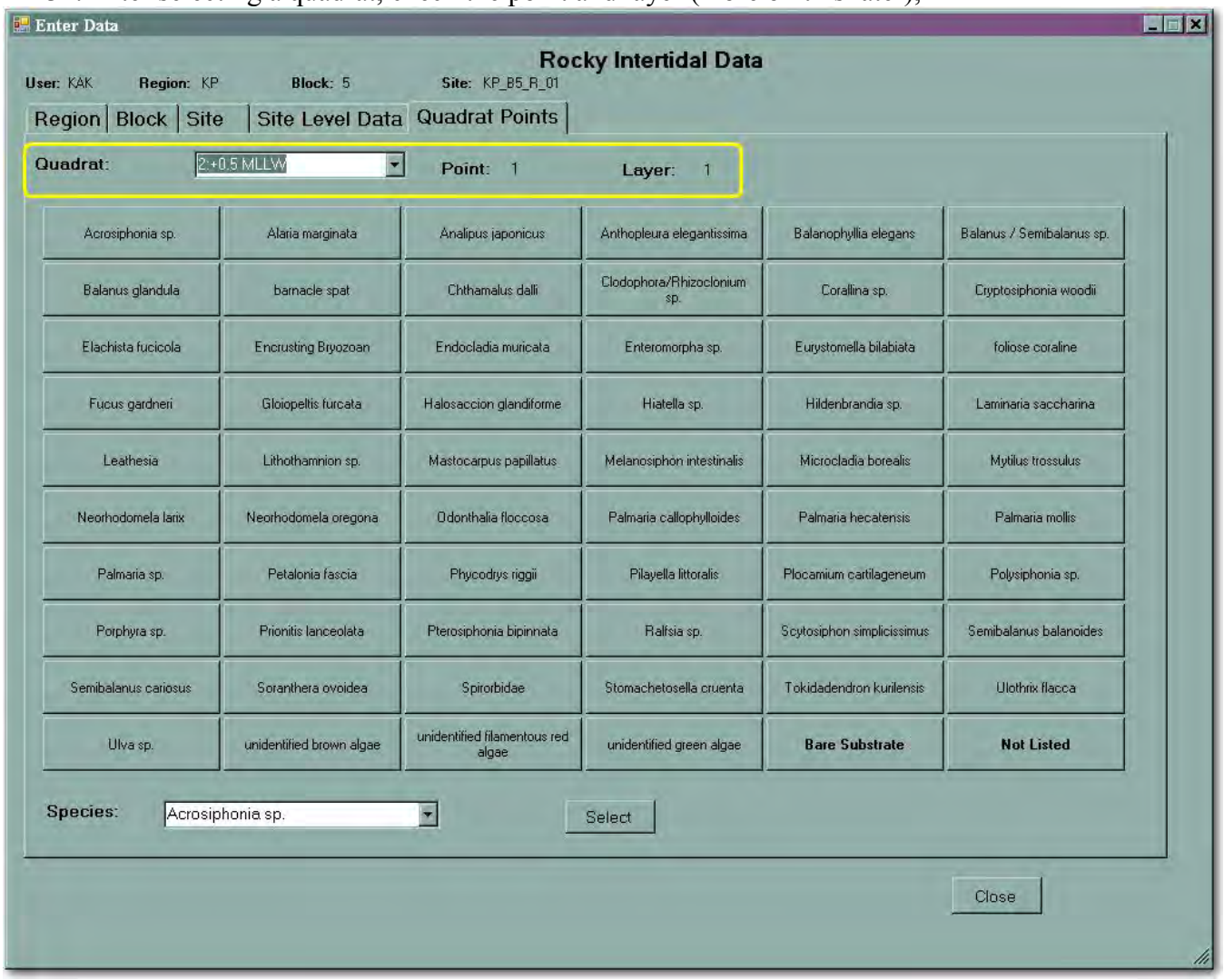
30. After selecting the quadrat points tab, the following data entry screen will appear. Note that you can still verify the data entry user, region, block, and site by checking the summary fields across the top of the form.



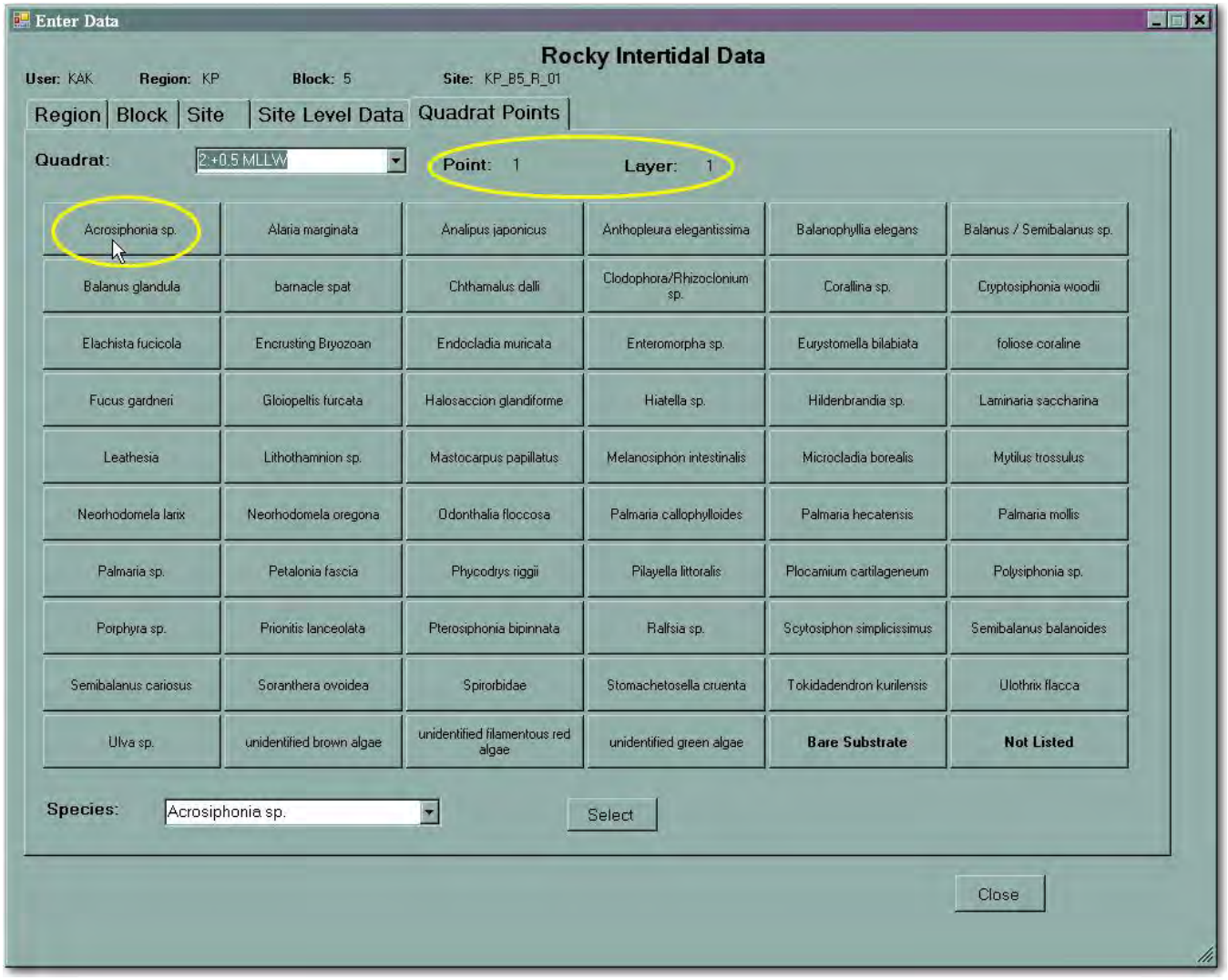
31. Using the stylus or mouse, single click on the quadrat drop-down list and select the quadrat you wish to enter data for.



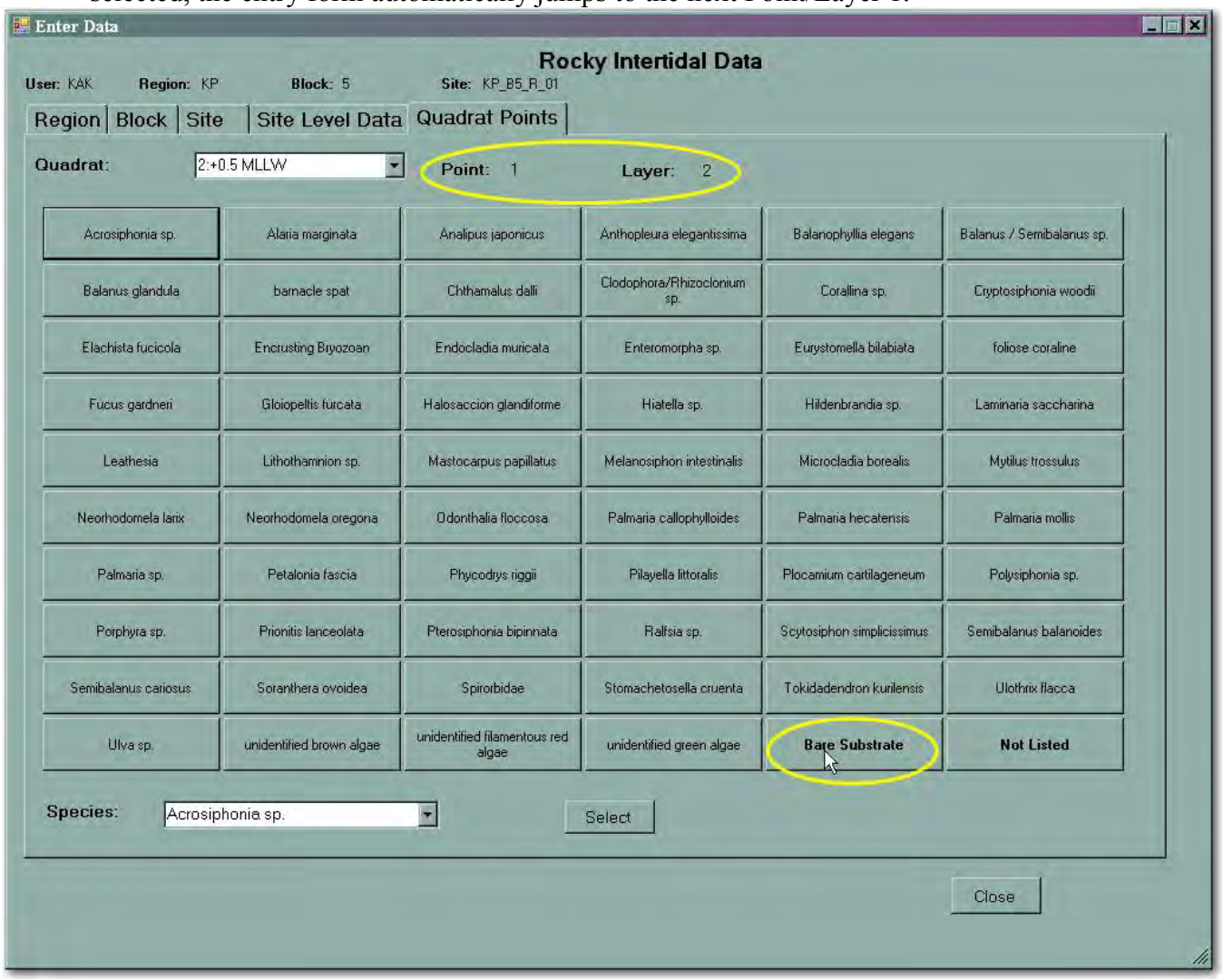
32. After selecting a quadrat, check the point and layer (more on this later),

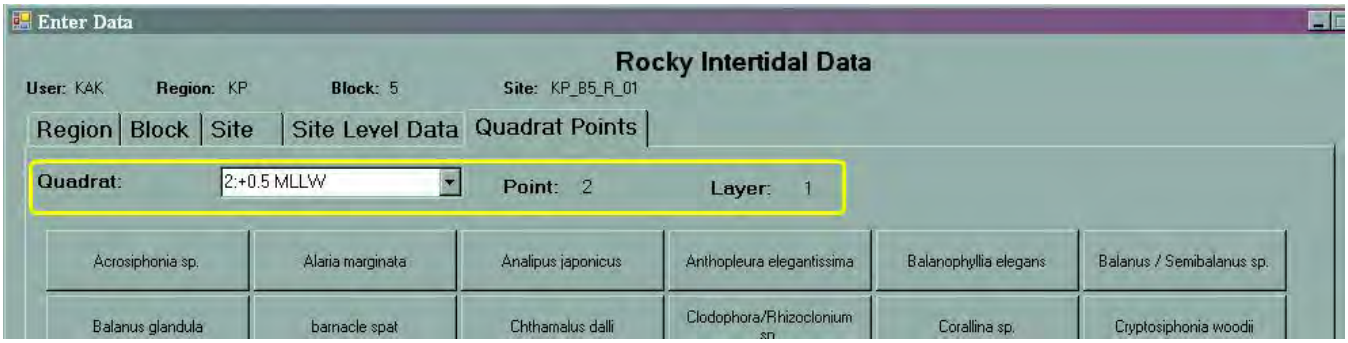


33. and begin entering point/layer data by single clicking on species buttons with the stylus (or mouse if you are so inclined). In the following illustrations, Quad 2, Lower (0.5 m tide height) has been selected. Acrosiphonia is being entered as Layer 1 for Point 1. After the Acrosiphonia button is actually clicked, the Point will remain 1, but the Layer field will increment to 2.

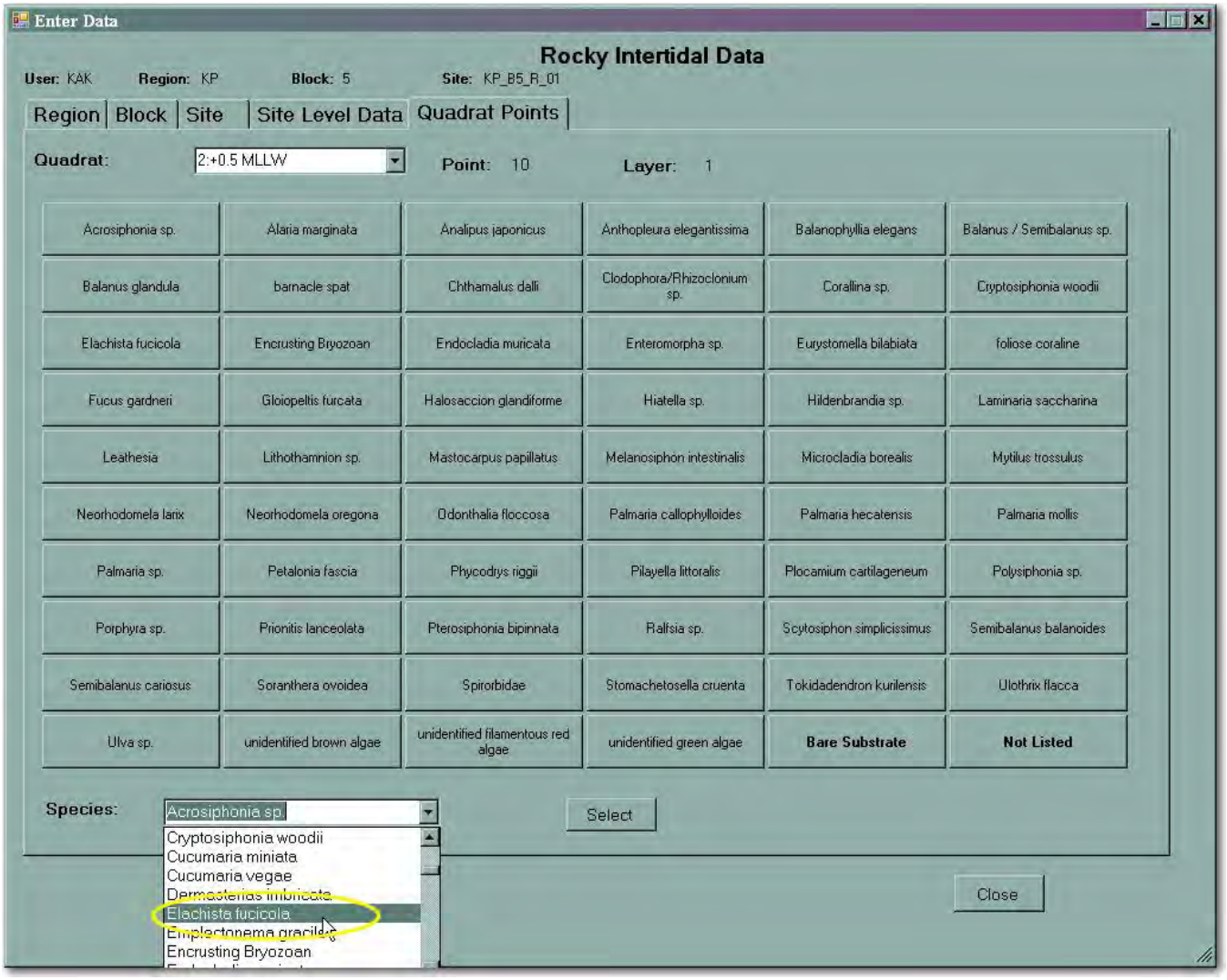


34. Now Bare Substrate is being selected as Layer 2 for Point 1. Once Bare Substrate is selected, the entry form automatically jumps to the next Point/Layer 1.

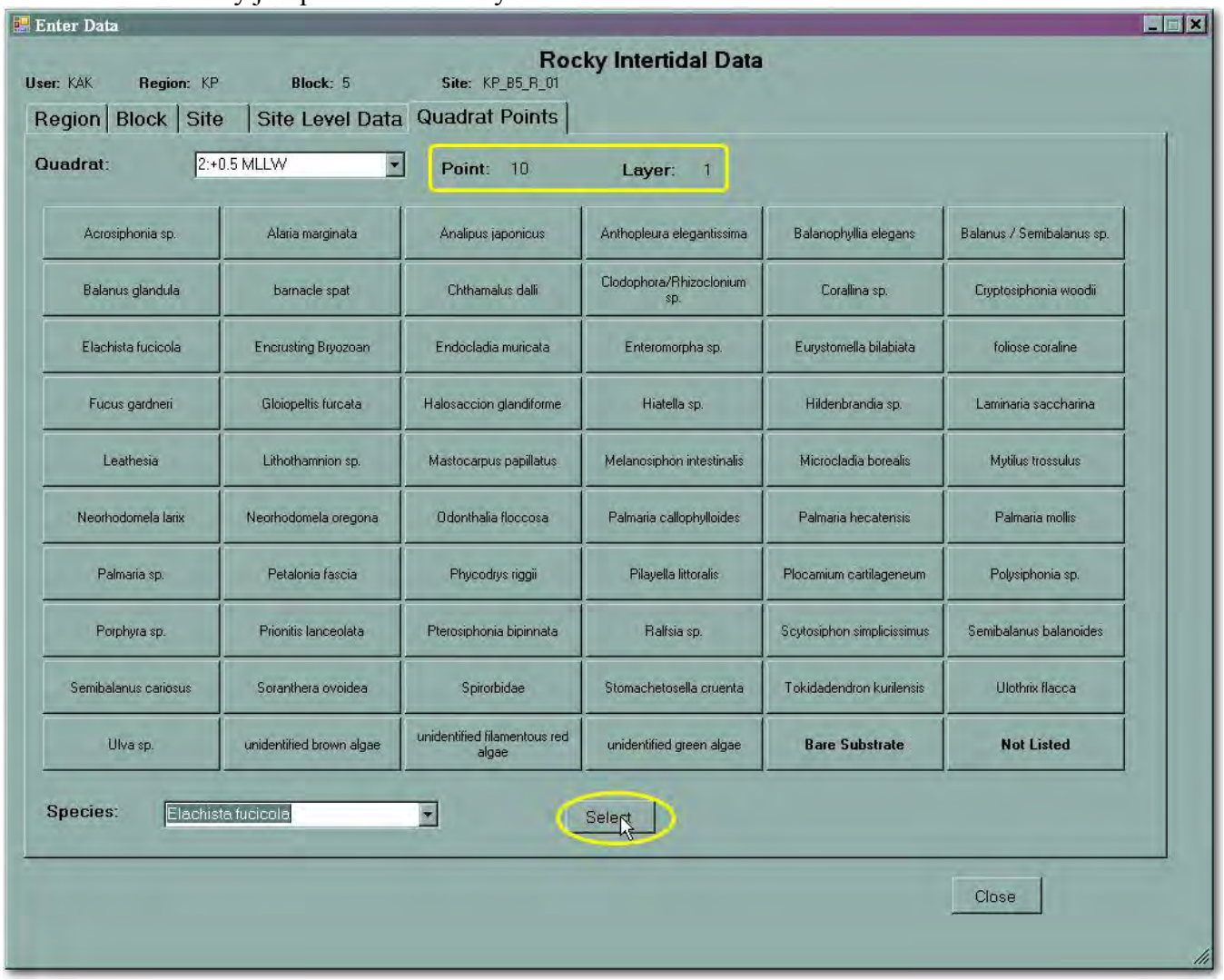


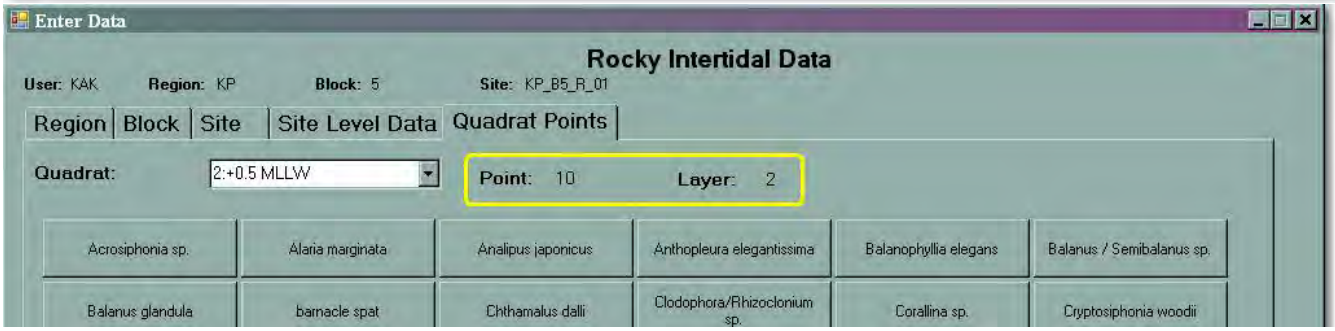


35. Continue entering Point/Layer data by single clicking on the buttons. If you're having difficulty finding a button you need, an alternate selection method is to use the drop-down list at the bottom of the screen. Using the mouse or stylus, select the species from the alphabetized list. In this illustration, we're using the list to enter data for Layer 1 of Point 10.

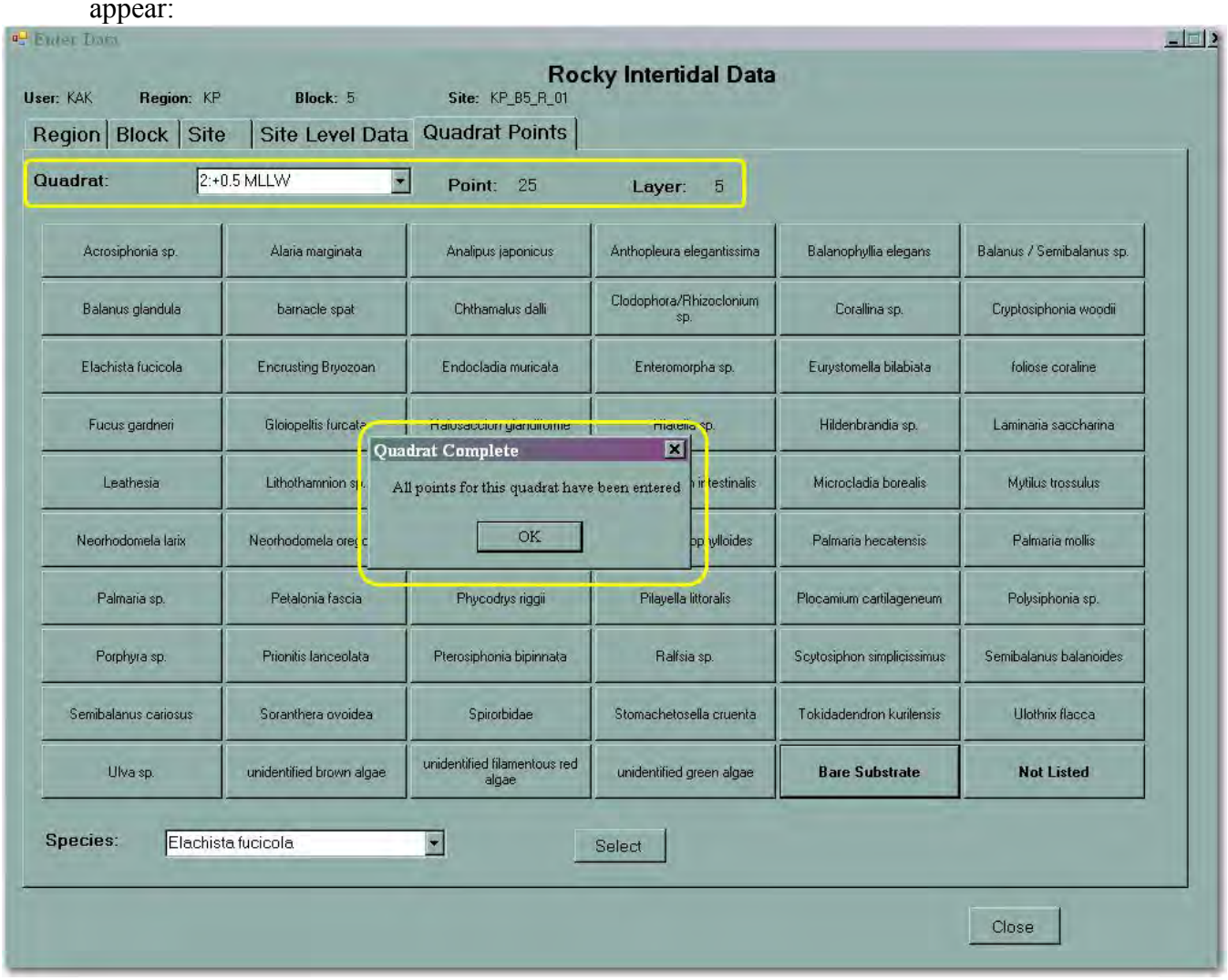


36. Once you've selected the species you wish to enter, single click on the select button to the right of the drop-down list. Once the select button is clicked, the entry form automatically jumps to the next Layer.

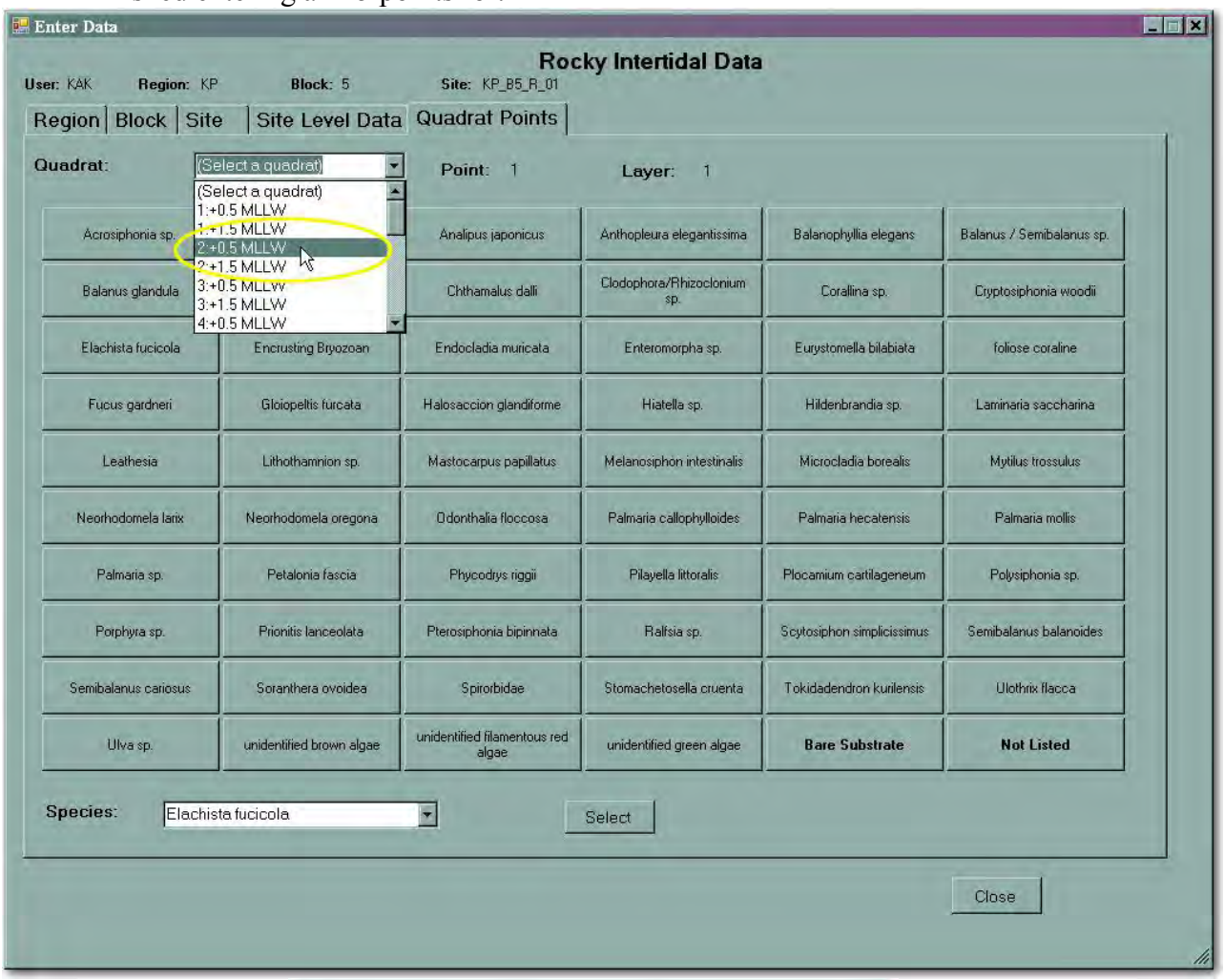


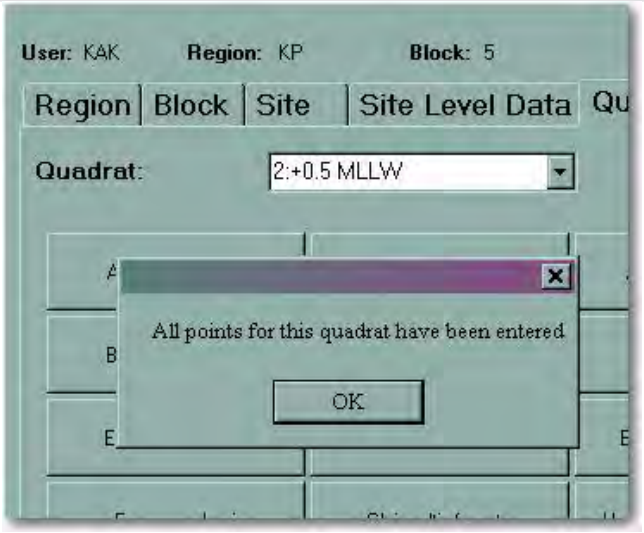


37. Continue entering Point/Layer data by single clicking on the buttons or using the drop-down list. Once you reach Point 25 and select Bare Substrate, the following message will appear:

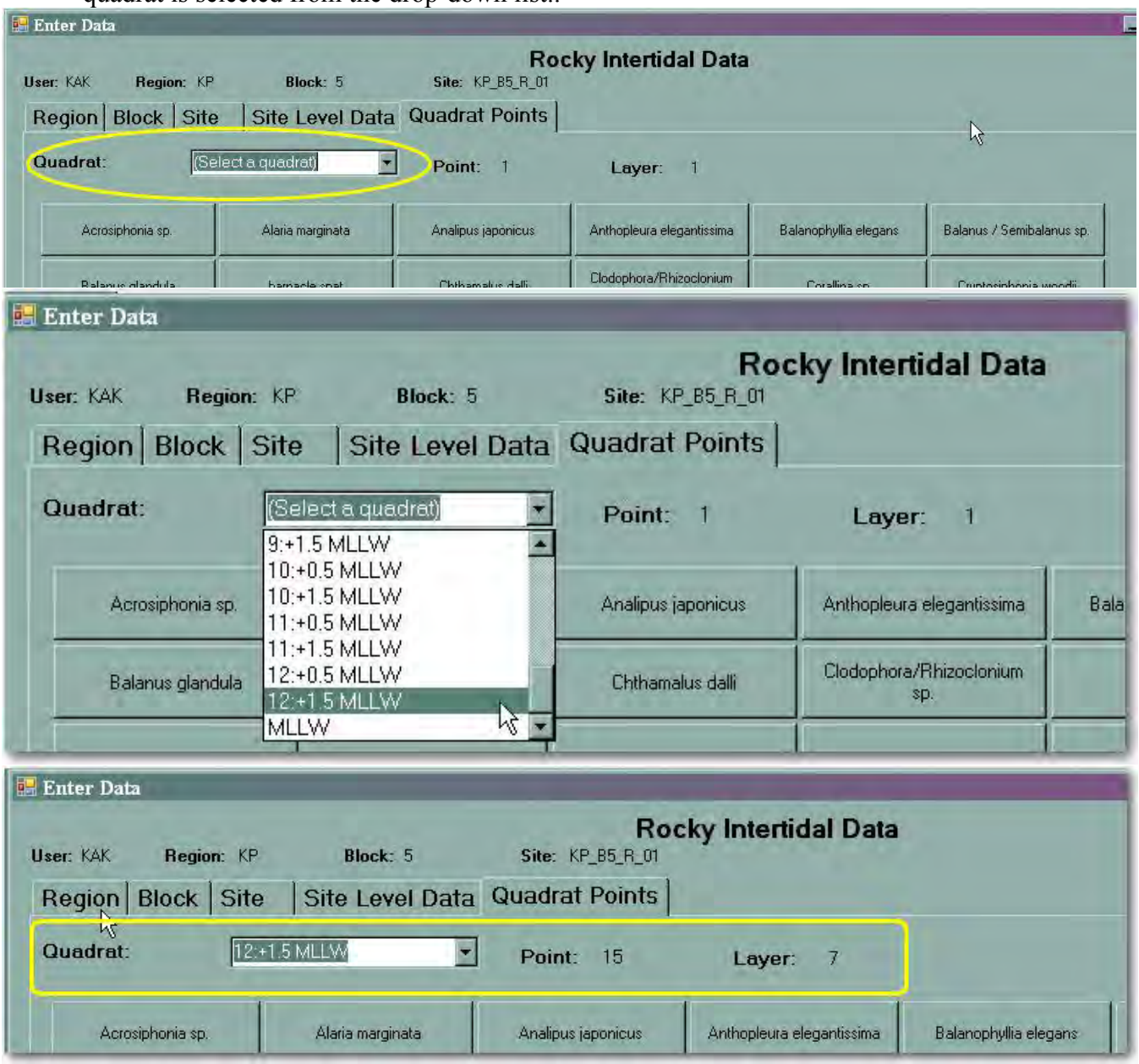


38. Repeat from step 32, entering quadrat point data for the site. When selecting a quadrat, if you choose one that has already been entered (on your field computer), you'll get a message stating so. In this illustration, we're choosing the same quadrat that we just finished entering all 25 points for.

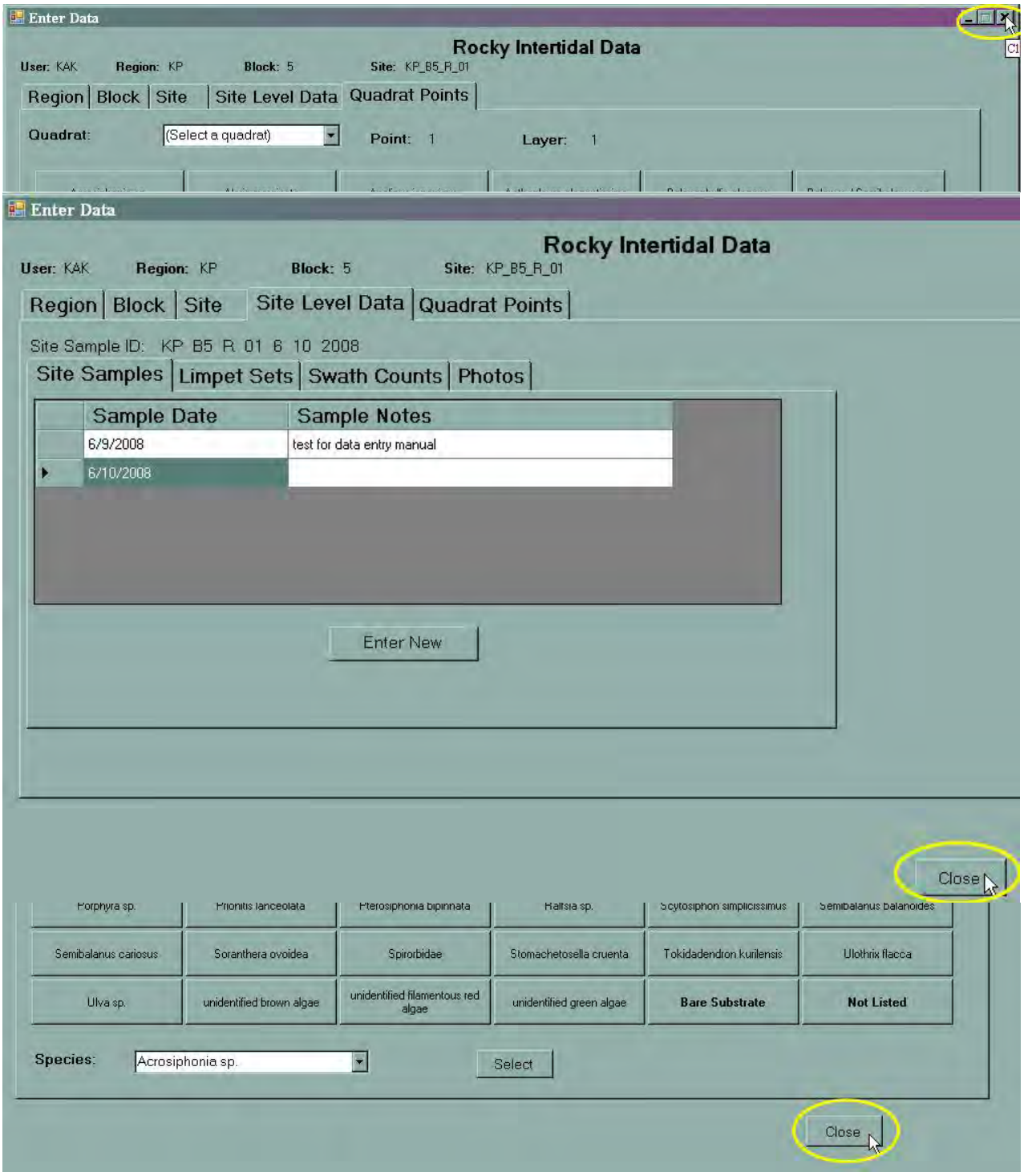




39. Repeat from step 32, entering quadrat point data for the site. When selecting a quadrat, if you choose one that has been partially entered (on your field computer), the Point & Layer summary fields will convey this. In this illustration, we're choosing a quadrat that had already had 15 points entered. Data entry can resume at Layer 1 of Point 16 once the quadrat is selected from the drop-down list..

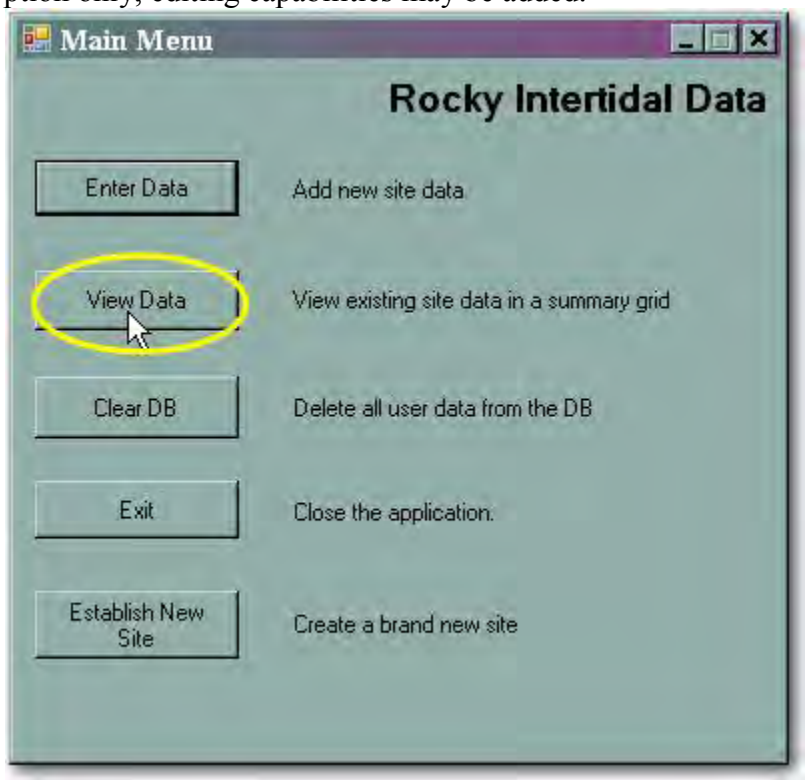


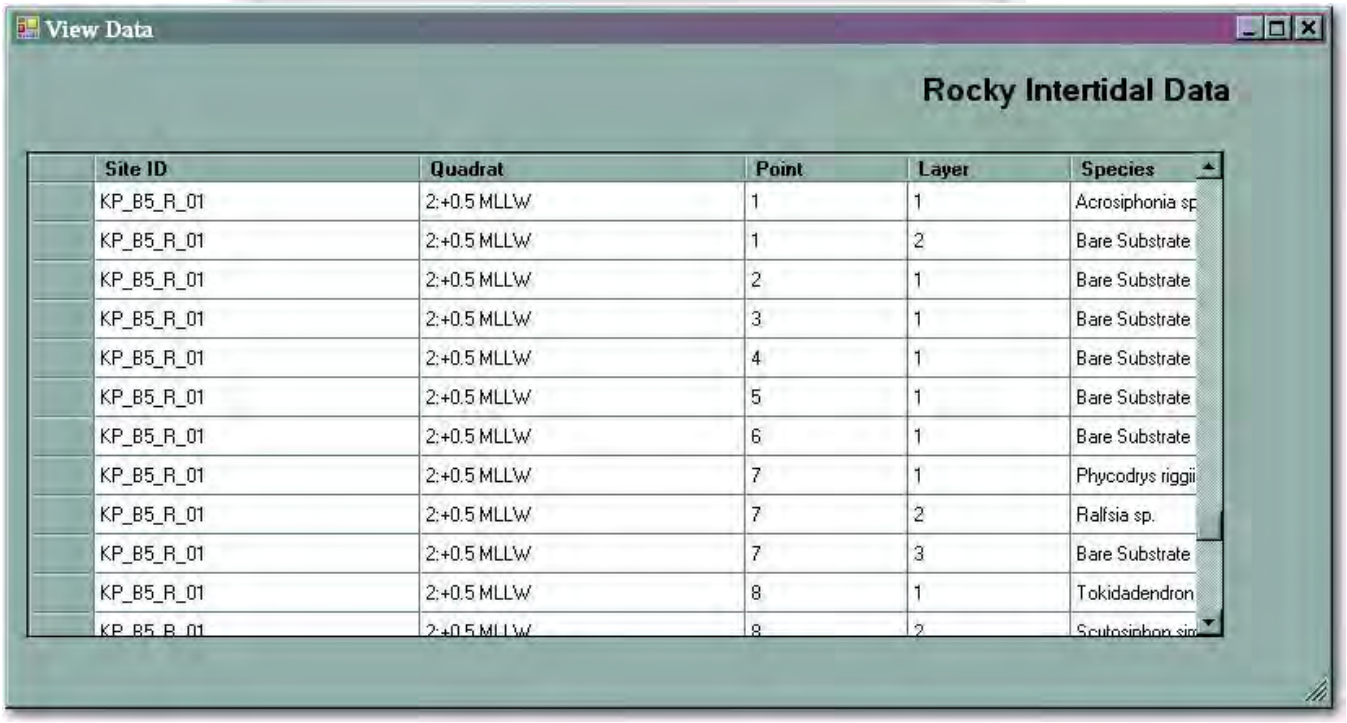
40. When you are finished entering data, single click on one of the close buttons or on the small —x button in the upper, right-hand corner of the entry screen.



41. Once you‘ve ended your data entry session, the main menu will reappear:

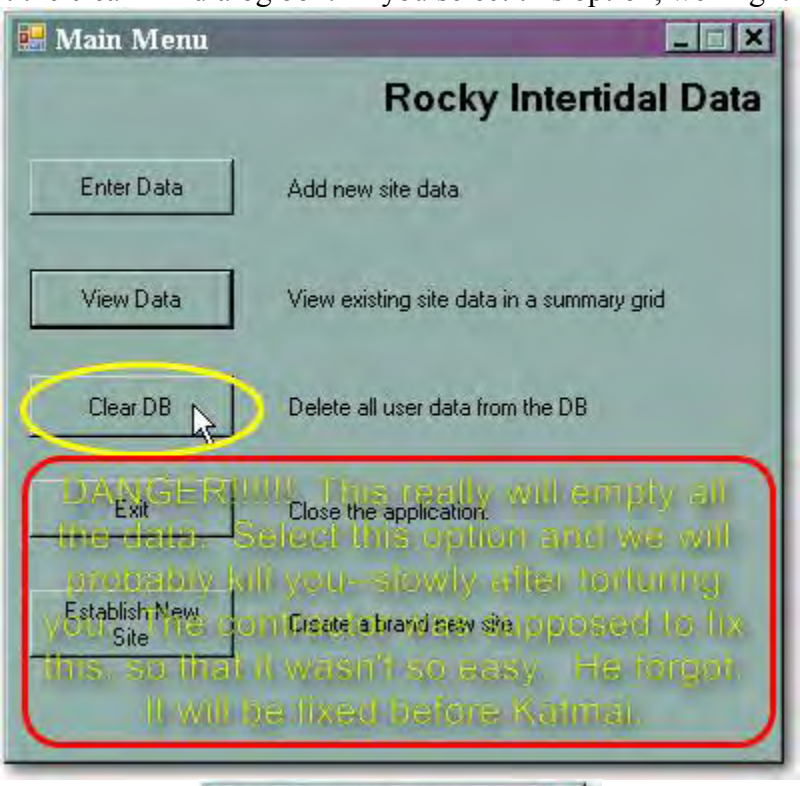
42. The View Data Button currently shows the quadrat point/layer data. For now it is a viewing option only, editing capabilities may be added.

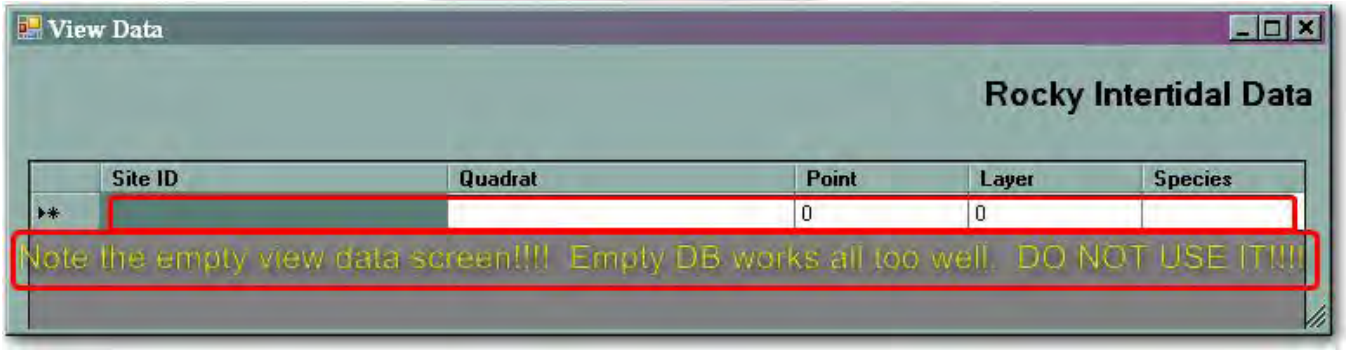




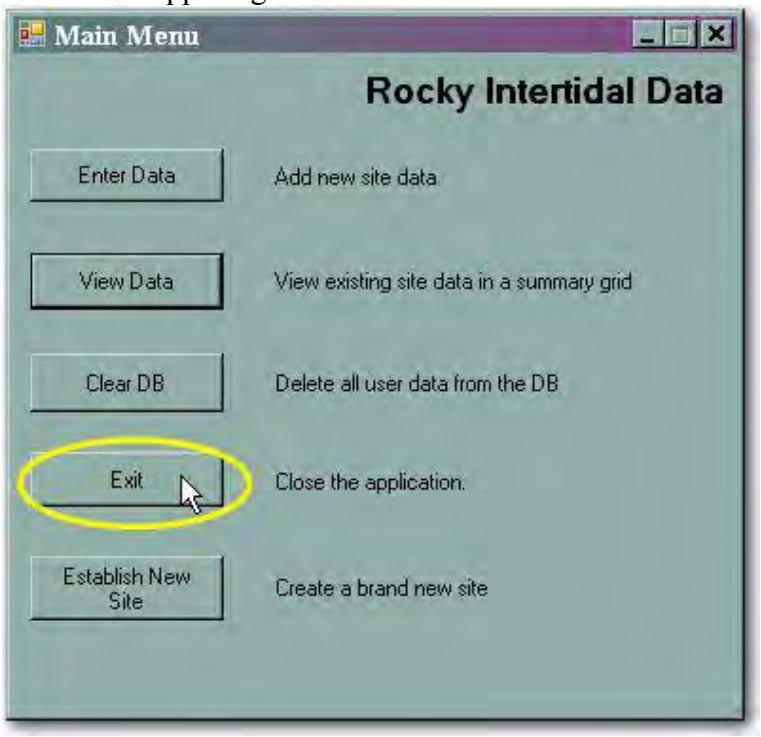
Site ID	Quadrat	Point	Layer	Species
KP_B5_R_01	2:+0.5 MLLW	1	1	Acrosiphonia sp
KP_B5_R_01	2:+0.5 MLLW	1	2	Bare Substrate
KP_B5_R_01	2:+0.5 MLLW	2	1	Bare Substrate
KP_B5_R_01	2:+0.5 MLLW	3	1	Bare Substrate
KP_B5_R_01	2:+0.5 MLLW	4	1	Bare Substrate
KP_B5_R_01	2:+0.5 MLLW	5	1	Bare Substrate
KP_B5_R_01	2:+0.5 MLLW	6	1	Bare Substrate
KP_B5_R_01	2:+0.5 MLLW	7	1	Phycodrys riggii
KP_B5_R_01	2:+0.5 MLLW	7	2	Ralfsia sp.
KP_B5_R_01	2:+0.5 MLLW	7	3	Bare Substrate
KP_B5_R_01	2:+0.5 MLLW	8	1	Tokidadendron
KP_B5_R_01	2:+0.5 MLLW	8	2	Scytosiphon sim

43. The Clear DB button was added to allow us to start each trip with a clean data entry DB. However, the contractor made it too easy to clear the data. This is a very dangerous button and really will clear all data from the DB. It was supposed to only be active for the DB manager and even then was supposed to have confirm/reject dialog boxes. Instead we have a button that really works, and only has a confirm clear DB dialog box—not a reject the clear DB dialog box. If you select this option, we might freak out on you.





44. Exit Button—Clicking this button will close the data entry menu. You can also click the small —x button in the upper right-hand corner.



45. Establish new site button. This button is to create an entire new site—e.g if additional sites are added. We'll be adding all the established sites in prior to each sampling trip. This button is to be used only if brand-new sites are being established on your trip.

2 WARNINGS and Other Main Menu Options

Lack of editing in data entry screens (for now)—keep notes where it would be useful.
Clear DB function on main menu.

Appendix E – Data Sheets

Initial Site Layout and Slope

Site number_____Site.name_____
Lat_____Long_____Date_____
Observers_____

Marker positions (decimal degrees, NAD83)

0Marker	Lat.	Long.
Supratidal A		
Supratidal B		
0.5 m		
1.5 m		

Distances between markers - Distances recorded in meters to the nearest 0.01 meters.

Supratidal A to 0.5 m	
Supratidal A to 1.5 m	
Supratidal B to 0.5 m	
Supratidal B to 1.5 m	

Slope determination - Distances between each one meter vertical rise in elevation.
Distances recorded in meters, to the nearest 0.01 meters.

Distance	MLLW to +1	+1 to +2	+2 to +3	+3 to +4

Site Diagram and distances of markers from start
0.5 m

1.5 m

Lottia

Site Information and Counts

Site Number_____Site Name_____
Observers_____Date_____
Hobo # in_____Hobo:# out_____Odi #in_____Odi #out_____
Photo number_____Camera_____
Quad distances

1	2	3	4	5	6	7	8	9	10	11	12

Transect counts of stars (4m x 100 m transect)

Species	Count	Species	Count

Lower 0.5 m

Counts of *Nucella* and *Katharina* (0.5 x 4 m)

	1	2	3	4	5	6	7	8	9	10	11	12
Nucella spp.												
Katharina												

Sessile species in quad that were not hit

1	**2**	**3**	**4**	**5**	**6**
7	**8**	**9**	**10**	**11**	**12**

Upper - 1.5 m

Counts of *Nucella* and *Katharina* (0.5 x 4 m)

	1	2	3	4	5	6	7	8	9	10	11	12
Nucella spp.												
Katharina												

Sessile species in quad that were not hit

1	**2**	**3**	**4**	**5**	**6**
7	**8**	**9**	**10**	**11**	**12**

Limpet sizes

1		2		3		4		5		6	

Radius for limpets

The Department of the Interior protects and manages the nation‘s natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 953/107701, May 2011

National Park Service
U.S. Department of the Interior

Natural Resource Program Center
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Fort Collins, CO 80525

www.nature.nps.gov

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