RED SEA URCHIN ASSESSMENT SURVEYS

DISTRICTS 101, 102, AND 104

2000

By

Kyle Hebert
and
Robert Larson

Regional Information Report[1] No. 1J01-07

Alaska Department of Fish and Game
Division of Commercial Fisheries
Juneau, Alaska

January 2001

[1] The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data, this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Division of Commercial Fisheries.

AUTHORS

Kyle Hebert is a fisheries biologist with the Alaska Department of Fish and Game, Region I, in the Petersburg office, 16 Sing Lee Alley, Petersburg, Alaska, 99833.

Robert Larson is a retired fisheries biologist formerly with the Alaska Department of Fish and Game, Region I, in the Petersburg office, 16 Sing Lee Alley, Petersburg, Alaska, 99833. He is currently employed by the U.S. Forest Service, Petersburg-Wrangell District, and stationed in Petersburg, Alaska.

ACKNOWLEDGEMENTS

This study was funded, in part, by grant NA96FN0195 from the National Oceanic and Atmospheric Administration (NOAA). The views expressed are those of the authors and do not necessarily reflect the views of NOAA or any of its sub-agencies. The Southeast Alaska Regional Dive Fisheries Association (SARDFA) also provided funds to expand surveys in selected areas.

We thank the ADF&G divers who helped us collect data: Scott Walker, William Bergmann, Brian Lynch, Tim Koeneman, Dave Gordon, John Clark, Marc Pritchett, Jan Rumble, and Ole Shelton. Thanks also to Denny Heimdahl and Bill Olsen for their skillful and safe operation of the state vessel *R/V Sundance.* John Clark provided biometric guidance on the sampling design and method of calculation. Doug Woodby reviewed the final version. Cori Cashen prepared the figures and provided overall editing and formatting of the final report. Finally, special thanks are due for the administrative support received from Jackie Tyson of the Alaska Department of Fish and Game.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

A population assessment survey was conducted in portions of commercial fishing Districts 101, 102, and 104 in Southeast Alaska to estimate red sea urchin biomass and size distribution in 2000. The survey was conducted by ADF&G divers during July and August 2000 in eight subdistricts that were subsequently opened to commercial fishing (101-29 experimental, 101-11, 101-21, 101-22, 101-23, 101-25, 102-80, and 104-30 experimental). Commercially available red urchin biomass estimated during this survey was 34.5 million kg (75.5 million pounds). Total red urchin biomass for all areas of Southeast Alaska opened to commercial fishing is estimated at 60.0 million kg (132.7 million pounds) with a 90% lower confidence bound of 38.0 million kg (83.9 million pounds). Subdistrict 104-20 was re-surveyed to improve density estimate precision, but biomass is not included in these totals. In addition, two control sites (101-27 and 104-30 control) were surveyed, but not opened to commercial harvest. Control site biomass (combined) is estimated at 3.3 million kg (7.2 million pounds). Subdistrict 113-22 was re-surveyed to observe and record evidence of near total elimination of the red sea urchin population by sea otters since last surveyed in 1997.

INTRODUCTION

Red sea urchin stock assessment surveys are usually completed by district once every three years. Typically annual district groupings have been 101, 102, and 103/104. However, this is not a rigid schedule and subdistricts from non-scheduled districts are often included in a year, particularly control or experimental areas, which require more intensive surveying. During 2000, red sea urchin assessment surveys focused on District 101. This was the third year, since red urchin assessment commenced in 1994, that surveys were concentrated in District 101. Additionally, experimental and control areas were surveyed in District 101 near Ketchikan, and District 104 near Craig (Figure 1).

Subdistricts 101-11, 101-21, 101-22, 101-23, 101-25, and 102-80 were previously surveyed in 1994 or 1995 and again in 1997. Subdistrict 113-22 was surveyed previously in 1997. By regulation, commercial red sea urchin fisheries in Southeast Alaska can only be conducted within three years of the latest biomass survey; hence, surveys were required in 2000 prior to allowing a commercial fishery in these areas during the 2000-2001 season.

Annual survey of experimental sites in Subdistricts 101-29 and 104-30 continued with the intention of further improving estimates of the biomass of red urchins along shorelines of Baker, Suemez, and Dall Islands in commercial fishing Subdistrict 104-30 and along the shoreline of West Gravina Island in 101-29. Subdistrict 101-29 has been previously surveyed in 1995, 1997, 1998, and 1999. Subdistrict 104-30 was surveyed in 1996, 1997 (Larson and Woodby 1997; Larson et al. 1998), 1998 (Hebert and Larson 1999), and 1999 (Hebert and Larson 2000) but prior to the survey in 1997 the subdistrict was divided into an experimental fishing portion and a fishery evaluation control area. Additional transect pairs were added to the experimental and control areas to improve the precision of biomass estimates. A second control area, comprised of Subdistrict 101-27, has been surveyed all years for the period 1997-2000. All experimental and control areas will continue to be surveyed annually to closely monitor population response to fishing pressure and environmental variability.

It is the policy of the Alaska Department of Fish and Game, Southeast Region, to provide for the development of new fisheries only when new funding sources are made available. This policy was adopted to prevent the reallocation of staff and other resources from established fisheries. Red urchin stock assessment and research conducted during 2000 was funded through nearshore fisheries grant money provided to ADF&G through the National Oceanic and Atmospheric Administration (NOAA). The Division of Commercial Fisheries received the federal nearshore fisheries grant to fund surveys and research on red and green urchins in Southeast Alaska for the period July 1, 1999 through June 30, 2002.

Significant geographic expansion of the red urchin fishery is not anticipated. Through observations made during surveys of other species, density of red urchins are low in subdistricts not currently in the rotation of assessment surveys, hence there were no new areas surveyed in 2000. The increasing geographic range and abundance of sea otters following their reintroduction in Southeast Alaska in the mid 1960s (Pitcher 1989) has dramatically reduced the extent of commercially viable populations of red sea urchins on the outer coast.

As part of an effort to expand the red sea urchin fishery as much as possible, the department has contracted with industry divers to conduct a red sea urchin reconnaissance survey to explore the extent of red sea urchins in deeper water than is currently surveyed in Subdistricts 101-21 and 101-22 (Duke Island and Bee Rocks). The department typically surveys to depths that are thought to support most of the red urchin population. However, with new information of urchins occurring deeper, surveys may be conducted to census a greater proportion of the population.

METHODS

The *R/V Sundance* was used as support vessel for all biomass assessment surveys in 2000. Surveys were conducted using six divers and two skiffs. Red urchin assessment of selected subdistricts were done concurrently with sea cucumber assessments.

Biomass Estimates

Urchin biomass was calculated as the product of estimated population size and the average mass of urchins for each subdistrict. The calculations began with estimates of urchin population densities made by scuba divers counting urchins on meter-wide transect pairs.

Shoreline Density Estimates

Shoreline transects were paired and the location of each transect pair was systematically distributed along the shoreline in each subdistrict (Figure 1). The distance between transect pairs was equal to the total shoreline length divided by the number of transect pairs in each subdistrict. The first transect pair in each subdistrict was located randomly in the first distance interval at one boundary of the subdistrict. All transect pair locations were marked on nautical charts for operational use during the surveys (Figures 1-13; latitudes and longitudes in Appendix 1). Transects within a pair were separated by 5 to 10 meters, with each diver on a team taking a census count of one of the paired transects while descending from shore. Transects extended from zero to 10 m depth (33 ft below mean lower low water, MLLW, corrected for tide height) 12.2 m (40 ft), 15.25 m (50 ft), or 17.1 m depth (56 ft) oriented perpendicular to shore. Reference dive depths were adjusted according to what depths red urchins commonly occurred in a particular geographic location (Table 1). Typically the vast majority of urchins occur above 10 m MLLW (ADF&G unpublished data), however significant numbers are observed deeper in exposed coastal areas (e.g. Subdistricts 101-11 and 104-30). Once a reference depth was established for a subdistrict, surveys were completed to that depth for all transects, where possible, in that subdistrict. Transect length varied depending on bottom slope. During past surveys, dives were limited to 10 meters below MLLW mainly for safety concerns, however if urchins were observed below 10 meters depth, then dive depths were increased to 15 m at the discretion of the divers. The adjustment in methodology in 1999 to systematic deeper surveys is an attempt to recognize that the red urchin population has naturally shifted to deeper water in areas exposed to direct ocean swell and surge.

Two divers swam parallel to one another on each transect pair, with each diver holding a meter rod (2.1 cm diameter white plastic pipe) in a horizontal position, perpendicular to the census path. Transect direction was maintained by reference to a compass mounted on the rod. Each diver counted the number of sea urchins seen under the rod, and wrote the count on the slate attached to the rod. Only urchins larger than 60mm were counted and urchins near this size class boundary were checked against a 60mm long mark on the plastic rod (Appendix 2). The beginning and ending times for each transect were recorded to allow for standardization of depths to MLLW. Divers also recorded data on substrate, vegetation, and the presence of other species of interest.

Average density, $\bar{d}$, was estimated in units of urchins per meter of shoreline length for each subdistrict:

$$\bar{d} = \left(\frac{\sum_{t}^{\Sigma c_i / m}}{n_t} \right) \tag{1}$$

where c is the count of sea urchins ≥ 60mm diameter on each transect i for i = 1 to m (m is at most 2 transects per pair), and n_t is equal to the number of transect pairs.

Shoreline lengths in each previously reported subdistrict (Table 2) (Hebert and Larson, 1999; Larson et al. 1998, Woodby et al. 1996, Woodby and Larson 1996, Larson and Woodby 1996) were measured with a hand-held map wheel, dividers on the largest scale nautical charts available (usually a scale of 1:40,000), or using ArcView GIS computer software using digitized NOAA Nautical Charts. Shoreline was measured as that shoreline of non-closed area which was deemed to be urchin habitat. Shoreline lengths for the research control area and experimental fishing area in 104-30 were measured as 43,874 m and 71,505 m, respectively.

Urchin Sizes and Weights

Average size of urchins was estimated for each area to convert densities to biomass. Urchins were collected from at least one sample depth chosen arbitrarily on each transect pair. Divers chose a location and collected all visible urchins surrounding the sample location until 30 urchins were obtained. In two subdistricts (101-11 and 101-29), pre-determined depths of 10, 20, 30, and 40 feet MLLW were used as target sample depths. A goal of 15 urchins per depth was used. The systematic use of sample depths was used to explore differences in size or size distribution by depth. When urchins were scarce, divers had to search for urchins outside of the chosen depth. Urchins were placed in mesh bags with a buoyed line extending to the surface. Bags were retrieved by the tender in the dive skiff.

Outside test (shell) diameters were measured to the nearest millimeter with calipers, excluding the spines (Appendix 3). If conditions permitted, urchins were measured immediately aboard the skiff and returned to the general area from which they were removed.

Average mass (g) was estimated from average test diameter (mm) for each area using the relationship

$$\text{mass} = 0.00124 \times \text{diameter}^{2.696} \tag{2}$$

Equation 2 was estimated from 113 urchins sampled from the test fishery in District 1 on December 20, 1995 using a log transformed regression (Woodby et al. 1996). The equation was applied to each urchin sampled for size.

The average mass (W_t) for each subdistrict was estimated as:

$$\overline{W_t} = \left(\frac{\sum_{j=i}^{\Sigma w_i / \Sigma o_i}}{n_j} \right) \tag{3}$$

Where w_i is the estimated weight (based on equation 2 above) of all urchins in sample *i,* o_i is the count of all urchins greater than 60mm in the sample, and n_j is the total number of weight samples taken in subdistrict j.

Population Size and Biomass

The population size of urchins ≥ 60mm diameter in each subdistrict was calculated as the product of average density (urchins per meter of shoreline) and the total available habitat (meters of urchin-compatible shoreline).

Total biomass (*b*) for each subdistrict was calculated as:

$$b_j = \bar{d}_j W_j l_t \tag{4}$$

were *l* is the length of shoreline in a subdistrict. The lower bound of the biomass estimate was calculated as the percent precision (Equation 5) times the biomass.

A sample goal of 15 to 25 transect pairs was established for each subdistrict. This sample size was expected to achieve 60 to 70% precision (defined in Equation) based on information from prior urchin surveys. This sampling goal is greater in experimental and control areas to increase the precision of the estimate. In non-control areas where precision from past surveys fell below the target, the number of transect pairs was increased to between 18 and 35. The certainty in the estimate of biomass is expressed as the percent precision in Table 2. The index is equal to the lower bound of the one-sided 90% confidence interval expressed as a percent of the average biomass:

$$\text{Percent precision} = 100\left(1 - t_\alpha \frac{SE}{\bar{b}_j \sqrt{n_j}}\right) \tag{5}$$

where *t* is the *t*-value from Student's distribution for a one-sided interval with significance level $\alpha = 10\%$, *SE* is the standard error of the biomass among *n* transect pairs (Table 2). The *t*-value is approximately 1.32 to 1.38 for the various subdistricts.

RESULTS AND DISCUSSION

The biomass estimate for commercial harvest areas surveyed in 2000 is 34,267 metric tons (38,074 short tons). The 90% lower bound estimate of biomass is 22,959 mt (25,510 st). Of the total biomass estimated for commercial areas, 17,746 metric tons were estimated for non-experimental District 1 areas and 8,126 mt were estimated for experimental (20% harvest rate) areas 101-29 and 104-30 experimental (Table 2). Control areas in 101-27 and 104-30 totaled 2,955 mt. Substantial changes in biomass have been observed for most commercially harvested subdistricts since last surveyed in 1997 (Table 2). Not including control areas, there was an overall net increase in total biomass of commercially harvested areas of 3,970 mt,

when 2000 and 1997 surveys are compared directly (i.e. using reference depths as used for quota determination). However, if adjustments are made to compare surveys completed using the same reference depth, then there was an overall net increase of 1,070 mt. Average densities across subdistricts, open to commercial harvest, ranged from less than 1 (113-22) to 504 (101-21) urchins per meter of shoreline for urchins 60mm test diameter or larger.

Total precision (a combination of density precision and weight precision) of the surveys ranged from 59 to 84%, discounting 113-22 which was zero due to lack of urchins found (Table 2). This result may be partially explained by patchy distribution of urchins, or variation in urchin weights sampled among transects. Weight precision accounted for a very small amount (less than 5%) of overall precision, in most instances. In Subdistrict 113-22 no urchins were sampled due to extremely low density, and weight precision was not calculated. This was the third year where variation in weight among transects was accounted for in biomass/quota calculations.

Recruitment and Size Distributions

Divers collected a total of 6,868 red sea urchins, among all surveyed subdistricts, to estimate average size and size distributions (Appendix 4). In general, the size distribution of urchins indicates the majority of the urchins are mature (>50mm) individuals (Figures 12-21b). Although partially a result of our inability to collect very small urchins (1-5mm), a small proportion of juvenile urchins (5-50mm) was usually observed in most areas. Most subdistricts had bimodal or amodal distributions of test diameters, depending on population size. Amodal distributions were most apparent in areas of low biomass, while bimodal distributions were observed in areas of large standing biomass. This may be partially due to an inability to detect modes in areas where low density of urchins prevented adequate sampling.

District 1

District 1 is characterized overall by a relatively large and stable biomass with light recruitment occurring in the past two years (Figures 12-16). Most subdistricts appear to have a large proportion of older or larger urchins with no obvious recent pulse of recruitment. Average size has increased in most areas since last surveyed in 1997 (Figures 12-16). This continues a trend of increasing average size in District 1 over the last four surveys (1994, 1995, 1997, and 2000).

Subdistrict 101-11 has a broad range of sizes and evidence of recruitment during the past two years (Figure 12). The size distribution is considerably different to that found in 1997 when there were low numbers of urchins in the 75-100mm size range. Since then it appears that urchins in the 55-75mm size range have grown and filled in the distribution. The average size has increased steadily since 1994, which is most likely due to growth and incorporation into the population of recruitment pulse which probably occurred in 1993. In this subdistrict, samples were taken at 10, 20, 30, and 40 foot MLLW to get a better understanding of size and recruitment by depth. There was a clear shift in the size distribution as depth increased (Figure 22). At 10 feet there was a near uniform distribution which gradually changed to a bimodal distribution at 40 feet, with modes at approximately 25mm and 100mm. It appears that medium

size urchins 45-70mm were more prevalent at shallower depths and higher numbers of small urchins (20-35mm) were at deeper depths. Also, larger urchins were observed with depth. This phenomenon could be evidence of large urchins providing a spine-canopy refuge for small urchins (Rogers-Bennett et al. 1995).

Subdistrict 101-21 has a fairly normal distribution with most urchins occurring between 50-150mm (Figure 13). There is little evidence of recent recruitment, however recruitment has appeared strong during previous surveys. Average size has increased steadily and substantially over the past three surveys, probably due to growth of urchins recruited into the population in 1994 and 1996.

Subdistrict 101-22 has a narrow range of urchin sizes, most occurring between 60mm and 135mm (Figure 14). Very few urchins less than 50mm appeared in the size distribution, suggesting no recruitment in the past two or three years. During the 1997 survey, only very light recruitment was revealed. However, surveys during 1994 and 1995 evidenced strong recruitment, probably due to a settling event in 1993.

Subdistrict 101-23 urchins are distributed somewhat evenly over a broad range of size classes, which lacks a strong modal point (Figure 15). Little evidence of recruitment has been noted over the past three surveys. This is the only area in District 1 where average size has decreased since last surveyed in 1997. A new size range of urchins (65-95mm) appeared in the 2000 samples that was not detected during the 1997 survey. These urchins are several years old and make up a substantial part of the population, but for unknown reasons were not seen as a strong recruitment pulse during previous surveys.

Subdistrict 101-25 has exhibited low but consistent recruitment over three surveys (Figure 16). The population appears to be stable with steady growth and aging of the population. The average size has increased since each survey, probably due to growth of larger urchins as opposed to incorporation of recent recruitment pulses.

District 2

Subdistrict 102-80 was the only area in District 2 surveyed in 2000. This area is surveyed out of rotation and instead surveyed concurrently with sea cucumbers for convenience. The size distribution of urchins appears healthy, however the average size has decreased from 107mm to 88mm since last surveyed in 1997 (Figure 17). Recruitment appears to be moderate to strong and decrease in average size is probably due to incorporation of newly recruited urchins.

District 113

Subdistrict 113-22 was the only area in District 113 surveyed in 2000. This area, which was a reasonably healthy population when surveyed in 1997, was found to be nearly devoid of red urchins. The area held much evidence of sea otter predation, including broken urchin tests and clam shells. Other nearby subdistricts were not surveyed and it is expected the red sea urchin populations there have also been removed by sea otters.

Control and Experimental Areas

Size distributions in District 4 control and experimental areas (104-30 control and 104-30 experimental) are similar with a broad range of sizes and strong recruitment in the past two years. The average size of urchins in Subdistrict 104-30 control was very similar in 1998, 1999, and 2000 (between 90mm and

91mm) and recruitment remains strong. The average size in Subdistrict 104-30 experimental has remained stable, but decreased from 86mm to 81mm over the past year, due to strong representation in the 15-70mm size range. In both areas there has been little change in population structure between surveys (Figures 18a-19b). Although for the past three seasons quotas have been based on experimental harvest rates of 20% in 104-30 experimental, the actual harvest rate has varied around this level. During the 1996-97, 1997-98, 1998-99, and 1999-00 seasons the harvest rates in 104-30 experimental have been approximately 26%, 6%, 17%, and 16% respectively. These harvest rates have not had a detectable negative impact on size or size distribution of urchins in this area. The size range in 104-30 experimental is one of the broadest in Southeast Alaska and recruitment remains consistently strong.

Control and experimental areas in District 1 (101-27 and 101-29, respectively) have also been stable for three years of surveys (Figures 20a-21b). Distributions for both areas are approximately normal with clear modes. Average size has remained stable over four years of surveys, however, recruitment has been very light in all years. Unlike 104-30 experimental area, 101-29 has not been harvested at an elevated level. Actual harvest has been below 3% for the past two seasons.

Urchins samples were also recorded by depth (10, 20, 30, and 40 feet) in Subdistrict 101-29 to observe differences in size and recruitment. There does not seem to be any relationship between size distribution and depth (Figure 22). More of this type of sampling needs to be done in other Subdistricts to get a better understanding of the effects of depth on urchin populations.

Urchin Density, Population Size, and Biomass

Estimates of biomass are compared to estimates from the previous survey (1997) without accounting for changes in methodology between surveys (Tables 2a and 2b). In addition, the percent change in biomass is reported after accounting for methodology changes. Both comparisons provide useful information. Comparison without adjustments for method changes provides information about how the resource available to the fishery has changed, whereas adjusted comparisons are useful for monitoring health of population. Adjustments include calculating biomass using the depths and shoreline used for the previous survey.

District 1

Comparing 2000 and 1997 estimates of biomass in areas open to 6% commercial harvest without adjusting for different methods indicates four areas (101-11, 101-21 shore, 101-23, and 101-25) increased (Tables 2a and 2b). Subdistrict 101-21 is divided into “shore” and “reef” segments because of different survey methods. The shore segment is surveyed with 1-meter rod to standard depths across shoreline, whereas the offshore reef complex is surveyed on a meter-squared and area basis due to the lack of shoreline. Two areas (101-21 reef and 101-22) decreased.

Comparing biomass after adjusting for depth differences indicates that three areas open to commercial harvest (101-21 shore, 101-23, and 101-25) increased. 101-11, 101-21 reef and 101-22 decreased. Two of the areas where decreases occurred (101-21 reef and 101-22) were located on offshore reefs systems. These reefs are in close proximity to each other and probably share identical environmental conditions. The two areas are also regularly harvested near the 6% annual limit. It is difficult to determine if a

common cause exists for the decline on these reefs or if is coincidence. In Subdistrict 101-21 reef, urchin density and average weight dropped slightly (2.9 to 2.8 urchins/m shore and 0.638 to 0.634 pounds, respectively) since 1997, however sampling error alone may account for such small changes. A larger density decline occurred in Subdistrict 101-22 (2.3 to 1.6 urchins/m shore), but average weight increased slightly from 0.63 pounds to 0.67 pounds. The substantially reduced density here probably accounts for the large decline in biomass since 1997. In areas where biomass increased (101-21 shore, 101-23 and 101-25), urchin density was also responsible for most of the change since 1997 (Tables 2a, 2b).

Estimates of area based density (urchins/m^2) were made in Subdistricts 101-11 and 101-29. Divers stopped at 10, 20, 30, and 40 ft MLLW, randomly placed a 1-m^2 frame and counted all urchins within the frame. This was done to obtain better estimates of density by depth strata and estimates of density for comparisons to other studies. We found that density within frames was usually low with many zero data entries because of patchiness of urchins. In Subdistrict 101-11 there was no strong trend in density by depth. Highest density was observed at 20 feet (Figure 23). A consistent trend was observed in Subdistrict 101-29, where density was highest at 10 feet and steadily decreased with depth. We did expect wide variation in density by depth among subdistricts. Areas exposed to ocean surge typically have lower densities in shallow depths because urchins are shifted below the heaviest surge zone, which can be to 20 feet.

Other Subdistricts

In Subdistrict 113-22 the red urchin population has collapsed. The density declined from 130.9 urchins/m shore to 0.7 urchins/m shore since 1997. A large number of broken urchin tests and clam shells were observed, suggesting heavy predation by sea otters.

In Subdistrict 102-80 there was a large decline in biomass, largely due to a reduction in density. No evidence of otters was observed.

Subdistrict 104-20 was surveyed in 1999 (Hebert and Larson 2000) but re-surveyed in April 2000 because of low precision of the density estimate (40%). The target for overall precision is to be within 70% of the mean estimate. After re-surveying, precision increased to 63%, which resulted in an additional 495,000 pounds of quota. Some of the increase in quota was due to a higher density estimate after the 2000 survey in addition to the higher precision (Table 2b).

Control and Experimental Areas

The biomass estimate for Subdistrict 101-29 was 178 mt higher than in the prior survey made in 1999. This represents a 9% increase in biomass. However, survey depth in this subdistrict was to 50 feet MLLW whereas in 1999 survey depth was 33 feet MLLW. When comparing only 33 foot survey depths, the biomass decreased 236 mt or a change of –11%. The reason for the decrease in Subdistrict 101-29 was due to significant declines in average density and average size. There was a small recruitment pulse evident from sampling, which may have caused the reduction in average size. Urchin biomass in Subdistrict 101-27 control area increased 54 mt (9%). The increase in 101-27 suggests favorable environmental conditions in the area of Gravina Island, but nevertheless the population in 101-29 decreased. The harvest rate in 101-29 was very low (0.8%) during the 1999-00 season, but harvest combined with sampling error could account for the moderate population decline that was observed.

Biomass in the experimental section of 104-30 increased substantially since 1999 when compared using actual survey depths (+52%) or accounting for differences (+35%). This is primarily due to a large increase in density from 161 urchins/m^2 to 268 urchins/m shore in 2000. Unlike the experimental area in 101-29, the harvest was relatively heavy (16% harvest rate) in 104-30 experimental and 80% of the quota was taken during the 1999-00 season. Urchin biomass has decreased substantially (-23%) in the 104-30 control area since last surveyed in 1999. Although density has remained the same, average size decreased from 0.96 pounds to 0.74 pounds, which accounted for the large decrease in biomass. Few urchins larger than 130mm were observed in 2000, where in 1999 a significant portion of the population was made up of large urchins.

LITERATURE CITED

Hebert, K. and R. Larson. 2000. Red sea urchin assessment surveys in Districts 101, 103, and 104, July 1999. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report Number IJ00-22, Douglas

Hebert, K. and R. Larson. 1999. Red sea urchin assessment surveys in Districts 101, 102, and 104, July 1998. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report Number IJ99-27, Douglas

Larson, R. and D. Woodby. 1996. Red sea urchin assessment surveys in District 103 and 104, July 1996. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report Number IJ96-21, Douglas.

Larson, R. L., D. Woodby, and J. Rumble. 1998. Red sea urchin assessment surveys in Districts 101, 102, 104, and 113, 1997. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report Number 1J98-13, Douglas.

Pitcher, K. W. 1989. Studies of southeastern Alaskan sea otter populations: distribution, abundance, structure, range expansion, and potential conflicts with shell fisheries. U.S. Fish and Wildlife Service Cooperative Agreement No. 14-16-0009-954. Alaska Department of Fish and Game, Anchorage.

Rogers-Bennett, L., W. A. Bennett, H. C. Fastenau, and C. M Dewees. 1995. Spatial variation in red sea urchin reproduction and morphology: implications for harvest refugia. Ecological Applications, 5(4), pp. 1171-1180.

Woodby, D. and R. Larson. 1996. Red sea urchin assessment surveys in District 102, August 1995. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report Number 1J96-23, Douglas.

Woodby, D, R. Larson, and T. Minicucci. 1996. Red sea urchin assessment surveys in District 101, August 1994 to May 1995. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report Number 1J96-20, Douglas.

Table 1. Southeast Alaska red sea urchin survey reference depths (MLLW) to which surveys were conducted in Districts 1, 2, and 4 during 2000.

Subdistrict	Reference depth (ft)	Reference depth (m)
101-11	50	15.25
101-21 reef	33	10
101-21 shore	56	17.1
101-22	33	10
101-23	56	17.1
101-25	50	15.25
102-80	33	10
113-22	33	17.1
101-27	33	10
101-29	50	15.25
104-30 control	33	10
104-30 experimental	50	15.25

Table 2a. Population size and biomass estimates of red urchins from management units (subdistricts) and two control areas (101-27 and 104-30 con.) in Districts 101, 102, and 104, Southeast Alaska, 2000.

Subdistrict	101-11	101-21 shore	101-21 reef	101-22	101-23	101-25	102-80	113-22
transects	31	35	19	20	21	26	14	20
count of urchins >59mm	989	970	509	534	366	563	377	0
average density (urchins>59mm)	107.8	504.3	2.8	1.6	79.0	97.5	44.3	0.7
standard deviation	128.3	840.4	2.3	0.7	103.3	135.5	35.6	1.1
percent precision[a]	70.6	62.5	79.3	84.3	59.7	63.0	68.8	0
shoreline length (m)	61,764	45,522	3,401,780	4,092,612	106,120	65,561	43,522	40,560
proportion urchins>59mm	0.906	0.944	0.960	0.964	0.929	0.956	0.862	0.000
average mass/count>59mm (lb)[b]	0.901	0.864	0.634	0.665	0.900	0.979	0.662	0.000
average biomass (lb/m)[c]	97.12	435.86	1.75	1.04	71.0	95.4	29.3	0.0
population size (urchins>59mm)	6,660,550	22,956,875	9,399,655	6,390,771	8,380,953	6,393,458	1,928,957	26,364
population size (all urchins)[d]	7,351,879	24,305,887	9,787,460	6,626,547	9,021,850	6,690,552	2,237,590	
biomass (lb)[e]	5,998,791	19,841,425	5,958,550	4,249,933	7,539,159	6,256,255	1,276,104	0
lower bound [f]	4,236,777	12,401,674	4,725,249	3,582,620	4,503,342	3,940,726	878,418	0
biomass (metric tons)	2,721	8,999	2,703	1,928	3,420	2,838	579	0
lower bound (metric tons)	1,922	5,625	2,143	1,625	2,043	1,787	398	0
% change biomass est. (actual)[g]	16%	51%	-6%	-28%	17%	28%	-23%	-100%
% change biomass (comparable)[g]	-6%	40%	-6%	-28%	7%	11%	-23%	-100%
quota (lb)	254,207	744,100	283,515	214,957	270,201	236,444	52,705	0

[a] Percent precision = the one-sided 90% lower confidence bound as a percent of the mean.
[b] Average mass = average mass of all urchins divided by the count of urchins >60mm.
[c] Average biomass = the product of average mass and average density.
[d] Population size (all urchins) = population size (urchins >60mm) divided by proportion of urchins > 60mm.
[e] Biomass = the product of average biomass (lb/meter shoreline) and shoreline length.
[f] Lower bound biomass = biomass times percent precision.
[g] Actual is change since 1996 survey without adjustments for changes in methods; comparable accounts for differences in survey depth and shoreline used since 1996 survey.

Table 2b. Population size and biomass estimates of red urchins from management units (subdistricts) and two control areas (101-27 and 104-30 con.) in Districts 101, 102, and 104, Southeast Alaska, 2000.

Subdistrict	104-20[h]	101-27	101-29	104-30 con	104-30 exp.	Totals/Averages[i]
transects	30	20	20	20	30	276
count of urchins >59mm	257	542	913	414	691	6868
average density (urchins>59mm)	352.0	42.4	149.4	156.0	268.2	121.2
standard deviation	502.2	38.5	111.8	190.2	75.0	138.6
percent precision[a]	63.0	68.2	75.6	58.8	62.7	62.8
shoreline length (m)	151,864	31,105	47,874	43,874	71,506	8,051,800
proportion urchins>59mm	0.784	0.967	0.913	0.860	0.738	0.833
average mass/count>59mm (lb)[b]	0.688	1.105	0.690	0.739	0.677	0.735
average biomass (lb/m)[c]	242.1	46.9	103.0	115.3	181.6	98.2
population size (urchins>59mm)	53,453,597	1,318,852	7,149,982	6,845,441	19,177,834	96,629,693
population size (all urchins)[d]	68,220,933	1,364,156	7,827,258	7,960,709	25,984,085	109,157,975
biomass (lb)[e]	36,763,322	1,457,518	4,931,217	5,056,845	12,982,857	75,548,654
lower bound [f]	23,159,106	993,790	3,728,159	3,480,924	8,146,353	50,618,031
biomass (metric tons)	16,675	661	2,237	2,294	5,889	34,267
lower bound (metric tons)	10,504	451	1,691	1,579	3,695	22,959
% change biomass est. (actual)[g]	76%	9%	9%	-23%	52%	0.1%
% change biomass (comparable)[g]	12%	9%	-11%	-23%	35%	-8%
quota (lb)	1,373,818	na	745,632	na	1,777,873	4,579,633

[a] Percent precision = the one-sided 90% lower confidence bound as a percent of the mean.

[b] Average mass = average mass of all urchins divided by the count of urchins >60mm.

[c] Average biomass = the product of average mass and average density.

[d] Population size (all urchins) = population size (urchins >60mm) divided by proportion of urchins > 60mm.

[e] Biomass = the product of average biomass (lb/meter shoreline) and shoreline length.

[f] Lower bound biomass = biomass times percent precision.

[g] Actual is change since 1996 survey without adjustments for changes in methods; comparable accounts for differences in survey depth and shoreline used since 1996 survey.

[h] Area re-surveyed out of rotation in April 2000 to attempt precision increase.

[i] Totals do not include re-survey of Subdistrict 104-20.

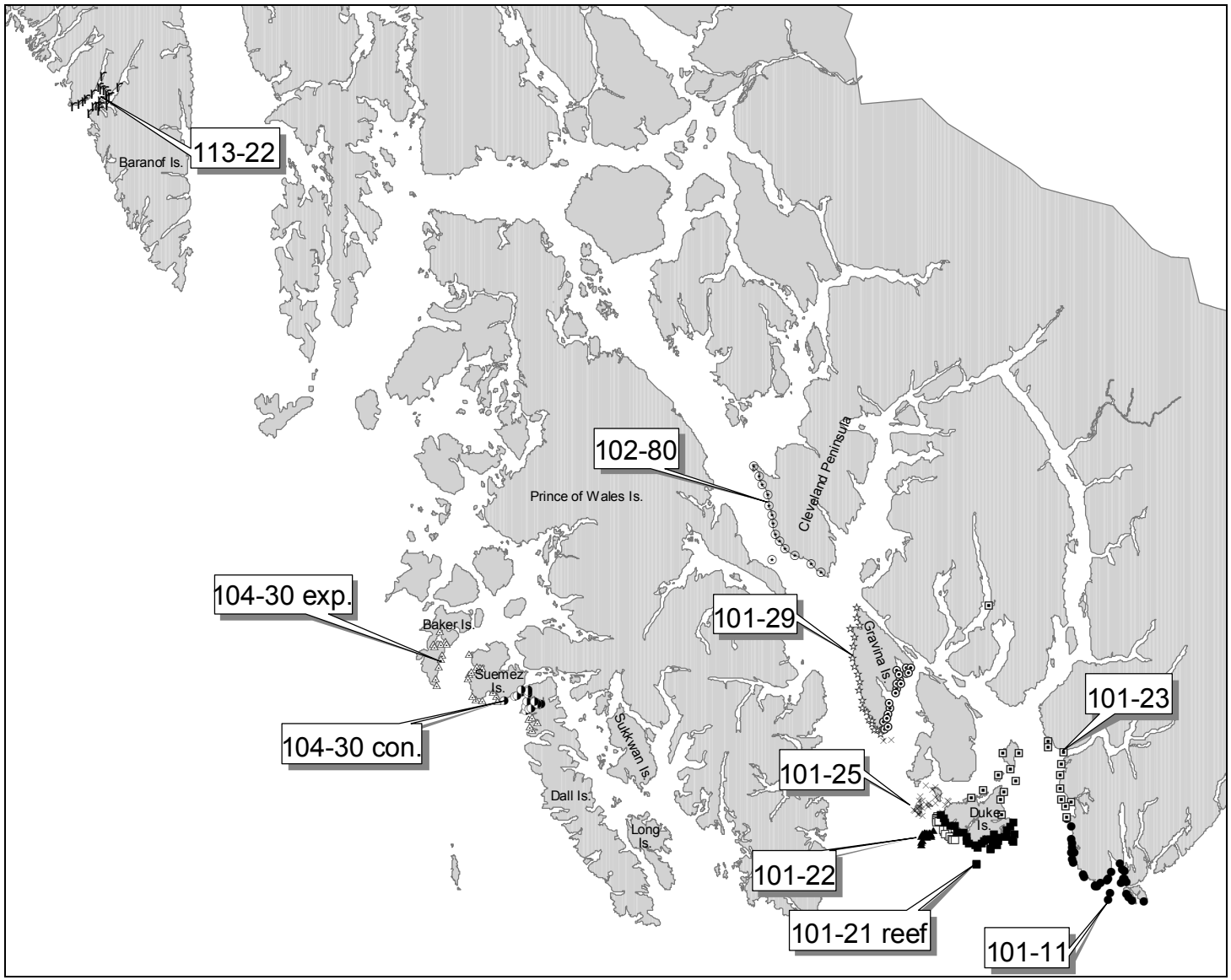


Figure 1. Map of southern Southeast Alaska showing transect locations in fishing and control areas.

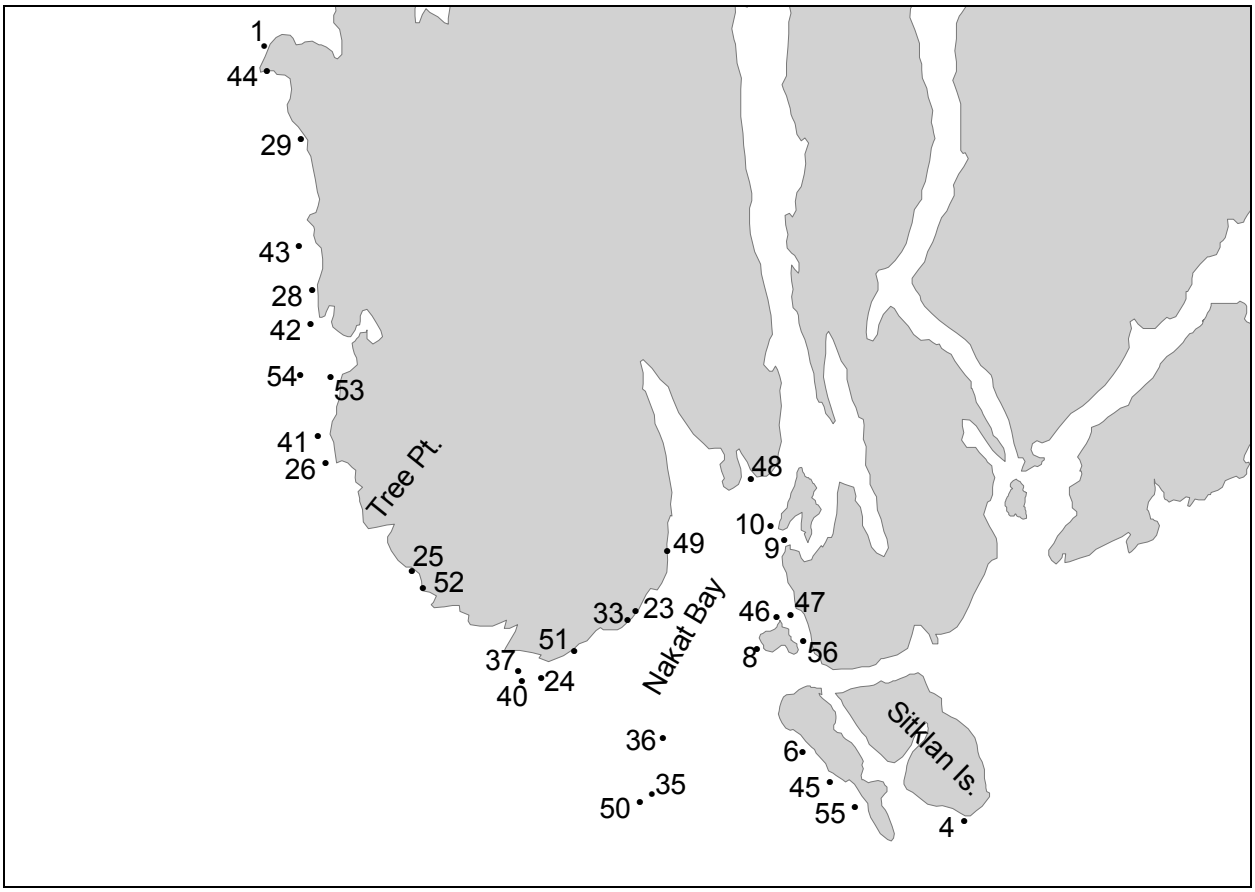


Figure 2. Map of transect pair locations in Statistical Area 101-11.

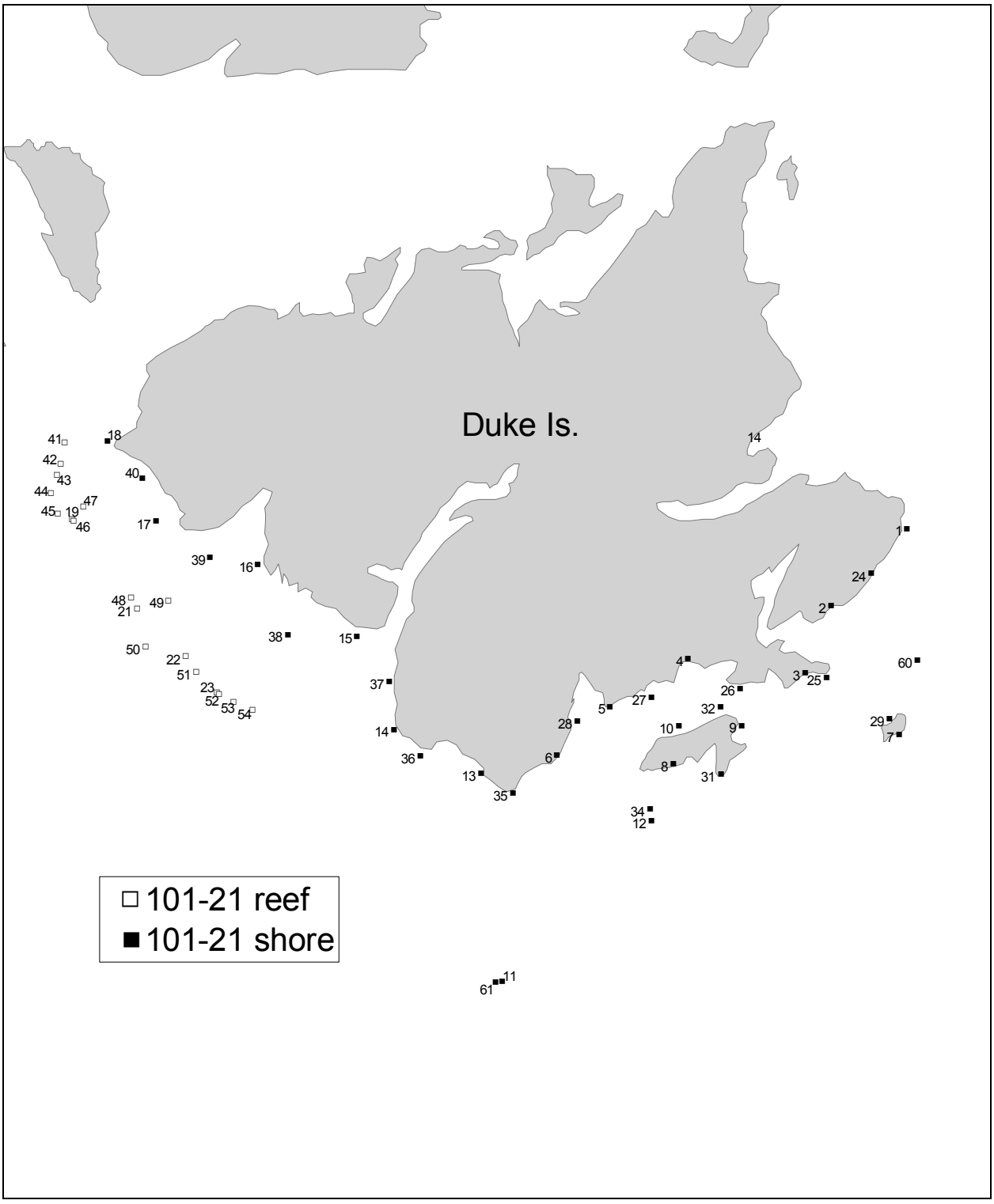


Figure 3. Map of transect pair locations in Statistical Area 101-21 shore and 101-21 reef.

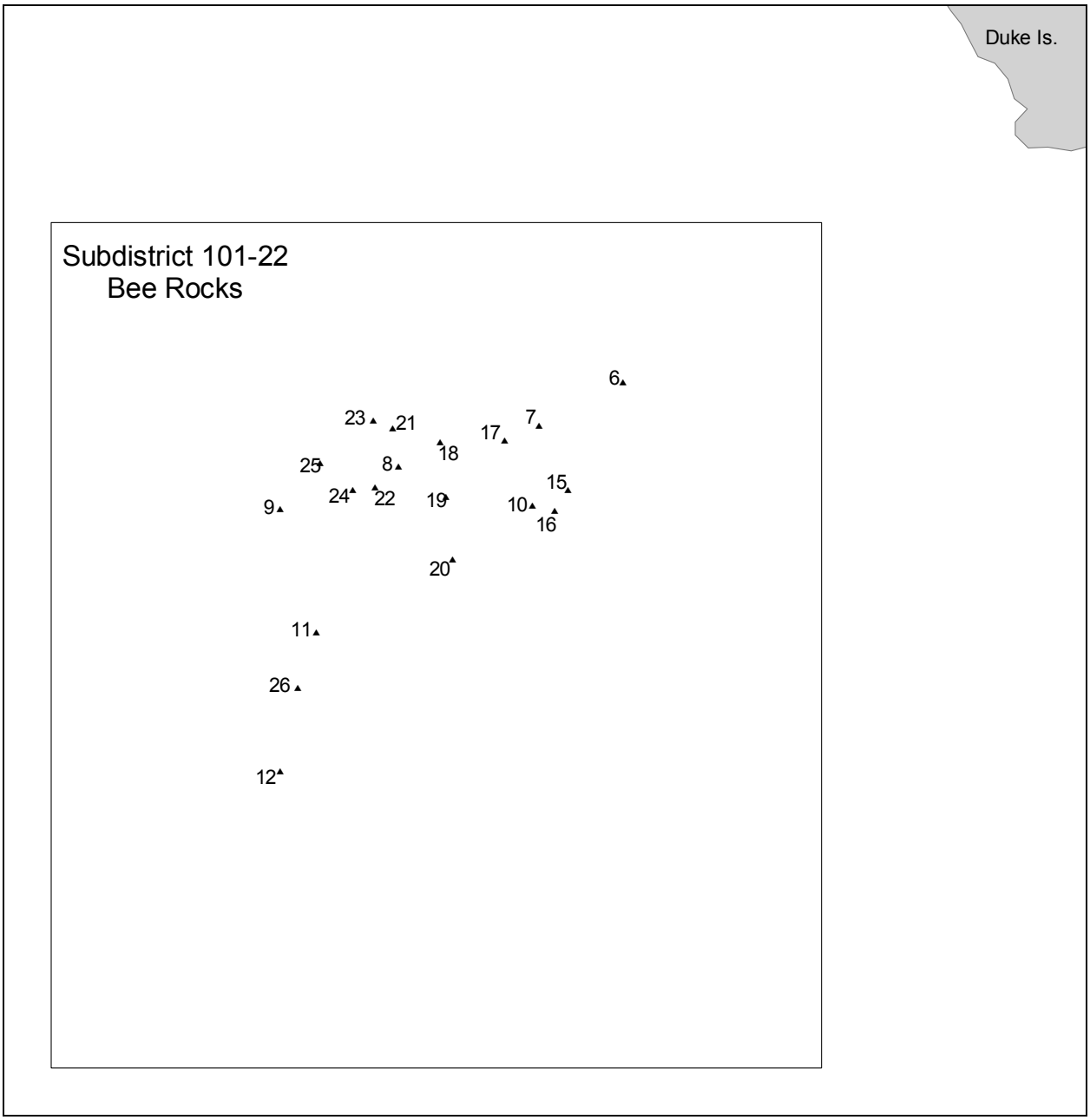


Figure 4. Map of transect pair locations in Statistical Area 101-22.

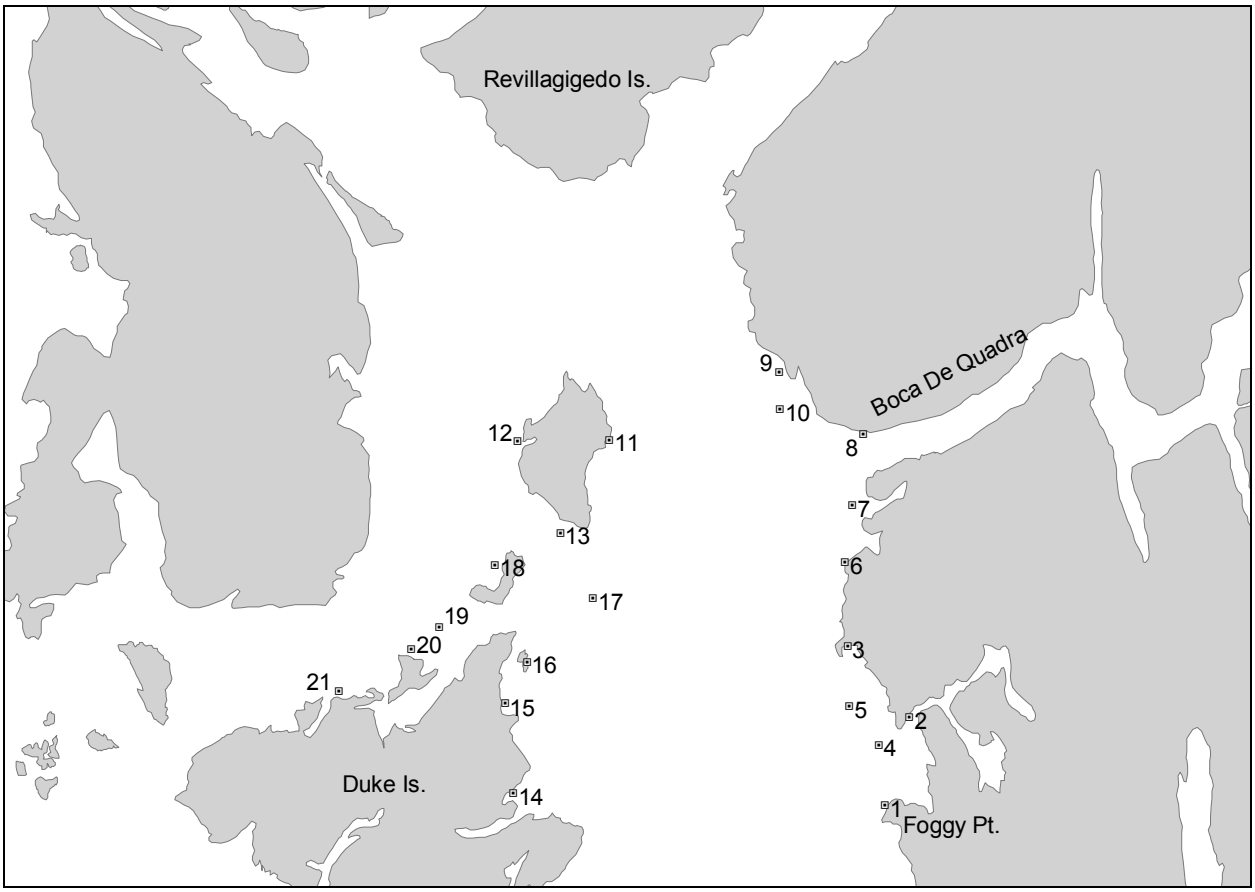


Figure 5. Map of transect pair locations in Subdistrict 101-23.

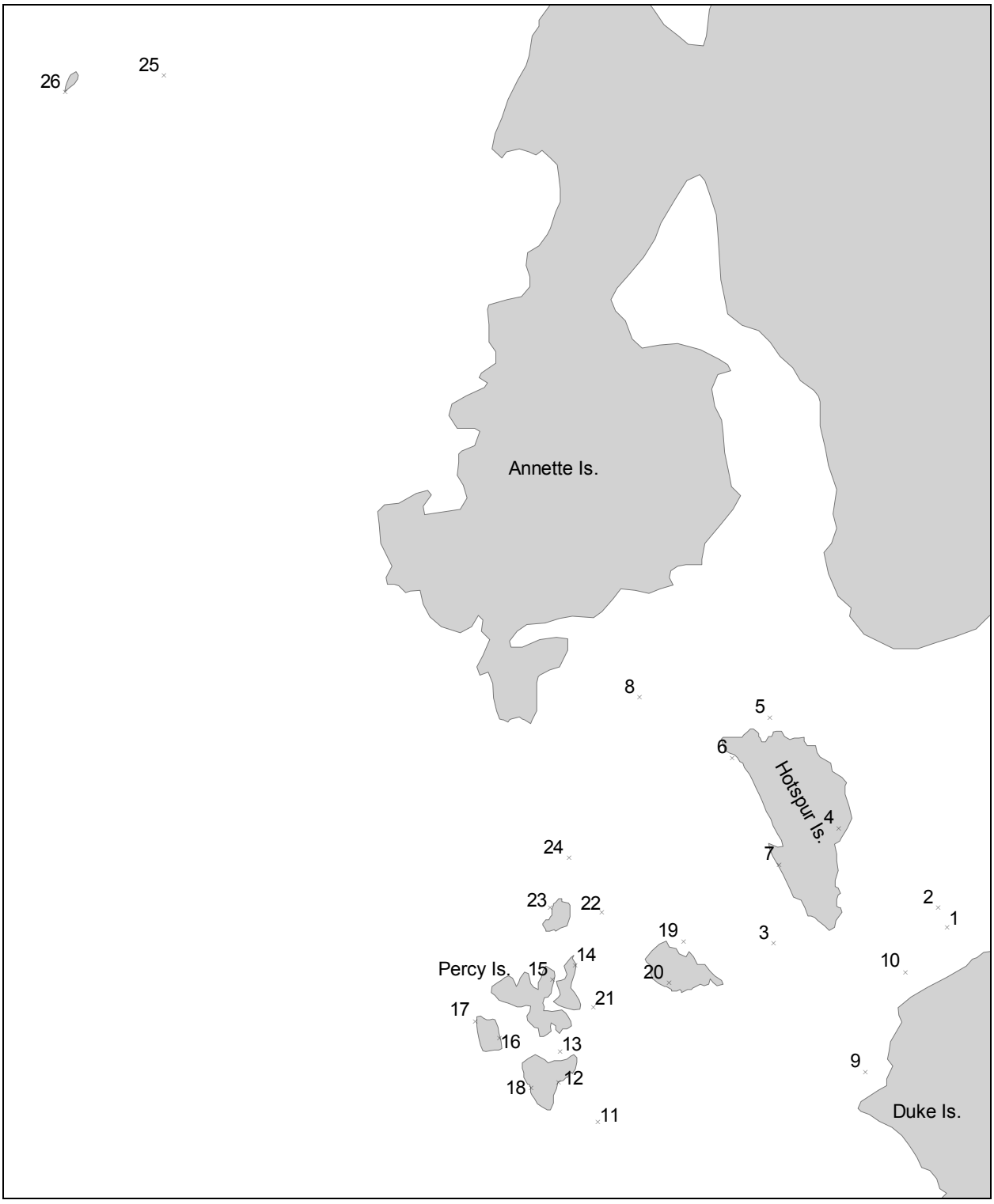


Figure 6. Map of transect pair locations in Statistical Area 101-25

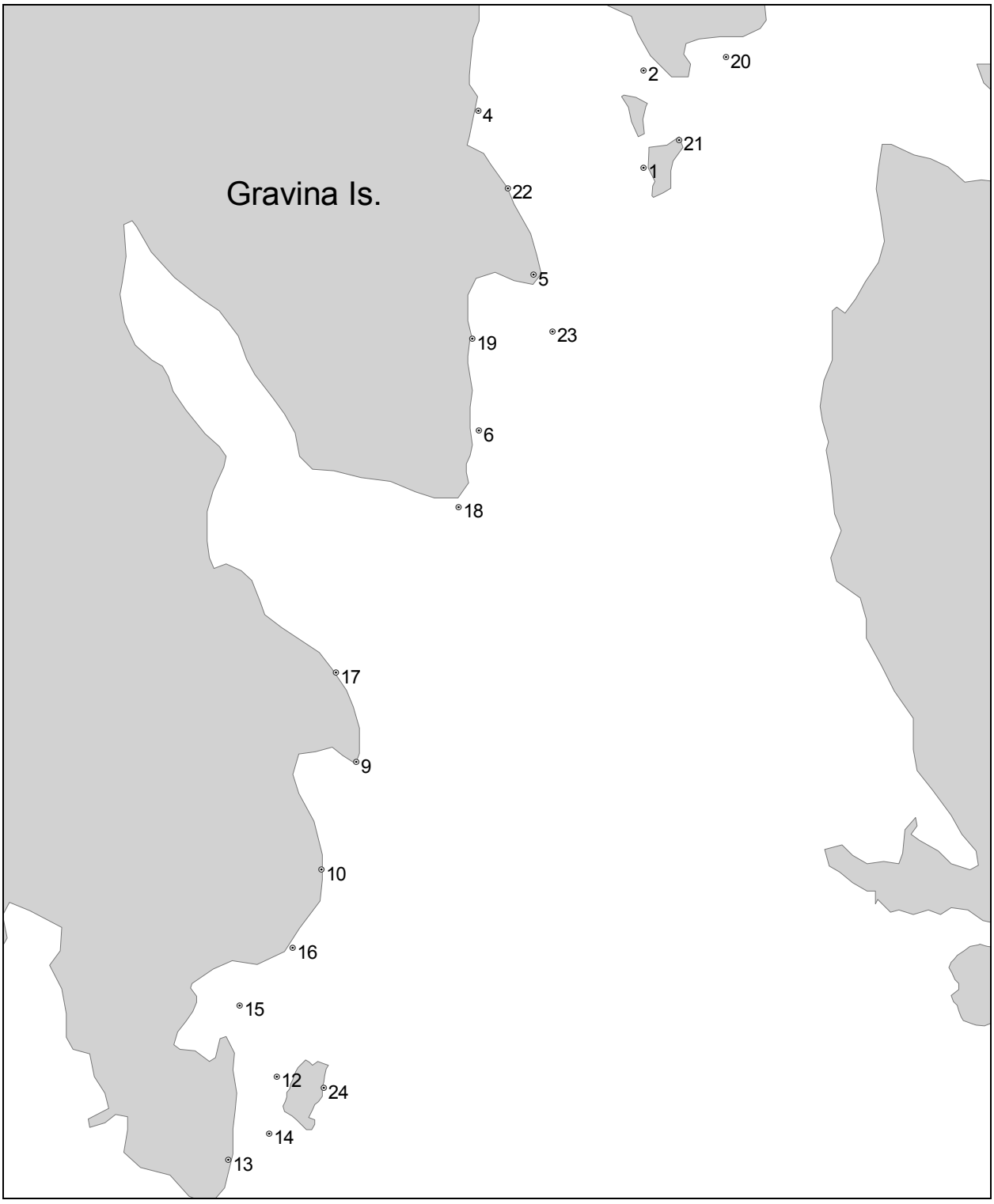


Figure 7. Map of transect pair locations in Statistical Area 101-27.

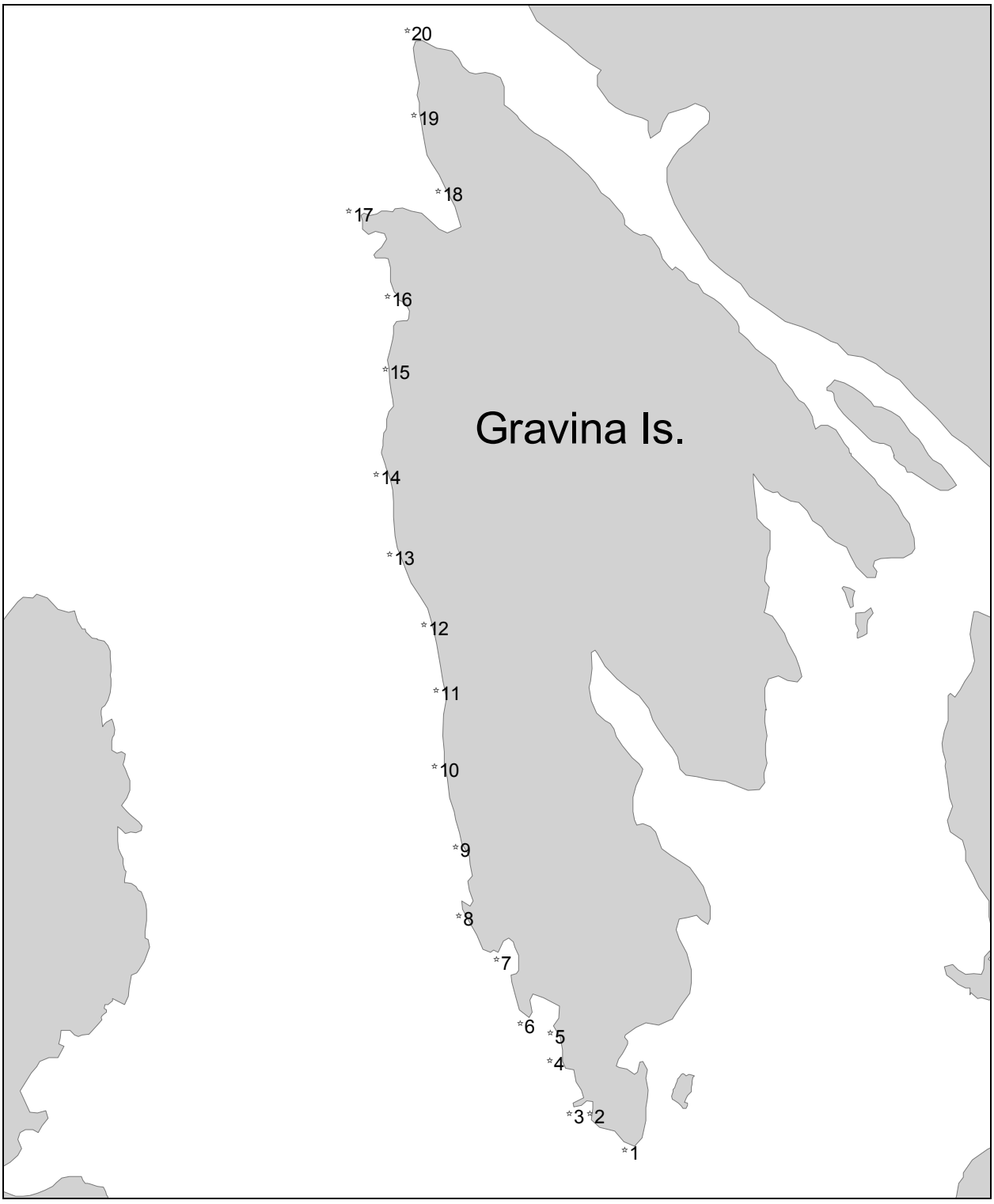


Figure 8. Map of transect pair locations in Statistical Area 101-29.

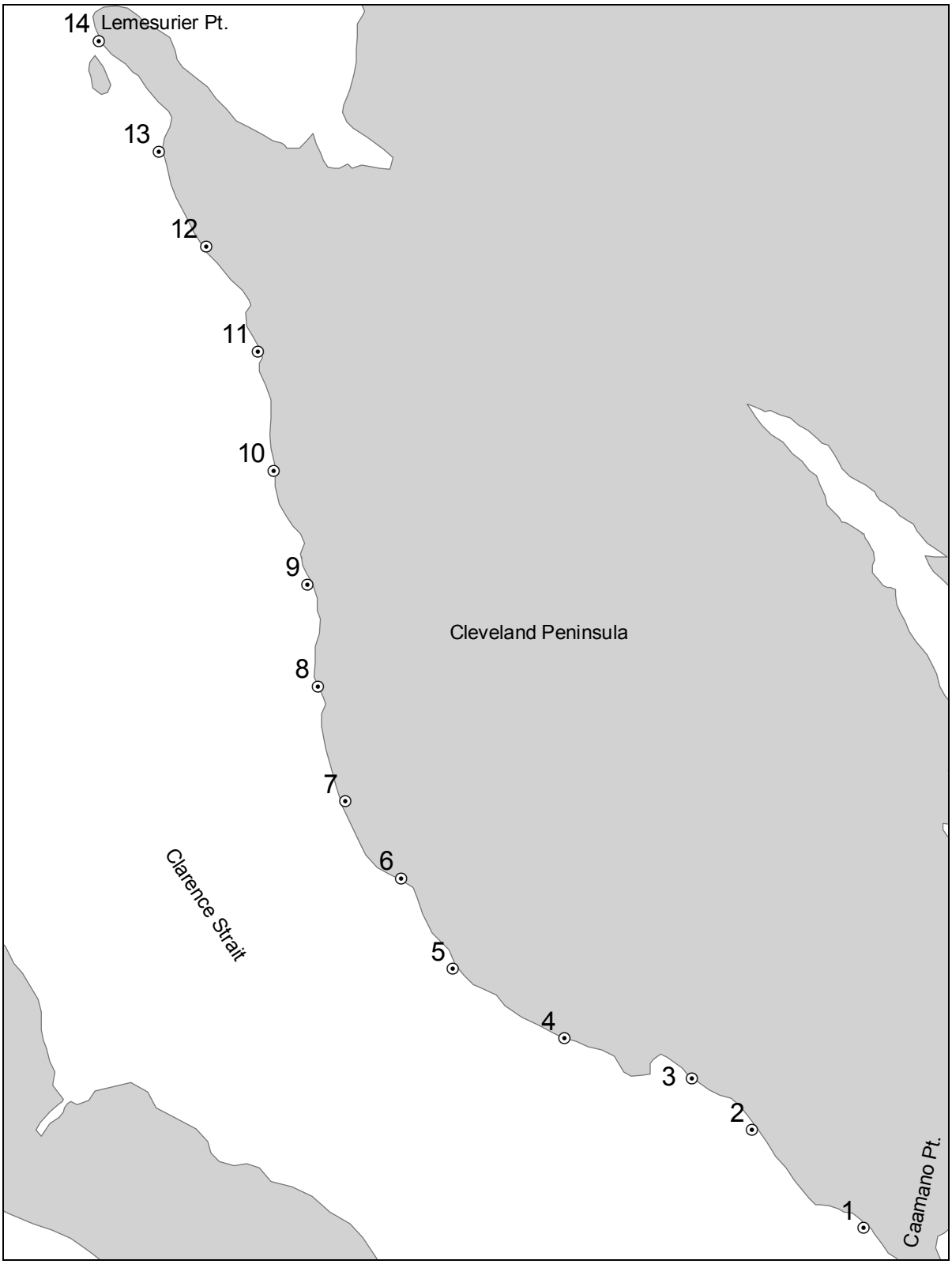


Figure 9. Map of transect pair locations in Statistical Area 102-80.

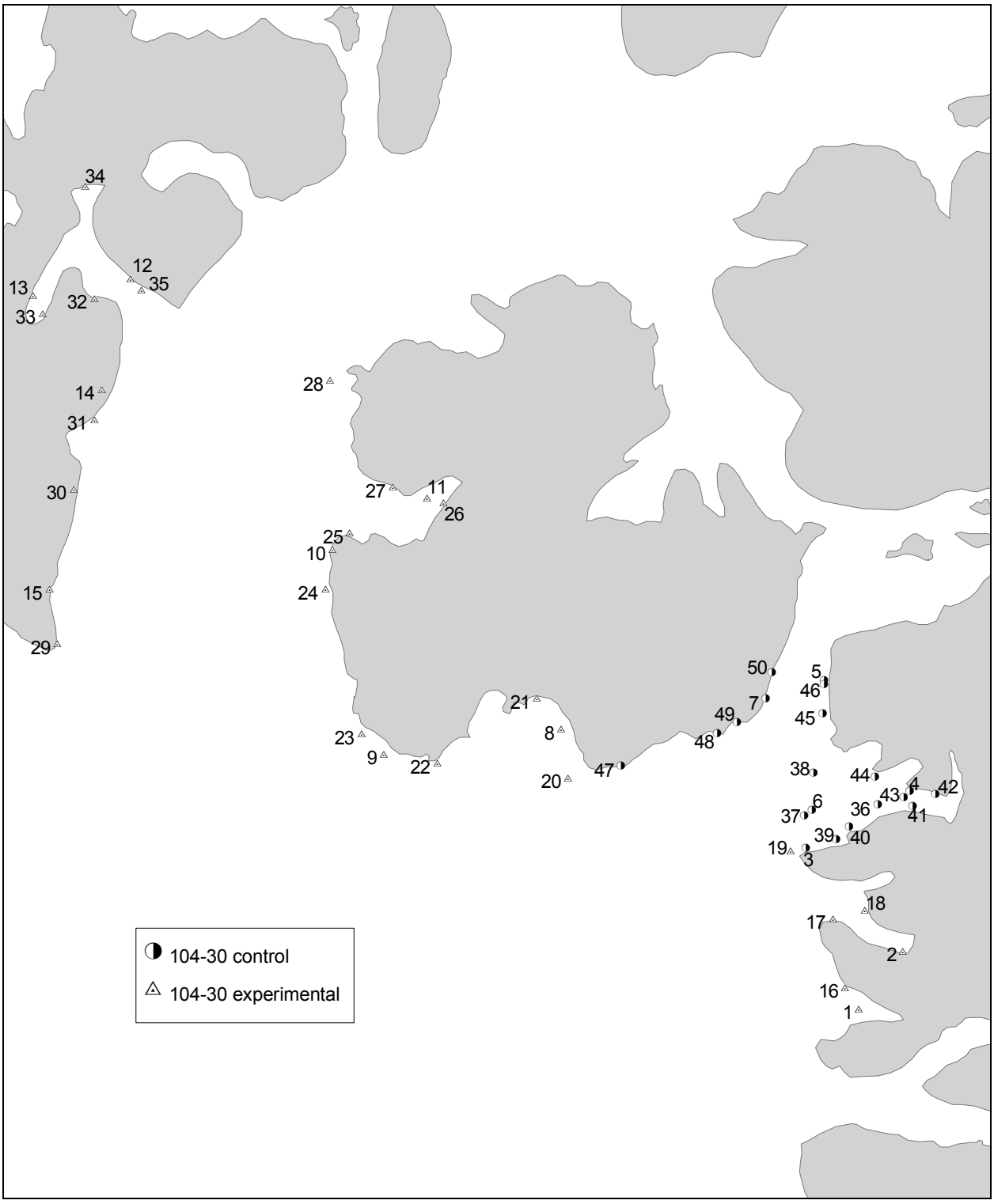


Figure 10. Map of transect pair locations in Statistical Area 104-30 control and 104-30 experimental.

Figure 11. Map of transect pair locations in Statistical Area 113-22.

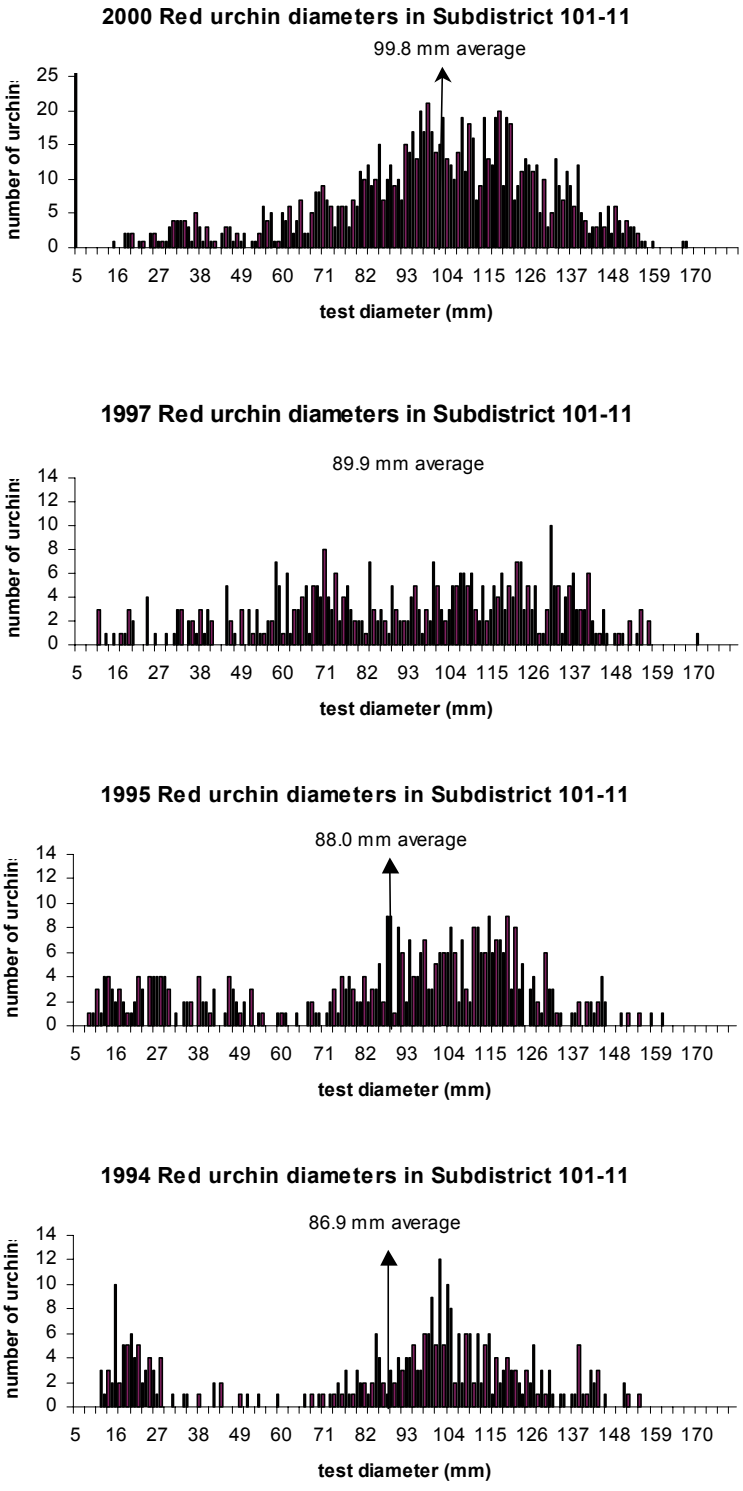
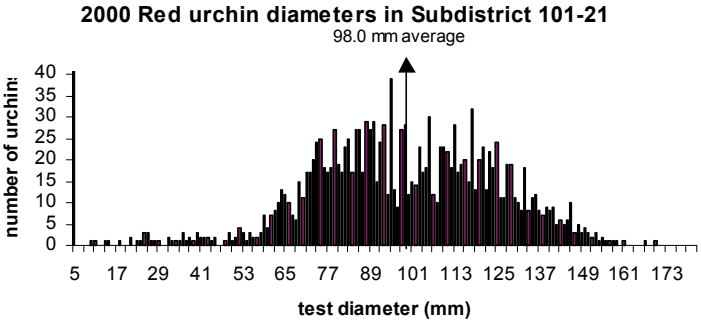
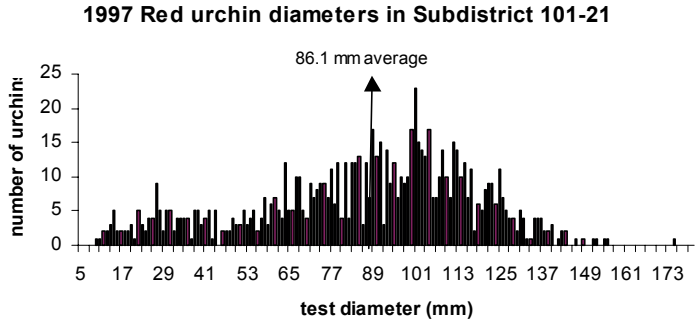
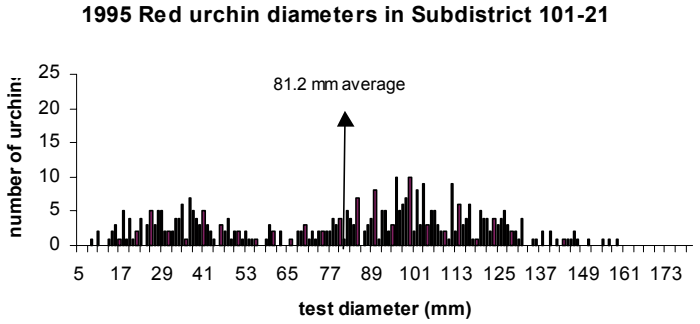


Figure 12. Red urchin size distributions in Subdistrict 101-11 during 1994-2000.







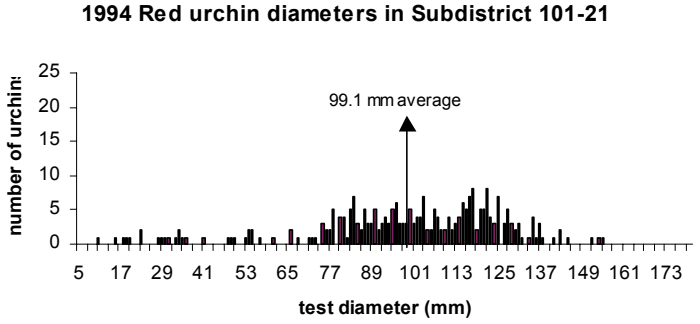


Figure 13. Red urchin size distributions in Subdistrict 101-21 during 1994-2000.

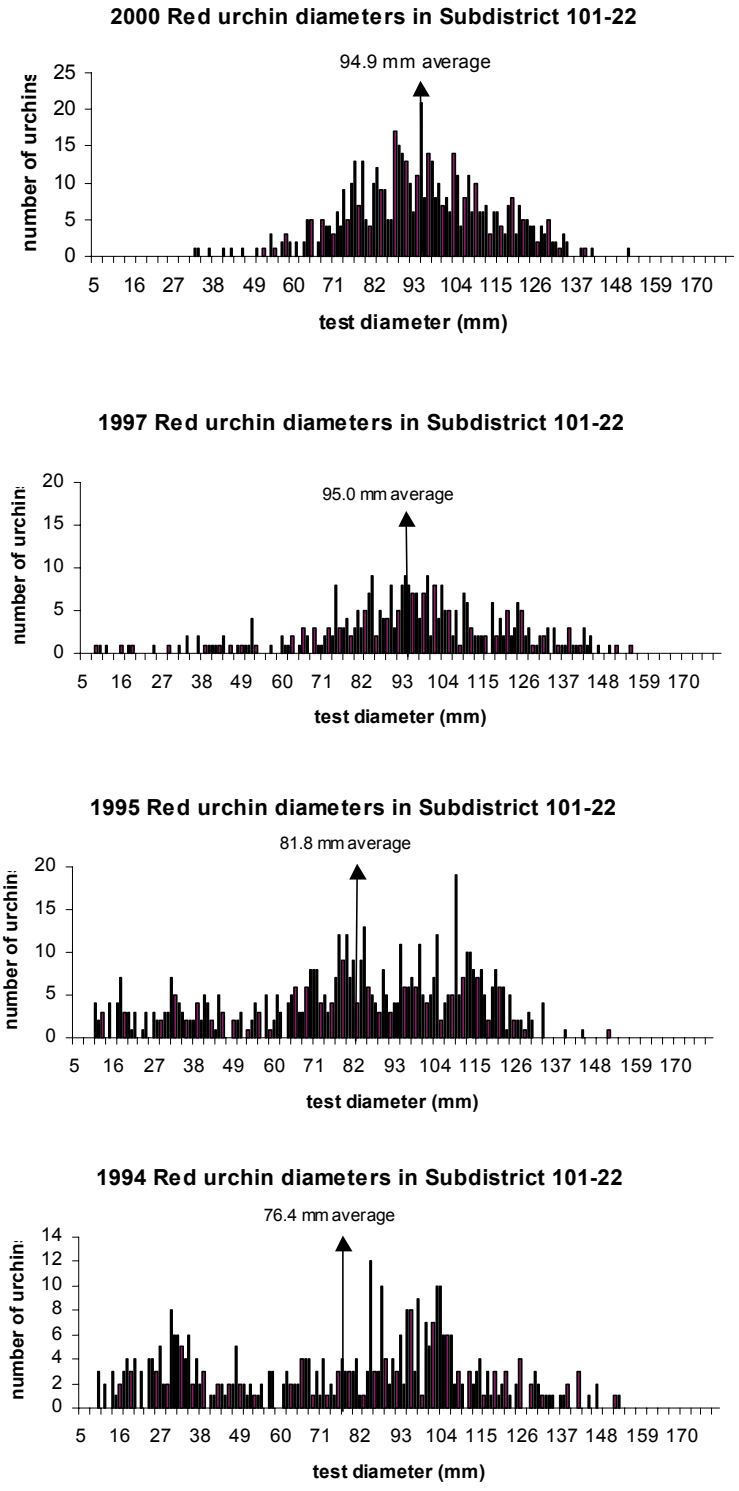
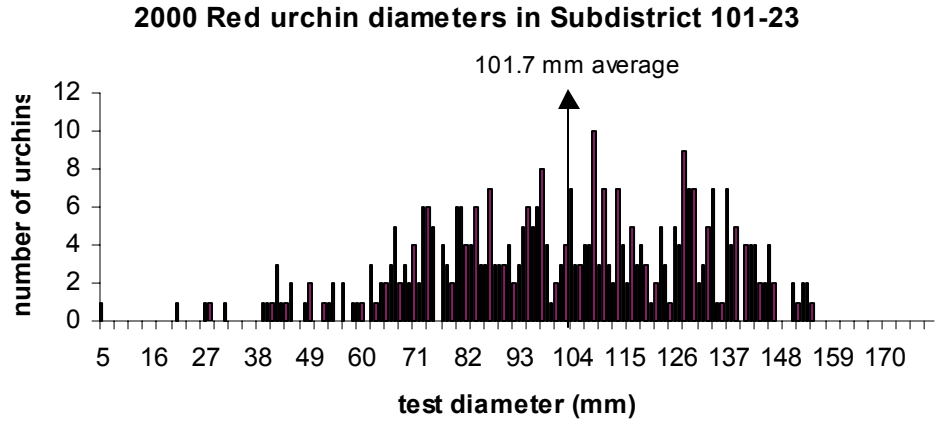
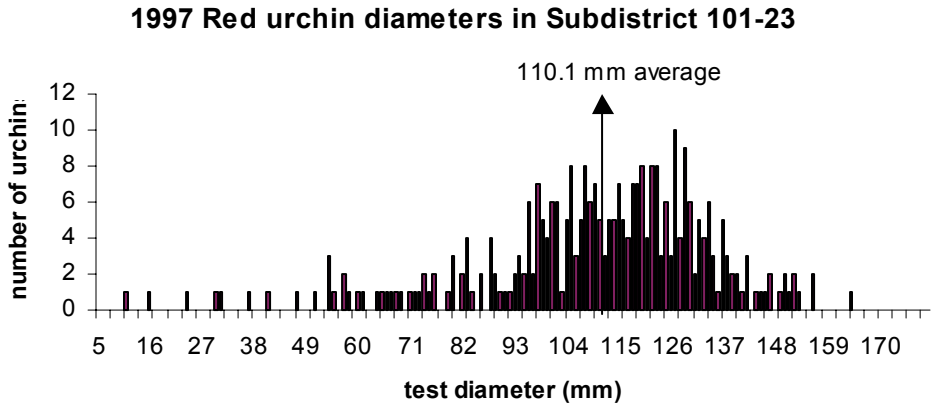


Figure 14. Red urchin size distributions in Subdistrict 101-22 during 1994-2000..





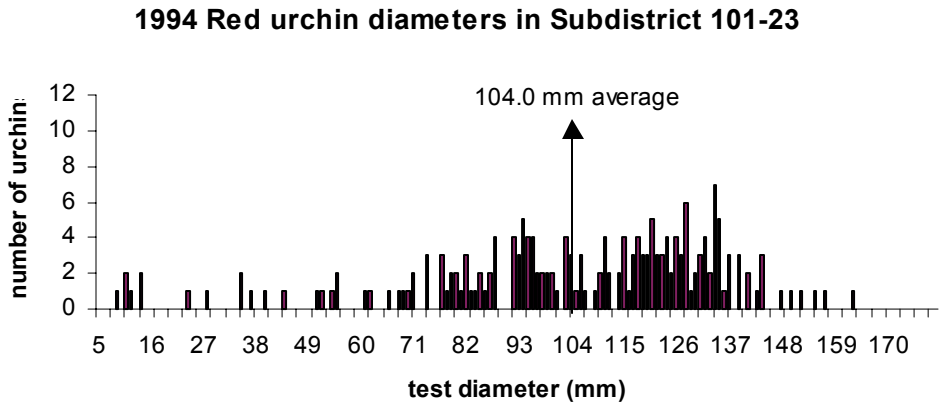
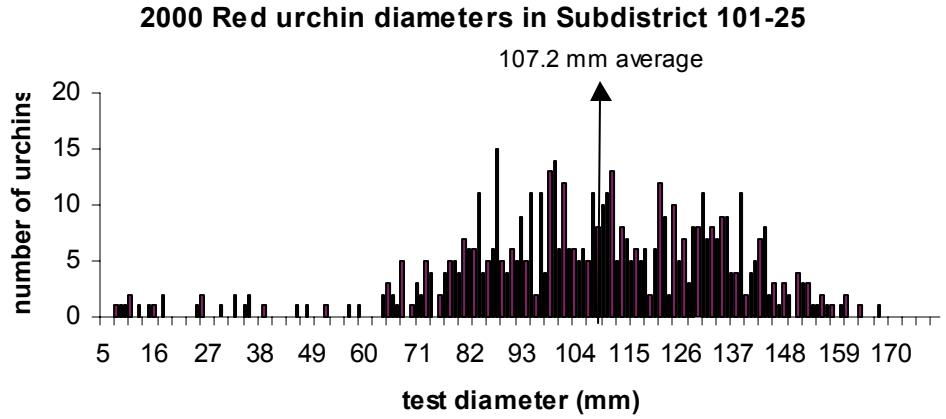
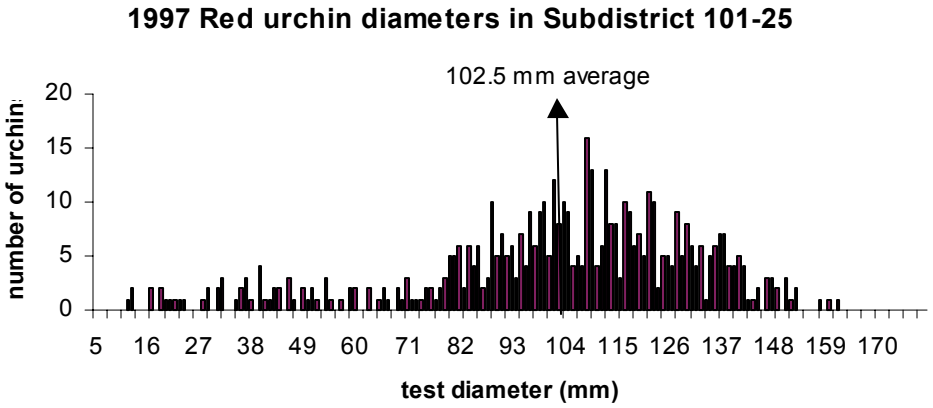


Figure 15. Red urchin size distributions in Subdistrict 101-23 during 1994-2000.





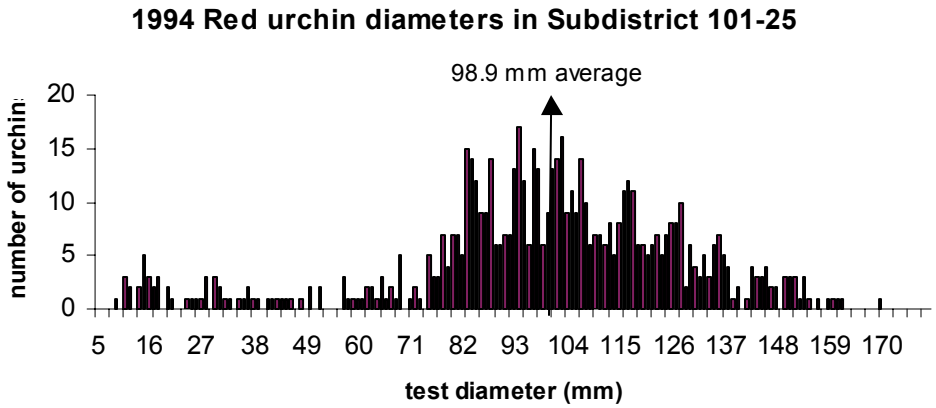


Figure 16. Red urchin size distributions in Subdistrict 101-25 during 1994-2000.

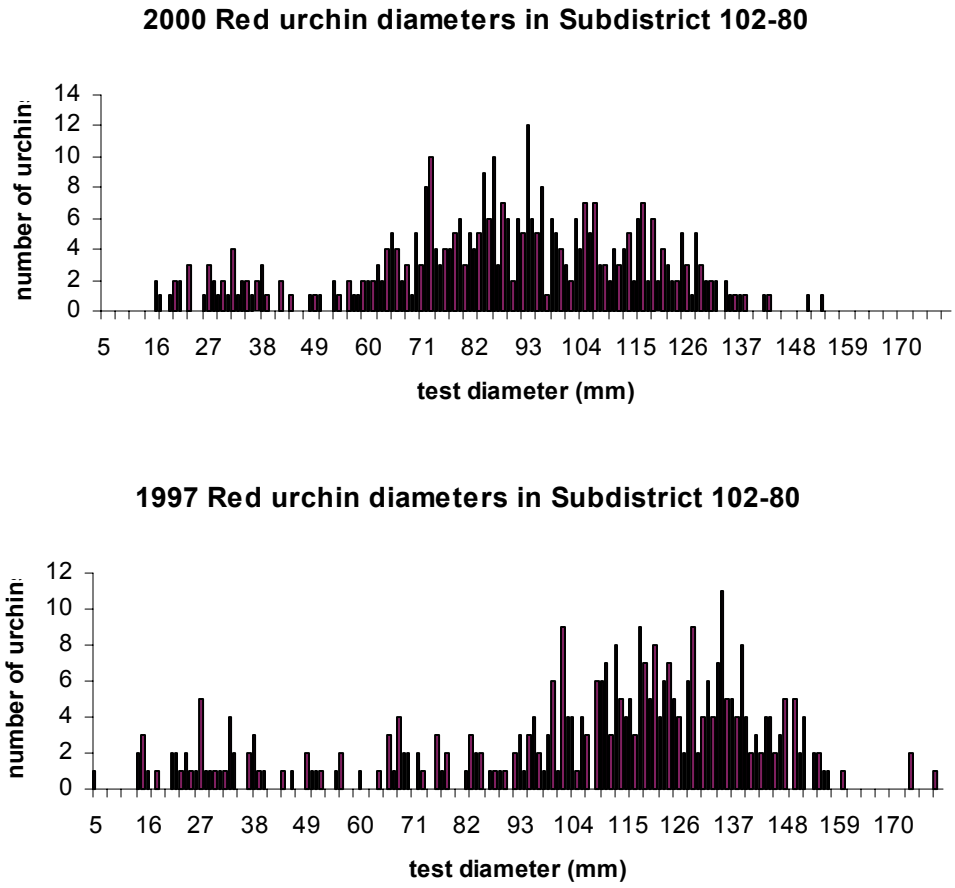


Figure 17. Red urchin size distributions in Subdistrict 102-80 during 1997 and 2000.

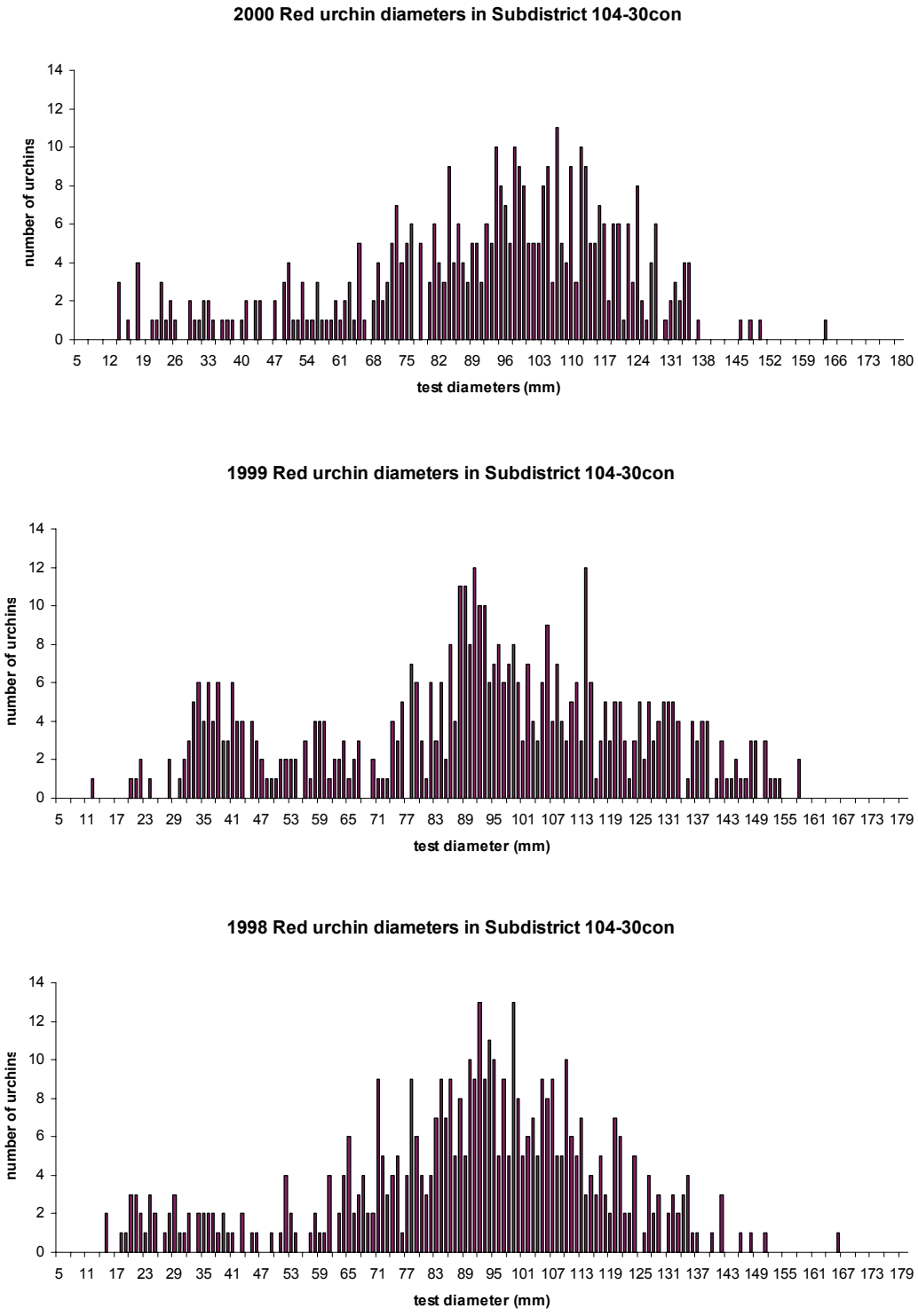


Figure 18a. Red urchin size distributions in Subdistrict 104-30 control area during 1998 through 2000.

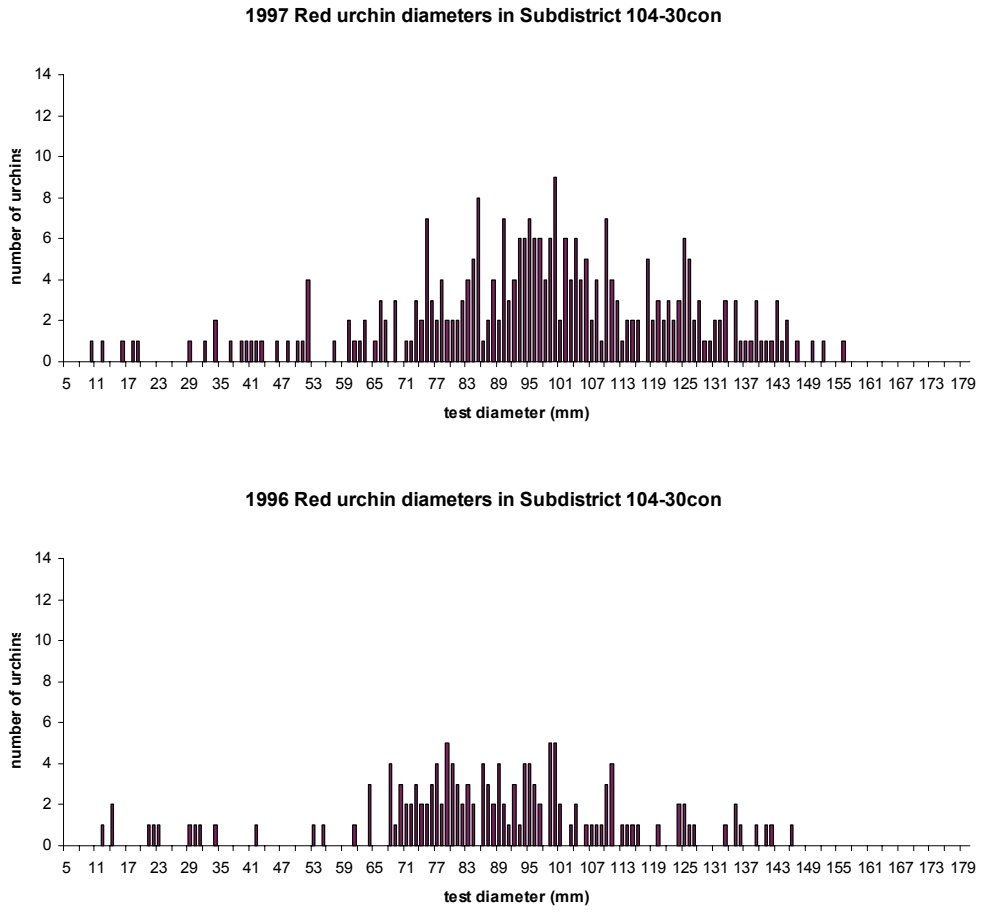


Figure 18b. Red urchin size distributions in Subdistrict 104-30 control area during 1996 through 1997.

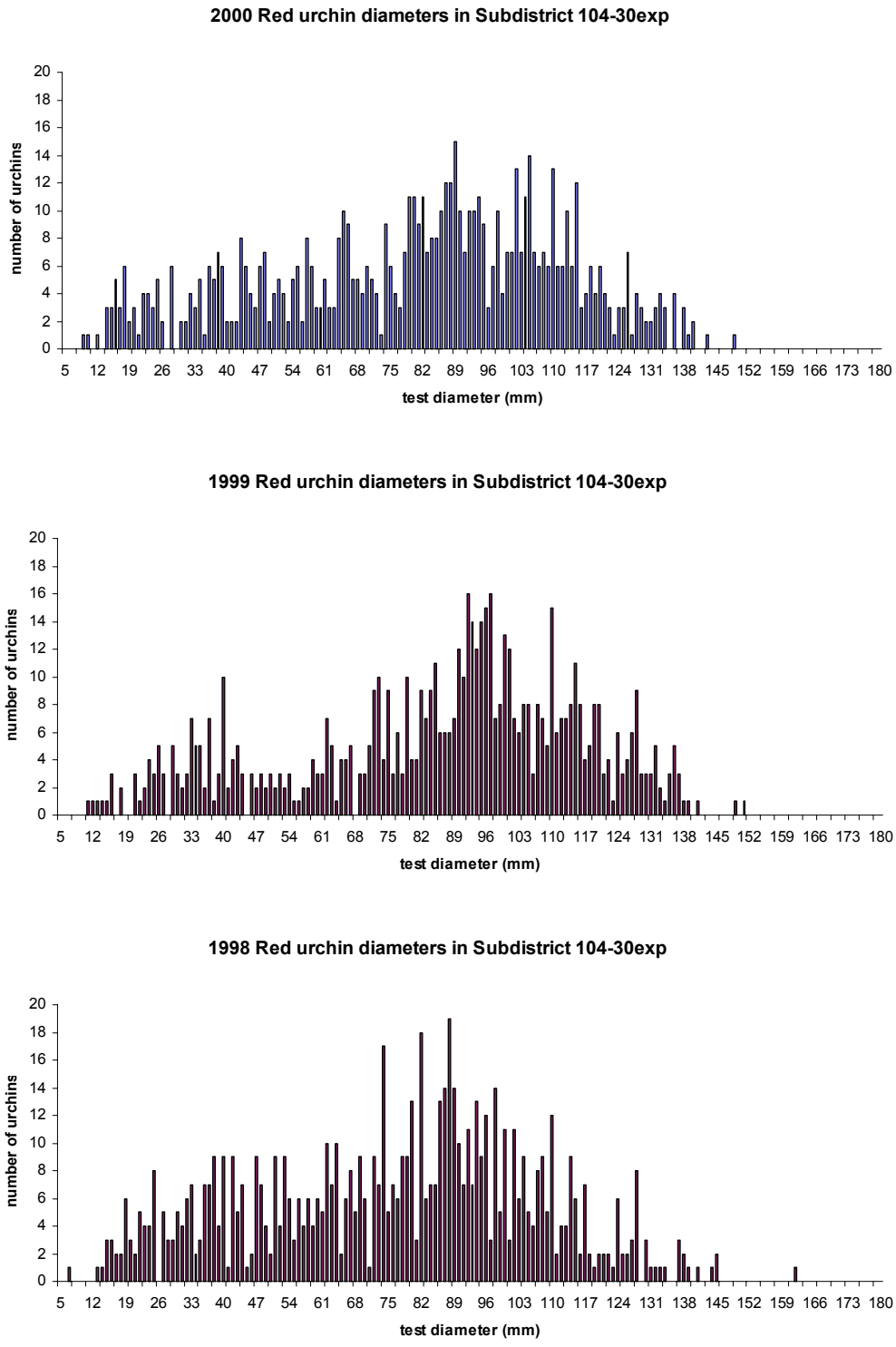
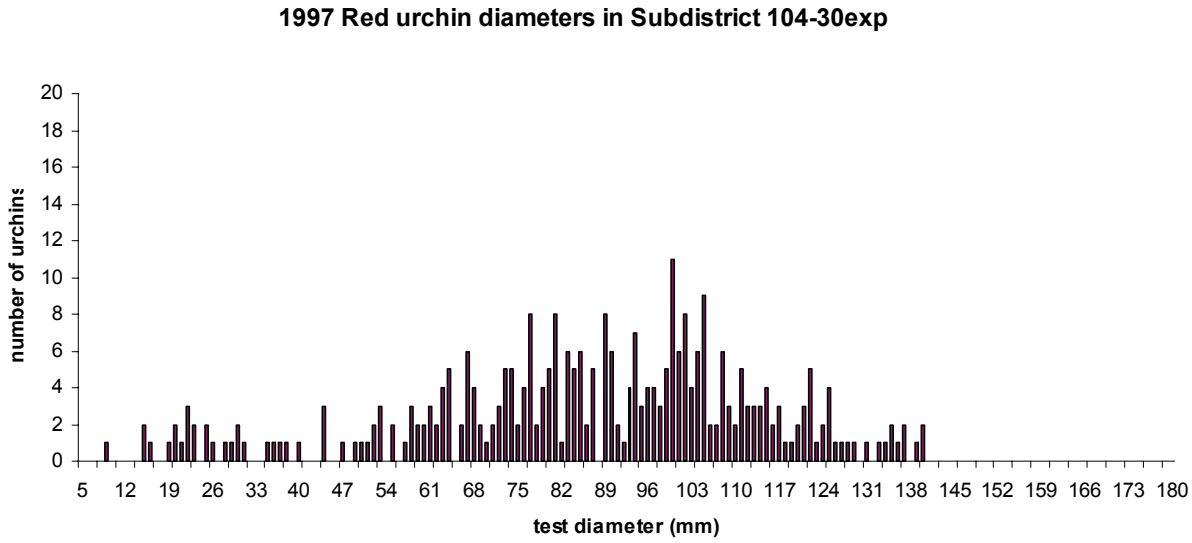


Figure 19a. Red urchin size distributions in Subdistrict 104-30 experimental area during 1998 through 2000.



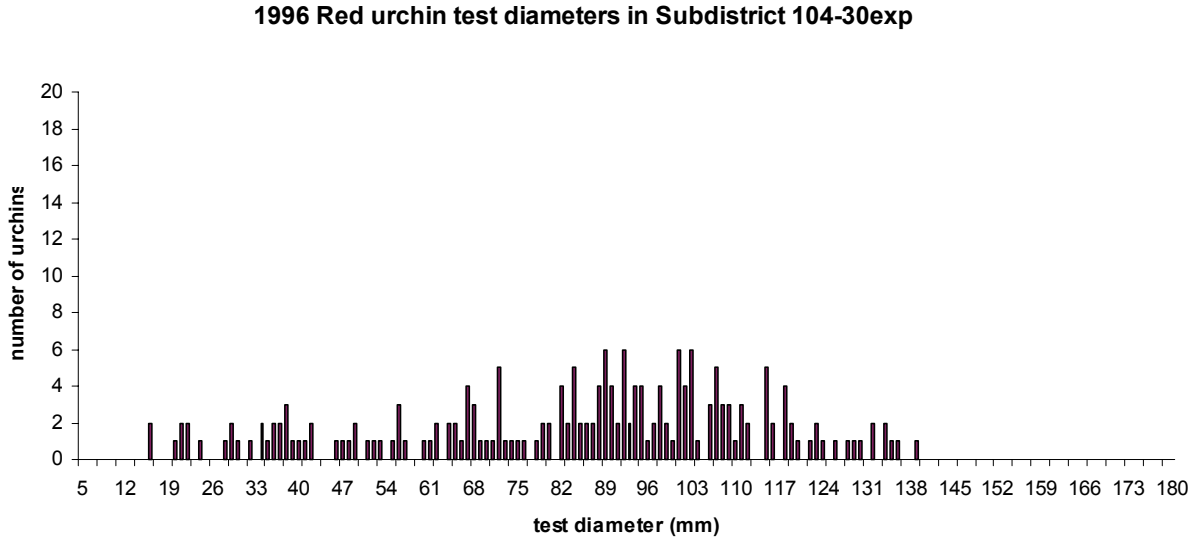


Figure 19b. Red urchin size distributions in Subdistrict 104-30 experimental area during 1996 through 1997.

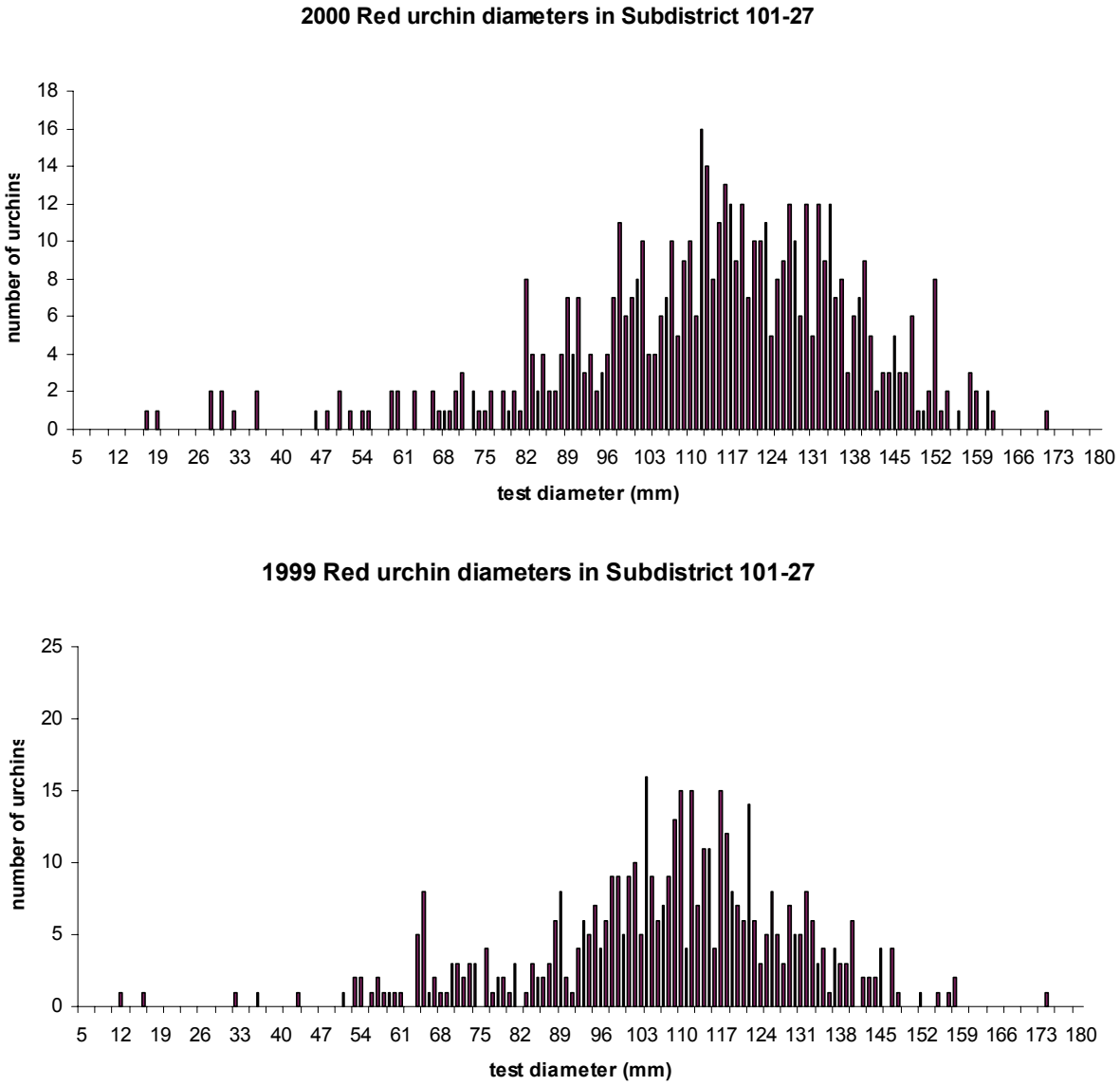
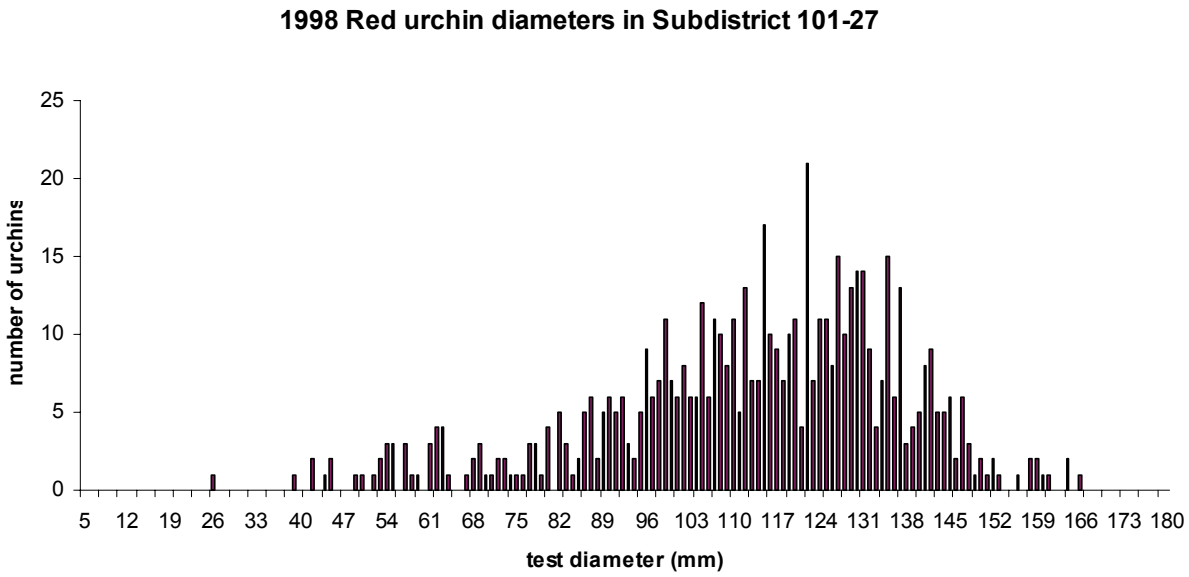


Figure 20a. Red urchin size distributions in Subdistrict 101-27 control area during 1999 through 2000.



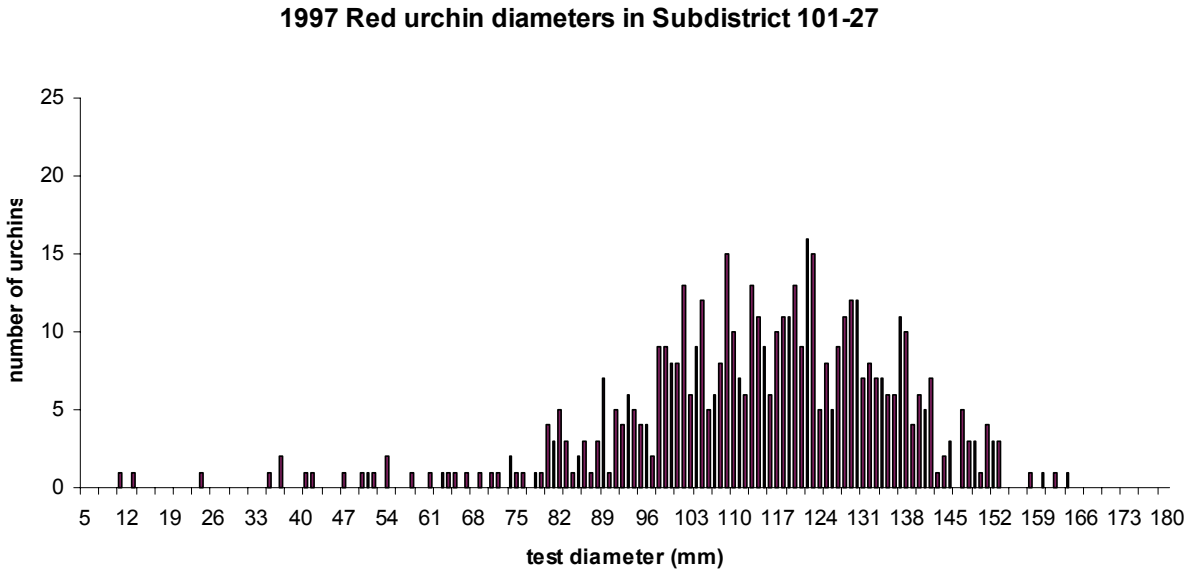


Figure 20b. Red urchin size distributions in Subdistrict 101-27 control area during 1997 through 1998.

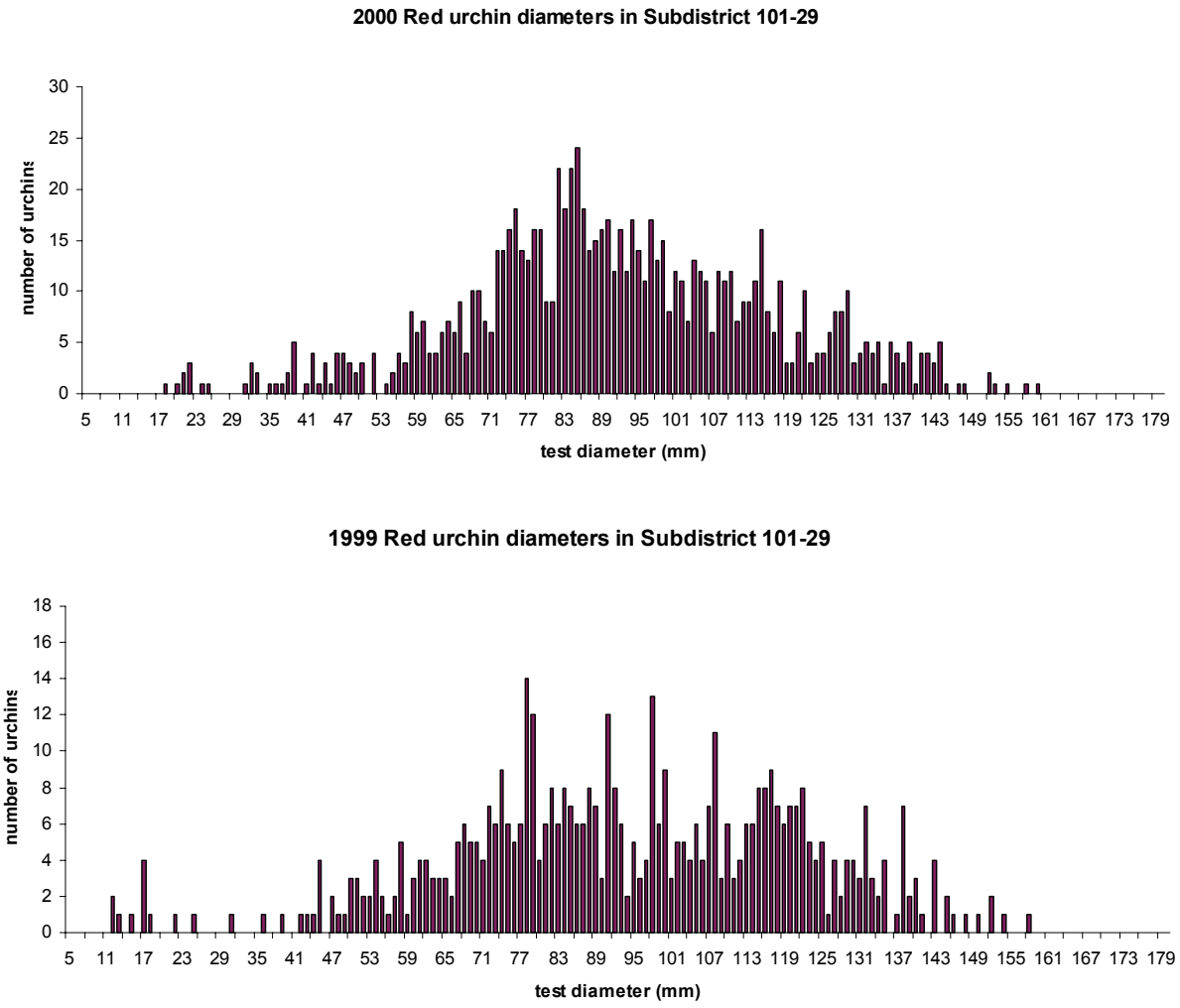


Figure 21a. Red urchin size distributions in Subdistrict 101-29 experimental area during 1997 through 2000.

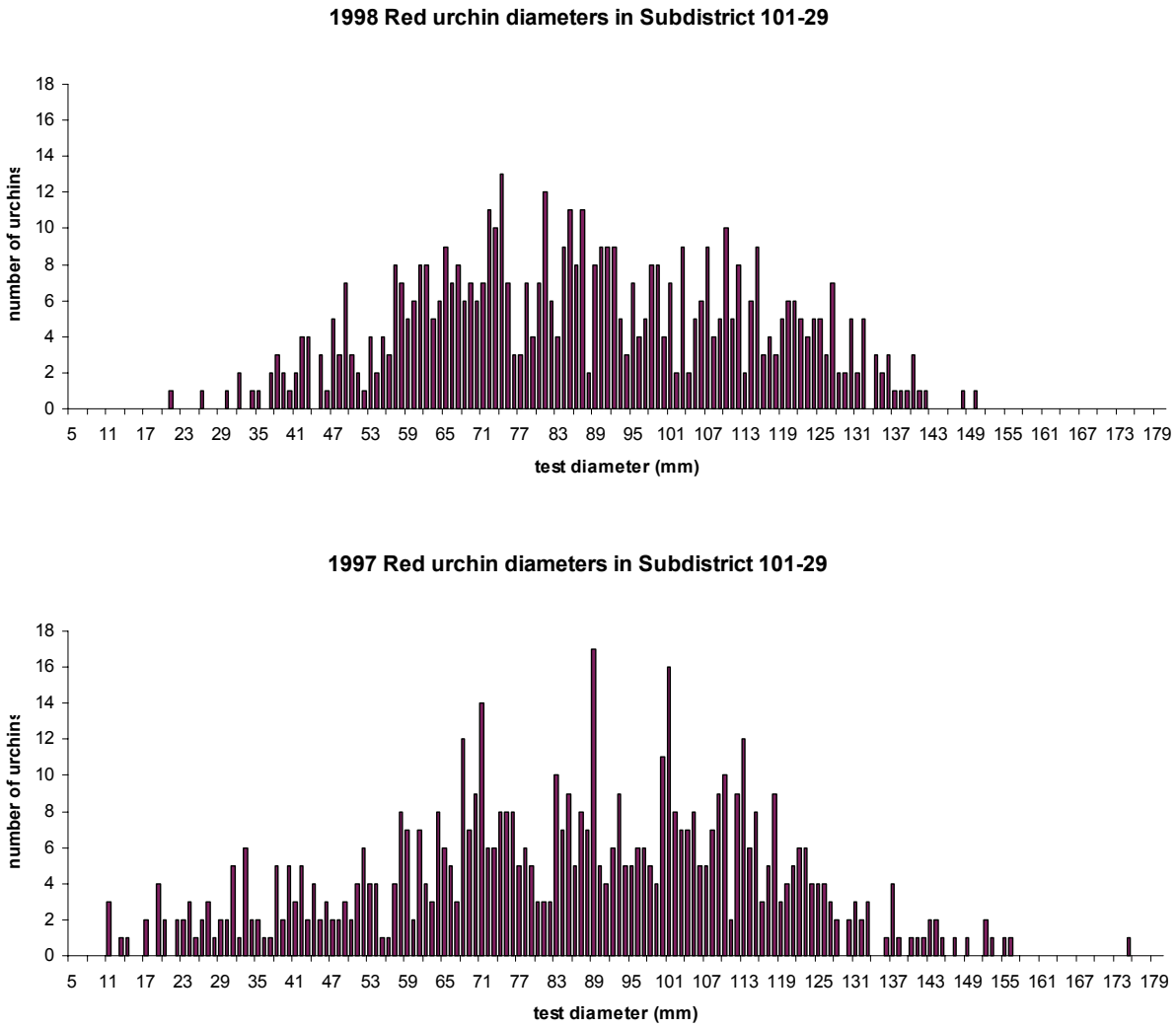


Figure 21b. Red urchin size distributions in Subdistrict 101-29 experimental area during 1997 through 2000.

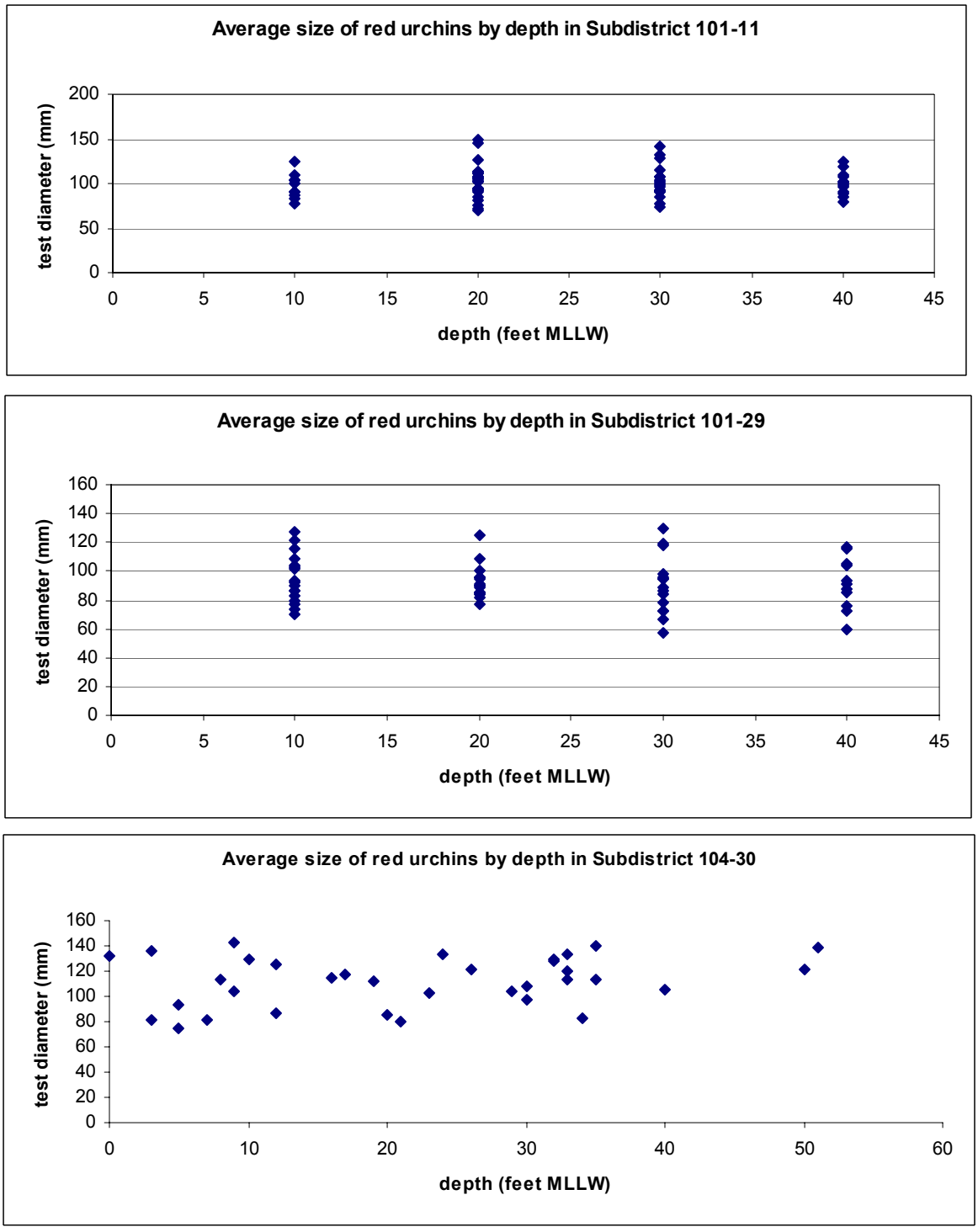


Figure 22. Red sea urchin average size by depth in Subdistricts 101-11, 101-29 and 104-30, Southeast, Alaska, 2000.

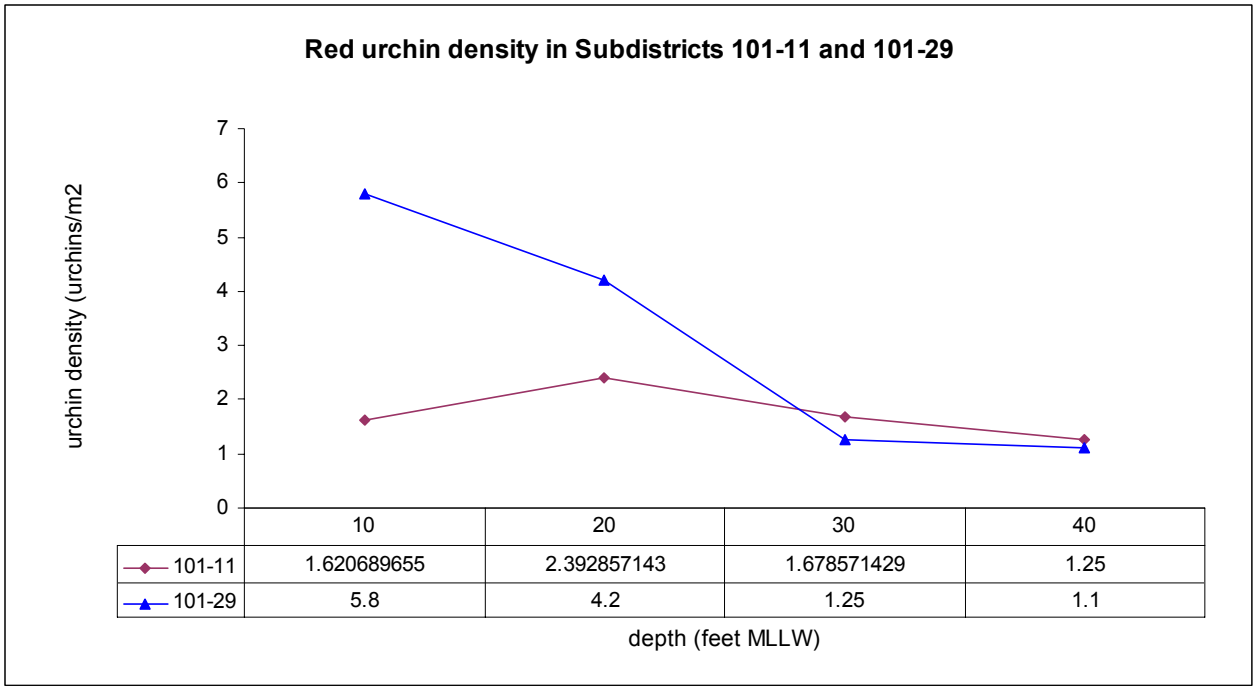


Figure 23. Red sea urchin average density by depth in Subdistricts 101-11 and 101-29, Southeast, Alaska, 2000.

APPENDIX

Appendix 1. Latitudes and longitudes of urchin transect pairs completed in Southeast Alaska, 2000.

Subdistrict 101-11

Transect number	Latitude	Longitude
4	54.724233	-130.652817
6	54.74247	-130.72708
8	54.76982	-130.748
9	54.79848	-130.73539
10	54.802217	-130.741583
23	54.77982	-130.803661
24	54.76205	-130.84685
25	54.790229	-130.906294
26	54.81888	-130.94575
28	54.86465	-130.95195
29	54.90451	-130.957
33	54.777464	-130.807174
35	54.7313	-130.796031
36	54.74637	-130.791165
37	54.763942	-130.857306
40	54.761463	-130.855709
41	54.8260333	-130.94925
42	54.855667	-130.952628
43	54.87615	-130.957817
44	54.922523	-130.972367
45	54.73468	-130.714625
46	54.77825	-130.73885
47	54.7788333	-130.732467
48	54.81465	-130.75085
49	54.79565	-130.7889
50	54.7292333	-130.801567
51	54.7692	-130.831767
52	54.7857833	-130.901033
53	54.8415667	-130.94355
54	54.84215	-130.957426
55	54.727984	-130.702963
56	54.771973	-130.726749

Subdistrict 101-21 reef

Transect number	Latitude	Longitude
19	54.9158	-131.5116
21	54.8962	-131.4870
22	54.8857	-131.4685
23	54.8779	-131.4565
41	54.9325	-131.5145
42	54.9278333	-131.516
43	54.9255	-131.517333
44	54.9215	-131.519667
45	54.9168333	-131.517
46	54.9155	-131.511167
47	54.9185	-131.50726
48	54.8986667	-131.489167
49	54.898	-131.475
50	54.88792	-131.4838
51	54.8823333	-131.4645
52	54.8775	-131.455833
53	54.8758333	-131.450333
54	54.8741667	-131.443167

Subdistrict 101-21 shore

Transect number	Latitude	Longitude
1	54.9138167	-131.1943
2	54.8968	-131.2233
3	54.8820667	-131.233133
4	54.8853	-131.2777
5	54.8749	-131.307167
6	54.8642	-131.3273
7	54.8687	-131.197433
8	54.8622	-131.2832
9	54.8707167	-131.2573
10	54.8706	-131.2812
11	54.8146167	-131.34815
12	54.8499	-131.2915
13	54.8602667	-131.356267
14	54.8698	-131.3893
15	54.8902833	-131.4033
16	54.9059	-131.4410
17	54.9153333	-131.479733
18	54.9329	-131.4981
24	54.9039167	-131.2079
25	54.8812167	-131.224917
26	54.8789	-131.2577
27	54.8769167	-131.291533
28	54.8716333	-131.3196
29	54.8722333	-131.201083
31	54.8601	-131.2651
32	54.8747833	-131.265333
34	54.8525333	-131.291983
35	54.85595	-131.344233
36	54.86413	-131.37935
37	54.8803333	-131.390933
38	54.8905333	-131.429533
39	54.9075	-131.459167
40	54.9249	-131.4850
60	54.8849	-131.1903
61	54.8145	-131.3507

-continued-

Appendix 1. (page 2 of 4)

Subdistrict 101-22

Transect number	Latitude	Longitude
6	54.893	-131.5301
7	54.8893	-131.5427
8	54.8857	-131.5641
9	54.882	-131.5819
10	54.8823	-131.5438
11	54.8713	-131.5764
12	54.8592	-131.5819
15	54.8836667	-131.538333
16	54.8818333	-131.540333
17	54.888	-131.548
18	54.8878333	-131.557667
19	54.883	-131.556833
20	54.8776	-131.5559
21	54.889	-131.564833
22	54.8838333	-131.5675
23	54.8896667	-131.567833
24	54.8836667	-131.571
25	54.886	-131.575833
26	54.8664	-131.5792

Subdistrict 101-23

Transect number	Latitude	Longitude
1	54.9290167	-130.973783
2	54.9664167	-130.955767
3	54.99635	-131.001017
4	54.9547833	-130.978033
5	54.97105	-130.999633
6	55.0317	-131.003
7	55.05575	-130.99745
8	55.08585	-130.989633
9	55.1119333	-131.051317
10	55.0959167	-131.050967
11	55.0833833	-131.1764
12	55.0828	-131.2436
13	55.0441167	-131.212383
14	54.9343	-131.2470
15	54.9721	-131.253167
16	54.9897	-131.2369
17	55.0164167	-131.1882
18	55.0308	-131.2604
19	55.0043	-131.30114
20	54.9948	-131.3219
21	54.9773667	-131.375283

Subdistrict 101-25

Transect number	Latitude	Longitude
1	54.9635333	-131.468483
2	54.967	-131.471367
3	54.9607833	-131.52165
4	54.981	-131.501667
5	55.0005	-131.522833
6	54.9933333	-131.534333
7	54.9746	-131.519933
8	55.004	-131.562667
9	54.9381667	-131.493583
10	54.9558	-131.481233
11	54.9294	-131.5754
12	54.9363167	-131.587383
13	54.94175	-131.58705
14	54.9569333	-131.5824
15	54.9543667	-131.5892
16	54.9441333	-131.605483
17	54.9471333	-131.613
18	54.9353333	-131.595783
19	54.9611333	-131.549133
20	54.9539167	-131.553667
21	54.9496833	-131.576717
22	54.96625	-131.574117
23	54.9671	-131.59
24	54.9758667	-131.584283
25	55.1130833	-131.7081
26	55.11015	-131.7383

-continued-

Appendix 1. (page 3 of 4)

Subdistrict 102-80

Transect number	Latitude	Longitude
1	55.50915	-131.999483
2	55.5297167	-132.040583
3	55.54025	-132.066
4	55.5490833	-132.11025
5	55.5635833	-132.1515
6	55.5825167	-132.170683
7	55.5987833	-132.19135
8	55.62275	-132.201683
9	55.6441833	-132.205467
10	55.6679333	-132.217933
11	55.6929167	-132.2238
12	55.7149333	-132.243067
13	55.73462	-132.26055
14	55.7578333	-132.28295

Subdistrict 113-22

Transect number	Latitude	Longitude
1	56.595	-135.117583
2	56.6029	-135.088417
3	56.61115	-135.06155
4	56.6254167	-135.03655
5	56.6636667	-134.996233
6	56.6401	-135.0082
7	56.6327167	-134.986967
8	56.6167	-134.972967
9	56.6396667	-134.925833
10	56.59815	-134.972283
11	56.6089667	-135.004767
12	56.58545	-135.0095
13	56.5935167	-135.032517
14	56.5794667	-135.049583
15	56.6060667	-135.071467
16	56.6341	-135.00175
17	56.62555	-134.975567
18	56.6188667	-134.963917
19	56.5935167	-135.003967
20	56.5975833	-135.01845

Subdistrict 101-27

Transect number	Latitude	Longitude
1	55.2700	-131.6450
2	55.2832	-131.6450
4	55.2777	-131.6842
5	55.2556	-131.6711
6	55.2345	-131.6840
9	55.1897	-131.7130
10	55.1752	-131.7212
12	55.1472	-131.7318
13	55.1359	-131.7434
14	55.1395	-131.7336
15	55.1568	-131.7407
16	55.1646	-131.7281
17	55.2018	-131.7179
18	55.2242	-131.6888
19	55.2469	-131.6855
20	55.2849	-131.6254
21	55.2738	-131.6366
22	55.2673	-131.6771
23	55.2479	-131.6666
24	55.1457	-131.7207

-continued-

Appendix 1. (page 4 of 4)

Subdistrict 101-29

Transect number	Latitude	Longitude
1	55.1290	-131.7524
2	55.1387	-131.7686
3	55.1387	-131.7783
4	55.1531	-131.7874
5	55.1603	-131.7872
6	55.1629	-131.8013
7	55.1801	-131.8124
8	55.1918	-131.8300
9	55.2103	-131.8317
10	55.2319	-131.8415
11	55.2523	-131.8410
12	55.2698	-131.8465
13	55.2886	-131.8624
14	55.3101	-131.8691
15	55.3383	-131.8647
16	55.3576	-131.8636
17	55.3802	-131.8816
18	55.3857	-131.8397
19	55.4059	-131.8513
20	55.4286	-131.8543

Subdistrict 104-30 Experimental

Transect number	Latitude	Longitude
1	55.1381	-133.2056
2	55.1544	-133.1838
8	55.2173	-133.3538
9	55.2103	-133.4416
10	55.2683	-133.4672
11	55.2828	-133.4202
12	55.3450	-133.5672
13	55.3401	-133.6158
14	55.3137	-133.5818
15	55.2570	-133.6077
16	55.1442	-133.2124
17	55.1638	-133.2186
18	55.1660	-133.2029
19	55.1831	-133.2396
20	55.2036	-133.3501
21	55.2262	-133.3656
22	55.2078	-133.4150
23	55.2162	-133.4527
24	55.2570	-133.4707
25	55.2729	-133.4586
26	55.2815	-133.4118
27	55.2861	-133.4372
28	55.3162	-133.4684
29	55.2416	-133.6038
30	55.2853	-133.5957
31	55.3051	-133.5855
32	55.3393	-133.5855
33	55.3351	-133.6111
34	55.3709	-133.5900
35	55.3417	-133.5621

Subdistrict 104-30 Control

Transect number	Latitude	Longitude
3	55.1837	-133.2320
4	55.1998	-133.1807
5	55.2312	-133.2231
6	55.1944	-133.2291
7	55.2260	-133.2520
36	55.1960	-133.1965
37	55.1928	-133.2327
38	55.2050	-133.2284
39	55.1861	-133.2170
40	55.1896	-133.2105
41	55.1956	-133.1791
42	55.1989	-133.1678
43	55.1979	-133.1837
44	55.2038	-133.1977
45	55.2217	-133.2239
46	55.2300	-133.2229
47	55.2068	-133.3239
48	55.2162	-133.2763
49	55.2193	-133.2664
50	55.2332	-133.2491

Appendix 2. Red sea urchin transect survey data collected in Southeast Alaska, 2000.

Subdistrict: 101-11				Subdistrict: 101-21 reef				Subdistrict: 101-21 shore			
transect no	side a	side b	maximum depth (mllw, ft.)	transect no	side a	side b	maximum depth (mllw, ft.)	transect no	side a	side b	maximum depth (mllw, ft.)
4	6	20	50	19	44	30	38	1	58	123	33
6	169	259	50	21	13	19	41	2	178	116	50
8	176	154	50	22	174	141	4	3	157	152	40
9	0	0	50	23	92	156	15	4	0	0	22
10	0	0	50	41	0	59	19	5	0	0	16
23	63	81	50	42	93	322	21	6	627	588	40
24	158	102	50	43	60	70	23	7	477	345	56
25	0	0	14	44	0	2	34	8	521	451	50
26	45	24	50	45	40	42	43	9	7	12	56
28	850	496	50	46	73	79	42	10	5	0	56
29	124	129	50	47	88	72	28	11	61	35	56
33	53	66	50	48	86	88	12	12	246	214	56
35	61	72	50	49	1	0	31	13	287	290	48
36	108	122	50	50	97	52	25	14	234	392	50
37	184	179	50	51	265	219	15	15	3864	4613	50
40	29	25	50	52	157	157	26	16	1298	1135	56
41	145	138	50	53	85	80	21	17	1973	2014	56
43	162	119	50	54	81	81	25	18	160	363	56
44	153	162	50					24	215	238	56
45	88	88	50					25	25	50	56
46	30	52	50					26	197	236	45
47	6	2	50					27	0	0	56
48	0	2	50					28	35	55	35
49	38	24	50					29	225	110	50
50	77	74	50					31	58	103	56
51	236	379	50					32	94	139	35
52	170	149	40					34	294	220	30
53	190	111	50					35	402	420	50
54	92	82	50					36	234	353	50
55	152	59	50					37	805	933	56
56	1	3	50					38	1380	1672	56
								39	2053	2188	50
								40	515	514	50
								60	181	214	56
								61	48	81	56

-continued-

Appendix 2. (page 2 of 4)

Subdistrict: 101-22				Subdistrict: 101-23				Subdistrict: 101-25			
transect no	side a	side b	maximum depth (mllw, ft.)	transect no	side a	side b	maximum depth (mllw, ft.)	transect no	side a	side b	maximum depth (mllw, ft.)
6	16	12	37	1	120	127	50	1	434	393	50
7	42	49	29	2	368	265	56	2	83	89	50
8	44	34	16	3	0	0	15	3	47	64	47
9	34	66	30	4	265	238	50	4	36	20	50
10	53	73	23	5	0	0	33	5	38	51	50
11	99	52	37	6	1	0	33	6	81	41	50
12	41	34	34	7	21	9	33	7	23	45	50
15	77	49	27	8	73	45	56	8	99	81	50
16	37	28	32	9	46	32	33	9	685	275	50
17	57	31	27	10	64	113	24	10	0	0	50
18	0	30	26	11	15	22	56	11	285	153	50
19	66	87	25	12	0	0	33	12	326	312	50
20	27	52	32	13	96	135	33	13	0	0	42
21	117	85	33	14	0	0	40	14	0	0	22
22	16	31	28	15	34	48	53	15	0	0	11
23	95	21	21	16	366	253	40	16	0	0	50
24	0	10	30	17	172	173	56	17	49	19	50
25	10	0	32	18	0	0	33	18	203	356	50
26	96	40	31	19	0	0	33	19	12	26	50
				20	0	0	33	20	0	0	50
				21	69	147	33	21	0	10	50
								22	0	0	50
								23	40	44	50
								24	135	262	50
								25	109	44	33
								26	31	70	40

-continued-

Appendix 2. (page 3 of 4)

Subdistrict: 101-27				Subdistrict: 101-29				Subdistrict: 102-80			
transect no	side a	side b	maximum depth (mllw, ft.)	transect no	side a	side b	maximum depth (mllw, ft.)	transect no	side a	side b	maximum depth (mllw, ft.)
1	49	24	33	1	35	69	50	1	37	31	33
2	86	96	33	2	5	4	50	2	65	93	33
4	11	17	33	3	90	95	50	3	0	0	33
5	19	25	33	4	53	47	50	4	128	60	33
6	129	117	33	5	6	0	40	5	67	65	33
9	25	20	33	6	149	153	50	6	29	19	33
10	97	69	33	7	51	49	50	7	30	55	33
12	4	6	33	8	335	352	50	8	38	17	33
13	10	29	33	9	329	317	50	9	20	8	33
14	13	3	33	10	313	214	50	10	1	0	33
15	1	0	33	11	130	54	50	11	19	25	33
16	6	9	33	12	287	242	50	12	42	63	33
17	3	3	33	13	229	189	50	13	130	116	33
18	55	152	33	14	140	224	50	14	38	45	33
19	31	27	33	15	236	175	50				
20	58	69	33	16	191	163	50				
21	41	30	33	17	293	280	50				
22	17	18	33	18	0	0	50				
23	78	109	33	19	33	38	50				
24	94	46	33	20	237	167	50				

-continued-

Appendix 2. (page 4 of 4)

Subdistrict: 104-30 con

transect no	side a	side b	maximum depth (mllw, ft.)
3	379	603	50
4	0	0	*
5	372	218	50
6	271	167	50
7	815	548	50
36	29	15	50
37	114	130	50
38	375	614	50
39	59	56	50
40	33	41	50
41	0	0	*
42	0	0	*
43	0	0	*
44	0	0	*
45	602	446	50
46	279	253	50
47	322	410	50
48	104	95	40
49	0	0	48
50	175	168	50

* transect not done because not urchin habitat.

Subdistrict: 104-30 exp

transect no	side a	side b	maximum depth (mllw, ft.)
1	224	183	50
2	0	0	*
8	771	707	50
9	68	38	50
10	1408	841	50
11	0	0	50
12	14	17	50
13	0	0	*
14	673	721	33
15	351	272	43
16	1300	2338	50
17	64	101	50
18	143	110	50
19	251	203	50
20	586	629	50
21	0	0	*
22	101	112	50
23	471	464	50
24	749	639	50
25	198	162	24
26	17	3	50
27	43	50	50
28	270	148	50
29	17	19	50
30	193	310	50
31	54	59	50
32	0	0	*
33	0	0	*
34	0	0	*
35	0	0	*

* transect not done because not urchin habitat.

Subdistrict: 113-22

transect no	side a	side b	maximum depth (mllw, ft.)
1	0	0	33
2	0	1	33
3	0	0	33
4	1	1	33
5	1	5	33
6	1	2	33
7	0	0	33
8	1	5	33
9	0	5	33
10	0	0	33
11	0	0	33
12	0	0	33
13	0	0	33
14	0	3	33
15	0	0	33
16	0	0	33
17	0	0	33
18	0	0	33
19	0	0	33
20	0	0	33

Appendix 3. Red sea urchin test diameters in millimeters by subdistrict and transect, collected in Southeast Alaska, 2000. First row are transect numbers.

Subdistrict 101-11

	Transect#	4	4	6	6	8	8	23	23	23	23	24	24	24
	Depth	20	30	20	30	20	30	10	20	30	40	20	30	40
		151	142	133	112	96	98	117	132	119	113	35	75	113
		137	143	154	94	111	126	126	117	115	120	113	99	116
		146	148	125	101	134	115	119	137	125	97	70	124	93
		145	145	123	109	55	83	117	101	124	108	87	117	81
		123	119	123	103	127	85	119	85	118	116	91	136	117
		105	125	113	94	114	90	107	117	116	116	108	119	129
		141	122	70	97	135	106	87	85	107	149	93	86	96
		140	126	75	87	126	120	113	106	124	100	90	70	102
		135	140	132	106	78	114	83	81	132	116	109	47	92
		151	126	106	94	105	116	84	102	130	60	81	36	106
		148	128	90	103	111	124	82	86	95	95	79	33	118
		100	138	95	116	54	105	91	113	103	101	69	33	69
		90	138	82	121	64	108	77	144	118	115	110	29	65
		52	94	118	114	110	134	85	81	126	30	104	18	73
			94	88	99	126	36	91	69	104	24	116		49
						82	54		100	89				32
						93	79							
						34								
						30								
Depth (ft)														
10	Average							99.87						
	Minimum							77						
	Maximum							126						
20	Average	126		108.5		93.95			103.5			90.33		
	Minimum	52		70		30			69			35		
	Maximum	151		154		135			144			116		
30	Average		128.5		103.3		99.59			115.3			73	
	Minimum		94		87		36			89			18	
	Maximum		148		121		134			132			136	
40	Average										97.33			90.69
	Minimum										24			32
	Maximum										149			129
Overall	Average	127.3		105.9		96.77		104				84.67		
Combined	Minimum	52		70		30		24				18		
	Maximum	151		154		135		149				136		
Overall	Average	126	128.5	108.5	103.3	93.95	99.59	99.87	103.5	115.3	97.33	90.33	73	90.69

-continued-

Subdistrict 101-11

	Transect #	26	28	28	28	29	29	29	33	33	36	36	37	37	37	40	40	40	41	41
	Depth	40	10	20	30	20	30	40	10	20	10	20	20	30	40	20	30	40	20	30
		106	69	105	99	120	98	120	138	133	120	80	37	77	120	106	132	125	68	120
		104	129	119	93	132	101	98	115	147	97	70	74	110	115	113	117	92	88	102
		102	66	125	86	96	114	94	138	123	85	56	85	93	138	125	118	60	65	114
		107	67	130	110	117	96	100	129	99	71	46	97	94	144	120	69	81	87	75
		82	63	98	87	92	94	98	97	123	72	61	70	100	125	96	128	114	78	84
		109	80	99	83	115	101	101	32	95	61	97	79	70	125	76	109	129	78	90
		86	120	98	49	88	95	93	136	120	63	84	90	110	33	120	90	130	83	113
		103	127	93	109	99	94	103	114	134	79	122	94	117	105	86	134	131	89	98
		83	108	101	99	77	102	82	135	119	116	71	97	119	107	126	98		94	78
		100	71	116	92	67	104	102	113	116	64	60	96	114	19	91	132		87	74
		96	124	110	99	97	110	92	109	133	68	87	80	119	25	110	117		53	85
		80	137	97	101	94	110	101	96	97	45	107	70	95	136	114	114		37	44
		31	18	97	97	101	59	125	76	83	82	75	67	105	127	118	109		56	32
		24	68	100	102	55	85	94	63	84	56	81	106	117	106	96	117		39	25
		38	66		92	71	103	98	119	74	72	61	27	96		109	40		54	19
		31				76	99	100	126		62	48	104	64		113				
											95		56	89		64				
													113	54		34				
													95							
Depth (ft)																				
10	Average		87.53						108.5		76.94									
	Minimum		18						32		45									
	Maximum		137						138		120									
20	Average			106.3		93.56				112		75.38	80.89			100.9			70.4	
	Minimum			93		55				74		46	27			34			37	
	Maximum			130		132				147		122	113			126			94	
30	Average				93.2		97.81							96.83			108.3			76.9
	Minimum				49		59							54			40			19
	Maximum				110		114							119			134			120
40	Average	80.13						100.1							101.8			108		
	Minimum	24						82							19			60		
	Maximum	109						125							144			131		
Overall	Average	80.13	95.67			97.15			110.3		76.16		93.17			105.7			83.2	
Combined	Minimum	24	18			55			32		45		19			34			19	
	Maximum	109	137			132			147		122		144			134			139	
Overall	Average	80.13	87.53	106.3	93.2	93.56	97.81	100.1	109	112	77	75	81	97	102	101	108	108	70	77

-continued-

Subdistrict 101-11

	Transect	41	43	43	43	44	44	45	45	46	46	46	47	47	49	49	50	50	50	51
	Depth	40	20	30	40	10	20	10	20	20	30	40	20	30	10	20	20	30	40	10
		56	110	123	61	80	83	100	125	147	138	153	149	139	123	121	108	112	95	131
		119	123	115	81	93	101	119	114	167	138	128	139	148	135	137	116	109	122	129
		118	87	124	36	120	85	118	95	144	135	146	144	146	132	153	105	119	107	85
		134	117	113	104	138	98	92	117	138	134	131	148	109	137	88	116	89	117	88
		107	103	95	80	97	84	124	115	151	138	111	166	124	135	143	83	103	74	92
		135	128	98	92	91	68	132	135	133	150	135	156	136	139	85	92	116	112	106
		139	112	113	76	87	95	94	117	133	136	143	138	132	96	136	114	109	22	64
		115	107	98	131	79	100	78	127	152	154	123		144	151	72	92	110	117	108
		120	98	72	85	78	84	110	112	146	150	148		136	132	76	73	92	41	139
		121	104	107	84	96	96	122	112	136	133	146		104	124	96	81	105	21	44
		88	85	102	99	91	71	80	115	155	135	141		149	132	126	102	31	117	89
		96	109	32	120	69	43	140	127	149	136	153		145	98	133	85	30	133	82
		59	80	101	59	39	36	54	128	148	152	53		142	108	124	47	33	132	64
		97	94	127	80	64	34	93	123		158	26		137	62	123	89	17	36	85
		29	72	109		29	43		44					89		55				37
		104					14													
Depth (ft)																				
10	Average					83.4		104							121.7					89.53
	Minimum					29		54							62					37
	Maximum					138		140							151					139
20	Average		102				70.94		113.7	146.1			148.6			111.2	93.07			
	Minimum		72				14		44	133			138			55	47			
	Maximum		128				101		135	167			166			153	116			
30	Average			102							141.9			132				83.93		
	Minimum			32							133			89				17		
	Maximum			127							158			149				119		
40	Average	102			84.86							124.1							89	
	Minimum	29			36							26							21	
	Maximum	139			131							153							133	
Overall	Average		96.2			77.17		108.9		137.4			140.3		116.5		88.67			99.51
Combined	Minimum		32			14		44		26			89		55		17			28
	Maximum		131			138		140		167			166		153		133			146
Overall	Average	102	102	102	85	83	71	104	114	146	142	124	149	132	125	111	93	84	89	90

-continued-

Subdistrict 101-11

	Transect #	51	51	51	52	52	53	53	53	54	54	54	55	55	56	
	Depth	20	30	40	10	20	10	20	30	20	30	40	20	30	40	Overall
		109	116	99	134	101	119	88	88	135	127	71	122	80	107	
		118	113	125	121	114	102	83	99	115	102	107	126	103	129	
		115	113	107	79	117	92	70	102	127	102	119	152	107	142	
		99	122	108	109	99	107	69	97	110	121	107	132	113	140	
		102	99	112	121	110	75	98	84	112	100	95	138	107	104	
		99	109	103	96	113	58	91	107	127	72	127	112	108	119	
		71	113	102	120	124	102	67	99	129	90	57	82	127	76	
		63	124	107	93	127	59	92	68	117	31	102	121	75	122	
		86	109	122	55	119	96	97	78	89	60	88	73	86	133	
		28	107		120	82	59	111	84	129	103	129	81	108	124	
		51	39		102	120	93	98	106	116	131	110	122	68	113	
		116	119		129	98	106	111	90	116	68	30	89	88	119	
		90	104		74	109	105	61	97	110	68	96	69	45		
		146			103	93	100	88	82	105	80	106	87	45		
						96	93	67	106	54	104		88	111		
							98	96	108							
							61	81	74							
								70								
								111								
								82								
								116								
								17								
								84								
Depth (ft)																
10	Average				104		89.71									97
	Minimum				55		58									18
	Maximum				134		119									151
20	Average	92.36				108.1		84.7		112.7			106.3			102
	Minimum	28				82		17		54			69			14
	Maximum	146				127		116		135			152			167
30	Average		106.7						92.29		90.6			91.4		102
	Minimum		39						68		31			45		17
	Maximum		124						108		131			127		158
40	Average			109.4								96			119	100
	Minimum			99								30			76	19
	Maximum			125								129			142	153
Overall	Average				106.1		88.9			99.78			98.83		119	101
Combined	Minimum				55		17			30			45		76	14
	Maximum				134		119			135			152		142	167
Overall	Average	92	107	109	104	108	90	85	92	113	91	96	106	91	119	

-continued-

Subdistrict 101-21

Transect #	1	2	3	6	7	8	9	11	12	13	14	15	16	17	18	19	21	22	23
	125	131	121	114	112	129	149	131	78	126	134	75	76	94	73	128	89	105	87
	138	110	120	109	117	77	98	136	91	142	133	72	84	72	123	89	132	89	75
	133	78	78	120	105	87	169	138	97	106	127	85	75	73	67	132	108	117	93
	119	117	119	131	105	126	117	137	89	130	105	123	89	86	71	115	108	87	102
	114	92	84	112	109	120	144	132	86	81	112	121	74	117	104	78	88	108	87
	125	116	79	135	114	127	146	132	78	108	97	113	72	94	75	87	105	99	82
	98	78	64	122	92	147	85	110	60	81	82	120	78	76	129	94	127	79	91
	109	89	130	107	95	79	152	129	92	134	112	84	74	76	112	114	113	74	104
	112	115	98	114	100	139	78	140	88	112	137	111	60	69	60	94	103	111	101
	122	128	98	116	87	115	112	93	104	95	111	104	77	122	120	90	101	90	101
	124	118	94	138	97	78	160	110	108	114	132	131	70	147	124	80	101	115	88
	111	114	84	140	103	134	141	140	117	91	119	99	83	123	68	88	124	104	94
	108	114	99	112	97	117	150	128	103	150	48	127	72	124	110	99	110	91	80
	110	127	104	109	72	73	135	123	124	59	87	124	72	143	98	97	101	74	85
	139	119	134	110	102	139	136	135	114	63	80	94	98	151	74	78	100	71	84
	112	87	102	135	104	31	134	138	124	58	92	105	103	73	68	102	97	82	108
	128	98	101	121	78	73	140	132	109	94	84	109	70	78	111	97	111	99	94
	128	111	98	107	106	67	92	117	106	129	91	78	68	71	88	95	114	89	28
	95	117	91	113	64	69	124	79	105	102	80	82	145	73	102	92	114	74	93
	101	116	87	109	76	91	145	94	124	76	117	116	122	92	65	105	103	100	83
	113	100	120	109	64	129	120	87	117	116	81	89	133	87	71	84	107	80	90
	122	87	85	111	82	136	149	107	118	125	95	105	132	84	62	119	109	89	79
	122	95	82	112	97	69	140	110	114	89	91	27	119	78	74	98	130	129	92
	86	95	73	104	90	137	127	88	41	79	79	98	138	87	64	89	115	61	77
	91	54	121	83	79	108	122	31	85	117	90	110	73	75	69	112	114	106	86
	84	91	102	68	44	142	145	39	110	80	83	81	92	64	65	94	124	99	83
	117	84	102	73	35	125	97	44	63	24	68	120	98	121	81	108	115	91	95
	108	97	118	79	41	35	96	94	112	113	50	99	75	107	94	94	109	93	85
	111	76	98	86	20		117		75	58	91	119	72	109	72	94	104	94	73
	93	82	128	88	20		147		105		34	126	81	115	74	116	138		77
	112		80				147		87				117		59				
			92						105				103		55				
			92						86				134		58				
									120				62		61				
													25						
													24						
													85						
													94						
													61						
													71						
Average	113	101.2	99.33	109.6	83.57	103.5	129.5	109.8	98.09	98.34	94.73	101.6	86.28	96.03	82.38	98.73	110.5	93.1	86.57
Minimum	84	54	64	68	20	31	78	31	41	24	34	27	24	64	55	78	88	61	28
Maximum	139	131	134	140	117	147	169	140	124	150	137	131	145	151	129	132	138	129	108

-continued-

Appendix 3. (page 6 of 23)

Subdistrict 101-21

Transect #	24	25	26	28	31	32	34	35	36	37	38	39	40	41
	136	93	99	145	128	113	63	112	132	121	122	101	129	88
	127	88	117	153	106	146	78	127	128	118	101	135	94	83
	129	87	77	149	109	94	109	128	141	132	124	107	85	90
	87	71	87	120	124	54	98	120	116	125	116	110	69	78
	97	80	116	158	130	124	85	123	128	121	102	119	71	72
	106	93	69	83	114	120	93	127	114	121	123	105	96	81
	89	104	84	139	117	139	58	124	87	128	112	100	101	125
	127	63	92	156	105	130	84	114	82	65	115	104	65	71
	69	62	116	123	118	144	63	102	77	124	105	106	98	88
	82	103	79	122	132	130	76	102	78	87	112	111	61	81
	129	76	84	146	124	119	82	110	93	152	122	115	111	90
	91	106	116	85	119	120	127	123	88	129	105	108	70	76
	68	91	84	143	119	135	127	62	82	118	71	116	69	56
	94	95	90	166	108	25	73	84	90	110	70	105	111	94
	76	98	83	125	119	92	67	70	78	125	82	123	70	72
	92	115	112	151	113	149	118	83	121	57	76	81	124	72
	98	48	91	145	119	127	97	98	128	118	71	117	100	135
	76	32	88	150	132	84	87	97	123	143	65	118	75	112
	109	100	22	127	113	111	37	112	140	155	81	109	75	80
	94	60	40	103	113	143	80	90	133	80	97	120	71	87
	92	96	118	145	102	128	79	87	113	142	94	124	74	81
	77	84	91	154	119	139	81	64	144	145	115	92	72	78
	79	84	60	99	107	26	70	73	117	142	102	116	66	71
	93	92	115	143	97	9	81	74	85	123	94	104	119	88
	106	86	94	83	127	10	126	82	78	51	112	94	65	82
	115	88	82	59	57	130	103	68	96	148	111	101	67	81
	97	81	84	81	33	113	66	83	61	132	135	113	108	77
	83	69	81	130	105	144	72	85	94	119	89	110	75	74
	92	89	85	81	104	123	107	66	78	145	92	105	83	80
	122	47		131		120	79	62	73	120	98	103	128	78
	77					142	119	88			88			74
	92					134	82	77						71
	108					120	98	70						68
						144								86
						14								74
						13								
Average	97.24	82.7	88.14	126.5	110.8	105.8	86.82	93.55	103.3	119.9	100.1	109	86.7	82.7
Minimum	68	32	22	59	33	9	37	62	61	51	65	81	61	56
Maximum	136	115	118	166	132	149	127	128	144	155	135	135	129	135

-continued-

Subdistrict 101-21

Transect #	42	43	45	46	47	48	49	50	51	52	53	54	60	61	Overall
	97	77	131	117	131	94	117	95	92	80	60	87	97	135	
	90	73	137	98	105	70	132	103	63	57	61	89	90	138	
	70	66	97	109	110	61	115	109	89	64	102	85	126	152	
	75	84	122	97	86	92	125	107	88	68	63	101	112	145	
	89	23	119	122	124	85	120	75	92	102	58	98	112	135	
	82	72	111	117	100	63	123	102	95	74	102	77	112	128	
	79	70	138	110	135	81	123	100	68	85	71	84	91	122	
	63	85	133	105	126	64	110	76	73	94	100	81	92	125	
	78	64	116	118	105	91	104	108	89	108	64	89	89	103	
	105	94	140	102	124	62	117	73	82	67	87	87	109	92	
	94	86	124	110	102	68	108	78	68	82	70	78	88	51	
	94	70	127	119	102	65	128	91	80	51	64	77	85	122	
	88	74	136	97	115	100	100	105	54	132	104	84	74	122	
	103	90	136	94	136	66	116	100	81	74	67	75	97	122	
	89	74	134	114	112	68	123	109	78	70	96	76	94	106	
	98	76	117	105	124	82	120	97	73	83	98	88	108	137	
	121	122	117	128	108	88	118	84	87	75	62	75	89	119	
	101	78	135	114	86	74	109	84	82	94	95	52	77	104	
	86	101	127	113	85	49	120	108	86	50	74	88	84	137	
	98	106	123	122	86	105	103	72	110	71	81	61	95	148	
	137	71	121	115	130	63	94	104	73	74	63	94	138	117	
	73	79	85	115	86	66	105	98	91	63	60	79	88	126	
	97	69	111	103	126	73	115	75	105	59	62	88	93	108	
	82	99	124	128	121	75	97	107	85	87	65	89	89	132	
	82	84	133	110	127	43	98	96	80	77	79	56	88	104	
	82	85	126	98	111	52	109	92	73	96	69	85	86	89	
	68	89	123	91	122	68	111	89	75	77	65	85	70	139	
	108	81	132	115	144	58	102	70	98	74	90	53	96	91	
	77	118	134	100	122	70	126	97	64	87	76	88	89		
	105		131	102	117	73	127	105	72	48	72	65	25		
	39		113	96	35		108	92		77			36		
	83		79	110	17			87		74			37		
										76			52		
										58					
										62					
										66					
Average	88.5	81.4	123	109.2	108.1	72.3	113.6	93.38	81.53	76	76	80.47	88.12	119.6	98
Minimum	39	23	79	91	17	43	94	70	54	48	58	52	25	51	9
Maximum	137	122	140	128	144	105	132	109	110	132	104	101	138	152	169

-continued-

Subdistrict 101-22

Transect #	6	7	8	9	10	11	12	15	16	17	18	19	20	21
	59	91	132	97	97	115	69	116	82	110	96	95	83	76
	87	107	92	92	111	107	65	92	96	119	100	103	100	75
	95	99	90	100	79	95	73	89	94	122	95	106	104	95
	82	110	130	94	109	122	75	94	98	108	142	109	95	89
	91	105	98	122	92	115	57	88	115	88	84	85	77	84
	107	89	125	89	90	116	54	102	94	104	94	89	80	88
	107	104	68	79	88	97	74	95	91	114	126	110	98	61
	85	104	86	123	68	104	108	90	103	94	94	100	130	59
	117	117	90	131	83	123	88	84	102	108	80	108	119	76
	82	41	88	102	100	120	57	83	108	77	111	106	126	93
	80	100	74	97	77	77	67	74	104	99	78	100	84	120
	79	94	127	125	98	122	72	101	113	37	64	120	93	95
	65	104	124	107	87	108	72	78	113	84	81	97	99	140
	71	79	128	85	97	96	72	110	101	109	61	83	101	101
	72	82	96	112	83	99	64	99	108	130	76	91	110	117
	120	119	94	88	101	129	65	88	63	82	79	119	117	93
	95	104	92	90	83	97	76	102	90	103	96	78	92	76
	122	119	84	80	89	103	58	98	105	112	84	84	110	86
	58	97	82	67	91	124	74	85	114	111	81	100	96	89
	79	129	90	79	93	113	69	77	76	113	78	78	104	82
	104	91	135	96	90	121	58	93	95	108	74	68	98	88
	71	109	101	72	95	104	55	88	106	97	79	95	128	89
	88	107	97	85	91	116	76	79	104	111	88	74	133	68
	85	118	84	69	85	124	50	89	64	116	79	90	102	70
	99	63	95	115	95	122	95	79	46	65	130	79	112	89
	110	113	98	79	98	97	64	93	98	118	91	73	111	83
	116	106	70	97	115	110	43	130	105	77	83	94	98	68
	89	91	77	112	88	91	73	95	101	82	89	105	74	75
	91	114	91	85	98	112	54	90	104	105	87	33	99	99
	83	98	94	91	90		34	95	104		64	74	74	112
	110		111		95		113	105	108		88	92	78	107
	65		109								89	52	76	121
	77											88		70
	105											95		88
												100		124
														113
Average	90	100.1	98.5	95.33	92.13	109.6	68.52	92.94	96.94	100.1	88.78	90.66	100	90.53
Minimum	58	41	68	67	68	77	34	74	46	37	61	33	74	59
Maximum	122	129	135	131	115	129	113	130	115	130	142	120	133	140

-continued-

Appendix 3. (page 9 of 23)

Subdistrict 101-22

Transect #	22	23	24	25	26	Overall
	105	134	73	120	142	
	108	131	102	152	117	
	119	134	121	95	86	
	86	90	93	128	82	
	127	82	85	92	120	
	109	123	72	97	154	
	107	87	113	90	132	
	103	108	88	78	71	
	121	139	51	76	80	
	123	126	79	85	141	
	126	134	89	77	145	
	123	129	105	69	122	
	105	75	42	76	147	
	116	124	38	81	74	
	103	77	63	77	139	
	102	120	72	95	130	
	86	98	80	92	117	
	110	128	103	88	133	
	119	80	83	87	120	
	89	132	112	83	91	
	125	135	24	77	148	
	81	82	84	72	85	
	90	96	125	105	126	
	92	102	91	97	94	
	100	71	90	73	132	
	120	122	117	83	141	
	105	75	73	77	134	
	118	89	55	125		
	115	86	109	102		
		54	106	83		
		120	94	70		
			83			
			103			
			72			
			39			
			42			
Average	108	105.9	82.53	90.39	118.6	96
Minimum	81	54	24	69	71	24
Maximum	127	139	125	152	154	154

-continued-

Subdistrict 101-23

Transect #	1	2	4	8	9	10	11	13	15	16	17	21	Overall
	105	102	105	118	130	94	108	132	130	99	142	146	
	67	98	108	106	138	93	119	143	138	79	111	99	
	64	130	114	112	139	73	153	114	129	110	118	117	
	81	126	103	130	128	120	134	138	151	125	87	124	
	68	109	107	111	151	121	99	94	126	92	111	154	
	80	89	120	104	132	86	134	147	81	106	102	141	
	80	108	115	112	146	119	126	84	137	96	107	133	
	73	109	111	92	142	129	129	139	142	73	98	128	
	77	88	122	109	116	95	123	69	70	75	87	126	
	67	96	114	104	154	124	139	89	132	87	78	115	
	56	63	109	82	129	110	115	118	66	80	82	138	
	71	64	122	112	124	123	144	143	128	75	95	139	
	107	56	98	113	134	53	135	137	130	82	83	133	
	98	83	89	101	116	91	128	91	137	40	66	131	
	78	84	104	97	128	85	146	143	117	90	81	130	
	77	80	134	111	129	95	96	87	104	90	58	134	
	67	104	114	100	141	115	137	117	69	126	87	147	
	74	44	105	95	129	86	128	85	139	81	77	152	
	70	87	109	80	108	93	21	59	153	117	86	104	
	98	65	102	99	134	114	95	96	131	85	73	144	
	123	42	114	96	127	98	146	123	134	80	94	137	
	66	62	97	91	133	88	141	97	49	133	94	155	
	65	42	95	73	127	120	142	98	145	103	87	145	
	62	52	91	54	127	93	119	119	129	79	73	114	
	71	49	97	71	104	98	137	123	128	109	68	133	
	84	83	74	45	54	101	111	128	28	72	84	110	
	103	69	82	83	77	109	141	103	136	84	88	109	
	60	106	74	67	48	128	109	107	42	109	71	137	
	43	75	75	78	97		127	111	117	84	72	130	
	5	45	74	81	74			27		81	62	143	
	75				39			31		113	74		
								41		97	67		
								94		90			
Average	75	80.33	102.6	94.23	117.9	101.9	123.5	103.8	114.4	92.18	86.34	131.6	102
Minimum	5	42	74	45	39	53	21	27	28	40	58	99	5
Maximum	123	130	134	130	154	129	153	147	153	133	142	155	155

-continued-

Subdistrict 101-25

Transect #	1	2	3	4	5	6	7	8	9	11	12	17	18	19
	108	102	115	143	95	81	156	105	84	109	93	153	125	100
	78	104	117	140	104	106	119	113	79	98	100	142	107	114
	123	142	130	148	125	88	84	123	126	91	111	142	121	158
	130	120	122	139	135	74	152	108	68	95	93	142	89	135
	112	111	131	114	135	121	143	111	105	89	84	143	92	122
	112	160	118	107	101	100	134	135	39	106	91	168	97	112
	126	132	130	122	121	88	130	99	108	123	83	139	116	144
	125	149	103	134	105	79	147	99	85	91	102	134	90	128
	113	139	123	118	110	73	145	26	72	92	138	95	110	110
	108	141	103	110	95	99	33	94	139	96	72	97	127	102
	103	122	131	131	115	92	164	109	135	85	36	128	117	122
	83	137	132	142	99	13	161	103	94	110	110	146	95	115
	137	125	127	143	87	111	11	93	108	97	119	104	117	118
	124	129	83	115	102	101	146	110	77	93	82	97	112	136
	91	144	119	141	101	100	144	65	132	102	79	156	74	123
	123	132	125	81	99	119	131	126	143	83	161	139	84	129
	119	122	125	112	112	129	136	99	97	93	85	125	76	153
	97	155	138	106	116	114	143	101	88	133	73	144	95	149
	105	144	10	107	26	82	138	134	146	93	133	100	111	129
	84	141	151	109	133	94	78	102	81	116	108	100	87	122
	78	136	133	148	108	95	131	97	135	100	104	141	84	114
	120	136	151	131	137	144	151	94	130	117	130	95	80	77
	86	139	111	131	122	73	154	103	89	100	90	85	88	125
	127	132	145	102	133	108	152	105	88	88	137	86	88	138
	136	121	133	128	129	104	132	99	129	93	95	91	84	157
	118	98	99	153	113	103	152	100	82	136	124	84	92	90
	100	86	139	95	122	112	134	106	140	127	82	68	78	114
	136	88	133	151	46	18	116	109	88	25	123	64	68	139
	99	81	122	148	9	144	131	102	87	101	93	59	70	127
	115	80	126	139	108	112		113	135		118	65	88	144
	84	79			57			106	131			35	74	99
		68			143			102	98					109
		64			134			133						112
					11									136
					125									
					111									
					139									
					139									
Average	110	120	120.8	126.3	105.3	95.9	129.2	103.8	104.3	99.38	101.6	111.8	94.71	123.6
Minimum	78	64	10	81	9	13	11	26	39	25	36	35	68	77
Maximum	137	160	151	153	143	144	164	135	146	136	161	168	127	158

-continued-

Subdistrict 101-25					
Transect #	23	24	25	26	
	123	113	111	81	
	117	88	92	86	
	109	106	112	77	
	111	99	97	111	
	131	112	94	100	
	33	100	67	88	
	36	126	95	112	
	123	122	52	135	
	122	110	71	82	
	136	135	88	121	
	132	79	109	71	
	115	86	88	83	
	134	99	82	65	
	119	102	89	97	
	130	110	129	112	
	107	80	99	74	
	111	8	87	48	
	104	96	88	66	
	115	83	93	71	
	108	100	73	109	
	125	110	98	97	
	127	81	107	91	
	131	84	66	76	
	101	90	84	114	
	117	102	68	77	
	127	116	100	108	
	129	89	73	87	
	30	102	114	130	
	15	80	114	97	
	16	81	121	87	
	18	78			
Average	101.7	95.71	92.03	91.77	107
Minimum	15	8	52	48	8
Maximum	136	135	129	135	168

-continued-

Appendix 3. (page 13 of 23)

Subdistrict 101-27

Transect #	1	2	4	5	6	9	10	13	14	16	17	18	19	20
	112	127	98	85	139	133	130	126	133	140	154	107	70	103
	136	145	145	99	107	117	89	115	122	132	127	79	148	91
	119	114	139	122	134	127	135	156	115	139	52	98	149	121
	107	135	142	112	112	101	120	130	116	158	109	121	128	95
	89	127	132	130	106	92	129	121	119	105	134	110	148	106
	116	118	116	88	120	92	135	113	123	110	107	107	95	78
	116	99	146	102	132	122	114	126	126	148	132	128	115	98
	66	101	128	63	124	120	138	105	133	100	130	114	91	91
	116	98	129	80	116	132	123	132	154	146	139	84	92	127
	30	102	136	86	107	74	126	140	128	127	132	118	93	97
	132	89	134	70	115	105	119	130	128	147	28	125	87	97
	85	108	125	78	137	103	152	136	132	136	144	82	122	98
	110	135	128	110	116	124	144	131	119	150	152	116	113	93
	54	101	109	68	105	115	121	131	112	119	117	109	82	112
	123	115	102	71	121	90	129	120	107	98	50	103	60	88
	116	125	138	106	137	122	127	138	133		50	119	113	107
	98	108	158	113	106	114	141	135	98		144	117	134	101
	127	119	158	112	123	109	126	110	133		151	118	48	88
	112	127	134	80	120	113	111	59	117		140	102	140	94
	125	117	159	104	117	111	19	100	76		159	134	124	96
	113	81	138	113	75	121	130	115	131		148	121	152	100
	130	112	128	89	120	127	112	134	32		162	113	98	102
	105	112	136	111	135	111	136	112	136		60	119	113	103
	97	120	140	117	135	36	121	131	130		141	90	118	86
	113	117	138	106	126	116	129	89	139		152	110	89	96
	109	102	128	91	141	123	124	130	119		152	110	82	99
	141	101	148	84	113	106	142	119	132		147	113	99	114
	117	93	146	94	112	101	133	116	109		153	83	152	97
	123	100	130	87	113		126	110	132		143	82	125	108
	134	82	118	110	106		151	112			171	83	115	107
		82	139	93	124		30	17				91	132	130
				134								73	82	
				102									85	
													114	
													82	
Average	109	110.1	133.7	97.27	119.2	109.2	121.4	117.4	120.1	130.3	126	105.6	108.3	100.7
Minimum	30	81	98	63	75	36	19	17	32	98	28	73	48	78
Maximum	141	145	159	134	141	133	152	156	154	158	171	134	152	130

-continued-

Subdistrict 101-27

Transect #	21	22	23	24	Overall
	127	121	123	128	
	152	111	117	122	
	161	109	88	97	
	121	96	90	36	
	145	108	122	90	
	125	134	71	91	
	115	152	123	96	
	119	109	95	100	
	129	117	83	138	
	133	107	98	112	
	122	114	99	139	
	147	137	118	127	
	114	113	109	76	
	140	69	110	126	
	28	97	100	104	
	112	73	104	115	
	123	118	102	134	
	134	128	97	125	
	129	130	91	59	
	118	117	115	122	
	133	148	101	123	
	46	143	112	98	
	140	141	85	105	
	125	140	99	83	
	126	143	71	118	
	136	131	102	123	
	140	133	100	122	
	66	145	101	145	
	67	161	89	108	
	63	104	102	116	
	116	55	111	119	
Average	117.8	119.5	100.9	109.6	114
Minimum	28	55	71	36	17
Maximum	161	161	123	145	171

-continued-

Subdistrict 101-29

	Transect #	1	1	1	1	2	2	3	3	3	3	4	4	4
	Depth	10	20	30	40	10	20	10	20	30	40	10	20	30
		97	106	126	132	143	138	96	83	60	97	82	99	81
		103	69	116	95	139	144	118	64	61	86	125	109	66
		99	70	116	105	152	133	89	82	57	98	84	89	87
		121	115	99	122	158	113	104	91	84	79	91	97	105
		118	122	147	141	128	75	129	78	66	101	85	109	68
		117	133	114	124	140	79	86	98	100	94	75	88	89
		117	108	129	114	127	84	102	95	70	99	69	84	42
		80	109	141	112	114	112	97	97	85	82	95	90	57
		122	83	89	113	80	92	85	74	97	102	99	98	73
		131	107	120	143	83	113	115	60	39	104	84	48	79
		83	103	116	142	85		134	112	110	82	101	58	71
		87	92	118	104	110		87	32	65	129	69	86	70
		97	96	122	105	114		101	115	64	101	72	74	73
		121	97	120	76			86	32	111	71	89	82	65
		42	121	104	106			132	47	105	85	76	45	59
		92	83					79		82				
										66				
Depth (ft)														
10	Average	102				121		103				86		
	Minimum	42				80		79				69		
	Maximum	131				158		134				125		
20	Average		101				108		77				84	
	Minimum		69				75		32				45	
	Maximum		133				144		115				109	
30	Average			118						78				72
	Minimum			89						39				42
	Maximum			147						111				105
40	Average				116						94			
	Minimum				76						71			
	Maximum				143						129			
Overall	Average	109				115		88				81		
Combined	Minimum	42				75		32				42		
	Maximum	147				158		134				125		
Overall	Average	102	101	118	116	121	108	103	77	78	94	86	84	72

-continued-

Subdistrict 101-29

	Transect #	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	10	10	11	11
	Depth	10	20	30	40	10	20	30	40	10	20	30	40	10	20	30	10	20	10	30
		113	92	58	82	107	59	77	49	79	104	62	89	94	107	129	79	92	108	89
		112	90	90	94	122	55	63	72	74	101	66	52	97	90	88	112	93	99	102
		109	108	56	82	95	101	65	76	75	112	65	87	82	69	87	122	81	116	133
		73	85	115	22	90	85	83	81	79	104	52	93	85	81	94	123	102	75	94
		126	85	106	94	81	78	85	73	80	115	59	75	92	84	119	124	101	77	119
		64	86	66	46	90	104	84	89	85	76	84	63	88	94	108	114	94	130	106
		99	75	52	18	96	108	86	100	62	78	72	48	78	85	84	127	79	60	137
		82	94	82	25	105	110	75	78	73	82	49	83	109	66	85	118	99	47	116
		66	84	74	62	130	120	58	77	76	128	33	69	75	89	105	110	89	82	142
		68	59	60	90	86	73	64	69	88	91	82	55	73	92	72	93	82	69	134
		105	78	64	22	89	78	78	68	74	72	38	41	74	101	83	127	76	46	115
		105	84	58	109	58	82	47	71	75	128	91	61	87	59	85	134	96	44	125
		64	68	65	108	102	74	56	97	85	74	39	39	79	68	78	91	98	89	145
		73	91	50	96	106	78	52	81	71	72	56	32	99	76	113	63	75	43	115
		84		98	88	21	79	22	61	57	86	54	39	38	65	93	62	75	48	114
				64	124					56		42	21				86	90	36	
										31		73					99			
										33		20					86			
Depth (ft)																				
10	Average	90				92				70				83			104		73	
	Minimum	64				21				31				38			62		36	
	Maximum	126				130				88				109			134		130	
20	Average		84				86				95				82			89		
	Minimum		59				55				72				59			75		
	Maximum		108				120				128				107			102		
30	Average			72				66				58				95				119
	Minimum			50				22				20				72				89
	Maximum			115				86				91				129				145
40	Average				73				76				59							
	Minimum				18				49				21							
	Maximum				124				100				93							
Overall	Average	80				80				70				87			96		99	
Combined	Minimum	18				21				20				38			62		36	
	Maximum	126				130				128				129			134		145	
Overall	Average	90	84	72	73	92	86	66	76	70	95	58	59	83	82	95	104	89	73	119

-continued-

Subdistrict 101-29

	Transect #	11	12	12	13	13	13	14	14	14	14	15	15	15	16	16	16	16	17	17
	Depth	40	10	20	10	20	30	10	20	30	40	10	30	40	10	20	30	40	10	20
		79	47	90	82	68	74	108	72	118	102	86	88	111	102	77	86	114	144	123
		104	111	117	127	87	80	102	116	91	77	80	96	106	97	96	69	88	130	128
		100	127	86	70	63	88	129	85	99	88	73	97	67	108	122	84	94	115	84
		97	72	83	75	116	77	95	78	118	94	87	96	115	42	110	87	132	127	110
		95	104	109	71	112	83	95	90	106	113	105	94	94	106	129	80	58	99	92
		143	86	115	110	105	72	103	96	112	115	108	58	121	86	113	96	73	138	81
		126	76	100	73	92	126	114	128	108	109	86	75	110	84	89	87	99	144	88
		84	91	76	106	98	97	127	93	101	74	83	85	95	78	74	84	84	110	72
		103	44	118	67	63	79	83	83	76	79	83	80	107	37	69	92	77	128	115
		101	50	80	74	92	84	132	77	88	78	107	80	94	87	115	103	88	128	73
		136	136	68	95	84	76	118	91	89	81	93	106	101	90	116	108	90	98	92
		133	74	85	72	72	77	111	83	95	98	112	59	110	74	76	121	75	118	85
		95	66	95	92	115	89	98	85	123	97	75	75	102	87	70	70	74	82	58
		93	82	68	104	95	111	101	86	73	84	118	90	109	77	98	61	60	102	83
		83	44	148	82	127	117	117	24	77	82	79	77	104	75	91	67	72	89	74
			68			46						125	85	98	66	84	87		104	
												90	122	125	46		70		118	
													60		39		78			
													85				93			
																	94			
																	71			
																	114			
Depth (ft)																				
10	Average		80		87			109				94			77				116	
	Minimum		44		67			83				73			37				82	
	Maximum		136		127			132				125			108				144	
20	Average			96		90			86							96				91
	Minimum			68		46			24							69				58
	Maximum			148		127			128							129				128
30	Average						89			98			85				86			
	Minimum						72			73			58				61			
	Maximum						126			123			122				121			
40	Average	105									91			104				85		
	Minimum	79									74			67				58		
	Maximum	143									115			125				132		
Overall	Average		88		88			96				94			86				97	
Combined	Minimum		44		46			24				58			37				50	
	Maximum		148		127			132				125			132				144	
Overall	Average	105	80	96	87	90	89	109	86	98	91	94	85	104	77	96	86	85	116	91

-continued-

Subdistrict 101-29

	Transect	17	17	19	19	19	19	20	20	
	Depth	30	40	10	20	30	40	20	30	Overall
		97	90	131	100	139	90	88	98	
		99	93	117	93	121	155	124	94	
		92	83	142	135	136	139	109	110	
		85	113	129	139	131	98	114	119	
		91	103	129	111	126	68	126	105	
		92	88	105	141	138	108	115	100	
		104	81	115	106	102	137	91	122	
		111	88	144	144	122	160	100	82	
		113	50	94	137	134	129	35	75	
		76	95	152	153	132	114	86	90	
		99	85	129	128	134	109	67	87	
		77	93	139	141	137	93	72	78	
		110	92		97	136	103	96	78	
		79	76			142	131	60	100	
			79			107		69	136	
									63	
Depth (ft)										
10	Average			127						95
	Minimum			94						21
	Maximum			152						158
20	Average				125			90		92
	Minimum				93			35		24
	Maximum				153			126		153
30	Average	95				129			96	90
	Minimum	76				102			63	20
	Maximum	113				142			136	147
40	Average		87				117			92
	Minimum		50				68			18
	Maximum		113				160			160
Overall	Average			125				93		93
Combined	Minimum			68				35		18
	Maximum			160				136		160
Overall	Average	95	87	127	125	129	117	90	96.06	

-continued-

Subdistrict 102-80

Transect #	1	2	4	5	6	7	8	9	11	12	13	14	Overall
	84	86	96	73	119	73	121	84	128	72	59	88	
	79	106	62	65	113	66	120	112	87	89	99	85	
	101	87	86	39	104	86	137	88	95	73	104	109	
	94	96	96	82	91	83	128	75	94	62	103	114	
	97	99	67	72	34	73	118	98	98	73	82	94	
	105	112	32	81	32	91	116	107	87	71	105	123	
	98	113	116	77	30	89	134	74	70	72	103	21	
	102	116	84	62	33	98	151	99	98	70	111	28	
	71	89	108	100	98	78	92	128	82	60	117	85	
	93	94	27	65	94	65	131	101	89	49	119	86	
	72	96	103	77	105	65	142	136	68	88	122	119	
	30	107	82	65	117	92	111	81	132	66	77	117	
	44	108	105	66	126	78	117	109	86	80	128	102	
	38	92	89	79	116	63	126	76	123	118	114	86	
	56	73	96	74	107	53	131	88	125	134	110	104	
	73	90	75	90	116	85	121	143	75	71	106	93	
	79	99	85	93	125	68	122	34	88	83	138	20	
	83	93	70	72	129	76	130	84	50	70	121	21	
	94	103	93	74	114	99	120	32	114	61	115	67	
	63	101	95	54	125	76	135	35	26	56	117	81	
	79	86	37	64	109	77	117	107	107	72	100	91	
	80	84	91	104	129	80	129	132	88	57	126	23	
	83	93	100	48	110	74	119	124	93	86	122	23	
	78	88	93	79	106	83	127	35	66	79	93	86	
	106	69	60	78	125	73	119	108	112	59	106	20	
	91	115	73	58	116	107	113	130	68	64	84	29	
	93	111	84	42	105	91	124	103	81	85	105	36	
	42	64	113	28	96	84	111	96	76	78	72	27	
	92	105	89	16	117	70	103	93	64	23	95	27	
	32	86	95	19	128	81	125	61	16	85	53	92	
			93	17	114	84		37		72	100		
				31	38	96		154			119		
				38	95	73		121					
								107					
Average	78	95.37	83.71	63.09	100.5	79.7	123	93.88	86.2	73.48	103.9	69.9	88
Minimum	30	64	27	16	30	53	92	32	16	23	53	20	16
Maximum	106	116	116	104	129	107	151	154	132	134	138	123	154

-continued-

Subdistrict 104-30 con

Transect #	3	5	6	36	37	38	39	40	45	46	47	48	50	
Depth	30	7	5	12	20	3	9	5	34	23	21	40	35	Overall
	134	100	62	108	76	120	110	103	112	127	122	72	118	
	85	102	56	125	94	132	96	69	111	134	73	128	128	
	94	110	99	78	107	115	102	98	107	104	124	132	135	
	107	113	93	108	113	69	95	99	115	94	75	109	128	
	119	97	44	84	93	127	96	98	91	126	74	107	100	
	95	112	102	88	75	99	73	107	94	104	121	130	124	
	94	76	117	108	84	104	132	90	117	119	128	115	146	
	96	59	80	101	80	75	65	106	37	103	122	90	124	
	100	49	53	87	81	127	94	110	113	96	86	110	95	
	108	101	53	112	81	113	118	84	97	111	68	127	122	
	114	76	50	78	84	105	119	107	113	119	53	98	135	
	85	73	54	84	105	113	117	106	18	116	41	113	125	
	150	81	101	113	76	122	94	104	105	133	71	98	89	
	82	51	84	105	72	63	89	70	112	116	76	99	135	
	107	109	114	103	82	61	99	71	16	128	81	122	105	
	120	63	100	101	73	29	106	101	120	111	108	134	164	
	93	119	91	96	107	83	75	112	85	116	47	89	110	
	95	100	50	81	104	120	102	148	110	103	92	98	131	
	123	114	55	74	82	105	112	124	105	117	41	120	124	
	86	84	76	56	113	116	99	65	86	117	44	90	97	
	115	62	86	75	78	103	94	26	84	92	114	122	68	
	104	83	72	65	97	100	137	33	114	88	119	112	93	
	99	63	66	72	69	98	117	110	107	83	86	95	105	
	109	57	43	60	69	70	84	72	18	116	73	105	94	
	124	23	90	96	73	73	112	131	18	98	95	92	107	
	89	95	97	49	95	60	82	107	14	128	93	124	109	
	92	92	90	89	78	49	110	65	24	99	116	104	115	
	99	98	56	58	64	32	116	92	25	123	120	112	104	
	40	88	65	74	87	33	133	85	124	100	47	14	110	
	31	102	52	71	80	34	135	87	87	112	21	98	74	
	36	29	50		81	32		78	91	98	22			
	96	43				23		134	123	100	23			
						30		86	94	25				
						50			14	18				
										38				
Average	98	82	74	87	86	82	104	93	82	103	81	105	114	92
Minimum	31	23	43	49	64	23	65	26	14	18	21	14	68	14
Maximum	150	119	117	125	113	132	137	148	124	134	128	134	164	164

-continued-

Subdistrict 104-30 exp

Transect #	1	7	8	9	10	12	14	15	16	17	18	19	20	22
Depth	33	9	17	30	35	0	8	16	10	3	19	33	32	50
	120	143	91	43	37	122	113	115	119	81	90	88	128	111
	65	110	102	100	85	93	100	111	70	116	74	113	94	88
	63	138	118	98	133	101	97	71	74	61	74	98	100	39
	95	134	106	90	64	106	105	105	82	47	80	98	107	106
	107	131	98	79	79	78	89	110	93	76	89	85	108	85
	103	115	78	83	70	68	104	114	101	37	87	104	117	114
	106	140	115	69	92	82	100	94	78	57	112	95	109	108
	90	113	89	38	33	55	78	78	98	136	109	71	102	100
	86	138	87	86	114	50	105	89	113	108	70	102	107	46
	57	115	110	73	38	61	93	94	104	132	82	89	91	44
	80	129	110	51	136	113	110	72	89	64	91	84	102	122
	66	103	105	108	79	114	105	74	104	64	79	113	88	41
	110	110	92	105	90	72	95	47	88	88	66	98	104	92
	93	115	91	99	82	39	101	58	126	104	110	93	89	103
	84	129	90	99	126	93	107	48	91	81	65	79	90	83
	101	95	72	98	138	86	98	52	87	99	90	82	81	118
	118	94	74	81	140	128	97	20	68	74	80	95	43	70
	91	109	87	45	125	84	105	18	65	119	107	81	88	106
	115	63	70	39	21	71	89	19	130	46	96	92	43	35
	102	68	76	92	57	132	95	24	80	64	94	111	64	42
	100	66	80	60	121	58	87	23	103	54	102	92	51	95
	85	28	43	96	122	108	70	16	55	44	111	58	43	88
	102	32	54	51	56	78	85	40	82	48	75	82	59	86
	87	34	71	103	34	48	65	40	47	49	69	113	52	79
	86	25	34	62	61	67	30	18	89	28	89	111	56	103
	87	26	44	92	55	79	26	14	80	31	89	95	33	82
	94	25	44	43	46	81	36	24	87	92	111	89	15	80
	93	28	33	60	16	36	30	18	62	109	89	94	9	85
	87	25	36	65	41	59	28	10	83	75	84	84	38	102
	97	22	28	104	34	65	17	14	62	32	86	86		93
				92	53			19	84	54	79	94		
				80	43			16	80	14	23			
				52				18		102	101			
				32										
				36										
				38										
				37										
				37										
Average	92	87	78	71	76	81	82	51	87	72	86	93	76	85
Minimum	57	22	28	32	16	36	17	10	47	14	23	58	9	35
Maximum	120	143	118	108	140	132	113	115	130	136	112	113	128	122

-continued-

Subdistrict 104-30 exp

Transect #	23	24	25	27	28	29	30	31	
Depth	26	32		24	51	29	12	33	Overall
	66	92	149	125	119	87	126	82	
	91	115	108	115	112	79	76	124	
	121	103	89	116	120	71	115	86	
	112	109	126	128	115	65	89	50	
	105	54	104	113	136	88	57	48	
	112	98	104	110	123	82	58	47	
	50	88	131	120	105	83	69	60	
	90	87	124	102	105	102	74	107	
	38	113	116	112	117	94	69	53	
	52	102	88	113	136	85	16	86	
	45	94	15	105	126	90	115	28	
	45	120	59	99	117	75	48	45	
	44	58	108	119	133	81	75	51	
	58	102	101	134	79	83	65	48	
	85	110	132	120	128	51	88	32	
	106	118	74	94	139	97	66	134	
	109	130	66	68	106	47	66	50	
	97	54	101	114	117	86	57	61	
	105	47	95	115	124	57	36	77	
	55	105	83	120	121	55	25	84	
	63	98	74	118	127	104	15	93	
	97	65	87	114	81	66	38	72	
	80	34	64	105	125	67	20	64	
	49	90	77	110	118	79	20	67	
	42	81	96	78	133	67	22	61	
	57	93	100	75	126	64	16	68	
	57	84	133	129	112	75	18	55	
	38	12	104	66	121	76	22	48	
	31	88	82	80	110	83	22	39	
	43	110	65	67	126	77	18	39	
			39			37			
			44			17			
			36			17			
						24			
						25			
						23			
						23			
Average	71	88	90	106	119	67	53	65	81
Minimum	31	12	15	66	79	17	15	28	9
Maximum	121	130	149	134	139	104	126	134	149

-continued-

Appendix 3. (page 23 of 23)

104-30 con

Transect #	3	5	6	36	37	38	39	40	45	46	47	48	50
Depth	30	7	5	12	20	3	9	5	34	23	21	40	35
Average	98	82	74.23	86.63	85.58	81.91	103.8	93.27	82.38	103.2	80.5	105.3	113.8

104-30 exp

Transect #	1	7	8	9	10	12	14	15	16	17	18	19	20	22	23	24	25	27	28	29	30	31
Depth	33	9	17	30	35	0	8	16	10	3	19	33	32	50	26	32		24	51	29	12	33
Average	120	143	118	108	140	132	113	115	130	136	112	113	128	122	121	130	149	134	139	104	126	134

The Alaska Department of Fish and Game administers all programs and activities free from discrimination on the bases of race, color, national origin, age, sex, religion, marital status, pregnancy, parenthood, or disability. The department administers all programs and activities in compliance with Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title II of the Americans with Disabilities Act of 1990, the Age Discrimination Act of 1975, and Title IX of the Education Amendments of 1972.

If you believe you have been discriminated against in any program, activity, or facility, or if you desire further information please write to ADF&G, P.O. Box 25526, Juneau, AK 99802-5526; U.S. Fish and Wildlife Service, 4040 N. Fairfield Drive, Suite 300, Arlington, VA 22203 or O.E.O., U.S. Department of the Interior, Washington DC 20240.

For information on alternative formats for this and other department publications, please contact the department ADA Coordinator at (voice) 907-465-4120, (TDD) 907-465-3646, or (FAX) 907-465-2440.