

✓✓

**1999 Tidewater Goby (*Eucyclogobius newberryi*)
Sampling in Rodeo Lagoon,
Golden Gate National Recreation Area, Marin Co.**

Darren Fong
Aquatic Ecologist
Golden Gate National Recreation Area

March 2000

Prepared for the

National Park Service
Golden Gate National Recreation Area
Division of Resource Management

U.S. Fish and Wildlife Service
Endangered Species Permits
Ecological Services
Portland Regional Office

INTRODUCTION

The tidewater goby (*Eucyclogobius newberryi*) is a small benthic fish (<50 mm standard length {SL}) found in coastal waters in California from San Diego to Del Norte counties. It is found in slightly brackish waters (0-10 parts per thousand). It is estimated that the goby has disappeared from nearly 50 percent of the coastal lagoons since 1900 (U.S. Fish and Wildlife Service, 1994). Various factors have led to the decline of goby including the inadvertent introduction of non-native fish and habitat degradation. These historic losses and current threats to existing populations led the U.S. Fish and Wildlife Service in 1994 to list the goby as endangered under the Endangered Species Act.

Rodeo Lagoon is the only remaining location with tidewater goby within the greater Bay Area counties. Historic records indicate that the goby occurred in at least 9 other locations within the San Francisco Bay Region such as Lake Merced and Corte Madera Creek (Swift *et al.* 1989).

Rodeo Lagoon is presently a 16.2 ha (40 acre) brackish water lagoon located at the tip of the Marin Peninsula within the management area of the Golden Gate National Recreation Area. Water depths are shallow, ranging between 2-6 feet during the late fall (Zembsch 1993). The lagoon provides habitat for wintering waterbirds, the federally listed, endangered California brown pelican (*Pelecanus occidentalis*), as well as the tidewater goby. In addition, the federally threatened California red-legged frog (*Rana aurora draytonii*) has been found in adjacent Rodeo Lake.

There have been several actions that have degraded conditions for the tidewater goby. Construction of a causeway and weir across the upper end of the lagoon during World War II hydrologically separated the lagoon into a predominantly freshwater lake (Rodeo Lake) and the existing brackish water lagoon (Philip Williams & Assoc., consultants, *in litt.*, 1993). No tidewater gobies were found within the lake (Wang 1983). This hydrologic separation presumably restricts upstream movement of aquatic organisms from the lagoon. In addition, water conditions may become less than hospitable for fish during the late summer. Recent measurements found dissolved oxygen levels of 0.7 mg/l at the lake bottom during an algal bloom (Codomo *et al.*, 1996). A live-cage study conducted by the U.S. Geological Survey in September 1998 with threespine stickleback (*Gasterosteus aculeatus*) and prickly sculpin (*Cottus asper*) demonstrated high mortality (>60%) in Rodeo Lake where daily minimum dissolved oxygen concentrations were less than 3.8 mg/L (Mike Saiki, USGS-BRD, unpubl. data, 1999).

A variety of habitat features may influence the distribution of goby within Rodeo Lagoon. Cover, such as submergent aquatic vegetation or turbidity levels, may influence the distribution of goby. Dissolved oxygen refugia may be important during summer and fall following the decay of algae in the lagoon. Swift *et al.* (1989) noted that goby appeared at the upper end of lagoons where freshwater inflow exists or at the

seaward end where high tide waves overtop the sandbar. However, the goby may tolerate low dissolved oxygen levels better than many of the larger lagoon fish inhabitants. Following a low dissolved oxygen event in 1996 and fish kill, gobies were the most frequently encountered fish in Rodeo Lagoon (Fong 1997). Further field and laboratory studies are needed to look at dissolved oxygen tolerances of tidewater gobies.

National Park Service Policy

It is a policy of the National Park Service (NPS) that the primary management objective in natural zones will be the protection of natural resources and values for appropriate types of enjoyment while ensuring their availability to future generations. Furthermore, the NPS will identify and promote the conservation of all federally listed threatened, endangered, or candidate species.

Permits

Because sampling activities would deliberately "take" an endangered species, a permit under section 10(a)(1)(A) of the Endangered Species Act was obtained from the U.S. Fish and Wildlife Service (subpermit no. GGNRA-2). The permit contains restrictions intended to minimize harm to the goby.

Previous Work

Several small studies have been conducted to describe the physical, chemical, and biological features of Rodeo Lagoon. Wang (1983) conducted surveys for tidewater goby and other fish species. In 1990 and 1991, Ramona Swenson sampled Rodeo Lagoon for tidewater goby (R. Swenson, UC Berkeley, pers. comm. 1994). A bathymetric survey for Rodeo Lagoon was conducted by Zembsch (1993). The University of San Francisco characterized summer water quality and phytoplankton information within the lagoon complex (Podlech *et al.*, 1993). Finally, a profile of lake and lagoon bottom elevations was conducted by Philip Williams & Assoc. (*in litt.*, 1993).

Trihey and Associates, under contract with GGNRA, evaluated the effectiveness of two sampling techniques, seines and drop traps, in estimating the density of tidewater goby within the lagoon (Trihey and Assoc. 1996). The results indicated higher variability among trap samples than among seines. Geographically, gobies were concentrated within 30 m of the shore and in waters between 0.5 and 1.0 m deep (Trihey and Assoc. 1996). In addition, higher densities of gobies were found in areas containing submerged aquatic vegetation than those containing only emergent vegetation or no vegetation (Trihey and Assoc. 1996). Finally, the Park has sampled the lagoon fish assemblage since 1996 (Fong 1997, Fong 1999).

Project Objectives

The primary objectives of this project were as follows:

- I. To monitor the distribution and abundance of tidewater goby.
- II. To measure habitat conditions that may be associated with the distribution and density of tidewater goby.

METHODS

Sampling Dates

We currently sample the lagoon fish community during the fall. This often coincides with poor water quality conditions (e.g., low dissolved oxygen), but stable hydrologic conditions (e.g., lagoon closed). For 1999, sampling activities occurred on October 12-14, 1999.

General Rodeo Lagoon Descriptions

We divided Rodeo Lagoon into six regions on the basis of gross similarities. A generalized map of dominant vegetative cover within a 2 m band along the shoreline is provided in Figure 2. This map was based on walking the shoreline and using visual observations to break cover types into segments that were recorded using a Trimble GPS unit. Although this map was based on field data from November 1995, shoreline cover conditions have changed little. The west region is predominantly submerged sandy beach and located on the windward side of the lagoon. The east region is on the backside of the lagoon and a deposition area for windblown materials (e.g., detached plants and algae).

Sample Site Locations

Sample sites were located within six regions (Figure 1). Based on recommendations from the 1996 Trihey report, a minimum of three regions- the West, Northwest, and East, were selected for sampling of goby population dynamics (Trihey and Assoc. 1996). The Trihey and Associates study found that the West region was dominated by mature adults, whereas the East end contained primarily juveniles. The Northwest region was the region with the highest densities of gobies and was suggested as an important sampling area.

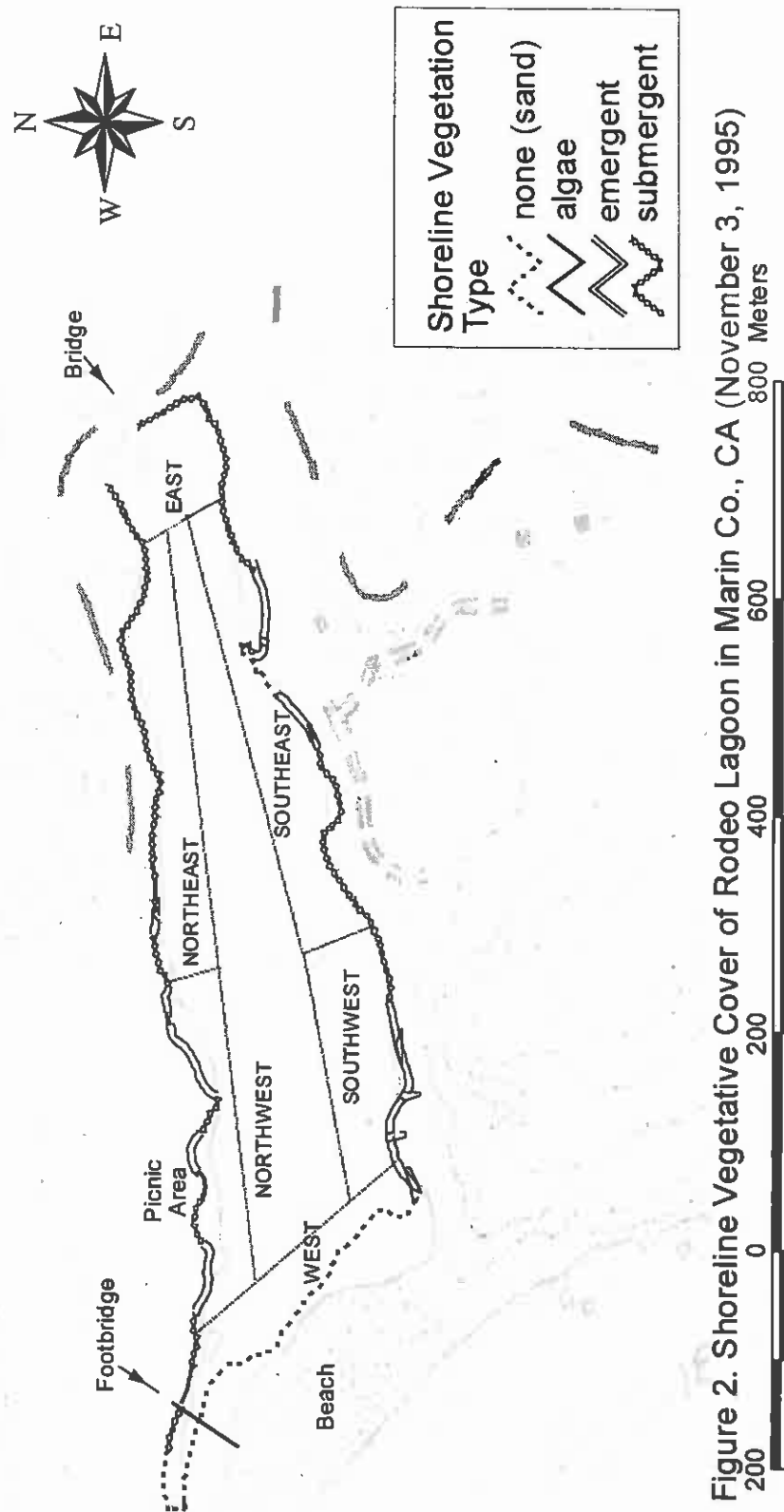


Figure 2. Shoreline Vegetative Cover of Rodeo Lagoon in Marin Co., CA (November 3, 1995)

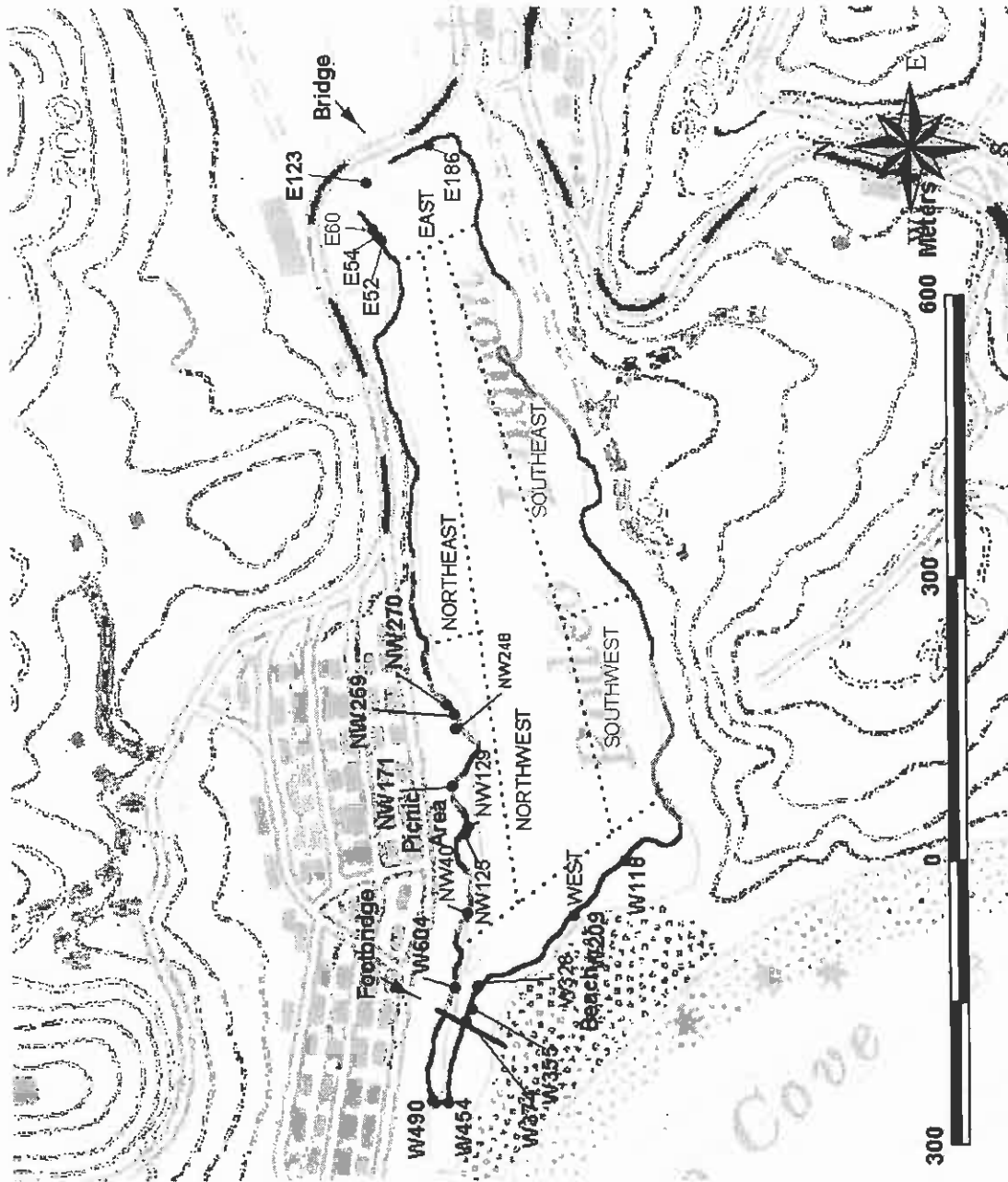


Figure 1: October 1999 Fish Sampling Stations at Rodeo Lagoon, Marin Co., CA

File: Rodeogob.apr

File: goby99.doc

Fish Sampling

We sampled between 5 to 8 sites per region. We measured the perimeter of each region and placed sample sites at distances selected randomly along the perimeter. In prior years, sample sites were placed haphazardly throughout each region. At each sample site, the beach seine was dragged perpendicular to the shore for approximately 3-5 m. Sampled areas ranged between 5-20 m². Based on suggestions by our volunteers, a large tarp was placed underneath the seine to minimize loss of fish into the surrounding environment. Fish were placed into aerated 5-gallon buckets for subsequent measurements. All collected fish species were identified and counted. Up to 30 gobies per site were chosen for standard length measurements. Up to 20 other fish per site were also selected and measured for standard length. All fish were released upon completion of measurements at the capture site.

General Habitat Information

A limited amount of habitat information was collected from each sample site. Following fish sampling, collection of habitat data occurred adjacent to the fish sampling area. Salinity, temperature, dissolved oxygen, and specific conductance measurements were obtained with a YSI Model 85 meter. We calibrated the unit with distilled water blank and known standards prior to the field sampling event. Appendix II summarizes the habitat information at each sample site.

Data Analyses

Data was entered into an Excel (Vers. 5.0) worksheet and checked for any errors. Descriptive statistics and graphs were generated in Excel. Statistical tests were conducted on Statview.

RESULTS

Goby Population Characteristics

No significant difference in goby abundance was found between the three regions (Kruskal-Wallis, $p=0.17$). At all sectors, juvenile gobies were the most abundant age class (Figure 3). For the purposes of this project, tidewater gobies were classified as adults at 27 mm SL or larger (Trihey and Assoc. 1996).

Threespine Stickleback Population Characteristics

Stickleback densities differed significantly between the three regions (Kruskal-Wallis, $p=0.005$) with mean densities in the East region higher than Northwest and North regions. Juvenile stickleback in the 16 to 20 mm (SL) length class were the most abundant size (Figure 4). For the purposes of this project, stickleback were classified

as adults at 40 mm SL or larger (Baker 1994).

Sculpin Population Characteristics

We believe that most of the captured sculpin were prickly sculpin. We identified a small subset of the collected sculpins using Peter Moyle's revised key to California freshwater fishes. All of these fishes were prickly sculpin. No Pacific staghorn sculpin (*Leptocottus armatus*) were collected during survey activities, although they were captured in prior years in very low numbers. It is possible that a small number of coast range sculpin (*Cottus aleuticus*) were present, but were not identified.

Sculpin densities differed significantly between the three regions (Kruskal-Wallis, $p=0.04$) with mean densities in the East region lower than Northwest and North regions. Sculpin captured from the East region had fish (albeit lower numbers) distributed evenly throughout the different size classes. The size distribution of captured sculpins at the West and Northwest zones were similar. Most fish were between 25 and 45 mm (SL) (Figure 5). These are most likely young-of-the-year fish. In their study on the Eel River, Brown et al. (1995) determined that prickly sculpin less than 50 mm SL were likely young-of-the-year.

Table 1: Beach seine data for West, Northwest, and East Zones of Rodeo Lagoon, Marin Co., October 1999.

Taxa	October 1999 Grand Mean Density (#/m ²)	% Occurrence
sculpin	5.0	14
threespine stickleback	18.5	52
tidewater goby	12.2	34
TOTAL	35.7	100

TABLE 2: SUMMARY BEACH SEINE DATA FOR OCTOBER 1999 BY REGION IN RODEO LAGOON, MARIN CO.

Zone	N	AREA (m ²)	Mean Density (Std. Dev.)			Units
			sculpin	threespine stickleback	tidewater goby	
WEST	8	83	6.9 (8.0)	0.3 (0.4)	11.0 (8.1)	# per sq. m
			26.3 (29.4)	1.0 (1.2)	51.2 (59.0)	# per cu. m
NORTHWEST	7	59.3	6.5 (3.7)	2.8 (3.3)	4.8 (5.2)	
			21.5 (12.3)	7.5 (8.6)	13.6 (12.2)	
EAST	5	42.81	1.6 (1.3)	52.4 (46.4)	20.7 (21.2)	
			5.7 (4.9)	138.7 (144.2)	75.5 (88.6)	

Figure 3: Length-frequency distribution of tidewater goby in Rodeo Lagoon, Marin Co.,
October 1999

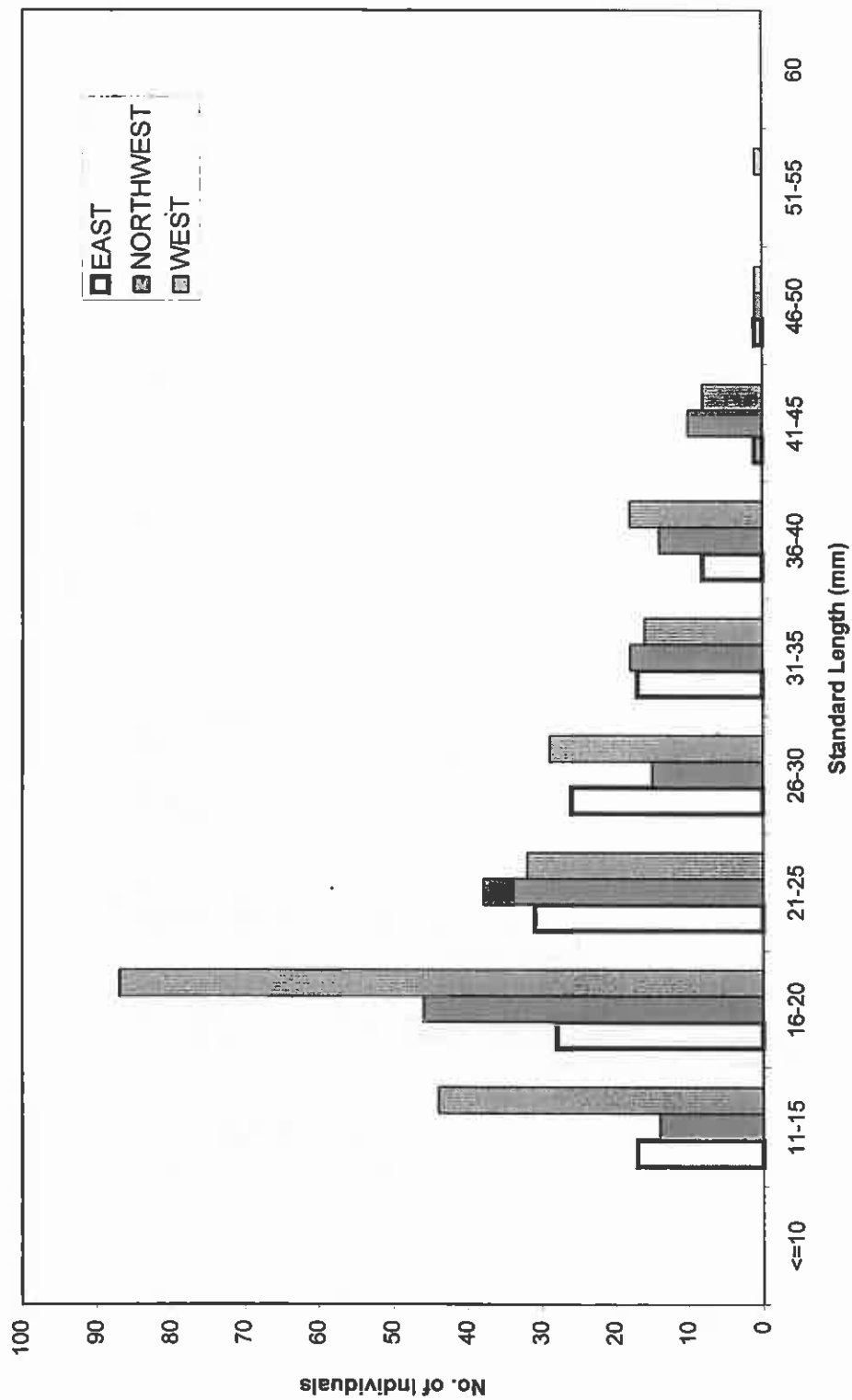


Figure 4: Length-frequency distribution of three-spine stickleback (*Gasterosteus aculeatus*) within Rodeo Lagoon, Marin Co., October 1999

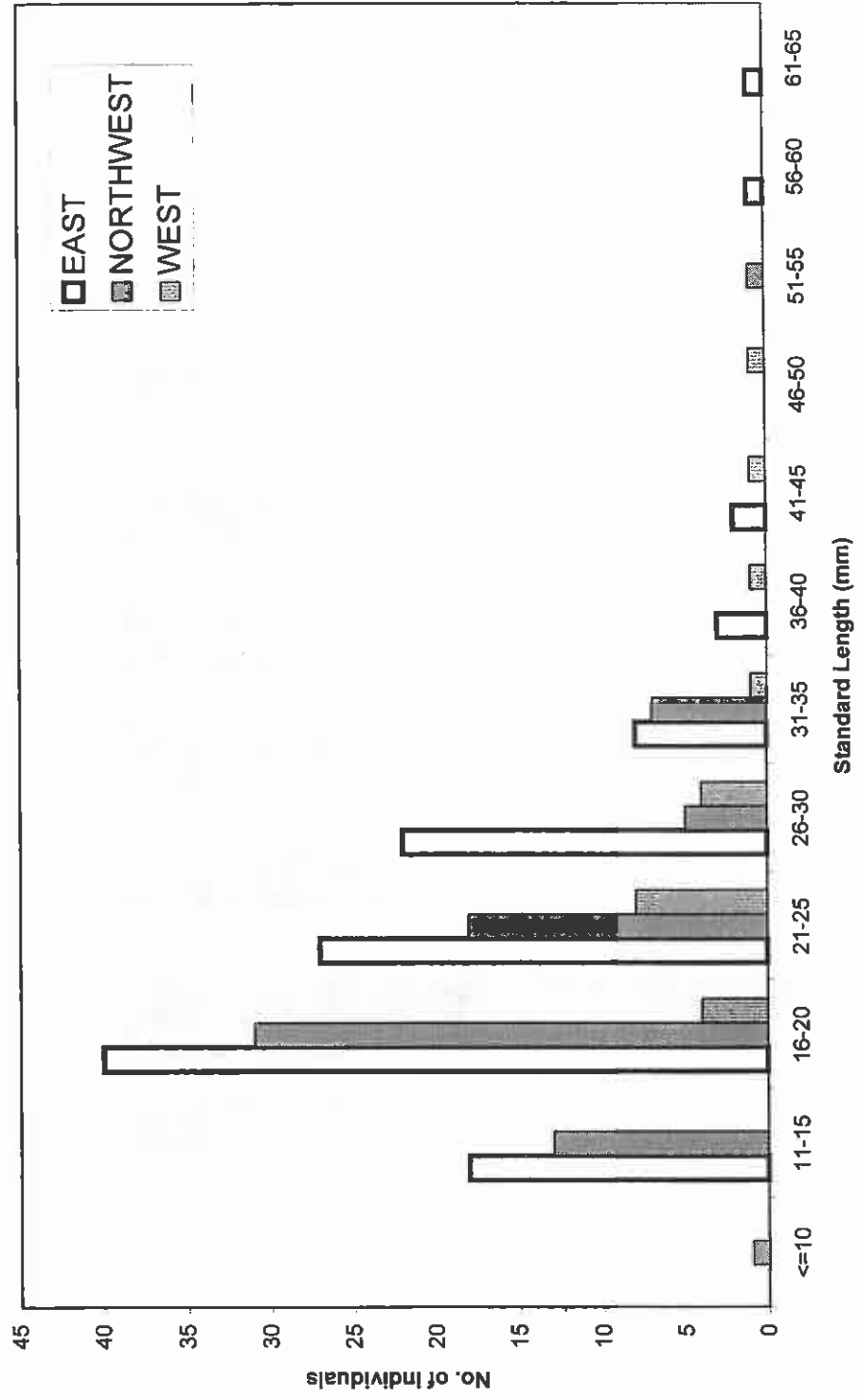
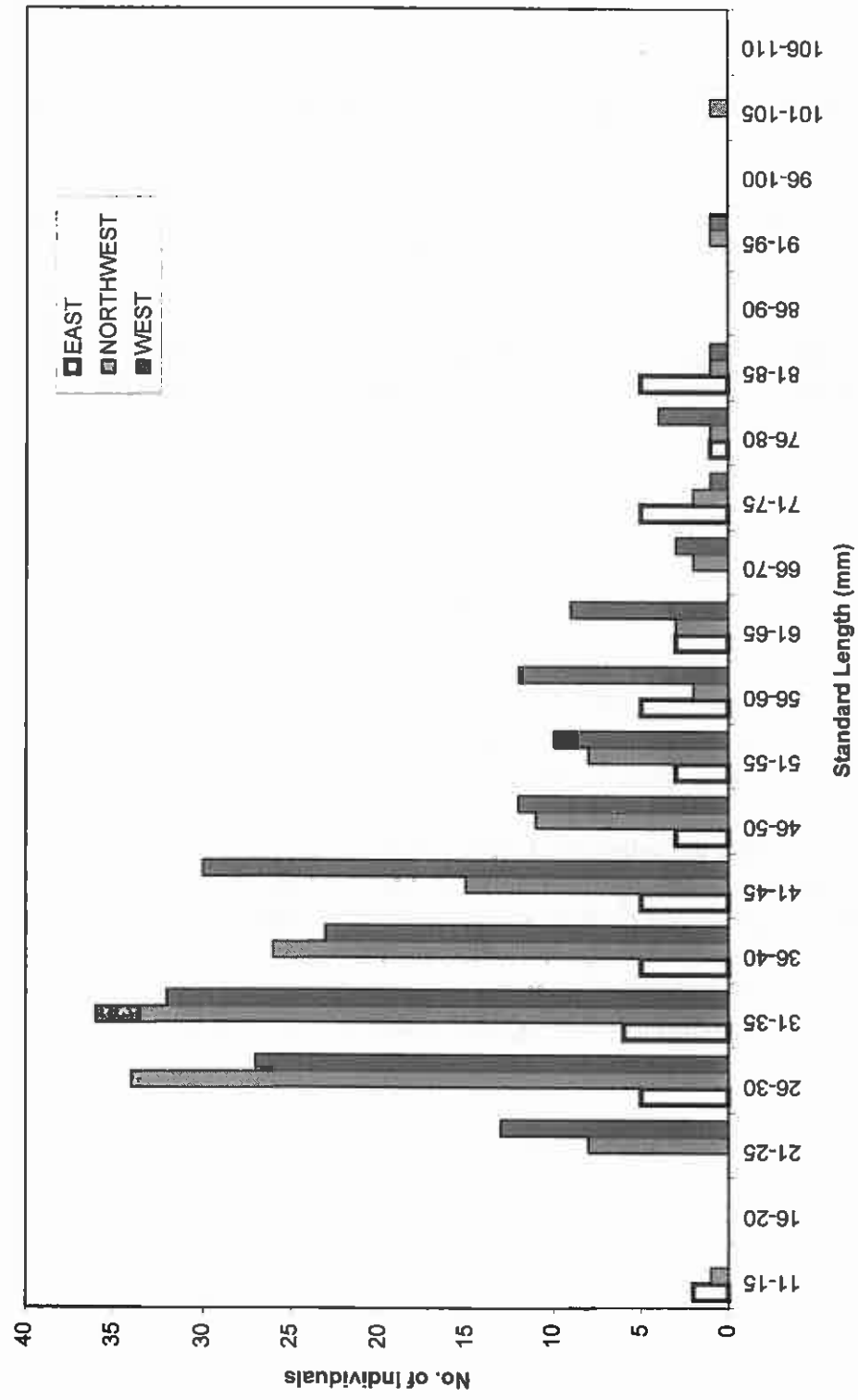


Figure 5: Length-frequency distribution of prickly sculpin (*Cottus asper*) in Rodeo Lagoon, Marin Co., October 1999



Annual Trends

Five years of beach seine data have been collected at Rodeo Lagoon. Prior to the fish kill in Fall 1996, sculpins comprised the largest percentage of fish captured during Fall 1995 sampling (Figure 7). During the fishkill, sculpins represented less than 1 percent of the entire catch during Fall 1996 (Figure 7). Three years following the fishkill, mean sculpin densities in 1999 (5.4 sculpin per sq. m) have recovered to similar densities recorded in Fall 1995 (4.3 sculpin per sq. m) (Figure 8).

Mean goby densities ranged from 6 to 12 individuals per square meter over the past three years. These densities are lower than the previous high of 42 individuals per sq. m in 1996 (Table 3, Figure 9).

TABLE 3: COMPARISON OF MEAN TIDEWATER GOBY DENSITIES BETWEEN FALL 1995-1999 SAMPLING EVENTS IN RODEO LAGOON, MARIN CO.

Zone	October 16-19, 1995*			October 3-5, 1996			Sept. 17-22, 1997			Oct. 6-8, 1998			Oct. 12-1 1999		
	N	Mean	S.D. (±)	N	Mean	S.D. (±)	N	Mean	S.D. (±)	N	Mean	S.D. (±)	N	Mean	S.D. (±)
WEST	7	0.1	0.1	5	34.1	23.5	8	19.9	14.8	8	10.3	8.9	8	11.0	8.1
NORTHWEST	4	6.5	5.8	4	70.1	55.0	5	0.6	0.6	8	3.9	2.8	7	4.8	5.2
EAST	5	0.1	0.1	3	16.8	14.6	7	0.9	0.9	8	4.8	5.7	5	20.7	21.2
SOUTHEAST	6	2.6	2.6	3	7.9	9.5	5	1.0	1.0	-	-	-	-	-	-
GRAND MEAN (except SE)**	3	2.2		3	40.3		3	7.1		3	6.3		3	12.2	

*Note: 3.2 mm mesh seines used after 1996, 6.4 mm mesh used in 1995.

**Grand mean based only on West, Northwest, and East zones.

Threespine stickleback densities fluctuated widely over the 5-year period. They reached their highest abundance during the Fall 1996 fish kill and again in fall 1999 (Figure 10). The proportional abundance of threespine stickleback has increased from a low in Fall 1997 (3%) to being the most frequently captured fish during Fall 1999 surveys (51%). This increase is due largely to the high numbers of stickleback captured in the East region in 1999 and resulted in a high grand mean for the lagoon.

Figure 6: Mean fish density and standard error at west, northwest, and east zones in Rodeo Lagoon, Marin Co., 1995-1999.

FILE:fish-all.xls

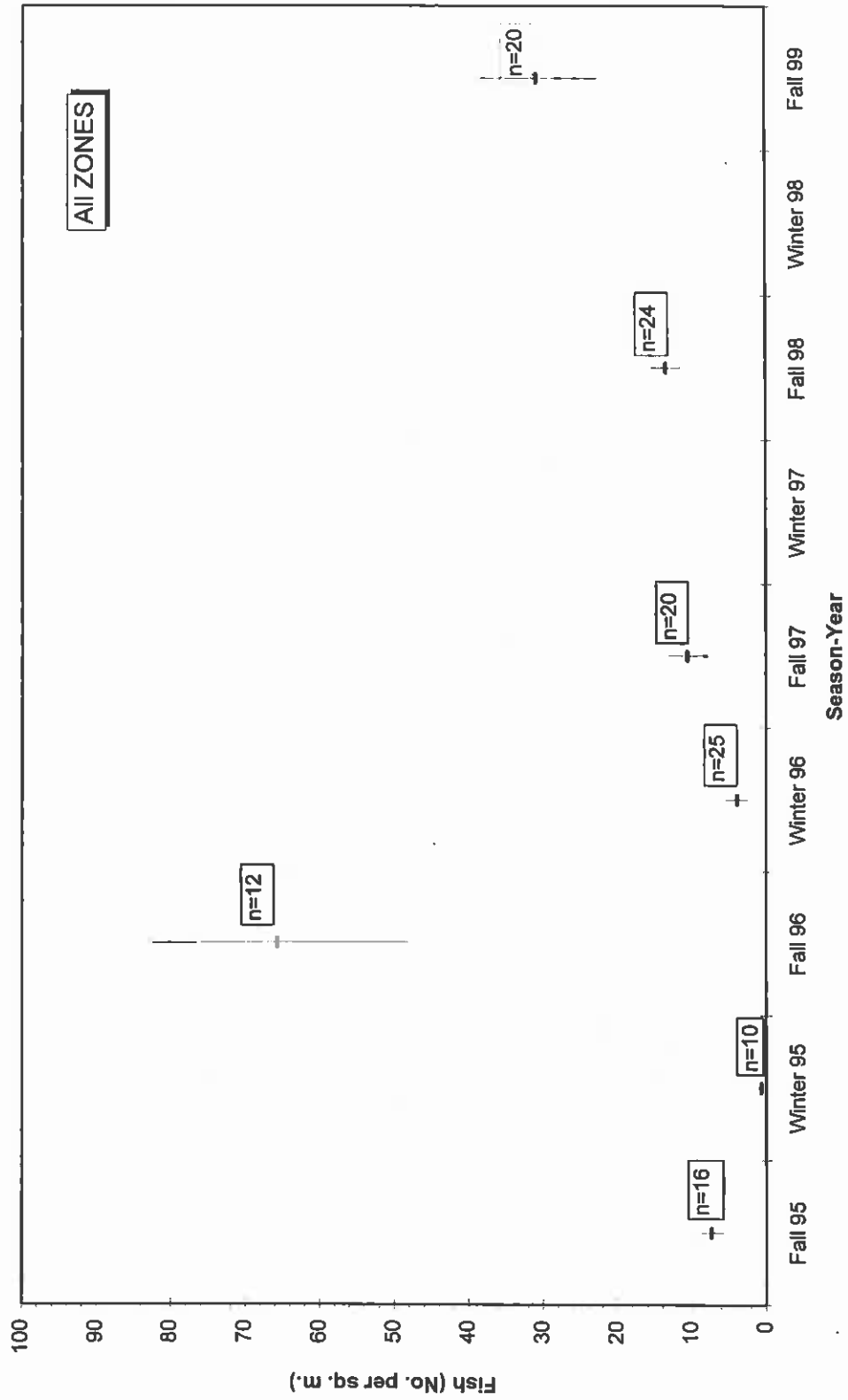


Figure 7: Relative abundance of 3 fish taxa in West, Northwest, and East zones of Rodeo Lagoon, Marin Co. from Oct. 1995 to Oct. 1999

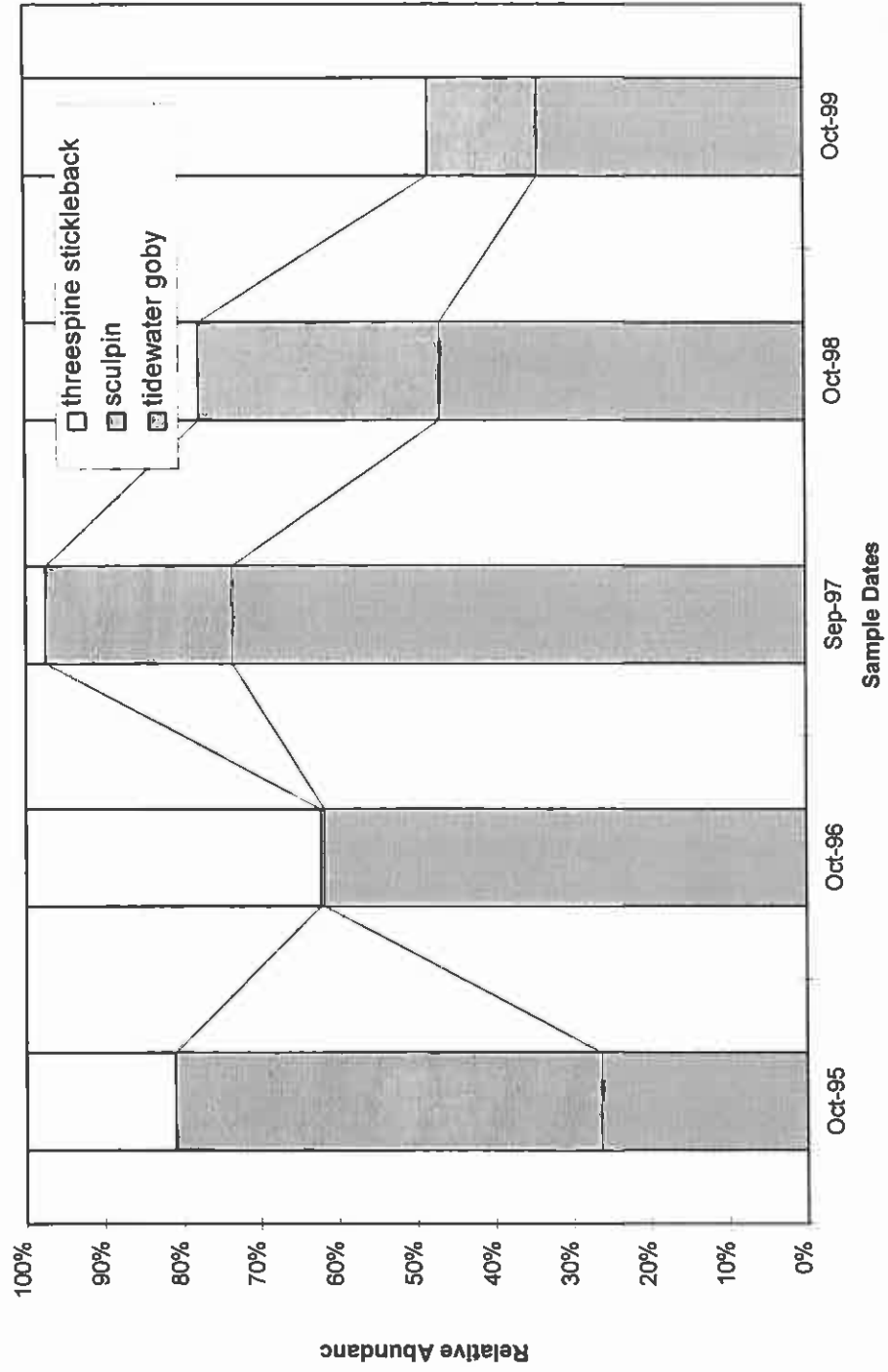


Figure 8: Mean sculpin (*Cottus asper* & *Leptocottus armatus*) density and standard error at west, northwest, and east zones in Rodeo Lagoon, Marin Co., 1995-1999.

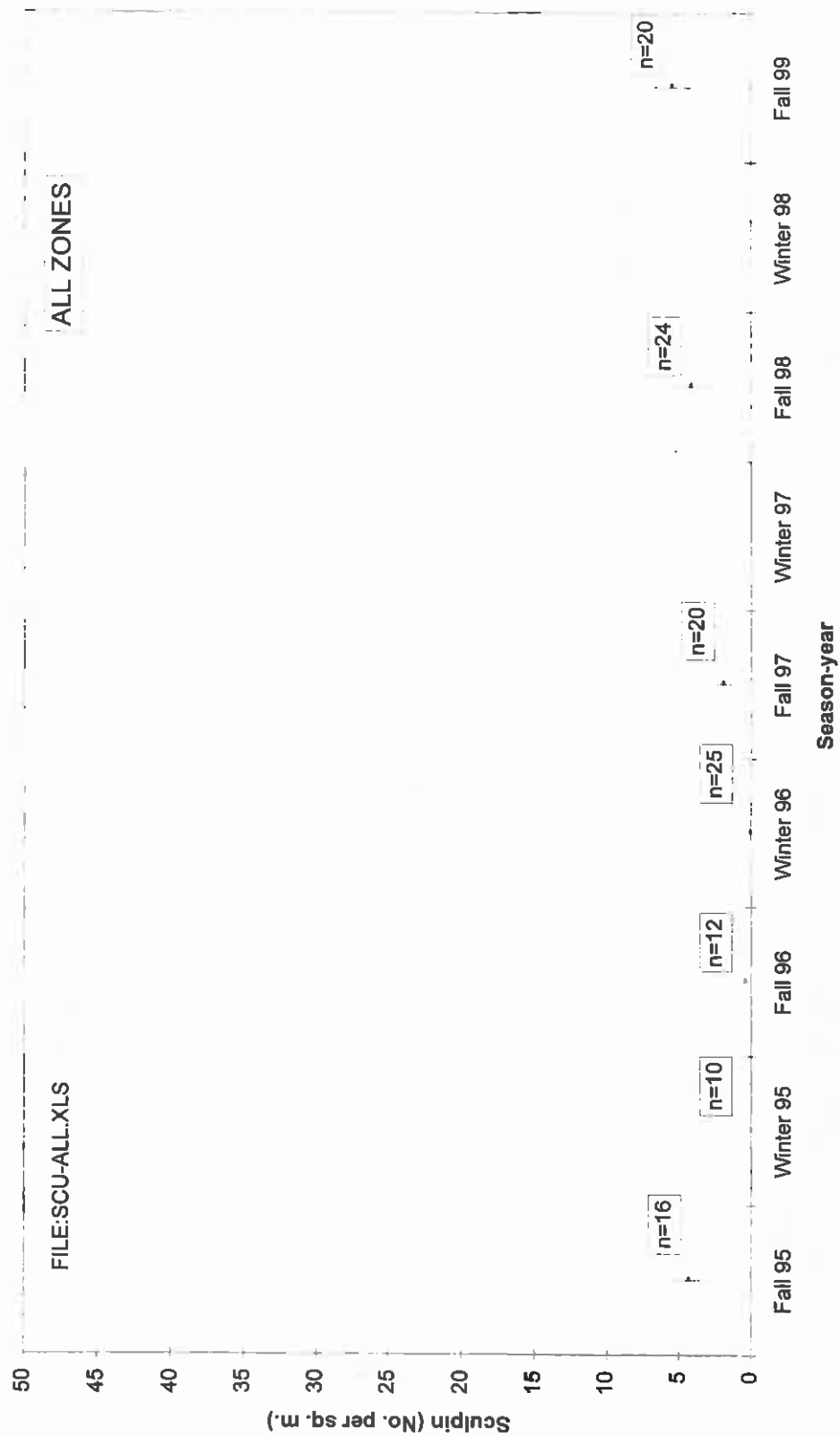


Figure 9: Mean tidewater goby (*Eucyclogobius newberryi*) density and standard error at west, northwest, and east zones in Rodeo Lagoon, Marin Co., 1995-1999.

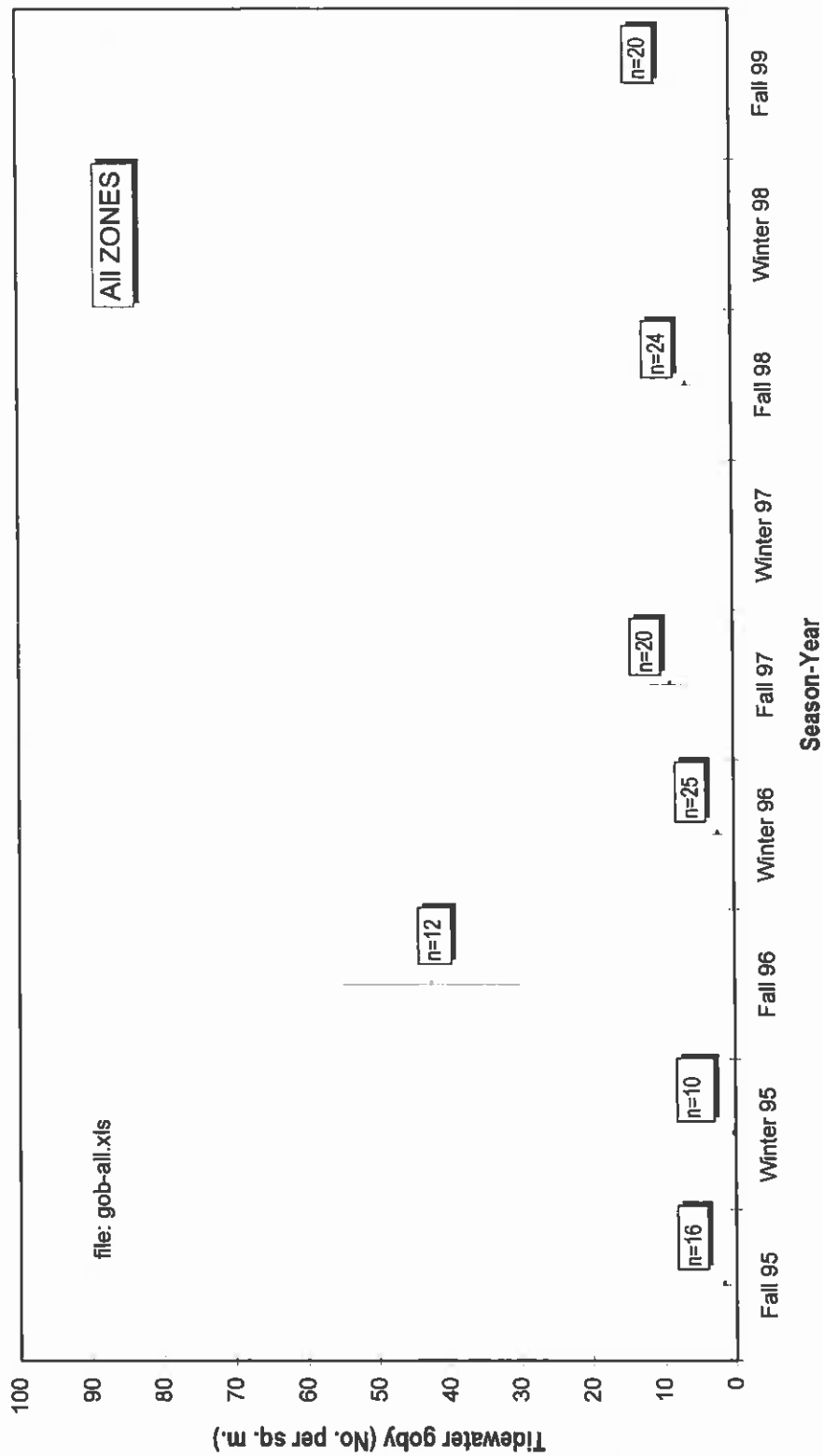
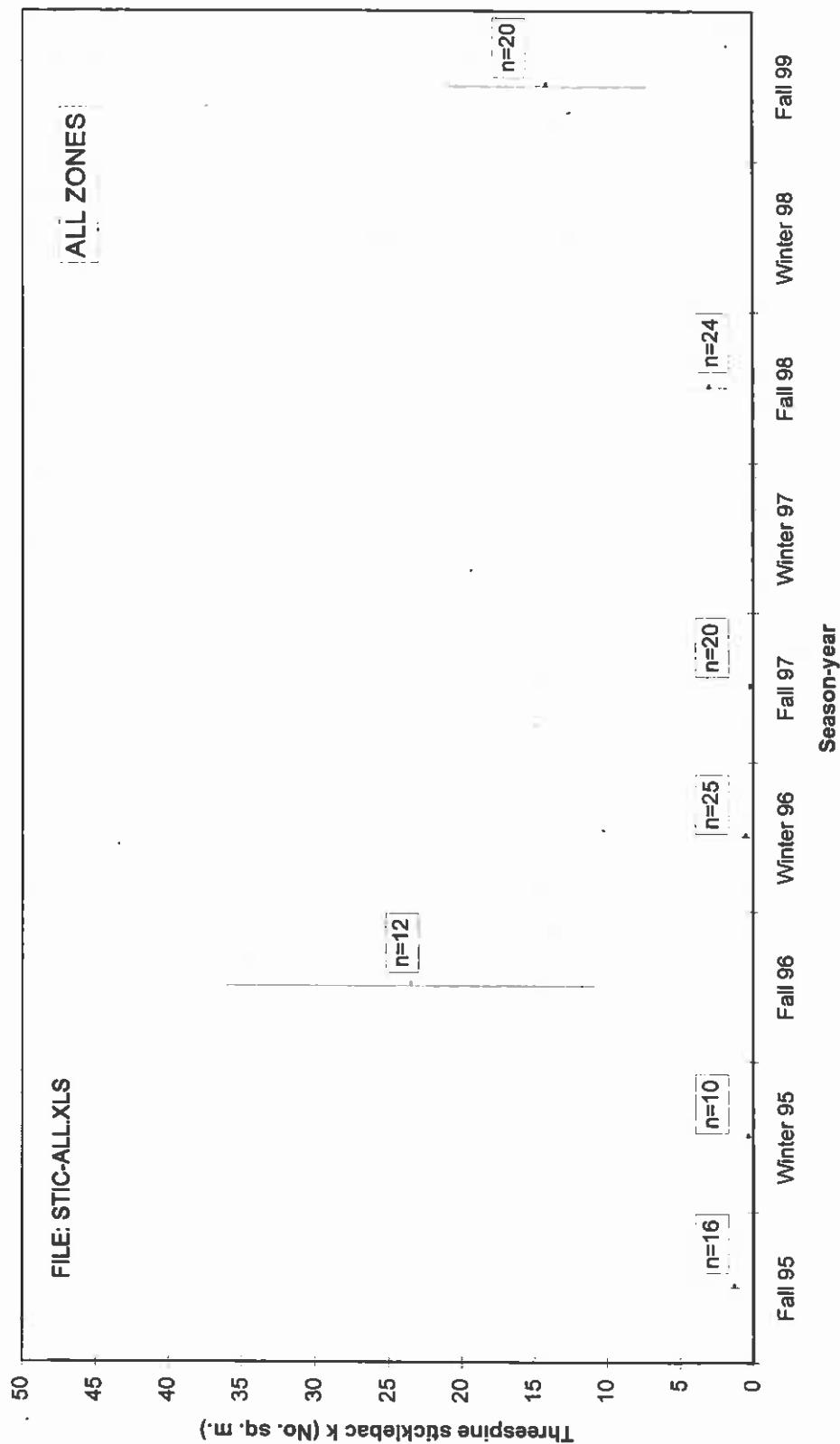


Figure 10: Mean threespine stickleback (*Gasterosteus aculeatus*) density and standard error at west, northwest, and east zones in Rodeo Lagoon, Marin Co., 1995-1999.



Habitat Conditions

As with prior years, substrate conditions differed amongst regions. West sampling sites were dominated by sands with the Northwest and East sites containing mostly "muck"-our highly scientific term to describe the often black, anoxic organic and silt-clay materials that seemed to suck our boots off.

Northwest and east sample sites had variable amounts of both emergent and submerged aquatic vegetation. The west sites generally lacked emergent vegetation. For your viewing pleasure, we have attached photos of representative East, Northwest, and West sites (Appendix I).

The lagoon mouth was closed during sampling activities. Late and heavy rainfall resulted in the lagoon being open for two large blocks of time in February and April-May.

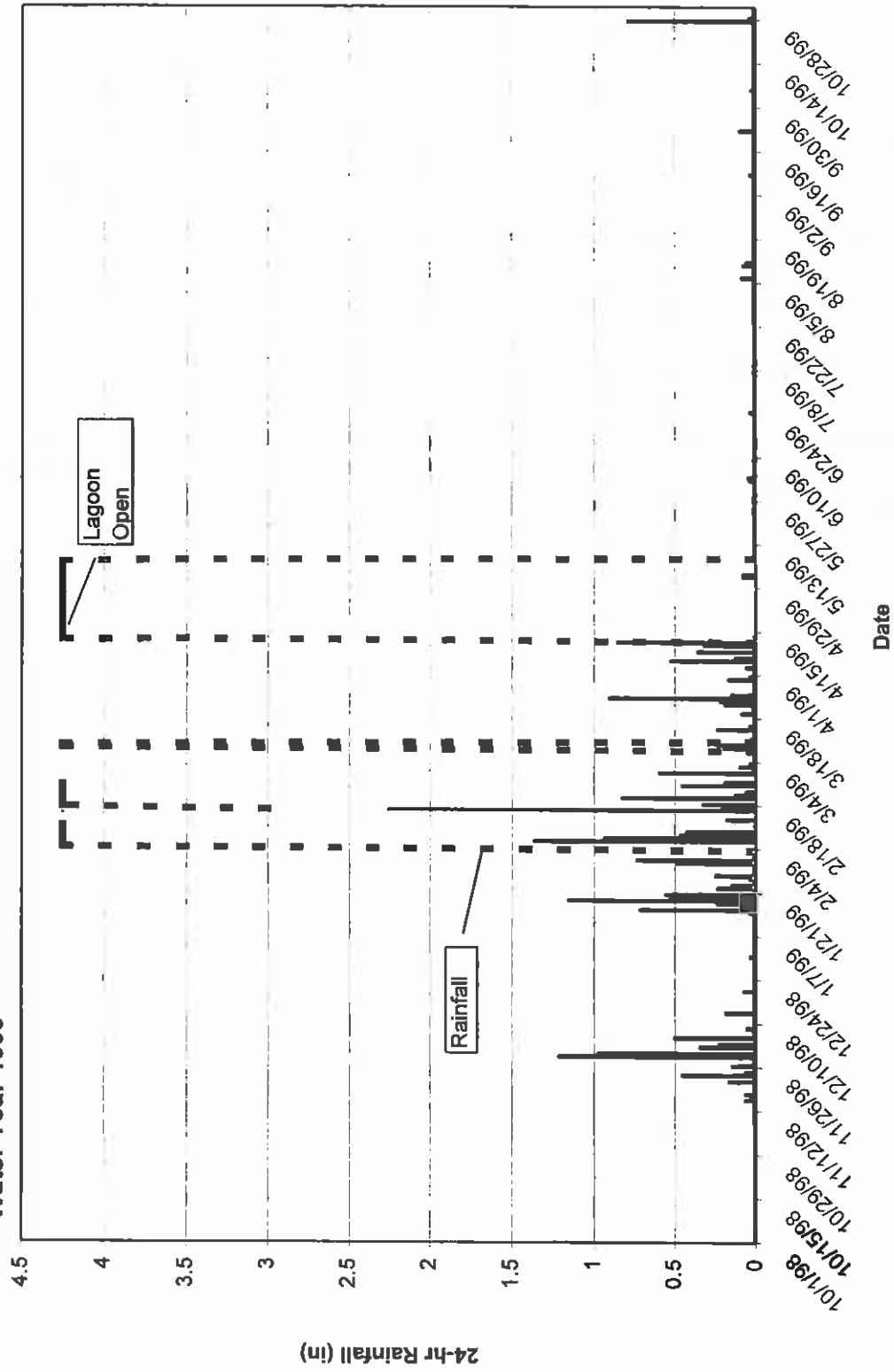
Most of the sampling activities occurred between late morning and late afternoon. Sampled areas often had large amounts of either aquatic vegetation or algae and it was not uncommon to get dissolved oxygen levels in excess of 100% saturation at the surface (Appendix II).

Mean summer salinity levels (1.4 parts per thousand) were lower than those recorded from prior sampling events (Fong 1999, Fong 1997b). All salinity levels were well within the tolerance range reported for the goby (Swift *et al.*, 1989).

Sampling injury and mortality

A total of 17 gobies were injured or killed during 1999 sampling activities (0.9% of collected gobies). Most mortalities were associated with small juvenile fish. Only a single prickly sculpin and threespine stickleback were injured or killed during sampling activities (0.1% and <0.1% respectively).

**Figure 11: Rainfall frequency, amount, and open/closure status of Rodeo Lagoon, Marin Co.,
Water Year 1999**



DISCUSSION

As with previous fish surveys, we collected only three fish species: prickly sculpin, threespine stickleback, and tidewater goby. Other coastal lagoons exhibit similar low fish species diversity when gobies are present (Holland 1992, Irwin and Soltz 1984).

No introduced fish species were collected during any sampling activities. Species such as golden shiner (*Notemigonus chrysoleucas*), striped bass (*Morone saxitalis*) and yellowfin goby (*Acanthogobius flavimanus*) have been reported historically from Rodeo Lagoon (Wang 1983). Wang suggests that salinity levels near the fresh end of brackish may restrict the colonization and establishment by yellowfin goby (Wang 1983). As with previous years, salinity levels were only slightly higher than freshwater levels.

ACKNOWLEDGEMENTS

Completion of field sampling and computer work would not have been possible without the diligent efforts of the following people: Elise Buisson, Ryan Jones, Michael Perlmutter, Anne Rauber, Meredith Savage, and Mark Youngkin.

Literature Cited

- Baker, J.A. 1994. Life history variation in female threespine stickleback. Pages 144-187. In: M.A. Bell and S.A. Foster (eds.), The evolutionary biology of the threespine stickleback. Oxford University Press, Oxford. 571 p.
- Brown, L.R., S.A. Matern, and P.B. Moyle. 1995. Comparative ecology of prickly sculpin, cottus asper, and coastrange sculpin, *C. aleuticus*, in the Eel River, California. Environmental Biology of Fishes. 42:329-343.
- Codemo, C.M., M. Podlech, R.J. Brown, and W.P. Jordan. 1996. Characterization of phytoplankton in Rodeo Lagoon and Rodeo Lake, GGNRA, during August 1996. Unpublished document prepared for Golden Gate National Recreation Area. 14 pp.
- Fong, D. February 1997. 1996 fall fish kill evaluation for Rodeo Lagoon, Golden Gate National Recreation Area, Marin Co. Unpublished report prepared the Division of Resource Management and Planning, Golden Gate National Recreation Area. 9 p.
- Fong, D. February 1997b. 1996 Tidewater Goby (*Eucyclogobius newberryi*) Sampling in Rodeo Lagoon, Golden Gate National Recreation Area, Marin Co. Unpublished report prepared the Division of Resource Management and Planning, Golden Gate National Recreation Area. 17 p.
- Holland, D.C. 1992. The distribution and status of the tidewater goby (*Eucyclogobius newberryi*) on Camp Pendleton, San Diego County, California. Unpublished document prepared for the Environmental and Natural Resources Management Office, U.S. Marine Corps Base, Camp Pendleton. 29 pp+appendices.
- Irwin, J.F. and D.L. Soltz. April 1984. The natural history of the tidewater goby, *Eucyclogobius newberryi*, in the San Antonio and Shuman Creek systems, Santa Barbara Count, California. Unpublished documented submitted to the U.S. Fish and Wildlife Service, Sacramento. 32 pp+appendices.
- Podlech, M., C.M. Codemo, R.J. Brown, and W.P. Jordan. November 1993. Some physical, chemical, and biological characteristics of Rodeo Lagoon, Rodeo Lake, and Rodeo Creek-Initial Study. Unpublished document prepared for Golden Gate National Recreation Area. 29 pp+ appendices.
- Swift, C.C., J.L. Nelson, C. Maslow, and T. Stein. 1989. Biology and distribution of the tidewater goby, *Eucyclogobius newberryi* (Pisces: Gobiidae) of California. Contributions in Science No. 404, Natural History Museum of Los Angeles County. pp. 1-19.

Trihey & Associates, Inc. 1996. Monitoring of the tidewater goby population in Rodeo Lagoon, Golden Gate National Recreation Area. Unpublished document prepared for the Golden Gate National Recreation Area. 22 pp+ appendices.

U.S. Fish and Wildlife Service. 1994. Endangered and threatened wildlife and plants: determination of endangered status for the tidewater goby. Federal Register 59(24):5494-5499.

Wang, J. February 1983. Ecology of fishes in Rodeo Lagoon and Rodeo Lake of the Golden Gate National Recreation Area, California, with emphasis on the tidewater goby, *Eucyclogius newberryi* (Girard) and the yellowfin goby, *Acanthogobius flavimanus* (Temminck and Schlegel). Unpublished report. 13 pp+appendices.

Zembsch, S. 1993. Golden Gate National Recreation Area, Fort Cronkite-Bathymetric survey of Rodeo Lagoon. Unpublished document prepared for the National Park Service-GGNRA. np

APPENDIX I: REPRESENTATIVE SITE PHOTOGRAPHS



Rodeo Lake, Site W355, Oct. 20, 1999 (rod-w355.jpg)



Rodeo Lagoon, Site E60, Oct. 20, 1999 (rod-e60)

APPENDIX I: REPRESENTATIVE SITE PHOTOGRAPHS



Rodeo Lagoon, Site NW 125, oct. 29, 1999

APPENDIX II: RODEO LAGOON HABITAT DATA

KEY TO CODES:

SAV: submerged aquatic vegetation, EAV: emergent aquatic vegetation, 0: 0%, 1: 1-24%, 2: 25-49%, 3: 50-74%, 4: >75%

Date	ZONE	STATION ID	Width (m)	Length (m)	Area (m2)	Max depth (m)	Min depth (m)	Ave. Vol (m3)	H2O temp (oC) top	H2O temp (oC) bottom	Salinit y (ppt) top	Salinit y (ppt) bottom	DO (mg/l) top	DO (mg/L) bottom	Saturatio n DO - top	Saturati on DO - bottom	Dom. Substrat e	Subdom. Substrate	SAV	EAV	AI	
10/12/99	W	118	3	6.3	18.9	0.45	0	4.253	16.7	16.5	1.5	1.5	9.61	8.96	99.7	92.6	sand		3	0		
10/12/99	W	209	3	3.9	11.7	0.6	0	3.51	17	16.9	1.5	1.5	8.7	8.24	90.9	85.8	sand		1	0		
10/12/99	W	328	3	3.65	11	0.27	0	1.478	17.4	17.4	1.5	1.5	7.48	7.59	78.7	79.9	sand	corophi um	1	0		
10/12/99	W	355	3	2.4	7.2	0.55	0	1.98	17.4	17.3	1.5	1.5	7.54	7.56	79.5	79.4	sand		1	0		
10/12/99	W	374	3	2.75	8.25	0.75	0	3.094	17.7	17.5	1.5	1.5	8	7.11	84.7	75.1	sand		0	0		
10/12/99	W	454	3	3.45	10.4	0.55	0	2.846	17.9	17.6	1.5	1.5	9.61	8.51	102.2	90	sand		0	0		
10/12/99	W	490	3	2.8	8.4	0.25	0	1.05	17.9	17.9	1.5	1.5	11.49	11.24	122.3	119.5	sand	muck	1	0		
10/12/99	W	604	3	2.4	7.2	1.07	0	3.852	19.7	17.6	1.5	1.5	14.95	11.78	164.9	124.5	sand		4	0		
10/13/99	NW	40	3	2.25	6.75	0.47	0.35	2.768	16.4	16.4	1.5	1.5	4.09	2.96	42.2	30.5	mud	sand	4	1		
10/13/99	NW	125	3	1.75	5.25	0.53	0.3	2.179	16.9	16.9	1.5	1.5	9.7	9.16	101.1	95.5	gravel		3	1		
10/13/99	NW	129	3	3.5	10.5	0.55	0	2.888	17.4	17.4	1.5	1.5	9.46	8.24	99.6	86.7	gravel		1	0		
10/13/99	NW	171	3	3.25	9.75	0.3	0	1.463	18.1	18.1	1.5	1.5	9.68	5.67	103.5	60.6	muck	mud	0	1		
10/13/99	NW	248	3	3.2	9.6	0.5	0.2	3.36	18	18	1.5	1.5	10.3	9.92	109.9	105.8	muck	mud	0	1		
10/13/99	NW	259	3	2.2	6.6	0.4	0.2	1.98									muck	sand	0	1		
10/13/99	NW	270	3	3.6	10.8	0.45	0.25	3.78	18.1	18.1	1.5	1.5	10.36	4.92	110.8	52.8	muck	mud	1	2		
10/14/99	E	52	3	2.7	8.1	0.4	0.15	2.228	16.5	16.4	1.3	1.3	9.56	8.57	98.7	88.3	muck	mud	3	0		
10/14/99	E	54	3	2.2	6.6	0.31	n.a.	n.a.	"	"	"	"	"	"	"	"	"	muck	mud	0	2	
10/14/99	E	60	3	2.65	7.95	0.25	0.15	1.59	18.7	18.7	1.3	1.3	9.07	5.26	97.9	56.8	muck	mud	0	1		
10/14/99	E	123	3	3.82	11.5	0.41	0.2	3.495	22.3	22.4	1.2	1.2	11.14	13.92	129	161.6	mud	muck	1	1		
10/14/99	E	186	3	2.9	8.7	0.7	0.42	4.872	21.1	18.7	1.3	1.2	11.25	4.19	127.5	45.2	muck	cobble	4	0		

APPENDIX IV: RAW FISH SAMPLING DATA AT RODEO LAGOON, OCTOBER 12-14, 1999
 (Code key: tw=tidewater goby, sb=threespine stickleback, psc=prickly sculpin, sc=unid. sculpin)

TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort	TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort
E 123	sb	123			E 123	tw	1	12	
E 123	tw	28			E 123	tw	1	20	
E 123	psc	7	55		E 123	tw	1	30	
E 123	psc	6	55		E 123	tw	1	34	
E 123	psc	5	56		E 123	tw	1	39	
E 123	psc	4	75		E 123	tw	1	23	
E 123	psc	3	80		E 123	tw	1	24	
E 123	psc	2	85		E 123	tw	1	23	
E 123	psc	1	85		E 123	tw	1	28	
E 123	sb	1	31		E 123	tw	1	25	
E 123	sb	1	21		E 123	tw	1	25	
E 123	sb	1	19		E 123	tw	1	27	
E 123	sb	1	22		E 123	tw	1	35	
E 123	sb	1	17		E 123	tw	1	18	
E 123	sb	1	36		E 123	tw	1	20	
E 123	sb	1	34		E 123	tw	1	24	
E 123	sb	1	19		E 123	tw	1	38	
E 123	sb	1	62		E 123	tw	1	30	
E 123	sb	1	28		E 123	tw	1	33	
E 123	sb	1	20		E 186	sb	911		
E 123	sb	1	22		E 186	psc	1	60	
E 123	sb	1	20		E 186	psc	1	65	
E 123	sb	1	30		E 186	psc	1	82	
E 123	sb	1	28		E 186	psc	1	36	
E 123	sb	1	25		E 186	psc	1	55	
E 123	sb	1	15		E 186	psc	1	83	
E 123	sb	1	31		E 186	psc	1	85	
E 123	sb	1	28		E 186	psc	1	75	
E 123	sb	1	27		E 186	psc	1	62	
E 123	sc	1	40		E 186	psc	1	59	
E 123	sc	1	42		E 186	psc	1	60	
E 123	sc	1	45		E 186	sb	1	23	
E 123	sc	1	37		E 186	sb	1	40	
E 123	sc	1	26		E 186	sb	1	32	
E 123	sc	1	30		E 186	sb	1	18	
E 123	sc	1			E 186	sb	1	24	
E 123	tw	1	32		E 186	sb	1	25	
E 123	tw	1	22		E 186	sb	1	26	
E 123	tw	1	29		E 186	sb	1	19	
E 123	tw	1	45		E 186	sb	1	35	
E 123	tw	1	30		E 186	sb	1	56	
E 123	tw	1	38		E 186	sb	1	22	
E 123	tw	1	37		E 186	sb	1	24	
E 123	tw	1	25		E 186	sb	1	20	
E 123	tw	1	30		E 186	sb	1	30	
E 123	tw	1	34		E 186	sb	1	28	
E 123	tw	1	32		E 186	sb	1	25	
E 123	tw	1	25		E 186	sb	1	27	
E 123	tw	1	33		E 186	sb	1	24	

APPENDIX IV: RAW FISH SAMPLING DATA AT RODEO LAGOON, OCTOBER 12-14,1999
(Code key: tw=tidewater goby, sb=threespine stickleback, psc=prickly sculpin, sc=unld. sculpin)

TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort	TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort
E 186	sb	1	15		E 52	sb	1	45	
E 186	sb	1	19		E 52	sb	1	19	
E 186	sb	1	30		E 52	sb	1	16	
E 186	sb	1	19		E 52	sb	1	27	
E 186	sb	1	39		E 52	sb	1	18	
E 186	sb	1	22		E 52	sc	1	28	
E 186	sb	1	21		E 52	sc	1	27	
E 186	sb	1	24		E 52	sc	1	11	
E 186	sb	1	20		E 52	sc	1	33	
E 186	sb	1	24		E 52	sc	1	38	
E 186	sb	1	21		E 52	sc	1	41	
E 186	sb	1	25		E 52	sc	1	33	
E 186	sb	1	26		E 52	sc	1	35	
E 186	sb	1	28		E 52	sc	1	34	
E 186	sc	1	65		E 52	sc	1	50	
E 186	sc	1	75		E 52	sc	1	57	
E 186	sc	1	43		E 52	sc	1	39	
E 186	sc	1	73		E 52	sc	1	5	
E 186	sc	1	73		E 52	sc	1	49	
E 52	sb	673			E 52	sc	1	26	
E 52	tw	401			E 52	sc	1	32	
E 52	sc	5			E 52	tw	1	28	
E 52	sb	1	18		E 52	tw	1	29	
E 52	sb	1	16		E 52	tw	1	15	
E 52	sb	1	17		E 52	tw	1	36	
E 52	sb	1	22		E 52	tw	1	20	
E 52	sb	1	30		E 52	tw	1	29	
E 52	sb	1	30		E 52	tw	1	21	
E 52	sb	1	20		E 52	tw	1	20	
E 52	sb	1	15		E 52	tw	1	23	
E 52	sb	1	14		E 52	tw	1	30	
E 52	sb	1	13		E 52	tw	1	16	
E 52	sb	1	34		E 52	tw	1	15	
E 52	sb	1	18		E 52	tw	1	22	
E 52	sb	1	16		E 52	tw	1	38	
E 52	sb	1	25		E 52	tw	1	39	
E 52	sb	1	13		E 52	tw	1	32	
E 52	sb	1	14		E 52	tw	1	34	
E 52	sb	1	28		E 52	tw	1	25	
E 52	sb	1	19		E 52	tw	1	32	
E 52	sb	1	20		E 52	tw	1	37	
E 52	sb	1	18		E 52	tw	1	17	
E 52	sb	1	17		E 52	tw	1	28	
E 52	sb	1	17		E 52	tw	1	14	
E 52	sb	1	11		E 52	tw	1	24	
E 52	sb	1	15		E 52	tw	1	13	
E 52	sb	1	22		E 52	tw	1	17	
E 52	sb	1	27		E 52	tw	1	22	
E 52	sb	1	16		E 52	tw	1	34	

APPENDIX IV: RAW FISH SAMPLING DATA AT RODEO LAGOON, OCTOBER 12-14,1999
 (Code key: tw=tidewater goby, sb=threespine stickleback, psc=prickly sculpin, sc=unid. sculpin)

TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort	TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort
E 52	tw	1	13		E 54	tw	1	32	
E 52	tw	1	32		E 54	tw	1	29	
E 52	tw	1	28		E 54	tw	1	18	
E 52	tw	1	35		E 54	tw	1	17	
E 52	tw	1	48		E 54	tw	1	15	
E 54	sb	320			E 54	tw	1	23	
E 54	tw	144			E 54	tw	1	22	
E 54	sb	1	18		E 54	tw	1	29	
E 54	sb	1	21		E 54	tw	1	16	
E 54	sb	1	19		E 54	tw	1	17	
E 54	sb	1	16		E 54	tw	1	15	
E 54	sb	1	16		E 54	tw	1	18	
E 54	sb	1	19		E 54	tw	1	23	
E 54	sb	1	17		E 54	tw	1	32	
E 54	sb	1	15		E 54	tw	1	20	
E 54	sb	1	14		E 54	tw	1	16	
E 54	sb	1	17		E 54	tw	1	28	
E 54	sb	1	17		E 54	tw	1	30	
E 54	sb	1	15		E 54	tw	1	22	
E 54	sb	1	14		E 54	tw	1	30	
E 54	sb	1	27		E 54	tw	1	14	
E 54	sb	1	22		E 54	tw	1	30	
E 54	sb	1	23		E 54	tw	1	33	
E 54	sb	1	32		E 54	tw	1	20	
E 54	sb	1	23		E 54	tw	1	32	
E 54	sb	1	42		E 60	tw	111		
E 54	sb	1	24		E 60	sb	1	13	
E 54	sb	1	26		E 60	sb	1	14	
E 54	sb	1	25		E 60	sb	1	17	
E 54	sb	1	30		E 60	sb	1	17	
E 54	sb	1	27		E 60	sb	1	13	
E 54	sb	1	13		E 60	sb	1	18	
E 54	sb	1	26		E 60	tw	1	14	
E 54	sb	1	18		E 60	tw	1	15	
E 54	sb	1	15		E 60	tw	1	12	
E 54	sb	1	18		E 60	tw	1	18	
E 54	sb	1	31		E 60	tw	1	13	
E 54	sb	1	22		E 60	tw	1	24	
E 54	sb	1	17		E 60	tw	1	26	
E 54	sc	1	31		E 60	tw	1	17	
E 54	sc	1	49		E 60	tw	1	22	
E 54	sc	1	45		E 60	tw	1	14	
E 54	tw	1	16		E 60	tw	1	25	
E 54	tw	1	17		E 60	tw	1	16	
E 54	tw	1	28		E 60	tw	1	22	
E 54	tw	1	26		E 60	tw	1	24	
E 54	tw	1	17		E 60	tw	1	29	
E 54	tw	1	17		E 60	tw	1	12	
E 54	tw	1	13		E 60	tw	1	28	

APPENDIX IV: RAW FISH SAMPLING DATA AT RODEO LAGOON, OCTOBER 12-14,1999
 (Code key: tw=tidewater goby, sb=threespine stickleback, psc=prickly sculpin, sc=unid. sculpin)

TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort	TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort
E 60	tw	1	24		NW 125	tw	1	14	
E 60	tw	1	26		NW 125	tw	1	22	
E 60	tw	1	19		NW 125	tw	1	34	
E 60	tw	1	22		NW 125	tw	1	33	
E 60	tw	1	16		NW 129	sc	97		
E 60	tw	1	17		NW 129	sb	2	14	
E 60	tw	1	17		NW 129	sb	1	17	
E 60	tw	1	23		NW 129	sc	1	36	
E 60	tw	1	26		NW 129	sc	1	38	
E 60	tw	1	19		NW 129	sc	1	29	
E 60	tw	1	24		NW 129	sc	1	24	
E 60	tw	1	24		NW 129	sc	1	30	
E 60	tw	1	14		NW 129	sc	1	29	
E 60	tw	1	23		NW 129	sc	1	41	
E 60	tw	1	25		NW 129	sc	1	49	
NW 125	sc	41			NW 129	sc	1	26	
NW 125	sb	1	14		NW 129	sc	1	42	
NW 125	sb	1	18		NW 129	sc	1	44	
NW 125	sb	1	17		NW 129	sc	1	27	
NW 125	sb	1	17		NW 129	sc	1	46	
NW 125	sb	1	14		NW 129	sc	1	32	
NW 125	sb	1	17		NW 129	sc	1	30	
NW 125	sb	1	27		NW 129	sc	1	35	
NW 125	sc	1	35		NW 129	sc	1	34	
NW 125	sc	1	31		NW 129	sc	1	46	
NW 125	sc	1	46		NW 129	sc	1	30	
NW 125	sc	1	32		NW 129	sc	1	45	
NW 125	sc	1	26		NW 129	sc	1	38	
NW 125	sc	1	24		NW 129	sc	1	32	
NW 125	sc	1	25		NW 129	sc	1	46	
NW 125	sc	1	31		NW 129	sc	1	40	
NW 125	sc	1	24		NW 129	tw	1	22	
NW 125	sc	1	49		NW 129	tw	1	41	
NW 125	sc	1	27		NW 129	tw	1	15	
NW 125	sc	1	30		NW 129	tw	1	20	
NW 125	sc	1	36		NW 129	tw	1	15	
NW 125	sc	1	26		NW 129	tw	1	21	
NW 125	sc	1	33		NW 129	tw	1	30	
NW 125	sc	1	23		NW 171	sc	23		
NW 125	sc	1	34		NW 171	sc	1	48	
NW 125	sc	1	30		NW 171	sc	1	31	
NW 125	sc	1	31		NW 171	sc	1	32	
NW 125	sc	1	40		NW 171	sc	1	38	
NW 125	sc	1	29		NW 171	sc	1	37	
NW 125	tw	1	23		NW 171	sc	1	45	
NW 125	tw	1	35		NW 171	sc	1	31	
NW 125	tw	1	28		NW 171	sc	1	27	
NW 125	tw	1	31		NW 171	sc	1	30	
NW 125	tw	1	18		NW 171	sc	1	30	

APPENDIX IV: RAW FISH SAMPLING DATA AT RODEO LAGOON, OCTOBER 12-14,1999

(Code key: tw=tidewater goby, sb=threespine stickleback, psc=prickly sculpin, sc=unld. sculpin)

TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort	TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort
NW 171	sc	1	37		NW 248	sc	1	42	
NW 171	sc	1	29		NW 248	sc	1	25	
NW 171	sc	1	30		NW 248	sc	1	28	
NW 171	sc	1	44		NW 248	sc	1	33	
NW 171	sc	1	33		NW 248	sc	1	15	
NW 171	sc	1	34		NW 248	sc	1	34	
NW 171	sc	1	31		NW 248	sc	1	73	
NW 171	sc	1	29		NW 248	sc	1	51	
NW 171	sc	1	31		NW 248	sc	1	45	
NW 171	sc	1	25		NW 248	sc	1	28	
NW 171	tw	1	32		NW 248	sc	1	38	
NW 171	tw	1	15		NW 248	sc	1	30	
NW 171	tw	1	28		NW 248	sc	1	55	
NW 171	tw	1	44		NW 248	sc	1	52	
NW 171	tw	1	24		NW 248	sc	1	37	
NW 171	tw	1	22		NW 248	sc	1	29	
NW 171	tw	1	40		NW 248	tw	1	25	
NW 171	tw	1	31		NW 248	tw	1	15	
NW 171	tw	1	18		NW 248	tw	1	24	
NW 171	tw	1	17		NW 248	tw	1	21	
NW 171	tw	1	26		NW 248	tw	1	22	
NW 248	sc	45			NW 248	tw	1	19	
NW 248	sb	3			NW 248	tw	1	20	
NW 248	tw	2			NW 248	tw	1	20	
NW 248	sb	1	16		NW 248	tw	1	19	
NW 248	sb	1	17		NW 248	tw	1	21	
NW 248	sb	1	21		NW 248	tw	1	17	
NW 248	sb	1	16		NW 248	tw	1	24	
NW 248	sb	1	16		NW 248	tw	1	23	
NW 248	sb	1	19		NW 248	tw	1	22	
NW 248	sb	1	23		NW 248	tw	1	20	
NW 248	sb	1	23		NW 248	tw	1	20	
NW 248	sb	1	17		NW 248	tw	1	19	
NW 248	sb	1	34		NW 248	tw	1	23	
NW 248	sb	1	22		NW 248	tw	1	20	
NW 248	sb	1	32		NW 248	tw	1	42	
NW 248	sb	1	24		NW 248	tw	1	41	
NW 248	sb	1	19		NW 248	tw	1	25	
NW 248	sb	1	25		NW 248	tw	1	21	
NW 248	sb	1	14		NW 248	tw	1	43	
NW 248	sb	1	17		NW 248	tw	1	45	
NW 248	sb	1	19		NW 248	tw	1	27	
NW 248	sb	1	20		NW 248	tw	1	36	
NW 248	sb	1	21		NW 248	tw	1	40	
NW 248	sc	1	30		NW 248	tw	1	19	1
NW 248	sc	1	64		NW 248	tw	1	16	1
NW 248	sc	1	36		NW 248	tw	1	16	1
NW 248	sc	1	38		NW 248	tw	1	21	1
NW 248	sc	1	31		NW 259	tw	5		

APPENDIX IV: RAW FISH SAMPLING DATA AT RODEO LAGOON, OCTOBER 12-14, 1999
 (Code key: tw=tide water goby, sb=threespine stickleback, psc=prickly sculpin, sc=unid. sculpin)

TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort	TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort
NW 259	sc	4			NW 259	tw	1	19	
NW 259	sb	1	17		NW 259	tw	1	18	
NW 259	sb	1	17		NW 259	tw	1	21	
NW 259	sb	1	22		NW 259	tw	1	20	
NW 259	sb	1			NW 259	tw	1	21	
NW 259	sc	1	49		NW 259	tw	1	30	
NW 259	sc	1	35		NW 259	tw	1	19	
NW 259	sc	1	31		NW 259	tw	1	15	
NW 259	sc	1	66		NW 270	sb	55		
NW 259	sc	1	42		NW 270	tw	21		
NW 259	sc	1	29		NW 270	sc	17		
NW 259	sc	1	30		NW 270	sb	1	25	
NW 259	sc	1	49		NW 270	sb	1	33	
NW 259	sc	1	38		NW 270	sb	1	23	
NW 259	sc	1	28		NW 270	sb	1	23	
NW 259	sc	1	32		NW 270	sb	1	20	
NW 259	sc	1	42		NW 270	sb	1	20	
NW 259	sc	1	37		NW 270	sb	1	13	
NW 259	sc	1	28		NW 270	sb	1	27	
NW 259	sc	1	33		NW 270	sb	1	23	
NW 259	sc	1	36		NW 270	sb	1	27	
NW 259	sc	1	36		NW 270	sb	1	21	
NW 259	sc	1	42		NW 270	sb	1	19	
NW 259	sc	1	61		NW 270	sb	1	33	
NW 259	sc	1	30		NW 270	sb	1	25	
NW 259	tw	1	18		NW 270	sb	1	19	
NW 259	tw	1	19		NW 270	sb	1	22	
NW 259	tw	1	15		NW 270	sb	1	20	
NW 259	tw	1	18		NW 270	sb	1	53	
NW 259	tw	1	17		NW 270	sb	1	32	
NW 259	tw	1	18		NW 270	sb	1	30	
NW 259	tw	1	16		NW 270	sc	1	70	
NW 259	tw	1	24		NW 270	sc	1	35	
NW 259	tw	1	17		NW 270	sc	1	36	
NW 259	tw	1	16		NW 270	sc	1	45	
NW 259	tw	1	29		NW 270	sc	1	37	
NW 259	tw	1	20		NW 270	sc	1	78	
NW 259	tw	1	18		NW 270	sc	1	22	
NW 259	tw	1	15		NW 270	sc	1	31	
NW 259	tw	1	21		NW 270	sc	1	73	
NW 259	tw	1	19		NW 270	sc	1	37	
NW 259	tw	1	22		NW 270	sc	1	30	
NW 259	tw	1	36		NW 270	sc	1	30	
NW 259	tw	1	27		NW 270	sc	1	33	
NW 259	tw	1	19		NW 270	sc	1	34	
NW 259	tw	1	20		NW 270	sc	1	29	
NW 259	tw	1	30		NW 270	sc	1	60	
NW 259	tw	1	20		NW 270	sc	1	31	
NW 259	tw	1	12		NW 270	sc	1	51	

APPENDIX IV: RAW FISH SAMPLING DATA AT RODEO LAGOON, OCTOBER 12-14, 1999
 (Code key: tw=tidewater goby, sb=threespine stickleback, psc=prickly sculpin, sc=unld. sculpin)

TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort	TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort
NW 270	sc	1	34		NW 40	sb	1	21	
NW 270	sc	1	35		NW 40	sb	1	20	
NW 270	tw	1	33		NW 40	sb	1	17	
NW 270	tw	1	20		NW 40	sb	1	15	
NW 270	tw	1	35		NW 40	sb	1	30	
NW 270	tw	1	42		NW 40	sb	1	19	
NW 270	tw	1	19		NW 40	sb	1	17	
NW 270	tw	1	40		NW 40	sb	1	15	
NW 270	tw	1	20		NW 40	sb	1	14	
NW 270	tw	1	15		NW 40	sb	1	17	
NW 270	tw	1	21		NW 40	sb	1	16	
NW 270	tw	1	35		NW 40	sb	1	12	
NW 270	tw	1	21		NW 40	sb	1	10	
NW 270	tw	1	24		NW 40	sc	1	37	
NW 270	tw	1	40		NW 40	sc	1	83	
NW 270	tw	1	23		NW 40	sc	1	51	
NW 270	tw	1	14		NW 40	sc	1	49	
NW 270	tw	1	19		NW 40	sc	1	60	
NW 270	tw	1	39		NW 40	sc	1	36	
NW 270	tw	1	25		NW 40	sc	1	37	
NW 270	tw	1	19		NW 40	sc	1	33	
NW 270	tw	1	16		NW 40	sc	1	50	
NW 270	tw	1	37		NW 40	sc	1	61	
NW 270	tw	1	20		NW 40	sc	1	41	
NW 270	tw	1	15		NW 40	sc	1	36	
NW 270	tw	1	30		NW 40	sc	1	34	
NW 270	tw	1	47		NW 40	sc	1	41	
NW 270	tw	1	37		NW 40	sc	1	51	
NW 270	tw	1	37		NW 40	sc	1	55	
NW 270	tw	1	33		NW 40	sc	1	51	
NW 270	tw	1	22		NW 40	sc	1	40	
NW 270	tw	1	38		NW 40	sc	1	33	
NW 270	tw	1	21		NW 40	sc	1	31	
NW 270	tw	1	28		NW 40	sc	1	45	
NW 40	tw	73			NW 40	sc	1	40	
NW 40	sb	30			NW 40	sc	1	28	
NW 40	psc	1	95		NW 40	sc	1	27	
NW 40	psc	1	105		NW 40	tw	1	42	
NW 40	sb	1	15		NW 40	tw	1	29	
NW 40	sb	1	20		NW 40	tw	1	24	
NW 40	sb	1	31		NW 40	tw	1	39	
NW 40	sb	1	14		NW 40	tw	1	23	
NW 40	sb	1	13		NW 40	tw	1	28	
NW 40	sb	1	16		NW 40	tw	1	22	
NW 40	sb	1	33		NW 40	tw	1	28	
NW 40	sb	1	15		NW 40	tw	1	37	
NW 40	sb	1	25		NW 40	tw	1	23	
NW 40	sb	1	21		NW 40	tw	1	37	
NW 40	sb	1	17		NW 40	tw	1	16	

APPENDIX IV: RAW FISH SAMPLING DATA AT RODEO LAGOON, OCTOBER 12-14,1999
 (Code key: tw=tldewater goby, sb=threespine stickleback, psc=prickly sculpin, sc=unid. sculpin)

TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort	TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort
NW 40	tw	1	22		W 118	sc	1	36	
NW 40	tw	1	17		W 118	sc	1	37	
NW 40	tw	1	42		W 118	tw	1	51	
NW 40	tw	1	17		W 118	tw	1	25	
NW 40	tw	1	33		W 118	tw	1	39	
NW 40	tw	1	35		W 118	tw	1	21	
NW 40	tw	1	32		W 118	tw	1	15	
NW 40	tw	1	13		W 118	tw	1	16	
NW 40	tw	1	33		W 118	tw	1	22	
NW 40	tw	1	26		W 118	tw	1	15	
NW 40	tw	1	32		W 118	tw	1	15	
NW 40	tw	1	14		W 118	tw	1	16	
NW 40	tw	1	25		W 118	tw	1	20	
NW 40	tw	1	25		W 118	tw	1	16	
NW 40	tw	1	25		W 118	tw	1	16	
NW 40	tw	1	18		W 118	tw	1	15	
NW 40	tw	1	19		W 118	tw	1	20	
NW 40	tw	1	31		W 118	tw	1	21	
NW 40	tw	1	44		W 118	tw	1	18	
NW 40	tw	1	32		W 118	tw	1	37	
NW 40	tw	1	32		W 118	tw	1	15	
W 118	tw	245			W 118	tw	1	17	
W 118	psc	1	70		W 118	tw	1	16	
W 118	sb	1	19		W 118	tw	1	14	
W 118	sb	1	18		W 118	tw	1	16	
W 118	sb	1	29		W 118	tw	1	15	
W 118	sb	1	38		W 118	tw	1	16	
W 118	sb	1	23		W 118	tw	1	16	
W 118	sb	1	24		W 118	tw	1	30	
W 118	sb	1	33		W 118	tw	1	17	
W 118	sb	1	46		W 118	tw	1	18	
W 118	sb	1	25		W 118	tw	1	17	
W 118	sb	1	25		W 118	tw	1	20	
W 118	sb	1	26		W 118	tw	1	20	
W 118	sb	1			W 209	sc	111		
W 118	sc	1	45		W 209	tw	104		
W 118	sc	1	70		W 209	psc	1	80	
W 118	sc	1	80		W 209	psc	1	76	
W 118	sc	1	45		W 209	psc	1	60	
W 118	sc	1	35		W 209	psc	1	60	
W 118	sc	1	35		W 209	sc	1	60	
W 118	sc	1	45		W 209	sc	1	45	
W 118	sc	1	40		W 209	sc	1	58	
W 118	sc	1	30		W 209	sc	1	45	
W 118	sc	1	30		W 209	sc	1	47	
W 118	sc	1	41		W 209	sc	1	60	
W 118	sc	1	64		W 209	sc	1	50	
W 118	sc	1	46		W 209	sc	1	55	
W 118	sc	1	54		W 209	sc	1	51	

APPENDIX IV: RAW FISH SAMPLING DATA AT RODEO LAGOON, OCTOBER 12-14, 1999
 (Code key: tw=tidewater goby, sb=threespine stickleback, psc=prickly sculpin, sc=unid. sculpin)

TATION ID	SPECIES	No.	Std. Length /lnj (mm)	Mort	TATION ID	SPECIES	No.	Std. Length /lnj (mm)	Mort
W 209	sc	1	28		W 328	sc	1	32	
W 209	sc	1	34		W 328	sc	1	29	
W 209	sc	1	40		W 328	sc	1	28	
W 209	sc	1	37		W 328	sc	1	34	
W 209	sc	1	41		W 328	sc	1	28	
W 209	sc	1	32		W 328	tw	1	29	
W 209	sc	1	54		W 328	tw	1	20	
W 209	sc	1	48		W 328	tw	1	24	
W 209	sc	1	30		W 328	tw	1	13	
W 209	sc	1	26		W 328	tw	1	12	
W 209	sc	1	44		W 328	tw	1	14	
W 209	sc	1	30		W 328	tw	1	15	
W 209	sc	1	35	1	W 328	tw	1	14	
W 209	tw	1	19		W 328	tw	1	29	
W 209	tw	1	16		W 328	tw	1	16	
W 209	tw	1	16		W 328	tw	1	20	
W 209	tw	1	16		W 328	tw	1	18	
W 209	tw	1	26		W 328	tw	1	17	
W 209	tw	1	23		W 328	tw	1	14	
W 209	tw	1	14		W 328	tw	1	18	
W 209	tw	1	40		W 328	tw	1	14	
W 209	tw	1	29		W 328	tw	1	14	
W 209	tw	1	37		W 328	tw	1	21	
W 209	tw	1	22		W 328	tw	1	35	
W 209	tw	1	43		W 328	tw	1	13	
W 209	tw	1	13		W 328	tw	1	24	
W 209	tw	1	19		W 328	tw	1	24	
W 209	tw	1	30		W 328	tw	1	19	
W 209	tw	1	38		W 328	tw	1	30	
W 209	tw	1	42		W 328	tw	1	16	
W 209	tw	1	20		W 328	tw	1	15	
W 209	tw	1	20		W 328	tw	1	28	
W 209	tw	1	13		W 328	tw	1	18	
W 209	tw	1	17		W 328	tw	1	19	
W 209	tw	1	26		W 328	tw	1	16	
W 209	tw	1	42		W 328	tw	1	23	
W 209	tw	1	25		W 328	tw	1	17	
W 209	tw	1	15		W 355	tw	17		
W 209	tw	1	17		W 355	sc	9		
W 209	tw	1	18		W 355	sc	1	32	
W 209	tw	1	16		W 355	sc	1	23	
W 209	tw	1	36		W 355	sc	1	34	
W 209	tw	1	15		W 355	sc	1	27	
W 209	tw	1	16		W 355	sc	1	27	
W 209	tw	1	13		W 355	sc	1	45	
W 328	tw	7		7	W 355	sc	1	31	
W 328	sc	1	35		W 355	sc	1	36	
W 328	sc	1	50		W 355	sc	1	35	
W 328	sc	1	30		W 355	sc	1	28	

APPENDIX IV: RAW FISH SAMPLING DATA AT RODEO LAGOON, OCTOBER 12-14, 1999
 (Code key: tw=tidewater goby, sb=threespine stickleback, psc=prickly sculpin, sc=unid. sculpin)

TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort	TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort
W 355	sc	1	29		W 355	tw	1	18	
W 355	sc	1	24		W 355	tw	1	18	
W 355	sc	1	24		W 355	tw	1	17	
W 355	sc	1	31		W 355	tw	1	15	
W 355	sc	1	25		W 355	tw	1	16	
W 355	sc	1	34		W 374	sc	1	30	
W 355	sc	1	38		W 374	sc	1	30	
W 355	sc	1	35		W 374	sc	1	40	
W 355	sc	1	40		W 374	sc	1	44	
W 355	sc	1	30		W 374	sc	1	31	
W 355	sc	1	25		W 374	sc	1	31	
W 355	sc	1	30		W 374	sc	1	30	
W 355	sc	1	25		W 374	sc	1	40	
W 355	sc	1	36		W 374	sc	1	36	
W 355	sc	1	24		W 374	sc	1	36	
W 355	sc	1	33		W 374	sc	1	25	
W 355	sc	1	27		W 374	sc	1	26	
W 355	sc	1	24		W 374	sc	1	43	
W 355	sc	1	26		W 374	sc	1	41	
W 355	sc	1	28		W 374	sc	1	34	
W 355	sc	1	33		W 374	sc	1	24	
W 355	sc	1	25		W 374	sc	1	29	
W 355	tw	1	15		W 374	sc	1	24	
W 355	tw	1	18		W 374	sc	1	33	
W 355	tw	1	16		W 374	tw	1	15	
W 355	tw	1	35		W 374	tw	1	15	
W 355	tw	1	19		W 374	tw	1	25	
W 355	tw	1	16		W 374	tw	1	24	
W 355	tw	1	18		W 374	tw	1	20	
W 355	tw	1	20		W 374	tw	1	20	
W 355	tw	1	15		W 454	sc	224		
W 355	tw	1	15		W 454	tw	37		
W 355	tw	1	30		W 454	sb	3		
W 355	tw	1	14		W 454	psc	1	92	
W 355	tw	1	19		W 454	sb	1	25	
W 355	tw	1	16		W 454	sc	1	43	
W 355	tw	1	18		W 454	sc	1	70	
W 355	tw	1	17		W 454	sc	1	45	
W 355	tw	1	17		W 454	sc	1	64	
W 355	tw	1	16		W 454	sc	1	44	
W 355	tw	1	19		W 454	sc	1	55	
W 355	tw	1	18		W 454	sc	1	35	
W 355	tw	1	14		W 454	sc	1	39	
W 355	tw	1	14		W 454	sc	1	34	
W 355	tw	1	19		W 454	sc	1	34	
W 355	tw	1	18		W 454	sc	1	33	
W 355	tw	1	17		W 454	sc	1	62	
W 355	tw	1	15		W 454	sc	1	63	
W 355	tw	1	15		W 454	sc	1	64	

APPENDIX IV: RAW FISH SAMPLING DATA AT RODEO LAGOON, OCTOBER 12-14,1999
 (Code key: tw=tidewater goby, sb=threespine stickleback, psc=prickly sculpin, sc=unid. sculpin)

TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort	TATION ID	SPECIES	No.	Std. Length /Inj (mm)	Mort
W 454	sc	1	60		W 454	tw	1	43	
W 454	sc	1	55		W 454	tw	1	15	1
W 454	sc	1	38		W 490	tw	168		
W 454	sc	1	43		W 490	sc	16		
W 454	sc	1	44		W 490	sb	1	45	
W 454	sc	1	50		W 490	sb	1	22	
W 454	sc	1	49		W 490	sc	1	60	
W 454	sc	1	60		W 490	sc	1	60	
W 454	sc	1	52		W 490	sc	1	28	
W 454	sc	1	46		W 490	sc	1	35	
W 454	sc	1	31		W 490	sc	1	52	
W 454	sc	1	37		W 490	sc	1	43	
W 454	sc	1	82		W 490	sc	1	60	
W 454	sc	1	35		W 490	sc	1	27	
W 454	sc	1	48		W 490	sc	1	34	
W 454	sc	1	64		W 490	sc	1	30	
W 454	sc	1	45		W 490	sc	1	40	
W 454	sc	1	52		W 490	sc	1	42	
W 454	tw	1	18		W 490	sc	1	65	
W 454	tw	1	25		W 490	sc	1	42	
W 454	tw	1	18		W 490	sc	1	40	
W 454	tw	1	21		W 490	sc	1	38	
W 454	tw	1	45		W 490	sc	1	43	
W 454	tw	1	17		W 490	sc	1	40	
W 454	tw	1	28		W 490	sc	1	50	
W 454	tw	1	25		W 490	sc	1	42	
W 454	tw	1	50		W 490	sc	1	25	
W 454	tw	1	38		W 490	sc	1	36	
W 454	tw	1	35		W 490	tw	1	23	
W 454	tw	1	17		W 490	tw	1	41	
W 454	tw	1	39		W 490	tw	1	33	
W 454	tw	1	15		W 490	tw	1	34	
W 454	tw	1	25		W 490	tw	1	20	
W 454	tw	1	15		W 490	tw	1	20	
W 454	tw	1	38		W 490	tw	1	30	
W 454	tw	1	17		W 490	tw	1	28	
W 454	tw	1	18		W 490	tw	1	43	
W 454	tw	1	39		W 490	tw	1	30	
W 454	tw	1	27		W 490	tw	1	28	
W 454	tw	1	27		W 490	tw	1	25	
W 454	tw	1	18		W 490	tw	1	29	
W 454	tw	1	19		W 490	tw	1	30	
W 454	tw	1	37		W 490	tw	1	20	
W 454	tw	1	20		W 490	tw	1	15	
W 454	tw	1	18		W 490	tw	1	25	
W 454	tw	1	43		W 490	tw	1	38	
W 454	tw	1	17		W 490	tw	1	29	
W 454	tw	1	23		W 490	tw	1	31	
W 454	tw	1	22		W 490	tw	1	23	

APPENDIX IV: RAW FISH SAMPLING DATA AT RODEO LAGOON, OCTOBER 12-14, 1999
(Code key: tw=tidewater goby, sb=threespine stickleback, psc=prickly sculpin, sc=unld. sculpin)

TATION ID	SPECIES	No.	Std. Length (mm)	Mort /Inj	TATION ID	SPECIES	No.	Std. Length (mm)	Mort /Inj
W 490	tw	1	38		W 604	tw	1	35	
W 490	tw	1	27		W 604	tw	1	12	
W 490	tw	1	38		W 604	tw	1	23	
W 490	tw	1	35		W 604	tw	1	34	
W 490	tw	1	27		W 604	tw	1	25	
W 490	tw	1	36		W 604	tw	1	20	
W 490	tw	1	35		W 604	tw	1	22	
W 490	tw	1	30		W 604	tw	1	20	
W 490	tw	1	36		W 604	tw	1	17	
W 490	tw	1	28		W 604	tw	1	21	
W 490	tw	1	40		W 604	tw	1	23	
W 604	tw	109			W 604	tw	1	16	
W 604	sc	12			W 604	tw	1	15	
W 604	sb	2			W 604	tw	1	15	
W 604	psc	1	75		W 604	tw	1	25	
W 604	sb	1	22		W 604	tw	1	30	
W 604	sb	1	20		W 604	tw	1	35	
W 604	sb	1	30		W 604	tw	1	34	
W 604	sb	1	23		W 604	tw	1	34	
W 604	sb	1	30		W 604	tw	1	27	
W 604	sb	1	20	1	W 604	tw	1	20	
W 604	sc	1	65		W 604	tw	1	25	
W 604	sc	1	52		W 604	tw	1	39	
W 604	sc	1	44		W 604	tw	1	19	
W 604	sc	1	50		W 604	tw	1	30	1
W 604	sc	1	56		W 604	tw	1	31	1
W 604	sc	1	76		W 604	tw	1	28	1
W 604	sc	1	43		W 604	tw	1	15	1
W 604	sc	1	50		W 604	tw	1	35	1
W 604	sc	1	35						
W 604	sc	1	44						
W 604	sc	1	57						
W 604	sc	1	34						
W 604	sc	1	35						
W 604	sc	1	42						
W 604	sc	1	45						
W 604	sc	1	61						
W 604	sc	1	44						
W 604	sc	1	39						
W 604	sc	1	38						
W 604	sc	1	45						
W 604	tw	1	27						
W 604	tw	1	18						
W 604	tw	1	20						
W 604	tw	1	12						
W 604	tw	1	25						
W 604	tw	1	20						
W 604	tw	1	15						
W 604	tw	1	35						