Exxon Valdez Oil Spill
Restoration Project Annual Report

Monitoring of Cutthroat Trout and Dolly Varden
Habitat Improvement Structures

Restoration Project 96043B
Annual Report

This annual report has been prepared for peer review as part of the *Exxon Valdez* Oil Spill Trustee Council restoration program for the purpose of assessing project progress. Peer review comments have not been addressed in the annual report.

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Study History: In 1989, the oil tanker *Exxon Valdez* ran aground on Bligh Reef spilling millions of gallons of crude oil into Prince William Sound (PWS). The ensuing oil spill damage assessment identified oil spill related injuries to the cutthroat trout (*Oncorhynchus clarki*), and Dolly Varden char (*Salvelinus malma*) populations in PWS. Information collected from 1989 to 1991 by the Natural Resources Damage Assessment (NRDA) studies documented lower growth rates for cutthroat trout and Dolly Varden char in oiled areas than in unoiled areas. It is unknown if growth rates have returned to normal.

In an attempt to mitigate for these impacts to cutthroat and Dolly Varden, the Forest Service installed habitat improvement structures to increase habitat suitability (EVOS project 95043B). However, it is uncertain the affect of habitat manipulation had on these species. Competition with juvenile coho salmon (*O. kisutch*) is believed to limit cutthroat trout production in quality pool rearing habitat. There is concern that certain types of habitat enhancements may increase coho salmon densities, and consequently increase competitive stress on cutthroat trout. This project was designed to evaluate the affects of the habitat improvements on fish abundance and species composition.

Abstract : This year, the Forest Service continued to monitor habitat improvement structures and their effects on cutthroat trout and Dolly Varden populations. Data collected in 1995 and 1996 appears to indicate that juvenile coho are utilizing the enhancements more than cutthroat trout and with one exception Dolly Varden increased. However, these results are preliminary. Additional monitoring is needed to increase the power of analysis.

Project Data: *Description of data* - There are three primary sets of digital data developed for this project: (1) mark-recapture, trapping effort, and length frequency information of juvenile cutthroat trout, Dolly Varden and coho salmon (2) modified Hankin and Reeves (1988) stream surveys, and (3) distribution of fish throughout the project area, by habitat type and specific enhancement structure location. *Format* - Data sets are in Excel spreadsheet format. *Custodian* - Contact Dan Gillikin at the Glacier Ranger District Office, USDA Forest Service, POB. 129 Girdwood, Alaska 99587, (907) 783-3242. *Availability* - copies of preliminary data sets are available upon written request.

Citation: Gillikin, D. 1996. Monitoring of cutthroat trout and Dolly Varden habitat improvement structures, *Exxon Valdez* Oil Spill Restoration Project Annual Report (Restoration Project 96043B), U.S. Forest Service, Glacier Ranger District, Girdwood, Alaska.

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EXECUTIVE SUMMARY

Distribution and abundance of cutthroat trout, Dolly Varden, and coho salmon were monitored at habitat improvement locations using mark recapture and Catch Per Unit Effort (CPUE) techniques to provide information on the distribution prior to effects from enhancement activities. Additionally the existing stream habitat at each project site was surveyed before and after structure installation to provide a basis of comparison.

Preliminary data suggests an overall increase in coho utilization at the enhancement structures and a decrease in use by cutthroat trout. Overall, CPUE for cutthroat trout declined at all sample sites. Dolly Varden generally increased at both the enhancement structures and overall. This information is based on pre-project trapping in 1995, and the data collected last season at the project locations. With only two years of data, it would be premature to draw conclusions on the affects that habitat improvements had on fish populations. Information collected in future years will add power to the analysis.

All sixty-three structures at the four project locations were inspected and minor repairs made. Of the 63 installed, only three cross-log structures required repositioning and additional anchoring. The three damaged structures were most likely dislodged in the fall of 1995 during the Typhoon Oscar flood event experienced throughout South Central Alaska. Generally, all the improvements were in good working order and functioning as predicted.

INTRODUCTION

In 1989, the oil tanker *Exxon Valdez* ran aground on Bligh Reef spilling millions of gallons of crude oil into Prince William Sound (PWS). The ensuing oil spill damage assessment identified oil spill related injuries to the cutthroat trout (*Oncorhynchus clarki*), and Dolly Varden char (*Salvelinus malma*) populations in PWS. Information collected from 1989 to 1991 by the Natural Resources Damage Assessment (NRDA) studies documented lower growth rates for cutthroat trout and Dolly Varden char in oiled areas than in unoiled areas (Hepler 1993). It is unknown if growth rates have returned to normal.

In an attempt to mitigate for these impacts to cutthroat and Dolly Varden, the Forest Service installed habitat improvement structures to increase habitat suitability (EVOS project 95043B). However, it is uncertain the affect of habitat manipulation had on these species. Competition with juvenile coho salmon (*O. kisutch*) is believed to limit cutthroat trout production in quality pool rearing habitat. There is concern that certain types of habitat enhancements may increase coho salmon densities, and consequently increase competitive stress on cutthroat trout. This project was designed to evaluate the effects of the habitat improvements on fish abundance and species composition.

OBJECTIVES

The main objective of this project is to monitor and document the responses of cutthroat trout, Dolly Varden, and coho salmon to modifications made to their habitat by enhancement activities.

Specific objectives are:

1. Measure the abundance and distribution of cutthroat trout, Dolly Varden and juvenile coho in the proposed project locations.

2. Measure and monitor cutthroat trout, Dolly Varden and juvenile coho utilization of newly installed habitat improvements.

3. Measure and monitor the effects that structures have on adjacent aquatic habitat.

4. Summarize findings on the effectiveness of the habitat structures installed in 1995.

METHODS

The primary null hypothesis for this project is that the number of cutthroat trout at the project locations will not change due to the habitat improvements made in 1995. More specific hypotheses are listed below:

Hypothesis 1. The abundance of cutthroat trout at the project sites will not increase over the monitoring project duration.

Hypothesis 2. The current distribution of cutthroat trout within the project area will not change over the duration of the monitoring project.

Hypothesis 3. Cutthroat trout and Dolly Varden will not be the predominant species to utilize the newly created habitat structures.

Hypothesis 4. Aquatic habitats adjacent to areas of improvement will not be affected by the structures installed in 1995.

Hypothesis 5. The structures installed in 1995 will not have benefitted cutthroat trout over the duration of the monitoring project.

The study took place in the Red Creek, Billy's Hole, Gunboat Lakes, and Otter Creek watersheds (Appendix 1). To test the proposed hypotheses, data was collected before and after habitat improvement work. There was, however, only one year of baseline data collected prior to placement of in-stream structures. The following methods were used to collect and analyze these data.

To compare habitat availability and fish utilization, all project area streams were surveyed using a modified Hankin and Reeves (1988) methodology. This method included stratification of habitat by channel and macrohabitat type. Macrohabitats were also categorized into three classes based on flow characteristics (slow, turbulent or non-turbulent), because we felt these were more repeatable for analysis (Appendix 2).

Fish abundance was estimated using a two stage stratified random sampling design utilizing auxiliary variables to improve the precision of estimators (Hankin 1986). Population estimations were derived from estimates using the Petersen Index and Bailey's 1951 formula to correct for bias, as described by Ricker (1975). Collection was conducted using baited minnow traps and fish were marked with caudal punches. Sampling effort was proportional to habitat availability. For example, if slow water habitats comprised 30 percent of the total available habitat within a reach, then 30 percent of the trapping effort was randomly placed in slow water habitats. Catch Per Unit Effort (CPUE) was also recorded. Comparisons were made between species, treatment areas, and between years. At this point, results are preliminary and more data is needed for a detailed analysis.

In addition to the habitat utilization work, all structures were examined to determine their effectiveness in the stream channel and to make repairs where needed.

RESULTS

Results from mark recapture studies proved to be problematic because of low recapture rates and high coefficients of variance (Table 1). Future sampling will incorporate design changes to account for these shortcomings. Although CPUE does not accurately define population numbers, it can be used as an indicator of relative abundance. Using these data, it appears that coho abundance has increased at two of the three habitat improvement sites (Figures 1, 3). Overall coho abundance has also increased in two out of the three sampling locations. However, only in Red Creek was there both an increase at both the habitat improvement sites and overall in the stream. Catch per unit effort at Gunboat Creek increased at the habitat improvement sites, but declined overall. The opposite trend was found at Otter Creek where coho decreased at the habitat improvement sites, but increased overall.

For cutthroat trout, CPUE decreased at the improvement sites in Red Creek (Figure 3). There was no change at Otter Creek, but too few fish were caught for comparison. However, overall, cutthroat trout declined at Otter Creek. Similar to the coho data, CPUE for cutthroat trout at Gunboat Creek increased at the habitat improvement structures, but declined overall in the system (Figures 3,4). At Red Creek CPUE dropped for cutthroat trout at both the improvement structures and overall in the system (Figures 3,4). Catch per unit effort for Dolly Varden increased at the improvement structures and overall in the Otter and Gunboat systems (Figures 5,6). However, CPUE declined at both improved sites and overall at Red Creek (Figures 5,6). Generally, all species used slower habitat types (Figure 7).

All sixty-three structures at the four project locations were inspected and minor repairs made, of the 63 installed only three cross-log structures required repositioning and additional anchoring. The three damaged structures were probably dislodged in the fall of 1995 during the Typhoon Oscar flood event experienced throughout South Central Alaska. In general, all the improvements were in good working order and functioning as predicted.

Table 1. Summary of mark recapture and CPUE data for project 95043B for 1995 and 1996, shaded values indicate a CV less than or near 0.20.

| Loc.	Spec.	Pop.Est		V (N)		CV		CPUE	
		95	96	95	96	95	96	95	96
Otter	CO	45	1220	324	10848	0.4	0.085	0.0019	0.0081
	CT	6	56	9	1344	0.5	0.654	0.0003	0.0002
	DV	128	1023	1536	7597	0.31	0.085	0.0039	0.0080
Red	CO	14	760	0	60805	0	0.324	0.0002	0.0024
	CT	105	72	1125	1344	0.32	0.509	0.0007	0.0003
	DV	427	374	8169	16456	0.21	0.343	0.0024	0.0012
GunR 2	CO	504	426	6720	9975	3.25	0.23	0.0127	0.0027
	CT	50	36	300	1296	0.38	1	0.0009	0.0004
	DV	48	594	768	24293	0.21	0.262	0.0004	0.0034
GunR 3	CO	N/A	30	N/A	244	N/A	0.51	N/A	N/A
	CT	N/A	54	N/A	1215	N/A	0.64	N/A	N/A
	DV	N/A	70	N/A	23	N/A	0.068	N/A	N/A
Billy	CO	N/A	N/A	N/A	N/A	N/A	N/A	0.0244	0.0282
	CT	N/A	N/A	N/A	N/A	N/A	N/A	0.0012	0.0001
	DV	N/A	N/A	N/A	N/A	N/A	N/A	0.0589	0.0124

Figures 1,2. Catch Per Unit Effort (CPUE) data for juvenile coho salmon (CO) at the four project locations. Structures are at enhancement sites, Overall is for the entire stream reach within the project areas. Base CPUE is pre-project data.
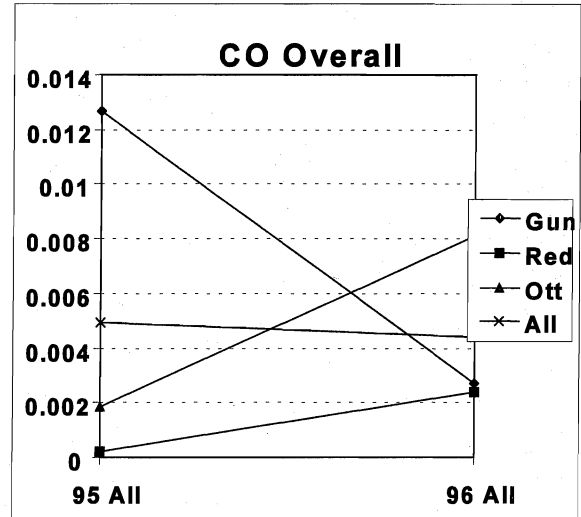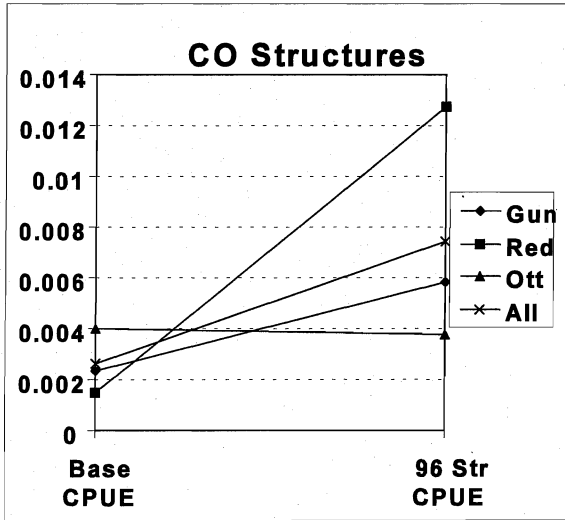

Figures 3,4. Catch Per Unit Effort (CPUE) data for juvenile cutthroat trout (CT) at the four project locations. Structures are at enhancement sites, Overall is for the entire stream reach within the project areas. Base CPUE is pre-project data.

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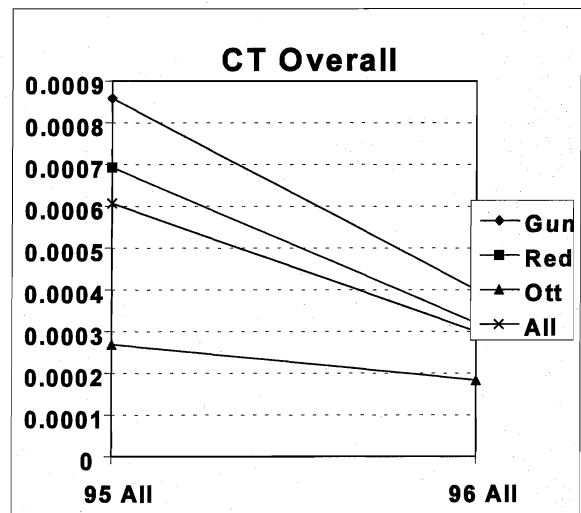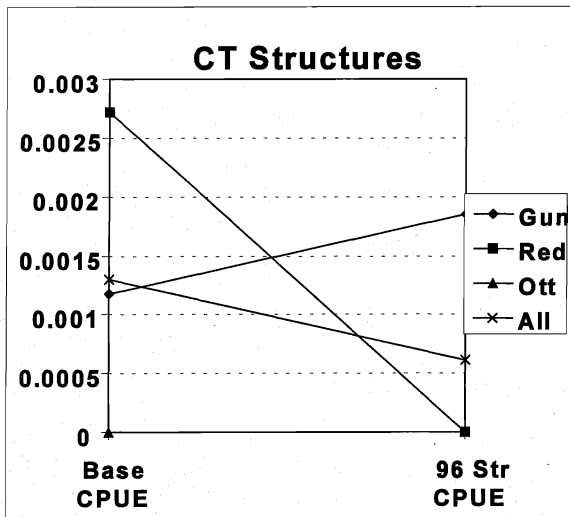
Figures 5,6. Catch Per Unit Effort (CPUE) data for juvenile Dolly Varden (DV) at the four project locations. Structures are at enhancement sites, Overall is for the entire stream reach within the project areas. Base CPUE is pre-project data.
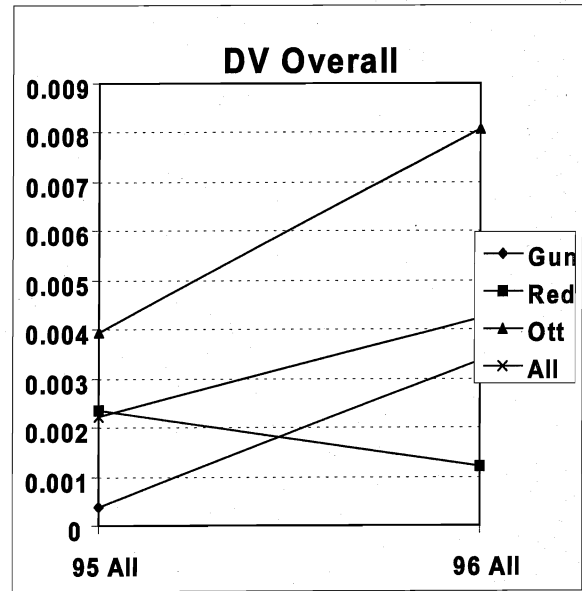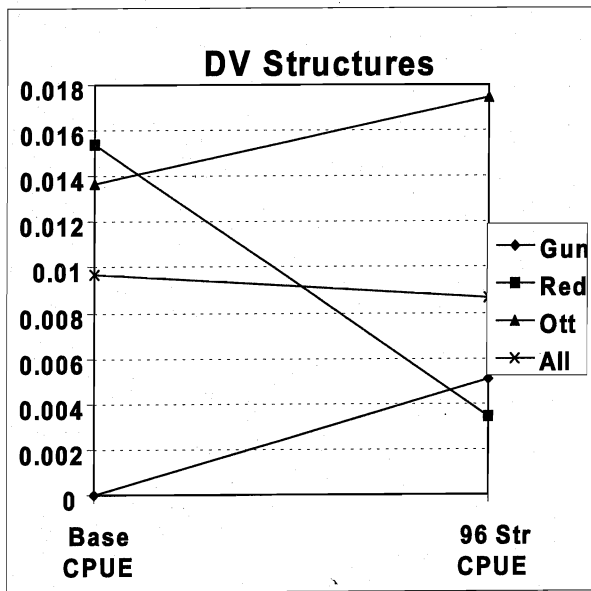
Figure 7. Summary of habitat utilization by species for Otter, Red Creek and Gunboat Lakes. T = Turbulent, N = Non-Turbulent, S = Slow Water habitat types.
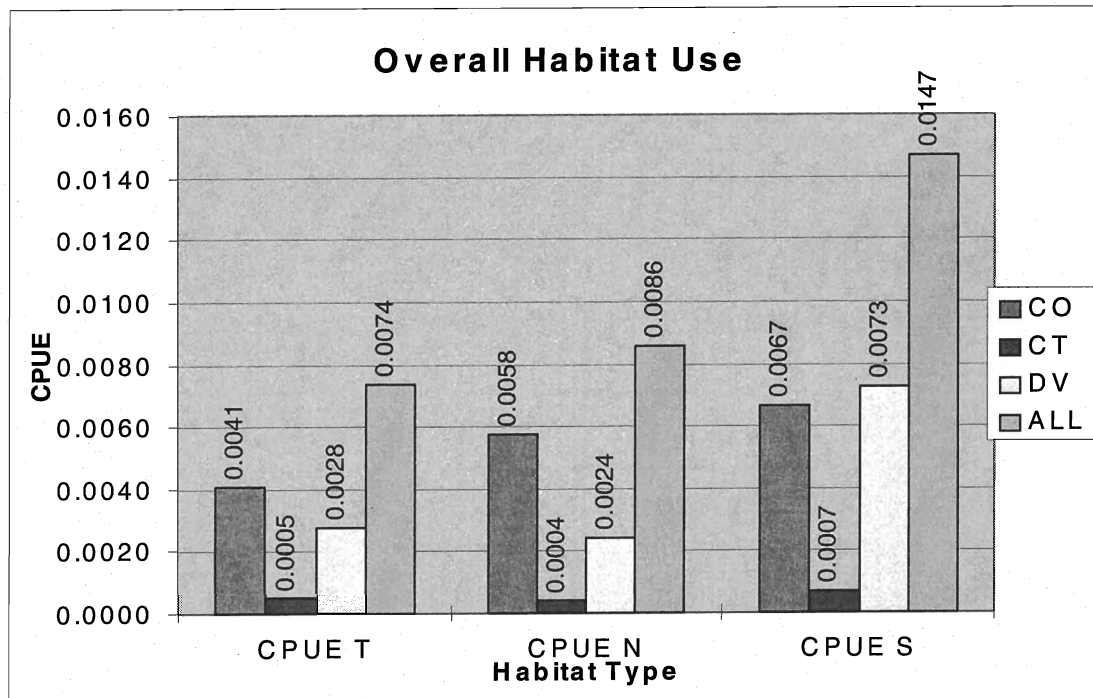
DISCUSSION and CONCLUSIONS

Mark recapture estimates proved to be highly variable and unreliable. Unless the recapture rate can be improved, it is suggested that results from CPUE data be used for comparisons. Moreover, results can be confounded by differences in seeding or from other natural population fluctuations. For example, the drop in cutthroat use at improvement sites might be due to the overall decline in CPUE, and not due to competitive interactions with coho salmon. However, it is interesting to note that coho were strongly associated with the improved sites despite their general overall decline. At this point, results are preliminary and further analysis will be conducted after all sampling is completed.
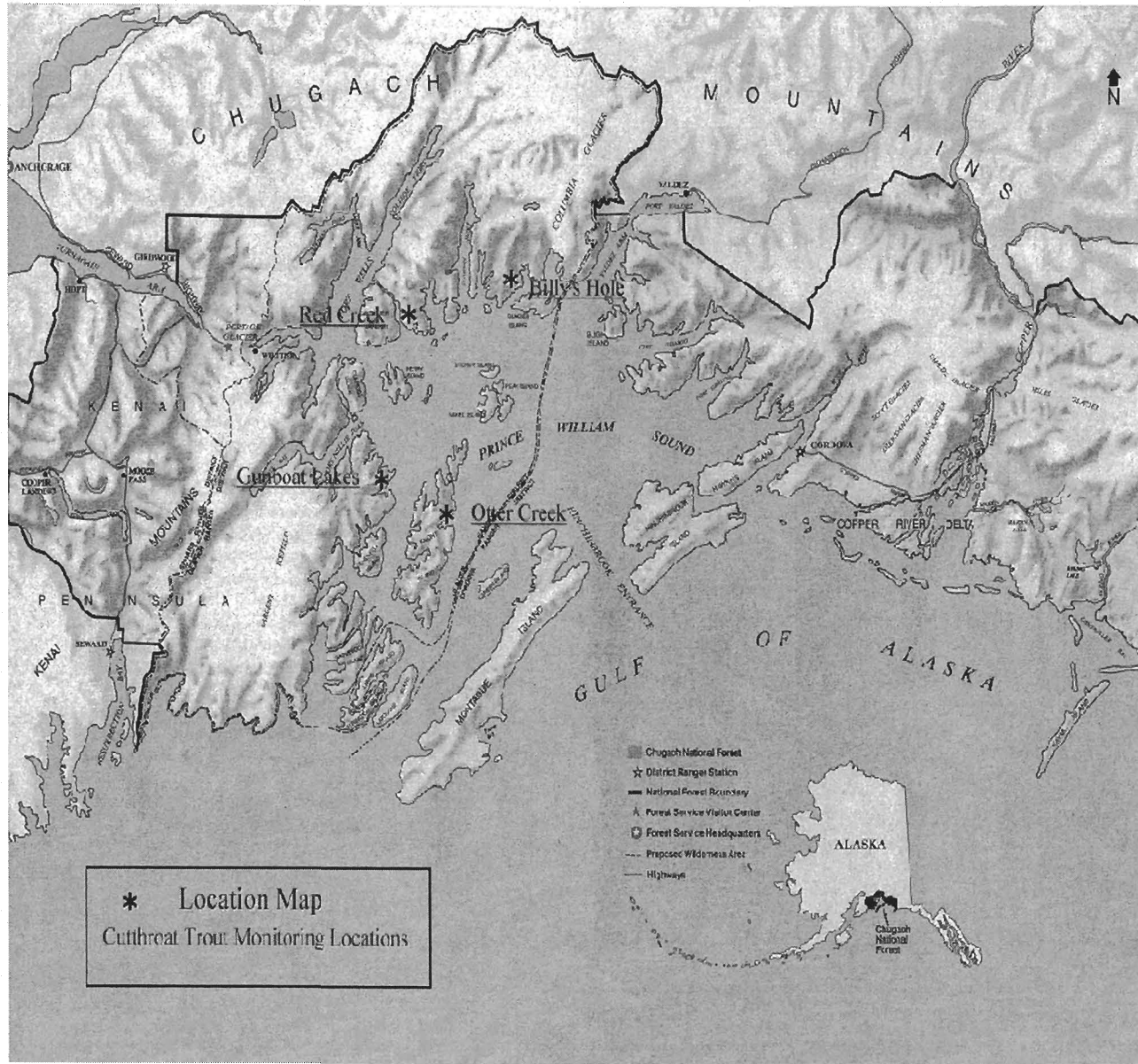
ACKNOWLEDGMENTS

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APPENDICES

Appendix 1. Cutthroat Trout Project Location Map

Appendix 2. Description of habitat classification technique.

<u>Fast Water Habitat Types</u> <u>Slow Water Habitat Types</u>

<u>Turbulent</u>	<u>Non-Turbulent</u>	<u>Dammed</u>	<u>Scoured</u>
Turbulent (Rapid)	Runs	Main	Lateral
High Gradient Riffle	Glides	Backwater	Mid-Scour
	Low Gradient Riffle		