

***Exxon Valdez* Oil Spill
Restoration Project Annual Report**

Monitoring of Cutthroat Trout and Dolly Varden
Habitat Improvement Structures

Restoration Project 97043B
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 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 since 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 habitat manipulation had on these species. Competition with juvenile coho salmon (*Oncorhynchus 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 was the third year completed as part of a four year project designed to evaluate the affects of the habitat improvements on fish abundance and species composition.

Abstract : It appears that with the exception of coho salmon and Dolly Varden at Gunboat Creek all fish populations are increasing. Correlations between overall abundance and abundance at enhancement sites make comparisons between treatments difficult. However, at Red Creek both cutthroat trout and Dolly Varden abundance decreased at the enhancement sites despite an increase overall. This could indicate that structures did not benefit these species. A slight increase in coho abundance at enhancement structures in Gunboat Creek as compared with an overall stream decline may suggest a beneficial effect for this species. At this point all results are preliminary. Further analysis will be conducted after all sampling is completed and will be included in the final report. Additional information collected in 1998 will increase the power of analysis.

Key Words: *Exxon Valdez*, cutthroat trout (*Oncorhynchus clarki*), Dolly Varden char (*Salvelinus malma*), coho salmon (*Oncorhynchus kisutch*), Prince William Sound.

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 char, 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.

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EXECUTIVE SUMMARY

Distribution and abundance of cutthroat trout, Dolly Varden char, and coho salmon were monitored in four small watersheds of Prince William Sound using mark recapture and catch per unit effort (CPUE) techniques to determine the effects of habitat improvement on fish populations. Additionally, the existing stream habitat at each project site was surveyed before and after structure installation to provide a basis of comparison.

Although increasing the sample sizes did improve confidence over previous sampling years, mark recapture estimates still proved to be highly variable and unreliable. It is suggested that results from CPUE data be used for comparisons. Results were variable based on location and year making trends difficult to determine. Overall, it appears that populations of all three species have increased since 1995, before stream enhancement occurred. The exceptions are coho and Dolly Varden at Gunboat Creek where overall abundance has declined. Determining the effects of the structures is difficult because it appears that abundance between structure sites and the overall stream is related. The results at Red and Gunboat Creeks are an interesting exception. At Red Creek, cutthroat trout and Dolly Varden decreased in abundance at the structures despite increases overall, whereas at Gunboat, coho may have increased slightly at the structures while overall abundance declined. This could indicate that structures did not benefit cutthroat and Dolly Varden populations. However, the differences between structure and overall abundance of coho at Gunboat Creek may suggest a beneficial effect for this species. Further analysis will be conducted after all sampling is completed and will be included in the final report. Additionally, all structures built under EVOS project 95043B were functioning properly.

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 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 since returned to normal.

In an attempt to mitigate for these impacts to cutthroat trout and Dolly Varden populations, the Forest Service installed habitat improvement structures (a total of 66 structures in four streams) to increase habitat suitability (EVOS project 95043B). However, it is uncertain the effect habitat manipulation had on these species. Competition with juvenile coho salmon (*Oncorhynchus 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 was the third year completed as part of a four year project designed to evaluate the affects 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 salmon in the streams where habitat improvement work occurred.
2. Measure and monitor cutthroat trout, Dolly Varden, and juvenile coho utilization of newly installed habitat improvements.
3. Measure and monitor the effects structures have on adjacent aquatic habitat.
4. Summarize findings on the effectiveness of the habitat structures installed in 1995.

METHODS

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 years.

The hypotheses tested are as follows:

- 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.

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

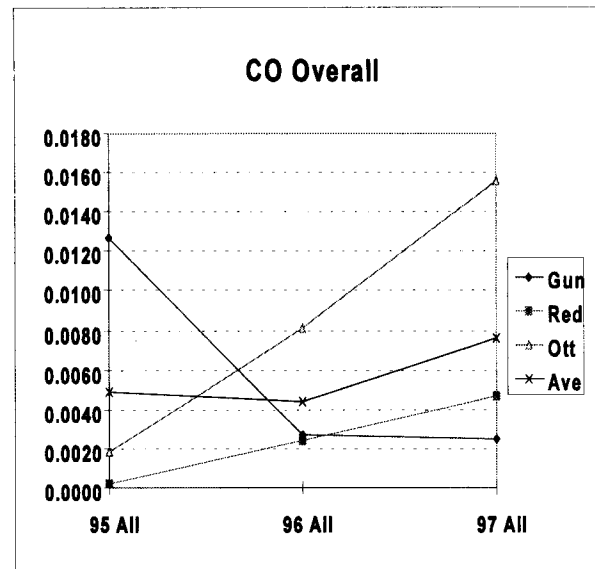
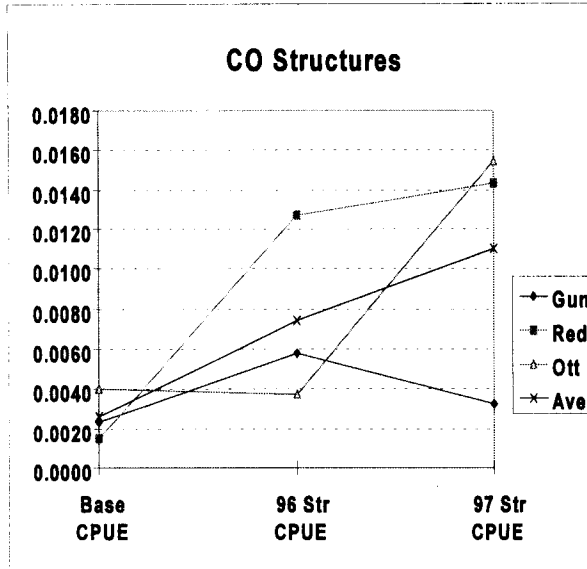
Despite increasing sampling effort this past year results from mark recapture studies proved to be problematic because of low recapture rates and high coefficients of variance (Table 1). Although CPUE does not accurately define population numbers it can be used as an indicator of relative abundance.

In Otter Creek all three species have increased in abundance at the structures and overall in the stream (Figures 1-6). At Red Creek coho have also increased at both the structures and overall. Cutthroat trout and Dolly Varden decreased in abundance at the structures but increased overall. In reach 2 of Gunboat Creek coho decreased overall, though abundance at enhancement structures appears to have been equal to or slightly higher than pre-improvement levels. Cutthroat trout have increased in abundance for these two treatments. Although Dolly Varden estimates are down from last year in Gunboat, this population is more abundant both at the structures and overall than in 1995 before improvements were made. Sampling was inconclusive at Billy's Hole and reach 3 of Gunboat Creek. Additionally, all structures built under EVOS project 95043B were functioning properly.

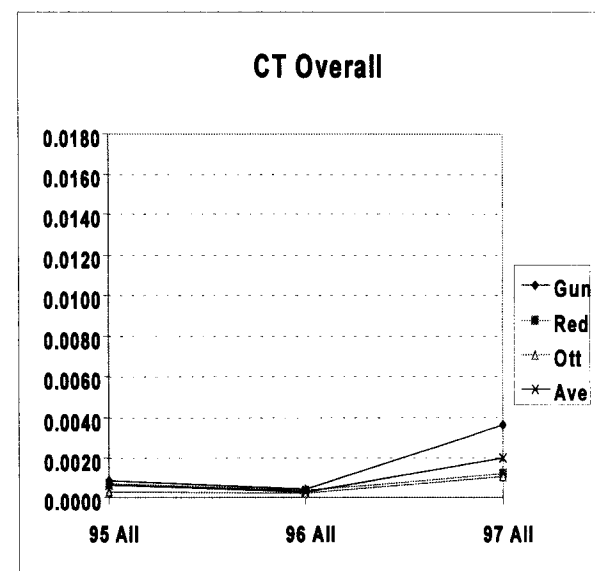
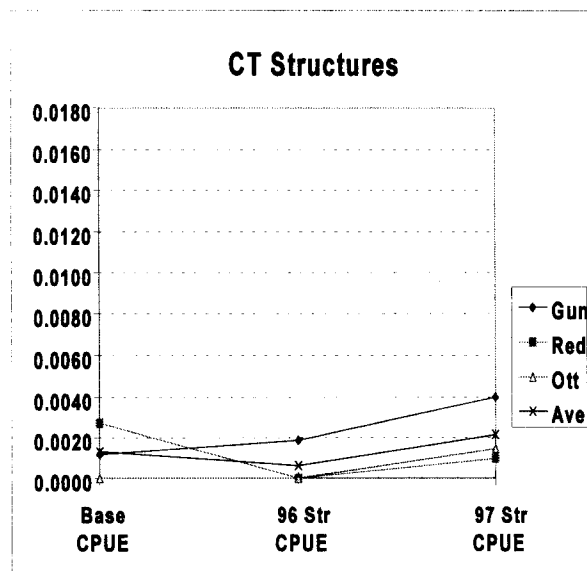
Table 1. Summary of mark recapture and CPUE data for project 97043B for 1995, 1996 and 1997. Shaded values indicate a CV less than or equal to 0.20.

Project Location	Species	Population Estimate (N)			Variance V(N)			Coefficients of Variance (CV)			Catch Per Unit Effort (CPUE)		
		95	96	97	95	96	97	95	96	97	95	96	97
Otter Ck.	CO	45			324	10848	5156	0.4	0.085	0.048	0.0019	0.0081	0.0156
	CT	6	56	300	9	1344	15000	0.5	0.654	0.408	0.0003	0.0002	0.0010
	DV	128			1536	7597	1118	0.31	0.085	0.045	0.0039	0.0081	0.0103
Red Ck.	CO		760		0	60805	2869	0	0.324	0.06	0.0002	0.0024	0.0047
	CT	105	72	852	1125	1344	69005	0.32	0.509	0.308	0.0007	0.0003	0.0012
	DV		374		8169	16456	6802	0.21	0.343	0.081	0.0024	0.0012	0.0041
Gunboat Reach 2	CO	504			6720	9975	1025	3.25	0.23	0.201	0.0127	0.0027	0.0025
	CT	50	36		300	1296	0	0.38	1	0	0.0009	0.0004	0.0036
	DV		594	28	768	24293	187	0.21	0.262	0.488	0.0004	0.0034	0.0010
Gunboat Reach 3	CO	N/A	30	16	N/A	244	64	N/A	0.51	0.5	N/A	N/A	N/A
	CT	N/A	54	43	N/A	1215	138	N/A	0.64	0.272	N/A	N/A	N/A
	DV	N/A		55	N/A	23	1210	N/A	0.068	0.633	N/A	N/A	N/A
Billy's Hole	CO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0244	0.0282	0.0205
	CT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0012	0.0001	N/A
	DV	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0589	0.0124	0.0260

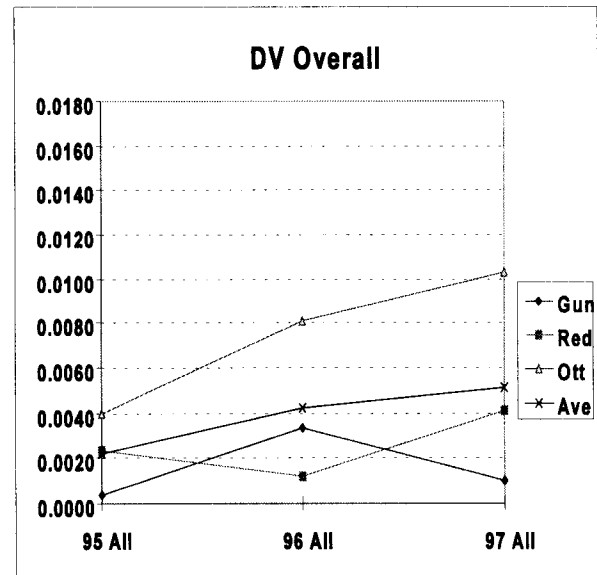
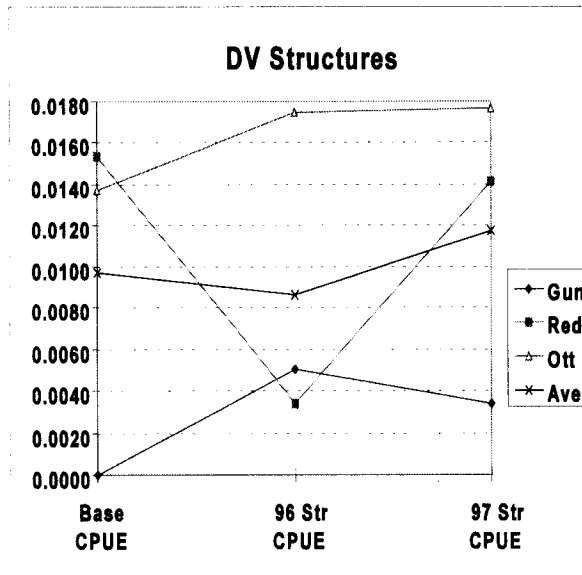
Figures 1, 2. Catch per unit effort (CPUE) data for juvenile coho salmon (CO) at the four project locations. Structures are at enhancement sites and overall is for the entire stream reach within the project areas. Base CPUE is pre-project CPUE at enhancement sites.



Figures 3, 4. Catch per unit effort (CPUE) data for juvenile cutthroat trout (CT) at the four project locations. Structures are at enhancement sites and overall is for the entire stream reach within the project areas. Base CPUE is pre-project data.



Figures 5, 6. Catch per unit effort (CPUE) data for juvenile Dolly Varden (DV) at the four project locations. Structures are at enhancement sites and overall is for the entire stream reach within the project areas. Base CPUE is pre-project CPUE at enhancement sites.



DISCUSSION and CONCLUSIONS

Although increasing the sample sizes did improve confidence over previous sampling years, mark recapture estimates still proved to be highly variable and unreliable. It is suggested that results from CPUE data be used for comparisons. Results were variable based on location and year making trends difficult to determine. Overall, it appears that populations of all three species have increased since 1995 before stream enhancement occurred. The exceptions are coho and Dolly Varden at Gunboat Creek where overall abundance has declined. Determining the effects of the structures is difficult as it appears that abundance between structure sites and the overall stream is related. The results at Red and Gunboat Creeks are an interesting exception. At Red Creek cutthroat trout and Dolly Varden decreased in abundance at the structures and increased overall, whereas at Gunboat Creek coho may have increased slightly at the structures while overall abundance declined. This could indicate that structures did not benefit cutthroat trout and Dolly Varden, but may suggest a beneficial effect for coho at Gunboat. Further analysis will be conducted after all sampling is completed and will be included in the final report.

ACKNOWLEDGMENTS

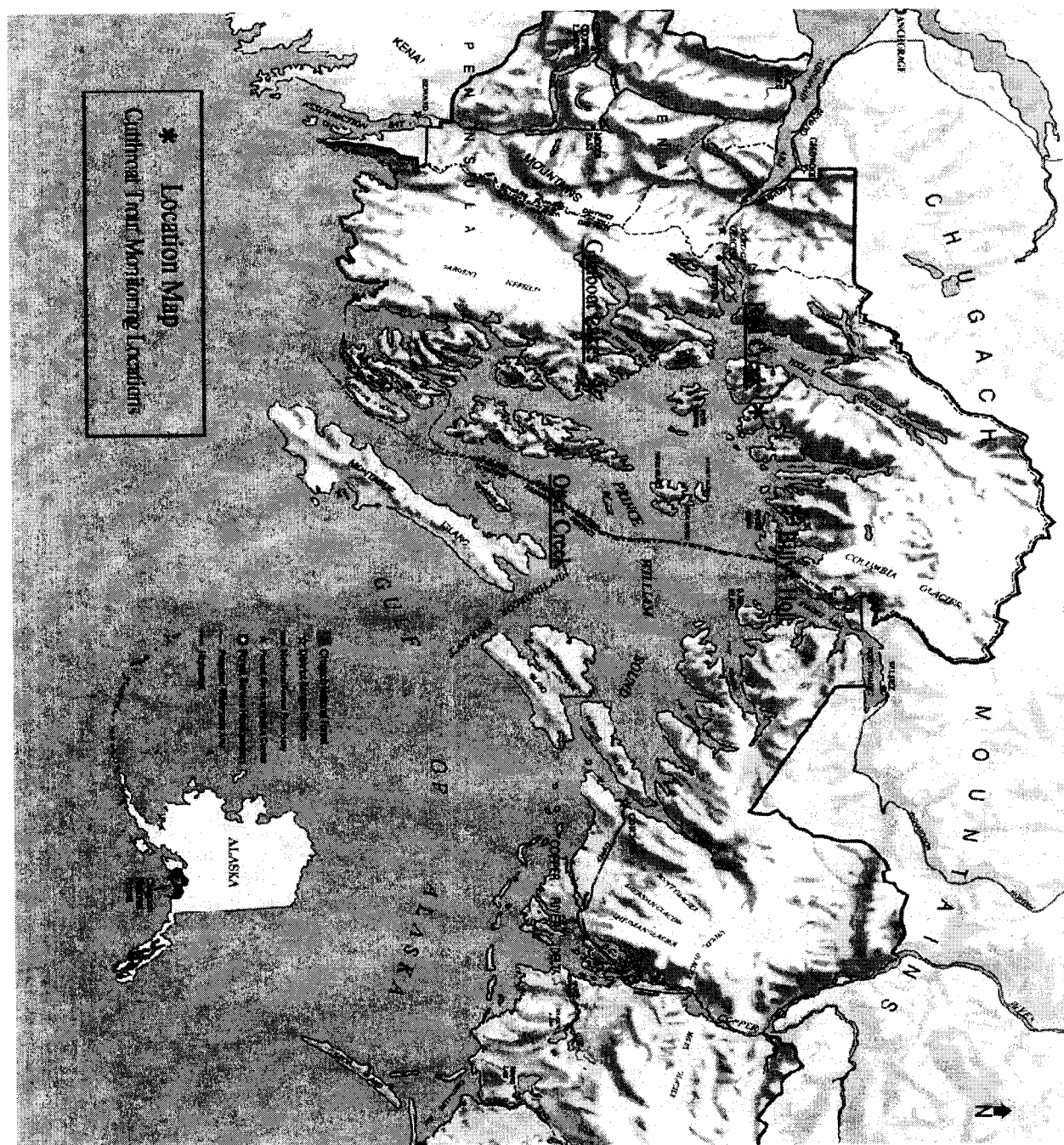
Glacier District fisheries crew, Will Frost, Dan Young, Beth Kitto and Mike Spink. The Glacier District also wishes to thank Karen Murphy for her assistance and guidance during this project.

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APPENDICES

Appendix 1. Cutthroat Trout Project Location Map



Appendix 2. Description of habitat classification technique.

