Aerial Monitoring of Dolly Varden Overwintering Abundance in the Anaktuvuk, Ivishak, Canning, Hulahula, and Kongakut Rivers, 2007.

Annual Report for Study 06-108.

Tim Viavant
Alaska Department of Fish and Game
Division of Sport Fish
1300 College Road
Fairbanks, AK 99701-1599

May 2008

TABLE OF CONTENTS

Page

LIST OF TABLES

Table **Page**

LIST OF FIGURES

Figure **Page**

ABSTRACT

Aerial counts of overwintering Dolly Varden *Salvelinus malma* were conducted by helicopter in the Ivishak, Anaktuvuk, Canning, and Hulahula rivers September 17-20, 2007. In the Ivishak River, 6,520 fish were counted in the 28 km overwintering index area. In the Anaktuvuk River, 5,807 fish were counted in the 40 km overwintering index area. In the Canning River, a preliminary index of 86 km of river was identified, and 3,936 fish were counted. In the Hulahula River, a preliminary index area of 69 km of river was identified, and 9,575 fish were counted. The 2007 aerial count in the index area of the Ivishak River was approximately 20% higher than the count from 2006 (5,411). The 2007 aerial count of the Anaktuvuk River was only slightly higher (6%) than the 2006 aerial count in the index area of the Anaktuvuk River (5,477). No previous counts of the Canning or Hulahula rivers were available for comparison.

INTRODUCTION

Anadromous Dolly Varden *Salvelinus malma* inhabit most of the major drainages of the Eastern Beaufort Sea (Figure 1). These fish spawn and rear in fresh water prior to smolting, but feed as adults in marine waters, and return to overwinter in fresh water each winter. Because these fish cannot tolerate the super-cooled temperatures of arctic sea water during winter, they must overwinter in fresh water five or more winters before spawning. Overwintering habitat is limited to areas with groundwater upwelling, and major overwintering concentrations are currently only known in specific areas of several larger drainages.

The Ivishak, Kongakut, and Anaktuvuk rivers support the largest documented overwintering populations of anadromous Dolly Varden of all the drainages of the Beaufort Sea west of Demarcation Point (Bendock 1980, 1982, 1983; Craig 1989; Furniss 1975; Yoshihara 1972, 1973). The Hulahula and Canning rivers also support overwintering populations for which there is no abundance information (Craig 1977, 1989).

These stocks provide for subsistence fisheries utilized by residents of Kaktovik, Nuiqsut, Barrow, and Anaktuvuk Pass (Craig 1987; Pedersen 1990; Fall and Utermohle 1995; Brower and Opie 1996, 2000). Subsistence harvests occur in marine fisheries during the summer, and in freshwater in the summer and winter. These fish are an important component of the subsistence diet in many areas, and in Kaktovik, Dolly Varden harvests represent up to 40% of the total subsistence fish harvest (Pedersen 1990). Overwintering and spawning populations also provide for sport fisheries accessed by the Dalton Highway, and on guided and unguided float trips.

From 2001 to 2003, aerial index counts of the Ivishak overwintering population were conducted by ADF&G, in conjunction with mark-recapture abundance estimates (Viavant 2005). Results of that project showed that, for that specific circumstance, aerial surveys of overwintering Dolly Varden had relatively high precision and consistently counted (including the variation in both methods) between 16% to 31% of the estimated abundance as measured by mark-recapture

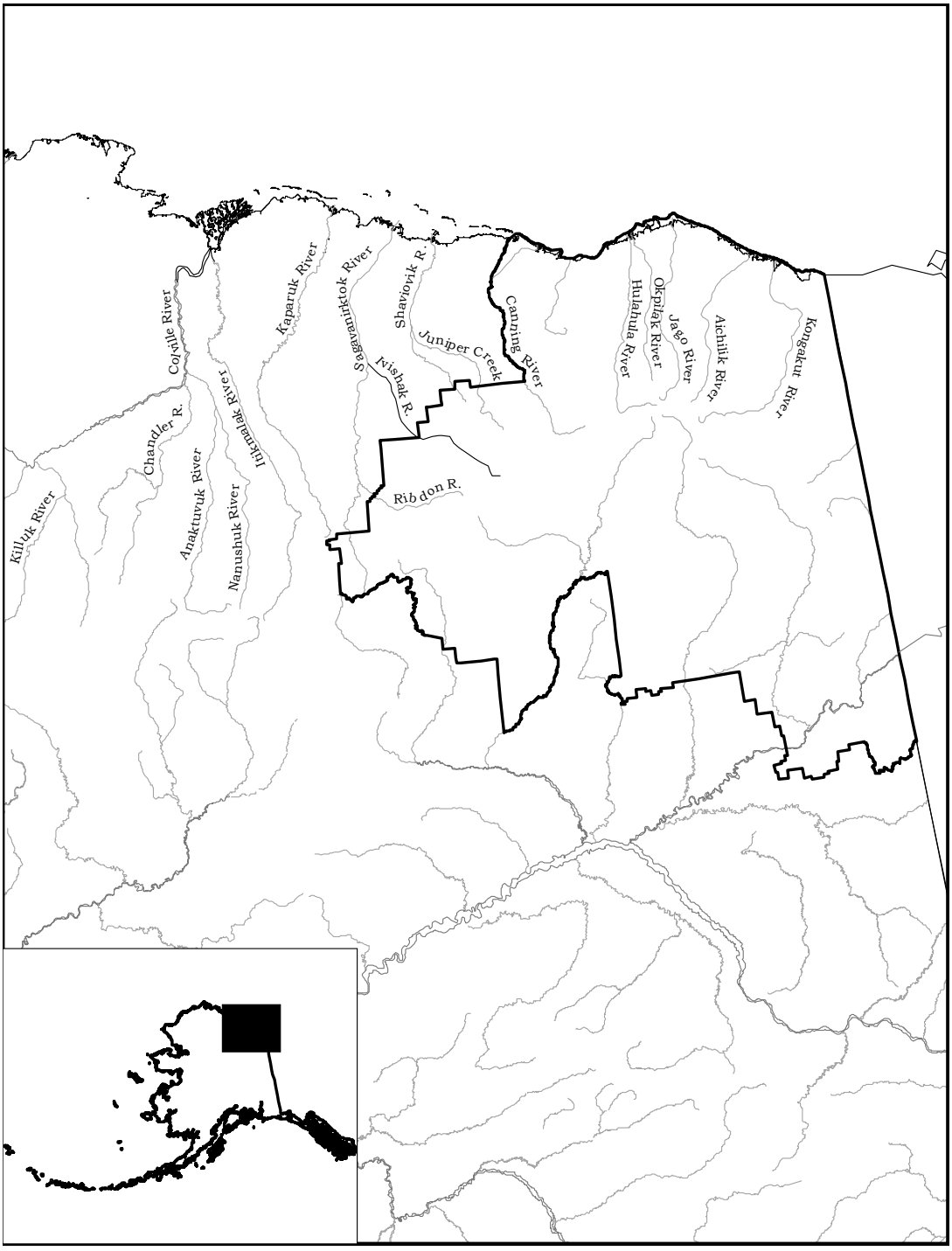

Figure 1.–Map of the eastern North Slope of the Brooks Range and coastal plain showing major drainages containing anadromous Dolly Varden and the boundary of the Arctic National Wildlife Refuge.

methods. During the 3 years of the project the estimated abundance within the index area of the Ivishak River declined by about 70%. Given the short timeframe of the study, and the complex life history of Dolly Varden, it is not clear if this decline is within the typical range of variation for these stocks, or if this decline should be cause for concern or future management action.

Because there are significant subsistence harvests from these populations, there is a need for a minimal level of continued monitoring of these stocks. This project provides for index monitoring of the overwintering abundance of Dolly Varden stocks from four of the five major overwintering systems on the North Slope.

OBJECTIVES

The objectives of this project were:

1) Conduct a single aerial count of overwintering Dolly Varden in established index areas of the Anaktuvuk, Ivishak, Canning, Hulahula, and Kongakut rivers.

Additionally, an objective of the first year of the project was to establish the boundaries of overwintering index areas on the Canning, Hulahula, and Kongakut rivers. This objective was not met during the first year of the project due to weather problems, and so was an additional objective of the project in 2007.

METHODS

STUDY AREAS

Aerial counts were conducted in index areas established during previous aerial surveys on the Ivishak and Anaktuvuk rivers (Viavant 2005). These index areas are defined by upstream and downstream boundaries (Figures 2 and 3). Surveys were successfully conducted within preliminary index areas that were established on the Canning and Hulahula rivers (Figures 4 and 5). These preliminary index areas were based on the geographic extent of the presence of at least 90% of observed overwintering Dolly Varden during initial aerial surveys of the drainages. These index areas are considered preliminary because they are based only one fish distribution during one survey during one year. Coordinates used to identify index area boundaries are degrees/decimal degrees (DD.dddd) and use the NAD 27 datum.

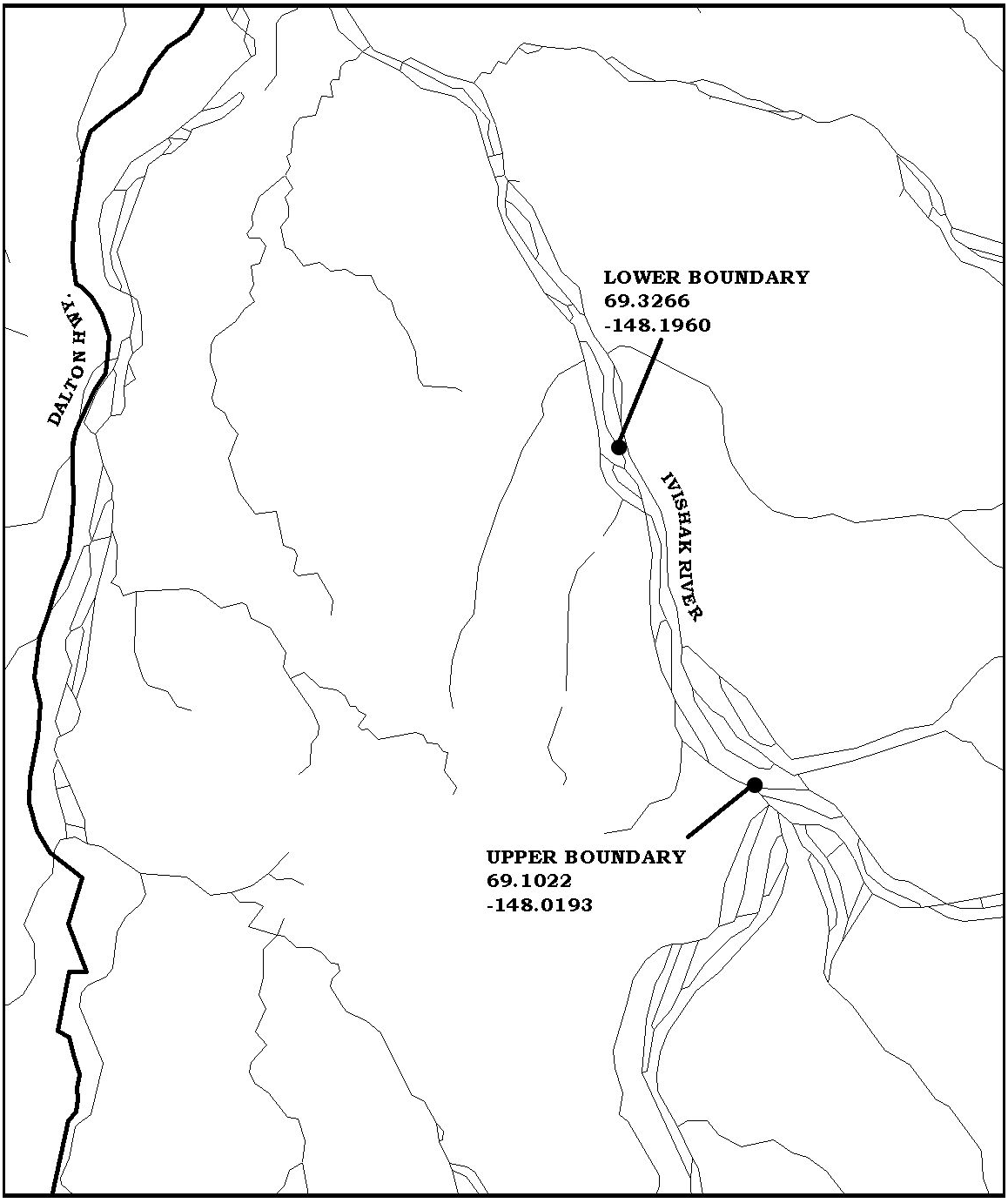

Figure 2.-Map of the Ivishak River, Alaska, showing the boundaries and subsections of the 28-km index area.

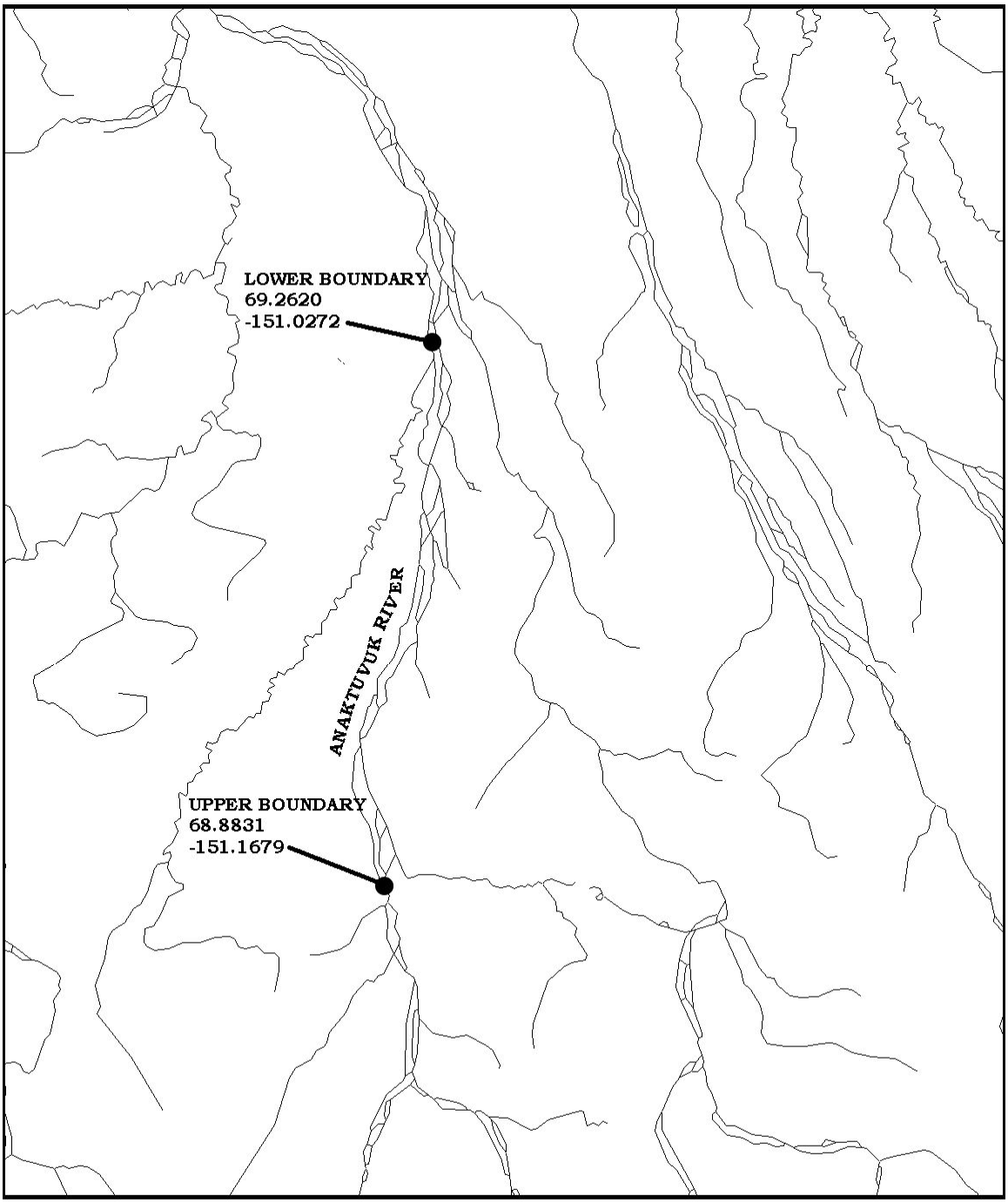

Figure 3.-Map of the Anaktuvuk River, Alaska, showing the boundaries and subsections of the 40-km index area.

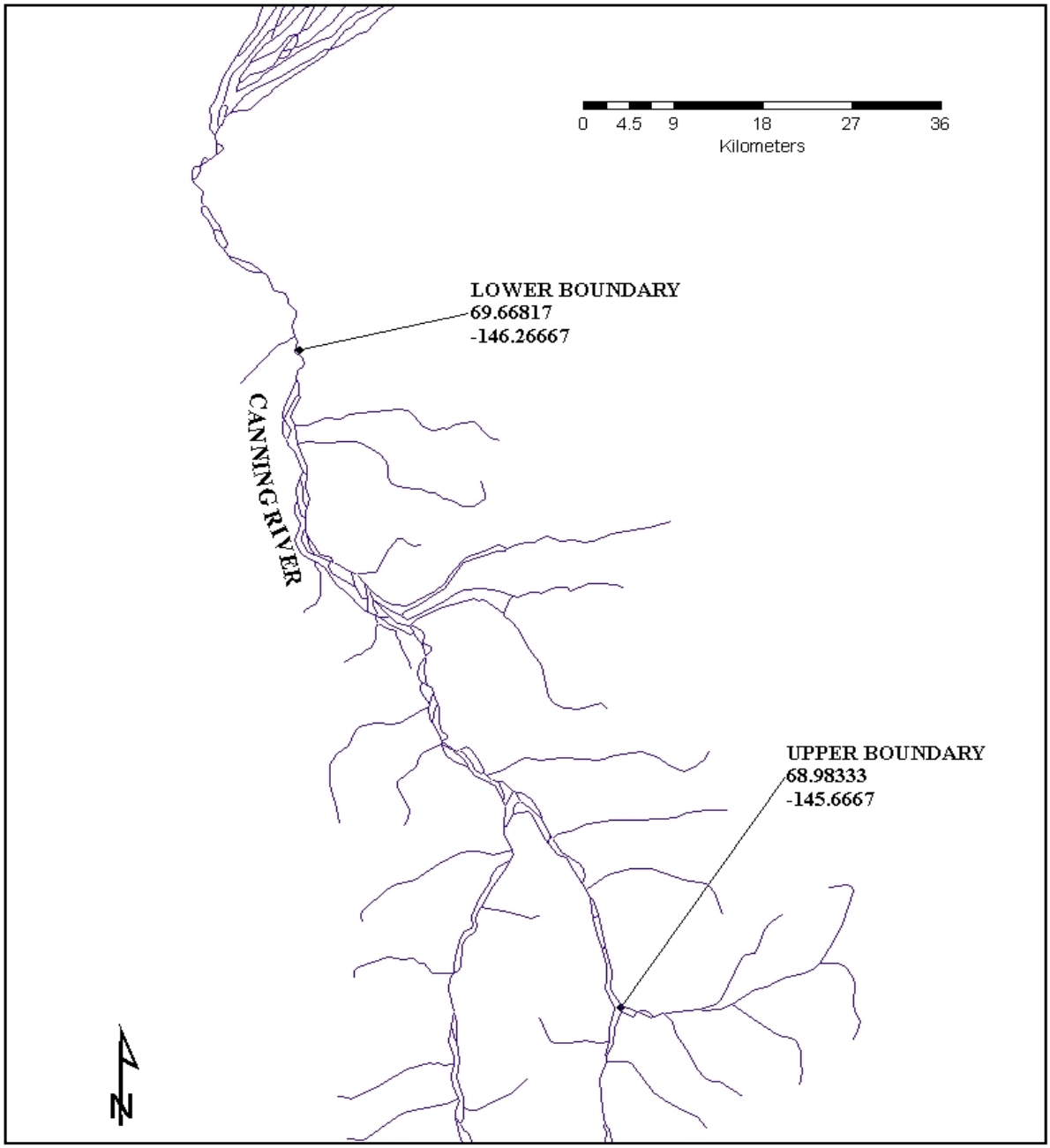

Figure 4.-Map of the Canning River, Alaska, showing the boundaries of the 86-km index area.

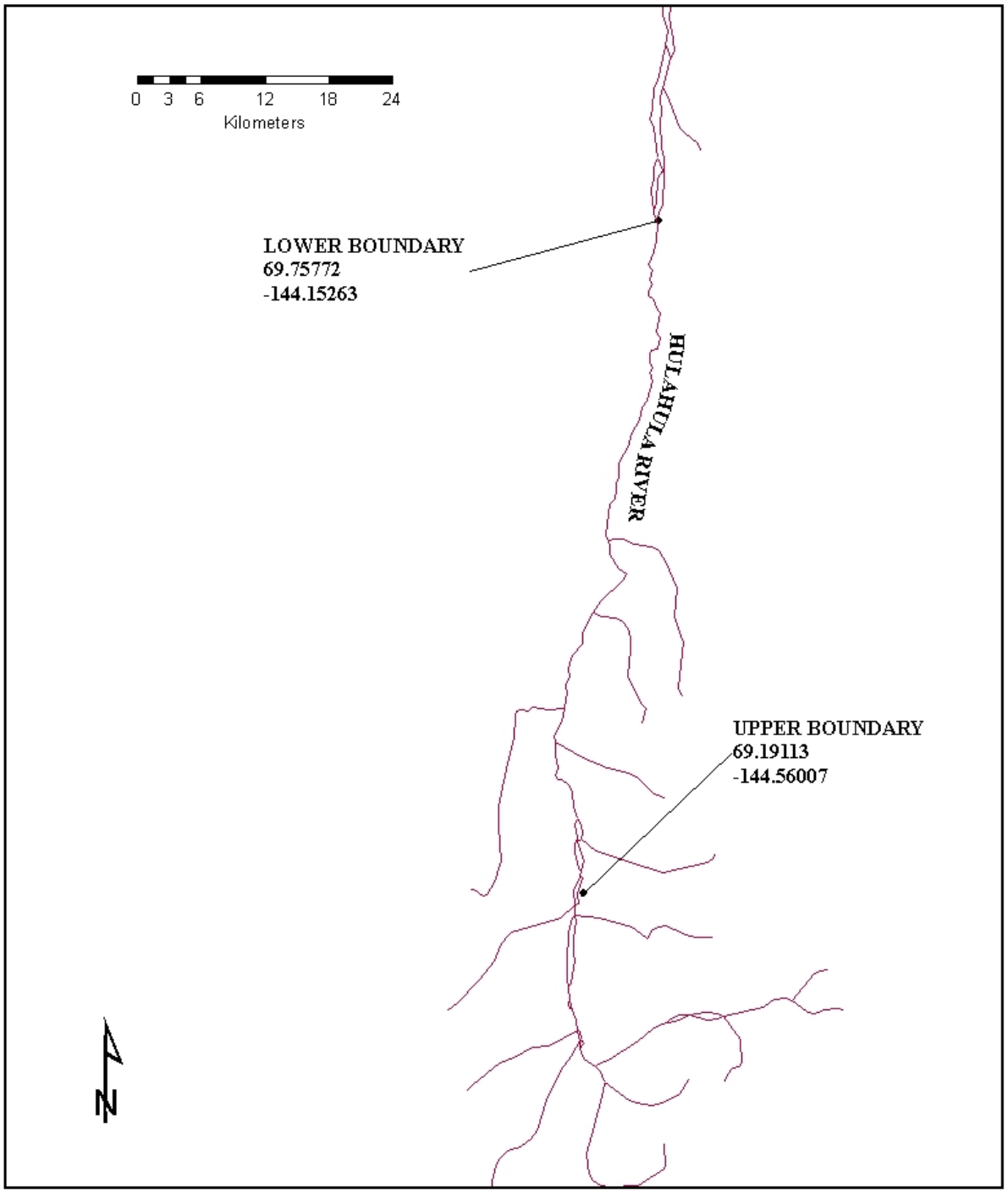

Figure 5.-Map of the Hulahula River, Alaska, showing the boundaries of the 69-km index area.

SURVEY METHODS

Counts were conducted from a helicopter by two observers, each counting only the fish present on one side of the river. All counts were conducted from upstream to downstream, flying at 40 km/hr, at approximately 125 m above ground level. In portions of the rivers where multiple channels exist, the majority of fish present were counted in the main channel. Counts were recorded on mechanical counters. In order to eliminate conscious or unconscious bias, the faceplates of the mechanical counters were covered and counts recorded by the helicopter pilot after the counts were completed. Weather conditions (wind and cloud cover), water clarity, and date and time of each survey were recorded for each survey.

RESULTS

Surveys were successfully conducted of the index areas of the Ivishak and Anaktuvuk rivers (Table 1). Surveys were also successfully conducted of the Canning and Hulahula rivers, and the boundaries of preliminary index areas identified (Figures 4 and 5). In the Canning River, a preliminary index of 86 km of river was identified, and 3,936 fish were counted. In the Hulahula River, a preliminary index area of 69 km of river was identified, and 9,575 fish were counted. Survey conditions were excellent for all surveys conducted during 2007. Logistical and budget limitations precluded conducting a survey of the Kongakut River.

Table 1.–Aerial counts of overwintering Dolly Varden from established index areas of the Ivishak and Anaktuvuk rivers, Alaska[a]

Year	Ivishak River	Survey Date	Survey Conditions	Anaktuvuk River	Survey Date	Survey Conditions
2001	10,932	9/21/2001	Excellent	No Survey		
2002	5,408	9/20/2002	Excellent	4,576[b]	9/22/2002	Excellent
2003	2,720	9/21/2003	Excellent	5,034	9/18/2003	Fair
2006	5,411	9/18/2006	Excellent	5,477	9/21/2006	Fair
2007	6,520	9/19/2007	Excellent	5,807	9/17/2007	Excellent

a Counts of the Ivishak River from 2001-2003 are averages of five replicate surveys (Viavant 2005), the survey date listed is the midpoint of the survey dates, all other counts are single counts.

b Survey conducted in 2002 was an incomplete survey.

DISCUSSION

The 2007 survey results from the Ivishak River showed an increase of approximately 20% from the 2006 survey, and are still in the mid-range of surveys conducted between 2001 and 2003. The 2007 Anaktuvuk River survey results showed a small increase (6%) from the 2006 results. The Ivishak River results are near the middle of the range of recent comparable surveys, the Anaktuvuk River results are the highest count of recent comparable surveys, but are only a small percentage above the lowest recent comparable survey.

Recent (2001–2007) aerial counts from the Ivishak and Anaktuvuk are not directly comparable to the historical counts from 1971-1995 (Table 2). Earlier surveys were conducted by a single observer, and some were conducted by fixed-wing aircraft. More importantly, the areas surveyed were not standardized and may not have been the same as those used in 2001-2006. While recent counts cannot be compared directly to historical counts, it is noteworthy that for both the Anaktuvuk and Ivishak rivers, the aerial index counts from 2006 and 2007 are at or below the lower end of the range of historical counts, and that even the highest recent count from the Ivishak (2001) is near the low end of the range of historical counts from 1971-1995.
It is somewhat reassuring that the 2007 count from the Ivishak River increased again over 2006, and is near the mid-range of recent comparable counts, and that the 2007 count from the Anaktuvuk River is slightly higher than the all of the last comparable counts.

The survey results from the Hulahula and Canning rivers can not be compared to any previous survey since none exist. The index areas surveyed and established as preliminary index areas for these drainages are significantly larger (almost double) than those index areas established in the Ivishak and Anaktuvuk rivers. During the surveys flown in 2007, fish distributed widely and very non-uniformly. Fish were observed and counted in sufficient numbers throughout the areas identified and the criteria used to establish index areas required index areas of this size.

The 2007 count on the Hulahula River can be compared with a didson sonar count of in-migrating Dolly Varden char conducted by the United States Fish and Wildlife Service. The preliminary count from this project (USFWS, *unpublished*) was 23,000 fish. The relationship between this count and the aerial survey count is substantially different from the relationship established between aerial counts and mark-recapture abundance estimates in the Ivishak River (Viavant 2005). In the Ivishak River, aerial counts typically represented between 16% and 31% of the mark-recapture abundance estimate. The 2007 aerial count on the Hulahula River represents 41.6% of the didson sonar count, or almost twice the proportion established on the Ivishak.

The difference in these relationships could result from many different factors, but the most logical explanation is the differences in distribution and density of fish as observed during aerial surveys. The index area on the Ivishak River is approximately 1/3 the size of the preliminary index area established on the Hulahula River, and in 2007 fish were widely distributed within the 69 km surveyed on the Hulahula River. Previous studies have suggested that aerial counts typically undercount abundance, and that this degree of undercounting is greatest at high

densities of fish (Eicher 1953; Bevan 1961; Jones 1995). It is possible that fish may have been more widely distributed in the Hulahula River during 2007 than in the Ivishak River during 2001-2003, and thus at lower densities the degree of undercounting may have been lower.

Table 2.–Historical aerial counts of overwintering Dolly Varden from the Ivishak, Anaktuvuk, and Kongakut rivers, Alaska[a].

Year	Date	Ivishak River	Anaktuvuk River	Kongakut River	Survey Aircraft	Survey Rating	Data Source
1971	22-Sept.	24,470			H	Good	Yoshihara 1972
1972	24-Sept.	11,937			H	Good	Yoshihara 1973
1973	11-Sept.	8,992			H	Excellent	Furniss 1975
1974	10-Sept.	11,000			H	Not Rated	Furniss 1975
1975	22-Sept.	8,306			H	Not Rated	ADF&G Unpublished
1976	22-Sept.	8,570			H	Fair	ADF&G Unpublished
1979	22-Sept.	24,403	15,717		FW	Excellent	Bendock 1980
1981	22-Sept.	24,873	10,536		FW	Excellent	Bendock 1982
1982	22-Sept.	36,432	6,222		FW	Excellent	Bendock 1983
1983	22-Sept.	27,820	8,743		FW	Excellent	Bendock and Burr 1984
1984	22-Sept.	24,818	5,462		FW	Excellent	Bendock and Burr 1985
1986	No survey			8,900		Not Rated	USFWS Unpublished
1989	22-Sept.	12,650		6,355	H	Good	ADF&G Unpublished
1993	3-Sept.	3,057			H	Good	USFWS Unpublished
1995	27-Sept.	27,036		14,080	H	Good	ADF&G Unpublished

[a] No surveys were done for years not listed. Survey aircraft was either a helicopter (H) or fixed wind aircraft (FW: Piper Super Cub).

CONCLUSIONS

Aerial survey assessments of overwintering Dolly Varden char in North Slope rivers should be viewed only as indicators of relative abundance. These surveys are useful in comparing stock status over time. Survey results from the Ivishak and Anaktuvuk rivers during September 2007 indicate overwintering abundances within the range of historical comparable estimates. Since there is only a short and incomplete time series of comparable survey counts, it is difficult to make conclusions regarding stock status from available data; however the 2007 index area

counts from the Ivishak and Anaktuvuk rivers do indicate that there have not been significant declines in overwintering abundance from recent available numbers.

These fish stocks provide for significant subsistence harvests. Given the potential for effects on these stocks from increased use by recreational users and habitat effects from resource development or climate change, there is an ongoing need for some minimal level of stock status monitoring. Although aerial monitoring of overwintering index areas in a few major drainages provides only a relative assessment of stock status, when these surveys are conducted over time, this relative assessment does provide for detection of significant changes in stock status.

ACKNOWLEGEMENTS

The author thanks the USFWS, Office of Subsistence Management, Fisheries Information Service, for providing $26,800 in funding support for the first year and $27,300 for the second year of this project through the Fisheries Resource Monitoring Program under agreement number 701811J333. Thanks to the USFWS, Fairbanks Field Office, for providing much-needed assistance. Thanks also to the Alaska State Troopers, Alaska Bureau of Wildlife Enforcement for use of the Happy Valley Field Station.

LITERATURE CITED

Bendock, T. N. 1980. Inventory and cataloging of arctic area waters. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report, 1979-1980. Project F-9-12, 21(G-I-I), Juneau.

Bendock, T. N. 1982. Inventory and cataloging of arctic waters. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report, 1981-1982. Project F-9-14, 23(G-I-I), Juneau.

Bendock, T. N. 1983. Inventory and cataloging of arctic area waters. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report, 1982-1983. Project F-9-15, 20(G-I-I), Juneau.

Bevan, D. E. 1961. Variability in aerial counts of spawning salmon. Journal of the Fisheries Research Board of Canada 18:337-348.

Brower, H. K. and R. Opie. 1996. North Slope Borough Subsistence Harvest Documentation Project: Data for Anaktuvuk Pass, Alaska for the period July 1, 1994 to June 30, 1995. Department of Wildlife Management, North Slope Borough, Barrow, Alaska.

Brower, H. K. and R. Opie. 2000. North Slope Borough Subsistence Harvest Documentation Project: Data for Kaktovik, Alaska for the period December 1, 1994 to November 30, 1995. Department of Wildlife Management, North Slope Borough, Barrow, Alaska.

Craig, P. C. 1977. Ecological studies of anadromous and resident populations of Arctic char in the Canning River drainage and adjacent coastal waters of the Beaufort Sea, Alaska. Arctic Gas Biological Report Series 41:1-116.

Craig, P. C. 1987. Subsistence Fisheries at coastal villages in the Alaskan Arctic, 1970-1986. Minerals Management Service, Alaska OCS Socioeconomic Studies Program, Technical Report No. 129, Anchorage.

Craig, P. C. 1989. An introduction to anadromous fishes in the Alaskan Arctic. Biological Papers of the University of Alaska, 24:27-54.

Eicher, G. J., Jr. 1953. Aerial methods of assessing red salmon populations in western Alaska. Journal of Wildlife Management 17(4):521-528

Fall, J. and C. Utermohle. 1995. An investigation of the sociocultural consequences of Outer Continental Shelf development in Alaska. Volume V- Alaska Peninsula and Arctic. U.S. Department of Interior, Minerals Management Service, Alaska Outer Continental Shelf Region. Anchorage, Alaska.

Furniss, R. A. 1975. Inventory and cataloging of Arctic area waters. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1973-1974, Project F-9-6, 15 (G-I-I), Juneau.

Jones, E. L., III. 1995. Observer variability and bias in estimation of Southeast Alaska pink salmon escapement. Masters Thesis. University of Alaska, Fairbanks.

Osborne, Mitch, Personal Communication. U.S. Fish and Wildlife Service, Fairbanks Field Office, Fairbanks, AK.

Pedersen, S. 1990. Assessment of the 1988-89 Kaktovik subsistence fishery. Internal report to US Fish and Wildlife Service. Cooperative Agreement No. 14-16-0007-88-7744. Subsistence Division, Alaska Department of Fish and Game, Anchorage, Alaska.

USFWS (U.S. Fish and Wildlife Service). *Unpublished.* Aerial survey data for North Slope Dolly Varden populations. USFWS, Fairbanks Field Office, Fairbanks, AK.

LITERATURE CITED (CONTINUED)

Viavant, T. 2005. Eastern North Slope Dolly Varden Stock Assessment. Alaska Department of Fish and Game, Fishery Data Series No. 05-07, Anchorage.

Yoshihara, H. T. 1972. Monitoring and evaluation of Arctic waters with emphasis on the North Slope drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1971-1972, Project F-9-4, 13 (G-III-A), Juneau.

Yoshihara, H. T. 1973. Life history aspects of anadromous Arctic char (Salvelinus alpinus) in the Sagavanirktok River drainage. In Monitoring and evaluation of Arctic waters with emphasis on the North Slope drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1972-1973, Project F-9-5, 14 (G-III-A) Part B, Juneau.