Arctic Development

Monitoring Stream Channel Improvements And Arctic Char Population In Kuuqutiga Creek

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SUMMARY

In the summer of 1991, channels were oonstruoted in the streambed of Kuuqutiga Creek in order to improve conditions for migrations of Arotic char. improvements oonsisted of ohanneiing the stream in three areas to inorease water depths and oonstruotion of rook diversion waiis to improve fiow in constructed ohannels. The present study was performed 15 June to 4 Juiy 1992 to determine if 1) spring fioods or ioe movement damaged channei improvements and 2) to obtain information on the present population of sea-run Arctic char in Kuuqutiga Creek.

it was found that the streambed of Kuuqutiga Creek is dry throughout the winter; therefore, there is no ioe soour of the streambed. The spring fiood waters were observed in iate June and early July. Although fiow was oonsiderabie, no damage was observed in ohannei improvement areas. Wide streambeds In these areas permit fiood waters to spread over a oonsiderabie distance. This in turn maintains relatively iow water flow through the channels during periods of high water.

The sea-run Arotio ohar population in Kuuqutiga Creek is very small. The downstream run was oomposed of oniy 464 mature fish, six of whioh were identified as post-spawners. The number of smoits (char migrating downstream for the first time in their iives) was estimated to be about 142. Most of the mature fish were quite thin. Nearly aii large mature fish moved downstream between 22 to 25 June. Neariy aii smoits moved downstream on 1-2 Juiy.

Counts of the numbers of sea-run char in Kuuqutiga Creek should be performed in future years. Ideally, oounts shouid be performed in 1993 and perhaps 1994 to provide three years of information on present conditions. if stream ohannei improvements are affeoting the population, the number of smoits shouid increase 5-6 years after the channel improvements were performed. Therefore, increases in the population are not expeoted untii about 1996.

Kuuqutiga Creek is an ideal drainage to oonduct pilot studies on the effeots of habitat Improvements on Arctic char populations because habitat improvements are permanent and the stream is relatively small so that accurate counts of migrating ohar are easily obtained.

ᓇᐃᓪᓕᒋᐊᕐᑕᐅᓯᒪᔪᖅ ᐅᓂᒃᑳᕐᑕᐅᔪᖅ

ᐊᐅᔭᖓᓂ 1991 ᐹᓂᐊᕗᔪᑦ ᓴᓇᔭᐅᓚᐅᕐᐳᑦ ᑰᑉ ᐊᑎᖓᓂ ᑰᖁᑎᒐᒥ ᐃᖏᕐᕿᐁᓐᓂᐊᓂᖏᑦ ᑕᓱ-ᐅᕐᒥᐅᑕᑦ ᐃᖏᕐᕿᔾᔪᓯᕐᑲᕐᑎᐊᕗᑉᓗᒥᑦ. ᐋᖅᑭᐊᕐᑕᐅᔪᑦ ᐃᓚᕐᑲᐅᓚᐅᕐᐳᑦ ᐊᑉᕗᑎᓂᐊᕗᔪᓂᒃ ᑰᓂᐊᕗᔪᓂᒃ ᐱᖑᓲᔪᓂ ᐋᖅᑭᐊᕐᓯᕐᔪᑕᐅᓇᓯᐊᕐᑐᑦ ᐃᒪᐅᑉ ᐃᑎᓂᖑᓂᒃ ᐊᒻᒪ ᓴᐳᑎᐅᔮᕐᑐᑦ ᓴᓇᔭᐅᓂᖏᑦ ᐅᔭᖅᑲᑦ ᐃᖏᕐᕿᕐᔪᑕᐅᔪᓗᑦ ᐋᖅᑭᐅᒪᐋᓐᓂᓯᑕᐅᒃᔭᐅᑉᓗᑎᒃ ᓴᓇᔭᐅᓯᒪᔪᑦ. ᖃᐅᔅᓴᕐᑕᐅᓚᐅᕐᑐᖅ ᖃᐅᔅᓴᕐᑕᐅᓚᐅᕐᐳᖅ ᔫᓐ 15-ᒥᑦ ᔪᓚᐃ 4-ᒧᑦ 1992-ᒥ. ᖃᐅᔨᓇᓱᒃᓗᑎᒃ 1.) ᐅᐱᓐᖑᕐᓴᒃᑯᑦ ᓴᕐᕙᐅᓂᐅᔪᓂᒃ ᓯᑯᐃᓪ-ᓘᓐᓃᑦ ᐃᖏᕐᕿᓂᖏᓐᓂᒃ ᐊᒻᒪ 2.) ᑐᓴᕐᓴᕐᑖᕈᒪᕗᓗᑎᒃ ᒫᓐᓇ ᐅᖃᕐᓂᐊᔭᖏᓐᓄᑦ ᑕᓄᐅᕐᒥᐅᑕᐃᑦ ᐃᖃᓗᐃᑦ ᑰᖁᑎᒐᒥ.

ᖃᐅᔨᓚᐅᕐᐳᑦ ᐃᓪᓕᖑ ᑰᖁᑎᒐᒥ ᐸᓂᖃᑦᑕᕐᓂᖑᓂᒃ ᐅᑭᐅᓗᒃᑖᖅ; ᑕᒪᓐᓇ ᐱᔪᑎᕆᐸᓗᒍ ᓯᑯ ᑲᑎᓐᓂᑯᖃᖃᑦᑕᖏᓚᖅ ᐃᓪᓕᖑᓂᑦ ᑰᑉ. ᐅᐱᓐᖑᕐᓴᒃᑯᑦ ᑰᒃᑐᕕᓂᐅᔪᑦ ᔫᓐ ᐊᑐᐊᓂᓛᓂᕐᑎᓪᓗᒍ ᐊᒻᒪ ᔪᓚᐃᒥ ᖃᐅᔅᓴᕐᑕᐅᔪᑦ ᖃᐅᔨᔭᐅᓚᐅᕐᐳᑦ. ᐊᖏᔫᓚᐅᕋᓗᐊᕐᑎᓪᓗᒍ ᓴᕐᕙᐅᓂᐅᔪᖅ ᓯᕗᒥᕐᑎᓚᐅᖏᓚᑦ ᓯᓇᑐᐃᓐᓇᕐᓂᒃ ᓯᕋᐃᓚᐅᖏᓚᑦ ᓴᓇᔭᐅᓂᑯᓂᒃ ᐹᓂᐊᕗᓂᑯᓂᒃ. ᓯᓂᕐᓂᖏᑦ ᓇᑎᖏᑕ ᑰᖓᓂᐅᔪᑦ ᐅᖑᓯᒃᑐᒧᑦ ᐃᖏᕐᕿᔪᑕᐅ-ᔪᓐᓇᓚᐅᕐᐳᑦ ᓴᕐᕙᐅᓂᐅᔪᒥ. ᑕᒪᓐᓇᓗ ᕗᓪᕙᓯᒍᑕᐅᖏᔪᑕᐅᑉᓗᓂ ᐃᒪᕐᓄᑦ ᐹᕗᔪᓂ ᖃᓂᐅᔪᓂ ᐃᒪᕐᒧᑦ ᕗᓪᕙᓯᓐᓇᓗᐊᕐᑎᓪᓗᒍ.

ᑕᓄᐅᕐᒥᐅᑕᐃᑦ ᐃᖏᕐᕿᓂᖏᑦ ᐃᖃᓗᐃᑦ ᑰᖁᑎᒐᒥ ᖃᐹᓐᓇᐅᕗᑦ. ᐊᖅᑲᕐᐸᓂᐊᔪᑦ 464 ᑐᐃᓐ-ᓇᐅᓚᐅᕐᐳᑦ ᐃᖃᓗᐃᑦ, ᐊᕐᕕᓃᑦ ᒪᓐᓂᓂᐅᓚᐅᕐᓯᒪᖏᕐᑑᑉᓗᑎᒃ ᓯᓂ. ᐅᕐᓄᓂᖏᓐᓂ ᓯᑉᐸᓂᕐᐹᒥᒃ ᐊᖅᑲᓇᐅᕐᑐᑦ (ᑕᐃᒪᖑᓂᑦ ᐃᖃᓗᕗᕋᒥᒃ ᐊᖅᑲᓚᐅᕐᓯᒪᖏᕐᑐᑦ ᐊᖅᑲᓇᐅᕐᑐᑦ) ᖃᓂᒋᔭᖑᓃᓐᓇᓯᒋᔭᐅᓚᐅᕐᐳᑦ 142. ᐃᓐᓇᐅᔪᑦ ᑕᒪᐃᓐᓂᖅᑲᔭᖅ ᑐᐊᕐᑐᓪᒪᓄᑯᔫᓚᐅᕐᐳᑦ. ᑕᒪᐃᓐᓂᖅᑲᔭᖅ ᐃᓐᓇᕈᕐᑐᑦ ᐃᖃᓗᐃᑦ ᐊᖅᑲᕐᐸᓂᐊᓂᓚᐅᕐᐳᑦ 22-ᒥᔭᖑᓂᑦ 25-ᒧᑦ ᔫᓐᒥ. ᑕᒪᐃᓐᓂᖅᑲᔭᖅ ᓯᑉᐸᓂᕐᐹᒥᒃ ᐊᖅᑲᕐᑐᑦ ᐃᖏᕐᕿ-ᓚᐅᕐᐳᑦ ᔪᓚᐃ 1-ᒥᑦ ᐊᒻᒪ 2-ᒥ.

ᓈᓴᕐᑕᐅᓂᖏᑦ ᑕᓄᐅᕐᒥᐅᑕᐃᑦ ᐃᖃᓗᐃᑦ ᑰᖁᑎᒐᒥ ᐱᓂᓄᐊᕗᖃᕐᑕᓄᐊᕐᑲᕐᐳᑦ ᐅᑭᐅᓂ ᐊᑐᕐᓂ-ᐊᓂᓵᕐᑐᓂ. ᐃᓯᒪᓐᓇᕐᐳᖅ ᐱᓂᓄᐊᕗᓇᔭᓄᐊᖅᓴᖏᓐᓂᒃ 1993-ᒥ ᐊᒻᒪ 1994-ᒥ ᐊᑐᐃᓐᓇᐅᑎᕐ-ᑎᔪᑕᐅᓂᐊᕐᓗᑎᒃ ᑐᓴᒃᓴᓂᒃ ᐅᑭᐅᓄᑦ ᐱᖑᓯᓄᑦ ᖃᓄᐃᒋᐊᖅᓴᖏᓐᓂᒃ ᒫᓐᓇ ᐃᓂᖅᑯᓯᓄᔭᖏᑦ. ᐃᖏᕐᕿᓂᐅᔪᑦ ᐋᖅᑭᐊᕐᑕᐅᓂᖏᑦ ᐱᕈᕐᐸᓂᐊᑎᕐᑎᖏᕐᐸᑕ ᐊᒥᓯᕈᕐᐸᓂᐊᑎᕐᑎᖏᕐᐸᑕ ᐅᖃᕐᓂᐊᔭᐅᔪᓂᒃ ᐃᖃᓗᓐᓄᑦ, ᓯᑉᐸᓂᕐᐹᒥᒃ ᐊᖅᑲᕐᐸᓂᐊᔪᑦ ᐃᖃᓗᐃᑦ ᐊᒥᓱᕗᓄᐊᕐᖃᔭᕐᐳᑦ ᐅᑭᐅᑦ ᑕᐸᓂᒪᑦ ᐊᕐᕕᓃᐸᓘᓐᓃᑦ ᐋᖅᑭᐊᕐᑕᐅᕐᖃᓂᒃᓯᒪᓂᕐᐸᑕ ᐹᓂᐊᕗᓚᐅᕐᑐᑦ. ᑕᒪᓐᓇ ᑕᐃᒪᓐᓇᐃᐸᑦ ᐊᒥᓱᓐᖑᕐᐸᓂᐊᓂᐊᖅᓯᒋᔭᐅᖏᓚᑦ ᐃᖃᓗᐃᑦ 1996-ᒥ ᑭᓯᐊᓂ ᐃᓚᕙᓂᐊᔪᓐᓇᖅᓯᒋᔭᐅᑉᓗᑎᒃ.

ᑰᖁᑎᒐ ᐃᒪᐃᖃᑦᑕᕐᓂᖑ ᐆᒃᑑᑎᒃᓴᕐᑕᐅᒃᔪᑎᒋᕙᖑ ᖃᓄᖅ ᐃᒃᐱᒋᖃᑦᑕᓚᖑᑕ ᐃᖃᓗᐃᑦ ᑕᓄᐅᕐ-ᒥᐅᑕᑦ ᐅᖃᕐᓂᖏᑦ ᓇᔪᕐᑕᖏᑦ ᐋᖅᑭᐊᕐᑕᐅᓚᐅᕐᑎᓪᓗᒥᑦ ᐋᖅᑭᒃᑕᐅᓯᒪᐃᓐᓇᕐᓂᐊᕐᑎᓪᓗᒥᓪᓗ ᑕᐃᒪᓐ-ᓇᐃᖏᓐᓇᕐᓂᐊᕐᑎᓪᓗᒥᑦ ᑰᖓᓂᐅᔪᕐᓗ ᒥᑭᕐᑑᑎᓪᓗᒍ ᓇᓴᕐᑕᐅᕐᑎᐊᕈᓐᓇᕐᐳᑦ ᐃᖃᓗᐃᑦ ᐃᖏᕐᕿᕙᓂᐊᔪᑦ ᒪᔪᕐᐸᓂᐊᔪᑦ ᐊᖅᑲᕐᑎᕐᐸᓂᐊᔪᓪᓗ ᑐᖑᐅᑕᐅᓯᒪᓗᐊᖏᓪᓗᑎᒃ ᓇᓚᐅᑦᑖᕐᑕᐅᔪᓐᓇᕐᐳᑦ.

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INTRODUCTION

In the late summer of 1991, the stream channel of Kuuqutiga Creek was improved in order to fadlitate sea-run Arotic ohar migrations. Improvements consisted of channeling the stream in three areas to increase water depths and oonstruotion of , rook diversion walls to improve flow in constructed ohannels. Details of this test project were reported by Sekerak (1991).

Because habitat improvement programs for Arctic char have never been formally attempted in the N. W. T., there is a great need for monitoring programs after improvements have been made to determine if:

1. the physioal modifications are relatively permanent; and
2. if the habitat modifications have affected fish populations in the expeoted manner.

The present study was performed with the followlng spedfic objectives:

1. to determine the effects of ioe soour and spring floods on the channel improvements that were constructed in summer 1991; and
2. to obtain baseline counts of the sea-run population of Arotic char in Kuuqutiga Creek.

The following material provides the above information in the form of a brief data report. Rationale and further details about the ongoing program to improve sea-run Arctic char populations in the Clyde River area are found in Sekerak et al. (1991), Sekerak (1990, 1991) and Sekerak and Qillaq (1992).

RESULTS

Stream Channel Improvements

Lake Levels and Stream Flow

Stream levels in Kuuqutiga Creek were monitored from 15 June to 4 July 1992. Upon arrival in the study area on 15 June, the stream bed of Kuuqutiga Creek was completely dry near the outlet of Kuuqutiga Lake (Plate 1) and only a small flow (visually estimated at considerably less that O,ln#/see) was observed at the mouth of the stream (Plate 2). The latter flow was the result of snowmelt between Kuuqutiga Lake and the estuary of Kuuqutiga Creek. It was apparent that the strearnbed of Kuuqutiga Creek is dry throughout the winter.

On 16 June, the Ievei of Kuuqutiga Lake was considerably below the surfaoe of the streambed (Plate 3). As shown in Table 1, surface stream flow began on 21 June. Thereafter, lake levels rose rapidly and on 2 July reached a high of 60 cm above the winter low water mark. Monitoring ceased on 4 July. It is assumed that the recorded high on 2 July was the highest level for the season, because air temperatures in early July remained relatively 0001 and most of the snow at low and moderate elevations had melted in late June.

Integritv of Stream Channels

Upon arrival in the study area, all of the stream channels and diversion walls oonstruoted in the summer of 1991 were visually inspected (Plate 4). Ail channels were dry or covered with snowdrifts and there was no sign of movement or slumping of any of the streambed improvements. This is undoubtedly due to the fact that flow in Kuuqutiga Creek ceases in the fall shortly after freeze-up and there is no build-up of ice In or near areas of channei improvement.

Table 1. Temperatures and lake ievels in Kuuqutiga Lake, 15 June to 4 July 1992.

Date	Time	Air TemD (℃)	Lake Water Temp (℃)	Relative Lake Level (cm)	Comments
June					
15				0	
16	18:00	6.0	3.0	0	
17	18:00	8.0	3.0	1.0	
18	18:00	8.0	3.5	2.0	
19	18:00	7.0	4.0	5.0	Subsurface fiow evident
20	18:00	8.0	5.0	10.0	
21	18:00	8.0	5.0	14.0	Surfaoe fiow evident
22	18:00	10.0	4.0	19.0	Aduit ohar migration begins
23	18:00	9,5	4.5	26.5	
24	18:00	9.0	4.5	32.0	
25	18:00	10.0	6.0	34.5	
26	18:30	5.0	5.0	40.0	
27	13:45	8.0	5.0	42.0	
28	18:00	6.0	4.5	46.0	
29	18:00	8.0	5.0	46.0	
30	18:00	10.0	5.0	49.0	
Juiy					
1	18:00	7.5	4.5	55.0	Smoit migration begins
2	18:00	11.5	5.0	60.0	
3	10:00	8.5	4.5	59.0	
3	12:00	9.0	4.5	56,0	

The streambed upstream of the channel improvements is generally shaiiow and wide. Some shaiiow ponds are present which do not go dry during winter, but freeze to the bottom. These areas are the only portions of the streambed that oontain ioe, which oouid theoretioaiiy drift downstream and obliterate stream ohannei improvements. However, ice in suoh areas is firmly frozen into the streambed and was observed to melt in situ (Piate 5). Hence, ice rafting and soouring of the streambed of Kuuqutiga Creek do not oocur.

The spring freshet of 1992 in Kuuqutiga Creek had little, if any, effect on oons-truoted ohanneis and diversion walls (Plates 6 to 10). The drainage area of Kuuqutiga

Creek Is relatively small and Kuuqutlga Lake undoubtedly dampens peak flows. In addition to these faotors, ohannel improvements are in areas where streambed widths are extreme (see Sekerak 1991); therefore, fiood waters are dispersed iateraiiy and water veicoities in ohanneiized areas remain relatively iow (Piates 9 and 10). it shouid also be noted that care was taken in construction of channeis and diversions so that the waiis of structures were stabie and siumping wouid not ooour.

Fish Abundance and Movements

information on numbers of Arctic char migrating downstream in Kuuqutiga Creek was obtained by installation of a fish trap in the main ohannei, oompiemented by rook weirs which extended aoross the entire channei. The main trap was ocnstructed with 2“ X 4" frames covered with l/4-inoh hardware oioth. Wings to iead fish into the trap were also 2“ X 4’ frames oovered with hardware oioth. Wings, in turn, extended to the rock weirs. it is beiieved that the trap was virtuaiiy 100% effective for fish iarger than 150-200 mm fork iength. Rook weirs oontained numerous smaii openings which smaiier fish undoubtedly used to move downstream to summer feeding areas. The fish trap was tended at ieast twice daily when aii fish were enumerated, measured for iength and reieased (Piates 11 and 12). A smaii number of fish were kiiied in order to obtain information on sex, maturity and age (Piates 13 and 14). Due to the very smaii size of the sea-run populations of Arctic char in Kuuqutiga Creek, numbers of fish killed was minimized.

Fish Abundance and Size

The downstream run of Arctic char in Kuuqutiga Creek, as documented by the fish trap, ocnsisted of approximately 765 fish in two distinct size groups (Figure 1). The first ocnsisted of 464 iarge fish between 520 and 779 mm in fork iength, with a modal iength between 580 and 599 mm.

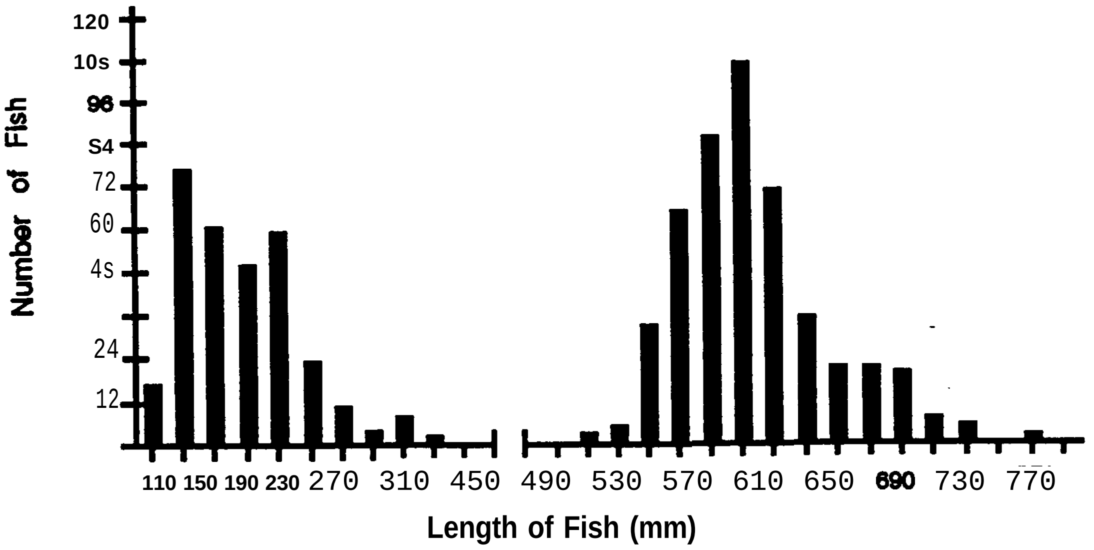

Figure 1. Length frequency of downstream migrating Arctic char, 21 June to 4 July 1992.

The second group was composed of smafl fish between 100 and 300 mm fork length. Within this group of "301 fish, two length modes were evident; the larger between 180 and 199 mm, the smaller between 120 and 139 mm (Figure 1).

Timing of Movements

Downstream migration of char in Kuuqutiga Creek was rapid (Figures 2 and 3). Neatly 100% of all large mature fish moved downstream within an eight-day period from 22 to 29 June. Movement of mature fish was most Intense from 22 to 25 June; 87% of afl mature fish moved downstream within this 4-day period.

Downstream movement of immature fish was equally rapid and intense (Figures 2 and 3). The main period of movement was 5-8 days after the major movement of adult fish. Over 96% of all immature fish migrated downstream over a two-day period—1 to 2 July. The downstream migration terminated on 4 July as abruptly as it commenced.

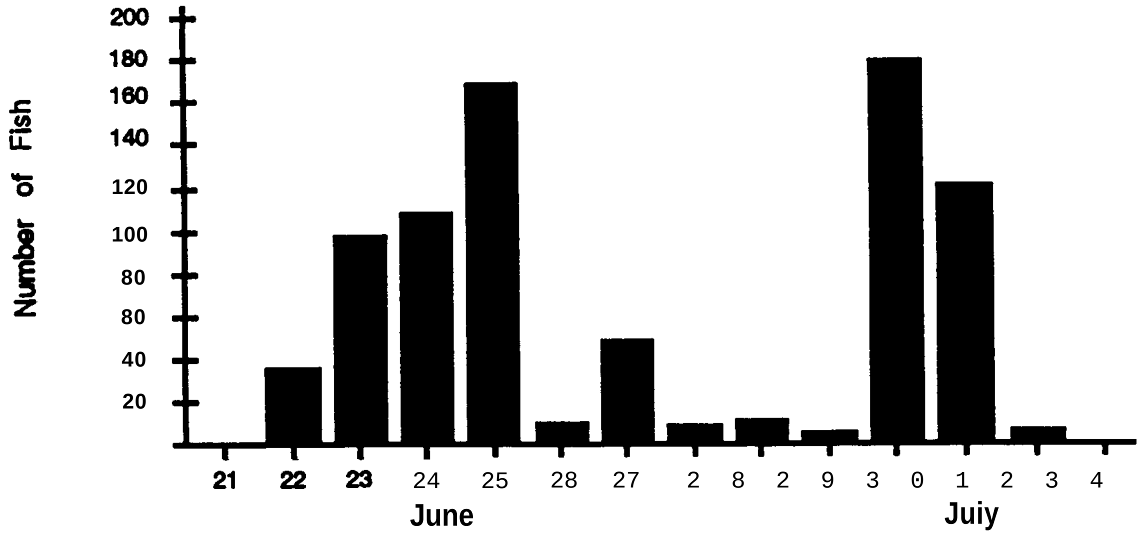

Figure2. Timing of downstream char movements in Kuuqutiga Creek, 21 June to 4 Juiy 1992.

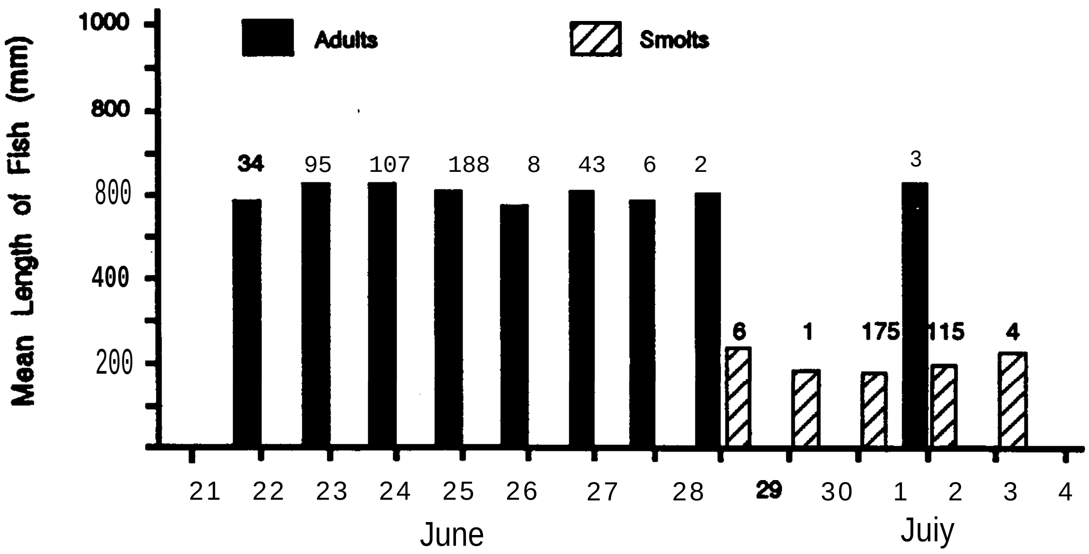

Figure 3. **Mean iength of Arctic char migrating down Kuuqutiga Creek over time, 21 June to 4 July 1992. Total number of char per day is shown at the top of eaoh bar.**

Numbers of Smelts

It is difficult to determine the exact number of smelts in Kuuqutlga Creek because many of the smaller fish that participated in the run were undoubtedly moving downstream to use Kuuqutiga Creek as a summer feeding area. (Observations in the , summer of 1991 indioated that large numbers of juveniie char are found in the 2-3 large ponds directly below Kuuqutiga Lake, and that they are relatively abundant throughout the upper portions of the stream.) Johnson (1980) reported that smoits descending from Nauyuk Lake were very compact in size distribution, being from 180 to 240 mm in length with a modai value of 220 mm. It is suspeoted that the modal value of smelts in Kuuqutiga Creek was 180-199 mm (see Figure 1). Forty-two specimens were iarger than the modal size. if an equal number of smoits are estimated to be smaller than the modai size, then about 142 smelts were present in the downstream run.

Numbers of Post-Spawners

Oniy six specimens were identified as post-spawners-fish that had spawned in the fail of 1991. These fish were all females and were Identified externally by their thinness and internally by 1) presence of numerous fresh retained eggs, 2) the smali size of newly developing ovaries and 3) the small size (<0.1 mm diameter) of eggs in the ovaries. The condition factors, K ($K = W \times 100/L^3$; where W = weight in grams a d L = length in oentimetres) of these fish were:

Lenath (mm)	Weiaht (g)	Condition Faotor
549	1100	0.6647
572	1000	0.6280
563	700	0.3922
577	1100	0.5726
610	1300	0.5726
548	1100	0.6684

The speoimen with the very low condition factor of 0.3922 was extremely emaciated and possibly near death.

Condition

Condition of the other 15 mature specimens that were kiiled for biological information is shown in Table 2. Condition faotors of ali fish were relatively low, indicating a generally light body to iength ratio. Condition faotors of non-reproduotives (fish that would not spawn in 1992) ranged from 0.6993 to 0.8189. Johnson (1989) reported that the condition of non-reproductives in spring in Nauyuk Lake was 0.89 and that of post-spawners was 0.71. Both of these values are substantially above those of char from Kuuqutiga Lake. Residents of Ciyde River have repeatedly said that char in Kuuqutiga Creek are thin. This is firmiy documented by the above data.

Tabie 2. Condition (K) of individual mature char in Kuuqutiga Creek. All were female exoept as indicated. N = non-reproductive; R = reproductive

Length Interval mm	K		
500-509			
510-519	0.8100 N		
520-529			
530-539	0.7793 N		
540-549			
550-559	0.7213 N	0.8189 N	
560-569			
570-579	0.7890 N	0.7728 N	
560-589	0.6993 N		
590-599	0.7673 N		
600-609	0.7261 N	0.9436 R	0.9740 R
610-619			
620-629			
630-639			
640-649	0.7754 N		
650-659			
660-669			
670-679	0.8057 N		
680-689			
690-699	0.7906 N Maie		

Age

Otoliths were collected from sacrificed fish for age determination. Ages are being determined by Department of Fisheries and Oceans personnel and are not available at the present time.

CONCLUSIONS

Habitat Improvements

All evidence suggests that the habitat improvements constructed in the streambed of Kuuqutiga Creek in 1991 will remain undamaged from ioe scour or flood waters for the foreseeable future. The drainage is an ideal system to test the effectiveness of habitat modifications because of its substrate, geomorphology and hydraulic oharacteristios.

Char Population

Data obtained in spring 1992 document that the ohar population in Kuuqutiga Creek is extremely small. The downstream run was composed of only 464 mature fish, six of which were identified as post-spawners. The number of smelts moving downstream was estimated to be about 142.

RECOMMENDATIONS

Monitoring ohar populations in Kuuqutiga Creek should continue. Clyde River residents have indicated a willingness to contribute labour if support can be found for travel, living and professional advioe. Ideally, monitoring should continue In 1993 and 1994 to provide at least three data points to describe baseline oondltions.

Effects of stream habitat improvements will take a number of years to begin to affect the population of char in Kuuqutiga Creek. Effects will first be felt in numbers of smelts. If population level effects are produced, the number of smelts may be increased in perhaps 5-6 years after stream improvements. Therefore, monitoring for effeotlveness of habitat improvements should begin in 1996.

Literature CiTED

Johnson, L. 1980. The Arctic charr, *Sa/ve/inus* ***alpinus***. In: Bioiogy of Arctic charr: Proceedings of the International Symposium on Arctic charr.

Johnson, L. 1989. The anadromous Arctic charr, *Sa/ve/inus* ***alpinus***, of Nauyuk Lake, , N.W.T., Canada. Physioi. ecoi. Japan. Spec. Vol. 1: 201-227.

Sekerak, A.D. 1990. Preliminary assessment of methods to enhance anadromous Arctic char populations in the Northwest Territories. Unpubl. Rep. by Applied Environmental Services for Economic Development and Tourism, GNWT. 87 p.

Sekerak, A.D. 1991. Clyde River Arctic char enhancement program 1991: stream channel improvements in Kuuqutiga Creek. Report by Clyde River Hunters and Trappers Association, Science Institute of the Northwest Territories and Applied Environmental Services, Yellowknife, for Dep. Economic Development and Tourism, GNWT. 28p+ Appendix.

Sekerak, A.D. and J. Qiiiaq. 1992. Feasibility of the creation of a new population of sea-run Arctic char near inugsuin Fiord, Baffin isiand, N.W.T. Unpubi. Rep. by Appiied Environmental Services, Clyde River HTA and Science inst. of NWT. In prep.

Sekerak, A. D., D. Iqarialu, J. Qiilaq and W. Kautuq. 1991. A community plan to increase fish populations near Clyde River, N.W.T. Unpubl. Rep. by Appiied Environmental Services, Clyde River Hunters and Trappers and Science Institute of the N.W.T.

PLATEs

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Platel. **Dry streambed of Kuuqutiga Creek immediately below Kuuqutiga Lake (15 June 1992). The stream channel constructed In 1991 Is In the foreground.**

ᐊᔾᔨ 1. ᐸᓂᑦᑐᖅ ᑰᖁᑎᒐ ᑰᒐᓛᑉ ᐃᒃᓚᖓ ᐊᑎᑦᑎᐊᖓᓂ ᑰᖁᑎᒐᒥ ᑕᓯᕐᒥ 15 ᒥᔫᖓᓂ ᔫᓐ 1992). ᓴᖅᑲᐅᕐᐱᐅᔪᑉ ᐹᖓ ᓴᓇᔭᐅᓂᖓ 1991-ᒥ ᑐᓄᐊᓂ ᑕᑯᔅᓴᐅᕗᖅ.

Plate 2. **Stream flow near the** mouth of Kuuqutiga Creek, 15 June 1992.

ᐊᔾᔨ 2. ᑰᒃᐸᓪᓕᐊᓂᐅᔪᖅ ᖃᓂᖓᓂ ᑰᖁᑎᒐᒥ ᓴᖅᑲᐅᔪᒥ 15 ᔫᓐᒥ 1992-ᒥ.

Plate 3. Kuuqutiga Lake, 15 June 1992. The dry stream and lake bed is in the foreground.

ᐊᔾᔨ 3. ᑰᖁᑎᒐ ᑕᓯᖅ, ᔫᓐ 15, 1992. ᐸᓂᕐᑐᖅ ᓇᑎᖓ ᑰᑉ ᐊᒻᒪ ᐊᑖ ᑕᑰᕐᓴᐅᕗᖅ.

Plate 4. Inspecting the stream channels constructed in 1991.

ᐊᔾᔨ 4. ᖃᐅᔨᓴᕐᑕᐅᓂᖏᑦ ᑰᒃᑐᑦ ᐹᖏᑦ ᓴᓇᔭᐅᓂᑯᐃᑦ 1991 -ᒥ.

Plate 5. **Ice meitlng in a smail pool of Kuuqutiga Creek.**

Q'? 5. ᓯᑯ ᐊᐅᑉᐸᓪᓕᐊᔪᖅ ᐃᒪᔨᕐᒥ ᑰᖁᑎᒐᒥᑯᖅᒥ .

Piate 6. **Beginning of surface flow in Kuuqutiga Creek, 21-22 June 1992.**

@~ 6. ᐱᒋᖕᓂᖓ ᖃᖓᑕᓯᐊᕐᐳᓂᖓ ᑰᖁᑎᒐᒥ, ᔫᓐ 21-22, 1992-r.

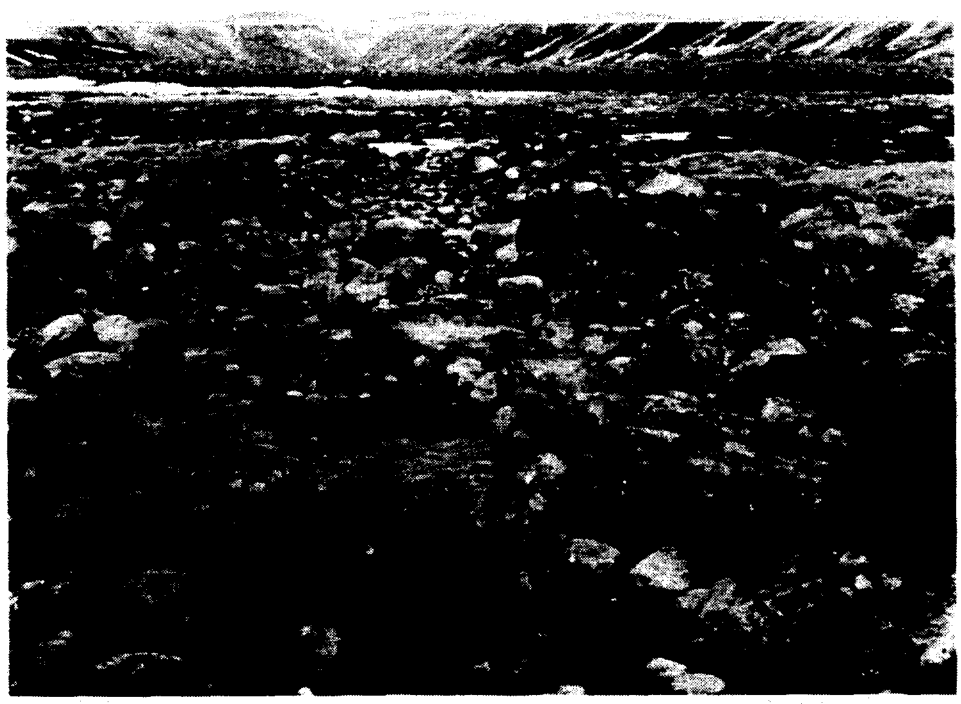
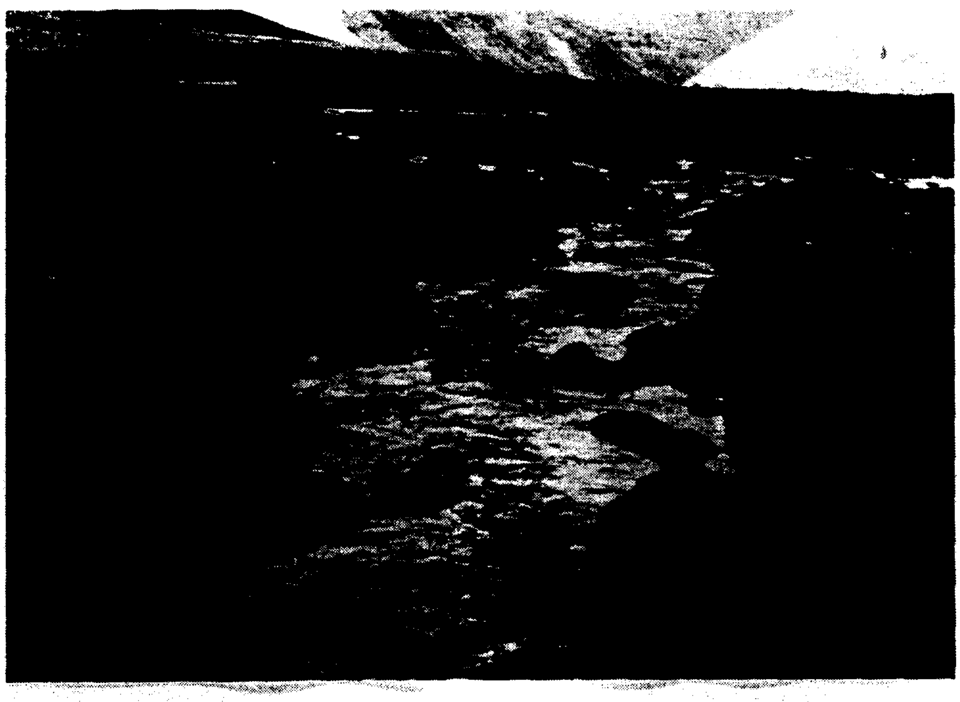


Plate 7. Stream flow in constructed channels in late August 1991 (see Plate 8).

ᐊᒃᐹ 7. ᓴᑦᕙᐅᓂᐅᔪᖅ ᓴᓇᔭᐅᓯᒪᔪᒥ ᐹᓂᐊᕐᔪᒥ ᐋᒡᒐᓯ ᓄᖑᐊᑕ ᖃᓂᒋᔭᖓᓂ 1991 (ᑕᑯᓗᒍ ᐊᒃᐹ 8).

Plate 8. Stream flow in the same channel during spring freshet in early July 1992 (see Plate 7)

ᐊᒃᐹ 8. ᓴᑦᕙᐅᓂᐅᔪᖅ ᐹᒥ ᑕᒃᕙᓂᑦᑕᐃᓐᓇᖅ ᐅᐱᕐᖔᒥ ᔪᓚᐃ 1992 ᐊᑐᕆᐊᓂᔅᑎᓪᓗᒍ (ᑯᓗᒍ ᐊᒃᐹ 7)



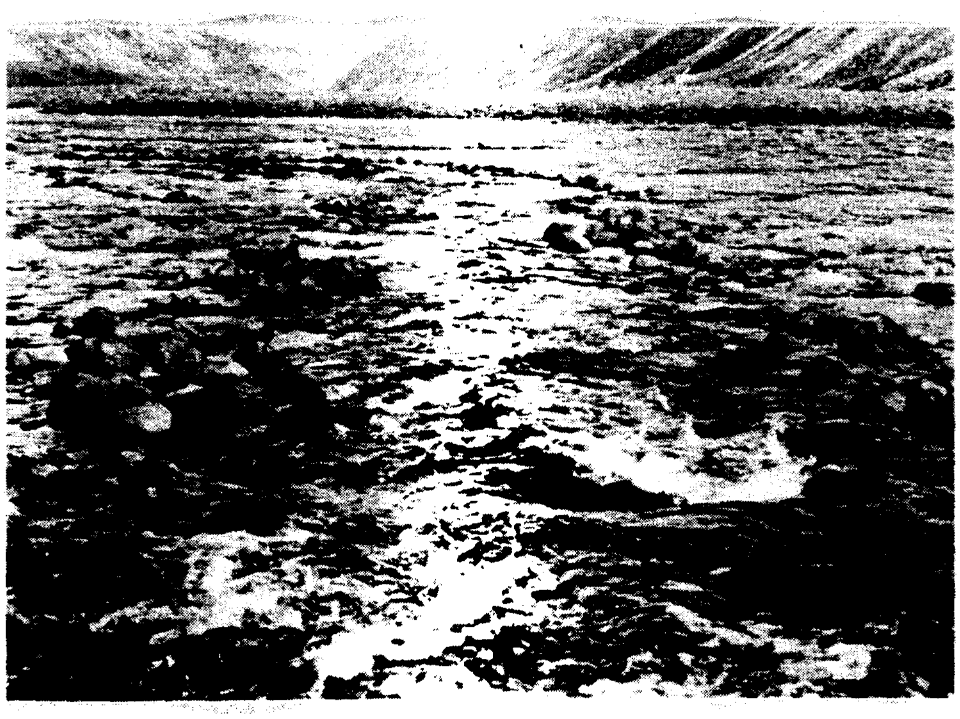


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Plate 9. **Stream flow in constructed channei, 30** June 1992 (see Piate 10).

ᐊᔾᔨ 9. ᓴᕐᕙᐅᓂᐅᔪᖅ ᓴᓇᔭᐅᓂᑯ ᐹ, ᔫᓐ 30, 1992 (ᑐᑯᓗᒍ ᐊᔾᔨ 10).

Plate 10. **Stream flow in same channel during peak flow, 2 July 1992 (see Plate 9).**

ᐊᔾᔨ 10. ᓴᕐᕙᐅᓂᐅᔪᖅ ᑕᕝᕙᓂᑦᑕᐃᓇᖅ ᑯᕝᕙᓯᓛᖑᓂᖓᓂ ᓴᕐᕙᐅᓂᖓ, ᔪᓚᐃ 2 1992 (ᑕᑯᓗᒍ ᐊᔾᔨ 9).

Plate 11. Counting Arotic char moving down Kuuqutiga Creek, spring 1992.

ᐊᔾᔨ 11 · ᑕᕆᐅᕐᒥᐅᑕᐃᑦ ᐃᖃᓗᐃᑦ ᓈᓴᖅᑕᐅᓂᖏᑦ ᑰᖁᑎᒐᒥ , ᐅᐱᕐᙳᓵᒃᑯᑦ 1992.

Plate 12. Releasing Arctic ohar after measurements, spring 1992.

ᐊᔾᔨ 12. ᐊᓂᑎᕐᑎᓂᖅ ᑕᕆᐅᕐᒥᐅᑕᓂᒃ ᐃᖃᓗᖕᓂᒃ ᐆᒃᑐᕋᓚᐅᕐᓱᒥᑦ, ᐅᐱᕐᙳᓵᒥ 1992.

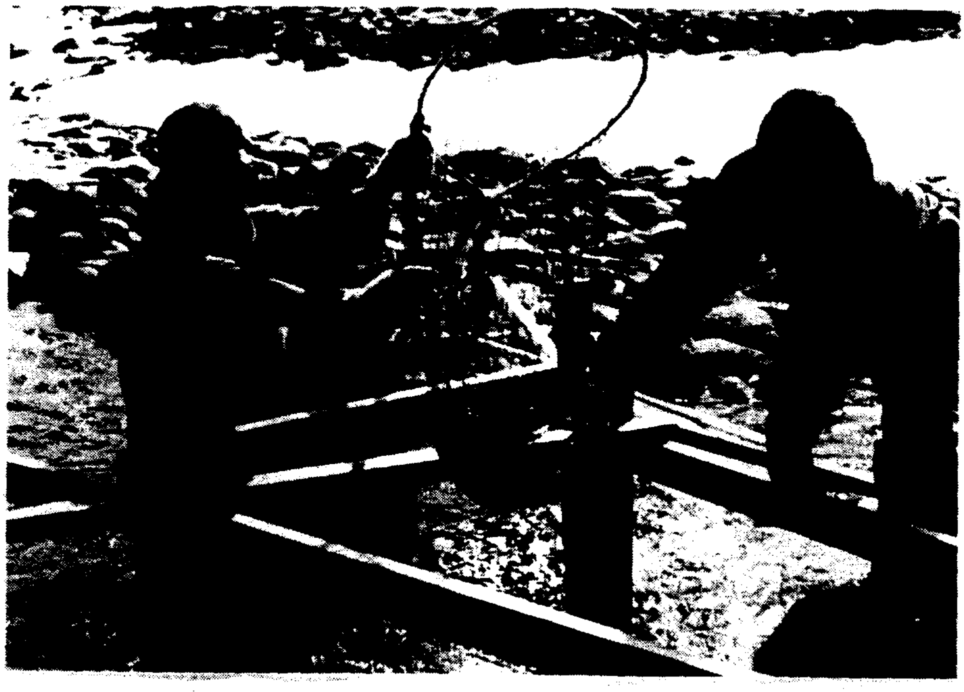
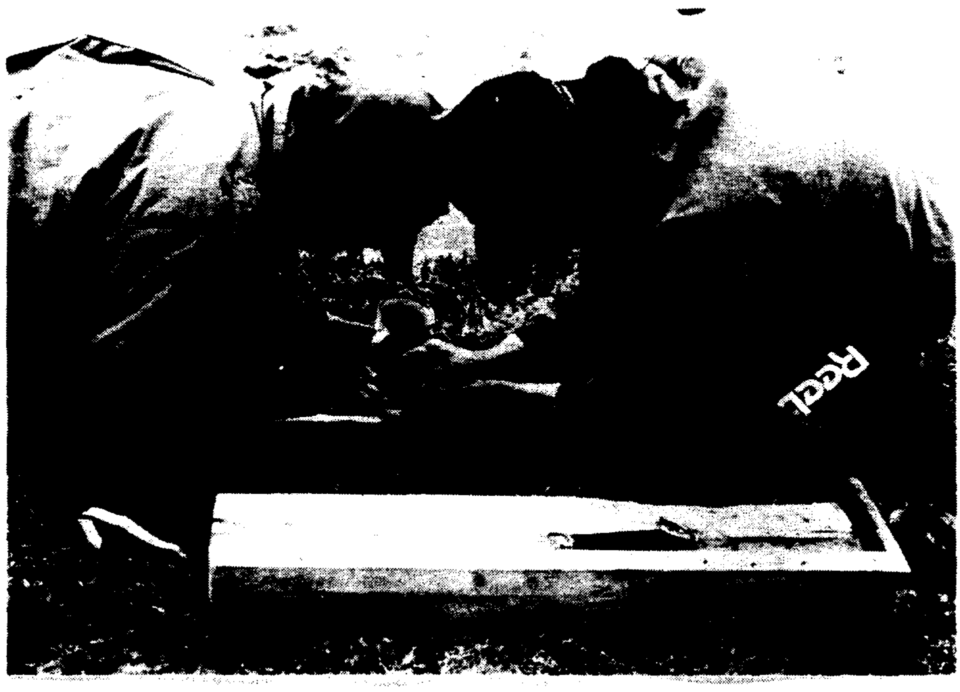


Plate 13. Obtaining scientific data from Arctic char, spring 1992. –

ᐊᒃᓯ 13. ᓱᓇᐅᐃᓐᓇᕐᓂᑦ ᐅᓂᖅᑲᖅᑕᐅᕙᒃᑐᓂᑦ ᖃᐅᔨᓴᐃ ᓂᖅ ᑕᕆᐅᕐᒥᐅᑕᓂᑦ , DA% ᐅᓭᒃᑯᑦ 1992.

Piate 14. **Specimens of Arctic char. The very thin fish spawned in the faii of 1991 and is in very poor condition.**

ᐊᒃᓯ 14. ᐆᒃᑑᑎᓕᐊᖑᓂᑯᑦ ᑕᕆᐅᕐᒥᐅᑕᓂᑦ ᐃᖃᓗᖕᓂᑦ. ᑐᐊᕐᑐᕐᒪᕆᐊᓗᒃ ᐃᖃᓗᒃ ᐅᑭᐊᒃᓵᒃᑯᑦ **1991.**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