Movements of Summer Run Steelhead Trout Tagged with Radio Transmitters in the Zymoetz River during Spring,1994.

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Abstract

Radio telemetry was used to determine spawning locations of wild adult summer run steelhead in the Zymoetz River. Conventional angling methods were used to capture adult steelhead in the river during the Spring, prior to spawning. Radio transmitters were inserted into the stomachs of fourteen fish. These steelhead were tracked by helicopter on six separate flights over a two month period. It was determined that ten of fourteen steelhead utilized the upper 20 km of the Zymoetz River, however, only two of those spawned at the outlet of McDonell Lake. The importance of a number of smaller systems in the upper Zymoetz watershed is discussed as is the need for a regulation change to protect overwintering summer steelhead.

Introduction

Estimating summer run steelhead (*Oncorhynchus mykiss*) spawning escapements for Skeena River stocks is a critical aspect of their management. It has been hypothesized that the majority of summer run Zymoetz River steelhead spawn at the outlet of McDonell Lake. This study was initiated to assess spawner distribution and determine whether or not population estimates conducted solely at the McDonell Lake outlet area would accurately reflect the entire Zymoetz River summer run steelhead population.

Funding for this project was provided by the Habitat Conservation Fund.

Study Area

General Description

The Zymoetz River, locally known as the Copper River, begins at the outlet of the McDonell Lake chain (including McDonell, Dennis and Aldrich lakes) 29 km southwest of Smithers, and flows in a generally southwest direction to its confluence with the Skeena River, 9 km northeast of Terrace, B.C (Figure 1.). The Zymoetz drains an area of 3080 km^1, is 109 km in length and has a monthly mean discharge that ranges from a low in March of 25.7 m^3/s to a high in June of 358 m^3/s (Water Survey of Canada, 1989).

Fish Populations

In addition to steelhead, other species present include sockeye salmon (*O. nerka*), coho salmon (*O. kisutch*), chinook salmon (*O. tshawytscha*), pink salmon (*O. gorbuscha*), chum salmon (*O. keta*) resident rainbow trout (*O. mykiss*), cutthroat trout (*O. clarki*), Dolly Varden char (*Salvelinus malma)* and/or Bull char (*S. confluentus*) and Rocky Mountain whitefish (*Prosopium williamsoni*). Descriptions of Zymoetz watershed topography, soils and flora are have been reported previously in Varner and Truelson (1975).

The Department of Fisheries and Oceans has estimated average escapement of sockeye, coho, pink, chum and chinook escapement over a ten year period to be 1860, 1117, 2310, 36 and 695 respectively (Anonymous, 1991). Escapement estimates are not available for the other species listed present. While sockeye, coho and steelhead have been found to utilize the headwater lakes, pink and chum have been observed spawning on only the lower 6.0 km and chinook have been observed only to Limonite Creek (Anonymous, 1991). Rainbow trout, cutthroat trout, Dolly Varden and/or Bull char and Rocky Mountain whitefish are widely distributed throughout the watershed.

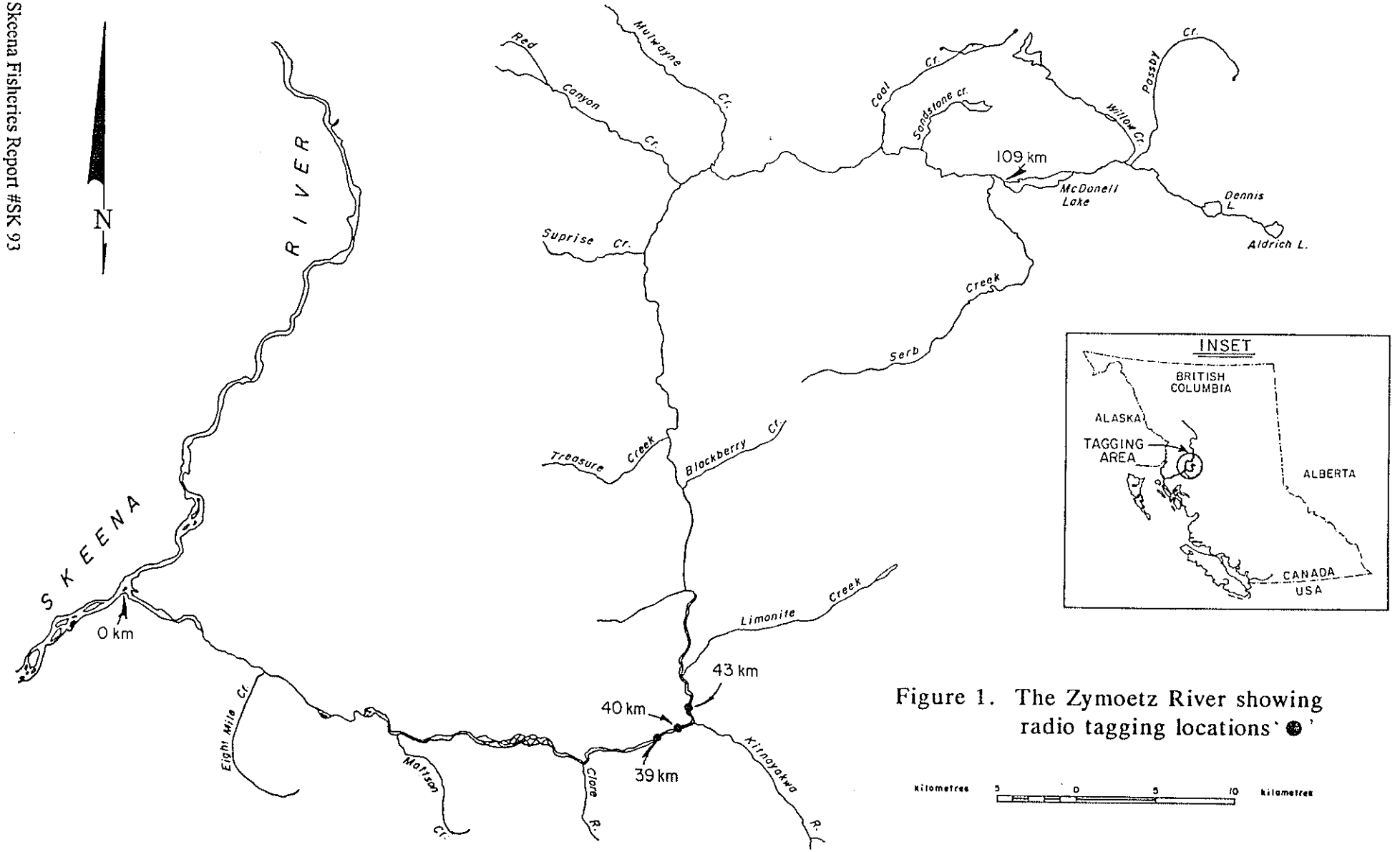

Figure 1. The Zymoetz River showing radio tagging locations '●'

Fisheries

Only recreational fishing takes place in the Zymoetz River watershed; there are no commercial or native fisheries. Over the past ten year period, an average of 460 anglers have fished for steelhead in the Zymoetz each year, accounting for an average yearly catch of 1775 steelhead (Anonymous, 1995). Other species listed are also captured in sport fisheries although no catch data is available. Current freshwater fishing regulations prohibit the retention of steelhead or salmon in the Zymoetz; trout, char and whitefish may be retained (Anonymous, 1994).

Methods

Fish Capture and Tagging

Wild adult summer run steelhead were captured using conventional angling methods. Steelhead that were less than 65 cm or that appeared to be in less than optimum condition were marked at the base of the left side of the dorsal fin with a single coloured, numbered anchor tag (Floy Tags, Washington, U.S.A.) and released. All fish greater than 65 cm (fork length) that were in good condition were radio tagged. While the fish was held at the water's surface, the radio transmitter was inserted orally into the stomach with the assistance of a hollow, flexible plastic tube. Vegetable oil was used to lubricate the transmitter. Anaesthetic was not used as the possible effect on migration was not known. Radio tagged fish were also marked with two anchor tags at the base of the left side of the dorsal fin. Sex, fork length, anchor tag number and colour, any scars or hook marks, fish condition and radio tag number (if radio tagged) were noted for each fish captured. All tagging locations were described using global positioning satellite equipment (Trimble, model 19437-60, USA).

Radio Telemetry

Radio telemetry equipment used in this study was obtained from Lotek Engineering (Newmarket, Ontario). Radio transmitters (model CFRT-3A) were cylindrical, 14.5 mm in diameter, 43 mm in length and had a 440 mm long antenna leading from the anterior end of the transmitter; the antenna protruded from the fishes mouth. The transmitter weighed 10.7 grams in air, 4.2 grams in water and was powered by a 3 volt lithium battery which had a 260 day life. All transmitters emitted a digitally encoded radio signal at a frequency of 151.010 MHz. Individual radio tag signals were detected and decoded by the telemetry receiver (model SRX_400 with software version 3.47 W16D). This receiver was used in combination with a six meter length of RG-58 A/U double shielded coaxial cable and a three element Yagi antenna for aerial tracking flights. The Yagi antenna was mounted to the helicopter's high frequency antenna (Figure 2.) with elements orientated perpendicular to the surface of the water to minimize radio signal attenuation (Lotimer, et al., 1994) . The receiver logged the time, transmitter code and relative signal strength in an internal memory that was later transfered to a computer file. Stationary receiver stations were not used in this study.

Tagged fish locations were recorded on a 1:50 000 scale map to the nearest 500 m.

Figure 2. Photograph of helicopter used for tracking flights showing location of antenna.

Data Interpretation

As steelhead may have exhibited an interrupted migration pattern and tracking flights were conducted at specific points in time, it is assumed that the calculated migration rate was the minimum possible migration rate. Migration rates were calculated by dividing the number of kilometers that an individual fish had migrated since last detection, by the number of days since last detection.

Determination of spawning locations was subjective. Radio tagged fish that were located at known spawning locations, that were repeatedly tracked to areas that had spawning potential or that migrated into Zymoetz tributaries were considered to have spawned there. Individual radio tagged fish were not observed spawning.

Results

Seventeen adult summer run steelhead were captured between kilometer 39 and 43 on the mainstem Zymoetz River on April 7, 1994. Fish ranged in fork length from 53 cm to 90 cm and the sex ratio was 0.7 ♂ to 1 ♀. Fourteen of the seventeen were radio tagged while three were anchor tagged only.

These steelhead were tracked by helicopter on six separate flights beginning on April 27, 1994 and concluding on June 17, 1994. It was determined that ten of fourteen steelhead utilized the upper 20 km of the Zymoetz River (Table 1., Appendices 1-14.). However, only two of those appear to have spawned at the outlet of McDonell Lake. One of these remained at the outlet for a minimum of 36 days while a second stayed for a minimum of 15 days. One of these fish was detected at the outlet of McDonell Lake for a short period both prior to ascending and after emigrating from Serb Creek.

Four radio tagged fish were found in tributary streams and are assumed to have spawned there. Two radios were found in Serb Creek; one was located approximately 2.5 km upstream of the Serb Creek-Zymoetz River confluence while a second radio was found approximately 10 km upstream of the confluence and resided in the creek for a minimum of 10 days. One fish was located in Willow Creek approximately 2 km upstream of its confluence with the Zymoetz. This fish resided in Willow Creek for a minimum of 10 days. One radio was located in Coal Creek 4.5 km upstream of its confluence with the Zymoetz River. This fish remained in Coal Creek for a minimum of 10 days.

Four radio tagged steelhead were tracked to the Coal-Sandstone creeks-Zymoetz River confluence areas for periods of up to 23 days. It is suspected that these fish spawned in the mainstem Zymoetz River in the vicinity of these creek confluences as suitable spawning habitat was found in these areas.

A single fish was tracked to the Surprise Creek confluence and remained there for a minimum of 8 days. It is uncertain whether or not this fish spawned at this location or continued its migration to another destination.

Another fish was last tracked to the Blackberry Creek confluence area and was not located after May 27. It is not known whether this fish spawned at this location.

Two of the transmitters are believed to have been regurgitated shortly after tagging. These transmitters were both deployed approximately 3 km downstream of the Kitnayakwa Creek confluence. One of these was located at the Clore River-Zymoetz River confluence area on all six tracking flights. The second was located downstream of the Clore River confluence on the first five tracking flights and was actually recovered on June 17 from a sand bar downstream of the Clore River confluence. The transmitter was in good condition and appeared to have been regurgitated before becoming lodged in the substrate. No transmitter malfunction was noted during the course of the study.

Table 1. Tagging information and subsequent locations on aerial tracks (river kilometers in brackets) of radio tagged Zymoetz River summer steelhead, 1994.

Code	Sex	Length (FL in cm)	Tagging Location 7 April, '94	Helicopter 27 April, '94	Helicopter 13 May, '94	Helicopter 18 May, '94	Helicopter 27 May, '94	Helicopter 9 June, '94	Helicopter 17 June, '94
1	F	66	1 km u/s -	u/s Kitnayakwa(43)	u/s Kitnayakwa(43)	d/s Mattock(51)	d/s Treasure Cr.(60)	d/s Red Canyon(82)	d/s Coal Cr.(98)
2	F	68	Kitayakwa (43)	u/s Kitnayakwa(43)	u/s Kitnayakwa(43)	u/s Limonite(46)	Blackberry Cr.(58.5)		
3	M	87		d/s Treasure(61.5)	McDonell outlet(109)	McDonell outlet(109)	McDonell outlet(109)	McDonell outlet(109)	McDonell outlet(109
5	F	76		u/s Kitnayakwa(43)	d/s Treasure Cr.(62)	u/s Mulwayne Cr.(85)	up Serb Cr.(108 + 2.5)		
6	M	90		d/s Surprise Cr.(71.5)	McDonell outlet(109)	up Serb Cr.(108 + 10)	up Serb Cr.(108 + 5)	McDonell outlet(109)	Surprise confl.(76.5)
14	M	75		d/s Kitnayakwa(39)	u/s Treasure Cr.(65)	u/s Coal Cr.(100)	d/s Coal Cr.(98)	d/s Coal Cr.(98)	
15	F	81		u/s Kitnayakwa(43.5)	u/s Lee Cr.(90.5)	up Coal(98.5 + 3)	up Coal (98 + 4.5)		
7	M	76	2 km d/s -	d/s Mattock(49.5)	McDonell outlet(109)	McDonell outlet(109)	McDonell outlet(109)		
8	F	68	Kitnayakwa (40)	d/s Kitnayakwa(39)	d/s Kitnayakwa(39)	u/s Kitnayakwa(43)	Mattock confl.(51.5)	d/s Surprise Cr.(76)	Surprise confl.(76.5)
9	F	70		d/s Kitnayakwa(37.5)	d/s Kitnayakwa(40)	u/s Blackberry(58.5)	u/s Coal Cr.(100)		
10	F	69	3 km d/s -	d/s Limonite(43.5)	d/s McDonell outlet(107)	up Willow Cr.(117 + 1)	up Willow Cr.(117 + 4)	d/s Clore R.(31)	
11	F	68	Kitnayakwa (39)	Clore confl.(33.5)	Clore confl.(33.5)	d/s Kitnayakwa(39)		u/s Sandstone(102.5)	d/s Clore R.(31)
12	M	75		Clore confl.(33.5)	Clore confl.(33.5)	Clore confl.(33.5)	Clore confl.(33.5)	Clore confl.(33.5)	Clore confl.(33.5)
13	M	73		d/s Clore R.(32)	d/s Clore R.(31)	d/s Clore R.(31)	d/s Clore R.(31)	d/s Clore R.(31)	recovered tag(31)

As the first tracking flight was conducted on April 27, 20 days after tagging, assessment of post tagging fallback was impossible. However, on that date, six radio transmitters were located downstream of the original tagging location. Two of these transmitters were later determined to be regurgitated, leaving four fish that had dropped back. Thirty six days after tagging two of those four fish had continued their upstream migration; by 41 days the remaining two fish had also migrated upstream of the initial tagging site.

Migration rates between tracking dates ranged from -0.3 km/day (downstream migration) to 4.6 km/day. Average individual fish migration rates for the entire study period ranged from 0.5 km/day to 2.1 km/day.

Discussion

Finding radio tagged steelhead (two) in Serb and Willow creeks was significant as these creeks were not previously identified as a systems utilized by steelhead. In fact Humphries and Morley (1978) believed that Zymoetz River steelhead only spawned in the mainstem river and at only two locations: the outlet of McDonell Lake and the area in the immediately vicinity of the Passby/Willow creek confluences. They felt sampling more than one location on the Serb was unnecessary as the river had high turbidity and consistently low water temperatures (5 degrees C). Chudyk (1980) and Lough (1983) also found Serb Creek to be glacial, cold and low in fisheries values.

Four steelhead spawned in the vicinity of the Coal and Sandstone creek-Zymoetz River confluences. Lough (1983) also noted that a radio tagged fish spawned in or near the lower end of Coal Creek and that Coal and Sandstone creeks supported juvenile rainbow trout. Lough summarized the Zymoetz River spawning habitat as "McDonell Lake outlet, mainstem and side channels below Clore River and tributaries and side channels from Red Canyon Creek to Coal Creek".

The timing of spawning was not determined in this study. However, 5 radio tagged fish (4 ♀ ,1 ♂) were either last tracked May 27 or began emigrating after May 27 (Table 1.). These five fish appear to have spawned in Coal Creek, Willow Creek, Serb Creek, the outlet of McDonell Lake and at the Coal Creek-Zymoetz River confluence. Three fish (2 ♂ ,1 ♀) were either last tracked June 9 or began their downstream emigration after June 9. Again, it was assumed that these three fish had completed spawning by this time. These fish appear to have spawned in Serb Creek or at the Coal-Sandstone creeks-Zymoetz River confluence areas. Three fish (1♂ ,2♀) were located at potential spawning sites on the last tracking flight. These fish were at the Coal Creek-Zymoetz River confluence, the Surprise Creek-Zymoetz River confluence and the McDonell Lake outlet on June 17.

In comparison, Lough (1980) radio tagged six steelhead between km 32 and 38 on August 23, 1978. Spawning locations were found for only two fish. One wintered in McDonell Lake and spawned at the outlet while the other wintered in the mainstem near Red Canyon Creek and also moved upstream to spawn at the outlet. Spawning for one of the fish was completed between May 25 and June 7. Lough (1983) also noted that although spawning took place in mid-May to early June, some held as long as until July 10.

Fishing is permitted on the Zymoetz River below Limonite Creek and on the Clore River year round. All other Skeena River summer run steelhead streams are closed to fishing while steelhead are overwintering and spawning. Chudyk and Whately (1980) reported that the area from the Clore River upstream to the end of the Copper River Road (downstream of Limonite Creek) was the most successfully fished area on the Zymoetz system, with 67.8% of the total catch reported. Lough (1983) recommended that "if (the fish below Limonite Creek) turn out to be mostly summer fish, then this fishery should be closed to afford them the same protection that covers the rest of the

summer run.". In view of these earlier studies and the results of the present investigation, existing angling regulations on the Zymoetz River are inconsistent with Skeena summer steelhead conservation objectives.

Recommendations

1. Population estimates conducted solely at the McDonell Lake outlet area would not reflect Zymoetz River summer run steelhead escapement; tributaries such as Serb, Coal and Willow creeks, as well as areas of the mainstem Zymoetz near the Coal and Sandstone creek confluences would have to be included. Estimates conducted at the McDonell Lake outlet area could serve as an index however.

2. This study clearly demonstrated that summer steelhead overwinter in areas of the mainstem Zymoetz River downstream of Limonite Creek, and that areas of the river adjacent to Kitnayakwa Creek are relatively densely populated. All summer run steelhead streams throughout the Skeena River drainage upstream from the Zymoetz River are closed to fishing after December 31. The Zymoetz River summer run steelhead be afforded the same protection through modification of current regulations.

Acknowledgments

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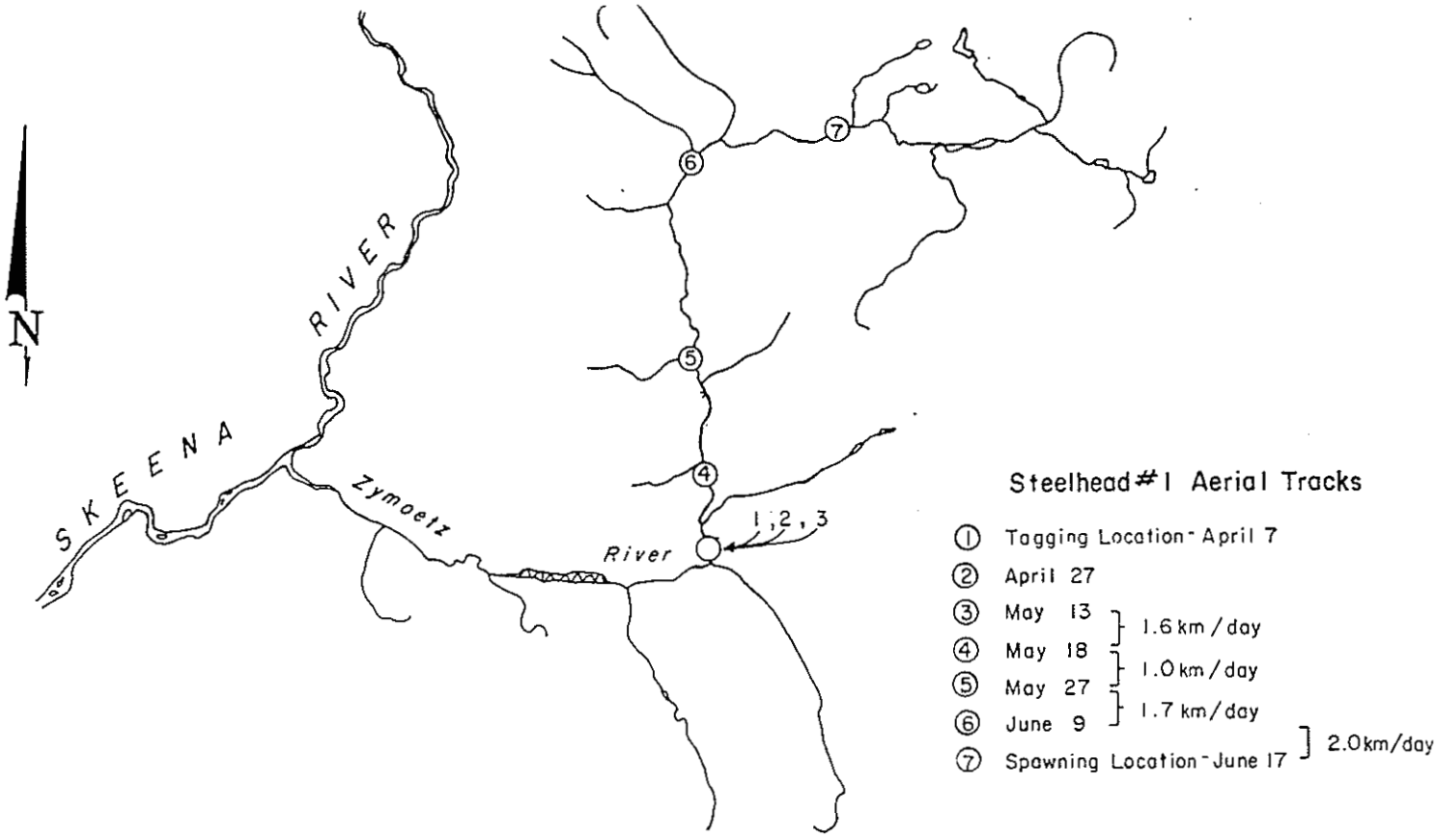
Appendices

Appendices 1-14: Movements of individual radio tagged steelhead and minimum rates of travel between tracking dates.



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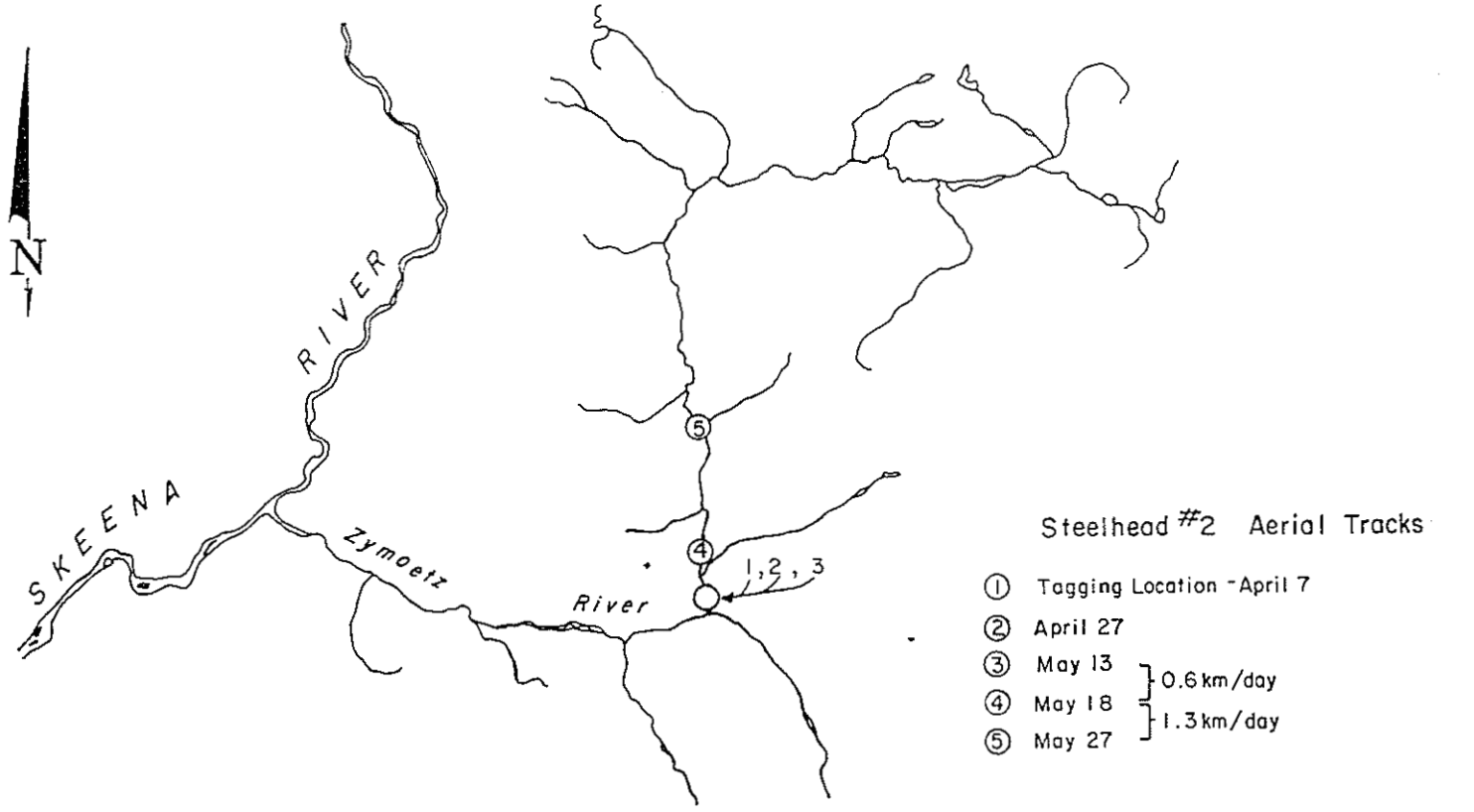

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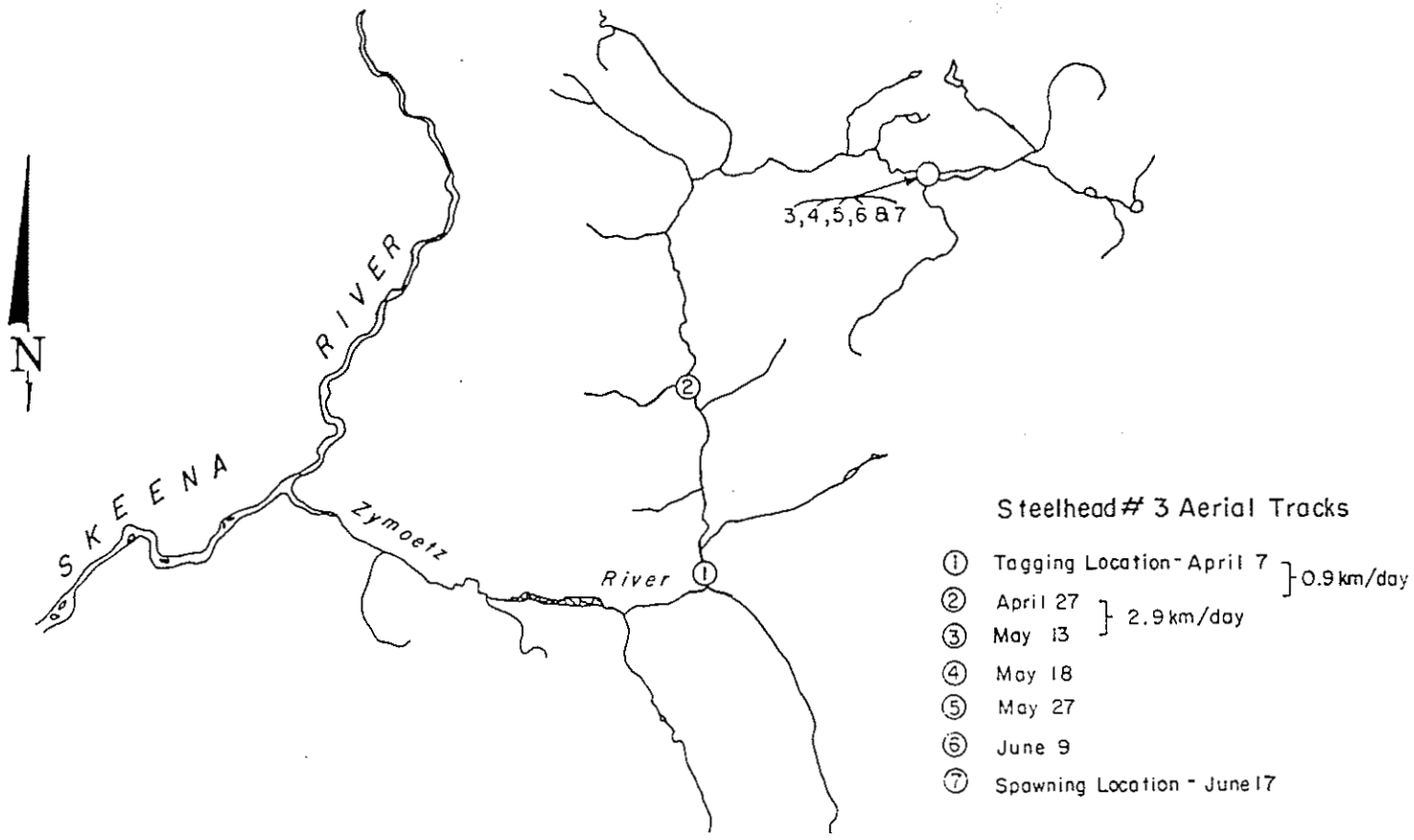

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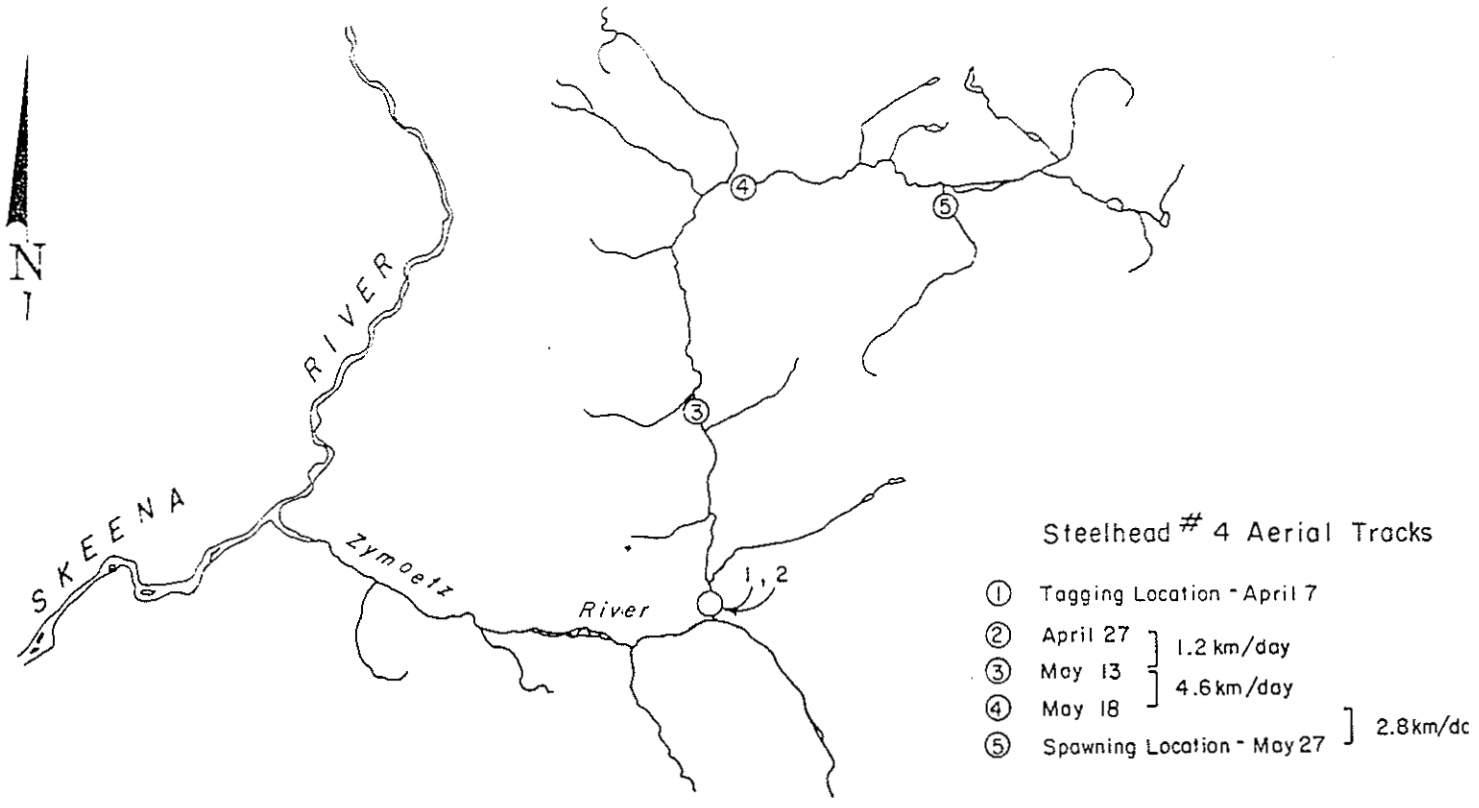

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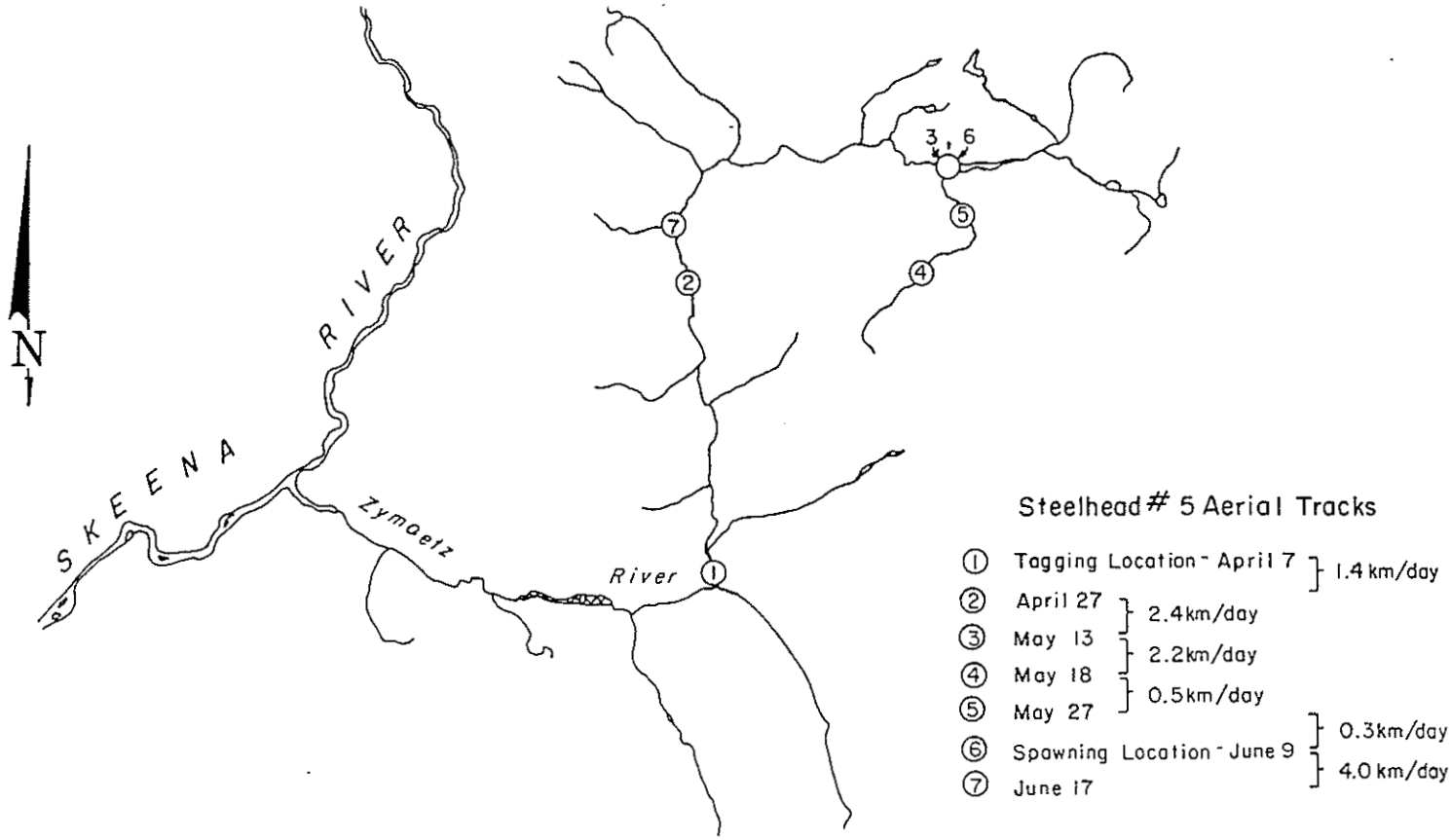

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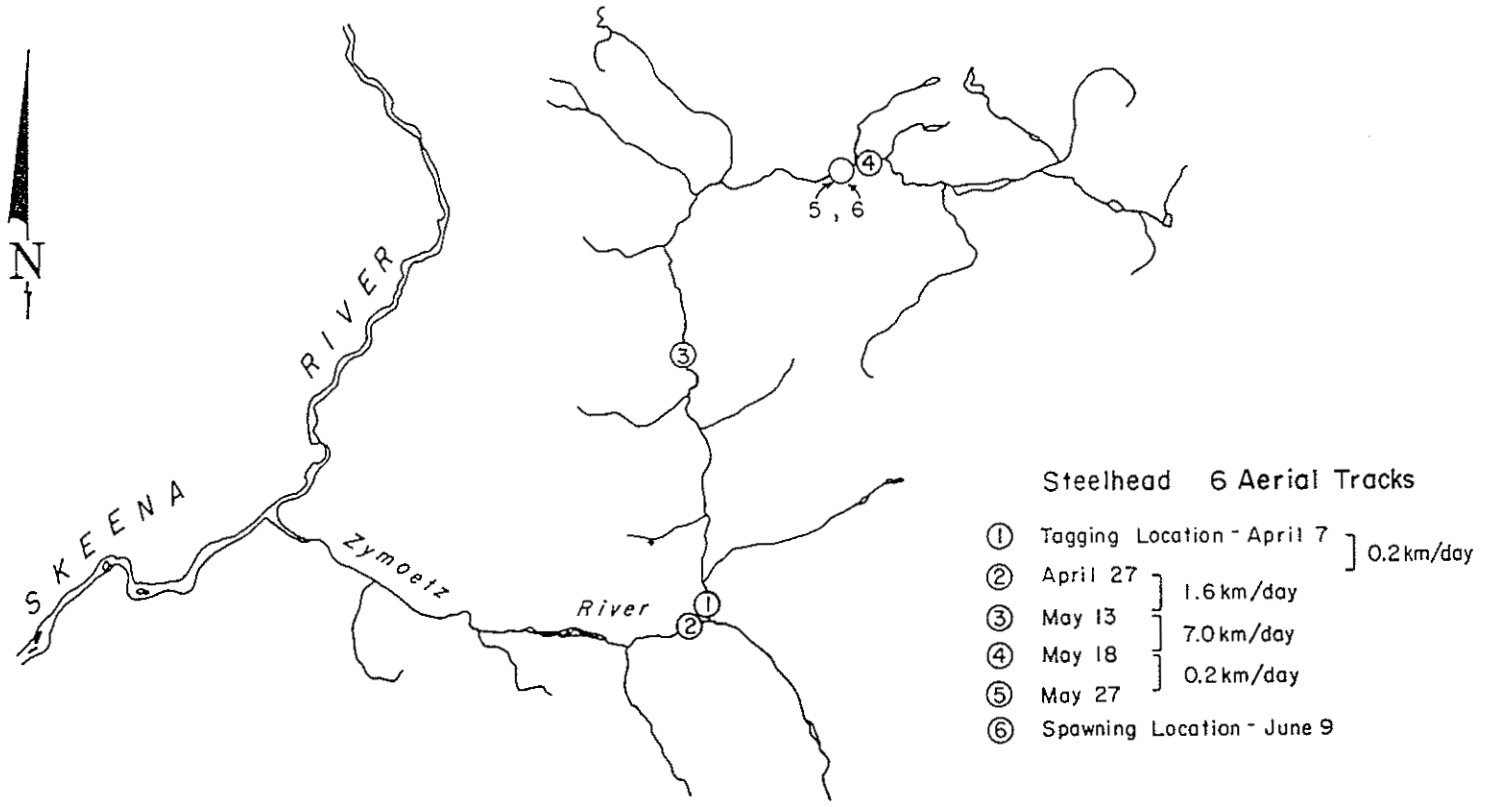

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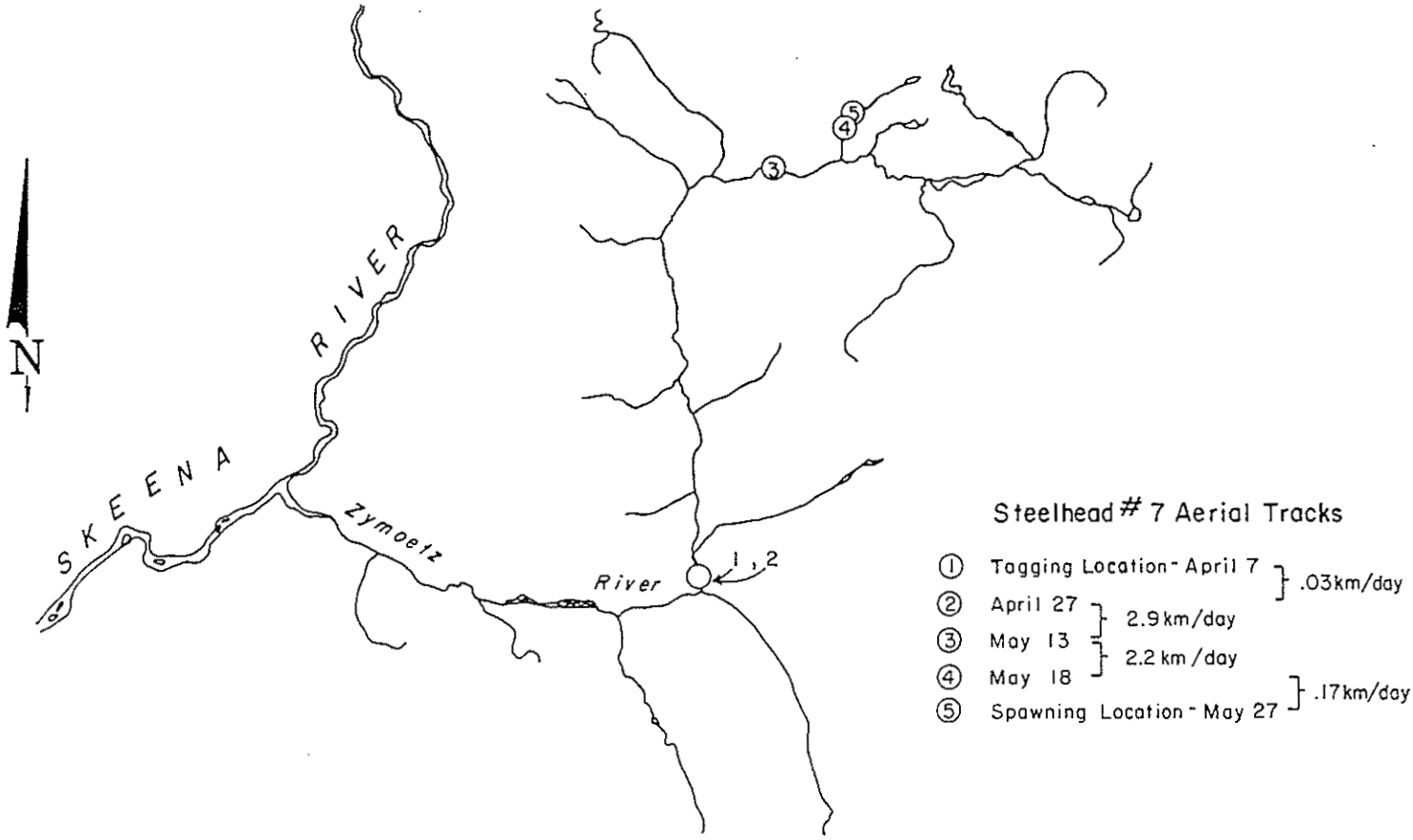

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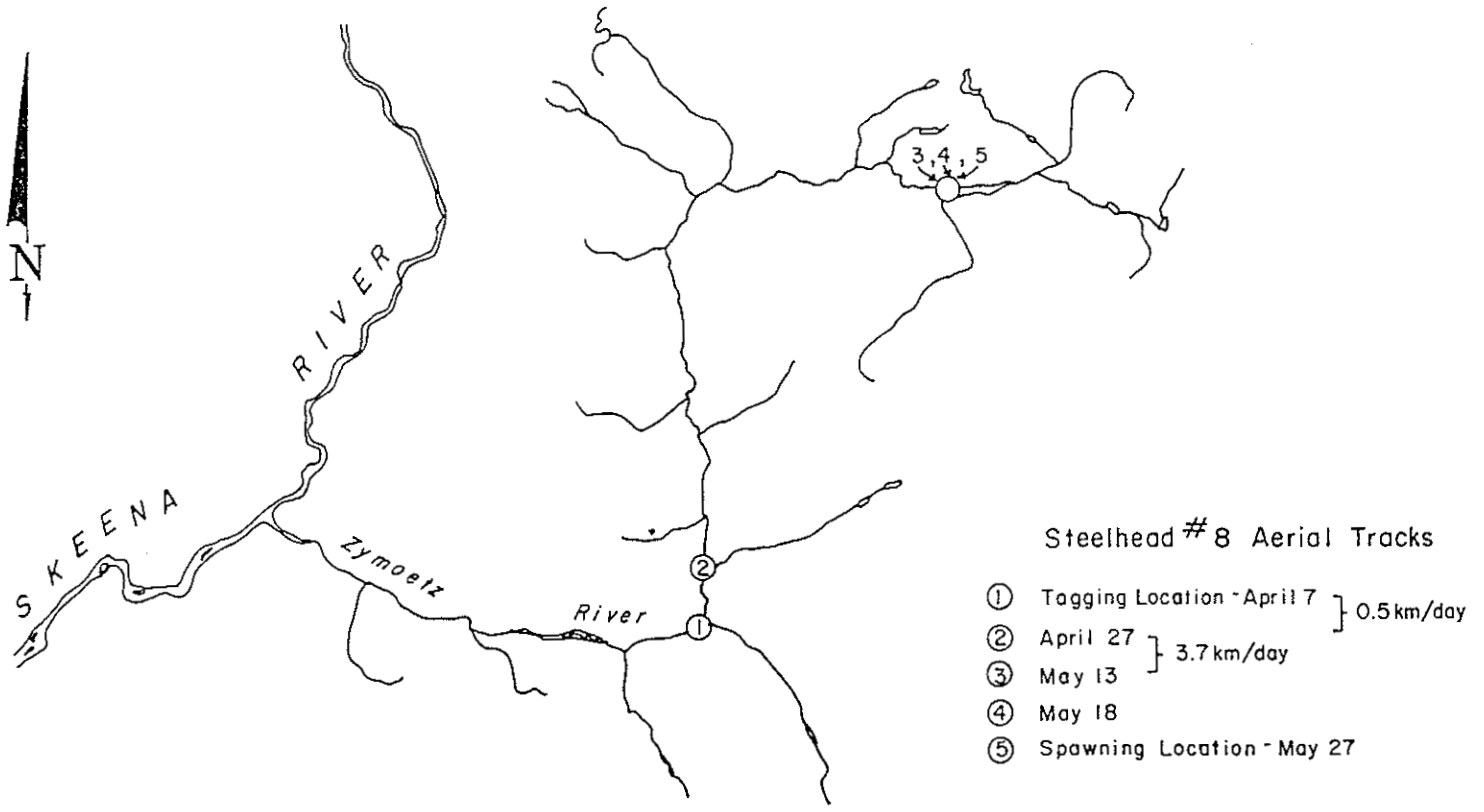

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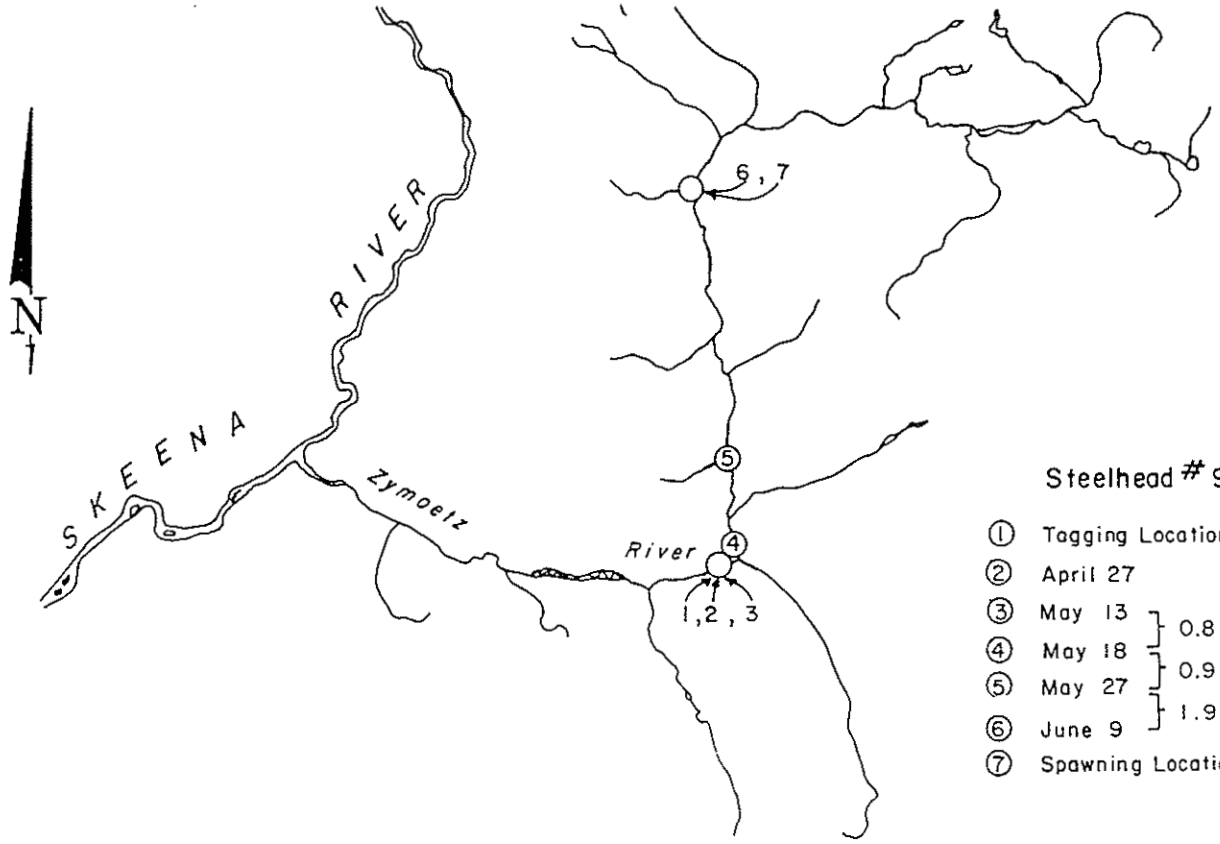

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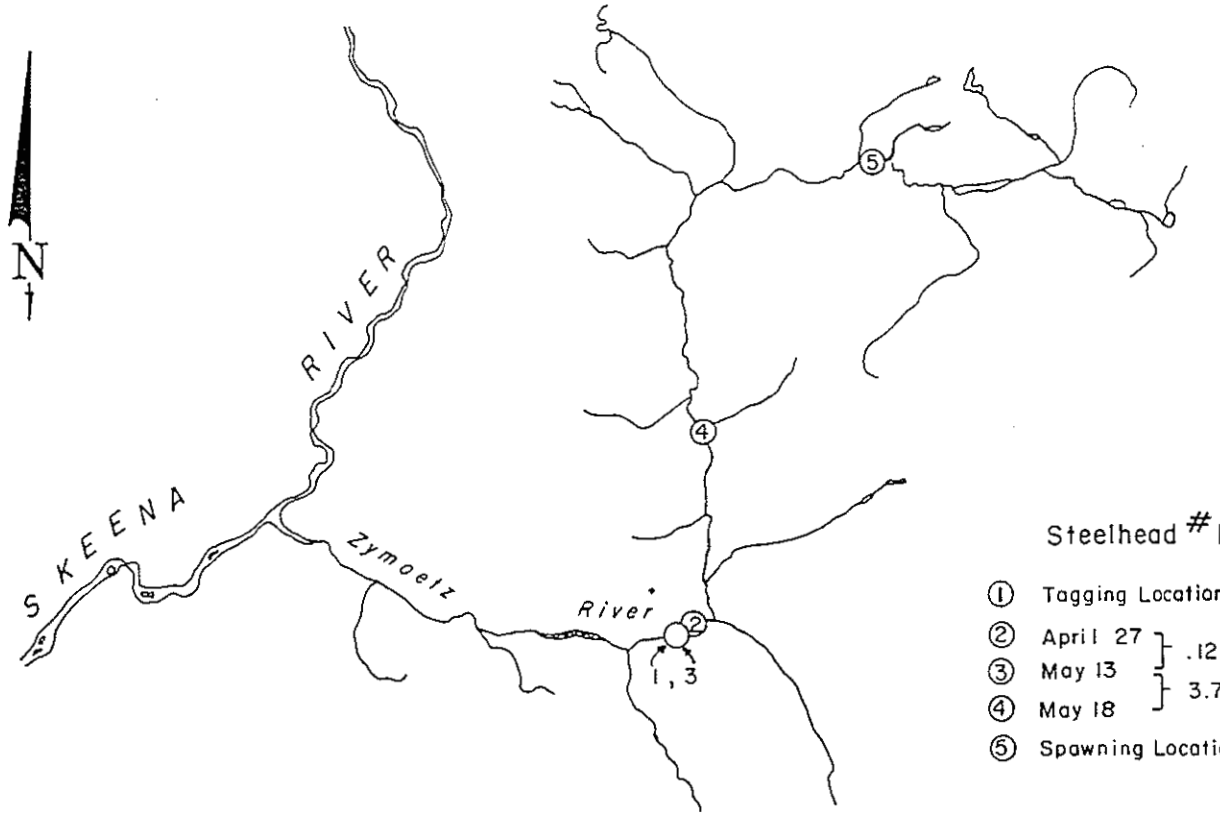

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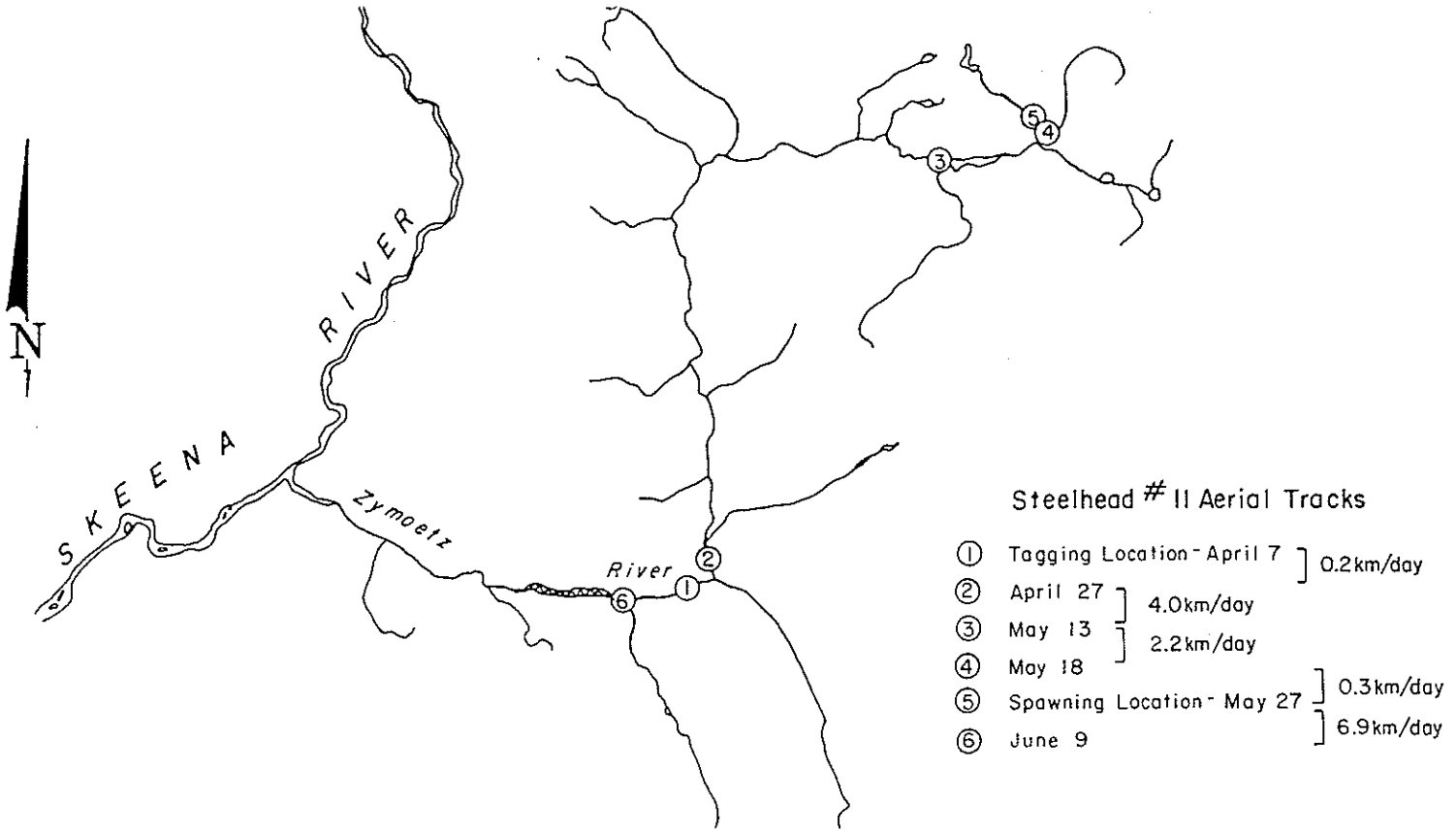

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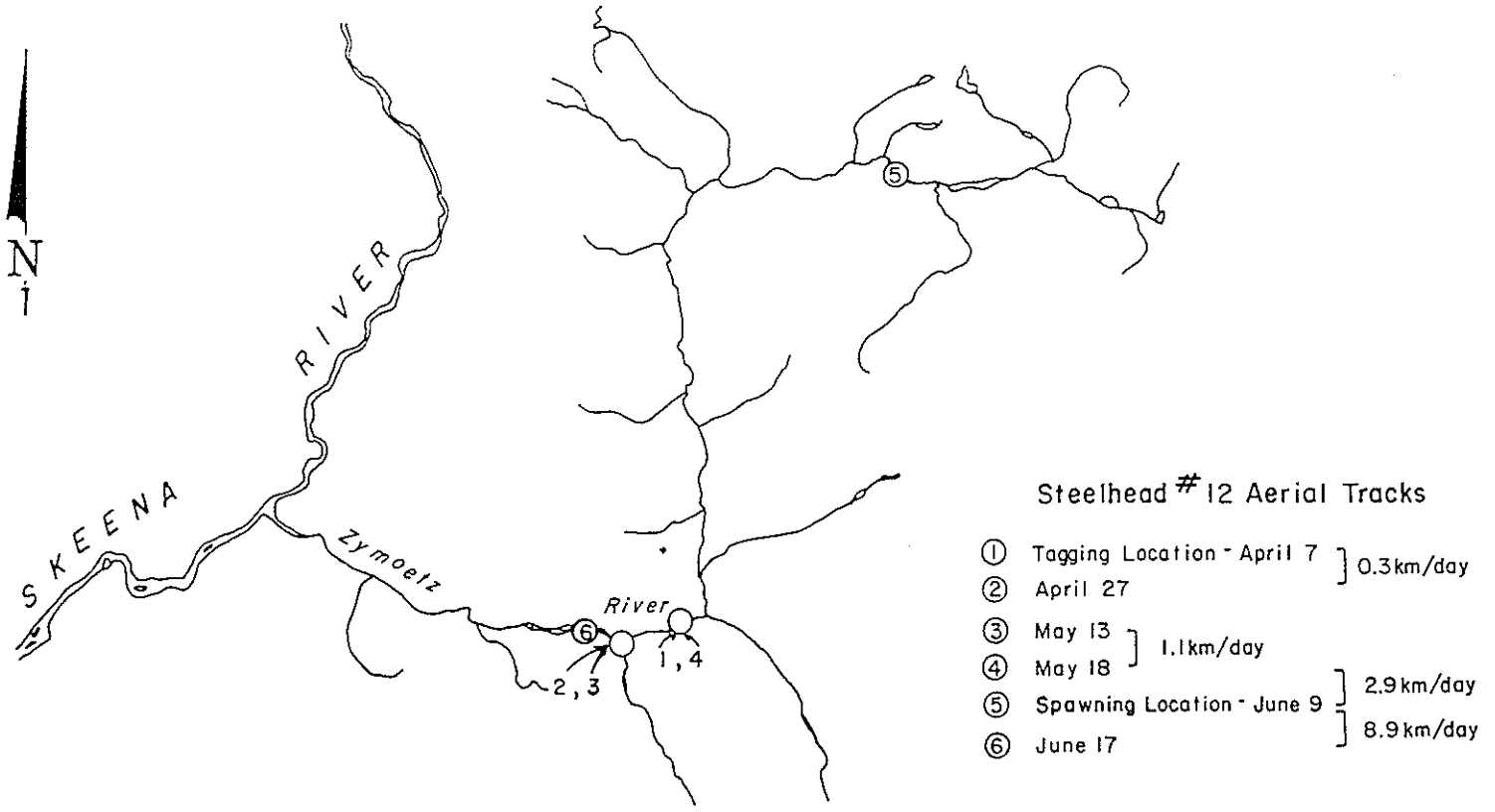

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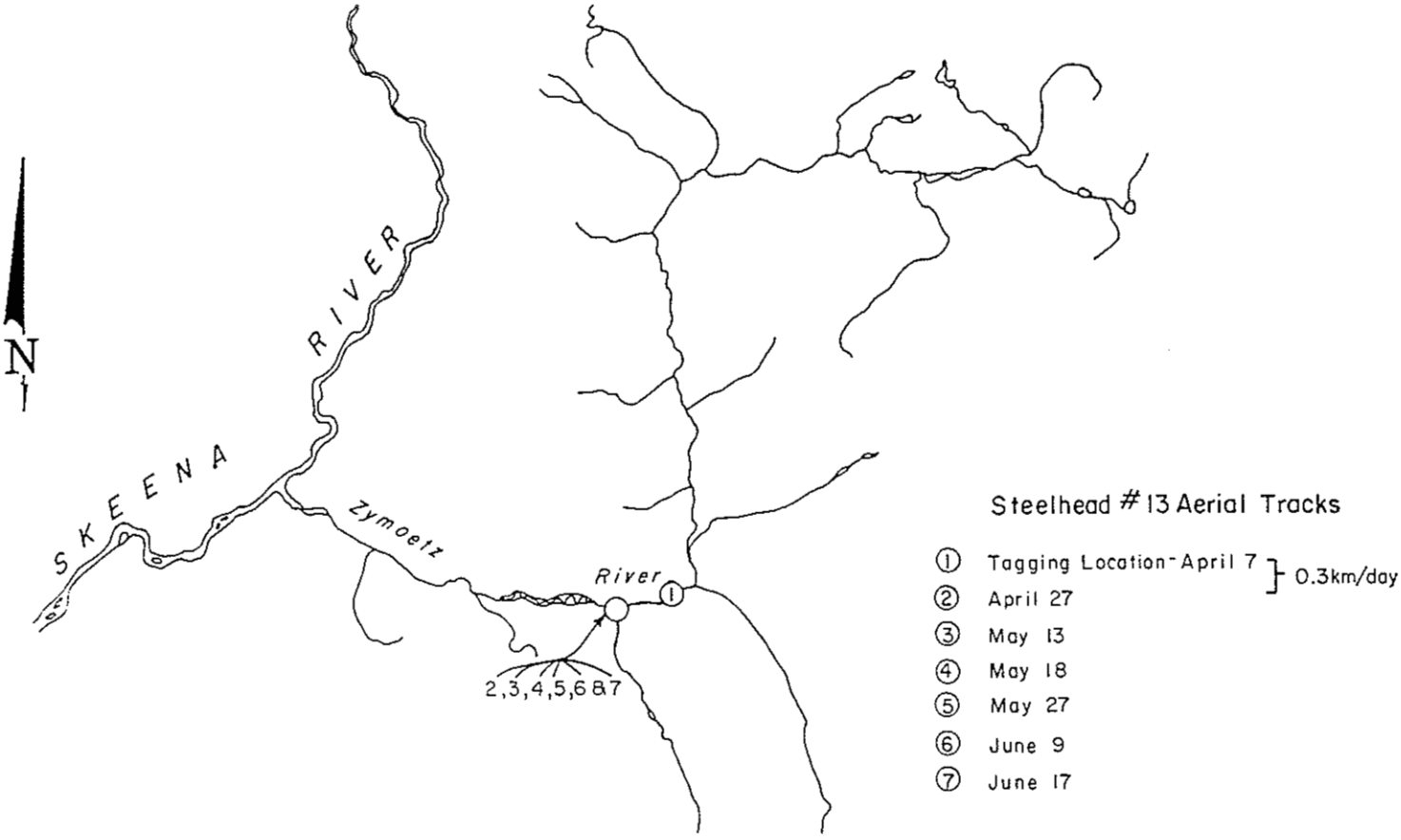

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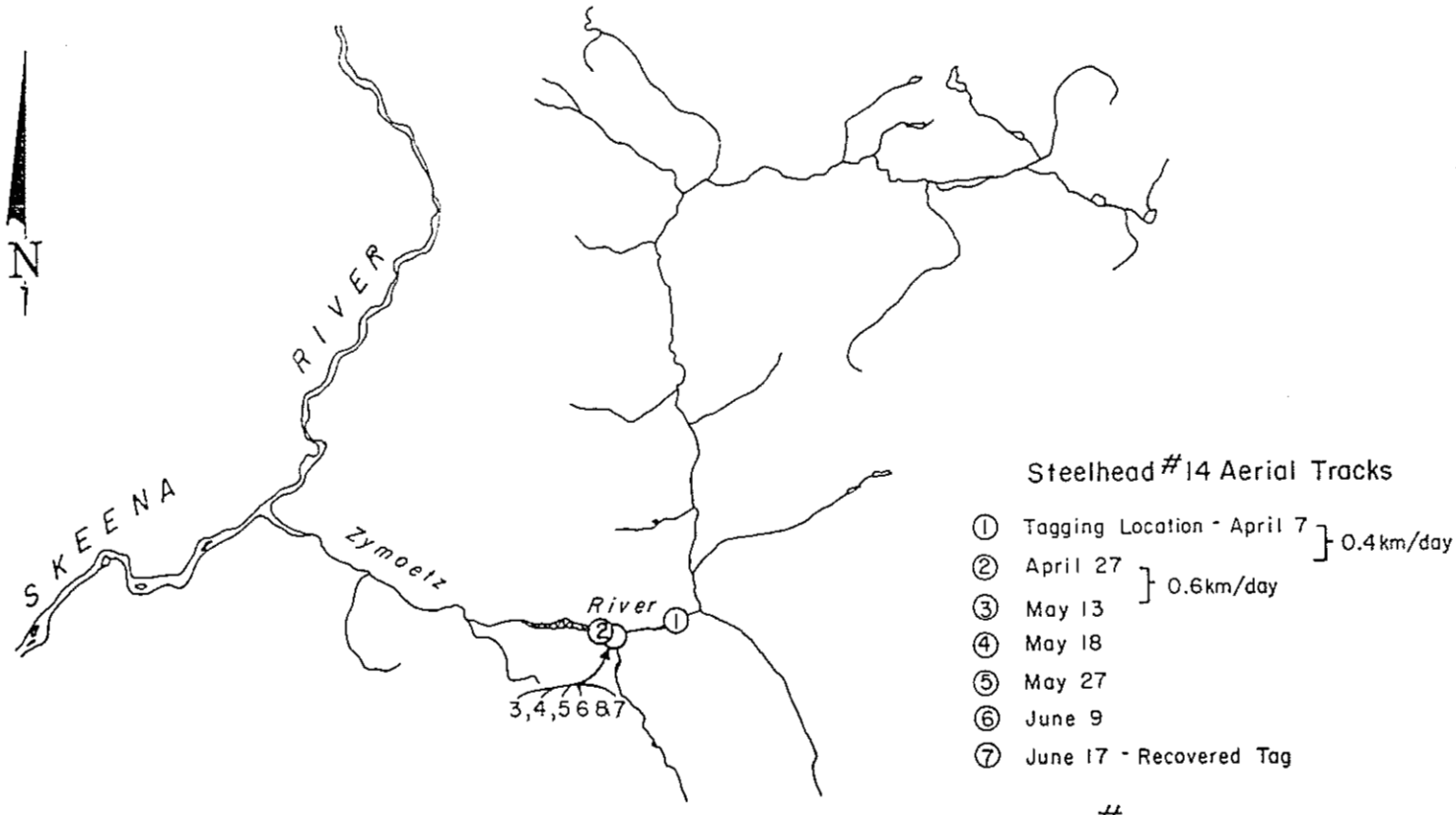

Appendix 14. Movements of Radio Tagged Steelhead, Fish #14