

Lake Chelan Kokanee Spawning Ground Surveys 2010 Final Report



Spawning kokanee (*Oncorhynchus nerka*) in Company Creek – Chelan County PUD, 2005. (Photo by Brad Buchsieb)

Prepared by:
Barry G. Keesee
Steve L. Hemstrom
And
Lance M. Keller

Chelan County Public Utility District
327 North Wenatchee Avenue
Wenatchee, Washington 98801

December 2010

Table of Contents

Table of Contents.....	2
List of Tables.....	3
List of Figures	3
Introduction	4
Study Area and Methods.....	4
Results and Discussion.....	5
Kokanee Spawners	5
Stehekin Tributaries.....	5
Lake Chelan Tributaries	6
Chinook Spawners.....	9
Summary and Conclusions	9
Fish Stocking	10
Acknowledgements	12
References	13

List of Tables

Table 1. Kokanee spawners observed in Stehekin River tributaries, 2010.....	6
Table 2. Kokanee spawners observed in Lake Chelan tributaries, 2010.....	7
Table 3. Peak kokanee spawner counts in the Lake Chelan drainage, 2001-2010.....	8
Table 4. Estimated kokanee escapement in the Lake Chelan drainage, 2001-2010.....	8
Table 5. Peak chinook spawner counts and estimated escapement in Company Creek and Blackberry Creek, 2001-2010.....	9
Table 6. Numbers of kokanee stocked into Lake Chelan from 1994 to 2010.....	11

List of Figures

Figure 1. Lake Chelan drainage with associated kokanee and chinook spawning streams.....	14
Figure 2. Total estimated kokanee escapement for Company, Blackberry, Safety Harbor, 25-Mile, and First Creeks, 2001-2010.....	15
Figure 3. Stehekin Area drainage with associated kokanee and chinook spawning streams.....	16

Introduction

Annual kokanee (*Oncorhynchus nerka*) and chinook (*Oncorhynchus tshawytscha*) salmon spawning ground surveys have been conducted within the Lake Chelan drainage by the Chelan County Public Utility District (District) since 1984. The District conducts these surveys as part of the Lake Chelan Fishery Plan (LCFP), which is included in Article 404 of the new Project License (FERC Project No. 637). The purpose of the District's spawning surveys within the basin is to document the annual trends of kokanee and chinook spawning populations and the effects of management actions within the Lake Chelan drainage.

Kokanee were stocked into Lake Chelan in 1917 and became the dominant sport fish in the lake until the mid 1970s. Kokanee populations declined after introductions of opossum shrimp (*Mysis relicta*) in 1967 (Brown 1984). Mysids were introduced to provide additional forage for kokanee; however, they appeared to be competitors with younger age classes of kokanee for the limited food sources in the lake. Mysids are generally not available to kokanee as forage, because they prefer to inhabit deeper water during daylight hours while kokanee feed near the surface (Peven 1989).

Chinook were originally introduced into Lake Chelan by the Washington Department of Fisheries (WDF)¹ in the mid 1970s and again in the 1990s to provide for a "trophy" fishery. The chinook grew well for the first few seasons, but their growth appeared to be tied to the abundance of kokanee (Brown 1984). The chinook have established an adfluvial population, with adult fish being observed on the spawning grounds and taken in the sport fishery.

Study Area and Methods

Most tributaries of Lake Chelan are generally steep and short (Figure 1). The Stehekin River is the principle tributary feeding the lake. The Stehekin is a relatively large glacial stream with the headwaters originating in the Cascade Mountains. The drainage covers an area of 321 square miles. The monthly mean flow for the Stehekin ranged between 412 and 3,861 cubic feet per second, based on data from water years 2001-2009 (*Water Watch*) courtesy of the U.S. Geological Survey. Kokanee spawn in the Stehekin River and primarily in two tributaries of the Stehekin: Company and Blackberry creeks (Figure 3). Except for the Stehekin River, kokanee do not travel far up the other Lake Chelan tributaries to spawn. The steep gradient of the streams usually confines kokanee spawning to the lower quarter mile. Kokanee run timing along Lake Chelan starts in the Stehekin Valley and progresses down lake throughout the spawning migration. The down lake streams included in the annual spawning ground surveys are Fish, Prince, Safety Harbor creeks (all on the north shore) and 25-Mile and First creeks on the south shore.

¹ In 1994, Washington Department of Fisheries (WDF) and Washington Department of Wildlife (WDW) merged to form Washington Department of Fish and Wildlife (WDFW).

In 2010, district personnel conducted surveys between 9 September and 14 October approximately every 7 days (Table 1). Surveys consist of walking in or along streams and counting all live kokanee and chinook. Large masses of kokanee congregating in pools are estimated. Data collected during these surveys are used to determine spawner days and escapement.

Spawner days are the total number of days spent in a stream by a population of fish in order for them to spawn. The estimated number of spawner days for each stream is determined by graphing the number of live fish counted over time and then by calculating the area of the resulting polygons (McNeil 1964; Neilson and Geen 1981; Shepherd et al. 1986).

Escapement is the number of adult fish returning to a stream that escape mortality from harvest and natural attrition, and comprise a spawning population (WDFW 2000). Kokanee escapement is calculated by dividing the estimated number of spawner days by the average time of spawner residence in the stream. The average spawner residence for kokanee is estimated to be 15 days (Brown 1984). The escapement for chinook spawners is estimated by using the same method used for kokanee (McNeil 1964; Neilson and Geen 1981; Shepherd et al. 1986). The average spawner resident time for chinook is estimated to be 13 days. According to Neilson and Geen (1981), a spawner resident time of 13 days is considered to be high and as a result, the escapement estimates are conservative.

Results and Discussion

Kokanee Spawners

Escapement is considered to be a better indicator of run size than peak counts. Escapement indicates the total number of fish that spawn in a stream during the entire spawning season. Peak counts only indicate the maximum number of spawners observed in a stream at one time during the spawning season.

Stehekin River Tributaries

Company Creek

In 2010, surveyors counted 7,176 kokanee in Company Creek during the first survey on 9 September, with a peak count of 29,991 kokanee on 16 September (Table 1). The estimated escapement for Company Creek was 52,824 kokanee (Table 4). In 2009 Company Creek had a peak count of 5,473 kokanee and an estimated escapement of 8,185 (Tables 3 & 4).

Blackberry Creek

In 2010, Surveyors counted 3,950 kokanee in Blackberry Creek during the first survey on 9 September, with a peak count of 4,627 kokanee on 23 September (Table 1). The estimated escapement for Blackberry Creek was 9,324 kokanee (Table 4). In 2009, Blackberry Creek had a peak count of 1,291 kokanee with an estimated escapement of 2,440 (Tables 3 & 4).

Table 1. Kokanee spawners observed in Stehekin River tributaries, 2010.

Survey Dates					
Tributaries	9-Sep	16-Sep	23-Sep	29-Sep	7-Oct
Company Creek	7,176	29,991	29,400	n/a	20,623
Blackberry Creek	3,950	4,425	4,627	n/a	2,947

Lake Chelan Tributaries

Fish Creek

In 2010, Fish Creek had a peak count of 393 kokanee on 16 September (Table 2). The estimated escapement was 551 kokanee (Table 4). In 2009 no kokanee were observed in Fish Creek. In 2008, Fish Creek had a peak count of 10 kokanee with an estimated escapement of 8 (Tables 3 & 4). In 2007, the woody debris that had been blocking the mouth of Fish Creek in 2006 was no longer present and kokanee spawners were able to access the stream. In 2007, the peak count was 220 with an estimated escapement of 172 (Tables 3 & 4).

Prince Creek

In 2010, Prince Creek had a peak count of 11 kokanee on 16 September (Table 2). The estimated escapement was 15 kokanee (Table 4). In 2009 Prince Creek had a peak count of 14 kokanee with an estimated escapement of 12 (Tables 3 & 4). The access for kokanee spawners in 2010 was blocked a short distance from the mouth due to habitat improvement structures placed in the stream. No spawners were observed above these structures. For more information about the habitat improvement structures please refer to Stone and Fielder (2004).

Safety Harbor Creek

In 2010, Safety Harbor Creek had a peak count of 15 kokanee on 7 October (Table 2). The estimated escapement was 26 kokanee (Table 4). In 2009, Safety Harbor Creek had a peak count of 74 kokanee with an estimated escapement of 84 (Tables 3 & 4). Safety Harbor Creek experiences heavy recreational use by hikers and campers. Recreators create swimming holes by blocking the water flow with rock dams. These rock dams make it difficult for spawning kokanee to ascend upstream. In 2010, Chelan County PUD survey staff again removed parts of the rock dams to allow kokanee better access. In 2008, the peak count was 21 kokanee with an estimated escapement of 20. In 2007, the peak count was 5 kokanee with an estimated escapement of 4. During the 2006 spring runoff a log jam was dislodged making it easier for kokanee to ascend further up the stream. In 2006, the peak count was 119 kokanee with an estimated escapement of 149 (Tables 3 & 4).

25-Mile Creek

In 2010, 25-Mile Creek had a peak count of 63 kokanee on 30 September (Table 2). The estimated escapement was 86 kokanee (Table 4). No kokanee were observed above the culvert that passes under the South Lake Shore Road. In 2009, 25-Mile Creek had a peak count of 110 kokanee with an estimated escapement of 143 (Tables 3 & 4). In 2009, kokanee spawners were observed a short distance above the culvert that passes under the South Lake Shore Road. The distance in drop from the culvert to the

pool below has increased over the last several years. This and low water flow may make it difficult for some kokanee to travel further upstream. In 2008, the peak count was 320 kokanee with an estimated escapement of 519. In 2008, kokanee spawners were observed a short distance above the culvert that passes under the South Lake Shore Road. In 2007, the peak count was 12 kokanee with an estimated escapement of 22 (Tables 3 & 4). No kokanee spawners were observed in 2007 above the culvert that passes under the South Lake Shore Road due to low water flow and blockage.

First Creek

In 2010, First Creek had a peak count of 69 kokanee on 30 September (Table 2). The estimated escapement was 100 kokanee (Table 4). In 2009, First Creek had a peak count of 80 with an estimated escapement of 56. In 2008, the peak count was 144 kokanee with an estimated escapement of 200 (Tables 3 & 4). No kokanee were observed in First Creek during the 2007 kokanee spawning surveys.

Grade Creek

No kokanee were observed in Grade Creek in 2010. Grade Creek was not surveyed in 2009. No kokanee were observed in Grade Creek from 2006 through 2008 spawning surveys.

Gold Creek

No kokanee were observed in Gold Creek in 2010. Gold Creek was not surveyed in 2009. No kokanee were observed in Gold Creek from 2006 through 2008 spawning surveys.

Mitchell Creek

No kokanee were observed in Mitchell Creek in 2010. Mitchell Creek was not surveyed in 2009. No kokanee were observed in Mitchell Creek during the 2007 and 2008 spawning surveys. In 2006 Mitchell Creek had a peak count of 10, with an estimated escapement of 7 (Tables 3 & 4). No kokanee were observed spawning in Mitchell Creek from 2003-2005.

Table 2. Kokanee spawners in Lake Chelan tributaries, 2010.

Survey Dates										
Tributaries	9-Sep	16-Sep	17-Sep	23-Sep	24-Sep	29-Sep	30-Sep	7-Oct	8-Oct	14-Oct
Fish Creek	n/a	393		355		250		176		
Prince Creek	n/a	11		9		5		7		
Safety Harbor	0	8		12		12		15		8
25-Mile Creek	n/a		22		40		63		42	19
First Creek	n/a		37		61		69		57	20
Grade Creek	No surveys conducted									0
Gold Creek										0
Mitchell Creek										0

Table 3. Peak kokanee spawner counts in the Lake Chelan drainage, 2001-2010.

Spawning Area	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
Company Creek	10,058	16,388	26,320	35,445	26,951	14,649	7,149	6,619	5,473	29,991	
Blackberry Creek	6,966	13,046	20,596	17,100	13,158	6,437	4,841	1,605	1,291	4,627	
Safety Harbor		101		2	20	119	5	21	74	15	
25-Mile Creek	122	465	112	17	727	284	12	320	110	63	
First Creek	84	375	0	34	462	44	0	144	80	69	
Mitchell Creek		12	0	0	0	10	0	0		0	
Gold Creek		1	0	0	14	0	0	0		0	
Grade Creek		65	0	0	13	0	0	0		0	
Prince Creek		269	73	184	246	72	57	2		14	11
Fish Creek		359	49	261	351	0	220	10		0	393
Total of Company, Blackberry, Safety-Harbor, 25-Mile, and First Creek		17,230	30,375	47,028	52,598	41,318	21,533	12,007		8,709	7,028

Table 4. Estimated kokanee escapement in the Lake Chelan drainage, 2001-2010.

Spawning Area	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
Company Creek	23,255	33,349	54,376	58,231	63,256	32,927	19,182	16,246	8,185	52,824	
Blackberry Creek	16,138	23,962	46,797	36,125	29,177	12,815	10,523	4,622	2,440	9,325	
Safety Harbor		101		1	18	149	4	20	84	26	
25-Mile Creek	162	654	136	15	1,022	319	22	519	143	86	
First Creek	80	557	0	20	566	30	0	200	56	100	
Mitchell Creek		14	0	0	0	7	0	0		0	
Gold Creek		1	0	0	7	0	0	0		0	
Grade Creek		73	0	0	7	0	0	0		0	
Prince Creek		269	73	235	245	93	45	2		12	15
Fish Creek		361	49	390	482	0	172	8		0	551
Total of Company, Blackberry, Safety-Harbor, 25-Mile, and First Creek		39,635	58,623	101,309	94,392	94,039	46,240	29,732		21,607	10,908

Chinook Spawners

Company Creek

In 2010, Company Creek had a peak count of 27 chinook spawners with an estimated escapement of 28. In 2009, Company Creek had a peak count of 33 chinook spawners with an estimated escapement of 49. In 2008, the peak count was 7 chinook with an estimated escapement of 9 (Table 5).

Blackberry Creek

In 2010, Blackberry Creek had a peak count of 2 chinook spawners with an estimated escapement of 3. In 2009, Blackberry Creek had a peak count of 5 chinook spawners with an estimated escapement of 10. In 2008, the peak count was 5 chinook with an estimated escapement of 8 (Table 5).

Table 5. Peak chinook spawner counts and estimated escapement in Company Creek and Blackberry Creek, 2001-2010.

Peak Counts	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Company Creek	6	3	2	2	18	0	2	7	33	27
Blackberry Creek	4	3	14	18	17	3	3	5	5	2

Escapement	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Company Creek	11	5	3	3	19	0	3	9	49	28
Blackberry Creek	7	5	20	41	17	5	5	8	10	3

Summary and Conclusions

Company, Blackberry, Safety Harbor, 25-Mile, and First creeks have been surveyed consistently since 1981. Between 1984 and 1989, these creeks comprised approximately 97.1% to 99.6% of the kokanee escapement when all streams with spawning habitat were surveyed (Peven 1990). From 1981 to 2005, there has been an overall steady increase in the estimated kokanee escapement for Company, Blackberry, Safety Harbor, 25-Mile, and First creeks. However, the estimated kokanee escapement for 2006 decreased greatly possible due to a flood event that occurred in the fall of 2003 in the Stehekin valley (Figure 2), which likely scoured many of the kokanee redds in Company and Blackberry creeks. From 2006 through 2009 kokanee escapement in Company and Blackberry creeks had steadily decreased. The estimated escapement for these aforementioned streams in 2009 was 10,908 kokanee. In 2010, the escapement increased substantially to 62,361 (Table 4). The majority of kokanee spawners are either 3 or 4 year old fish (2+ and 3+ fish) (Peven 1990).

Mysids are present in Lake Chelan. Mysids may compete with younger age classes of kokanee for food and can have a substantial impact on the kokanee population in the lake. Large predatory fish such as chinook and lake trout can also adversely affect a kokanee population.

Fish Stocking

Article 6(d) and Section 4.6.3 of Chapter 6 of the Comprehensive Plan requires Chelan PUD to make available to the WDFW sufficient funding to rear annually the following resident fish at the Chelan Hatchery for stocking in Lake Chelan:

1. Approximately 5,000 pounds of salmonid fingerlings (for example: 500,000 fish at 100 fish/lb., presently kokanee).
2. Approximately 33,000 pounds of catchable-sized salmonids (for example: approximately 100,000 fish at 3 fish/lb., presently Westslope cutthroat trout and triploid rainbow trout).

As provided in Article 6(d) (1), the estimated cost to Chelan PUD of these activities is \$30,000 per year (in 2003 dollars).

Article 6(d) (2) and Section 4.6.3 of Chapter 6 of the Comprehensive Plan provide that:

(2) If WDFW, after coordination with the National Park Service, United States Department of Agriculture Forest Service, and United States Fish and Wildlife Service, and after consultation with the Lake Chelan Fishery Forum, decides, at any time during the term of the New License or any subsequent annual licenses, to reduce or eliminate fish stocking into Lake Chelan, the resulting savings shall be available to WDFW for other Lake Chelan fish management activities. Funds to be made available from reductions in fish production shall be determined as equivalent to the proportion of fish production poundage reduced. The funds saved shall be calculated as follows: take the number of pounds of fish production reduced, divide by the 38,000 pounds of fish initially to be produced, and multiply by the \$30,000 (as adjusted under section 19 of the Agreement up to the year of the decision to reduce production). For example, if 5,000 pounds of kokanee production was eliminated, \$3,950 would be available for other fish management activities ($5,000/38,000 \times \$30,000$ escalated = \$3,950 escalated).

The historic stocking effort for kokanee stocking in Lake Chelan from 1994 to the present is shown below (Table 6).

Table 6. Numbers of kokanee stocked into Lake Chelan from 1994 to 2010.

Year	Number	Date released	Release location	Stock used
1994	756,315	April, May	25-Mile Ck	LW, OR
1995	452,400	May	25-Mile Ck	LW
1996	71,060	April	25-Mile Ck	LW
1997	505,659	May	25-Mile Ck	LW
1998	933,021	April, May	Lake & 25-Mile Ck	LW
1999	329,322	April	Lake	LW
2000	478,266	April	Lake	LW
2001	286,831	April	Lake	LW
2002	467,291	May 6, 21, 24	Lake	LW
2003	499,953	May 9, 17, 22	Lake	LW
2004	515,838	May, June	Lake	LW
2005	478,956	May 10, 17, June 13	Lakeside & Mill Bay	LW
2006	0	n/a	n/a	n/a
2007	91,643	May	Lake	LC, LW
2008	227,000	May	Yacht Club	LC
2009	189,524	June	Yacht Club	LC
2010	83,070	May 6	Yacht Club	LC
Total	6,363,149			

Key for fish stock:

OR = Oregon (unspecified)

LW = Lake Watcom (Washington)

LC = Lake Chelan (Washington)

Acknowledgements

Several District employees assisted with spawning surveys this fall. Todd West assisted with manpower and administrative support. Bob Nielsen coordinated transportation arrangements for the field work in the Stehekin Valley. Fish and Wildlife personnel conducting the surveys included: Steve Hemstrom, Barry Keese, and Lance Keller.

References

- Brown, L.G. 1984. Lake Chelan Fisheries Investigations. Washington Department of Wildlife. Wenatchee, WA.
- McNeil, W.J. 1964. Redd Superimposition and Egg Capacity of Pink Salmon Spawning Beds. J. Fish. Res. Bd. Canada. 21: 1385-1396.
- Neilson, J.D. and G.H. Geen. 1981. Enumeration of Spawning Salmon from Spawner Residence Time and Aerial Counts. Trans. Amer. Fish. Soc. 110: 554-446.
- Peven, C.M. 1989. Lake Chelan Spawning Ground Surveys. Chelan County Public Utility District. Wenatchee, WA.
- Peven, C.M. 1990. Lake Chelan Spawning Ground Surveys. Chelan County Public Utility District. Wenatchee, WA.
- Shepherd, B.G., J.E. Hillaby, and R.J. Hutton. 1986. Studies on Pacific Salmon (*Oncorhynchus spp.*) in Phase 1 of the Salmonid Enhancement Program. Volume 1: SUMMARY. Canada. Tech. Rep. Fish, Aquat. Sci. 1482: vii + pp 1-180 (Two Volumes).
- Stone, J.M. and P.C. Fielder. 2004. Lake Chelan Spawning Ground Surveys. Chelan County PUD. Wenatchee, WA.
- Washington Department of Fish and Wildlife (WDFW). 2000. WDFW Summer Chum Salmon Conservation Initiative. www.wdfw.wa.gov

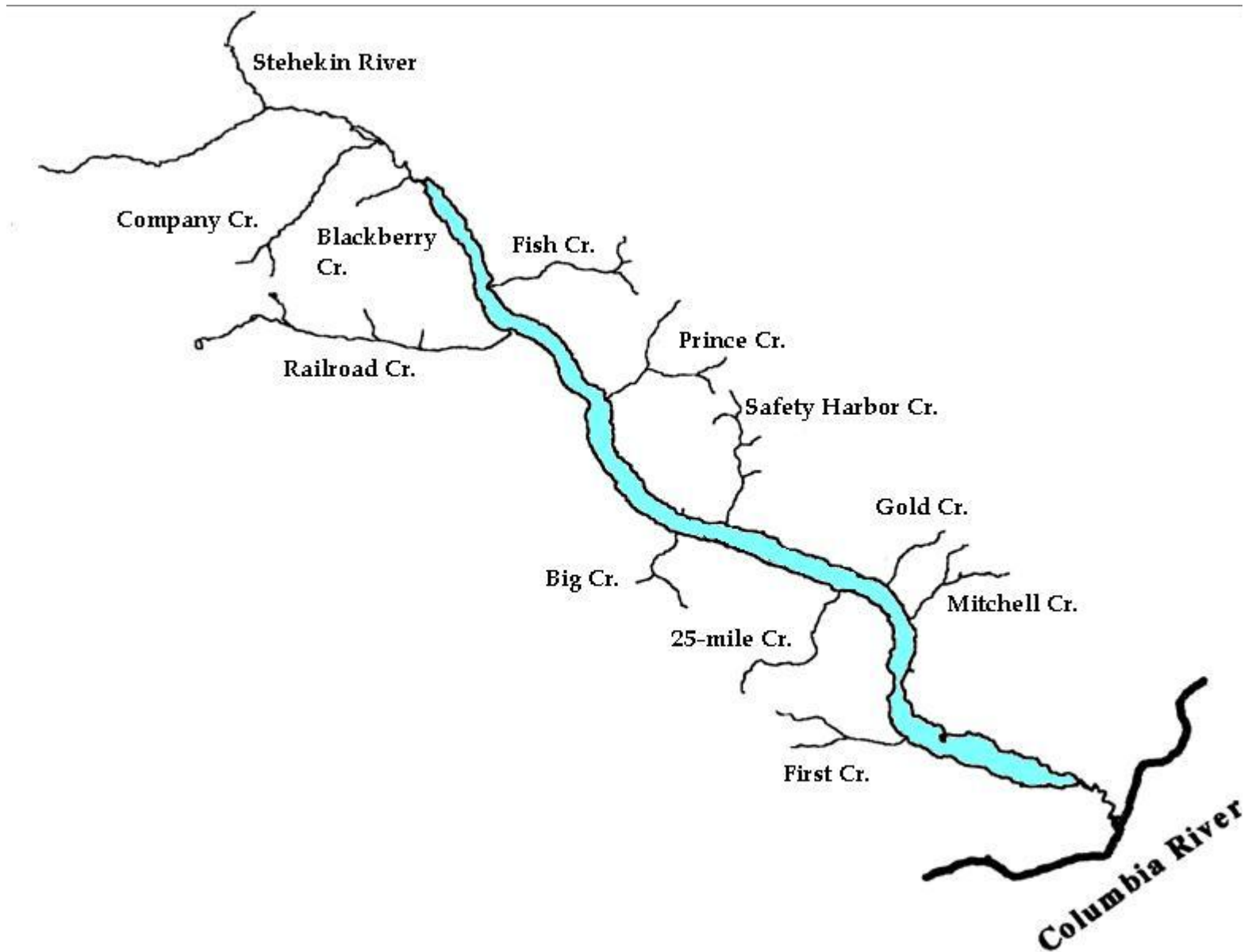


Figure 1. Lake Chelan drainage with associated kokanee and chinook spawning streams.

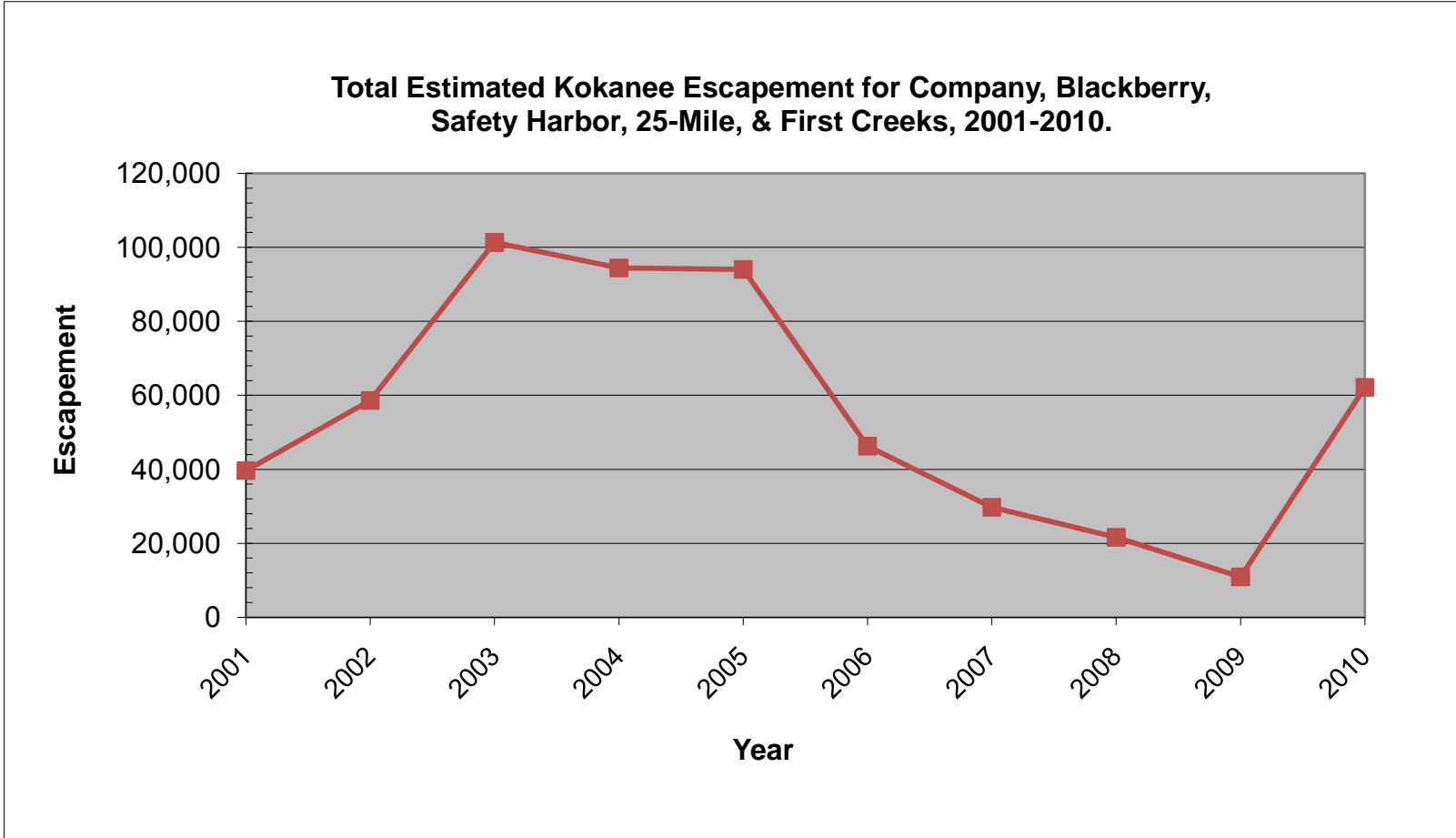


Figure 2. Total estimated kokanee escapement for Company, Blackberry, Safety Harbor, 25-Mile, and First Creeks, 2001-2010

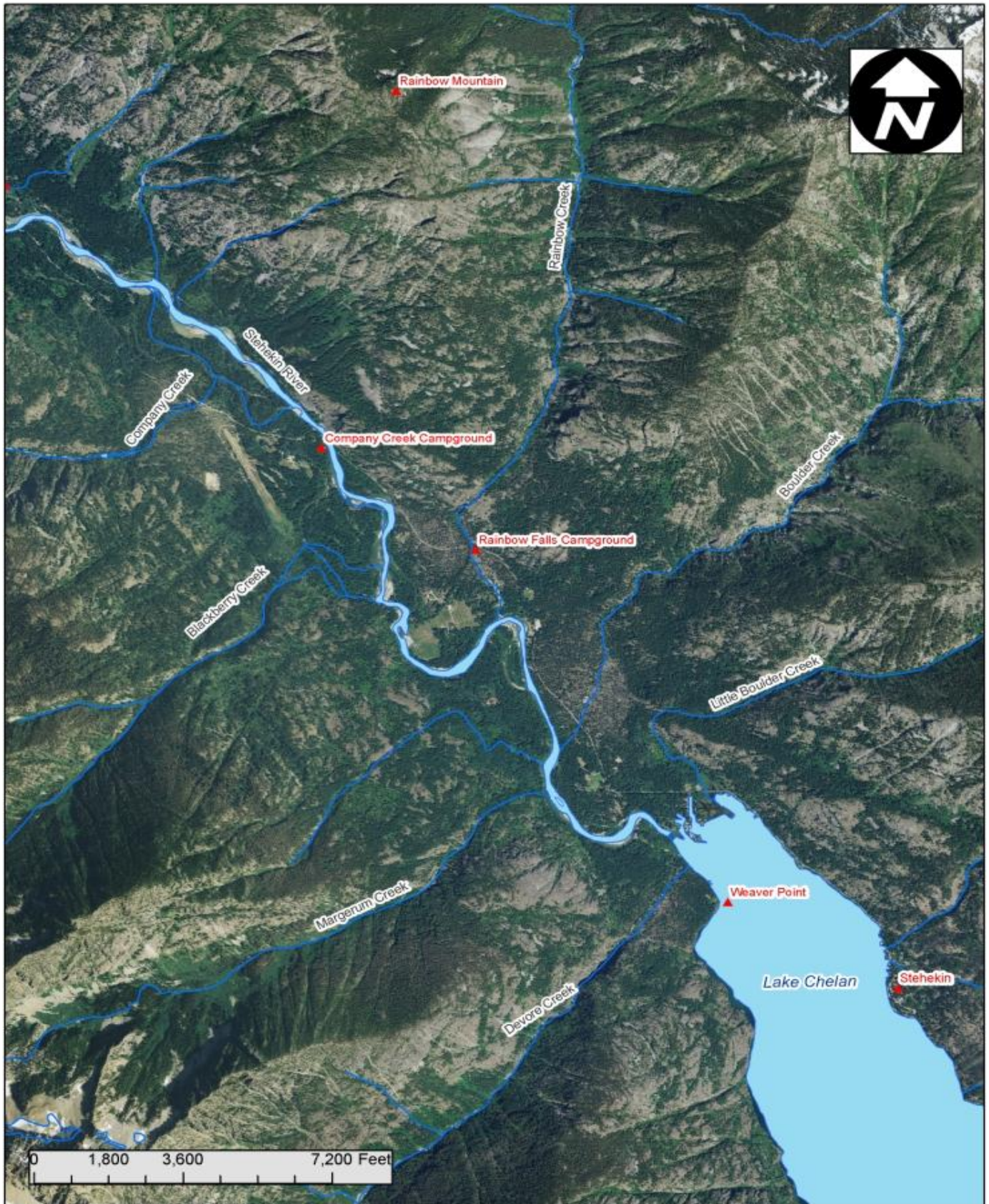


Figure 3. Stehekin Area drainage with associated kokanee and chinook spawning streams.