DRAFT FISHERIES INVESTIGATIONS REPORT 2010

TAKATZ LAKE HYDROELECTRIC PROJECT (FERC No. 13234)

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Prepared for:

City and Borough of Sitka Electric Department

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EXECUTIVE SUMMARY

In February, 2008, the City and Borough of Sitka ("City") received a Preliminary Permit ("Permit") for the Takatz Lake Hydroelectric Project (FERC No. 13234, "Project") from the Federal Energy Regulatory Commission (FERC) in Washington D.C. This Project would potentially affect resources in the Takatz, Sadie, Baranof and Medvejie river basins which fall within the potential project boundaries. During the 2010 field season, studies were conducted primarily in the in the Takatz Creek Drainage with some additional information from the other potentially affected water bodies including, Takatz Bay, Sadie Lake Drainage, Baranof Lake Drainage, and Medvejie Drainage. To fulfill one element of the FERC application requirements this report documents the result of fisheries surveys conducted during the 2010 field season.

During study planning among Stakeholders four priorities were determined for the 2010 field season. These were:

- Emphasis during the 2010 field season should be on the Takatz River Basin due to 1) the limited existing information on aquatic resources in this area; and 2) the fact that most direct impact on aquatic resources would be in this Basin;

- Studies in the Baranof River Basin would concentrate on 1) temperature monitoring in Baranof Lake; 2) observations of fish use near two inflow tributaries at the upper end of the lake; and 3) fish use of the beaver ponds connected to these tributaries;

- Studies in the Medvejie River Basin would focus on Dolly Varden and resident fish presence or absence in Medvejie Lake and Upper Medvejie River; and

- Studies in and near Sadie Lake would not be a high priority.

TAKATZ RIVER BASIN

In the Takatz River Basin fish distribution was primarily limited by two waterfalls in Takatz Creek. Only Dolly Varden char *(Salvelinus malma)* that were presumed to be a barrier isolated resident population were encountered from a large water fall (Upper Falls) at Stream Mile 1.83 (SM) (Reach 2) downstream to a lower waterfall (Lower Falls)(Reach 1). Downstream of the Lower Falls pink and chum salmon were the primary species encountered. The absence of juvenile coho salmon in the surveys above the Lower Falls suggests that anadromous access is limited to below this point.

No Dolly Varden were captured during a combined total of 917 trap hours as well as during observation surveys above the Upper Falls. In the area between the Upper Falls and Lower Falls in Lower Taktz Creek (Reach 2) as well as in adjacent tributaries and smaller connected inflow areas 920 Dolly Varden were observed during a snorkel survey on June 30th, and a total of 2,323 Dolly Varden were captured during 1,867 trap hours. Fork Lengths during trapping ranged from

46 mm to 230 mm, and varied depending on trap type, area, habitat, and possibly time of year. Similarly, results during the snorkel survey differed from trapping length and abundance data taken earlier and later in the year in the same areas. These variances suggest a complex life history with varied species forms, seasonal habitat movements, and likely intermingling of species forms during at least a portion of the season.

Chum salmon (*Oncorhynchus keta*) were first observed in the stream in late July and peaked on August 13th with 315 observed. The last viable chum salmon were observed on September 22. Pink salmon (*Oncorhynchus gorbuscha*) were first observed on August 4th, and the number of pinks peaked on September 4th with 2,284 observed, and decreased rapidly after mid September and no pinks were observed by surveys on October 5th. Both chum and pink spawning activity was highly concentrated in a short section of the upper intertidal area (Sub-Reach 1-4) dominated by medium to coarse (11-64 mm) gravels.

SMALL TAKATZ BAY DRAINAGES

All of the Small Takatz Bay Drainages were primarily intertidal or contained very short areas of fish passage. Chum salmon counts in all the potentially affected drainages were very low and ranged from 0 to 5 fish. Pink salmon counts likewise were relatively small and ranged from 0 to 83 pink salmon.

SADIE LAKE BASIN

Sadie Lake contains a naturalized population of cutthroat trout (*Oncorhynchus clarki*) that are generally regarded to have originated from Baranof Lake stock planted by a non-agency entity. Work on the Sadie Lake Drainage was limited to foot surveys on May 31st, and August 20th thru the 21st as well as personal communications with people familiar with the drainage. Both foot surveys and communications suggest that that the main inlet tributary and the outlet are potentially important habitat areas.

BARANOF LAKE BASIN

Cuthtroat trout (*Oncorhynchus clarki*) are the only fish species known to inhabit Baranof Lake and its inflow tributaries downstream to a large water fall at tidewater. During snorkel surveys in early May a total of 216 cutthroat were observed, primarily >160 mm in length. Except for the Lower Baranof River Outlet, the highest counts in this size range were in tributaries at upper (West) end of the lake. Handheld temperatures suggested that snorkel surveys were conducted at the early part of the spawning run for 2010, and we are currently waiting for the return of functioning temperature loggers from the factory due to scratched download interfaces to confirm this.

Two hoop traps were fished overnight on October 20 in order to document fish presence in the beaver area at the west end of the lake documenting trout use of these areas per ADF&G request. A total of 39 cutthroat trout primarily ranging in size from 124 to 265 mm with one outlier of

312mm were captured. Fish smaller and larger than those captured were observed by both fisheries and wildlife personnel in these areas as well.

MEDVEJIE RIVER BASIN

Like the Takatz Basin fish distribution in the Medvejie River Basin is influenced by likely fish passage barriers. During 2010 surveys we encountered Dolly Varden from a cascade approximately .31 miles upstream from the Upper Medvejie River's confluence with the lake to its outlet. Anadromous fish distribution in the Medvejie River Basin is influenced by barrier nets at tidewater and hatchery weirs as well as a series of cascades upstream. These upstream cascades correspond to the current ADF&G limits of anadromous distribution (ADF&G, 2009a, ADF&G, 2009b). During much of the year the area from just below the outlet of Medvejie Lake to the vicinity of the hatchery is reduced to subsurface flow due to low lake levels.

A total of 996 Dolly Varden were captured during trapping in Medevjie Lake in late September 2010. Fork lengths ranged from 59 to 382 mm with a greater representation in the length classes less than about 160 mm indicating a barrier isolated resident population. At least 20 fish ranging in size from 104 to 382 mm appeared to show signs of sexual maturity either thru reproductive products, ovipositor extension, or a kype.

On October 8th we observed 17 Dolly Varden in the Upper Medvejie River**,** 2 at delta on the south shore of Medvejie Lake, and 15 Dolly Varden just below the lake outlet, indicating that most of spawning likely takes place in the Upper Medvejie River, and the outlet.

During a foot survey on September 1st a total of 317 chum and 2 pinks were observed from tidewater to the picket weir in the North Fork of the Lower Medvejie River, and 1 chum and 55 king jacks were observed in the South Fork just below a water supply dam.

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PROJECT DESCRIPTION

Generally, the Project would consist of one or two dams on Takatz Lake, a power conduit consisting of a mostly unlined tunnel and steel penstock leading to a powerhouse located at tidewater on Takatz Bay (Figure 1). Installed capacity of the Project would be approximately 27 megawatts (MW).

The originally proposed Project transmission line would extend from the powerhouse underwater in Takatz Bay, Chatham Straight and Warm Springs Bay to overhead or buried segments which would continue westward past Baranof Lake and Baranof River. The transmission line would then enter a tunnel through the Baranof Mountains. From the western tunnel portal, the transmission line would continue down the Medvejie River valley past Medvejie Lake and on to its interconnection with the existing transmission line from the City's Green Lake Project (FERC No. 2818).

ALTERNATIVE TRANSMISSION ROUTING

Based on comments received during SD1 review and after Scoping meetings, the City has developed a new transmission alternative which avoids potential effects on marine resources and on the community of Baranof Warm Springs. This routing, referred to as the "Overland Transmission Alternative", or simply "Overland Alternative" is shown in Figure 1.

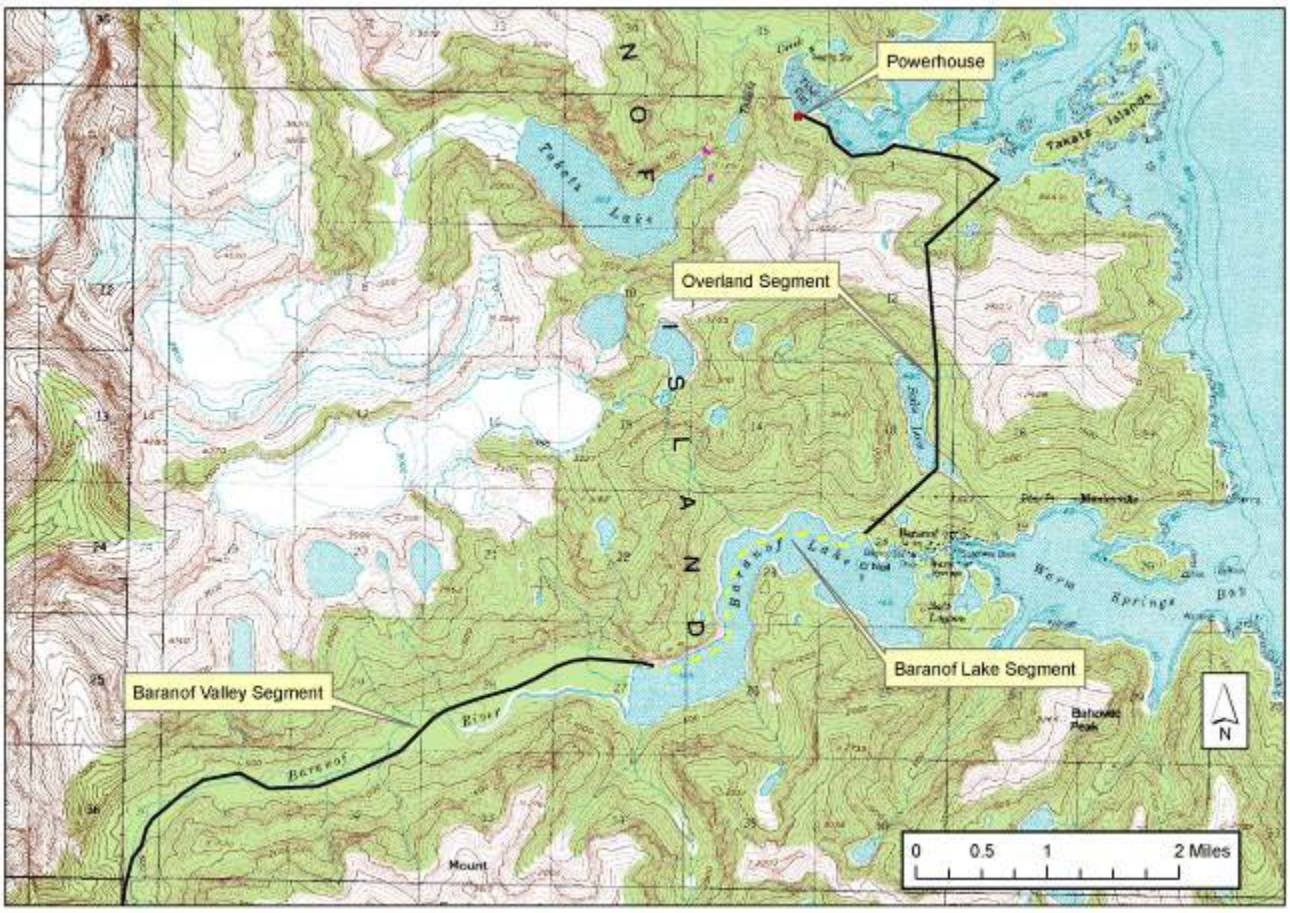

Figure 1. Detail of Overland Transmission Alternative

The primary feature of this transmission route would be the overland segment south from the powerhouse, past Sadie Lake, thence south and west to the shore or Baranof Lake. While Figure 1. shows an underwater segment beneath Baranof Lake, the City may elect to use an overhead segment along the north shore of Baranof Lake, depending on the outcome of fisheries and bathymetric surveys.

The Overland Alternative does not change the routing of the transmission segments beyond the point at which the line emerges from upper Baranof Lake.

At this time, the Overland Alternative is the City's preferred transmission alternative because it responds to concerns for impacts on both the community of Baranof Warm Springs and those on marine resources in Chatham Straight. Further, the Marine Alternative would necessitate extensive and difficult marine engineering feasibility analyses.

STUDY PLANNING and CONSULTATION

STUDY PLANNING

A Draft Fisheries Study Plan (Draft Plan) for 2010 was distributed for agency review on March 23, 2010. Written comments on the Draft Plan were submitted by Alaska Department of Fish and Game (ADF&G) on April 29, 2010. An interagency meeting was conducted on May 13, 2010, to discuss ADF&G's comments on the Draft Plan. Draft minutes of the interagency meeting were distributed on June 9, 2010.

2010 STUDY SCOPE and OBJECTIVES

During the May 13 meeting, attendees agreed on the following priorities for 2010 aquatic resources studies:

- Emphasis during the 2010 field season should be on the Takatz River Basin due to 1) the limited existing information on aquatic resources in this area; and 2) the fact that most direct impact on aquatic resources would be in this Basin;

- Studies in the Baranof River Basin would concentrate on 1) temperature monitoring in Baranof Lake; 2) observations of fish use near two inflow tributaries at the upper end of the lake; and 3) fish use of the beaver ponds connected to these tributaries;

- Studies in the Medvejie River Basin would focus on Dolly Varden and resident fish presence or absence in Medvejie Lake and Upper Medvejie River;

- Studies in and near Sadie Lake would not be a high priority; and

- A Fisheries Workgroup consisting of Karl Wolfe, Patrick Fowler, Troy Tydingco and Roger Harding would be formed to facilitate rapid communication and decision-making during the 2010 field season.

STUDY AREAS and NOMENCLATURE

Because studies would be conducted in several different river basins, stream reaches and other aquatic habitats, researchers established the following study area breakdown and nomenclature. Generally, these areas are organized by major river basin or other drainage area, with stream reaches and other features identified within the broader areas.

TAKATZ RIVER BASIN

Major Takatz River Basin Study Areas

Study Areas in the Takatz River Basin included the following, from upstream down (Figure 2):

Upper Takatz Creek, extending from about 2.0 miles from the Takatz Lake confluence to the Creek's headwaters;

Takatz Lake, including all normally inundated lake areas; and

Lower Takatz Creek, extending from the outlet of Takatz Lake downstream to its confluence with tidewater at normal low tide (Figure 3). This Study Area included Lower Takatz Creek tributaries and adjacent areas.

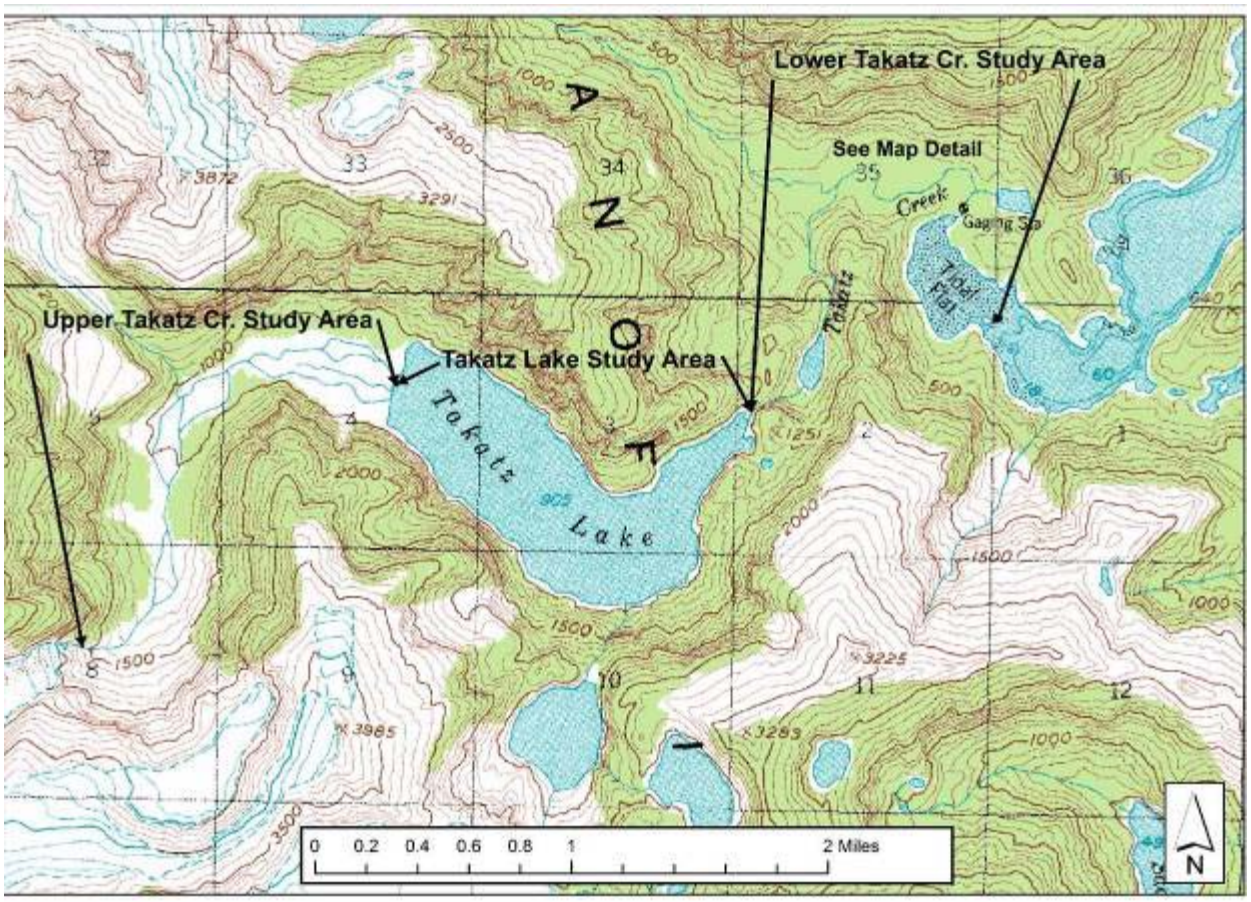

Figure 2. Major Takatz River Basin Study Areas

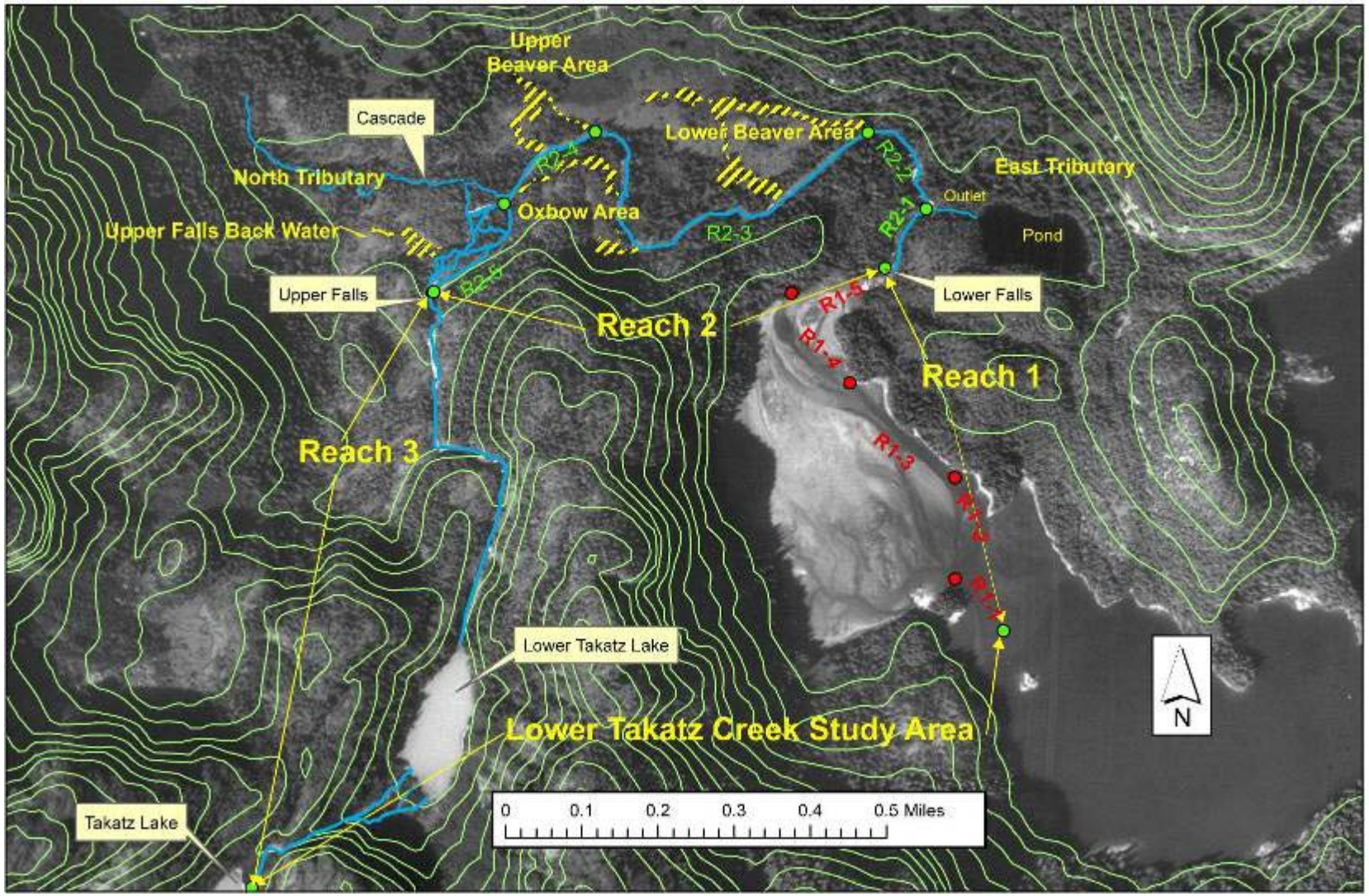

Figure 3. Lower Takatz Creek Study Area detail with reach and sub-reach breaks indicated by dots

LOWER TAKATZ CREEK STUDY AREAS

The most intensive area studied in 2010 was from the outlet of Takatz Lake (Reach 3) to the areas in Lower Takatz Creek which were exposed by changes in tide stage (Reach1). In this overall area, several study sub-areas were designated to illustrate different habitat types and stream reaches defined by fish passage barriers.

Major Stream Reaches

Lower Takatz Creek, from the outlet of Takatz Lake to the upstream limit of tidewater was divided into three Study Reaches, numbered 1, 2, and 3, as described in the following:

Reach 3 extended from the outlet of Takatz Lake approximately 1.04 miles downstream to the the Upper Falls;

Reach 2 continued from the downstream end of Reach 3, 1.13 miles to the base of the Lower Falls in Takatz Bay. Reach 2 was further subdivided into five Sub-Reaches, (numbered 1 through 5) of the main channel, based on differences in stream characteristics and habitat type (See Figure 3).

Figure 4. Upper Falls at SM 1.86 from top of Reach 2.

Also within the limits of Reach 2 were several distinct aquatic habitat features (Figure 6), including:

- **Fish Passage Barriers in Reach 2.** Two major waterfalls occurred in Reach 2, the Lower and Upper Falls, located at SM .73 and SM 1.86, respectively (Figure 4, Figure 5, and Figure 3);

- **Major Inflow Tributaries.** Fish surveys were conducted in the lower reaches of two significant tributaries which entered Lower Takatz Creek in Reach 2: 1) the North Tributary, entered at about SM 1.79 as well as SM 1.68; and 2) the East Tributary which consisted of a pond and outlet stream which entered at about SM 0.83;

- **Beaver Areas.** Bordering Reach 2 to the north were two areas of intensive beaver activity, denoted Lower Beaver Areas and Upper Beaver Area. The Lower Beaver entered at SM .98 and SM 1.12 and the Upper Beaver Area entered at SM 1.51 and SM 1.57 (See Figure 3). These beaver complexes are minor tributaries of Lower Takatz Creek.

- **The Oxbow Area.** The Oxbow Muskeg was a tributary area adjacent to Lower Takatz Creek that entered at SM 1.34. The Oxbow Channel was a side channel that communicated hydraulically with Reach 2 and extended downstream from SM 1.73 to SM 1.43 (Figure 6, See Figure 3).

- **The Upper Falls Backwater.** A backwater pond with a small spring fed inflow tributary entered at about SM 1.82 (Figure 6, See Figure 3).

Figure 5. Lower Falls at SM .73 from top of Reach 1

Figure 6. Lower Takatz Photo Detail

Reach 1 extended from the downstream end of Reach 2 to the normal low tide mark in Takatz Bay. Like Reach 2, Reach 1 was further subdivided into five Sub-Reaches, (numbered 1 through

5) of the main channel, based on differences in stream characteristics, tidal influence, and habitat type (See Figure 3).

SMALL TAKATZ BAY DRAINAGES

Several small streams drained into Takatz Bay within the potentially-affected area. These were named in a counter-clockwise rotation (See Figure 7) from the upper end of Reach 1 (note: these stream names were assigned by project personnel and may not relate to names assigned by previous mapping and/or naming protocols). These were:

- Cripple Creek;
- Powerhouse Creek;
- Cruise Boat Creek;
- South Shore Falls;
- Muskeg Creek; and
- Island Creek.

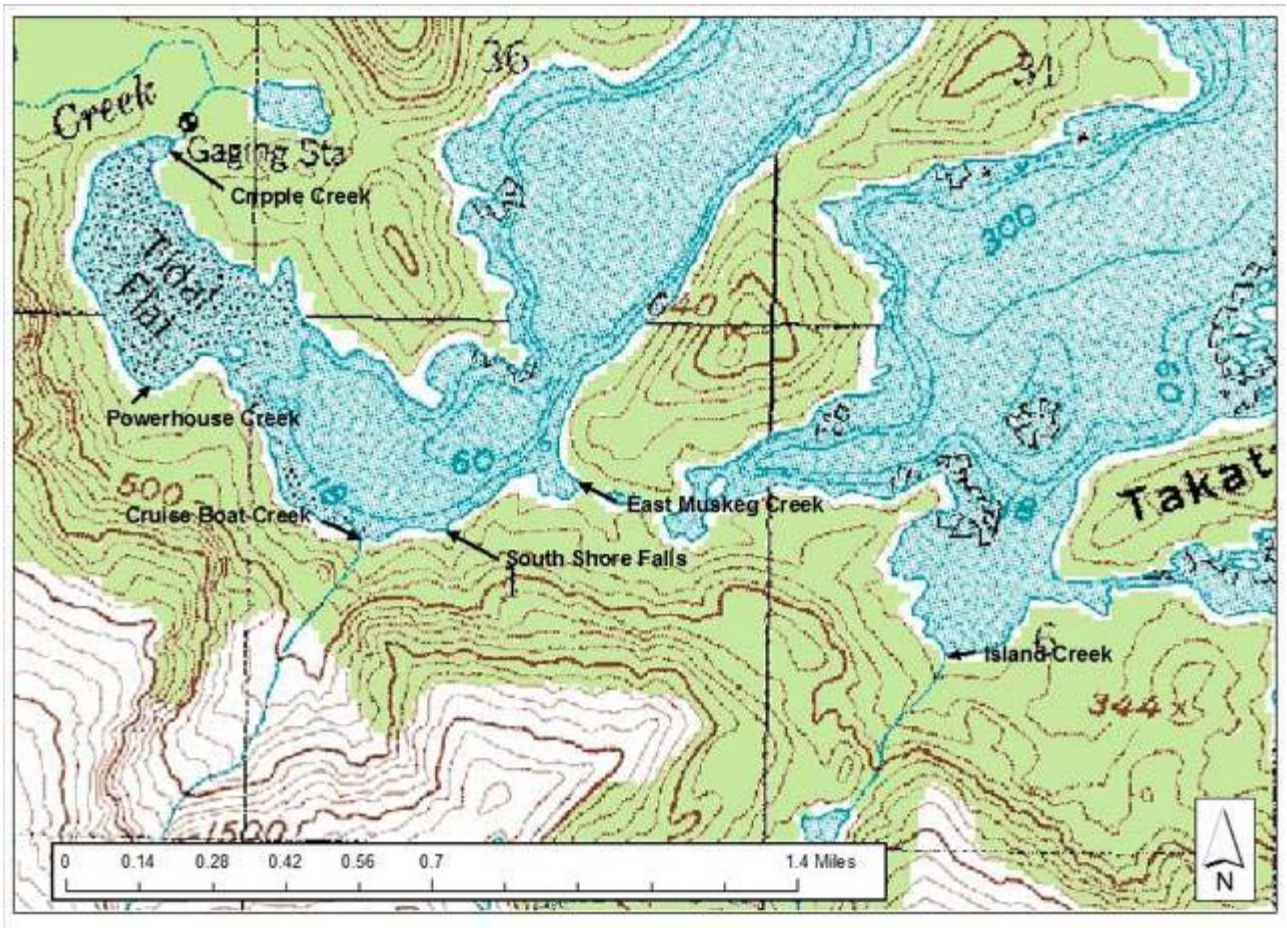

Figure 7. Small Takatz Bay Drainages

SADIE LAKE BASIN

Study areas in this lake basin were limited in 2010 to the lake, its outlet, and two inlet streams (Figure 8).

BARANOF RIVER BASIN

Upper Baranof River, from high water level in Baranof Lake upstream to its headwaters (Figure 9);

Baranof Lake and Inflow Tributaries, including all normally inundated areas of the lake and various inflow tributaries, primarily along the North and North Western lakeshore (Figure 9, Figure 10). These where initially assigned a three symbol code based on their ADF&G statistical area, the compass direction of their confluence with the lake, and finally their numeric relation east to west towards the back of the lake. Later most were assigned names when none previously existed. In a clock wise direction from the North East these are;

- Camp Creek BN1
- True Camp Creek BN2
- CW1
- Under Boulder Creek CW5
- Caddis Creek CW4
- Water Fall Creek CW6
- Cabin Creek CS2
- Slide Creek CS1
- South Creek AS1

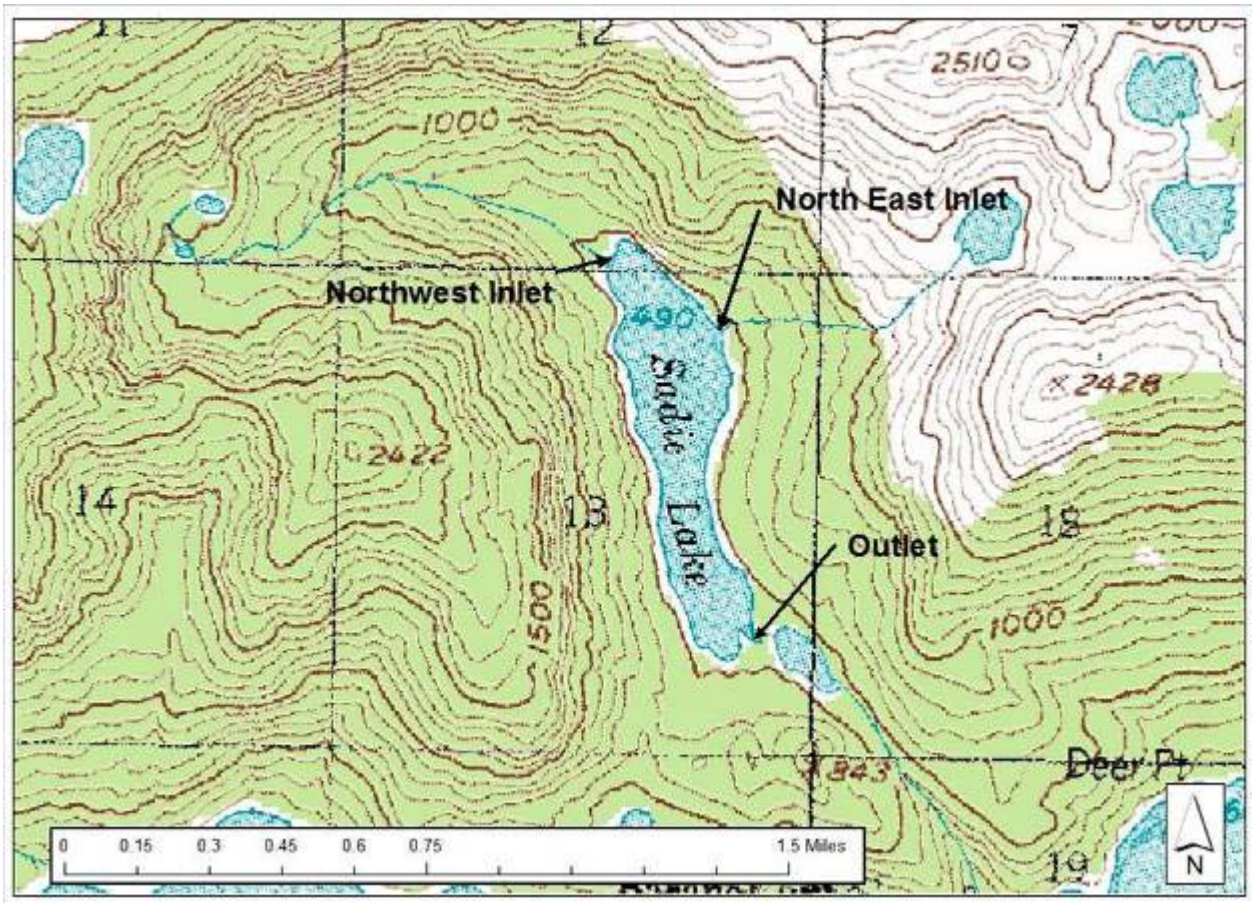

Figure 8. Sadie Lake Study Areas

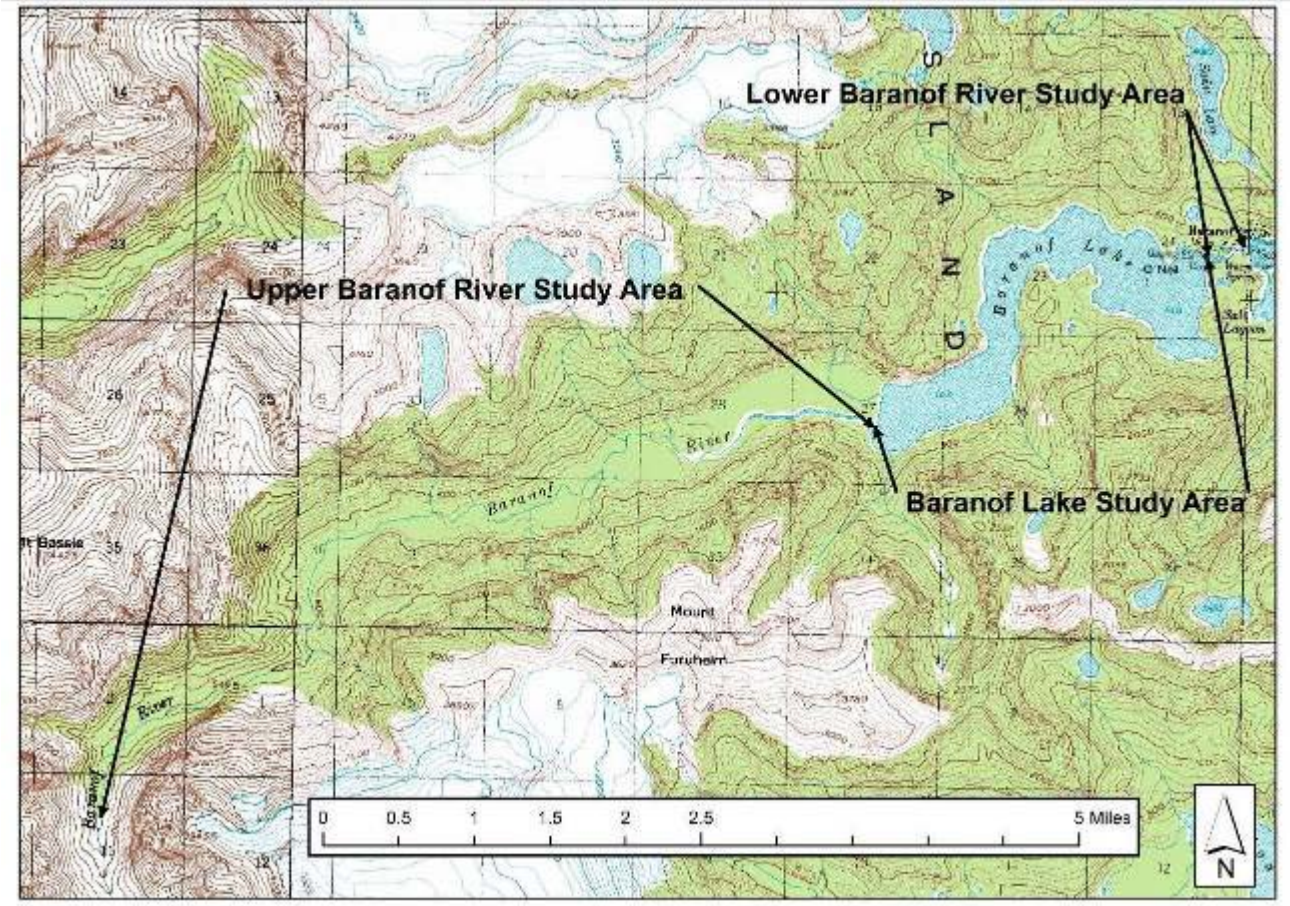

Figure 9. Baranof River Basin Study Areas

Under Boulder Creek, Caddis Creek, and Waterfall Creek were located in the lower section of Upper Baranof River Valley. South Creek was a free stone muskeg based tributary and the remainders were alluvial in areas accessible to fish.

The Beaver Area which was located near the inflow of Upper Baranof River; and emptied into Water Fall Creek, Under Boulder Creek and Caddis Creek.

Lower Baranof River, from the outlet of Baranof Lake to the normal high tide mark in Baranof Bay (Figure 9, Figure 10 (Outlet AE1)).

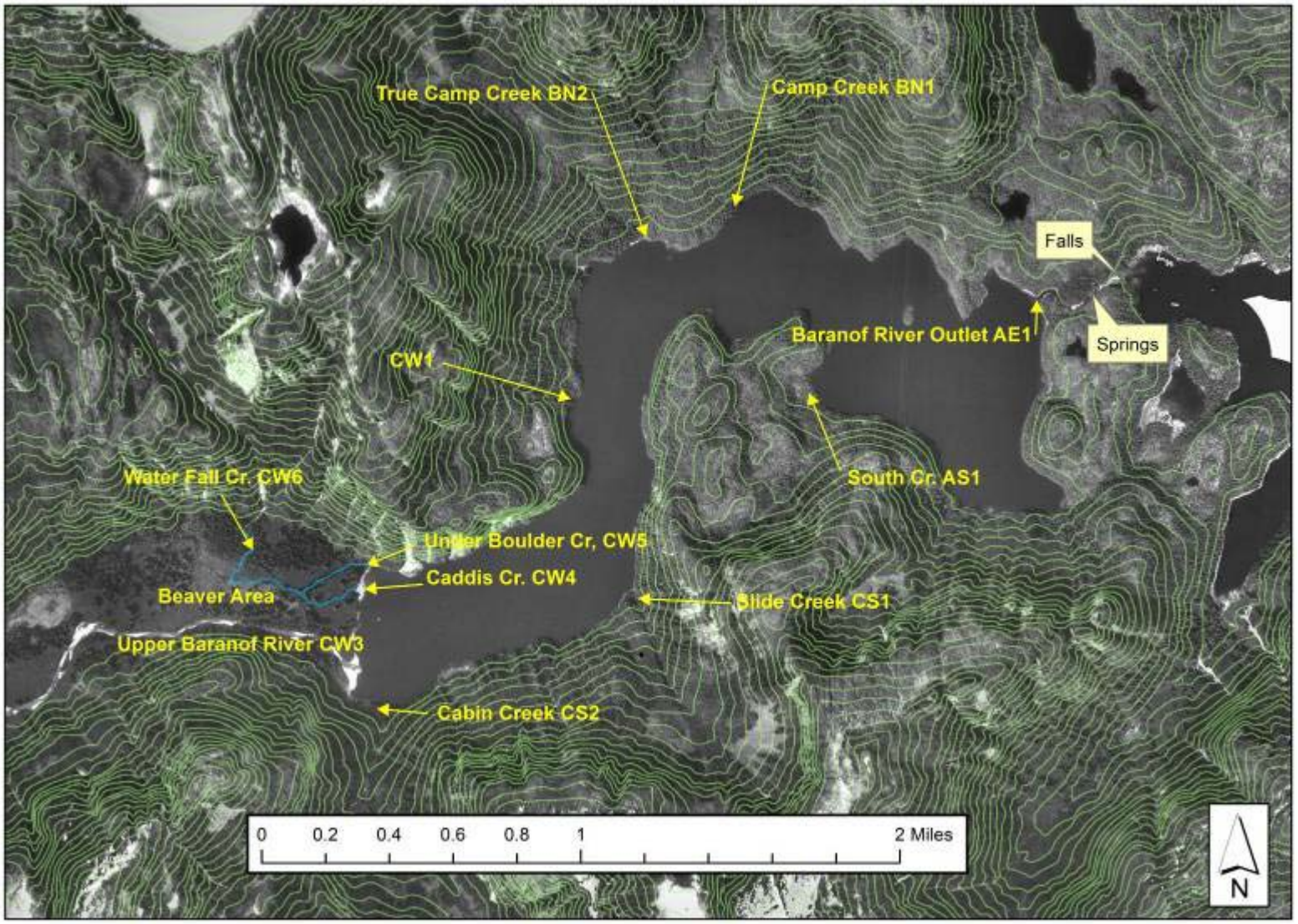

Figure 10. Baranof Basin Study Areas detail

Figure 11. Baranof Basin west end lake tributaries

MEDVEJIE RIVER BASIN

Study areas in this basin included the following, from upstream down (Figure 12):

Upper Medvejie River, from high water level in Medvejie Lake upstream approximately 0.5 miles;

Medvejie Lake, including all normally inundated areas of the lake; and

Lower Medvejie River, from Medvejie Lake outlet downstream to the normal high tide mark.

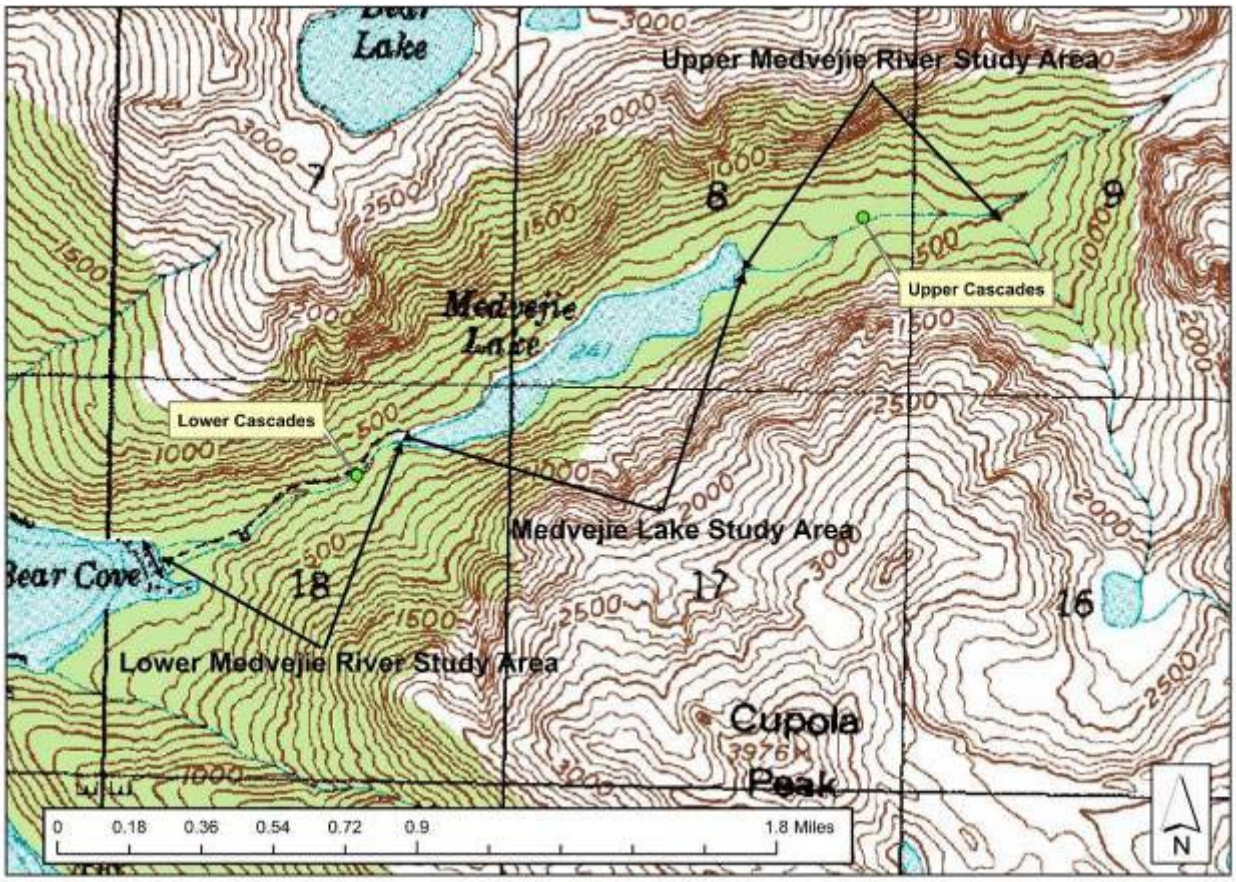

Figure 12. Medvejie River Basin 2010 Study Areas

METHODS

Based on the study planning and consultation, researchers conducted three primary study components during 2010. These were:

1. Fish Surveys, to determine presence or absence of fish, timing or periodicity of life stages and relative abundance; and

2. Habitat Evaluation, to determine aquatic habitat features associated with the various fish species and life stages. In 2010, Habitat Evaluation field methods consisted primarily of monitoring substrate composition and water temperature.

3. US Forest Service (USFS) channel class designations and Alaska Department of Fish and Game (ADFG) reach designations and available aerial photography were also reviewed prior to field work (Paustian et al 1992, USDA 2010, ADF&G 2010).

Detailed descriptions of methods for these study components are provided in the following:

(In this report, distances along streams are denoted by Stream Mile (SM), the distance upstream from the downstream major water body, e.g. tidewater or the primary lake in a basin.)

FISH SURVEYS

Surveys of various types were used in 2010 to document presence or absence of fish in the various River Basins, as described in detail below. Surveys generally fell into two categories: 1) **fish observations** and 2) **fish captures**, as described below.

Fish Observations

Fish observations fell into four categories: **1) Index Surveys; 2) Stream Surveys; 3) Snorkel Surveys; and 4) Boat Surveys** as described below.

Index Surveys

Index surveys were frequent general abundance surveys conducted in the vicinity of the Lower Barrier Falls (SM .73) because of the resting habitat available there above mean high tide. Information from these surveys was intended to be used as a basis for general abundance and run timing, and to determine times when the stream surveys, described below, would best be conducted. Index surveys were conducted from June 27 to July 29 when it was determined that this area was not representative of anadromous abundance or timing.

Stream Surveys

Stream surveys were conducted as needed throughout all representative habitats and reaches to determine anadromous and resident fish distribution, abundance, and habitat utilization throughout the potentially occupied sections of the stream. Polarized glasses were used to reduce water surface glare during all foot surveys. Stream surveys in 2010 varied depending on drainage due to differences in focus, species present and logistical issues such as ice.

Snorkel Surveys

Snorkel surveys were done to evaluate occurrence and habitat use of juvenile and adult cutthroat and Dolly Varden and were conducted within accessible areas in which stream hydraulics offered suitable observation conditions. Snorkel surveys were conducted in both upstream and downstream directions depending on environmental factors and likely holding areas were visually inspected using a mask and snorkel (Northcote and Wilkie 1963, Thurow R.F. 1994). Wherever stream conditions allowed, surveys were conducted upstream to minimize fish disturbance. Observations were initially recorded on a wrist mounted slate with a 100 mm scale in order to reduce disturbance and to allow for optic magnification due to the dive mask (Goldstein 1978, Gardiner 1984). Immediately after observations and other relevant data were recorded on a standardized field form and efforts were quantified by recording start and stop

locations using GPS coordinates. At this same time data was noted on detailed aerial photographs and/or maps of the various study areas.

Boat Surveys

Boat surveys were conducted in intertidal and lake shore areas where foot or snorkel methods were not feasible. Polarized glasses were used and the primary observer was located on the bow.

Fish Observation Data Recording and Mapping

For all observation techniques, data were entered into an Excel spreadsheet in the office, and checked against the original aerial photos, maps and field forms.

During each field survey, the observer noted the following.

- Number of fish by species
- Time of day (Stop and Start times)
- General weather condition
- Water temperature
- Relation of observation time to tide status (Reach 1 in Lower Takatz)
- Water transparency
- Activity (actively moving upstream, milling, exhibiting spawning behavior, etc.)
- Location of fish in the stream (i.e., are they concentrated in a pool or run, or are they spread evenly throughout the stream). Notations included locations of fish both across and up and down the channel.

A base map of the stream was annotated during each survey to show specific points of observation within the channel. Notes were made of species composition, fish activity, and habitat conditions and utilization.

Fish Captures

All fish captures were conducted under Collecting Permit number SF2010-130 issued in May, 2010 by ADF&G. An amendment was added to this permit to allow for capture of additional specimens in June of 2010. The permit authorized captures by either fish traps or various types or hook and line sampling, as described in the following:

Fish Trapping

Bait for hoop traps and minnow traps consisted of sterilized salmon eggs or those disinfected in beta dine solution. Bait for hoop traps was placed in commercial cup canisters and for minnow traps perforated film canisters. All traps were marked with individual trap numbers for that day to avoid any confusion and to ensure all traps were retrieved at the end of the sampling period.

Hoop traps were 1.4 m long and consisted of four 0.6-m-diameter steel hoops with 9-cm throats attached to the first and third hoops. Knotless nylon netting with a mesh size of 1 cm covered the hoop traps. Traps were supported horizontally with at least two aluminum bars and willow or alder saplings were often used in conjunction with these due to the necessity of keeping the outside mesh open near current. Due to the necessity of sinking traps in specific locations before being caught in adjacent currents, cobble sized anchors were often utilized.

Minnow traps consisted of either ¼ or 1/8 inch wire mesh and were 9 in. in diameter and 17 ½ in. long with two 1 in. entrances. Minnow Traps were connected to floats as well or anchored to shore or other immobile objects, depending on location and other environmental conditions.

Since the primary objective of minnow trapping was to document presence or absence of fish, minnow trapping was concentrated in high quality juvenile rearing areas promising the maximum number of fish. Later minnow trapping in the Lower Takatz Creek Study Area and its tributaries was expanded to document limits of fish populations as well.

Rod and Reel Sampling

Hook and line fishing was conducted using light spin and fly-fishing tackle with tackle choice being determined by fish location, feeding activity, or habitat type sampled. Spin fishing was conducted by casting small (size 10-6 hooks) spoons, spinners, jigs and other lures. Fly-fishing utilized size 22-8 hooks on both wet and dry flies.

To more accurately quantify rod and reel fishing effort, the following protocols were observed:

- Time was recorded at the beginning and end of the rod and reel sampling sessions;
- After moving between areas and not fishing, a new sampling session was initiated;
- All tackle was prepared and checked before the start of sampling;
- Tackle was kept well sorted in clear plastic boxes and spares (lures, flies, leaders, etc.) were kept rigged outside the box to minimize time when lures were lost;
- Snagged lures were broken off and no attempts were made to retrieve lost lures until after the sampling period had ended;
- Fish captured were kept in coolers or five gallon buckets until after sampling for that time period was completed;
- During any delays such as backlashes etc. the clock was stopped and fishing effort suspended until the matter was resolved.
- Sampling sessions were assigned consecutive numbers and location, number of fish captured, and any comments were noted for each numbered session on a trap catch form.

Fish Capture Data Recording and Mapping

All fish captured were measured for fork length to the nearest mm and were released immediately after recovery in the area of capture. No anesthetics were used during this study.

Location, catch, habitat descriptions, and the number of gear units (rod and reel and trap hours) for each gear type were recorded on trap catch forms and location was also recorded on maps as well as trap catch forms. Pictures taken at trap sights for later referrals where linked by photograph number to location and waypoint. Sample number, lengths, gear type, and trap number for captured fish were recorded by date and location. Other comments including but not limited to mortality status, scars, physical condition, evidence of sexual maturity, etc. were also recorded.

Way points were downloaded using Expert GPS software and linked to photographs using the same software. Data were entered into an Excel spreadsheet in the office, and checked against the original maps and field forms. Catch per unit effort (CPUE) was determined using the means of ratios approach in order to examine possible factors effecting daily catch rates as well as the total ratio approach for the entire event (Neilsen and Johnson 1982). Length-frequency plots were developed for the various study areas and dates to examine size classes and develop baseline information.

HABITAT EVALUATION

Substrate Composition

Substrate particle size distributions were calculated from at least 100 individual foot step samples per analysis taken along zig-zag transects **(**Bain 1995**,** Bevenger and King 1995, Wolman 1954**).** All substrate composition samples were taken in confirmed spawning areas in Reach 1 Sub Reach 4 of the Lower Takatz Creek Study Area.

Substrate size categories were assigned using a modified Wentworth scale as described in the USFS Tier III sampling protocol (USFS 2001) using a USGS Gravelometer (US_SAH-97**)**. Substrate sampling took place on August 14th, August 28th, and Sept 17th.

Temperature Monitoring

Water temperature was measured in all basins using both continuous and grab-sample measurement techniques.

Continuous Temperature Monitoring

Continuous temperature monitoring was conducted using Optic StowAway temperature loggers (Model 3, Version 5) manufactured by Onset Computer Corporation. These loggers were capable of measuring and recording temperatures between -4 and +38°C.

In the Upper Takatz Creek, Takatz Lake and Sadie Lake Study Areas, continuous temperature monitoring was centered on lake outflow temperatures. In the Lower Takatz River study area, temperature loggers were placed in all sub-study areas and tributaries.

In the Baranof River Basin, temperature loggers were placed in all tributary inflows, the lower reaches of Upper Baranof River, the west end of Baranof Lake and in the Lower Baranof River.

In the Medvejie River Basin, loggers were placed in the Upper Medvjie River, near the outflow of Medvejie Lake, and in areas adjacent to the two water intakes for Medvejie Hatchery.

Grab-Sample Temperature Measurement

Grab sample temperature measurements were taken using Enviro-Safe Armor Case thermometers capable of reading temperatures between -5 and +50^{o}C. Grab sample measurements were taken in all areas where temperature loggers were emplaced (to test accuracy of the loggers) and in areas of interest in terms of fish life stage usage and the effects of tributary inflow and other variable factors.

STUDY TIMEFRAME

Unless otherwise noted, all dates in this report refer to field work done in 2010. Survey timing and frequency varied by River Basin, depending on logistical access, objectives, and species encountered. Surveys began in April in the Medvejie and Baranof River Basins and ended on November 16 in the Lower Takatz River Study Area. Detailed tables showing all sampling dates, locations and effort are in Appendix I.

TAKATZ RIVER BASIN

Surveys in the Takatz River Basin began in the Lower Takatz Creek Study Area Reaches 1 and 2 on May 22 and ended in the same areas on November 16. Because of snow and access difficulties, sampling in Reach 3, Takatz Lake and the Upper Takatz Creek Study Areas began in mid-July. Sampling in these areas ended on September 12 (Appendix 1).

SMALL TAKATZ BAY DRAINAGES

Concentrated salmon surveys were conducted in the Small Takatz Bay Drainages on July 27th for chum salmon and on September 6th for pink salmon (Appendix 1)..

SADIE LAKE BASIN

Sadie Lake Basin was surveyed on May 31, August 20 and August 21 (Appendix 1).

BARANOF RIVER BASIN

Surveys in the Baranof River Drainage were focused on spring spawning of cutthroat trout were observational in nature, and took place in resident fish areas from April 9 to May 8. Exceptions to this focus were one intertidal survey to determine intertidal logistics on May 8, and foot surveys and limited trapping event in the Beaver Area (BA1) to document cutthroat trout rearing (Appendix 1).

MEDVEJIE RIVER BASIN

Work in the Medvejie Drainage began on March 25th with a foot and boat survey and ended on October 8th with a foot and snorkel survey (Appendix 1).

RESULTS

(Unless otherwise noted, all dates reference in this section refer to dates in 2010.)

TAKATZ RIVER BASIN

Upper Takatz Creek

Observation Surveys

No fish or signs of fish activity were observed in Upper Takatz Creek during 5 fish observations.

Fish Captures

No fish where captured during 262 trap hours in the Upper Takatz Creek Study Area. No hook and line sampling was conducted in this area.

Takatz Lake

Observation Surveys

No signs of fish activity or fish were observed during 8 observation surveys in Takatz Lake.

Fish Captures

No fish where captured in Takatz Lake during 568 trap hours in the Takatz Lake. No hook and line sampling was conducted in this area.

Lower Takatz Creek

Reach 3

Observation Surveys

No fish were observed during the single foot survey in the area below Lower Takatz Lake Reach 3 on May 23 or during 4 foot surveys from Takatz Lake downstream to SM 1.84.

Fish Captures

No fish where captured during 87 trap hours in Reach 3. No hook and line sampling was conducted in this area.

Reach 2

Surveys and captures in Reach 2 proved the most productive of those in all other areas. All fish observed or captured in Reach 2 were Dolly Varden char, as described in the following:

Observation Surveys

Foot Surveys in Reach 2 were generally ineffective due to visibility problems due to glacial water conditions and fish use of undercut banks.

Snorkel surveys were conducted on June 30th in all Reach 2 Sub-Areas except the Upper Falls Back Water and the pond area of the East Tributary.

A total of 920 Dolly Varden were observed, with the Oxbow Channel and North Tributary having the highest fish counts (Figure 13) followed by Lower Reach 2 of Lower Takatz Creek.

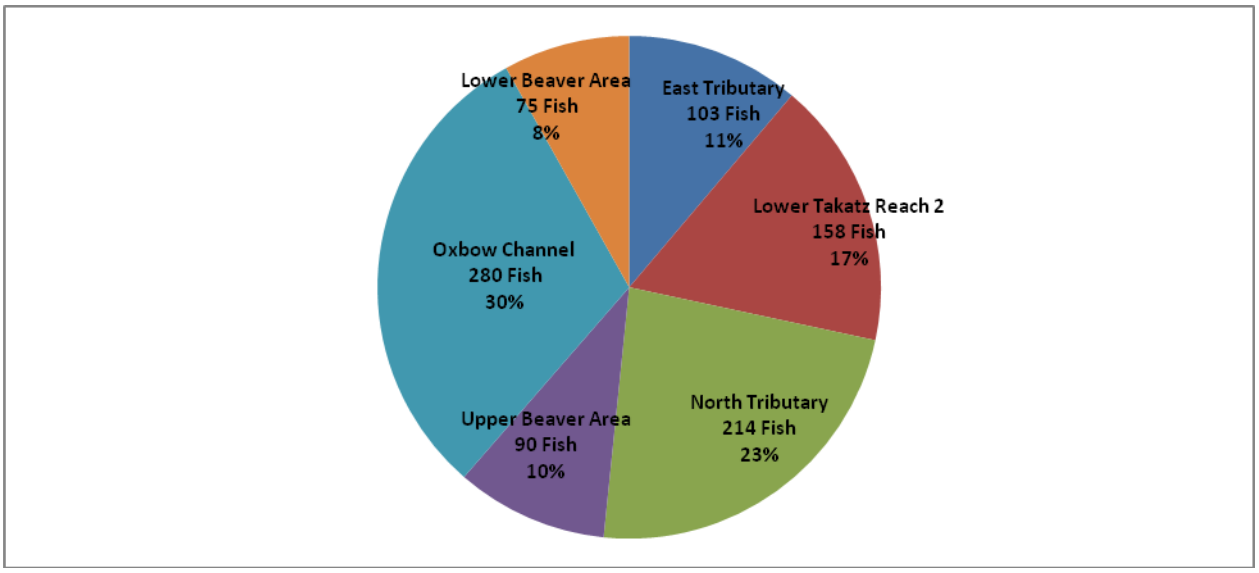

Figure 13. Total fish numbers observed and percent relative abundance in Lower Takatz Creek Reach 2 and adjacent areas during June 30 Snorkel Surveys.

Fish <100mm were found primarily in slow water areas of the Oxbow Channel in isolated pools, the East Tributary outlet stream, and the Upper Beaver Area near a flooded sedge area (Table 1).

The highest concentrations of fish between 100-140 mm were found in the North Tributary and the Oxbow Channel. In these two areas there were large concentrations of large woody debris that had formed pools due to a large avalanche event that occurred after 1995. In Lower Takatz Creek Fish from 100 to 140 mm were associated with undercut banks and submerged root wads.

The majority of fish observations in size classes >140 mm occurred in Lower Takatz Creek and the North Tributary in relation to deep pools and submerged large woody debris (Table 1).

Table 1. Number of Dolly Varden observed by area and length groupings

Reach/Inflow	<100 mm	100-140 mm	>140 mm
Lower Takatz Cr. Reach 2	19	89	50
North Tributary	0	149	65
Oxbow Channel	100	180	0
East Tributary (outlet stream)	98	5	0
Upper Beaver Area	66	24	0
Lower Beaver area	26	47	2
Total	309	494	117

Fish Captures

During 2010 surveys Dolly Varden were the only fish species present and were distributed throughout Reach 2 to the Upper Falls. Dolly Varden were also present in both the North Tributary and East Tributary inflows as well as the other smaller beaver and muskeg inflows in their respective flood plains. Fish distribution in the smaller beaver and muskeg inflows was limited by the steep foot slope topography running to the base of the flood plain. Dolly Varden were not captured above a cascade in the North Tributary (Figure 14, see Figure 3).

Figure 14. Cascade in North Tributary at upstream extent of fish captures

Hoop trap CPUE's were highest in Reach 2 of Lower Takatz Creek and the East Tributary pond where the mean lengths were longer and fish in the longest size classes (>140 mm) were present (Table 2, Table 3). These areas contained deeper water habitats in the form of pools and a pond respectively.

Table 2. Lower Takatz Reach 2 and area inflow tributaries hoop trap CPUE and catch by area and date

Reach/Inflow	Sub Reach	Date Set	# of Traps	Total Catch	AVG CPUE	Max CPUE	Min CPUE
Lower Takatz Creek Reach 2	2	7/28	2	244	5.02	6.77	3.27
	3	9/13	2	126	2.74	2.99	2.48
	4	8/25	2	58	1.36	2.73	0.00
	5	8/25	2	138	3.29	3.65	2.94
North Tributary	NT2	6/9	1	5	0.20	0.20	0.20
East Tributary	ET (pond)	6/9	3	194	3.13	6.11	0.33
Oxbow Muskeg	OXM	9/13	1	14	0.60	0.60	0.60
Lower Beaver Area	LBA1	8/26	3	150	2.40	2.63	2.23
Lower Beaver Area 2	LBA2	10/6	1	10	0.42	0.42	0.42
Upper Beaver Area	UBA	6/12	2	28	0.58	0.70	0.46
Upper Falls Backwater	UFBW	6/9	1	23	1.12	1.12	1.12

Table 3. Lower Takatz Reach 2 and area inflow tributaries hoop trap fork lengths by area and date.

Reach/Inflow	Sub Reach	Date Set	Mean FL (mm)	Min FL (mm)	Max FL (mm)	StDev FL (mm)	N=
Reach 2 Main Creek	2	7/28/2010	111.37	60	230	33.05	244
	3	9/13/2010	121.86	82	222	25.89	126
	3	10/6/2010	96.50	87	106	13.44	2
	4	8/25/2010	116.76	74	205	29.35	58
	5	8/25/2010	120.47	62	189	25.24	138
North Tributary		6/10/2010	107.60	89	128	14.93	5
East Tributary	outlet	6/9/2010	131.43	77	230	29.77	194
Oxbow Muskeg		9/13/2010	92.71	68	155	24.88	14
Lower Beaver Area		8/26/2010	101.06	59	168	25.06	150
Lower Beaver Area 2		10/6/2010	87.70	67	129	21.75	10
Upper Beaver Area		6/12/2010	91.86	65	132	15.63	28
Upper Falls Back Water		6/10/2010	95.30	72	121	14.57	23
Totals			115.17	59	230	30.29	992

In small inflow areas with slower water flow such as the Oxbow Muskeg, Lower Beaver Area 2, and Upper Beaver Area mean lengths tended to be shorter and the minnow trap CPUE's were higher (Table 4, Table 5). The East Tributary outlet also had high catch rates in the smaller size classes.

Size selectivity by trap type was displayed throughout the study period in Lower Takatz (Figure 15).

Table 4. Lower Takatz Creek Reach 2 and area inflow tributaries minnow trap CPUE and catch and catch by area and date

Reach/Inflow	Sub Reach	Date Set	# of Traps	Total Catch	AVG CPUE	Max CPUE	Min CPUE
Lower Takatz Creek Reach 2	2	7/28	10	232	1.02	2.04	0.21
	3	10/6	4	30	0.32	0.60	0.08
North Tributary	NT2	6/9	10	83	0.35	0.95	0.00
	NT3[1]	8/5	2	0	0.00	0.00	0.00
East Tributary	ET(trib)	6/9	6	133	1.00	3.14	0.09
Oxbow Channel	OXCH	9/13	3	63	0.98	2.23	0.00
Oxbow Muskeg	OXM	9/13	2	43	0.95	1.23	0.68
Lower Beaver Area 2	LB2	10/6	7	134	0.81	2.07	0.00
Upper Beaver Area	UBA	6/12	10	387	1.60	3.14	0.37
Upper Falls Back Water	UFBW	6/9	10	211	1.01	2.67	0.29

[1] Trapping area above Cascade in North Tributary

Table 5. Lower Takatz Reach 2 and area inflow tributaries minnow trap fork lengths by area and date.

Reach/Inflow	Sub Reach	Date Set	Mean FL (mm)	Min FL (mm)	Max FL (mm)	StDev FL (mm)	N=
Reach 2 Main Creek	2	7/28/2010	91.81	52	172	23.56	232
	3	10/6/2010	99.50	67	180	24.99	28
North Tributary		6/10/2010	105.87	60	152	20.40	83
East Tributary	creek	6/9/2010	67.41	46	108	11.41	133
Oxbow Channel		9/13/2010	95.81	62	141	22.71	78
Oxbow Muskeg		9/13/2010	87.91	63	157	20.40	45
Upper Beaver Area		6/12/2010	87.17	52	129	15.02	387
Lower Beaver Area 2		10/6/2010	93.90	47	154	25.31	134
Upper Falls Back Water		6/10/2010	98.18	50	184	26.73	211
Totals			90.38	46	184	22.79	1331

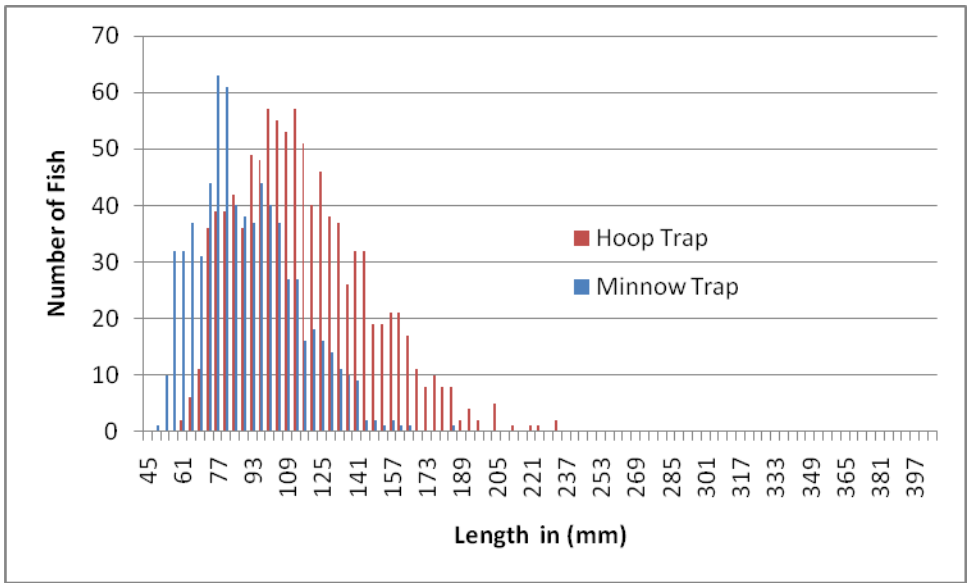

Figure 15. Lower Takatz Creek length frequencies pooled for all areas and dates by trap type

Rod and reel sampling in Reach 2 and its inflow tributaries was limited to 4.37 hr with a total catch of five Dolly Varden and an average CPUE of 0.89 fish per hour (Table 6). The low average CPUE was due to a low catch rate June 6 in Reach 2-5 when all areas fished had 1 to 10 follows from undercuts per cast but heavy thalweg current limited success (Table 6). Three fish were caught on the same day in the top pond of the Lower Beaver Area measuring 93, 135, and

143 mm respectively. Two fish measuring 194 and 204 mm were captured in Reach 2-2 where the East Tributary confluence meets Lower Takatz Creek in a large pool on September 6.

Table 6. Lower Takatz Creek Reach 2 rod and reel sampling CPUE

Reach /Inflow	Sub Reach	Date Set	Time Fished (HR)	Total Catch	Avg. CPUE
Lower Takatz Creek Reach 2	2-2	9/6/2010	0.50	2	4.00
Lower Takatz Creek Reach 2	2-5	6/11/2010	3.12	0	0.00
Lower Beaver Area	LBA1	6/11/2010	0.75	3	4.00
Totals			4.37	5	0.89

Reach 1

Observation Surveys

Various life stages of chum and pink salmon and Dolly Varden char were the primary fish species observed in Reach 1.

Schools of pink and chum salmon smolts were evident at high tides and in the bay during the first surveys on May 22 and during continued surveys until June 12. Adult Dolly Varden were routinely observed to feed on both smolts and salmon eggs. Two to four adult sockeye salmon (*Oncorhychus nerka*) were evident in Reach 1 from mid to late August just below the Lower Barrier Falls and one adult coho salmon (*Oncorhychus kisutch*) was observed on September 14.

Other incidental observations included miscellaneous sculpin (*Cottidea sp.)* and gunnel (*Pholis sp.)* species as well as the occasional starry flounder (*Platichthys stellatus*) at high tides.

Adult chum salmon were observed in Takatz Bay as early as early as June 11th, but were not observed in Reach 1 until July 27th (Figure 16). Chum salmon numbers peaked on August 13th with 315 fish observed (Figure 16). The last viable chum salmon were observed on September 22nd.

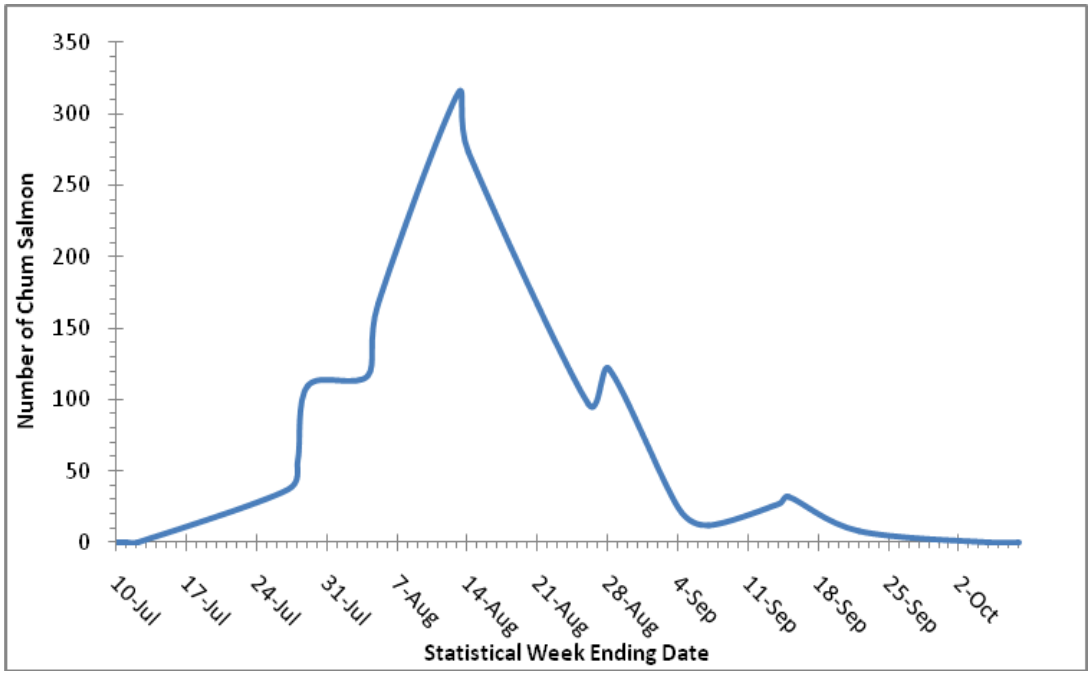

Figure 16. Number of chum observed organized by statistical week ending date

Four **pink salmon** were observed on August 4th. The number of pinks peaked on September 4th with 2284 observed and then dipped shortly after on September 7th. Numbers of pinks began to decrease rapidly after mid September and no pinks were observed by surveys on October 5th.

Overall the primary salmon runs were observed from the last week of July to thru September in 2010.

Chum and pink activity and spawning was concentrated in Sub-Reach 4 of Reach 1 (Table 7, Table 8, See Figure 3)

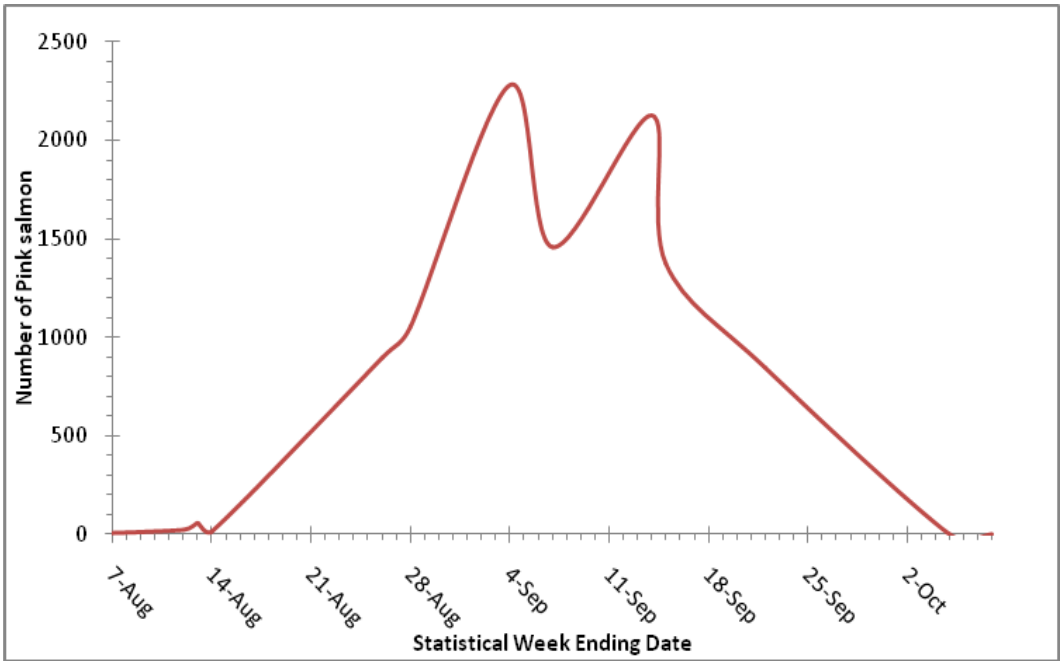

Figure 17. Number of pinks observed organized by statistical week ending date

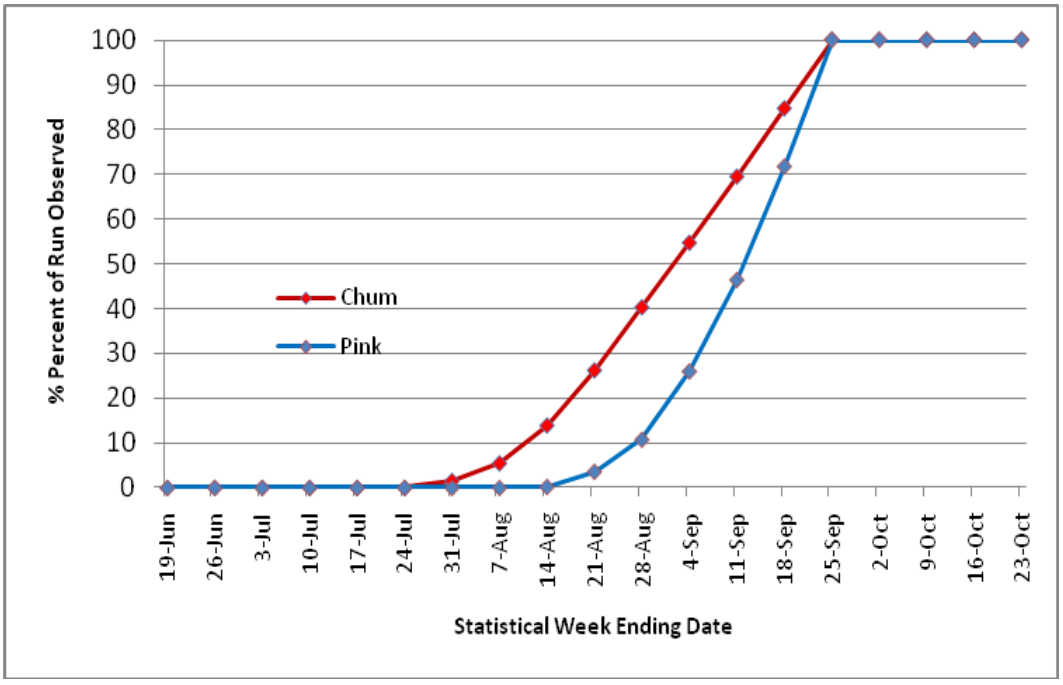

Figure 18. Cumulative percent of chum and pink runs by average count observed during statistical week

Table 7. Percent of adult chum salmon observed Reach 1 by sub-reach and activity

Sub-Reach	% All Activities[1]	% Spawn Only	% Spawn/Other[2]	% Spawn and Spawn/Other
1	0.00	0.00	0.00	0.00
2	2.91	2.29	0.00	1.93
3	3.91	0.23	3.00	0.67
4	85.90	96.67	95.18	96.44
5	7.28	0.80	1.81	0.96

[1] Includes counts of Spawning, Holding, Actively Migrating and all combinations thereof.

[2] Spawn/Other contains counts when a complete distinction couldn't be made between spawning and other activities for a count.

Table 8. Percent of adult pink salmon observed in Reach 1 by sub-reach and activity

Sub-Reach	% All Activities[1]	% Spawn Only	% Spawn/Other[2]	% Spawn and Spawn/Other
1	0.00	0.00	0.00	0.00
2	0.98	0.13	0.41	0.29
3	7.21	0.00	8.63	5.07
4	84.31	87.58	89.12	88.49
5	7.49	12.29	1.84	6.15

[1] Includes counts of Spawning, Holding, Actively Migrating and all combinations thereof.

[2] Spawn/Other contains counts when a complete distinction couldn't be made between spawning and other activities for a count.

Fish Captures

No fish trapping was conducted in Reach 1 during the 2010 field season.

One Dolly Varden 180 mm in length was captured by rod and reel during .75 hours of fishing at the base of the Lower Falls on September 6.

Habitat Evaluation

Three separate foot step substrate samples were conducted on August 14, August 28, and September 7 in areas of concentrated spawning in Reach 1-4. Although percentages of particle sizes varied, during all sampling medium gravels to coarse gravels (11-64 mm) dominated the samples (Figure 19).

Median particle sizes ranged from to 19.1 to 25.3 mm with the greatest variance in the lower percentiles and particle classes taking place during the August 28th sampling (Figure 19, Table 9).

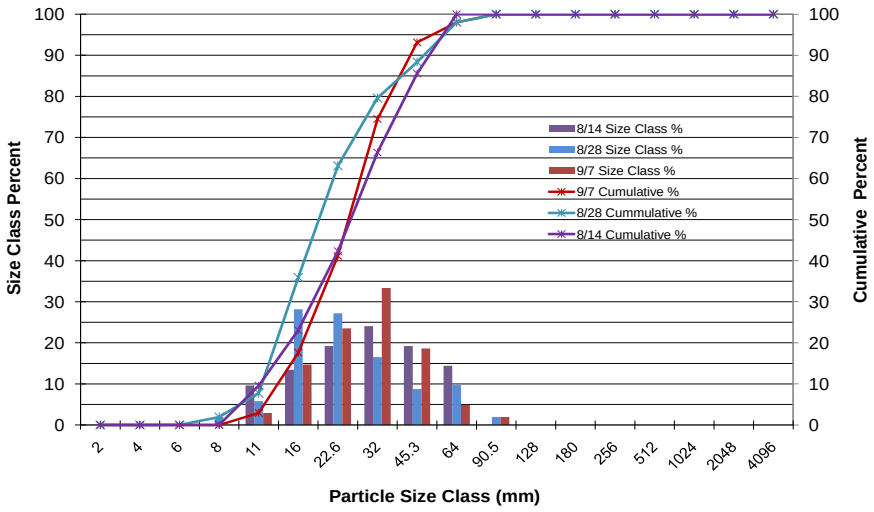

Figure 19 Particle size class percent (bar graph) and cumulative frequency percent distributions of zig-zag transects taken over concentrated spawning areas in Reach 1-4

Table 9. Particle size percentile points in millimeters by date

Date	Particle Size Statistics in (mm)					
	D_{16}	D_{35}	D_{50}	D_{65}	D_{84}	D_{95}
8/14/2010	13.1	19.8	25.3	31.4	44.0	56.8
8/28/2010	12.3	15.8	19.1	23.5	38.1	57.4
9/7/2010	15.3	20.6	24.8	29.0	38.0	51.7

SMALL TAKATZ BAY DRAINAGES

Observation Surveys

The Small Takatz Bay Drainages were typically short with upstream fish passage limited by steep terrain just upstream from the high tide line (see Figure 7). Chum salmon counts in all inflow tributaries ranged from 0 to 5 fish with no obvious time preference between 7/28 and 9/6, 2010.

Pink salmon counts varied from 0 to 83 with the greatest number observed on 9/6/2010 in Powerhouse Creek (Table 10). The second greatest numbers of pink salmon were seen in Cruise Boat Creek on 8/26 and 9/6, 2010.

Table 10. Chum and pink salmon counts at Small Takatz Bay Drainages

Tributary	Date	Chum	Pink
Cripple Creek	7/28/2010	5	0
	8/26/2010	0	0
	9/6/2010	0	15
Powerhouse Creek	7/27/2010	2	0
	8/26/2010	0	23
	9/6/2010	1	83
Cruise Boat Creek	7/27/2010	0	0
	8/26/2010	0	23
	9/6/2010	5	42
South Shore Falls	7/27/2010	0	0
	9/6/2010	0	9
East Muskeg Creek	7/27/2010	5	0
	9/6/2010	0	0
Island Creek (formerly Unnamed Creek)	7/27/2010	0	0
	9/6/2010	1	19

Fish Captures

No capture techniques were utilized during 2010 surveys in the Small Takatz Bay Drainages.

SADIE LAKE BASIN

Work on the Sadie Lake Drainage was limited to foot surveys on May 31, and August 20 thru the 21 as well as personal communications with people familiar with the drainage. Cutthroat trout are known to populate the lake (Figure 20), and in particular the main inlet at the Northwest head on the lake (Figure 21). Fish are also reported from the outlet to saltwater . A smaller inlet is located at the northeast end of the lake and spawning habitat there appears to be confined to a small delta.

Observation Surveys

During both foot surveys, cutthroat were observed in the submerged log piles near the outlet (Figure 22), rising at various locations thorough the lake, as well as in the vicinity of a beaver lodge near the main inlet (Figure 21).

Although no spawning activities were observed, the main northwest inlet and the small delta at the northeast inlet appear to contain suitable spawning habitat. Due to its steep and confined nature, the lower outlet populations are most likely due to a cascade down effect from the lake population.

Fish Captures

No fish captures were conducted in Sadie Lake Basin in the 2010 field season

Figure 20. Sadie Lake looking north from vicinity of outlet

Figure 21. Main Inlet at the northwest head of Sadie Lake with beaver lodge located at the center of the frame

Figure 22. Entrance to the outlet of Sadie Lake

BARANOF LAKE BASIN

Due to the similarity of timing, methods and species results for the Baranof Study Areas are combined.

Observation Surveys

No fish were observed during observation surveys prior to May 6. During snorkel surveys from May 6 to May 8 a total of 216 trout were observed, primarily in the 160-180mm and >180 mm size ranges. During this same time no fish were observed that were less then 120mm in length.

Many of the fish in the smaller classes (to 160mm) were found in upper part of the Lower Baranof River (AE1) and South Creek (AS1) where overall temperatures were greater than 5.5 degrees Celsius. In Water Fall Creek (CW6) juvenile fish were concentrated near an inlet from a beaver pond with temperatures at 5.0^{o}. F&G Camp Creek BN1 was the exception; here juveniles were all in one concentrated area of 2.5^{o} water.

In the size classes >160 mm the highest counts were in the Lower Baranof River (AE1), Upper Baranof River (CW3), and Water Fall Creek (CW6) and were due to overall available habitat. Cabin Creek (CS2) also had a high count, but available habitat was limited to short distance upstream from the lake by a cascade. South Creek contained some available habitat and like Lower Baranof Creek contained warmer water temperatures. Handheld water temperatures varied with most tributaries and areas ranging from $2.5\text{-}5.5^{o}$ C. The exceptions to this were the lake surface, Lower Baranof Creek, and South Creek which ranged above 5.5^{o} C.

Table 11. Cutthroat trout observed by size during snorkel surveys May 6 through May 8

Stream	Stream Name/Area	Date	Number of Trout Observed		
			<160 mm	>160 mm	Total
AE1	Lower Baranof River Outlet	5/6/2010	11	20	31
	Lower Baranof River Outlet	5/8/2010	9	23	32
	Lower Baranof River Below Springs Pool	5/8/2010	6	7	13
AS1	South Creek	5/6/2010	0	12	12
	South Creek	5/8/2010	5	12	17
BN1	FG Camp Creek	5/6/2010	10	2	12
BN2	True Camp Creek	5/6/2010	0	9	9
CS1	Slide Creek	5/8/2010	0	1	1
CS2	Cabin Creek	5/6/2010	0	17	17
CW1	CW1	5/6/2010	0	1	1
CW3	Upper Baranof River	5/7/2010	0	33	33
CW4	Caddis Creek	5/7/2010	0	9	9
CW5	Under Boulder Creek	5/7/2010	0	3	3
CW6	Water Fall Creek	5/7/2010	7	19	26
Total			48	168	216

During foot surveys on October 21, three trout >180mm and innumerable smaller trout in association with flooded sedges were also observed in the Beaver Area. At least two juveniles <100mm that appeared to be from the 0+ age class were also observed in the same area. Two other <100mm juveniles were observed in the Upper Baranof River (CW3) at two separate areas of the stream edge which contained shallow slack water and large woody debris.

Capture Techniques

Two hoop traps were fished overnight on October 20 in order to document fish presence in the beaver area at the west end of the lake. A total of 39 cutthroat trout primarily ranging in size from 124 to 265 mm with one outlier of 312mm were captured (Figure 23).

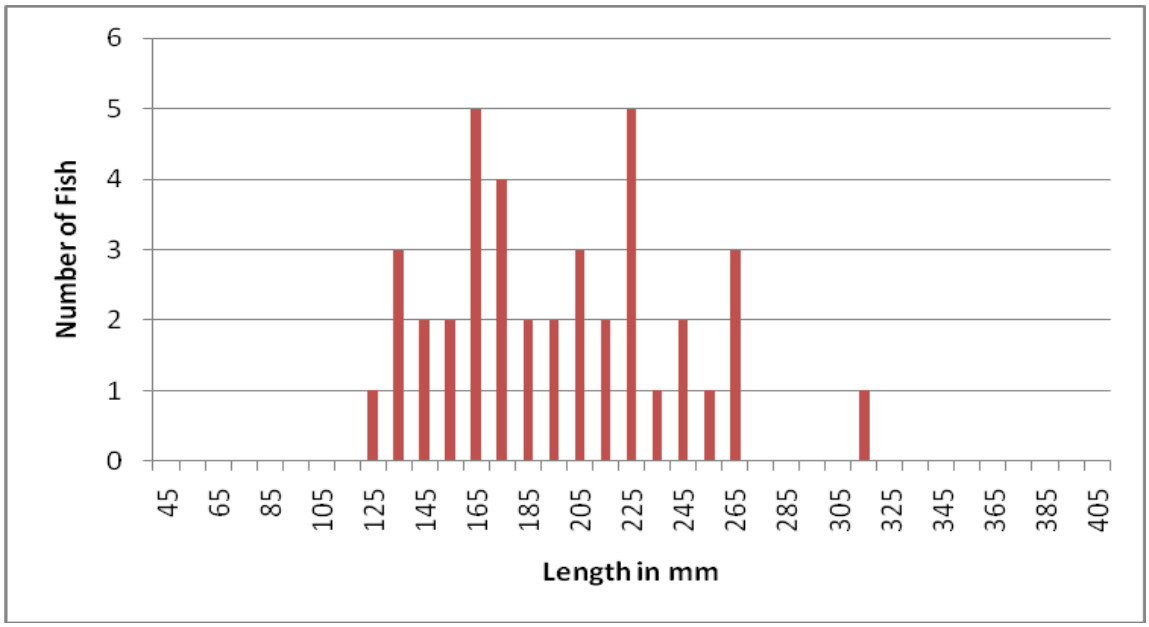

Figure 23. Length Frequency (10 mm increments) of Cuthroat trout captured on October 21 in the beaver area at the west end of Baranof Lake.

No Rod and Reel Surveys were conducted in 2010.

MEDVJIE RIVER BASIN

Upper Medvejie River

Dolly Varden were the only species encountered during surveys in the Upper Medvejie River and were observed from its confluence with Medvejie Lake to a point about .31 miles upstream just downstream of a small cascade (Figure 24).

Figure 24. Small cascade just upstream of the last observed Dolly Varden in Upper Medvejie River.

Observation Surveys

No fish were observed in the Upper Medvejie River during a foot survey on September 30. During snorkel surveys on October 8 a total of seventeen Dolly Varden were observed. All of the observed fish were longer than 120 mm and the majority of fish ranged from 140 to 180 mm.

Table 12. Number of Dolly Varden observed in the Upper Medvejie River by size (mm).

Date	<100	100-120	120-140	140-160	160-180	>180	Total
9/30/2010	0	0	0	0	0	0	0
10/8/2010	0	0	1	6	9	1	17

Fish Captures

No fish capture techniques were utilized in the Upper Medvejie River.

Medvejie Lake

Observation Surveys

During observation surveys 2 Dolly Varden were observed during snorkel surveys on October 8 on a gravel delta midway on the south shore of the lake. During the same survey a total of 15 fish Dolly Varden with 6 in the 140-160 mm, 8 in the 160-180 and 1 >180 mm were observed just downstream of the lake outlet.

Fish Captures

A total of 996 Dolly Varden were captured during trapping in late September 2010. Fork lengths ranged from 59 to 382 mm with a greater representation in the shorter length classes <180mm (Table 13)(Figure 25). Catch rates and fork lengths varied by trap type but there was a surprising overlap in lengths between the two types (Table 13, Figure 26).

During trapping at least 20 fish ranging in size from 104 to 382 mm showed signs of sexual maturity either thru reproductive products, ovipositor extension, or a kype.

Table 13. Summary of trap catch, catch per unit effort, and fork length, of Dolly Varden captured in Medvejie Lake in late September 2010 by trap type.

Trap Type	Num. Trap	Total Catch	Avg. CPUE (Hr.)	Max CPUE (Hr.)	Min. CPUE (Hr.)	Min. Fork Length (mm)	Max. Fork Length (mm)	Avg. Fork Length (mm)	Stdev. Fork Length (mm)
Hoop	4	291	3.09	4.31	1.70	64	382	143.46	51.93
Minnow	20	705	1.42	3.10	0.40	59	301	121.98	35.58

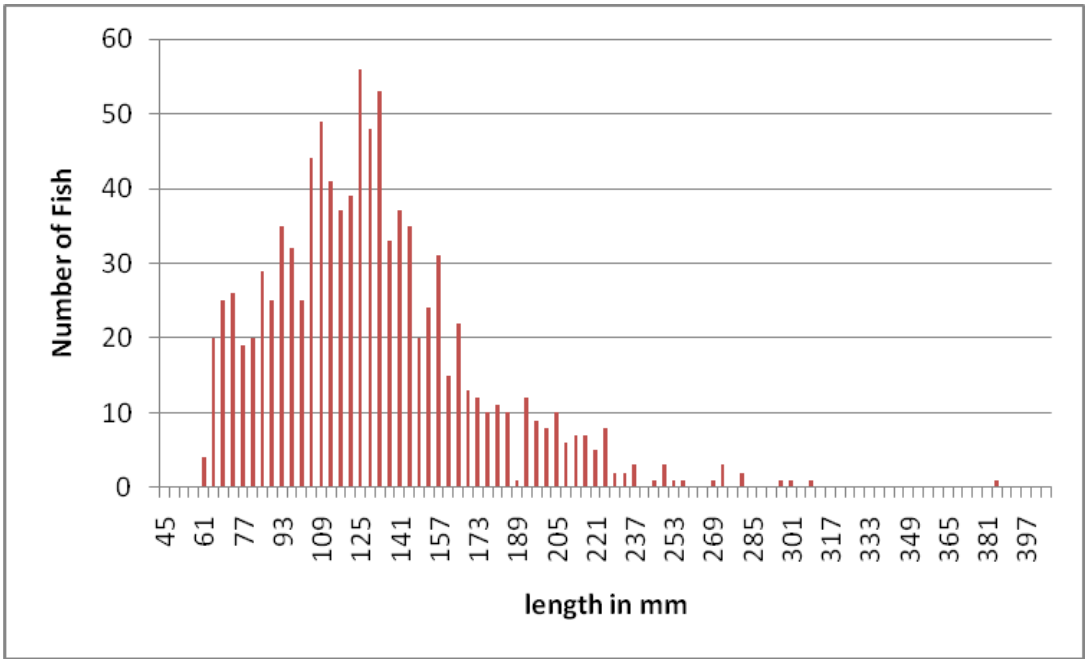

Figure 25. Length frequencies (4 mm increments) of Dolly Varden captured in late September in Medvejie Lake pooled for all trap types.

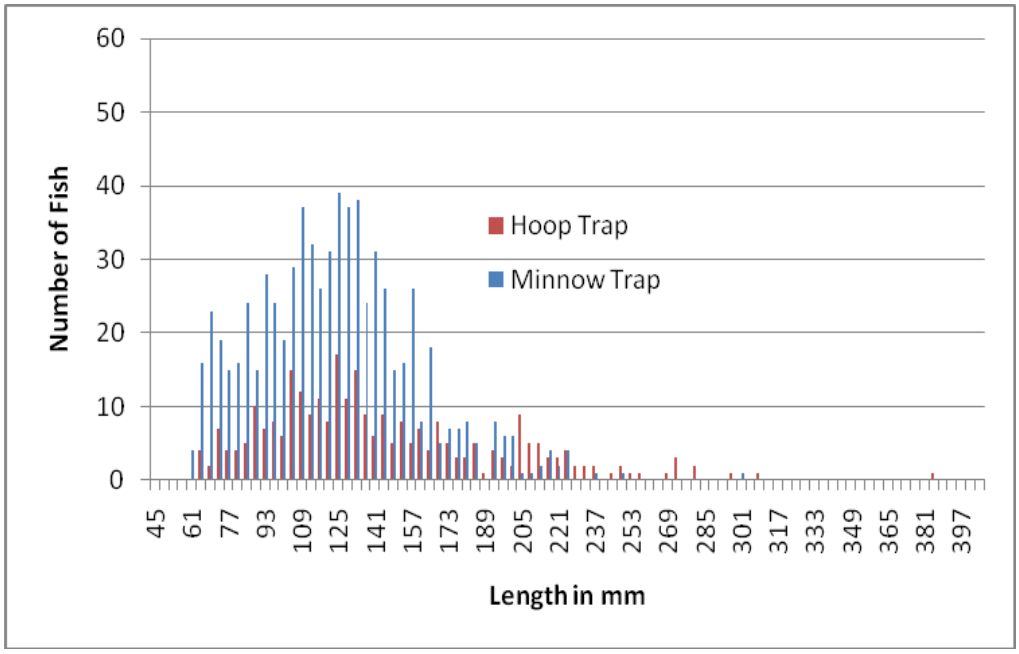

Figure 26. Length frequencies (4mm increments) by trap type of Dolly Varden captured in late September in Medvejie Lake

Lower Medvejie River

Observation Techniques

During a foot on September 1 a total of 317 chum and 2 pinks were observed from tidewater to the picket weir in the North Fork of the Lower Medvejie River, and 1 chum and 55 king jacks were observed in the South Fork of the Lower Medvjie River just below a water supply dam.

Fish Captures

No capture techniques were conducted in Lower Medvejie River.

DISSCUSSION

TAKATZ BASIN

Fish distribution in the Takatz Basin and its inflow tributaries appears to be limited by its geo morphology which has created barriers to fish passage. The most significant in-stream barriers are the "Lower Falls" and "Upper Falls" which appear to be barriers to anadromous and resident fish populations respectively. Above the Upper Falls, Reach 3 is a series of water walls, cascades, and rapids in a high gradient and highly contained channel. The two exceptions to this are a small lake basin (Lower Takatz Lake) from about SM 2.40 to SM 2.60, and a short section extending .06 miles downstream from the Takatz Lake outlet at the top of Reach 3.

At a starting elevation of about 900 feet, for fish to be present in the **Upper Takatz Creek**, **Takatz Lake,** and the **top of Reach 3** it is generally assumed they would have been planted. Prior to the onset of studies there was anecdotal evidence that this had occurred but no official stocking records have currently been found. If fish are present in these areas it would be in limited numbers. Fish presence appears unlikely since the most likely areas (as well as other less desirable) were sampled both by observation surveys and fish capture techniques;

- In **Upper Takatz Creek** side channels, the edge of channels and clear channels from alluvial fan inflows into remnant glacial side channels which are considered the highest quality habitat in this area (USFS 2010);
- In **Takatz Lake** all inflow and alluvial fan confluences including Upper Takatz Creek, as well as the area adjacent to the the outlet;
- **The top of Reach 3** which contained warmer water temperatures as well as large amounts of epithylic periphyton and net spinning caddis for the altitude.

Reach 2 of the Lower Takatz Study Area, its Inflow Tributaries, and adjacent aquatic habitat areas contained only Dolly Varden. The absence of coho salmon fry suggests that the Dolly Varden sampled are part of an above barrier isolated "resident" population(s). These isolated resident populations have been well documented in Southeast Alaska (Ihnlenfeldt 2005; Armstrong and Morrow 1980, Hastings 2005, Schmidt and Robards 1976, Blacket 1973). Barrier isolated populations were created when prehistoric geologic conditions such as ice, terminal moraines, and/or ocean levels made streams accessible to anadromous Dolly Varden populations (Hastings 2005). As anadromous access was discontinued with changing conditions these isolated populations created resident forms which have been further divided into stream-resident form and stream-lake resident forms (Armstrong and Morrow 1980).

It has been concluded that the stream-form has a slower growth rate, reaches maturity at an earlier age, and has a shorter life span (Armstrong and Morrow 1980, Blackett 1973). Studying the stream-resident form nearby in Falls Creek on Admiralty Island Blackett (1973) found that the females there matured at age three and four with an average length of 114mm (range 91-207mm). Similar to Falls Creek, Lower Takatz Creek contains glacier melt, beaver pond seepage, and inflow from smaller tributaries. Schmidt and Robards (1976) studied the stream-lake resident form at Osprey Lake on Baranof Island and found that most of the fish were four years old and averaged 157mm in length with the oldest 8 years and 217 mm in length. During the same study Schmidt and Robards (1976) found that Dolly Varden found in the inlet stream averaged 80mm in length and were two years old. No studies that we are aware of have been done in a system with a small lake and outlet accessible to a larger higher order watershed. Data taken during the 2010 field season suggests that we have both resident forms with seasonal movements and habitat usage.

The **Observation Snorkel Survey** on June 30 is most likely indicative of fish usage during the early summer months.

Our observation of fish less them 100mm in length in slower water areas and the smaller East Tributary outlet is likely due to two primary reasons; one habitat related and one form related. During our survey the highest counts were observed in high quality juvenile habitat in the Upper Beaver Area in association with flooded sedges, and in the Oxbow Channel in association with the smaller isolated pools created by avalanche debris. Both these areas offer high quality habitat for fish in this length class. Our observation of less than 100mm fish in the East Tributary outlet is similar to Schmidt and Robards (1976) finding of fish in this length class in their inlet stream with a stream lake- resident population. This observation was supported by our trapping results as well.

Armstrong and Elliot (1972) found that although juvenile anadromous Dolly Varden inhabited a wide range of habitats to, they displayed a preference for undercuts. This is finding coincides with our observed preference of undercuts in Lower Takatz Creek for fish ranging from 100 to 140 mm.

Our finding of Dolly Varden greater than 140 mm primarily in pools with submerged LWD is likely due to a habitat preference and aggressive territorial behavior by the largest fish. Aggressive territorialism is known for anadromous juvenile Dolly Varden charr (Armstrong and Morrow 1980).

Trapping's primary objective in 2010 was to identify species present and their limits of distribution. We therefore started in the most likely and accessible areas first and moved into other areas as our knowledge of the area improved. During the initial trapping period from June 9-12 the East Tributary Pond had larger catches and lengths then the other areas which like our observation surveys suggests a stream-lake resident form in this inflow.

Also during the June 9-12 trapping period similar trap spacing and count was placed in the North Tributary; a moderate grade controlled channel and Upper Falls Back Water a palustrine habitat area with a spring fed inflow. Both minnow and hoop trap CPUE's were higher in the Upper Falls Back Water while the North Tributary had few fish >140mm. However, by the late June snorkel survey we observed more fish in the larger length classes in all areas of The North Tributary (below the cascade) suggesting summer seasonal movement by Dolly Varden into these areas. Movement by Dolly Varden into upstream and spring fed areas for winter rearing has been observed in Southeast Alaska (Armstrong and Elliot 1972, Blackett 1968, Elliot 1976). Given the severe winter weather and reduced flows experienced in the basin, seasonal movement out of the swifter stream habitat types found in much of the North Tributary and Reach 2 of Lower Takatz Creek for winter rearing is probable. Likely winter rearing areas would be spring fed inflows such as the beaver areas and Upper Falls Backwater for fish <140mm and deep holes or the East Tributary Pond for fish >140mm. There is also likely movement from late August into the fall as into spawning areas.

The most likely spawning areas are located just below pools in Reach 2 of the main creek. This was also evidenced by the comparatively longer lengths we encountered there at that time of year. Due to the lack of spawning habitat in the East Tributary inflow and the catches of comparatively large fish in nearby areas of the main creek it is likely that these fish are utilizing Lower Takatz Creek for spawning as well.

During the 2010 field season we ran into logistic difficulties late in the season in traveling to the drainage and in performing snorkel surveys for spawning Dolly Varden when we were there due to inclement weather. Dolly Varden are thought to be quite selective when choosing spawning areas concentrating in specific areas near pool outflows. Although we examined likely areas by foot survey and capture techniques late August to early October, and then again in mid November we were unable to find any fish displaying spawning characteristics or behavior. Due to almost getting trapped by ice at tidewater in mid November we were forced to end our sampling season at this point.

Dolly Varden data from the 2010 field season in Reach 2 and adjacent inflow areas suggest a complex life history with varying species forms, seasonal habitat movements, and likely intermingling of species forms during the summer and fall seasons.

In **Reach One** chum and pink salmon were the primary species encountered during the 2010 field season.

Chum Salmon in Reach One of Lower Takatz Creek began entering the creek in mid to late July 2010 with a peak count in mid August and counts declining after that. This run timing is similar to both the adjacent terminal harvest area (THA) and the stocks in Kelp Bay just to the north from which the THA stock is derived. Like those stocks Lower Takatz Creek run timing was likely about one statistical week late for 2010 (NSRAA 2010). On average approximately 40,000,000 million chum fry are reared and released Takatz Bay each year contributing to a major seine fishery. At this time it is unknown what percentage of the chum observed in Takatz Creek are from the nearby rearing facility and what percentage are from either naturalized stock or stock native to the stream. Whatever the source of the stock spawning area was mainly limited to a small area (Sub-Reach 1-4). Upstream of this area the strong current (during most tide levels) and subsequent larger substrate make the upstream area less suitable for spawning. Downstream, unlike pink salmon, chum salmon are less likely to spawn in lower intertidal areas (Salo 1991).

Pink Salmon in Reach One began entering in early August with a peak count during the first week in September. Pink counts began to decline rapidly after the second week in September and no pink salmon were observed on October 5. This run timing is consistent with other nearby "middle timing" runs as described by Sheridan (1962). Like chum salmon, pink salmon spawning was largely concentrated in one area. Pink salmon are known to spawn lower in the intertidal zone then chum salmon. One possible reason for the concentration of pink salmon spawning is the relatively low peak number of 2000 pinks which allowed their use of only preferred habitat.

Habitat Evaluation in Reach One consisted of three separate zig-zag foot step surveys with each survey containing greater then equal to 100 substrate measurements. The domination of medium gravels 11-64mm in all the samples is indicative of very high quality spawning substrate. We were initially surprised by the lack of smaller substrate samples particularly fines. Another study in Glacier Bay with a similar delta just below fast water also had a small percentage of particle size classes <11mm with most of theirs in that range consisting of glacial silt (Shipley 2010). Rukholv (1969) found that the percentage of small substrate sizes (<2 mm) was lower in redds then in stream bed samples. In Reach 1-4 spawning and redd distribution was bank to bank during the low tides at which the samples were taken. Our tight grouping of particle sizes is probably due to both factors.

Medians (D_{50}) for each of the surveys were 25.3, 19.1, and 24.8 mm. The two medians of 24.8 and 25.3mm are close to the median size preferred by chum salmon while the 19.1 ranges between those preferred by pink and chum salmon (Kondolf and Wolman 1993). The use of his area by pink salmon suggests that other factors are also involved selection of this area by both species.

Chum salmon tend to prefer sites with upwelling spring water (Heard 1991). Prior to redding activities large portions of Reach 1-4 were covered in sea hair *(Enteromorpha sp.)* which is known to prefer freshwater seeps in the mid to upper tidal zone. It is likely that this area contains upwelling freshwater at its uppermost point either from a pool located directly above or possibly sub-surface spring flows.

SMALL TAKATZ BAY DRAINAGES

Takatz Bay Inflow Drainages consisted of six small drainages. Two of these, Cripple Creek and Power House Creek, entered Reach One (intertidal area) of Lower Takatz Creek at the upper and lower tidal zones respectively. The other four are located along the south shore of Takatz Bay at all tide levels.

In all of the tributaries both chum and pink salmon counts were low due to the small amount of available habitat. Power House Creek contained the largest overall counts with counts including fish that could possibly have been holding just upstream of it confluence of Lower Takatz Creek until water or tide levels allowed easier upstream access in the main creek. Power House Creek counts were still relatively small and spawning habitat was limited to the upper intertidal due to low flows and areas of fine sediment in lower sections.

SADIE LAKE BASIN

Sadie Lake contains a naturalized population of cutthroat trout that are generally regarded to have originated from Baranof Lake stock planted by a non-agency entity. The Northwest Inlet (main) and its confluence appear to contain the majority of suitable spawning habitat while both this area and the outlet area appear to be important rearing areas. In-stream habitat in the North East Inlet is limited by steep topography to a small delta, but it likely contributes some nutrient

input as well as limited spawning habitat. Fish downstream of the outlet are likely due to a cascade down effect and upstream mobility is limited by steep topography.

BARANOF BASIN

Baranof Lake is considered a "high use" cutthroat trout lake by the Alaska Department of Fish game (Bangs 2008) and contains only that species. As such it has been one of the most intensively studied lakes in South East Alaska (Bangs 2008, Harding *et.al* 2009)**.** The abundance of cutthroat trout in Baranof Lake was estimated for a ten year period from 1994 and 2003 with estimates ranging from 5616 to 12,511 and an average of estimate of 8,235 (SD=1980) of fish greater than or equal to 180 mm. During these studies it was also shown that temperatures in the inflow tributaries and along the lake margins were highly variable. Our handheld temperatures confirmed this, and we are currently awaiting the return of temperature loggers due to the scratched download interfaces surfaces requiring factory download.

During our **Observation Snorkel Surveys** we observed the majority of our fish <160 mm in locations at or above 5.0 C^o particularly the Lower Baranof River. During the winter Harding *et al* (2004) also noted observations of rearing trout in the lake outlet. The one exception to this temperature relationship at F&G Camp Cr. was likely due to substrate turnover by the surveyor becoming entangled in the buried temperature logger wire. It has been shown that in temperatures less than about 5-6 C^o juvenile trout seek refuge among the substrate interspaces in streams and decrease feeding activities (Chapman and Bjorn 1969, Cambell and Neuner 1985, Bustard and Narver 1975) and that adult trout in Alaska move to lake and or deep hole habitats (Whitesel et al 1957).

It has been shown that temperatures of about 3-6 C^o initiate spawning activity, and that actual spawning occurs when daily maximum temperatures reach 6-9 C^o (Behnke 1992). During the snorkel surveys conducted from May 6 to May 8 temperatures at the lake surface, Lower Baranof Creek, and South Creek were in the later spawning range while all other areas where in the previous lower range which initiate spawning activities.

With the exception of the Lower Baranof River and South Creek which had warmer temperatures, and Cabin Cr. our highest counts highest counts of fish >160mm were in the inlets on the western lake shore and were related to linear length of available habitat. It is therefore likely that we were at the early end of the spawning activities in the majority of the areas and were observing the early "initiation" portion of the run and in particular small precocious males 160 to 180mm in length. Harding *et. al* (2004) concluded that spawning activity timing in respective tributaries was likely highly variable. It was further concluded that spawning occurred primarily during May and early June, but could last well into July, and in some years began before the lake was ice free.

Finding larger fish in shallower depths particularly near the west inlets, Der Hovanisian and Marshall (1994) concluded that spawning was likely underway while sampling May 27-29 and June 10- 12, 1993. During foot surveys we observed what appeared to be 0+ juveniles in nearby

adjacent areas. It is likely that much of the cutthroat trout spawning in the Baranof Basin takes place at the west end inlets over a period of time as upstream areas become suitable with warming temperatures.

During limited Capture Techniques in the Beaver Area we documented trout use of this area per ADF&G request. Since we observed numerous trout smaller than the size captured it is likely that our sample was biased towards larger fish by the use of hoop traps. Fish larger than those captured by the hoop traps were also observed by both fisheries and wildlife personnel in these areas as well. Beaver ponds and related areas have long been known to provide superior rearing habitat for salmonids (Collen and Gibson 2000).

MEDVEJIE RIVER BASIN

For anadromous stocks fish timing and distribution in the Lower Medvejie River is influenced by barrier nets and hatchery weirs near tidewater and a series of cascades upstream. These upstream cascades correspond to the current ADF&G limits of anadromous distribution (ADF&G, 2009a, ADF&G, 2009b). During much of the year the area from just below the outlet of Medevjie Lake to the vicinity of the hatchery is reduced to subsurface flow due to low lake levels. We found Dolly Varden from the outlet of Medvejie Lake upstream about .31 miles to a series of short cascades.

During **Observaton Snorkel Surveys** on October 8 we observed 17 Dolly Varden in the Upper Medvejie River, 2 fish in the main body of Medvejie Lake, and 15 Dolly Varden just below the lake outlet, indicating that most of spawning likely takes place in the Upper Medvejie River, and the outlet. With some of the fish beginning to show signs of sexual maturity during trapping in late September it is likely that we observed at least a portion of the spawning run during this survey.

Medvejie Lake Fish Captures lengths indicated a stream-lake resident form of Dolly Varden (Schmidt and Robards 1976; see Lower Takatz Reach 2 discussion above). Although our average fork lengths were slightly larger than those found by Schmidt and Robards (1976), Armstrong and Morrow (1980) found that lengths and growth rates varied considerably from lake to lake. Also our lengths are considerably shorter than those found in spawning anadromous stocks (Armstrong 1974; Heiser 1966).

The **Lower Medvejie Creek Foot Surveys** on September 1 count of 317 chum and two pinks in from a barrier net to a weir in the North Fork and a much lesser count of 1 chum and 55 king jacks in the South Fork is in line with NSRAA's mandate of maintaining of the natural runs while being allowed to keep a clean water supply. Even in years when the picket weir fails and there is sufficient above ground flow for anadromous access to the series of lower cascades the substrate above the weir is primarily large cobble and boulder. Also during normal winters there are no above surface flows in this area likely limiting egg survival. The king salmon jacks were from king stocks reared and released at the hatchery and are not part of a naturalized stock.

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APPENDICES

Appendix 1. 2010 Study Dates by Study Area and Date.

Table 1. 2010 Upper Takatz Creek Study Area sampling dates by sampling type and area.

Dates[1]	Trapping Areas	Observation Survey Areas[2]
7/17-7/18	Upper Takatz Creek	To SM 0.3 (f)
7/18		To headwaters (f),
8/14		To SM 1.2 (f)
8/15		To SM 1.2 (f)
9/12	Upper Takatz Creek (9/11-9/12)	To headwaters (f)

[1] First date = trap set and survey , Second date= trap pull
[2] Survey types: (b)=boat, (f/b) foot/boat, f=foot

Table 2. 2010 Takatz Lake Study Area sampling dates by sampling type and area.

Dates[1]	Trapping Areas	Observation Survey Areas[2]
7/16-7/17	South Lake Shore,	South Lake Shore (b), Outlet (f/b)
7/17-7/18	Outlet, Inlet, South Lake Shore	Inlet Stream to headwaters (f), Lake (b), Outlet (f/b)
7/18-7/19	Southwest Lake Shore, Outlet	Outlet (f)
8/14-8/15	North Lake Shore	North and South Lake Shore (b), Outlet (b)
8/15		North and South Lake Shore (b), Outlet (b)

[1] First date = trap set and survey , Second date= trap pull
[2] Survey types: (b)=boat, (f/b) foot/boat, f=foot

Table 3. Lower Takatz Study Area General Fish Observation Survey Dates by Type and Reach and/or Area.

Date	Type	Reach (Sub Reach)/Area (Sub Area)
5/22	Foot	Reach 1-2, Upper Beaver Area
5/23	Foot	Reach 1- 2, Reach 3, Upper Falls Back Water, North Tributary, East Tributary, Lower Beaver Area
6/9	Foot	Reach 1- 2(2), East Tributary, North Tributary, Upper Falls Backwater
6/11	Foot	Reach 2 (4-5)
6/12	Foot	Reach 2 (2)
6/30	Snorkel	Reach 1-2 (1-5), East Tributary, North Tributary,
7/16	Foot	Reach 3 (Takatz Lake Outlet to SM 1.84)
7/17	Foot	Reach 3 (Takatz Lake Outlet to SM 1.84)
7/17	Foot	Reach 3 (Takatz Lake Outlet to SM 1.84)
7/19	Foot	Reach 3 (Takatz Lake Outlet to SM 1.84)
7/28	Foot	Reach 2 (1-5)
8/5	Foot	North Tributary Above Cascade
8/25	Foot	Reach 2 (2-5)
8/26	Foot	Reach 2 (2)
9/6	Foot	Reach 2 (2)
9/13	Foot	Reach 2 (2-3)
10/6	Foot	Reach 2 (2-3)
11/16	Foot	Reach 2 (2-4)

Table 4. Lower Takatz Study Areas Fish Captures By Sampling Type and Reach or Area.

Date	Sampling Type	Reaches (Zones) or Areas (Zones) Sampled
6/9	Trapping	East Tributary, North Tributary, Upper Falls Backwater
6/11	Hook and Line	Reach 2 (4-5), Lower Beaver Area
6/12	Trapping	Upper Beaver Area
7/16	Trapping	Reach 3 (Takatz Lake Outlet to SM 1.84)
7/17	Trapping	Reach 3 (Takatz Lake Outlet to SM 1.84)
7/18	Trapping	Reach 3 (Takatz Lake Outlet to SM 1.84)
7/19	Trapping	Reach 3 (Takatz Lake Outlet to SM 1.84)
7/28	Trapping	Reach 2(2)
8/5	Trapping	North Tributary Above Cascade
8/25	Trapping	Reach 2 (4-5)
8/26	Trapping	Lower Beaver Area (East Braid)
9/6	Hook and Line	Reach 1(5), Reach 2(2)
9/13	Trapping	Oxbow Area Reach 2(3)
10/6	Trapping	Lower Beaver Area (West Braid)

Table 5. 2010 Lower Takatz Anadromous Fish Observation Surveys by Date, Method, Type, and Tide.

Date	Survey Method	Survey Type	Tide	Tide stage
6/27	foot	full	low	rising
6/30	snorkel	full		
7/4	foot	full	low	rising
7/6	boat/foot	full	high	falling
7/6	foot	full	low	falling
7/8	foot	index	mid	rising
7/11	foot	full	mid	rising
7/12	boat/foot	full	high	slack
7/12	foot	index	mid	slack
7/27	snorkel/foot	full	high	falling
7/28	boat/snorkel	full	high	rising
7/29	snorkel/foot	full	low	rising
8/4	foot	full	low	slack
8/5	foot	full	low	slack
8/12	boat/foot	full	high	slack
8/13	foot	full	low	rising
8/14	foot	full	low	rising
8/26	foot	full	low	slack
8/28	foot	full	low	slack
9/4	foot	full	low	slack
9/7	foot	full	low	falling
9/14	foot	full	low	slack

Table 5. Continued

Date	Survey Method	Survey Type	Tide	Tide stage
9/15	foot	full	low	falling
9/22	foot	full	low	slack
10/5	foot	full	low	rising
10/8	foot	full	low	falling
11/16	foot	full	low	falling

Table 6. 2010 Baranof Lake Drainage Freshwater Observation Surveys.

Date	AE1	AS1	BN1	BN2	BN3	CW1	CS1	CS2	CW2	CW3	CW4	CW5	CW6	BA1
4/9	**Foot**	**Foot**	**Foot**	**Foot**		**Foot**	**Foot**	**Foot**	**Foot**		**Foot**	**Foot**	**Foot**	**Foot**
4/10										**Foot**				
4/11											**Foot**	**Foot**	**Foot**	**Foot**
4/23	**Foot**	**Foot**		**Foot**		**Foot**	**Foot**	**Foot**	**Foot**					
4/24									**Foot**		**Foot**	**Foot**		
5/6	**Snorkel**	**Snorkel**	**Snorkel**	**Snorkel**	**Snorkel**	**Snorkel**	**Snorkel**	**Snorkel**						
5/7									**Snorkel**	**Snorkel**	**Snorkel**	**Snorkel**	**Snorkel**	
5/8	**Snorkel**	**Snorkel**				**Snorkel**	**Snorkel**			**Snorkel**	**Snorkel**	**Snorkel**	**Snorkel**	
10/20	**Foot**	**Foot**	**Foot**	**Foot**		**Foot**	**Foot**	**Foot**	**Foot**		**Foot**	**Foot**	**Foot**	**Trap**
10/21										**Foot**				**Foot**

Table 7. 2010 Medvejie Drainage Surveys.

Date	Areas Surveyed	Survey Type
3/25	Lower Medvejie (Hatchery to Lake) Medvejie Lake	Foot /Boat
9/1	Lower Medvejie (Intertidal to Lake)	Foot
9/24-25	Medvejie Lake (North Shore)	Trapping
9/28-29	Medvejie Lake (South Shore)	Trapping
9/30	Upper Medvejie (Lake Inlet)	Foot/Boat
10/8	Upper Medvejie (All)	Snorkel/Boat