

# Summary of 2002 Stream Fish Surveys in Southwest Alberta

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### **Executive Summary**

The objective of the Blairmore District Co-operative Fisheries Inventory Program (CFIP) is to collect species presence and fish habitat data within southwestern Alberta (C5 management unit). This fisheries data has been entered into a standardized database, the Fisheries Management Information System (FMIS). The FMIS database provides program partners with local watershed data, assisting in future resource management strategies. The 2002/2003, inventory program is a collaborative effort between Alberta Sustainable Resource Development (SRD), Atlas Lumber Ltd., Shell Canada Limited and the Alberta Conservation Association. Program partners will receive an inventory catalogue and an annual report listing detailed information for each site surveyed. During the 2002 field season, ACA staff completed 76 backpack electroshocking inventory surveys and four float shocking inventory surveys. Of the 76 backpack surveys, 69 were appropriate for a detailed fisheries and habitat survey, however, the remaining seven were unsuitable for electroshocking due to a lack of flow. Habitat surveys were not conducted for the float shocking surveys. The CFIP program will continue in the 2003-2004 fiscal year obtaining fisheries information from priority drainages. The ACA has contributed funds towards the 2003-2004 field season with funding confirmation from Atlas Lumber Ltd.

## 1.0 Introduction

Since originating in 1994, the Co-operative Fisheries Inventory Program (CFIP) has proven to be a successful fisheries evaluation. A partnership between industry, government and the Alberta Conservation Association (ACA) has enabled a systematic and consistent province wide inventory assessment that benefits all parties. Resource managers have found the inventory data invaluable when seeking effective management strategies. The CFIP data is essential for land and resource management and a critical data set for current and future fisheries management.

The Blairmore region began a Co-operative Fisheries Program during the 1999-2000 year and continued in the 2000-2001 year. Prior to these CFIP assessments, few inventories had been conducted in south western Alberta and this area lacked sound fisheries records (Dahl-Fequet, 2001). During 1999-2000, Atlas Lumber Ltd. funded the initial CFIP program entirely through their Forest Resource Improvement Association of Alberta (FRIAA) fund. The inventory crew sampled 99 sites within the Atlas Lumber Quota area. This included the Livingstone River, Racehorse Creek and Dutch Creek drainages. At the time, these areas were chosen for their proximity to current and future logging activities. Cutthroat trout, bull trout and mountain whitefish were the fish species encountered during the surveys (Dahl-Fequet, 2001). Atlas Lumber Ltd. and ACA funded for two crews during the 2000-2001 CFIP field season and 120 inventory sites were surveyed in total. The Atlas crew sampled 91 sites and the ACA crew sampled 29. Priority areas included the Castle River, Carbondale River, Waterton River, Willow Creek and Oldman River drainages. Cutthroat trout, bull trout, mountain whitefish, brook trout, rainbow trout, rainbow/cutthroat trout hybrid, lake chub, longnose dace, trout perch, brook stickleback, spottail shiner and longnose sucker were fish encountered during the 2000-2001 inventory (Fisher, 2001).

In June of 2002, the ACA inventory crew began the 2002-2003 CFIP year focusing on the Crowsnest River, Castle River, Oldman River and Livingstone River drainages. A total of 80 inventory sites were surveyed. The ACA, Atlas Lumber Ltd., and Shell Canada Ltd. funded the field season. Cutthroat trout, bull trout, mountain whitefish, brook trout, rainbow trout, rainbow/cutthroat trout hybrid, longnose dace, trout perch, longnose sucker, white sucker, mountain sucker and emerald shiner were fish encountered during this inventory year (Table 1.1).

Table 1.1 Fish Species Codes and Scientific Names

<b>Fish Species</b>	<b>Species Code</b>	<b>Scientific Name</b>
Cutthroat Trout	CTTR	<i>Oncorhynchus clarki</i>
Rainbow Trout	RNTR	<i>Oncorhynchus mykiss</i>
Rainbow/Cutthroat Hybrid	CRTR	<i>Oncorhynchus</i> Hybrid
Bull Trout	BLTR	<i>Salvelinus confluentus</i>

Brook Trout	BKTR	<i>Salvelinus fontinalis</i>
Mountain Whitefish	MNWH	<i>Prosopium williamsoni</i>
Longnose Sucker	LNCS	<i>Catostomus catostomus</i>
White Sucker	WHSC	<i>Catostomus commersoni</i>
Mountain Sucker	MNSC	<i>Catostomus platyrhynchus</i>
Emerald Shiner	EMSH	<i>Notropis atherinoides</i>
Longnose Dace	LNDC	<i>Rhinichthys cataractae</i>
Lake Chub	LKCH	<i>Couesius plumbeus</i>
Trout Perch	TRPR	<i>Percopsis omiscomaycus</i>
Brook Stickleback	BRST	<i>Culaea inconstans</i>
Spottail Shiner	SPSH	<i>Notropis hudsonius</i>

Detailed maps, fisheries data and habitat data can be found in the “2002 Reference Catalogue”.

### 1.1 Purpose

To deliver a Co-operative Fisheries Inventory Program in watersheds that have been selected as priority areas in co-operation with Blairmore program partners, to complement previous CFIP data in the Blairmore region and to supply additional data for resource management strategies. Principles guiding the collection and reporting of CFIP data are:

- Standard inventory data collection methodologies
- Use of Geographic Information System (GIS) technology
- Fisheries and fisheries habitat inventory completion prior to resource development
- Integration of inventory results into the development of fisheries resource management strategies and effective management programs
- Shared responsibility between government and industry for inventories

### 1.2 Objectives

- To gather current fisheries presence data and rank the aquatic habitat within priority areas
- Input data into the Fisheries Management Information System (FMIS)
- To collect and store fisheries information in a standardised (GIS compatible) database that will be presented in routinely updated map formats
- To ensure that data collected can be used to make proactive management and development decisions
- To encourage and pursue partnership with government, private industry and special interest groups in the areas of data collection, funding and delivery of the fisheries inventory program

## 2.0 Background

Baseline fisheries inventory data and ongoing monitoring is required when formulating management decisions with respect to fish and fish habitat. This

type of data can be applied when revising current management strategies or implementing new regulations.

A majority of resource industries that affect fish or fisheries habitat are currently responsible for collecting up to date fisheries data. Initially this resulted in suitable fisheries data, but the data was not standardized and was not available or distributed to all parties making the resource management decisions. When data is collected using various formats, data comparison and integration can be problematic. A standardized data collection procedure that would allow resource managers to have access to all fisheries data within the province of Alberta was required.

Thus, the initial Co-operative Fisheries Inventory Program in 1994, led to a province based inventory program. The success of this collaborative project set the current trend of industry, government and ACA to pooling their resources and funding current inventory projects.

## 2.1 Study area

The 2002 study area is located within the south west corner of the ACA Southern Region and within the Sustainable Resource Development, Blairmore District (Figure 2.1).



Figure 2.1 ACA Southern Region and Blairmore Study Area.

The study area falls within the Oldman River watershed. Major drainages within the study area include the Crowsnest, Castle, Livingstone and Waterton Rivers and Willow Creek.

## 2.2 Physical Characteristics

The Southern Region is situated in the Rocky Mountain and Foothills Natural Regions of Southern Alberta. The Montane Subregion is the most prevalent subregion in the area, characterized by open forests and grasslands. The forests are dominated by douglas fir (*Pseudotsuga menziesii*), lodgepole pine (*Pinus contorta*), white spruce (*Picea glauca*), limber pine (*Pinus flexilis*) and trembling aspen (*Populus tremuloides*). The grasslands are dominated by numerous grasses accompanied by many herbs, some of which are unique only to this area. The Montane Subregion is an essential wildlife wintering area because of its unique mountain valley plant community and warmer climate when compared to adjacent subalpine areas. The recurring Chinook winds produce snow-free phases during the winter (Archibald et al, 1996).

## 2.2 Biological Characteristics

The Southern Region supports a diversity of wildlife species including elk (*Cervus elaphus*), moose (*Alces alces*), mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*), bighorn sheep (*Ovis canadensis*), mountain goat (*Oreamnos americanus*), grizzly bear (*Ursus horribilis*), black bear (*Ursus americanus*), cougar (*Puma concolor*) and wolf (*Canis lupus*). Many songbird, game bird, birds of prey and waterfowl species are found in this region as well. The Harlequin duck (*Histrionicus histrionicus*) breeds and rears young within mountain waterways of this region. CFIP staff encountered a few breeding Harlequin pairs during the fisheries inventory. Cool and cold water fish species are prevalent in this region. Native and non-native Salmonid spp dominate watercourses within the region. Biological productivity in this region is low to moderate due to a shortened growing season and thus, cool temperatures and low nutrient levels.

## 2.4 Resource Development

Mineral exploration and development, petroleum and natural gas exploration and development, timber harvesting, domestic grazing and recreational activities are all heavily influencing development within the area. These resource industries impact the natural environment by removing much of the natural vegetation and increasing backcountry accessibility with an extensive road network. Random camping is becoming a concern due to its growing popularity and resultant permanent occupancy in areas usually situated along a watercourse. The use of off highway vehicles is very popular in this area and the popularity continues to increase. The trail systems often traverse the creeks in the study area, affecting channel banks and substrate composition downstream. This amplification in resource use is influencing the character of our natural resources.

### **3.0 Methods**

The focus of the 2002-2003 program year was to sample priority drainages. Several priority drainages were developed as a result of meetings conducted with Sustainable Resource Development (SRD) and funding partners. SRD indicated that several mainstem fisheries were yet to be inventoried for baseline data, while Atlas Lumber required specific waterbody inventory for prospective logging activities. The main objective of the Blairmore CFIP crew was to ensure that the fisheries data was collected using the Co-operative Fisheries standardized methodology. Additional creeks were selected when previously surveyed sites required updating or specific areas were otherwise considered valuable.

#### **3.1 Site Selection, Site Location, Water Quality and Channel Profile**

##### *Site Selection*

The general sampling objective of the field inventory crew was to sample mainstem sites of prioritized drainages. Additional sites were performed on particular creeks when a significant barrier was encountered, a creek was particularly long or habitat notably varied within a creek. Sampling was limited at some reaches due to high creek gradient, site inaccessibility and equipment limitations due to large water or ephemeral water.

Site location, water quality and habitat characteristics were recorded on field inventory form (Appendix I) and the fisheries sampling data was recorded on field inventory form (Appendix II).

##### *Site Location*

Inventory site locations were geo-referenced (NAD 83) in field as Universal Transverse Mercator (UTM) locations using a Garmin 12XL Global Positioning System (GPS) unit. These stored waypoints were later entered into an Arcview GIS computer program for mapping. Streams with registered gazetteer names were recorded and unregistered streams were classified as unnamed (or by local name) when entered into the FMIS database.

##### *Water Quality and Channel Profile*

Prior to any instream operations, water quality was assessed and recorded. Parameters measured included water temperature (°C) and total dissolved solids (TDS) (mg/L). Water temperature was measured using a waterproof digital thermometer and TDS was measured using a "TDS Testr3". Channel profile was assessed as either a u-shaped, v-shaped, planar or notched channel.

### 3.2 Biological Assessment

The focus of the biological assessment was to confirm a fish presence within a stream. Each fish sampled was identified to species and measured for fork length.

#### *Fish Sampling*

A Smith Root Type XII-B model backpack electrofisher was used for fish sampling. Fish inventory proceeded 300 meters upstream from the downstream end of a reach, applying a pulsed direct current (PDC) to the water. The stream was fished according to the habitat available, thus electricity was applied in an on/off electrical pattern maximizing capture efficiency and preventing pushing of fish. All fisheries data was recorded on field form Appendix II.

#### *Species Identification*

All fish species sampled were identified according to the standard identification criteria of the field crew and/or to Nelson and Paetz (1992).

#### *Fisheries Data*

The fork length of all fish species captured was measured to the nearest millimeter (mm). Fork Length is defined as the straight line distance from the most anterior point of the snout to the central part of the caudal fin (tail fin) margin (Nelson and Paetz, 1992).

### 3.3 Habitat Assessment

Following electrofishing, the physical habitat attributes considered imperative to fish production were collected and recorded (Appendix I). Habitat data was collected from the corresponding 300 meter electrofished reach. Habitat measurements were taken at 50 meter intervals, totalling five transects. Physical attributes recorded at each transect included wetted width, rooted width, water depth, water velocity and substrate composition. Water depth and substrate composition were measured at three points along a transect as long as wetted width was greater than one meter in length. If wetted width was less than one meter, only one depth and substrate reading was required. Bank stability, cover composition and pool/riffle/run ratios were determined from inter-transect areas (Figure 3.1).

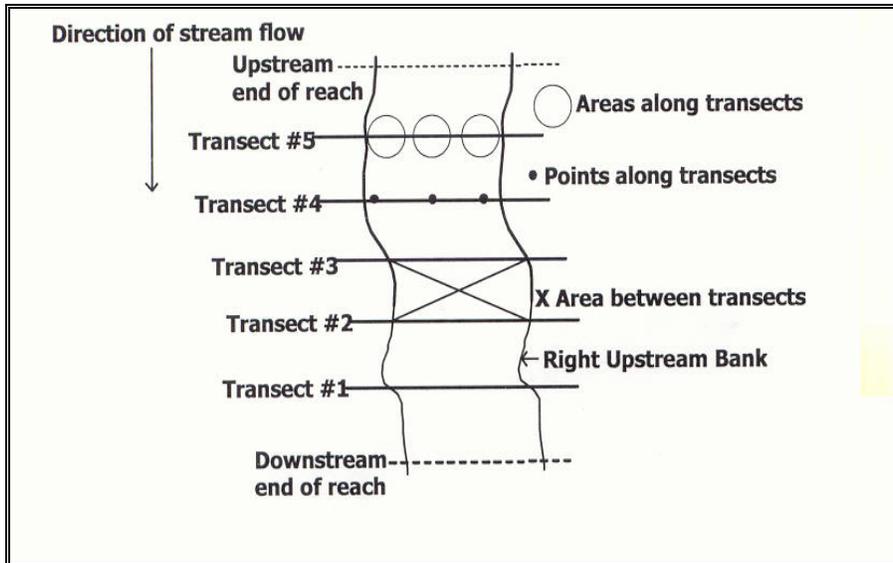


Figure 3.1 Portrayal of CFIP Sampling Methodology (Fitzsimmons and Fontana, 2001)

The Stream Inventory Legend (Appendix III) provides a symbol reference and habitat parameter key.

### *Habitat Ranking*

The 300 meter sampled section of stream was subjectively evaluated for its potential to provide spawning habitat for adult fish (including impeding barriers), rearing habitat for juvenile fish and the likelihood to overwinter fish. These rankings were recorded on a high, moderate or low scale. Spawning and rearing rankings were based on sportfish habitat requirements (Nelson and Paetz, 1992). Coldwater sportfish require deep pools with depths of 40-60 centimeters+ that are protected and hold relatively still water (Raleigh et al. 1984, Chisholm et al. 1987, Brown and Stanislawski, 1996).

### *Stream Width and Depth*

At each transect, wetted width (m) and rooted width (m) were measured to the nearest centimeter. Water depth (m) was recorded at three points within each inter-transect to the nearest centimeter.

### *Water Velocity*

Stream velocity was measured using the float method (Buchanan and Somers, 1969). This involves recording the time taken in seconds, for a floating tennis ball to travel a given distance in meters (m/sec).

### *Substrate Composition*

Stream substrate composition was determined by subjective visual assessment at the same three points as each water depth measurement. Each point was assessed for substrate type and each substrate was expressed as a percentage, totalling 100%. Substrate classification by particle size was determined according to the categories listed in Table 3.1.

Table 3.1 Substrate Categorization.

<b>Substrate Size</b>	<b>Classification</b>
<2 mm	Fines/Bedrock
2-16 mm	Small Gravel
17-64 mm	Large Gravel
65-256 mm	Cobble
>256 mm	Boulder

A five percent minimum was used when incorporating low substrate percentages. Percentages were calculated at five percent increments.

### *Bank Stability*

At each inter-transect, bank stability was subjectively assessed for bank erosion and sedimentation potential. Left and right bank stability was categorized using the bank stability rankings in Table 3.2.

Table 3.2 Bank Stability Chart

<b>Bank Stability</b>	<b>Ranking Standard</b>
Stable	Banks well vegetated such that they are not susceptible to erosion.
Slightly Unstable	>50% of banks in section are stable, limited indication of erosion and stream siltation.
Moderately Unstable	> 50% of bank instability, some indications of stream siltation from bank instability.
Highly Unstable	Massive bank slumping, large deposits of silt in stream.

The primary cause of any bank instability was assigned as a natural, livestock, road crossing, pipeline crossing, seismic, forestry or mining event.

### *Cover Composition*

Stream cover composition was subjectively assessed and expressed as a percentage between the eight categories presented and defined in Table 3.3.

Table 3.3 Cover Composition Type

Cover Type	Cover Type Definition
Surface Turbulence	The proportion of stream surface area broken by riffles sufficient to provide cover to a fish below.
Aquatic Vegetation	The proportion of stream area providing cover due to the presence of aquatic vegetation.
Instream Debris	A measure of the volume of instream woody debris providing cover.
Terrestrial Canopy	The proportion of cover provided from overhanging terrestrial vegetation.
Rock/Boulder	The proportion of cover created by rock and boulder.
Undercuts	The proportion of banks that have lateral scouring, forming sufficient cover.
Turbidity	The degree of isolation or cover provided by water turbidity.
Depth	The proportion of the stream that provides cover formed by water depth.

The cover composition was determined when the inter-transect was assessed for all available cover types. A five percent minimum was used when incorporating a low cover composition. Cover composition was calculated at five percent increments. All measurements incorporated any braided sections and both left and right banks (undercuts) along a 300 meter inventory reach.

#### *Pool-Riffle-Run Ratio*

Subjective assessments of the pool, riffle, and run ratios (equalling 100%) for the inter-transect areas were made. A channel section was classified as a pool when water plunged into a pool below. Riffle areas consisted of broken surface water sections and run areas largely consisted of uninterrupted water flows.

#### *Photographic Documentation*

Digital photos were obtained along each survey reach to provide a visual representation of the stream. On average, three photographs were taken within a surveyed reach, including typical habitat sections, areas consisting of crossings, disturbances, barriers or any additional notable features.

#### *Assessment Observations*

Any additional comments considered significant to a surveyed reach were included. These comments clarified any unusual habitat measurements encountered during the survey. The encounter of any aquatic invertebrates, algae, wildlife or springs was noted. General landscape description and water clarity was also recorded.

### 3.4 Float Shocking Surveys

Large sections of the Oldman and Castle Rivers were inventoried, floating an inflatable raft equipped with an electrofishing device and a three-person crew. The electrofishing unit consisted of a Smith Root 5.0 GPP, a generator, an eggbeater anode and two “36 cable dropper” cathodes. An oarsman controlled the raft while two personnel fished with the anode and dip netted at the front of the raft. Both rivers consisted of 2 float inventory sections. Sampling was limited in areas due to spooking of fish, swift flows, restricted watercraft manoeuvring, sizeable wetted width and deep pools.

### 3.5 Survey Sites Without Fish Collection

Occasionally, streams that were surveyed and were incapable of supporting fish due to gradient or insufficient flows were assessed as water quality sites, thus, electrofishing was not practical. These sites included three habitat transects at 50 meter intervals measuring only wetted and rooted widths and water depth. A site location, habitat ranking and 2 photographs were included along with any detailed comments of the site. Dry sites were only photographed and geo-referenced for a site location.

### 3.6 Data Management

All fisheries and habitat data collected were entered into Microsoft Excel spreadsheets designed as load forms for the FMIS provincial database. The completed forms were loaded into the FMIS database and subsequently extracted for catalogue and GIS data using Oracle Discoverer software.

## 4.0 Results

Precipitation was above average in the spring of 2002, resulting in substantial water flows, subsequently causing a delay with surveys. Surveying commenced at the end of June and continued throughout the summer, concluding at the end of September, 2002. The following is an overview of the surveyed creeks and fish capture results. Fisheries presence within each of the surveyed creeks is listed in Table 4.1. More detailed fisheries and habitat information can be found in the “2002 Reference Catalogue”.



## 4.1 Crowsnest River Watershed

The Crowsnest River sources from Crowsnest Lake, which is located at the Continental Divide, the Alberta and British Columbia provincial boundary. The river flows easterly, increasing in size and strength as water accumulates from various tributary creeks. The river flows through the community of the Crowsnest Pass and out into the foothills where it empties into the Oldman River system. Each tributary creek of the Crowsnest River contributes to its renowned trout fishery. The Crowsnest River is a choice fly fishing river, regarded as one of the premier fly fishing streams in Western Canada. It supports healthy populations of rainbow trout, cutthroat trout, brown trout, mountain whitefish and some bull trout. The lower portion of the river is open to angling year round. The following inventoried creeks are tributaries of the Crowsnest River watershed. Flows were above average for the initial few weeks of sampling due to above average precipitation during the months of May and June.

### *Allison Creek*

Allison creek flows southerly, draining into the Crowsnest River. The creek flows between Crowsnest Mountain and the Continental Divide, ranging in headwater elevation of 1920 meters to 1340 meters at its confluence. The channel is relatively straight and well defined with very steep walled banks and abundant terrestrial bank cover. Several tributaries flow into Allison Creek including the outlet of Chinook Lake. Allison creek has been stocked several times in the past (1926-1965) with rainbow trout, cutthroat trout and brook trout. Bull trout once spawned in Allison creek, but due to channel alterations above and below Highway 3, the bull trout have not been able to continue their inherent migration (Fitch, 1977). Allison Creek was extensively surveyed in 1978 by the regional fisheries biologist at that time. Lethbridge Community College has conducted student surveys since 1981. The 2002 sample location was upstream of a concrete weir that is upstream of the Chinook Lake confluence. The stream habitat in this reach was largely comprised of run sections and stable cobble banks. Moderate fish habitat was found within corner sections consisting of small undercut banks and instream debris. Cattle and All Terrain Vehicle activity were apparent within the creek and area. Spawning habitat was rated high due to a moderate amount of spawning substrate, excellent flows and no migration barriers. Moderate cover was available in form of instream debris and rock/boulder habitat, but the overwintering potential was low due to a lack of adequate depths. Fish collection resulted in the capture of 16 sportfish, 14 of which were cutthroat trout and 2 of which were brook trout. The majority of fish were captured within the instream debris sections.

### *Blairmore Creek*

Blairmore Creek flows on a moderate gradient between Grassy Mountain and McGillivray Ridge to its confluence with the Crowsnest River, ranging in elevations of 2134 to 1311 meters. Many of Blairmore Creek's tributaries flow from McGillivray Ridge at a very high gradient, creating a continual migration barrier. Blairmore Creek was stocked with rainbow and cutthroat trout in the 1940's and a fisheries survey was conducted in 1978. In 2000, an environmental assessment was completed on Blairmore Creek due to a proposed culvert crossing for town development. Two surveys were conducted on Blairmore Creek in 2002; CR21 and CR22. There had been previous logging activity adjacent to the creek at CR21. The upper reach (CR21) had more fish habitat in the form of instream debris, terrestrial cover, rock/boulder and undercuts, whereas the lower reach (CR22) consisted only of rock/boulder habitat. Spawning and rearing habitat was rated high for both sections and overwintering potential was moderate at CR21 and low at CR22. Fish collection at CR21 and CR22 resulted in the capture of 60 and 42 sportfish respectively. Cutthroat trout, rainbow trout and cutthroat rainbow hybrids were sampled. The majority of fish at CR21 were captured within the instream debris and undercut sections. At CR22, the majority of the fish were found within the rock/boulder habitat.

### *Byron Creek*

Byron Creek drains Byron Hill and Hastings Ridge, flowing northeast at a moderate gradient to its confluence with the Crowsnest River. The CFIP crew inventoried Byron Creek in 2000 but no fish were sampled at that time. Byron Creek has an impassable migration barrier approximately 1000 meters from the confluence. Two surveys were conducted on Byron Creek; CR11 and CR12. Because, the upper reach (CR11) was upstream of the barrier, there were not any fish encountered at this site. The reach had a moderate cover composition and moderate overwintering habitat but the spawning substrate ranked low. The reach below the barrier (CR12), consisted of moderate cover and spawning substrate but lacked overwintering habitat. Fish collection at CR12 resulted in the sampling of 24 rainbow trout. The fish were captured within each type of cover available to them.

### *Connelly Creek*

Connelly Creek drains the southern portion of the Livingstone Range and a few small ponds and lakes within the white zone (settled/domestic grazing area) before it connects with the Crowsnest River. A fisheries survey was conducted on Connelly Creek in 1978 during limited flows and no fish were sampled at that time. The 2002 sample location was downstream of the North Burmis Road. The channel converts into a small pond just upstream of the survey site on the west side of the North Burmis Road. Cutthroat trout were seen swimming in the pond. Run sections within a meandering and incised channel characterized the

stream habitat in this reach. Suitable fish habitat was found throughout the channel. Although cattle activity was apparent within the riparian area, the riparian area was in good condition. Spawning habitat was rated moderate due to a moderate amount of spawning substrate, excellent flows and no migration barriers. Rearing habitat ranked high with available cover in the form of instream debris, terrestrial canopy, undercut and rock/boulder habitat. Overwintering potential was moderate with some areas of adequate depth. Fish collection resulted in the capture of 18 cutthroat trout and 1 longnose sucker. Fish were captured throughout all sections of the reach due to the excellent cover available.

### *Cow Creek*

Cow Creek flows in a southeasterly direction draining the Livingstone Range at Centre and Caudron Peaks. The creek primarily flows through the white zone ranging in headwater elevation of 1951 meters to 1158 meters at its confluence with Todd Creek. A fisheries survey was conducted on Cow Creek in 1978, sampling 10 sportfish and 62 non-sportfish. In 1994, the occasional rainbow and bull trout telemetry survey was conducted. During 2002, the survey reach was typified by run sections within a meandering and incised channel that supported a significant amount of terrestrial cover. Cattle were present during the survey and had highly impacted the banks in a few sections of the reach. The remaining sections were so heavily covered with terrestrial vegetation that the livestock were unable to utilize the water's edge. Spawning habitat was rated low due to silty substrate. Rearing habitat ranked high with excellent cover in the form of instream debris, terrestrial canopy, undercut and rock/boulder habitat. Overwintering potential was moderate with some areas of adequate depth. Fish collection resulted in the capture of 44 fish; 18 rainbow trout, 2 white sucker, 3 longnose sucker, 14 longnose dace and 7 emerald shiner. Sampling efforts were limited due to the significant amount of terrestrial cover.

### *Drum Creek*

Drum Creek flows on a moderate gradient between Turtle and Hillcrest Mountains, through the town of Hillcrest until it reaches its confluence with the Crowsnest River. Two surveys were conducted on Drum Creek; CR7 and CR14. The upper reach (CR7) was above the townsite, adjacent to the last residence at the upstream portion of the creek. Spawning habitat was rated moderate, while rearing and overwintering potential was high. The lower reach (CR14) was located downstream of Hillcrest, adjacent to beaver pond habitat. CR14 consisted of moderate spawning and overwintering habitat and high rearing habitat. Fish collection at CR7 resulted in the capture of 15 brook trout. CR14 resulted in the sampling of 13 rainbow trout and 1 brook trout. The majority of fish were captured within sections enclosed by instream debris, undercuts and terrestrial canopy.

### *East Crowsnest Creek*

East Crowsnest Creek drains Mount Ptolemy, Ptolemy Pass and a few small settling ponds, constructed during the earlier open pit mining activities. East Crowsnest Creek flows on a moderate gradient, uniting with Crowsnest Creek. Numerous aquatic insects were observed throughout the reach. Two surveys were conducted on East Crowsnest Creek; CR1 and CR2. The upper reach (CR1) was upstream of a significant barrier that was believed to impede fish migration. The lower reach (CR2) was downstream of the barrier. Fish were absent at both sites, suggesting a significant barrier downstream of these sites. Flows were high during the time of survey. Both sections experienced bank slumping due to steep banks and unstable substrate material. CFIP staff encountered a breeding pair of Harlequin duck on both reaches and bear scat along the creek bank. Both CR1 and CR2 consisted of a moderate spawning rating due to moderate amounts of spawning substrate, excellent flow and a few migration barriers. Rearing habitat ranked moderate with cover in form of instream debris, terrestrial canopy and rock/boulder habitat. Overwintering potential was low, lacking in areas of adequate depth.

### *Falls Creek*

Falls Creek is the local name for a small creek that flows on a significant gradient through East Hillcrest until it joins with Drum Creek. The sample location was downstream of the East Hillcrest Road, adjacent to a horse stable. The riparian area downstream of the survey reach had been harvested of its timber. The stream habitat in this reach was largely comprised of run sections and numerous low water barriers, creating small plunge pools. Fish habitat was found throughout the channel. The horse stable was fenced up to the creek, allowing the horses access to the water. Spawning habitat was rated low due to a lack in spawning substrate and numerous migration barriers. Rearing habitat ranked moderately with available cover in form of natural and manmade instream debris, terrestrial canopy, undercut, and rock/boulder habitat. Overwintering potential was low due to a lack of adequate depth. Fish collection resulted in 2 rainbow trout. The fish were captured within the initial 100 meters of the reach below a significant 1.8 meter water fall barrier.

### *Girardi Creek*

Girardi Creek is the local name for a productive creek that flows between Sentry Mountain and Chinook Peak to its confluence with the Crowsnest River, immediately downstream of Crowsnest Lake. The sample location was along a cutline and road crossing. Cattle activity was evident along the road and riparian area. The stream habitat in this reach was characterized by riffle and run sections with a few plunge pools. The upstream portion of the channel was highly incised, creating unstable banks. Fish habitat was found throughout the channel. Spawning habitat was rated low due to a lack in spawning substrate.

Rearing habitat ranked high with a large amount of rock/boulder habitat with some instream debris and undercut sections. Overwintering potential was low due to a lack of adequate depth. Thirty cutthroat trout were captured within all rearing habitat available.

### *Gold Creek*

Gold Creek drains Grassy Mountain and the west slopes of the Livingstone Range, flowing into a wide valley bottom through the community of Frank, ultimately discharging into the Crowsnest River. Caudron, Morin and Green Creeks are tributaries of Gold Creek. Gold Creek holds a significant amount of history for the Crowsnest Pass and its mining settlements. The Gold Creek watershed encompassed a fully functional townsite (Lille), a railway, coal mining structures and mining activity at Grassy Mountain. In the past, Gold creek received a significant amount of attention due to its importance as a fishery resource to the Crowsnest proper. The creek has been stocked with rainbow trout, brook trout and cutthroat trout since 1926. A significant migration barrier is located approximately 7.5 kilometers upstream of the confluence. The creek did not support a fish population above this barrier in 1977. The creek was stocked with cutthroat trout above the barrier in 1977 and was surveyed in 1986 demonstrating a success (Clements, 1986). Over the years, other censuses and assessments have also been on Gold Creek. A significant amount of private lands were logged within the Gold Creek drainage in 1995. Cattle are active within the area. Overall, banks were relatively stable throughout the surveyed reach. The stream habitat in this reach was comprised of run sections with very little riffle areas. Fish habitat was lacking throughout the channel. Spawning habitat was rated high due to areas of suitable spawning substrate. Rearing habitat ranked moderate, with some rock/boulder habitat and instream debris. Overwintering potential was low due to a lack of adequate depth. Fish collection resulted in the sampling of 13 cutthroat trout, captured within rock/boulder habitat along the creek banks.

### *Green Creek*

Green Creek flows into Gold Creek. Green Creek immediately flows at a significant elevation gradient upstream of the confluence, creating impassible stepping barriers. Cattle activity was present along the water's edge at a seasonal residence adjacent to the creek. Numerous aquatic insects were observed throughout the reach. The stream habitat in this reach was typified by riffle, run and pool sections created by boulder ledges. Fish habitat was moderate throughout the reach but the gradient produced a continuous barrier. Spawning habitat was rated low due to numerous migration barriers found within some areas of suitable spawning substrate. Rearing habitat ranked moderate with moderate rock/boulder habitat, instream debris, terrestrial cover and undercuts. Overwintering potential was moderate with some areas of adequate depth. Green Creek was absent of fish.

### *Island Creek*

Island Creek flows northerly on a moderate gradient from Loop Ridge until it drains into the southwest shore of Island Lake. Island Creek was inventoried for management purposes in 1979. A concrete dam, constructed for domestic water supply purposes, was a major barrier to upstream movement at that time (Fitch, 1980). The barrier has since been removed. A log haul road runs parallel with the creek to its headwaters where it had been extensively logged in the past. Because of future logging potential, the 2002 CFIP crew conducted several surveys on Island Creek and its tributaries. The upper reaches were classified as water quality sites due to their lack in flow and elevation gradient. The remaining surveys were inventory sites with fish sampled at each site. Overall, the majority of spawning and rearing habitats were rated moderate due to areas of suitable substrate and moderate rock/boulder habitat, instream debris and terrestrial cover. Overwintering potential was low due to a lack in areas of adequate depth. Numerous low water barriers were encountered throughout but did not appear to affect migration at these sections. At each site, a low number of juvenile cutthroat trout were sampled. These were encountered within the instream debris and pool sections.

### *Lyons Creek*

Lyons Creek drains Willoughby and Hastings Ridges flowing northerly through the town of Blairmore and into the Crowsnest River. A small section of Lyons Creek was slightly diverted in the 1980's to improve slope erosion on the Sartoris road. Several surveys were conducted on Island Creek and its tributaries. The upper reaches along Willoughby Ridge were categorized as water quality and dry sites due to their lack in flow and significant elevation gradients. Other survey sites sampled several rainbow trout. Overall, the majority of spawning and rearing habitats were rated moderate with areas of suitable substrate and moderate rock/boulder habitat, instream debris and terrestrial cover. Overwintering potential was low due to a lack in areas of adequate depth. Flows were high at the time of survey but significantly decreased over the summer months. A large number of juvenile rainbow trout and a few adult rainbow trout were sampled between these sites.

### *Morin Creek*

Morin Creek flows into Gold Creek from the Livingstone Range and is located adjacent to the Lille historical site. Morin Creek was inventoried in 1978 and was found dry at that time. Cattle activity, a random campsite and off highway vehicle crossings were present within the surveyed reach. Numerous logjams were present throughout. Run sections with some riffle and pool areas characterized the stream habitat in this reach. Fish habitat was prevalent throughout the reach. Spawning habitat was rated moderate due to numerous migration barriers and some silty areas. Rearing habitat ranked high with excellent rock/boulder habitat,

instream debris and undercuts. Overwintering potential was moderate with some areas of adequate depth. A total of 16 adult and juvenile cutthroat trout were captured. Fish were sampled above all low water barriers within the instream debris and undercut sections.

### *Ptolemy Creek*

Ptolemy Creek drains several peaks within the northern portion of the Flathead Range before it unites with Crowsnest Creek. A log haul road runs parallel with the creek. Previous logging activity was evident directly south of the surveyed reach. Numerous aquatic insects were observed throughout the reach. Flows were swift and strong at the time of survey. The surveyed reach consisted of uninterrupted riffle and run sections. Spawning habitat was rated low due to a lack in spawning substrate. Rearing habitat ranked high with available cover in the form of aquatic vegetation, undercut and rock/boulder habitat. Overwintering potential was low due to a lack of adequate depth. Fish were absent throughout the reach, likely suggesting a significant barrier downstream of this site.

### *Rock Creek*

Rock Creek flows southeasterly from the southeast slopes of the Livingstone Range to its confluence with the Crowsnest River. Rock Creek is open to extensive livestock grazing and several road and pipeline crossings. Rock Creek is a major livestock watering source to local landowners. A fisheries survey was conducted on Rock Creek and its tributaries in 1976 and 1978. The creek has been stocked with Rainbow trout since 1926. Two sample sites (CR15 and CR16) were completed in 2002. Run sections within a meandering and incised channel, creating moderate bank instability typified the stream habitat at CR15. Suitable fish habitat was found throughout the channel. Spawning habitat was rated low due to a lack of spawning substrate and a significant amount of silty substrate. Rearing habitat ranked high with excellent cover in the form of instream debris, terrestrial canopy, undercut and rock/boulder habitat. Overwintering potential was moderate with some areas of adequate depth. A total of 25 cutthroat trout were sampled. Fish were present throughout all sections of the reach due to the excellent cover available, but the cover limited capture efficiency at times. The upper reach (CR16) was void of fish. The section flowed through a grazed area that was heavily impacted by livestock. Spawning ranked low due to a significant amount of silty materials. Rearing habitat was moderate with a significant amount of terrestrial cover and instream debris. Overwintering potential was low due to a lack of flow and depth. According to the landowner, fish have been observed downstream near the road crossing in the past. The culvert at the road crossing and a series of culverts upstream of the road crossing on the ranch property are likely impeding further upstream migration.

### *Star Creek*

Star Creek drains Mount Parrish and Mount McLaren, flowing northerly into the Crowsnest River at West Coleman. Star Creek has a walking trail adjacent to its channel leading to Star Creek Falls. The Star Creek Fall is a significant barrier to fish migration, yet Atlas Lumber personnel encountered rainbow trout and cutthroat trout upstream of this barrier in 2002. The stream habitat in this reach was comprised of run and riffle sections. Spawning habitat was rated moderate with areas of suitable substrate. Rearing habitat ranked moderate with areas of rock/boulder and instream debris. Overwintering potential was moderate with some areas of adequate depth. A total of 20 adult and juvenile cutthroat trout were captured. Fish were sampled above all low water barriers within instream debris.

### *Todd Creek*

Todd Creek flows southeasterly for approximately 55 kilometers through the white region, supplying many landowners with water for their livestock before entering the Crowsnest River. Goat Creek, South Todd Creek, Cow Creek and Wildcat Creek are some tributaries of Todd Creek. Fisheries surveys were conducted on Todd Creek in 1976 and 1978. Extensive habitat and fisheries inventories were taken in 1990 for the Oldman River Dam Project, and in 2001 for a proposed road crossing upgrade. The crossing upgrade was completed in 2001 but an enhancement pool created downstream of the new culvert no longer exists due to high flows and sediment movement. Several streambank fencing projects have been completed along Todd Creek in effort to restore riparian vegetation within pasturelands, ultimately improving fisheries habitat within this white region. Two sample sites (CR26 and CR27) were completed in 2002. The stream habitat at CR26 was almost entirely typified by run sections within a meandering and incised channel, creating bank instability. Banks were also impacted by livestock activity. Spawning habitat was rated low due to a lack in spawning substrate and a significant amount of silty substrate. Rearing habitat ranked moderate with cover in the form of instream debris, terrestrial canopy and undercuts. Overwintering potential was high with many areas of adequate depth. One rainbow trout, 3 trout perch, 26 longnose dace, 35 longnose sucker and 1 emerald shiner were sampled. Water turbidity and depth affected capture efficiency during the inventory. The upper reach (CR27) was located at the road crossing upgrade. Cattle activity was evident downstream of the crossing. Portions of the surveyed reach possessed significant channel incisement. Spawning ranked moderately due to suitable substrates upstream from the crossing. Rearing habitat ranked high with a significant amount of terrestrial cover, instream debris and undercuts. Overwintering potential was rated moderate with areas of suitable depth. A total of 16 cutthroat trout, 16 rainbow trout, 3 cutthroat rainbow hybrid and 5 longnose dace were sampled.

## 4.2 Upper Oldman River Watershed

The Oldman River sources from High Rock Range at the Continental Divide (Alberta and British Columbia provincial boundary). From these headwaters the river flows through the mountains, foothills and prairie regions prior to joining with the South Saskatchewan River, ultimately draining into Hudson's Bay. The Oldman River system supplies several industries with water. The river is essential to food manufacturing, crop irrigation, power production, recreation, human consumption and of course, the fisheries and wildlife of the region. The following paragraphs are inventoried tributary creeks within the upper watershed of the Oldman River. These creeks contribute to an exceptional trout fishery in the upper watershed and are important bull trout spawning tributaries. The Upper Oldman River is a popular camping and fly fishing destination to many individuals. Native cutthroat trout and bull trout dominate this portion of the Oldman River.

### *Beehive Creek*

Beehive Creek drains Beehive Mountain, which is located within the Beehive Natural Area, contributing to the early development of the Oldman River system. The stream habitat in this reach is characterized by riffle and run sections with a few plunge pools. Numerous aquatic invertebrates were present. Spawning habitat was rated low due to a lack of spawning substrate. Rearing habitat ranked high with a large amount of rock/boulder habitat, instream debris, terrestrial canopy and undercuts. Overwintering potential was moderate with a few areas of adequate depth. A total of 48 cutthroat trout were sampled. The trout were slender for their size. The creek possessed a high fish population relative to the creek size, possibly suggesting food and habitat competition between resident fish.

### *Cache Creek*

Cache Creek drains the southern portion of the Beehive Natural Area and flows into the Oldman River, just upstream of the Oldman River Falls. An equestrian/hiking trail runs parallel with the creek. Banks are steep but generally stable. The channel flows at a moderate gradient with a headwater elevation of 2134 meters and mouth elevation of 1737 meters. A fisheries inventory was conducted on Cache Creek in 2000. One sample site was completed in 2002. The stream habitat in this reach was largely comprised of run sections with some riffle sections. Spawning habitat was rated moderate with areas of suitable spawning substrate. Rearing habitat ranked high with excellent rock/boulder habitat, instream debris, terrestrial canopy and undercuts. Overwintering potential was moderate with some areas of adequate depth. A total of 32 cutthroat trout were sampled. The trout in Cache Creek were not slender like the trout of Beehive Creek and other creeks inventoried north of Cache Creek.

### *Hidden Creek*

Hidden Creek drains Tornado Mountain and is located outside the Beehive Natural Area boundary. An old road runs parallel with the creek, traversing its channel several times. This road is currently used by off highway vehicles year round. Previous logging and current livestock activity was apparent in the upper reaches of Hidden Creek. Fisheries inventories were conducted on Hidden Creek in 1973, 1974 and 2000. Several surveys were conducted on Hidden Creek in 2002. Banks were generally stable throughout the reaches. A significant migration barrier exists approximately four kilometers upstream of the confluence. This was the only barrier encountered during the surveys. The creek supports healthy fish populations above and below the barrier. Markings on the cutthroat trout from above the barrier are noticeably different from those trout captured below this barrier. The cutthroat trout above the barrier had very bright orange underbellies and black spotting throughout the body, whereas the trout below were less orange in color and possessed less spotting. The creek channel in the upper reaches was slightly incised and very sinuous. Overall, the spawning and rearing habitats were rated high due to areas of suitable spawning substrate and excellent rock/boulder habitat, terrestrial cover and undercuts. Overwintering potential was rated moderate with some areas of adequate depth. Numerous cutthroat trout and some bull trout were sampled at each site. The fish were captured within the undercut and terrestrial cover habitats. Adult bull trout were observed swimming upstream Hidden Creek for spawning (below the barrier).

### *Honeymoon Creek*

Honeymoon Creek flows south from Cabin Ridge to the Oldman River. The creek flows within a straight, v-shaped, steep walled valley for most of its 14 kilometers. An old coal exploration road runs parallel with the creek. The road is currently used by off highway vehicles year round. Livestock activity was apparent in the upper and lower reaches of Honeymoon Creek. A fisheries inventory was conducted on Hidden Creek in 1973 and 2000. A significant migration barrier exists 0.8 kilometers upstream of the confluence (Radford, 1975). Two sample sites (OM6 and OM7) were completed in 2002, with OM6 located upstream of the barrier. The stream habitat at OM6 was typified by repeated run, riffle and pool sections. Spawning habitat was rated low due to a lack of spawning substrate and the presence of numerous significant barriers. Rearing habitat ranked high with excellent terrestrial canopy and rock/boulder habitat. Overwintering potential was rated high with several areas of adequate depth. This site was absent of fish. The lower reach (OM7) ranked low for spawning habitat due to a lack of suitable substrates. Rearing habitat was rated high with a significant amount of rock/boulder cover. Overwintering potential was rated low due to a lack of suitable depth. Six adult and juvenile cutthroat trout and 1 adult bull trout were sampled.

### *Lyall Creek*

Lyall Creek drains Beehive and Lyall Mountains and is located within the Beehive Natural Area. The creek flows on a moderate elevation gradient, creating a stepped riffle effect within run sections. Numerous aquatic invertebrates were present. Spawning habitat was rated low due to numerous migration barriers and little spawning substrate. Rearing habitat ranked high with a large amount of rock/boulder habitat and terrestrial canopy. Overwintering potential was low, lacking in areas of adequate depth. A total of 28 adult and juvenile cutthroat trout were sampled.

### *Oldman River*

The Oldman River itself was inventoried in 2002 via float electrofishing methods. The Oldman River has interminably involved several fisheries and habitat surveys over the years, with the most recent cooperative inventory completed in 2000. Travelling downstream the river's characteristics and composition change significantly. The lower section of the Oldman River (below the dam) has been the center of attention since the completion of the Oldman Dam in the early 1990's. Two fisheries inventories were completed in 2002, upstream of the dam. No habitat assessments were conducted. An upper inventory section, concluding near the Gap (an opening in the Livingstone Range), and a lower section, concluding upstream of the Oldman Reservoir, were floated. The upper surveyed reach was located within the forest reserve. It consisted of instream cover in form of logjams, snags, overhanging vegetation, undercuts and rock/boulder habitat. Within the two kilometer stretch, 9 mountain whitefish, 6 cutthroat trout and 2 bull trout were sampled. The lower reach was located within private grazing lands. This section consisted of instream cover in form of overhanging banks, bedrock ledges and rock/boulder habitat. Ten mountain whitefish, 1 cutthroat trout, 11 rainbow trout, 1 cutthroat rainbow hybrid, 7 bull trout, 7 longnose dace, 6 white sucker and 158 longnose sucker were sampled within the 10 kilometer float.

### *Oyster Creek*

Oyster Creek flows southerly along side Straight and Pasque Creeks. The creek flows within the valley bottom between High Rock Range and Pasque Mountain. Oyster Creek is the first major tributary to enter the headwaters of the Oldman River. A log haul road runs parallel with the entire creek and continues north, joining with the Lost Creek drainage in Kananaskis Country. These upper reaches of the Oldman have been harvested extensively for timber. The Oyster Creek drainage encompasses numerous cutblocks. Year round off highway vehicle routes traverse the creek. A fisheries inventory was conducted on Oyster Creek in 1973 and 1974. Two sample sites (OM15 and OM16) were completed in 2002. The stream habitat at OM15 was mainly comprised of run sections.

Spawning habitat was rated low due to a lack in spawning substrate and the presence of a significant amount of fine material (possibly a result of cutblock erosion). Rearing habitat ranked high with excellent terrestrial canopy, undercuts and rock/boulder habitat. Overwintering potential was low due to a lack of areas with adequate depth. Caddisfly casings were abundant throughout the reach. A total of 44 adult and juvenile cutthroat trout were sampled. OM16 ranked identically to OM15 except for moderate channel incisement that created bank instability. A total of 45 adult and juvenile cutthroat trout were sampled. A tributary which enters upstream of this site contributes to half of Oyster's total flow.

### *Pasque Creek*

Pasque Creek flows southerly, draining the west side of Pasque Mountain. The Pasque Creek watershed has almost entirely been harvested of its timber. A 25 to 40 meter riparian buffer exists. Fisheries inventories were conducted on Pasque Creek in 1973 and 2000. Trout fry counts were conducted in 1990 and 1991. Two sample sites (OM13 and OM14) were completed in 2002. The stream habitat at OM13 was typified by run sections. Spawning habitat was rated moderate with areas of suitable substrate, but covered in fine material (likely silt load from logging operations). Rearing habitat ranked high with excellent terrestrial canopy and rock/boulder habitat. Overwintering potential was rated low due to a lack of adequate depths. A stream crossing was in very poor condition resulting in unstable banks at this section. A total of 41 adult and juvenile cutthroat trout were sampled. Several additional juvenile fish in the 60 millimeter range were also observed. The spawning habitat at the OM14 site was rated moderate with areas of suitable substrate and the absence of low water barriers. Rearing habitat ranked high with excellent instream debris and rock/boulder habitat. Overwintering potential was rated moderate with some areas of adequate depth. Numerous aquatic invertebrates were present. Banks were steep but relatively stable. A total of 27 adult, juvenile and young of the year (YOY) cutthroat trout were sampled with several additional juvenile and YOY observed.

### *Slacker Creek*

Slacker Creek flows southeasterly until it flows into the Oldman River directly across from Soda Creek. Fisheries surveys were conducted in 1973 and 2000. A fall creating a barrier to upstream migration is located approximately 1.5 kilometers upstream of the confluence (Radford, 1975). A previous cutblock exists adjacent to the creek on its south side. Two surveys were conducted on Slacker Creek, OM11 and OM12 in 2002. The upper reach (OM11) was located above the waterfall barrier and no fish were sampled. The spawning habitat for OM11 was rated low due to a lack of suitable substrate and a few low water barriers, while OM12 was rated moderate with some areas having suitable substrate and lacking in migration barriers. Rearing habitat was rated moderate

for both sections with cover largely consisting of rock/boulder habitat. Overwintering potential was rated low at both sites due to a lack of adequate depth. In total, 26 adult and juvenile cutthroat trout were sampled at OM12.

### *Soda Creek*

Soda Creek drains Beehive Mountain and is located within the Beehive Natural Area. The creek flows on a moderate elevation gradient creating many cascading low water barriers. The stream habitat in this reach was characterized by run, riffle and pool areas. A significant amount of brown algae was present. Numerous aquatic invertebrates were present. Spawning habitat was rated low due to numerous migration barriers and little spawning substrate. Numerous fish were holding below the larger barriers. Rearing habitat ranked high with a large amount of rock/boulder habitat, instream debris, undercuts and terrestrial canopy. Overwintering potential was rated moderate with some areas of adequate depth. A total of 26 adult cutthroat trout were sampled. The trout were found within all cover types. The trout here resembled the trout of Beehive Creek and were very slender for their length. Soda Creek supports a large fish population relative to the size of creek and habitat available.

### *South Hidden Creek*

South Hidden Creek drains the southern portion of Tornado Mountain. An old road runs parallel with the creek. The road is now used by off highway vehicles year round. Previous logging activity and current livestock activity was apparent in the upper reaches of South Hidden Creek. A fisheries inventory was conducted on Hidden Creek in 1973 and 1974 but South Hidden was not surveyed at this time. The stream habitat in this reach was typified by run sections and some riffle areas. Numerous aquatic invertebrates were present. Spawning habitat was rated high with excellent spawning substrates and no migration barriers. Rearing habitat ranked moderate with a large amount of rock/boulder habitat and some terrestrial canopy. Overwintering potential was rated low, lacking in areas of adequate depth. A total of 4 adult and juvenile cutthroat trout were sampled and were collected within areas of terrestrial cover.

### *Straight Creek*

Straight Creek flows southerly, flowing between Oyster and Pasque Creeks. Much of the Straight Creek watershed has been harvested of its timber, and timber harvesting was taking place at the headwaters of Straight Creek during the time of this survey. A fishery inventory was conducted on Straight Creek in 2000 but no fish were encountered at that time. Two sample sites (OM17 and OM19) were completed in 2002. OM17 was located upstream of the survey site of 2000. The stream habitat at OM17 was mainly comprised of run sections. Spawning habitat was rated moderate with areas of suitable substrate, but covered in fine material (likely silt load from logging operations). Rearing habitat

ranked high with excellent instream debris, undercut and rock/boulder habitat. Overwintering potential was low due to a lack of adequate depths. A moderate amount of aquatic invertebrates were present. One adult cutthroat trout within a bank undercut was sampled. The spawning habitat at the OM19 site rated moderate with areas of suitable substrate, some low water barriers and some silty areas. Rearing habitat ranked high with excellent instream debris, terrestrial canopy and rock/boulder habitat. Overwintering potential was low, lacking in areas of depth. Cattle activity was evident within the riparian area. There was a significant amount of willow cover for the initial 100 meters of the reach. A road crossing leading to the old abandoned mine site at Mount Gass is likely impeding the majority of upstream fish migration. Banks were steep but relatively stable. A total of 9 adult and juvenile cutthroat trout were sampled. Several additional juvenile and young of the year were observed. Fish were located within the rock/boulder habitat and instream debris sections.

#### 4.3 Livingstone River Watershed

The Livingstone River drains Plateau Mountain, the Livingstone Range and Cabin Ridge before it flows into the upper reaches of the Oldman River. The lower section of the Livingstone is comprised of a v-shaped, steep walled canyon, while the upper reach consists of gentle meandering flows. The natural resources of the Livingstone River drainage are impacted by the lumber industry, oil and gas industry and recreation industry. In 1995, the Livingstone watershed regulations were changed over to catch and release angling only. The Livingstone River and its tributaries have been inventoried and assessed since the 1970's. The Livingstone watershed consists of several tributaries that flow from the surrounding ridges. The following inventoried creeks are two of which contribute to the Livingstone River fishery. The Livingstone River consists of cutthroat trout, bull trout and mountain whitefish sportfish species.

##### *Isolation Creek*

Isolation Creek is a tributary of the Livingstone River that flows easterly, draining Cabin Ridge. The creek flows at a moderate elevation gradient with headwater elevations of 2500 meters and 1680 meters at its confluence. The creek is a v-shaped, steep walled, sheltered waterbody that is approximately 11 kilometers in length. An old road parallels the creek for its entire length. This road is now used heavily by off highway vehicles. Fisheries inventories were conducted on Isolation Creek in 1973 and in 1999. Several surveys were also conducted in 2002 because of future logging interest. Three upper surveyed reaches below Cabin Ridge were water quality sites due to their lack in flow and high elevation gradient. Flows in this area were typified by subterranean flow and cascading barriers. The remaining three surveys were inventory sites with no sampling of fish. Numerous aquatic invertebrates were present. Overall, the majority of spawning habitats were rated moderate with excellent spawning substrate but numerous low water barriers. Rearing habitat was rated high with areas of

excellent rock/boulder habitat, instream debris and moderate terrestrial cover. Overwintering potential was different at each site with high, moderate and low areas of depth. Numerous low water barriers were encountered throughout the surveyed reaches. The lower half of Isolation Creek appeared very fishy even though no fish were encountered. A waterfall barrier exists on Isolation Creek approximately 1.5 kilometers from the confluence and fish were found below the falls during the 1999 survey (Dahl-Fequet, 2001).

### *Savanna Creek*

Savanna Creek flows easterly draining the east side of Pasque Mountain. The creek flows at a gentle to moderate gradient with headwater elevations of 2540 meters and 1730 meters at its confluence. The creek is v-shaped and partially exposed and meanders for the majority of its 17 kilometer length. The valley walls are quite steep in some areas but stable. An old coal exploration road parallels the creek for its entire length and is presently used by off highway vehicles. Fisheries inventories were conducted on Savanna Creek in 1973 and 1999. Because of future logging interest, several surveys were conducted on Savanna Creek in 2002. Three upper inventory sites were absent of fish. These sites were characterized by a moderate gradient, low spawning potential, moderate to high rearing potential and low overwintering potential. The rearing habitat consisted of rock/boulder and instream debris with some terrestrial canopy. Off highway vehicle crossings were present at the upper and mid sections. A moderate amount of aquatic insects were present. Two inventory sites were completed at the central portion of the creek. These sites resembled the upstream habitat characteristics. Cattle activity was present at one of the sites. Two inventory sites (L11 and L12) at the downstream portion of Savanna Creek did result in fish capture and the significant barriers impeding upstream migration were located at L12. The creek at L11 was typified with a v-shaped channel, steep unstable banks and run sections. Spawning habitat was rated moderate with some spawning substrates although migration barriers were absent. Rearing habitat ranked highly with a large amount of rock/boulder habitat and some instream debris. Overwintering potential was moderate with some areas of adequate depth. Two adult cutthroat trout and 2 adult bull trout were sampled. Fish were collected within instream debris sections. L12 was located below the six waterfalls that impede upstream migration within Savanna Creek. Spawning habitat was rated low with some spawning substrate but very significant migration barriers. Rearing habitat ranked high with rock/boulder habitat, undercut and instream debris. Overwintering potential was high with several plunge pools of adequate depth created by steep bedrock ledges and strewn boulders. Three adult cutthroat trout and 2 adult bull trout were sampled. Fish were collected within instream debris below the first set of falls. Fish were absent upstream the initial set of falls. Fish do not migrate upstream of this barrier.

#### 4.4 Castle River Watershed

The Castle River sources from Clark Range on the Continental Divide near Waterton Lakes National Park. A large number of permanent tributaries are part of the Castle River watershed, draining many ridges within the foothills before flowing into the Oldman River northwest of Pincher Creek. Petroleum exploration and development, domestic livestock grazing, cultivation and recreational development are the primary land uses within the Castle region. The Castle River system receives attention by many anglers, containing mountain whitefish, rainbow trout, cutthroat trout and bull trout fish species. The following are inventoried tributary creeks within the Castle watershed.

##### *Barnaby Creek*

Barnaby Creek flows into the Castle River after draining Southfork and Barnaby Lakes, which drain Southfork Mountain. Both Southfork and Barnaby Lakes contain stocked populations of golden trout (*Oncorhynchus aguabonita*), that are native to the Sierra Nevada Range in California. The channel profile is v-shaped and the creek flowed at a moderate to high gradient. Channel incisement and a cobble/smalls bank mixture create unstable edges throughout most of the reach. The stream habitat in this reach was characterized by long runs broken by riffle sections. Spawning habitat was rated low, lacking in areas of suitable spawning substrate and containing numerous low water barriers. Rearing habitat ranked high with excellent rock/boulder habitat, instream debris, terrestrial canopy and undercuts. There was a great deal of instream debris within the channel due to extensive blow down. Overwintering potential was low lacking adequate depth. A total of 19 cutthroat trout were sampled. Trout were found within instream debris and terrestrial cover sections.

##### *Castle River*

The Castle River was inventoried in 2002 using float electrofishing methods. The Castle River and its several tributaries have been involved in several fisheries and habitat surveys over the years. The river changes in character and composition from a v-shaped cross section at the headwaters to a u-shape at the downstream portions. Two fish inventories were completed on the Castle River in 2002. No habitat assessments were conducted. An upper inventory section concluded near the Castle Rodeo grounds and a lower section concluded upstream of the Oldman Reservoir at the old highway crossing. Both sections were situated within private grazing lands. The upper survey section consisted of instream cover in the form of bedrock ledges, choppy riffles, terrestrial cover, instream debris, undercuts and rock/boulder habitat. Ten mountain whitefish, 5 bull trout, 10 rainbow trout, 32 longnose sucker, 2 white sucker and 1 longnose dace were sampled within the 7.2 kilometer stretch. The lower reach consisted of instream cover in form of bedrock ledges, strewn boulders, instream debris and rock/boulder habitat. Fish collection resulted in the sampling of 4 mountain

whitefish, 8 rainbow trout, 3 bull trout, 3 longnose dace, 3 white sucker and 55 longnose sucker within a 10 kilometer float. Sportfish were located within the boulder habitat, instream debris and at the tail end of riffle sections.

### *Gladstone Creek*

Gladstone Creek drains Mount Gladstone flowing at a moderate elevation gradient to the confluence with Mill Creek. Cattle activity was present within the creek and surrounding area. A fisheries survey was conducted on Gladstone Creek in 1978. In 1994, Gladstone Creek was part of a rainbow and bull trout telemetry survey. Featureless runs and shallow riffles characterized this section. Spawning habitat was rated moderate with some areas of suitable spawning substrate. Rearing habitat ranked high with a large amount of rock/boulder habitat and some instream debris. Overwintering potential was moderate with some areas of adequate depth. Five cutthroat trout, 18 rainbow trout, 2 rainbow/cutthroat hybrids, 2 bull trout, 2 mountain whitefish and 1 mountain sucker were sampled. The fish were collected within riffle and instream debris sections.

### *Mill Creek*

Mill Creek flows northeasterly from Windsor Mountain and Victoria Ridge to its confluence with the Castle River. Fisheries surveys were conducted on Mill Creek in 1978 and 2000. Gravel substrates are abundant within the middle to upper reaches of Mill Creek providing bull trout with excellent spawning habitat. During the 1990s, habitat structures were placed within the creek to enhance the bull trout spawning habitat. Cattle activity was evident in this reach. Homogenous run sections with small riffle areas typified the survey reach. Spawning habitat was rated high with excellent spawning substrate and no low water barriers. Rearing habitat ranked high with excellent rock/boulder habitat. Other rearing habitat was limited in this section. Overwintering potential was moderate with some areas of wintering depth. Two cutthroat trout, 1 brook trout and 17 bull trout were sampled. Fish were captured throughout all sections of the reach due to the excellent rock/boulder cover available.

### *Screwdriver Creek*

Screwdriver Creek drains Mount Backus flowing northeasterly to the Castle River. The channel is relatively straight and well defined. Cattle activity was present within the creek and riparian area. The cattle have heavily impacted the banks and vegetation. A fisheries survey was conducted on Screwdriver Creek in 1978. A culvert at highway 507 creates a migration barrier for upstream fish movement (Fitch, 1979). A 2002 survey was conducted upstream of this barrier. The channel was slightly incised which caused some unstable banks. Tea stained subterranean boulder flows and stagnant algae pools characterize this section in late summer. All habitat was ranked low within this section of the

survey reach due to a lack in flow. Fish collection resulted in the sampling of 2 longnose sucker. The fish were collected within stagnant algae pools.

### *West Castle River*

The West Castle River is a major tributary of the Castle River. The West Castle River flows in a northerly direction draining the Clark Range and Barnaby Ridge. The channel is meandering on a small floodplain surrounded by steep valley slopes. Timber within the headwaters of West Castle River were extensively harvested in the past. The most recent fisheries inventory within the West Castle River was in 2000. Two sample sites (C7 and C8) were completed in 2002. Featureless run sections typified the stream habitat at C7. Sign of cattle activity and a random campsite were located within the area. Spawning habitat was rated high with areas of excellent spawning substrate. Rearing habitat ranked moderate with some rock/boulder habitat and very little instream debris and undercuts. Overwintering potential was high with areas with adequate depth. Shocking efficiency was limited due to the wide channel. Two bull trout, 1 cutthroat trout and 1 rainbow trout were sampled. Fish were collected within sparse sections of instream debris. The spawning habitat at the C8 site rated moderately with areas of suitable substrate. Rearing habitat ranked moderate with rock/boulder habitat and very little instream debris. Overwintering potential was low lacking in areas of adequate depth. One bull trout was sampled. Very few fish were encountered within these sections of the West Castle River. A lack in cover composition may be a limiting factor to a more productive fishery.

### *Whitney Creek*

Whitney Creek flows north from Victoria Peak and Prairie Bluff to its confluence with Mill Creek. The channel is a relatively straight, v-shaped and sheltered creek flowing at a moderate gradient. A fisheries survey was conducted on Whitney Creek in 1978. Shell Oil placed artificial habitat structures into Whitney Creek during a mitigation project in 1986 (Clements, 1988). Two sample sites (C3 and C4) were completed in 2002. A road leading to a gas well runs parallel to the surveyed sections. Run sections broken by shallow riffle areas typified the stream habitat at C3. Spawning habitat was rated moderate with areas of suitable spawning substrate and no low water barriers. Rearing habitat ranked high with excellent cover in form of instream debris, terrestrial canopy, undercuts and rock/boulder habitat. Overwintering potential was low, lacking in areas of adequate depth. A total of 22 adult and juvenile cutthroat trout and 1 adult bull trout were sampled. Fish were captured throughout all sections of the reach. The lower reach (C4) had identical habitat rankings as C3. Steep walled banks and loose cobble material caused some bank slumping at both surveyed sections. A total of 29 cutthroat trout and 2 bull trout were sampled at this reach.

## 5.0 Discussion

The Blairmore Co-operative Fisheries Inventory Program met the objectives of the 2002/2003 inventory year by collecting and reporting priority watershed data. Updated and new fisheries data within the Blairmore region is now available, facilitating a proactive approach to resource management and development. The standardized format of the CFIP data will be incorporated into the provincial FMIS database, making this current data and all previous CFIP data accessible. Baseline data identifies the presence or absence of fish and describes the physical condition of the available habitat. This is only the gateway to the overall fisheries condition within a watershed, thus, repeated inventories would identify seasonal and yearly fluctuations. Repeated inventories are especially useful when monitoring the effects of enhancement projects or resource extraction.

The 2002 inventory survey identified areas that may affect the overall fisheries resource within the Blairmore region and should be mentioned. Many creeks inventoried suggested that permanent migration barriers are hindering fish from utilizing excellent upstream habitats. East Crowsnest Creek is one such creek that did not support a fish population but had a moderate fishery potential and numerous aquatic invertebrates present. Inventories were conducted upstream and downstream of a barrier which was thought to impede migration, although fish were not encountered at either site. A significant barrier must exist downstream of these sites and should be identified. The barrier may be very close to the confluence with Crowsnest Creek or it may be on Crowsnest Creek itself. Crowsnest Creek should be inventoried and East Crowsnest Creek should be examined for significant barriers upstream of the confluence and then inventoried.

Ptolemy Creek was an additional creek that was devoid of fish. Ptolemy Creek enters Crowsnest Creek downstream of the East Crowsnest Creek confluence, thus, it is likely that the barrier is on Crowsnest Creek downstream of the Ptolemy confluence. Ptolemy Creek is comprised of excellent water flows and rearing habitat. Crowsnest Creek requires inventory to identify the key barrier within this drainage.

As mentioned in the results, Star Creek Falls is a significant barrier to fish migration, yet Atlas Lumber personnel encountered rainbow trout and cutthroat trout upstream of this barrier in 2002. The 2003 CFIP crew should confirm this with a second inventory above the falls.

An inventory conducted in 1973 stated that significant migration barriers exist on Honeymoon Creek, the first located 0.8 kilometers from the mouth. The 2002 inventory findings support this statement with a sampling of fish below this location and no sampling of fish above. The barrier should be located in the future to obtain a geo-referenced location, as it leaves much of Honeymoon Creek free of fish when upstream habitat may support fish populations.

During a 1973 survey, Slacker Creek was also identified as having a migration barrier approximately 1.5 kilometers upstream of its mouth. Two inventory sites were conducted in 2002 and fish were not encountered upstream of this barrier, but were sampled downstream of the barrier. The barrier should be geo-referenced in the future. These areas that are devoid of fish, yet possess good to excellent fish habitat may be prospective stocking sites.

The lower half of Isolation Creek in the Livingstone River drainage should be considered as a future stocking site. A fish barrier approximately 1.5 kilometers from the mouth was located during the 1999 CFIP inventory. During the 2002 inventory, fish were absent above this barrier but the available upstream fish habitat was excellent. The habitat ranked high in spawning, rearing and overwintering habitat, but due to several low water barriers the spawning habitat was adjusted to a moderate standing due to fish migration limitations. Numerous aquatic invertebrates were present and flows were excellent. Isolation Creek shows potential as a future stocking site within the Livingstone River drainage. Timber extraction is one of the greatest impacts on fish and fish habitat in the Upper Oldman drainage. Many of the tributaries in this region have been extensively logged during previous years. Another human activity in this region is causing much concern. Random camping has become a very popular method of vacationing for individuals looking for a comfortable wilderness experience. The Upper Oldman drainage is swarming with vacation trailers and ATV's during the summer months. A few creeks in this region require off highway vehicle (OHV) crossing attention. Hidden Creek is a crucial cutthroat and bull trout fishery within the Upper Oldman drainage. Hidden Creek is located adjacent to the Beehive Natural Area and off highway vehicle use is permitted within this watershed. An old road, now an OHV trail, parallels the creek to the headwaters and traverses the creek several times in the upper reaches. These crossings are causing bank slumping and silty substrates to enter the creek. The crossings should have OHV bridges constructed across the creek, minimizing the impact of this recreational path.

A creek that requires immediate attention is Straight Creek. An old road crossing leading to the Mount Gass abandoned mine site is impeding upstream migration near its confluence with the Oldman River. The creek channel has diverted from its original path and now the flows spread out over the crossing and braid into several indistinct and subterranean channels. This is causing a major barrier downstream due to the lack of a channel with sufficient flow. The original channel is apparent on the other side of the crossing. Constructing a defined channel at the road and placing a bridge over the crossing would improve the fish population in this creek.

Several stream bank fencing projects have been implemented at domestic grazing properties on the east side of the Livingstone Range (North Burmis Road). During the 2002 survey, Connelly Creek was found to be a very productive cutthroat trout fishery. Connelly Creek is located within this grazing

area and merits assessment for future riparian enhancement projects at the North Burmis Road and at Highway 22. Rock Creek is another creek in this region and it supports many cutthroat trout. This creek is affected by the domestic livestock industry as well, thus, stream bank fencing may be appropriate here also. A series of culverts on a tributary of Rock Creek are likely impeding upstream migration but flows are limiting as well.

In conclusion, some future research considerations include evaluating the stocking potential of creeks that are currently lacking in fish populations and identifying and protecting productive fisheries. An OHV crossing program may be beneficial to locating areas that are of concern regarding these crossings and fish habitat. Continuing stream bank fencing should be a priority in affected areas and monitoring the fisheries resource on a continual basis would identify problem areas and construct a representative database of the region. Monitoring the fisheries resource through creel surveys, population estimates and CFIP inventories will ensure that the Crowsnest region maintains its standing as one of the premier fly fishing destinations in Western Canada.

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# Appendix I. Fish Habitat Survey Form

Waterbody Name		Activity Date	Habitat Assessment Notes
Habitat Type	Habitat Rank	For Species	Habitat Ranking Notes
spawning			
rearing			
overwintering			

UTM Easting		UTM Northing		Site Location Notes							
Water Temperature (C)	pH	Total Dissolved Solids (mg/L)		Conductivity (micromhos/cm)		Dissolved Oxygen (mg/L)		Channel Profile		Turbidity (Secchi Visibility) (m)	
Transect #	Wetted Width (m)	Rooted Width (m)	Station #	Depth (m)	Depth Averages	Station Water Velocity (m/s)	% Fines / Bedrock (<2mm)	% Small Gravel (2-16 mm)	% Large Gravel (17-64 mm)	% Cobble (65-256 mm)	% Boulders (>256 mm)
T1			2								
			3								
			4								
T2			2								
			3								
			4								
T3			2								
			3								
			4								
T4			2								
			3								
			4								
T5			2								
			3								
			4								
			Average								

Bank/Shoreline Segment #	Segment Length (m)	Left Bank Stability	Reason for LB Instability	Right Bank Stability	Reason for RB Instability	% Cover Composition	DIS-T1	T1-T2	T2-T3	T3-T4	T4-T5	T5-U/S
1	50					Surface Turbulance						
2	50					Aquatic Vegetation						
3	50					Instream Debris						
4	50					Terrestrial Canopy						
5	50					Rock/Boulder						
6	50					Under-Cuts						
						Turbidity						
						Depth						

	DIS-T1	T1-T2	T2-T3	T3-T4	T4-T5	T5-U/S
% Pool						
% Riffle						
% Run						

Photo No. \_\_\_\_\_ Evidence of Barriers (Y/N) \_\_\_\_\_ Type: \_\_\_\_\_ Severity: \_\_\_\_\_

Comments:



# Appendix III. Stream Inventory Legend

**Habitat Form**

**Stream Characteristics**  
 Waterbody ID: Provided from FMIS  
 Waterbody name: official Gazetteer name provided from FMIS  
 Activity Date: MM/DD/YYYY  
 Habitat Inventory Type = Assessment  
 Habitat Type: Habitat most likely used by a sport species: spawning, rearing, or overwintering  
 Habitat Rank: Quality of the habitat type: High, Moderate, Low or Nil  
 For Species: Species most likely to use the habitat type (salmonidae)

**Water Quality**  
 Water Temperature: °C  
 pH: 1 to 14  
 Total Dissolved Solids: mg/L  
 Conductivity: micromhos/cm  
 Dissolved Oxygen: mg/L  
 Channel Profile: V-shaped, U-shaped, Notched or Planar

**Habitat Data**  
 Transect #: 1 to 5 - each 50m apart  
 Left upstream bank (LUB)

**Fish Collection Form**

**Electrofishing**  
 Amperage: .01 to 10  
 Time Fished: eg 1485sec  
 Distance Fished: eg 300m

**Angling**  
 Number of Anglers: 1,2,3 etc.  
 hours fished: the number of hours each angler fishes  
 Bench Seine  
 Mesh Size: in mm - 2/3" = 9, 1/2" = 12, 3/4" = 19, 1" = 25  
 Length of Net: meters  
 Depth of Set: meters  
 Distance Sampled: meters  
 Gill Netting  
 Date Set: MM/DD/YYYY  
 Time Set: eg 2:35 pm  
 Date Lifted: MM/DD/YYYY  
 Time Lifted: eg 9:45 am  
 Mesh Size: in mm - 1.5" = 38, 2.0" = 51, 2.5" = 63, 3.0" = 76, 3.5" = 89, 4.0" = 102

Station #: L 2 | C 3 | R 4

Flow direction: Right upstream bank

**Depth:** @ station in meters  
**Station Water Velocity:** Velocity @ 1 station - m/s  
**Substrates:** must equal 100% : 1) Fines = <2mm  
 2) Small gravel = 2-16 mm  
 3) Large gravel = 17-64 mm  
 4) Cobble = 65-256 mm  
 5) Boulders = >256 mm

**Bank/shoreline segment No. = 1 @ d/s of T1 & 6 @ u/s of T5**  
**Segment Length:** segment length at which stability is determined (generally 50 m)  
**Bank stability:** 1-S-Stable, 2-U-Slightly Unstable, 3-M-Moderately Unstable, 4-H-Highly Unstable  
**Reason for left/right bank instability:** Natural, livestock, road crossing, pipeline crossing, Seismic activity, forestry, mining

**Fish Sampling**  
 Capture Method: ES, GN, AN, BS  
 Sample #: 1,2,3 etc.  
 Species: BLTR, CTTR, BNTR, BKTR, LKCH, etc.  
 Sex: F - Female, M - Male or U - Unknown  
 Maturity: Immature, mature, ripe, spent or unknown  
 Aging Structure: Otoliths, finray, scale, operculum or cleithrum  
 Tag or fin clip type: external tag spaghetti or fin clip adipose  
 Additional tag or fin clip type: external tag spaghetti or fin clip type  
 Initial capture: Y - Yes or N - No