

2.3.7. Fish Species

Species status, habitat use, distribution within Alberta and the probability of occurrence within the FMA area will be discussed, for specific species of interest.

2.3.7.1. Fish Species of Interest—Selection of Specific Species

The ‘species of interest’ discussed in this subsection are 1) fish species that are either known or thought to inhabit waterbodies in the FMA area, 2) either considered a ‘species of special concern’ by the Fisheries Management Division of Alberta Sustainable Resource Development, or 3) on the Alberta Natural Heritage Information Centre (ANHIC) ‘tracking’ or ‘watch’ lists. Fish species that are thought to have healthy, viable populations within the FMA area are not discussed in detail. Presently, fish species are not included in the provincial Wildlife Act. ANHIC does however rank fish species based on their rarity and the ranks are described in Table 2.41. All species that are either on the ‘tracking’ or ‘watch’ lists and are known or thought to be found in the FMA area, are discussed in detail, as to their distribution, habitat and spawning characteristics and their current status in Alberta.

Furthermore, information on the native rainbow trout is also presented although it is currently not a ‘species of special concern’ or on the tracking or watch lists. There is a lack of data for the native rainbow trout populations in Alberta in general. However because suitable habitat is close to the ANC FMA area, it has been included as an unofficial species of interest. The information presented here is a synthesis from sources within Alberta and British Columbia (where they are more widely distributed). Information on walleye is also presented because it a popular sport-fish and due to the recent introduction of reduced catch limits (due to over-fishing).

Table 2.41 Natural heritage element rarity ranks.

Code	Description
G1/S1	Critically imperiled because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction
G2/S2	Imperiled because of rarity (6-20 occurrences) or because of other factors demonstrably making it very vulnerable to extinction throughout its range
G3/S3	Either very rare or local throughout its range, or found locally in a restricted range (21-100 occurrences)
G4/S4	Apparently secure, though it might be quite rare in parts of its range, especially at the periphery
G5/S5	Demonstrably secure, through it might be quite rare in parts of its range, especially at the periphery

Source: Adapted from Nature Conservancy 1999

Global or G-rank: Based on the range-wide status of a species.
 Sub-national or S-rank: Based on the status of a species in an individual state or province. S-ranks may differ between states or provinces based on the relative abundance of a species in each state or province.

2.3.7.2. Macroinvertebrates

Although there have not been any studies dealing specifically with macroinvertebrates within the ANC FMA area, the ecological role that macroinvertebrates play in aquatic

food chains has been well documented (Huryn and Wallace 2000; Pauly et al. 1998; Breitbart 1988). One of the most important roles macroinvertebrates play is the conversion of unavailable forms of carbon into materials that can be consumed by higher trophic levels. Aquatic invertebrates are divided into two general types: benthic (bottom-dwelling) species and those that inhabit the water column.

Benthic communities occur not only on the bottom of rivers, streams and lakes, but also on rock, sediment and plant surfaces. Furthermore, the profundal (bottom) and littoral (edge) habitats for benthic species are substantially different from one another and host entirely different suites of species. The profundal benthic communities are relatively simple communities of bacteria, protozoa, invertebrates and fish (Moss 1988). In lakes, these communities generally depend on the detritus from the overlying water as their source of energy. The littoral communities generally support a wider range of species.

Very little information relating to aquatic macroinvertebrates is available for the ANC FMA area.

2.3.7.3. Fish Descriptions

Alberta's fish communities are relatively diverse, with 51 native species representing 13 families (Nelson and Paetz 1992). Tables 2.42 and 2.43 provide a list of non-game and game fish species, and the general habitat types that likely occur in the ANC FMA area. This list is based on direct observations where they are available, the provincial Fisheries Management Information System (Alberta Environment 2001), and on Nelson and Paetz's *The Fishes of Alberta* (1992).

Table 2.42. Non-game fish species expected to occur in the ANC FMA area.

Common Name	Scientific Name	Stream	River	Lake
Brook stickleback	<i>Culaea inconstans</i>	x	x	x
Fathead minnow	<i>Pimephales promelas</i>	x		x
Finescale dace	<i>Phoxinus neogaeus</i>	x		x
Iowa darter	<i>Etheostoma exile</i>	x		x
Lake chub	<i>Couesius plumbeus</i>	x	x	x
Longnose dace	<i>Rhinichthys cataractae</i>	x	x	x
Longnose sucker	<i>Catostomus catostomus</i>	x	x	
Northern redbelly dace	<i>Phoxinus eos</i>	x		x
Pearl dace	<i>Margariscus margarita</i>	x		x
Pygmy whitefish	<i>Prosopium coulteri</i>		x	
Redside shiner	<i>Richardsonius balteatus</i>		x	
Slimy sculpin	<i>Cottus cognatus</i>	x		x
Spoonhead sculpin	<i>Cottus ricei</i>	x	x	
Trout-perch	<i>Percopsis omiscomaycus</i>	x	x	x
White sucker	<i>Catostomus commersoni</i>	x	x	x

Table 2.43 Game fish species expected to occur in the ANC FMA area.

Common Name	Scientific Name	Stream	River	Lake
Arctic grayling	<i>Thymallus arcticus</i>	x	x	x
Athabasca Rainbow Trout	<i>Oncorhynchus mykiss</i>	x	x	
Brook trout	<i>Salvelinus fontinalis</i>	x	x	
Bull trout	<i>Salvelinus confluentus</i>	x	x	x
Burbot	<i>Lota lota</i>	x	x	x
Lake whitefish	<i>Coregonus clupeaformis</i>		x	
Mountain whitefish	<i>Prosopium williamsoni</i>	x	x	
Northern pike	<i>Esox lucius</i>	x	x	x
Rainbow trout	<i>Oncorhynchus mykiss</i>	x	x	x
Walleye	<i>Stizostedion vitreum vitreum</i>		x	x
Yellow perch	<i>Perca flavescens</i>	x		x

Fish Species of Interest

Arctic Grayling (*Thymallus arcticus*)

Distribution

Within Alberta, Arctic grayling are primarily known in the Peace, Hay and Athabasca River Drainage systems. Within the FMA area, Arctic grayling have been observed in numerous rivers and streams and healthy populations are known to exist in the Little Smoky River and its tributaries (Nelson and Paetz 1992).

Habitat and Spawning Characteristics

Arctic grayling are commonly known as 'cold-water' fish and can live to approximately 12 years. They are typically restricted to cool streams, rivers and lakes, where they feed on aquatic and terrestrial insects, and on bottom organisms and plants (Nelson and Paetz 1992). Grayling are also known to feed on fish and small mammals, including shrews and voles, however this behaviour is relatively rare.

Spawning generally occurs in streams in late May to early June, when the water temperature ranges between 5-10 °C (Nelson and Paetz 1992). Grayling typically migrate from lakes and larger rivers to smaller streams to spawn. Commonly, the males on the spawning ground are territorial and will drive away other males when challenged. Females produce between 5,000 to 10,000 eggs annually and, following spawning, the eggs are commonly buried in streambed gravel.

Status

While Arctic grayling are distributed widely throughout most of northern Alberta, the total population sizes have declined in the past 20 to 30 years. Arctic grayling are a popular, easily caught sport fish and because of this, larger fish

can be rapidly depleted under even moderate angling pressure (Nelson and Paetz 1992).

Although Arctic grayling are generally tolerant of a wide range of environmental conditions, they can be susceptible to pollution, damage to riparian habitat and alteration of stream flow conditions. Due to these factors and their response to angling pressure, Arctic grayling are listed as a 'species of special concern' by the Fisheries Division of Alberta Environment. New angling regulations were introduced in 1998 to protect larger fish in order to help population sizes recover.

Athabasca Rainbow Trout (*Onchorhynchus mykiss*)

Distribution

Native populations occur in the upper reaches of the Athabasca River Basin and upper Peace River Basin, reaching downstream to the south slopes of the Swan Hills. However, because rainbow trout are easy to raise in hatcheries, and are a very hardy and active sport fish, they have been stocked widely throughout Alberta lakes. There has most certainly been breeding between the native Athabasca Rainbow trout and the introduced trout and suspected hybridization with cutthroat trout in many Athabasca streams (Nelson and Paetz 1992).

Habitat and Spawning Characteristics

Athabasca rainbow trout are 'cold-water' fish and do best in lakes and streams with temperatures below 20 °C (Nelson and Paetz 1992). Rainbow trout can occupy a wide range of habitats, from large rivers and lakes in low valleys, to tributary streams and small lakes in rolling mid-elevation areas, to alpine streams and lakes (British Columbia Ministry of Fisheries, no date-a.). Stream-dwelling trout are typically found in small to moderate sized streams and rivers that are shallow and have a gravelly bottom, and pool-riffle habitats (British Columbia Ministry of Fisheries, no date-a.). Lake-dwelling trout generally are found in deeper, cool lakes with adequate shallows and vegetation for food production. A gravelly tributary to the lake is required for spawning habitat (British Columbia Ministry of Fisheries, no date-a.).

The rainbow trout diet consists primarily of leeches, mollusks, crustaceans and both aquatic and terrestrial insects (Nelson and Paetz 1992). The habitat has a significant effect on rainbow trout growth rates. The native Athabasca rainbow trout in the Tri-Creeks area has the lowest observed growth rate in North America, and may well be the lowest in the world (Nelson and Paetz 1992). The Athabasca rainbow trout spawn later than the more southern, introduced rainbow trout. Spawning generally begins when water temperatures are approximately 6 °C, in late June. Hatching occurs as late as September (Nelson and Paetz 1992).

Status

As a whole, rainbow trout are widespread and numerous throughout the province. However this is largely due to stocking of introduced rainbow trout and not the presence of native fish. Few studies have been devoted to the native Athabasca rainbow trout, and as such little is known about current population

sizes and trends. The Athabasca rainbow trout is not currently ranked or tracked by the Fisheries Division of Alberta Environment, due to a lack of data.

Bull Trout (*Salvelinus fontinalis*)

Distribution

Within Alberta, the bull trout is the only native trout species that can be found in all of the major eastern slopes drainages including the Peace, Athabasca, North Saskatchewan, Red Deer, Bow and Oldman river drainages (Berry 1994). It occupies 20,000 km of stream habitat and approximately 12,000 ha of habitat in 24 lakes (Berry 1994). Despite this apparent wide distribution, the range for bull trout in Alberta has decreased substantially in the past 25 to 50 years.

Habitat and Spawning Characteristics

Bull trout are typically found in lakes and streams, from alpine areas to sea level (Nelson and Paetz 1992). Three distinct life-patterns have been recognized. *Stream-residents* spend their entire lives in smaller, less productive headwater streams (Berry 1994). *River* populations spend the majority of their lives in larger rivers but migrate to smaller tributaries to spawn, while lake populations reside in lakes and also migrate to tributaries to spawn (Berry 1994). Bull trout prefer a maximum water temperature below 18 °C, and are most commonly associated with streams where flow levels are high in the spring and early summer and low through the remainder of the year (Berry 1994). The bull trout's primary food source is bottom fauna, insects and other fish, and occasionally surface food as well (Nelson and Paetz 1992).

Spawning usually occurs between September and October in small streams fed by groundwater or in streams or rivers with a medium gravel base (Berry 1994; Nelson and Paetz 1992). The eggs are shallowly buried in the gravel and remain there all winter. The eggs typically hatch between March and April, approximately 6-7 months following spawning.

Status

Bull trout face significant competition for habitat and food from introduced species such as brook and brown trout. These species share similar habitat, spawning and feeding requirements as the bull trout, and have reduced or displaced entire bull trout populations (Berry 1994). Moreover, bull trout and brook trout hybridization has led to the loss of some bull trout populations because the hybrids are sterile (Berry 1994).

Bull trout are susceptible to overfishing because the productivity is low in the streams they inhabit. Bull trout do not mature for approximately 5 to 6 years. Consequently, most bull trout harvested by anglers are immature and have not had the opportunity to spawn.

In 1995, the Bull Trout Management and Recovery plan was initiated. The species was designated a 'species of special concern' and a zero-limit placed on the harvest of the bull trout. Continued monitoring by the province will determine when populations have increased sufficiently to allow for a harvestable surplus.

Pygmy Whitefish (*Prosopium coulteri*)

Distribution

Pygmy whitefish have been found in only a few locations in Alberta, including Waterton Lake, Solomon Creek (upper Athabasca river drainages), the Snake Indian River (where it drains into the Athabasca river in Jasper National Park), Athabasca river (between the Snaring and Snake Indian rivers) and in the Athabasca river at Whitecourt (Mackay 2000).

Habitat and Spawning Characteristics

Pygmy whitefish are generally found in the deepest locations of deep, cold lakes and in fast, cold mountain streams (Mackay 2000). In streams, pygmy whitefish coexist with the mountain whitefish but are much less abundant. Very little is known about the diet of riverine pygmy whitefish populations; however, some information is available for the lake dwelling populations. Their diet appears to be quite varied, consisting of invertebrates, larvae, insects and crustaceans (Mackay 2000).

Little information about spawning characteristics is available for riverine populations of the pygmy whitefish. In lake populations, spawning occurs in the fall, ranging from November to mid-January. Spawning tends to occur earlier in the Athabasca river population than for other recorded locations (Mackay 2000). Pygmy whitefish mature at an early age and at a small size (Mackay 2000).

Status

The population of pygmy whitefish in Alberta appears to be small and localized. Only eight fish have been collected from five locations in the province (Mackay 2000). There are too little data to estimate population size or trends within the province. However, their wide distribution along the upper Athabasca River tends to indicate a viable population (Mackay 2000).

The Alberta Natural Heritage Information Centre (ANHIC) ranks the pygmy whitefish as S1 based on the very few known observations in the province (ANHIC 2000). It is also considered 'vulnerable' by the Fisheries and Wildlife Management Division of Alberta Environment. However there is currently no management strategy specific to the pygmy whitefish (Alberta Environment 1999; Mackay 2000).

Spoonhead Sculpin (*Cottus ricei*)

Distribution

The spoonhead sculpin has a relatively wide distribution through Alberta, and are known in the Slave, Peace, Athabasca, North Saskatchewan, upper Red Deer, Bow and upper Oldman river drainages (Nelson and Paetz 1992).

Habitat and Spawning Characteristics

Spoonhead sculpins are not commonly found in lakes, but are abundant in foothills and plains streams (Roberts 1988a). This species is commonly found in muddy rivers, but require clean, rocky or gravel bottomed streams for

reproduction and protective cover (Roberts 1988a). Spoonhead sculpins primarily consume aquatic invertebrates, such as stoneflies (*Hesperoperla* spp.). This species quite commonly becomes a food source for a variety of trout species, northern pike, burbot and walleye. In smaller creeks or the shallows of larger rivers, they might also be consumed by predators that forage underneath small rocks, including the burbot, American water shrew and American Dipper (Roberts 1988a).

Specific life history data for Alberta spoonhead sculpin populations is limited, and most information is inferred from eastern North American populations. Spawning generally occurs along lakeshores, creek bottoms and the margins of rivers between April and May, when the water temperature is approximately 6 °C (Roberts 1988a). The eggs hatch after approximately three weeks, but may hatch earlier if the water temperature is greater than 8 °C.

Status

Although the spoonhead sculpin is widespread through Alberta, their population numbers and trends are not well known. Where they are known to occur, they tend to be present in low numbers and there is a general lack of knowledge about the provincial population. Therefore, they are currently listed as S3 by ANHIC.

Spoonhead sculpins may also serve as indicators of the substrate cleanliness in rivers and streams. This species is not generally subject to harvest by anglers, thus population shifts reflect changes in the environment rather than angling pressure (Roberts 1988b).

Walleye

(*Stizostedion vitreum vitreum*)

Distribution

Walleye are widespread and abundant through Alberta. They are found in the Petitot, Hay, Slave, Peace, Athabasca, Beaver, North and South Saskatchewan, lower Red Deer, lower Battle, lower Bow, and lower Oldman river drainages (Nelson and Paetz 1992). Walleye are known as 'cool-water' fish and so are not found in the colder headwater streams and rivers of the mountains and high elevation foothills.

Habitat and Spawning Characteristics

In Alberta, walleye are most commonly found in lakes and large rivers (Nelson and Paetz 1992). They generally prefer large, moderately fertile lakes, and the most productive populations occur in lakes greater than 400 ha in size (Berry 1995). Their diet consists of fish, aquatic invertebrates, and insects. They will consume any species of fish available to them, and can be cannibalistic if other fish species are not available (British Columbia Ministry of Fisheries. no date-b).

Spawning occurs in streams and lakes during early spring, when water temperatures are approximately 5 °C (Nelson and Paetz 1992). Walleye tend to spawn over shallow, gravelly areas in tributary streams and lakes, just following ice break up. Females lay anywhere from 20,000 to over 600,000 small eggs in an evening (Nelson and Paetz 1992; British Columbia Ministry of Fisheries. no

date-b) and the eggs generally hatch after 12 to 18 days. Males mature at five years of age, while females do not mature until age six or older. Individuals can live to over fourteen years of age.

Status

The present distribution of walleye is not substantially different from their historical range, although some populations have been lost. Walleye disappeared from Wabamun Lake in the 1920s, from Pigeon Lake in the 1960s and were practically gone from North Buck Lake, Skeleton Lake, Lac La Biche and several others by the 1970s (Berry 1995). Despite stocking programs that have introduced tens of millions of eggs and fingerlings since the 1930s, walleye populations have continued to decline due to overfishing of adult walleye (Berry 1995).

While the Alberta walleye population is not in danger of extinction, controls were taken in 1995 to mitigate the decline in population. Currently, walleye are ranked as S3 on the ANHIC watch list.

2.3.8. Significant Biological Features

A key component in the protection of significant areas pertaining to wildlife and vegetation was the formal recognition of the Little Smoky Corridor, and the development of the Little Smoky River Corridor Management Strategy (see Appendix #5). Area stakeholders requested that this area be recognized as a unique area due the significant presence of rare plants. Special management initiatives were considered for its protection, and in response, ANC has applied land use controls to protect the habitat and the rare plants within it.

2.4 Social, Cultural and Economic Features

From ongoing public consultation between ANC and directly with communities in the FMA area and indirectly through the Regional Forest Advisory Committee, the range of non-market goods and services is relatively narrow. Table 2.44 lists the main activities and indicates the relative level of use intensity.

Table 2.44 Non-Market activities in the FMA area

Type of Activity	Activity Intensity
Hunting	H
Fishing	H
Berry-Picking	L
Summer ATV	M
Winter ATV	M – H
Hiking	L
Wildlife Viewing	M
Canoeing / Rafting	M
Camping	M – H

¹ L – Little known activity
M – Moderate level of activity
H – Significant amount of activity

Figure 2.58 depicts the general locations of documented recreational activities in the FMA area. Figure 2.59 depicts areas of documented and potential sport fishing in the area.

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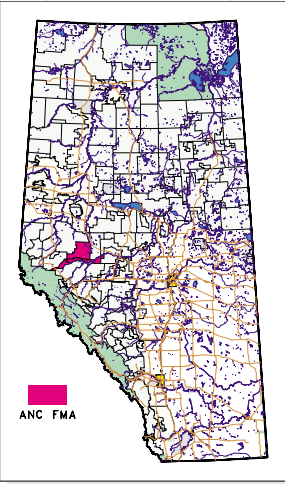
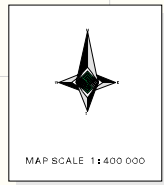
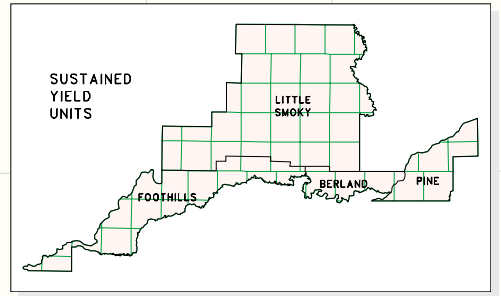
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
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FOREST MANAGEMENT AREA**

SIGNIFICANT FEATURES


Figure 2.58



SIGNIFICANT FEATURE TYPES AND GENERAL LOCATIONS

-  CABIN
-  CAMPSITE - RANDOM USE
-  HOODOOS
-  HISTORICAL - LOGGING CAMP
-  HISTORICAL - MILLSITE
-  HISTORICAL - STOP POINTS ON GRANDE PRAIRIE TRAIL
-  HISTORICAL - GRANDE PRAIRIE TRAIL (FROM MEDICINE LODGE & EDSON TO GRANDE PRAIRIE)
-  RECREATION AREAS

Map 14
Map Date: Feb 5, 2001
Map Scale: 1 : 400000
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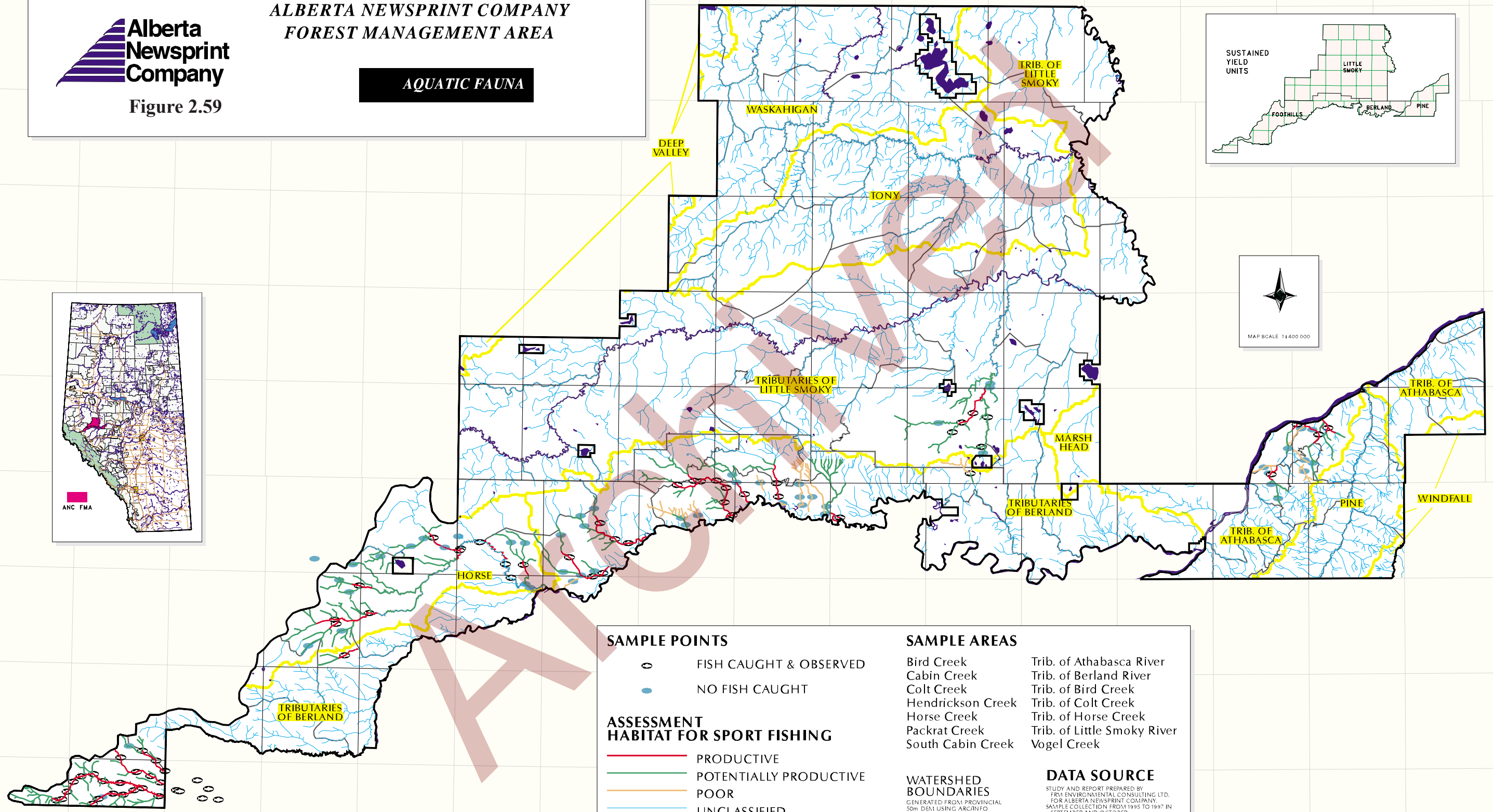
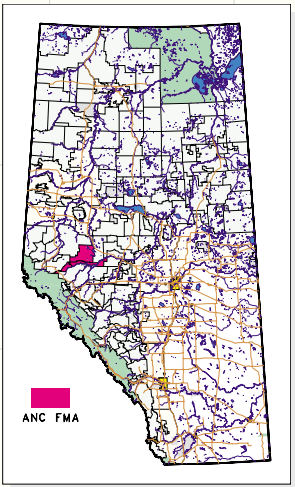
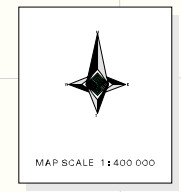
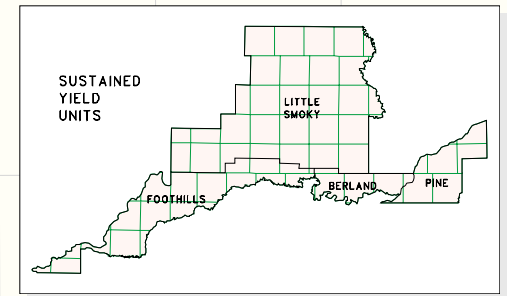
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AQUATIC FAUNA

Figure 2.59



SAMPLE POINTS		SAMPLE AREAS	
	FISH CAUGHT & OBSERVED	Bird Creek	Trib. of Athabasca River
	NO FISH CAUGHT	Cabin Creek	Trib. of Berland River
ASSESSMENT HABITAT FOR SPORT FISHING		Colt Creek	Trib. of Bird Creek
	PRODUCTIVE	Hendrickson Creek	Trib. of Colt Creek
	POTENTIALLY PRODUCTIVE	Horse Creek	Trib. of Horse Creek
	POOR	Packrat Creek	Trib. of Little Smoky River
	UNCLASSIFIED	South Cabin Creek	Vogel Creek
WATERSHED BOUNDARIES		DATA SOURCE	
GENERATED FROM PROVINCIAL 50m DENI USING ARC/INFO		STUDY AND REPORT PREPARED BY FRM ENVIRONMENTAL CONSULTING LTD. FOR ALBERTA NEWSPRINT COMPANY. SAMPLE COLLECTION FROM 1995 TO 1997 IN SEPTEMBER AND OCTOBER.	

Map 11
Map Date: Feb 5, 2001
Map Scale: 1 : 400000
Map Production by Silvacom Ltd.
Silvacom Ref: F-057
Map File: /F-057/maps/map11/fish_study



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Literature Cited

Alberta Environment and Alberta Conservation Association (AE and ACA). 2001. Biodiversity/Species Observation Database. Accessible through Alberta Environment, Fisheries and Wildlife Management Division, 2nd Floor Great West Life Bldg., 9920-108 St., Edmonton, AB.

Alberta Environmental Protection. 1994. Natural regions and subregions of Alberta.

Alberta Environmental Protection. 1994. Ecological Land Survey Site Description Manual. Edmonton, Alberta.

Alberta Environmental Protection. 1996. Forest site interpretation and silvicultural prescription guide for Alberta—Version 2.0. Environmental Training Centre.

Alberta Forestry, Lands and Wildlife. 1988. Integrated resource inventory of the Fox Creek-Knight area. Alberta Forestry, Lands and Wildlife, Land Information Branch, Edmonton, Alberta.

Anonymous. 1996. The status of Alberta wildlife. Department of Environmental Protection, Natural Resources Service, Wildlife Management Division, Edmonton, AB.

Archibald, J.H., Beckingham, J.D. 1996. Field Guide to ecosites of northern Alberta. Natural Resources Canada, Canadian Forest Service, Northwest Region, Northern Forestry Centre, Edmonton, Alberta. Special Report 5

Argus, G.W. and K.M. Pryer. 1990. Rare vascular plants in Canada – Our national heritage. Botany Division, Canadian Museum of Nature, Ottawa, Ontario.

Beckingham, J.D., I.G.W. Corns and J.H. Archibald. 1996. Field guide to ecosites of west-central Alberta. Natural Resources Canada, Canadian Forest Service, Northwest Region, Northern Forestry Centre, Edmonton, Alberta. Special Report 9.

Bentz, J. and A. Saxena. 1994. Significant ecological features inventory of the Whitecourt/Swan Hills integrated resource planning area. Prepared for Resource Information Division, Alberta Environmental Protection, Edmonton, AB. Prepared by Geowest Environmental Consulting.

Berry, D.K. 1994. Alberta Bull Trout Management and Recovery Plan. Alberta Environmental Protection, Natural Resources Service, Fisheries Management Division, Edmonton, Alberta.

Berry, D.K. 1995. Alberta Walleye Management and Recovery Plan. Alberta Environmental Protection, Natural Resources Service, Fisheries Management Division, Edmonton, Alberta.

Branton, Greg. Forester, Alberta Newsprint Company, Whitecourt, AB. Personal Communication.

British Columbia Ministry of Fisheries. n.d.-a. B.C. Fish Facts—Rainbow Trout. <http://www.bcfisheries.gov.bc.ca/Publications/rainbowtrout.pdf>.

British Columbia Ministry of Fisheries. n.d.-b. B.C. Fish Facts–Walleye. <http://www.bcfisheries.gov.bc.ca/Publications/walleye.pdf>.

Caceres, M.C. and M.J. Pybus. 1997. Status of the northern long-eared bat (*Myotis septentrionalis*) in Alberta. Alberta Environmental Protection, Wildlife Management Division, Wildlife Status Report NO. 3, Edmonton, AB.

Chow, Ven Te., Maidment, David R. Mays, Larry W. Applied Hydrology. McGraw-Hill. New York. 1988

Federation of Alberta Naturalists (FAN). 1992. The atlas of breeding birds of Alberta. Edited by Glen Semenchuk. Federation of Alberta Naturalists, Edmonton, AB.

GDC. 1999. Summary Report 2nd Ecosite Map for Alberta Newsprint Company's FMA Area. GDC, Edmonton, AB.

Graham, K.G. 1997. Habitat use of long-toed salamanders (*Ambystoma macrodactylum*) at three different scales. M.Sc. Thesis, University of Guelph, Guelph, ON.

Graham, K.L. and G.L. Powell. 1999. Status of the long-toed salamander (*Ambystoma macrodactylum*) in Alberta. Alberta Environmental Protection, Fisheries and Wildlife Management Division, and Alberta Conservation Association, Wildlife Status Report No. 22, Edmonton, AB.

Hamilton, I.M., J.L. Skilnick, G.Troughton, A.P. Russell, and G.L. Powell. 1998. Status of the Canadian toad (*Bufo hemiophrys*) in Alberta. Alberta Environmental protection, Wildlife Management Division, and the Alberta Conservation Association, Wildlife Status Report No. 12, Edmonton, AB.

Hamilton, I.M., K.L. Graham, L. Powell, and A. Russell. 1996. The range of long-toed salamanders in northwestern Alberta. Alberta Environmental Protection, Fish and Wildlife Service, Edmonton, AB.

Harms, V.L., P.A. Ryan and J.A. Haraldson. 1992. The rare and endangered native vascular plants of Saskatchewan. Prepared for the Saskatchewan Natural History Society. The W.P. Fraser Herbarium, University of Saskatchewan, Saskatoon, Saskatchewan.

Hausenbuiller, R.L. 1985. Soil science–principles and practices. 3rd Edition. Washington State University. Wm. C. Brown Publishers. Dubuque, Iowa.

Heinrich, R., B. Beck, J. Beck, M. Todd, R. Bonner, and R. Quinlen. 1995. Grizzly bear fall feeding habitat. In: Beck, B., Beck, J., Bessie, W., Bonar, B., Todd, M. (eds). 1996. Habitat Suitability Index Models for 35 Wildlife Species in the Foothills Model Forest. Draft Report. Foothills Model Forest, Hinton, AB.

James, M.L. 2000. Status of the trumpeter swan (*Cygnus buccinator*) in Alberta. Alberta Environment, Fisheries and Wildlife Management Division, and Alberta Conservation Association, Wildlife Status Report No. 26, Edmonton, AB.

Johnson, D., L. Kershaw, A. MacKinnon and J. Pojar. 1995. Plants of the western boreal forest and aspen parkland. Lone Pine Publishing, Edmonton, Alberta.

- Jurgensen, M.F., A.E. Harvey, R.T. Graham, M.J. Larsen, J.R. Tonn, D.S. Page-Dumroese. 1990. Soil organic matter, timber harvesting and forest productivity in the Inland Northwest. 7th. In Sustained Productivity of Forest Soils. Annual. North American Forest Soils Conference. University of British Columbia, Vancouver, B.C.
- Kershaw, L., A. Mackinnon and J. Pojar. 1998. Plants of the Rocky Mountains. Lone Pine Publishing, Edmonton, Alberta.
- Knapik, L. J. and J. D. Linday. Reconnaissance Soil Survey of the Iosegun Lake Area, Alberta. Alberta Research Council 1983.
- Lesica, P. and F.W. Allendorf. 1995. When are peripheral populations valuable for conservation. Conservation Biology 9: 753-60.
- Mackay, W.C. 2000. Status of the Pygmy Whitefish (*Prosopium coulteri*) in Alberta. Alberta Environment, Fisheries and Wildlife Management Division, and Alberta Conservation Association, Wildlife Status Report No. 27, Edmonton, Alberta.
- McCune, B., and L. Geiser. 1997. Macrolichens of the Pacific Northwest. Oregon State University Press. 386 pages.
- McNabb, D.H. 1992. Planning harvesting operations to protect forest soils, pp. E13-18 In: Addendum to the Preprint Book, 73rd Woodland Section Annual Meeting, Sept. 14-16, 1992, Penticton, BC., Can. Pulp and Paper Association., Montreal, Quebec.
- Moss, B. 1988. Ecology of Fresh Waters—Man and Medium. Blackwell Scientific Publications, Boston, MA. USA.
- Moss, E.H. 1983. Flora of Alberta. Second edition. Revised by J.G. Packer. University of Toronto Press, Toronto, Ontario.
- Nelson, J.S. and M.J. Paetz. 1992. The Fishes of Alberta. University of Alberta Press, Edmonton, Alberta.
- Page-Dumroese, D., A. Harvey, M. Jurgensen and R. Graham. 1990. Organic Matter Function in the Western-Montane Forest Soil System. In: Symposium on Management and Productivity of Western-Montane Forest Soils, Boise, Idaho. April 10-12, 1990.
- Pawlina, I. 1998. Integration of wildlife into the process of selection and evaluation of protected areas in Alberta. Ph.D. Thesis, University of Alberta, Edmonton, AB.
- Pawlina, I., L. Versteeg, C. De La Mare, and J. Beckingham. 2000. Wildlife species of concern. Chapter 1 in Millar Western Forest Products Detailed Forest Management Plan, Whitecourt, AB.
- Peterson, S. Status of the wolverine (*Gulo gulo*) in Alberta. Alberta Environmental Protection, Wildlife Management Division, Wildlife Status Report No. 2, Edmonton, AB.
- Powell, G.L., A.P. Russell, S.J. Nelson, I.M. Hamilton, and K.L. Graham. 1997. The status of the long-toed salamander (*Ambystoma macrodactylum*) in Alberta. Alberta Environmental Protection, Fish and Wildlife Service, Edmonton, AB.

Rayner, M. et al. 1985. Integrated resource inventory and evaluation of the Berland area. Volume I. Study overview. Natural Resource Information Services, Alberta Energy and Natural Resources, Edmonton, Alberta.

Roberts, W. 1988a. The sculpins of Alberta. *Alberta Naturalist* 18(4): 121-127.

Roberts, W. 1988b. Changes in the abundance of fishes in the Red Deer River below the Dickson Dam. *Alberta Naturalist* 18(1): 1-6.

Schofield, W. 1998. Rare bryophytes. In Conference proceedings: Living on the edge: a symposium on the rare plants of British Columbia. University of British Columbia, Vancouver, B.C.

Schofield, W.B. 1992. Some common mosses of British Columbia. Royal British Columbia Museum. 394 pages.

Silvacom Ltd. 1999. Forest Inventory and Timber Supply Analysis.

Silvacom Ltd. 2001. Forest Inventory and Timber Supply Analysis. Supplemental Landscape Assessment.

The Nature Conservancy. 1982. Natural heritage program operations manual, with revisions through June 1988. The Nature Conservancy, Arlington, Virginia.

Vitt, D.H., J.E. Marsh, R. Bovey. 1988. Mosses, lichens and ferns of Northwest North America. Lone Pine Publishing, Edmonton, Alberta.