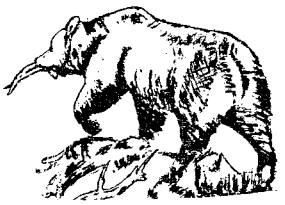
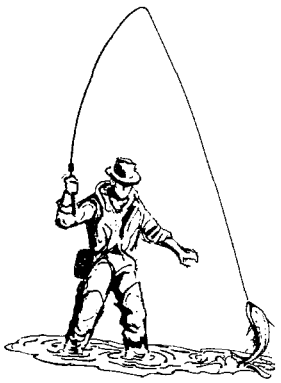
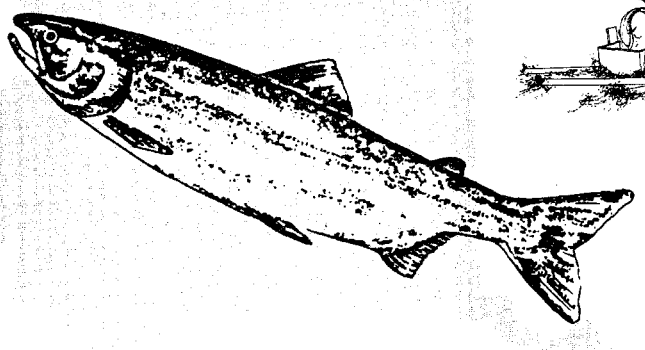
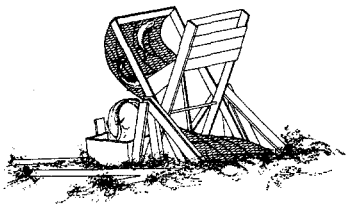
FISHERY MANAGEMENT PLAN

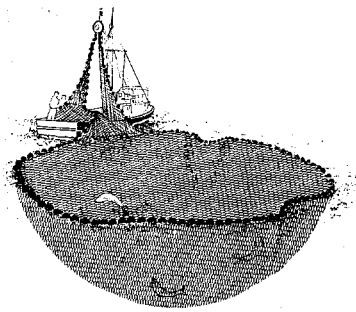
YUKON FLATS NATIONAL WILDLIFE REFUGE











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April 1990

U.S. Fish and Wildlife Service
Yukon Flats National Wildlife Refuge
Fishery Management Plan

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Fairbanks, Alaska
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SUMMARY STATEMENT

The Yukon Flats National Wildlife Refuge Fishery Management Plan (Fishery Plan) provides comprehensive management direction to insure that fish species and habitats are conserved, while maintaining sustainable harvests. The Fishery Plan defines the purposes for which the refuge is managed and a resultant planning direction achieved through development of management objectives and specific tasks. Tasks are assigned priorities and Federal tasks are assigned annual costs for their continuation. The planning effort is designed to span a 5-year period at which time it will be updated. It should be noted that this particular document does not include habitat or public use management activities, which will be addressed in separate planning efforts.

A description of the environment is presented and fishery resources, human use, management history and major issues and concerns described. Objectives and tasks are developed from the issues and concerns. Major concerns identified during the planning process included a lack of baseline fishery data, potential overharvest of salmon stocks, impact from development and use of lands adjacent to the refuge, and public use conflicts. Most of these concerns are largely beyond the direct control of refuge management as they take place outside the refuge boundaries.

Objectives developed to address major concerns range from program administration to data collection activities. In general, objectives are aimed at administering the fishery management program at its current level, based on the best available information while obtaining additional data to improve the information base.

Work priorities for both the U.S. Fish and Wildlife Service (Service) and the Alaska Department of Fish and Game (Department) over the next five years will emphasize the tasks to administer the current fishery program. Beyond this, Service work will emphasize monitoring of refuge salmon stocks, evaluating the impacts of off-refuge mining activities, and collecting baseline fishery data on the numerous rivers, sloughs and lakes throughout the refuge.

SECTION I. INTRODUCTION

Section 304 of the Alaska National Interest Lands Conservation Act (Alaska Lands Act) requires the preparation and periodic revision of each Refuge Comprehensive Conservation Plan (Conservation Plan). One function of the Conservation Plan is to specify a program for management and conservation of fishery resources of the refuge. This Fishery Plan is a five year plan which outlines an effort to obtain needed fishery information for verification and support of natural diversity of refuge fish stocks, support of continued subsistence use of fishery resources, protection of refuge habitat, and develop increased visitor contact for public awareness of the Wildlife Refuge Program in Alaska as well as the National Refuge Program. In preparation of this resource plan, consideration has been included for the multiple use of the aquatic habitat, including waterfowl, terrestrial mammals, and human use of the resources.

The Yukon Flats National Wildlife Refuge encompasses approximately 8,480,000 acres of federal lands and an additional 2,696,000 acres of selected and conveyed lands (Figure 1). It is bordered on the north by the Brooks Range, on the south by the White-Crazy Mountains and on the west by the Trans-Alaska Pipeline. The refuge is bisected by the Yukon River which has created a broad wetland plain of lakes, marshes, and meandering tributaries, which are highly productive waterfowl habitat. A total of 147 bird, 39 mammal, and 18 fish species have been documented to occur on the refuge.

Application of fishery management strategies will occur as a cooperative effort between the Department and the Service. Day to day operations are guided by a Memorandum of Understanding between the Service and the Department (Appendix A).

Congress established the Yukon Flats Refuge in 1980 with the passage of Alaska Lands Act. Section 302(9)(B) of Alaska Lands Act states that purposes for which the Yukon Flats Refuge is established and shall be managed include:

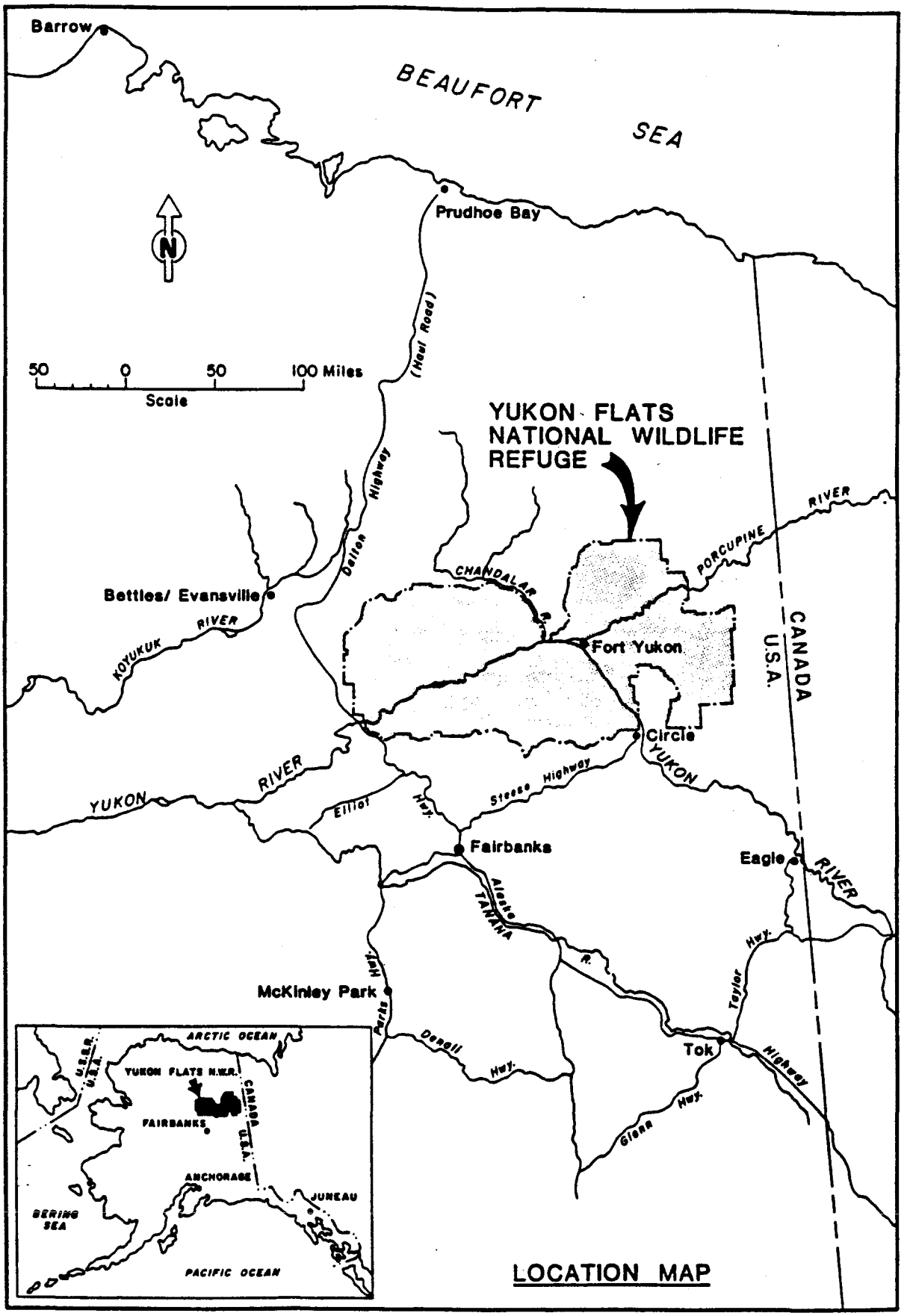
(i) to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, canvasbacks and other migratory birds, Dall sheep, bears, moose, wolves, wolverines and other furbearers, caribou (including participation in coordinated ecological studies and management of the Porcupine and Fortymile caribou herds, and salmon:

(ii) to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitat;

(iii) to provide, in a manner consistent with the purposes set forth in subparagraphs (i) and (ii), the opportunity for continued subsistence users by local residents; and

(iv) to ensure, to the maximum extent practicable and in a manner consistent with the purposes set forth in paragraph (i), water quality and necessary water quantity within the refuge.

Figure 1. Location of the Yukon Flats Refuge.



SECTION II. GENERAL PHYSICAL AND BIOLOGICAL ENVIRONMENT

Physical Environment

Setting

Containing the largest interior basin in Alaska, the Yukon Flats Refuge encompasses 8.48 million acres of federal land in east central Alaska. Extending 225 miles east-west along the Arctic Circle, the refuge lies between the Brooks Range (to the north) and the White-Crazy Mountains (to the south). The "pipeline corridor" runs along the refuge's western boundary while the eastern boundary extends to within 30 miles of the Canadian border. The Yukon River bisects the refuge, creating the dominant terrain feature of the refuge.

As many as 40,000 lakes and ponds may occur on the refuge, mostly concentrated in the flood plain along the Yukon and other rivers. Upland terrain, where lakes are less abundant, is the source of important drainage systems.

The abundance of water in lakes, ponds, and streams provides habitat for waterfowl from all four North American flyways. Though the refuge supports a varied population of mammals, fish, and birds which are important in maintaining the traditional subsistence lifestyle of local residents, it is the waterfowl nesting and rearing habitat which are of national and international significance. The Yukon Flats region is a segment of the continental waterfowl breeding grounds almost unequaled in extent and continuous high productivity.

Land Status

Major legislation affecting land ownership in the Alaska refuges includes the Alaska Statehood Act, the Alaska Native Claims Settlement Act, and the Alaska Lands Act. These laws implemented the transfer of lands from federal to state and Native ownership.

The land status of the Yukon Flats Refuge is constantly changing because lands within the refuge boundary selected by Natives and Native corporations are in the process of being conveyed, relinquished, or invalidated (rejected).

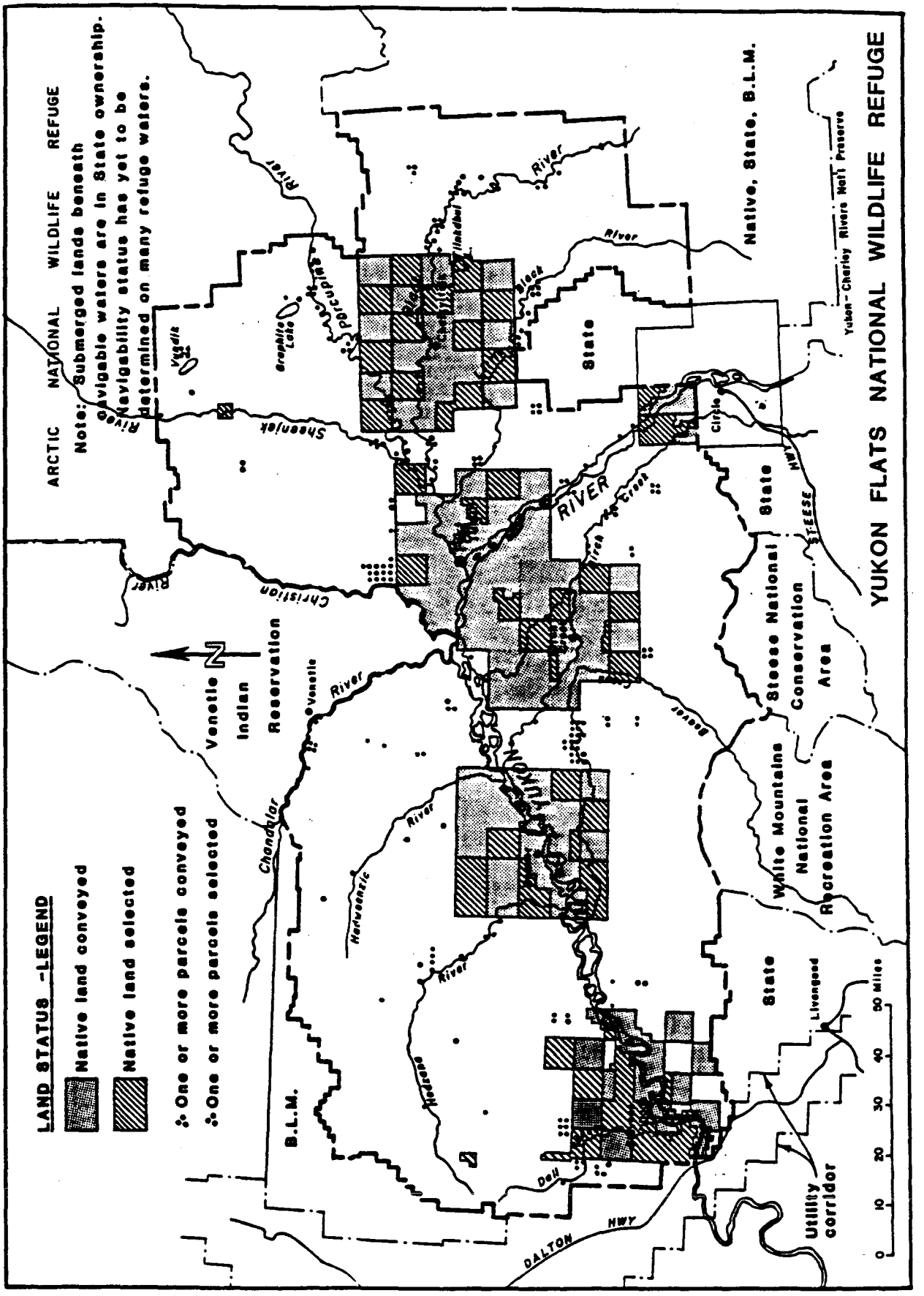
Of the 11,176,000 acres of land within the refuge boundary, 8,480,000 acres or 76% of the land is under the jurisdiction of the federal government, and the remaining 24% is largely Native selections. Figure 2 shows the ownership of selected and conveyed lands.

Climate

The Yukon Flats Refuge has a continental subarctic climate characterized by great seasonal extremes of temperature and daylight. Fort Yukon holds the state record high temperature of 100°F and comes close to the record low at -75°F. Warm summer temperatures are augmented by essentially continuous sunlight, while extreme winter colds are prolonged by long hours of darkness. Freezeup of ponds and lakes usually occur in October and last until the middle of May. Precipitation is low, averaging about 6.5 inches annually at Fort Yukon.

Extensive flooding of lowland areas frequently accompanies breakup. This flooding is the primary source of water for many of the lakes in the Flats, as precipitation is insufficient to maintain water levels.

Figure 2. Land status, Yukon Flats Refuge (October, 1985). Source: Division of Realty, USFWS-Region 7.



Topography
The refuge is divided into three physiographic zones. These are:

Riparian and Wetlands. Areas less than 600 feet in elevation or along major rivers. This zone includes 8,300 square miles or 48 percent of the refuge.

Uplands. Areas between 600-1,000 feet in elevation. This zone includes 5,000 square miles or 29 percent of the refuge.

Mountains. Areas of the refuge over 1,000 feet in elevation. This zone includes 4,000 square miles or 23 percent of the refuge.

The Yukon Flats, consisting of about 6.5 million acres, is a lake-dotted, marshy plain of alluvial lowlands, flood plains, outwash fans, and meander belts. Elevation is about 300 feet in the west and 600 to 900 feet in the north and east. Through the Flats the Yukon River and lower stretches of its tributaries are intricately braided streams with meandering channels. Uplands surrounding the Yukon Flats begin at a conspicuous escarpment 150 to 600 feet high and rise gradually to the base of encircling highlands. Overall topography is that of a rock-floored bench, covered with gravel and silt. The surface is partially gullied and terraced in the north; more rolling in the south.

Encircling the Yukon Flats are highlands and mountains. The Porcupine Plateau, an area of low ridges with gentle slopes and rounded to flat summits, lies along the northern and eastern boundary of the refuge. Elevations reach to 2,500 feet with a few domes and mountains rising to 3,500 feet. The Chandalar, Sheenjek, and Coleen rivers drain the northern portion of the plateau; the Black and Little Black rivers, which originate in the Ogilvie Mountains southeast of the refuge, drain the area south of the Porcupine River.

Along the western boundary of the refuge are the Hodzana Highlands, an area of 4,000-foot ridges drained by the Hadweenzic, Hodzana, and Dall rivers. The eastern Brooks Range lies north of the Hodzana Highlands and Porcupine Plateau, north of the refuge boundary.

Bounding the Flats to the south is the Yukon-Tanana Uplands, of which the White and Crazy Mountains are the northern extension. Birch, Preacher, and Beaver creeks are the major drainages on the northern side of these mountains, whose summits range from 4,000 to 5,000 feet in elevation.

Geology
On the Yukon Flats, underlying the modern river flood plain alluvium, the most extensive deposits are alluvial fans deposited by major streams during the Pleistocene glacial age. The largest fans were generated by tributaries from the north, which carried abundant loads of outwash from glacial deposits in the southern Brooks Range. More recent alluvial fans drain locally from the uplands and along the escarpment north of the Yukon Flats, most extensively in the west. Deposits of wind-blown sand, probably dating from the glacial age, occur in dune fields above the flood plain north of the lower Yukon River and in broad blankets landing higher terraces and parts of the upland farther north.

Uplands south of the Yukon River are covered with loess (wind-blown glacial flour) up to 100 feet thick, probably of the Pleistocene glacial age. Dune shape and sediment size distribution indicate wind direction was from the Brooks Range glaciers to the north. Underneath the loess south of the Yukon, and laid bare in areas of the uplands to the north, are stratified locally-cemented deposits of sand, silt, and gravel as much as 100 feet thick.

No glacial deposits extend into the refuge, though recognizable moraine remnants and erratics of up to four separate glaciations occur north of the refuge.

Soils

Soil types found in the upper Yukon-Porcupine area vary considerably. Wet, loamy soils overlain with a thick peat layer and a shallow permafrost table are common. Such associations occupy broad lowlands adjacent to the Yukon and tributaries such as the Chandalar, Sheenjek, and Porcupine rivers. Peat deposits are also found in conjunction with these soils. Interlayered silty and sandy soils occupy broad flood plains in the Yukon Flats.

Wet, loamy soils are also found on upland sites, though these are generally better drained. Very gravely and stoney loams of variable drainage occupy hillsides, steep slopes, and ridgetops bordering the Yukon Flats. Well-drained brown loams are found on hills and ridges of the Porcupine Plateau and on the uplands both north and south of the Flats. Gray calcareous loams are also present on the terraces and hills of the Porcupine Plateau.

Water Resources

Lakes, sloughs, and streams dominate the landscape of the Yukon Flats Refuge. The estimated 40,000 lakes and 25,000 stream miles that occur on the refuge provide the basis for abundant and diverse fishery resources. The Yukon Flats area is susceptible to spring flooding, "recharging" many of the lakes, sloughs, and marshes on the Flats, which maintains the area as high value waterfowl and fish habitat.

Entering the refuge along its southern boundary approximately 10 miles downstream from Circle, the Yukon River flows northwesterly in a braided channel for some 60 miles to Fort Yukon, then bends and flows southwest for another 240 miles in a meandering course with many sloughs before leaving the refuge in a narrow valley between the Ray and White mountains.

The Porcupine River is the major tributary of the Yukon River in the refuge, joining the Yukon just downstream from Fort Yukon. The Porcupine and its tributaries which include the Sheenjek, Black, Little Black, Sucker, and Grass rivers and Chandalar Creek drain the eastern portion of the refuge. Headwaters of the Sheenjek are in the eastern Brooks Range (Davidson Mountains) while the Black and Little Black have headwaters in the Ogilvie Mountains and southern portion of the Porcupine Plateau. The Sucker and Grass rivers and Chandalar Creek drain areas almost entirely within the refuge.

Other important tributaries of the Yukon within the refuge include the Chandalar and Christian rivers which drain the southern slopes of the Brooks Range and the western portion of the Porcupine Plateau; the Hadweenzic, Hodzana, and Dall rivers which drain the Hodzana Highlands and eastern slopes of the Ray Mountains; and Birch and Beaver creeks which drain the White and Crazy mountains. Birch and Beaver creeks flow onto the Flats from the south, while the others flow into the Yukon from the north. These watersheds include the Hodzana and Hadweenzic watersheds in the northwest section of the refuge, the Chandalar Creek watershed in the northeast corner, and the Grass and Sucker river watersheds in the southcentral portion of the refuge. Having these watersheds entirely within the refuge and virtually in their natural condition provides the opportunity to study basically undisturbed watersheds. See Figure 3 for refuge watersheds and the Fisheries Resources section for an expanded description.

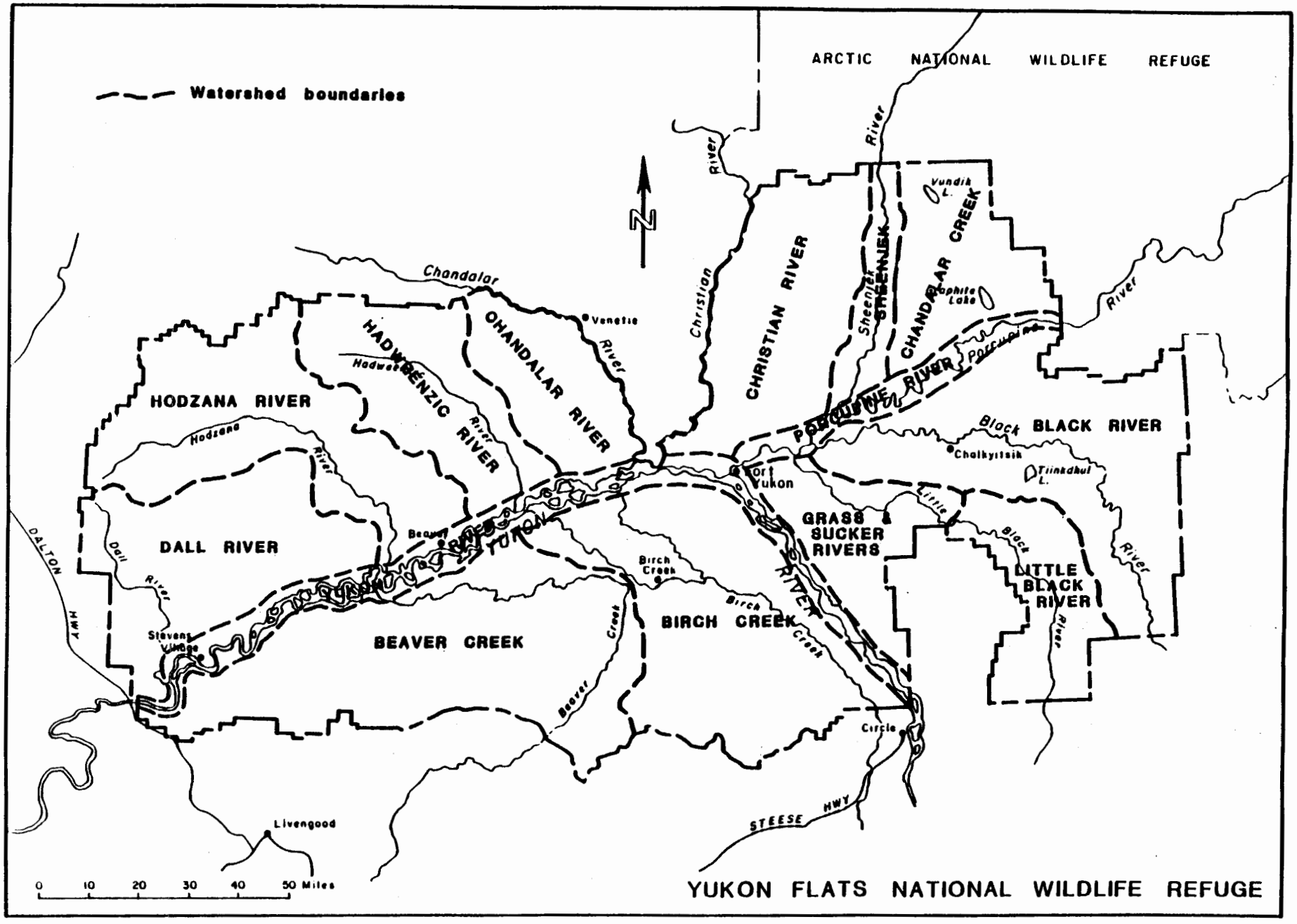


Figure 3. Watersheds on the Yukon Flats Refuge. Source: Division of Planning, USFWS-Region 7.

Some of the most extensive floods in Alaska have occurred on the Yukon River system. The relatively short summers concentrate the major portion of the annual runoff into less than five months. High flows occur from May through September; low flows from October through April. Beginning in late September, freezing weather at the head of tributaries rapidly advances downstream, and by April, flow is gradually reduced to only the infiltration of groundwater in the stream bed. In May, rapid snowmelt occurs, overflowing frozen or ice-jammed channels and often leading to spectacular spring breakup floods. Most peak discharges in the region occur following breakup. The maximum recorded flow on the Yukon River near the western boundary of the refuge is 670,000 cfs; average discharge at this point is 119,000 cfs (Lamke et al. 1983). Smaller peaks sometimes occur in late summer from heavy precipitation, particularly where permafrost is near the surface, preventing infiltration.

The chemical quality of surface water in the refuge and adjacent areas is good. Dissolved solids average less than 200 milligrams per liter (mg/l). All of the waters sampled are of the calcium bicarbonate type with no appreciable iron content. Streams in the refuge have an average sediment load of not more than 100 mg/l throughout most of the year. Streams in the flats commonly carry less than 100 mg/l of sediment, while in the uplands and mountains surrounding the flats, sediment loads may be as high as 500 mg/l. Surface water temperatures noted in the area of the refuge range from 32 to 52 degrees Fahrenheit.

Exceptions to the pristine water quality of refuge streams are Birch and Beaver creeks. Mining in the headwaters of these drainages has taken place nearly continuously over the past 100 years. Historic gold mining practices created large amounts of sediment input within these waters forming thick bedload deposits further downstream. Over the years these deposits have likely impacted the downstream fishery habitat on the refuge. Residence of Birch Creek village have complained for years about upstream mining on Birch Creek causing the decline in fish abundance and the poor quality of their drinking water source (L. Swenson, Yukon Flats Refuge, personal communication). Recent changes in the Environmental Protection Agency's National Pollution Discharge Elimination System permits for placer mining require nearly all placer mines to recycle their process water and places strict limits on turbidity, thus reducing much of the sediment problem associated with mining activities. However, it will likely take many years for Birch Creek to fully recover from the impacts caused from historic mining practices.

Water Rights

The Fish and Wildlife Service will work cooperatively with the State of Alaska to quantify and record instream flows to support the values for which the refuge was established. Alaska's instream flow law (Alaska Statute 46.15.145) allows for quantification of specified instream water uses, the establishment of a priority date upon receipt of a completed application, the issuance of a Certificate of Registration, and a mandatory ten year review of all reservations of water. The applicant must support the quantification with sound hydrological and biological proof of need. The method for providing these data is not designated. Reserved water rights were written in the Alaska Lands Act for most refuges, although quantification is necessary to validate those rights.

BIOLOGICAL ENVIRONMENT

Vegetation

The Yukon Flats is within the northern boreal subzone of central Alaska. Vegetation patterns on the refuge are complex - primarily the result of fire history, sediment deposition during periodic flooding, a braided drainage system, and discontinuous permafrost.

Forests predominate at lower elevations with timberline at 2,300 to 3,000 feet. White spruce, black spruce, white birch, quaking aspen, and balsam poplar make up the forests. Above treeline, arctic dwarf birch, labrador tea, crowberry, blueberry, and mountain avens are common. Shrub communities of alder and willow are most abundant on riparian sites. Herbaceous plants, cotton grass, and sedge, are most abundant in shrub-graminoid tussock tundra. Water sedge and water horsetail predominate as emergent vegetation around pond and lake margins.

Wildlife

Thirty nine species of mammals, 18 species of fish, and 147 species of birds including 13 species of raptors and 24 species of waterfowl are known or thought to occur on the refuge. Refuge wildlife species dependent upon fish include: red-throated, Arctic, common and yellow-billed loon; common and red-breasted merganser; osprey; bald eagle; Bonaparte's, mew, herring, glaucous-winged, and glaucous gull; raven; American dipper; black and grizzly bear; and river otter. A complete list of common and scientific names can be found in the Yukon Flats National Wildlife Refuge Comprehensive Plan.

SECTION III. FISHERY RESOURCES

Species Descriptions

Yukon River fish populations represent a complex resource that is only now beginning to be understood. The Yukon Flats Refuge includes about 300 miles of the upper Yukon River as well as 12 major tributaries. In addition there are thousands of lakes on the refuge. Table 1 is a list of the fish species found on the refuge; however, more species may be present since few comprehensive fishery inventories have been completed to date. The following species descriptions and general life history information are taken from previous fishery investigations throughout the Yukon Flats Basin. Information specific to refuge fisheries is described later in this section under Yukon River tributaries.

Salmon that migrate through or spawn on the refuge travel more than 800 miles from the mouth of the Yukon to reach the refuge. Streams important for salmon spawning and migration on the refuge include the Yukon River and its major tributaries; the Hodzana, Hadweenzic, Chandalar, and Porcupine rivers and Beaver and Birch creeks; and the Sheenjek and Black rivers, tributaries of the Porcupine River.

Chinook (King) Salmon
The Yukon River chinook salmon run, thought to number 200,000 to 500,000 fish, is one of the largest natural runs of any river system in the world. Adult chinook salmon enter the refuge in late June on their way to spawning streams within the refuge, but primarily to streams farther up the Yukon River. Spawners bound for headwater areas in Canada are known to travel more than 2,000 miles in a 60-day period.

Chinook salmon mature in their second to seventh year, but primarily from the fifth to seventh year. Females usually return as six and seven year olds. Spawning generally takes place in main channels of larger streams during late summer. Fry emerge from the gravel spawning areas in early spring. Many refuge streams are important feeding areas and migration routes as the juveniles remain in freshwater for up to two years before traveling to the sea. No major concentrations of spawning chinooks are known within the refuge.

Coho (Silver) Salmon
Coho salmon enter the Yukon Flats fishery the first part of September on their way to upriver spawning grounds. Fry emerge the following June and take up residence in smaller streams where they generally remain for two to four years before the smolts migrate to the sea. Coho salmon may spawn in tributaries of the Porcupine drainage; however, no reliable documentation are available.

Chum Salmon
The Yukon River chum salmon population numbers from two to seven million fish, one of the largest populations of any river system in North America. Two chum salmon runs are evident on the Yukon Flats Refuge - a summer run and a fall run. Several drainages in the Yukon Flats Refuge are important spawning, migration, and rearing streams. They include, but are not limited to, the Chandalar, Sheenjek, Hodzana, Dall, Black, and Porcupine rivers and Beaver Creek. The Sheenjek and Chandalar rivers are two of the most important spawning streams in the upper Yukon River for fall run chum salmon. Alevins emerge from the gravel in May and begin their seaward migration. They remain in the sea for four to seven years before returning to spawn.

Table 1. Fish of the Yukon Flats National Wildlife Refuge area.

Common Name	Scientific Name
	PRETROMYZONTIDAE
Arctic lamprey	Lampetra japonica
	SALMONIDAE
Coho salmon	Oncorhynchus kisutch
Chinook salmon	Oncorhynchus tshawytscha
Chum salmon	Oncorhynchus keta
Dolly Varden char	Salvelinus malma
Arctic grayling	Thymallus arcticus
Broad whitefish	Coregonus nasus
Humpback whitefish	Coregonus pidschian
Least cisco	Coregonus sardinella
Bering cisco	Coregonus laurettae
Round whitefish	Prosopium cylindraceum
Sheefish or Inconnu	Stenodus leucichthys
	UMBRIDAE
Alaska blackfish	Dallia pectoralis
	ESOCIDAE
Northern pike	Esox lucius
	CATASTOMIDAE
Longnose sucker	Catostomus catostomus
	GADIDAE
Burbot	Lota lota
	COTTIDAE
Slimy sculpin	Cottus cognatus
	CYPRINIDAE
Lake chub	Couesius plumbeus

Dolly Varden Char

Dolly Varden char are primarily associated with the upper reaches of clearwater streams that have perennial ground water sources. Dolly Varden found within the refuge appear to be from resident populations and no cases of anadromy have been documented. Spawning activity begins in September and continues into October. Fry emerge in May. Resident populations are smaller in body size than the anadromous populations found elsewhere. One population of Dolly Varden has been identified on the refuge in the Hodzana River above Caribou Bar (Glesne et al. *In Preparation*).

Arctic Grayling
Arctic grayling are found in most clear, cold water streams and tributaries on the refuge. Migration from the mainstem areas of large rivers to smaller headwater streams begins shortly after "ice out". Spawning takes place during the months of May and June. Fry emerge in 11 to 23 days depending on water temperature. Grayling fry are small, very fragile, and subject to catastrophic losses during spring flooding.

Broad Whitefish
Broad whitefish are common in larger river-lake-slough systems and prefer areas of slower moving water. They are also found in landlocked lakes. Spawning activity of all whitefish is similar. They begin lengthy migration runs to spawning areas in mid-September. Spawning is usually complete by mid-October. Most broad whitefish are mature by age six or seven.

Sheefish
There are nine major sheefish populations identified in Alaska. Sheefish on the refuge belong to the Lower Yukon River, Porcupine and Black river populations described by Alt (1978). Spawning generally occurs from late-September to mid-October followed by a rapid migration to downriver wintering areas. Males mature at the age of five to seven and females from seven to nine. Sheefish are alternate year spawners and are distinguished from other whitefish by the large mouth and large body size of up to 50 pounds, though the sheefish on the refuge seldom attain this size.

Bering Cisco
Bering cisco are present at the mouths of middle Yukon River tributaries early in the summer (Nowitna River, June 7; Porcupine River, June 17). This is the spawning migration and will continue until mid-October.

Round Whitefish
Round whitefish are found in refuge clearwater streams with gravel bottoms. They seem to prefer the swifter headwater areas although they are also found in the larger rivers and lakes. The round whitefish spawning period is from mid-September to mid-October.

Humpback Whitefish
Most common on the larger river systems of the refuge, humpback whitefish prefer the slower moving waters in the river-lake-slough systems. They are also found in landlocked lakes. Sexually mature (age five to seven) whitefish migrate to spawning areas during mid-September to mid-October. The humpback whitefish is often confused with the broad whitefish.

Least Cisco
Least cisco are abundant on the Yukon Flats Refuge in lakes and slow moving streams. Spawning runs begin during mid-September to spawning areas in the upper reaches of clearwater streams. Eggs winter in the gravel and hatch in early spring.

Burbot
Found in rivers and lakes on the refuge, burbot are especially abundant in deepwater lakes and slow moving turbid water areas, though they use clear water areas for spawning activity. Spawning migrations of up to 50 miles have been recorded. Spawning generally takes place in January and February (Chen 1969). Age at maturity is four to seven years. Evidence exists that suggest burbot are alternate year spawners.

Northern Pike
Northern pike are found in most rivers and in lakes that are deep enough and have an adequate oxygen supply to "overwinter" fish populations. Its wide distribution on the refuge and superior flesh quality makes the northern pike an important subsistence fish. Spawning takes place in weedy areas in lakes, sloughs, and flood areas in river systems as soon as the ice breaks up.

Spawning within river systems is usually associated with lengthy spawning runs. Northern pike mature in five to six years in Alaska. Whitefish provide an important food item for northern pike, but the mature northern pike forage items include anything from small insects to small mammals.

Other Fish Species
Alaska blackfish, Arctic lamprey, longnose sucker, lake chub, and slimy sculpin are also found on the refuge and are important as prey species to other fish, birds, and mammals. Occasionally, these species are used for subsistence, dog food, or trapline bait.

Habitat Descriptions

Fish habitat occurring within the Yukon Flats Refuge is of four general types: (1) the Yukon mainstem; (2) the sloughs and backwaters of the Yukon; (3) the streams tributary to the Yukon; and (4) the thousands of lakes, ponds and marshes of the Yukon Flats. The tributaries of the upper Yukon can further be divided into three major habitat types, as described by Reynolds (1982): mainchannel, backwaters, and clearwater tributaries. Fishery resources contained within these general habitat types are described as follows:

Yukon Mainstem
Several characteristics of the mainstem Yukon limit its value as fish habitat except as a route for fish movement and migration. During the summer, high concentrations of suspended sediments and its associated turbidity limit primary production and aquatic insects upon which fish depend for food. Bottom materials range from fine silt up to boulders. During low waters, gravel-silt bars are evident throughout the main channel. The total amount of spawning area afforded by the mainstem Yukon for resident and migratory fish species is unknown.

Yukon Sloughs
The backwaters of the Yukon River are of great importance as a rearing area for small fish. Currents are almost nonexistent and silt loads are at least partially deposited, producing a mud bottom and lessened turbidity. Vegetation such as horsetail occurs at the margins of many backwater areas and affords excellent cover for small fish. Broad, humpback, and round whitefish, northern pike, grayling, longnose sucker, sheefish, burbot, lake chub, slimy sculpin, and Arctic lamprey have all been reported within these backwater systems. More detailed studies on habitat utilization and species abundance are needed to better understand the significance of these areas as fish habitat.

Yukon River Tributaries

Dall River
The Dall River originates in the Endicott Mountains, drains southward and enters the Yukon River at mile 852. Its waters are deeply brown stained and currents are extremely slow throughout most of the drainage. Approximately two-thirds of the river drains across a broad marshy floodplain of interconnected lakes and sloughs. Fishery data is very limited on this system, but chum salmon, humpback and broad whitefish, least cisco, Bering cisco, sheefish, burbot, northern pike, longnose suckers, grayling, and lake chub have been reported (Alt 1973; Craig and Wells 1975; B. Arvey, ADF&G-Fairbanks, personal communication).

The Dall River probably receives the highest concentration of sportfishing activity on the refuge, mainly because of its accessibility from the Dalton Highway, 24 miles downstream. Conflicts between residents from Stevens Village and recreational users from the Fairbanks area have occurred. Dinyee Village Corporation selected much of the land surrounding the Dall River and considers recreational use of their lands (without Dinyee's permission) as a trespass violation. The village has had to take this position to curtail vandalism and a general degradation of the area caused by a few inconsiderate campers.

Hodzana River
The Hodzana River is approximately 140 miles long, drains an area of 1,293 square miles, and enters the Yukon at mile 930. Fishery inventory information is more complete within this drainage than in any other system on the refuge. The Service conducted a two year fisheries investigation (1984-85) sampling substrate composition, macroinvertebrates, and fish species throughout much of the drainage (Glesne et al. *In Preparation*). A total of 13 species of fish were collected from the Hodzana River. More species were collected at lower river stations. Northern pike, Arctic grayling, round whitefish, broad whitefish, humpback whitefish, and least cisco were collected in greatest abundance. Arctic grayling were distributed throughout the Hodzana and collected in greatest abundance from upper fourth order and lower third order reaches. Northern pike were distributed throughout fourth order reaches.

Both a summer and fall run of chum salmon spawn in the Hodzana with current populations estimated to be less than 1000 fish/run (Glesne et al. *In Preparation*). However, upper Yukon chum salmon stocks have shown a marked decline in recent years so the system may be capable of sustaining a greater number of spawners.

Hadweenzic River
The Hadweenzic River enters the Yukon mainstem at mile 952. Like the Dall and Hodzana rivers, the Hadweenzic River originates from the Endicott Mountains in the central Brooks Range. Reported fish inventory data is nonexistent for this drainage; however, it is probably reasonable to assume that many of the species found in the Dall and Hodzana Rivers would likely occur here as well. The Hadweenzic was recently added to the Alaska's Fisheries Atlas (1978) as supporting a small population of summer chum salmon (Rost *In Preparation*). A complete fishery inventory is needed on this system, with special attention focused to its limitations for salmon spawning.

Chandalar River
The Chandalar River is 567 miles long, draining an area of 15,407 square miles, and enters the Yukon mainstem at river mile 982. Land status is shared between the State (Middle and North forks), Arctic Refuge (East Fork), Yukon Flats Refuge, and Venetie Indian Reservation (mainstem).

The Chandalar supports chinook, and a summer and fall run of chum salmon. Until recently its importance as a producer of fall chum salmon was thought to be minor. Barton (1984) reported that annual aerial surveys since 1974 typically average less than 5,000 fish, with the highest reported count occurring in 1974 of 17,160. In 1986, the Service deployed two side-scanning sonar devices on the lower Chandalar River which tallied a seasonal total of 59,313 fish (Simmons *In Preparation*). The apparent discrepancy between counting estimates can be attributed to the difficulty in surveying this system from the air. New upstream limits for spawning chinook salmon for this system were recently added to the Alaska's Fisheries Atlas (1978) to extend up the Middle and East forks of the Chandalar (Rost *In Preparation*).

Humpback, broad, and round whitefish, Arctic grayling, and northern pike are considered to be abundant in the Chandalar and are reported to be heavily depended upon by villagers at Venetie (McLean and Raymond 1983). Available data indicate that whitefish are most abundant below the confluence of the East Fork and the mainstem Chandalar, often associated with river connected lake systems. The long spawning migrations described by Alt (1978) in other drainages such as the Chatanika and Kobuk rivers are not known to occur in this system. Instead, whitefish utilize stream connected lakes for feeding and overwintering, and spawn in nearby creeks. Whitefish within this system are slower growing than in other parts of interior Alaska, possibly because of lower food availability (McLean and Raymond 1983).

Northern pike are commonly found in river connected sloughs in the lower 20 miles of the river where stream gradients are lowest. Grayling are quite common in the headwater reaches of the Chandalar where pool/riffle development is predominant. Other fish species documented in the Chandalar drainage include sheefish, slimy sculpin, Dolly Varden char, lake trout, burbot and longnose suckers (McLean and Raymond 1983).

Christian River
The Christian River is approximately 118 miles in length, covers a drainage area of 2,718 square miles, and enters the mainstem Yukon 1,018 miles from its mouth. Fish inventory information is almost nonexistent for this system. The river was recently added to the Alaska's Fisheries Atlas (1978) for both summer chum and chinook salmon spawning habitat (Rost *In Preparation*). It was noted during the aerial survey reconnaissance that a series of log jams several miles upstream from the mouth were likely to inhibit or preclude upstream fish movement.

Porcupine River Complex
The Porcupine drainage covers over 46,000 square miles and is over 550 miles long. Of the nine tributaries that make up this expansive watershed, the Porcupine mainstem, Black River, Little Black River, and the Sheenjek River are partially contained within the Yukon Flats Refuge. In total production this system accounts for the majority of the Alaskan fall chum salmon production. Within the confines of the refuge boundary the mainstem of the Porcupine provides a migration route for salmon to tributary spawning streams.

The Sheenjek River enters the Porcupine River 37 miles upstream from the confluence of the Porcupine and the Yukon. The river is over 270 miles long, with a drainage area of 4,788 square miles. The Department has enumerated fall chum salmon on the Sheenjek River since 1981. Based upon available sonar escapement data, the Department has set a spawning escapement objective of 60,000 fall chum salmon for the Sheenjek River. Table 2 is a summary of sonar escapement of fall chum salmon for this system.

Table 2. Sonar counts of fall chum salmon, Sheenjek River, 1982-1986. Source: Whitmore et al 1986.

	1982	1983	1984	1985	1986
Counts	31,421	49,392	27,130	152,768	83,197

Alt (1978) surveyed this area for sheefish life history information and concluded that there are probably two distinct populations within this drainage, a Porcupine population, and a Black River population. The Porcupine population spawns in the upper reaches of the Porcupine River. The Black River population utilizes an area of the Salmon Fork, near the Kevinjik Creek confluence for spawning, is dispersed throughout much of the Black River drainage, and intermixes with the Porcupine population in the lower river.

Fishery resource information on other species within the Porcupine drainage is, for the most part, lacking. The Sheenjek and Porcupine rivers were considered for inclusion under the Wild and Scenic Rivers Act. Preliminary studies were conducted on the fishery resources of these systems; however, they should be considered very cursory in content (Reynolds 1982). Species lists reported in this study are listed in Table 3.

Table 3. Fish species list and habitat preferences for Porcupine Drainage Complex. Source: Reynolds 1982.

	Main Channel	Backwater	Clearwater Tributaries
Chinook salmon	X	X	X
Chum salmon	X	X	X
Coho salmon	X	X	X
Sheefish	X		X
Broad whitefish	X	X	
Humpback whitefish	X	X	
Least cisco	X		
Bering cisco	X		
Round whitefish	X		X
Arctic grayling	X		X
Northern pike	X	X	
Burbot	X	X	
Longnose sucker	X	X	X

Birch Creek

Birch Creek is 314 miles long and drains an area of 3,776 square miles. The upper 126 miles is designated as a "wild" river pursuant to the Wild and Scenic Rivers Act, and is administered by the Bureau of Land Management (Bureau). Refuge fishery resources have probably been impacted due to habitat degradation from upstream placer gold mines which have operated for nearly a century. Adverse impacts to fish and their habitat directly below headwater mining operations in Birch Creek have been well documented by LaPerriere et al.(1984). However, complete quantification of deleterious affects downstream within the refuge boundaries is lacking. Water samples collected by the refuge in 1987 showed high levels of turbidity (140 NTU), but in 1988 were greatly reduced (5 NTU). This improvement is likely due to stricter regulations and enforcement efforts associated with upstream mining. It will likely take many years to fully restore downstream spawning areas affected by past sediment deposition.

Alaska's Fisheries Atlas (1978) lists both chum and chinook salmon occurring downstream from the Steese Highway bridge; however, the last reported sighting of a salmon in this river was in 1974 (Barton 1984). Historical records of salmon populations prior to mining are unavailable, since mining in this area started at the turn of the century. Salmon production potential from this system is unknown.

Recent fish inventory investigations on the upper Birch Creek watershed indicate that many of the unmined clearwater tributaries contain grayling and slimy sculpins (Kretsinger 1986; ADEC 1986). Other reported resident species include round whitefish, longnose suckers, sheefish, and burbot.

A thorough fishery inventory of the refuge portion of the drainage is needed to better understand existing levels of fish utilization and to monitor changes afforded by recent improvements in upstream mining operations.

Beaver Creek

Like Birch Creek, Beaver Creek drains from the White Mountains, before entering the Yukon mainstem at mile 930. The Alaska Lands Act established the upper portion of Beaver Creek (127 river miles) as a component of the National Wild and Scenic River System. The initial 111 mile wild river segment of Beaver Creek flows through a portion of the White Mountains National Recreation Area, administered by the Bureau. The final 16 mile segment flows through a portion of the Yukon Flats Refuge. A river management plan, jointly prepared by the two agencies, was approved in December, 1983. The river, including the designated river corridor, is managed under the policies and guidelines developed in this management plan. Beaver Creek has been determined to be a navigable river from its mouth upstream to Victoria Creek.

Fishery resource information is almost nonexistent for the refuge portion of the river. Studies conducted by the Bureau in the upper reaches of Beaver Creek showed that sizeable populations of grayling utilize this region for both spawning and feeding. The Alaska's Fisheries Atlas (1978) lists chum and king salmon spawning up to Victoria Creek. Aerial surveys conducted in 1985 revealed several chinook salmon in the mainstem near Victoria Creek (Rost *In Preparation*).

Fish habitat may also have been affected from past headwater mining activities on Beaver Creek. The effects of many years of mining has had on downstream refuge fish habitat is probably considerably less than that of lower Birch Creek since the level of mining activity on this drainage is much lower.

Lake Habitat

Yukon Flats Refuge has an estimated 40,000 lakes. Lake types include upland basins, thaw lakes, river flooded lowlands, and oxbows. Spring runoff, summer thunderstorms, and river flooding charge the lakes. Most have variable water depths and shorelines from year to year. Closed basins in bog areas generally maintain stable water levels, while closed basins in drier areas are charged by infrequent flooding and exhibit long periods of receding depths.

Alkali salt is contained in many of the lakes on the refuge. These lakes are recognized by the milky white color of their water and by evaporative crusts on dried out beds. Analysis of samples from the lakes identify this alkali material to be primarily trona (Clautice and Mowat 1981), a sodium bicarbonate industrial mineral used in the manufacture of glass and paper. Source of the trona is suggested to be groundwater emanating from evaporative beds. Bicarbonates and carbonates have been correlated with productivity in freshwater lakes (Moyle 1970).

Thaw Lakes

The vast majority of lakes on the refuge have been created by thawing of the underlying permafrost. This process has been described by Livingstone et al. (1958) for other areas of Interior Alaska. Thaw lakes are typically round to moderately irregular in shape and generally have very shallow depth (maximum depth less than 3 meters). Exceptions to this exist where beaver have dammed up outlets and where ice lenses have thawed, creating deep pockets.

Productivity and fisheries use on Yukon Flats Refuge and five other Interior Refuges were investigated in 1984-85 by Glesne (*In Preparation*). Major factors affecting productivity and fisheries use are related to the edaphic characteristics of the surrounding area, connections to rivers, potential for flooding, and lake morphometry. Water quality characteristics of thaw lakes relating to productivity were generally lower for deeper lakes and lakes isolated from river systems. Lakes connected to the rivers or periodically receiving flood waters exhibited higher value for alkalinity, conductivity, and nutrient concentrations (Glesne *In Preparation*).

Thaw lakes without river connections and with low probability of flooding were generally devoid of fish. The primary limiting factor is shallow depth, making the habitat unsuitable for overwintering. Those with adequate depth (mean depth generally greater than 10 feet) had populations of northern pike only or northern pike and Alaska blackfish.

Thaw lakes connected to rivers exhibited greater density and diversity of fish. Primary species collected in these lakes included broad whitefish, northern pike, humpback whitefish, least cisco, and longnose suckers. It is expected that these lakes are primarily used as summer feeding and rearing areas as depth is too shallow to permit overwintering.

Oxbow lakes

Oxbow lakes are formed from cutoffs of the meandering river channel in the lower gradient courses of the Yukon and its tributaries. These lakes are much less common than thaw lakes on the refuge. Most oxbow lakes are closely associated with larger river channels and therefore are either connected or subject to frequent flooding. Fish species composition and abundance is similar to river connected thaw lakes. Oxbow lakes exhibit greater depth and most are capable of providing overwintering habitat for fish.

Upland Basins

Only a few upland basins are found on Yukon Flats. In general, productivity of upland lakes is less than that of lowland lakes and largely relates to the greater depth of these waters.

SECTION IV. HUMAN USE AND MANAGEMENT HISTORY

Subsistence Fishing

Salmon probably contributed to the diet of the human inhabitants of the area since man first arrived in the region. Before 1900, fish for human consumption were caught in wooden and woven traps, weirs, and by use of dip nets (USDI 1964). About 1904, the fish wheel was introduced to the area and proved to be exceedingly effective in catching salmon from turbid and muddy waters. Fish were required in larger quantities during the gold rush era, not only as food for new inhabitants but also to feed the increasing number of dog teams needed for winter travel. In the sparsely populated regions of the Yukon, the dog team was indispensable to travel. Taking salmon for dog food was extremely important, and amounted to hundreds or thousands of tons annually, primarily Yukon River chum salmon. The demand for salmon increased until about 1925, when a decline in mining activities and the completion of the Alaska Railroad in 1923 reduced river traffic along the Yukon River system (USDI 1964). Dog teams were further reduced with the advent of the airplane mail transport in the early 1930's. Thus, the number of fish wheels operating in the Yukon declined rapidly.

The Athabascan Natives of the Yukon Flats region (Kutchin Indians) have traditionally depended heavily upon fish as a food resource. Nelson (1973) wrote of the Kutchin people:

> Of all the food resources exploited by the Tranjik Kutchin, fish are one of the richest and most reliable. In fact, it is reasonable to speculate that fish were the most important single resource during the aboriginal past, and in some years this is probably still true.

Villages in the sparsely populated interior region were advantageously located on main rivers and streams, and served as base centers from which traditional fishing trips were made seasonally to fish campsites up or downriver. The harvest of subsistence fish is traditionally carried out on an annual cycle closely corresponding to peak abundance of each fish species as described by Caufield (1983). In the spring, whitefish, pike, and suckers are harvested from small creeks and sloughs of the Yukon and Porcupine rivers using gillnets. By summer, traditional fish camps on the Yukon are reestablished in preparation for the chinook salmon migration. Of the three species of salmon harvested for subsistence purposes, chinook salmon are the most highly sought after for human consumption. Chinook salmon are preserved by cutting the flesh into strips, then the strips are air dried and smoked on racks for later use during the winter. The majority of the chinook, chum, and coho subsistence harvests are accomplished using fishwheels primarily and gillnets to a lesser extent (F. Andersen, ADF&G-Fairbanks, personal communication).

In August, the chinook salmon run has tapered off and harvest effort is directed toward the chum salmon run which will continue until freezeup. The majority of the chum salmon harvest takes place in late August and early September. Coho salmon are also harvested in the fall, but their abundance is considerably less than chum salmon. Chum salmon are primarily used for feeding dog teams which are still common throughout the interior villages. However, in more recent times the subsistence harvest of chum salmon for use as dog food is considerably less than it was in the past, largely due to the replacement of dog teams with snowmobiles.

Resident fish are caught incidentally in fishwheels and gillnets during the salmon harvest. In winter, whitefish, pike, burbot, and grayling are caught by setting nets under the ice of lakes and sloughs and by jigging with hook and line. Resident fish are taken both for human consumption and for feeding dog teams (Caufield 1983; Sumida *In Preparation*).

Currently residents of seven communities within or adjacent to the Yukon Flats Refuge regularly take fish and wildlife from the refuge. These communities are Beaver, Birch Creek, Chalkyitsik, Circle, Fort Yukon, Stevens Village, and Venetie. Except for Fort Yukon, these are small bush communities typical of rural interior Alaska. Residents of villages lying within the refuge boundary depend heavily on fish for subsistence. However, upper Yukon River residents consider moose the most important food source even though the volume of fish exceeds that of the moose (Caulfield 1979; Nelson 1973).

Table 4 provides information on subsistence fish harvests from villages within and adjacent to the refuge.

Table 4. Estimated subsistence harvests of Yukon River salmon, Yukon Flats villages, 1986. Source: Whitmore et al. 1986.

Village	No. of Families	Kings	Summer Chum	Fall Chum	Coho	Total Salmon	Whitefish/ Sheefish
Stevens Village	17	2,839	3,116	4,150	67	10,172	408/ 71
Beaver	8	708	0	3,321	124	4,153	100/ 55
Fort Yukon	31	3,083	3,264	8,543	118	15,008	2,899/ 556
Circle	16	2,233	459	3,650	37	6,379	80/ 14
Venetie	8	32	0	3,193	0	3,225	0/ 0
Chalkyitsik	7	0	0	1,533	8	1,541	1,473/ 440
Total Yukon NWR	87	8,895	6,839	24,390	354	40,478	4,960/1,146
Total Yukon R.	1,152	54,505	290,832	167,146	34,770	492,748	42,188/15,010

Commercial Fishing

Records of commercial fishing in the Yukon River date to 1918, when commercial packing of salmon began in the Yukon Delta area. Most of the commercial harvest of salmon occurred in the lower downstream sections of the river, but an average of more than 1,800 salmon were commercially harvested annually from the Yukon in Alaska above Koyukuk Village during the period from 1963 to 1972. Commercial fishing is not permitted on any of the Alaskan tributaries of the Yukon River, with the exception of the Tanana River.

The results of heavy commercial fishing in the lower river led to a decline in runs of fish to the upper reaches of the river. Controversy over the new commercial ventures continued for several years and motivated biological investigations during 1920. On the basis of these studies, commercial fishing was restricted in the delta area, and by 1924 all commercial fishing in the area was eliminated. In 1930, commercial fishing was permitted outside the delta area and in 1935 was permitted within the river. Also in 1935, the use of fishwheels as commercial gear for aboriginal people and permanent white residents of the Yukon basin was legalized.

Commercial harvest quotas were set in 1936, permitting the taking of 25,000 king salmon within the Yukon River. This quota remained in effect until 1954 when the river was divided into three subdistricts. The quota for the upper district was set at 5,000 kings (from Anvik to the Yukon Territory border). Since 1960, the Department has managed the Yukon River commercial fishery and created new subdistricts in the upper Yukon River to include the area from Marshall to the Canadian border. Within the Yukon District, the Yukon Flats area encompassed part of the Department's management subdistrict 334-40 (Y4), which extended from the mouth of the Koyukuk River upstream to the Alaska-Canada border, including all tributary drainage streams and rivers. In this district, fishing was allowed seven days a week until quotas of 2,000 king salmon and 2,000 chum and coho salmon combined were taken (ADF&G 1973).

In 1974, the Department revised the subdistrict boundaries for commercial fisheries in the upper Yukon River. Subdistricts 334-10 (Y1) and 334-20 (Y2) remained the same while 334-30 (Y3) and 334-40 (Y4) were reduced in size. In addition, two new subdistricts were created to better manage the rapidly expanding fisheries of the Upper Yukon (Y5) and Tanana Rivers (Y6). The map in Appendix B reflects these district changes.
A very limited amount of commercial salmon fishing occurs within the boundary of the refuge,

primarily on Native selected and conveyed lands and Native allotments. The refuge boundary is part of subdistrict 5-D; the Department's Yukon River commercial fishery management area that extends from near the refuge's western edge up river to the Canadian border.

As shown in Table 5, commercial harvests on the refuge (5-D) are comparatively small relative to harvests in the remainder of District 5 as well as other parts of the Yukon.

Table 5. Yukon area commercial salmon catch and effort data, 1986. Source: Whitmore et al 1986.

District/ Subdistrict	No. of Fishermen	Chinook	Summer Chum	Fall Chum	Coho	Total Salmon
District 5						
5-A	1	0	0	1,332	0	1,332
5-B	13	1,494	682	12,302	0	14,083
5-C	13	875	8	7,471	0	8,354
5-D	3	364	0	1,343	0	1,707
Subtotal District 5	30	2,733	690	22,448	0	25,476
Total Upper Yukon	132	4,185	51,473	25,990	441	82,089
Total Lower Yukon	672	95,875	669,996	113,452	46,814	925,995
Total Yukon	804	99,970	721,469	139,442	47,255	1,008,084

Of the three commercial fishermen operating in District 5-D, one operates at Stevens Village, another at Fort Yukon, and another outside the refuge boundary near Circle (F. Anderson, ADF&G-Fairbanks, personal communication).

Commercial fishing quotas established by the Board of Fisheries, for District 5 have flexible guideline harvests of 2,700 to 3,300 chinook salmon and 10,000 to 40,000 fall chum and coho. In anticipation of weaker returns of fall chums for the 1986 season, the Board set a lower guideline harvest of 0 to 50,250 combined for Districts 4, 5, and 6 (Whitmore et al. 1986).

Recreational Use

Subsistence activities (fishing, hunting, trapping, and the collection of vegetation materials) account for over 90 percent of the public use occurring on the refuge. Various recreational activities, centered primarily around sport hunting, fishing, and river floating, comprise the remaining segment of public use. The most commonly floated rivers include Beaver and Birch creeks and the Yukon, Porcupine, Sheenjek, and Chandalar rivers.

Both sport and subsistence fishing are allowed on the refuge, subject to Alaska fishing regulations. Nearly all the salmon caught on the refuge are taken with set nets and fish wheels by local residents. A limited amount of fly-in sport fishing occurs, but most sport fishing is incidental to other recreational activities such as river floating and hunting. The Dall River is probably the heaviest used sport fishing area on the refuge because of its accessibility from the Dalton Highway.

SECTION V. ISSUES AND CONCERNS

1. **A potential exists for over-harvest of refuge salmon stocks due to commercial fishing activities downstream of the refuge boundaries.**

High seas and in-river commercial and subsistence fishing can have a significant impact on the number of chum and king salmon reaching the refuge due to the mixing of salmon stocks within that fishery. Small stocks of several hundred fish or less are more likely to be overharvested than are larger stocks. Fishery managers need methods to evaluate escapement of selected salmon stocks, both in-season and post-season. The Service is involved in Treaty negotiations with Canada over allocation and conservation issues for transboundary chinook and fall chum salmon stocks. The Service is participating in research of developing stock identification within the mixed stock fishery of the lower Yukon River which may help improve management within the main river and spawning escapement to individual drainages.

This project is viewed as a very high priority by the State of Alaska because it may assist fisheries managers in protecting stocks of salmon which may presently be exploited above sustainable levels. Alaska Lands Act requires the Service to provide the opportunity for continued subsistence uses by local residents. Local residents rely heavily on fisheries harvest for sustenance. Both chum and chinook constitute an important source of protein for subsistence users on the Yukon Flats Refuge.

2. **Degradation of refuge aquatic habitat and water quality may have occurred from upstream (off-refuge) placer mining operations.**

Nearly 100 years of placer mining on Birch and Beaver creeks may have had deleterious affects on refuge fish habitat, especially on spawning gravels. Excessive sediment loads can cause loss of spawning habitat due to filling in and compaction of spawning gravels. Deposition of sediments may reduce or block the interchange of surface and subsurface water needed for successful incubation of fish eggs and larvae.

3. **The use and development of inholdings and lands adjacent to the refuge may adversely affect fish and their habitat on the refuge.**

Concerns include loss and/or alteration of habitat, increased pollution, increased exploitation of available refuge stocks and refuge resources, and increased human use. Coordination between federal, state, and local agencies during all land-use planning activities is necessary to assure management integrity with adjacent lands.

There are large areas of privately owned land within the boundaries of Yukon Flats Refuge. These lands could be developed in the future for a variety of uses including oil, gas, and mineral exploration, agriculture, residential, and other commercial activities. These activities could impact the refuge's fish stocks.

4. **Public use conflicts will continue to grow as the popularity of sportfishing on the refuge increases.**

Recreational use of the refuge in the form of float trips and river boating accessed from the Dalton Highway can create conflicts with local villagers. It is important that fishery inventory data be collected on those drainages where conflicts occur to insure that refuge fish stocks are not being overexploited. It is equally important that subsistence harvest data be collected to insure that these needs are met. Close coordination with the Department will be undertaken to insure that each agencies' management responsibilities are clearly defined.

5. Fishery resource populations may deteriorate without sufficient data to measure such declines and refine fishery management techniques.

The Yukon Flats Refuge encompasses an expansive complex of drainages where information on their fishery resources is substantially lacking. Overexploitation of the refuge fish stocks may occur from overharvesting taking place both on and off the refuge. Additional data are needed as a basis for preparing stock specific spawning escapement goals and to assess the impacts of development on the refuge. Continuation of subsistence monitoring of salmon harvest data and more consistent harvest data of non-salmon species are needed to determine whether current harvest levels are sustainable. Information is also needed to expand scientific knowledge about the life history of fish species in order to strengthen management capabilities and to benefit the people utilizing the refuge fishery resources.

SECTION VI. GOALS AND OBJECTIVES

Goal I: To conserve the fish and wildlife populations and habitats in their natural diversity including but not limited to salmon.

Objective I.1: To administer the fishery management program of the Yukon Flats Refuge as a continuing commitment through 1994.

Objective I.2: To regulate the harvest of refuge fish populations in accordance with agency regulations as a continuing commitment through 1994.

Objective I.3: To monitor escapement of refuge salmon stocks as a continuing commitment through 1994.

Objective I.4: To determine the spawning and rearing areas for coho, chinook, and chum salmon in five tributaries of the Yukon River by 1994.

Objective I.5: Evaluate the impacts of off-refuge mining to the fish populations of Beaver Preacher and Birch creeks by 1993.

Objective I.6: To complete fish population and habitat studies for three refuge tributaries and three refuge slough systems by 1993.

Objective I.7: To complete fish population studies on three refuge lakes by 1994.

Goal II: To fulfill International Treaty obligations of the United States with respect to fish and their habitats.

Objective II.1: To provide baseline information on locations and size of spawning stocks of fall chum and chinook on the refuge by 1993.

Goal III: Provide the opportunity for continued subsistence uses of fish resources by local residents.

Objective III.1: To cooperate with the Department in monitoring and evaluating subsistence harvest of all fish species within the refuge through 1994.

Objective III.2: To determine if sportfishing harvest in the Dall River is adversely impacting the northern pike population by 1994.

Goal IV: Ensure to the maximum extent possible that the water quality and the water quantity within the refuge is maintained.

Objective IV.1: To collect and analyze baseline water quality and quantity data for refuge streams affected by upstream mining activity as a continuing commitment through 1994.

SECTION VII. STRATEGIES AND CONSTRAINTS

Common Management Strategies

The Service will cooperate with the Department in the management of fish populations on the refuge and adjacent areas. The Service will also review the Department's fish management projects to ensure that they are compatible with the Master Memorandum of Understanding between the Department and the Service and the general management directions developed within the Yukon Flats Conservation Plan. All fisheries work on the refuge will be coordinated among the refuge manager, the Service's Fishery Assistance Office in Fairbanks, and Department's local offices.

The Service has adopted a national policy to provide increased recreational (sport) fishing opportunities on national wildlife refuges. The Service will determine where and if this activity can best be accomplished without adversely impacting fish populations, detrimentally impacting subsistence fishing, and non-human use (wildlife) of the resource. Changes in seasons, methods, and means of the sport fishery harvest may be proposed pending this evaluation.

The Service will strive to maintain fish populations at their current levels with the management of wild stocks in their natural state being the first priority. Sport fishing regulations are not expected to change throughout the 5-year duration of this plan. For development activities on refuge lands the Service will design special use permits to safeguard aquatic habitat and spawning habitat quality. For development activities taking place outside the refuge but affecting spawning habitat on the refuge, the Service will request assistance from the State of Alaska, Environmental Protection Agency, and the Corps of Engineers whose jurisdictions are to enforce regulations governing riverine water quality and habitat protection.

Commercial, sport, and subsistence fisheries are now managed in accordance with the policies of the Service and the Department and regulations of the Board of Fisheries. Management direction recognizes subsistence use as the highest priority among beneficial human uses of the resources. The subsistence fishery is subject to very few restrictions in order to give preference to subsistence users.

Fishery management on the refuge is directed to maintaining subsistence fishing as a first priority, but concurrent with commercial and sport fisheries. Opportunities for subsistence harvest of fish resources will continue to be protected by recognizing this beneficial use as the highest priority. Sport fishing will continue to be permitted in all refuge areas, although production capacity is limited and intensive sport fishing may impact fish populations. Restrictions may be imposed to control the harvest of some populations if they are determined to be overexploited.

Coho and chinook salmon have previously been identified by the Service as national resource species. The Service has developed general management strategies for each species in its Alaska Regional Resource Plan. The strategies relevant for refuges, such as collecting survey data, monitoring populations, and protecting habitats, are reflected in the management directions developed for this plan.

The Service and the Department will cooperatively evaluate the results of field studies and surveys with respect to both refuge originating migratory and resident species. The Service will confer and work closely with the Department on the local level in the interpretation of the results and the development of future management direction. The Service may recommend changes in state regulations when biological information indicates that fish populations are adversely impacted.

Setting escapement goals and new harvest regulations will be accomplished through developing a fishery database, which does not currently exist for all species and ecosystems within the refuge. Consequently, many of the fishery investigations identified in this plan center on survey and inventory of the existing fishery resources of the Yukon Flats Refuge.

Common Management Constraints

A critical factor in implementing any of the specific fishery tasks identified in this plan will be the level of available funding. Specific tasks have been prioritized (Section IX) to accommodate a given funding level. Service administrators are presently working towards obtaining special appropriations for implementation of these tasks.

The remoteness and expansive size of the drainages on the Yukon Flats Refuge curtails our ability to gather the fishery data needed for assessing current harvest regulations of the refuge's fishery resources. Fishery management is complicated further by the migratory behavior of most fish species indigenous to the refuge. Refuge fish exhibit lengthy migrations of 50 to over 3000 miles associated with their yearly spawning or life cycles. The total ecosystem for three of the five Pacific salmon species (chinook, chum, and coho) includes refuge streams, the Yukon River, parts of the north Pacific Ocean, and the Bering Sea. Interception of refuge salmon stocks occurs throughout this ecosystem making spawning escapement objectives for individual tributaries extremely difficult to achieve.

Refuge Lake Management

Resident Species Management

Planned fishery investigations on refuge lakes will be limited to studies on Vundik, Graphite, and Burman lakes. Emphasis will be placed on collecting information on fish species composition and age, length, and weight data, habitat descriptions, and water quality data. These lakes currently receive some subsistence and sport fishing pressure throughout the year, however, the current harvests levels are unknown as are the impacts to the fish populations.

Fish populations will be monitored using various sampling techniques including traps, nets, and hook-and-line gear. Exploited fish populations will be examined to determine if the current management strategies are appropriate for maintaining healthy fish populations.

Refuge River and Stream Management

Anadromous Fish Management

Service efforts will focus on collecting accurate salmon escapement data on refuge tributaries, verification of fall chum salmon escapement by aerial surveys during peak spawning periods, and development of accurate escapement goals. Salmon escapement goals will be established to support reproduction of the species and ultimately sustain adult fish populations for human and non-human use.

Aerial surveys will be attempted during the period corresponding to peak spawning of Chandalar River fall chums so that ratios of sonar/aerial counts can be established, eliminating the need for the more costly sonar counts. Based upon recent radio telemetry and aerial surveys, Chandalar chinook salmon stocks are estimated to be less than 200 spawning fish. Aerial surveys will continue on an annual basis to assess annual fluctuations in this currently small stock.

Since 1981, the Department has monitored annual fall chum salmon escapement on the Sheenjek River using side-scan sonar. The Department's Commercial Fish Division will use spawning escapement data on this and other selected tributaries in evaluating harvest regulations on a post-season basis and in forecasting run strength based upon brood year escapement. It is anticipated that the Department will continue the sonar operation on the Sheenjek River; however, should the lack of State funding eliminate this project, the Service would make an intensive effort to continue this project on a temporary basis.

Data on the Sheenjek River chinook stock is insufficient for purposes of managing the resource or its associated habitat. The Service will conduct a combination of radio telemetry and aerial surveys on this drainage to evaluate the importance of this stock within the refuge.
Black River, Birch Creek, Beaver Creek, and the Christian River are all documented to have chinook, coho, or chum salmon stocks, however information on annual spawning escapements has been limited

to an occasional aerial survey. A combination of radio telemetry studies to locate key spawning areas, along with subsequent aerial surveys, will provide an improved database for making management decisions. This information will be used to support stipulations in special use permits and develop recommendations for spawning escapement goals.

Anticipated constraints for continuation of the present fishery management program include: (1) the logistics for collection of fishery data are complicated due to common salmon run timing, upper Yukon coho and fall chum runs occurring during periods of stream ice-up, and weather occasionally inhibiting the ability to conduct aerial surveys; (2) the time requirement needed to process technical information; and (3) the off-refuge harvest of salmon in a mixed stock fishery complicates managing fish for local purposes.

Electrophoretic stock identifications for fall chums in the Chandalar and Sheenjek rivers are well established at this point in time; however, other salmon stocks throughout the refuge remain genetically unidentified. With the potential threat of overharvesting of small stocks and environmental perturbations such as upstream mining activities, efforts will be made to genetically identify each salmon stock within the refuge. In most cases, samples will be collected from juveniles so that identification should not impose harm to existing small populations. The ability to identify a genetically similar strain of salmon will then be possible should restocking of the species be required at some point in the future.

The Department annually conducts subsistence fish harvest surveys in most of the villages within the refuge boundaries. These surveys provide valuable information to resource managers regarding trends in utilization of fishery resources for subsistence purposes, as well as for determining the overall harvest of salmon throughout the Yukon drainage. It is anticipated that these surveys will be continued by the State, provided that funds are made available.

Resident Fish Management

For purposes of these discussions, both the anadromous and nonanadromous forms of sheefish that occur on the refuge are included as resident fish. Current knowledge of refuge sheefish populations is limited to a few discrete spawning populations along with numerous occurrences of nonspawners on many refuge tributaries. Whether these nonspawners represent discrete refuge populations or represent populations from off the refuge is unknown. Intensive sampling at the mouths of refuge tributaries as well as at suspected spawning riverine habitats during the spring and again in the fall will more clearly define refuge stocks.

Radio transmitters will be implanted in captured individuals identified as prespawners to identify spawning habitats and movement patterns throughout the refuge. Identified areas where sheefish have been reported, but information is incomplete, include the mainstem Yukon River below Fort Yukon, the Black River near the Salmon Fork, the Porcupine River near the Coleen River, Beaver Creek, Birch Creek, Dall River, and the Hodzana River. Given the amount of information that is to be collected, investigations are planned to take place over a four year period. Suitable harvest regulations for individual populations will be developed when discrete populations are identified and relative population densities established.

One of the major riverine habitat types identified in this plan are the extensive slough systems off the main channel of the Yukon River. Resident fish species utilization of this habitat type are unknown. Fishery surveys will be conducted on Crazy, Hodzana, and Beaver sloughs to determine fish utilization within this habitat type. Collection of species composition and abundance along with specific habitat utilization within the slough systems will provide the refuge manager with the tools necessary to protect fishery habitat from any future activities such as oil exploration and development.

Three tributaries within the refuge where information on resident fish utilization are lacking include, the Dall River and Birch and Beaver creeks. Past and present mining activities have significantly disturbed fish habitat in Birch and Beaver creeks. Harvest levels of northern pike from the Dall River may be above a sustainable level. Information on resident fish populations in these three systems within the confines of the refuge are mostly undocumented. Given the relatively high recreational usage of these systems along with their importance to local villagers for subsistence purposes, it is important to document what fish populations currently utilize these systems as well as to determine what the habitat potential might be with improved mining practices. Recommendations concerning the harvest of resident fish in these systems will be made upon completion of these investigations.

The Yukon Flats Refuge has an ongoing water quality and contaminant sampling program which is being conducted on major tributaries within the refuge boundaries. Water, sediment, and fish tissue collections are collected for each tributary sampled. A baseline data collection effort will be pursued for Beaver, Birch, and Preacher creeks and the Chandalar River for the purpose of documenting change, if it occurs. Refuge fishery investigations will be closely coordinated with efforts to obtain water, sediment, and fish tissue by other groups or agencies. The Service's office of Fisheries Management Services will assist in data gathering and appropriate application of results in this cooperative effort.

SECTION VIII. FISHERY MANAGEMENT ACTIVITIES FOR THE YUKON FLATS NATIONAL WILDLIFE REFUGE, 1988-1992.

Goals	Objectives	Tasks	Responsible Office	Date/Funding/FTE
Goal I: TO CONSERVE FISH AND WILDLIFE POPULATIONS AND HABITAT IN THEIR NATURAL DIVERSITY INCLUDING BUT NOT LIMITED TO SALMON.				
	Objective I.1 To administer the fishery management program on Yukon Flats Refuge as a continuing commitment through 1994.	Task I.1.1. Meet legal mandates with respect to refuge fisheries. Prepare management recommendations, attend planning meetings, prepare news releases, and coordinate both intra and interagency fisheries matters.	Yukon Flats NWR	1990/10,000/0.2 1991/10,000/0.2 1992/10,000/0.2 1993/10,000/0.2 1994/10,000/0.2
		Task I.1.2. Provide technical advise to Yukon Flats Refuge staff.	Fairbanks, FAO	1990/10,000/0.2 1991/10,000/0.2 1992/10,000/0.2 1993/10,000/0.2 1994/10,000/0.2
	Objective I.2. To regulate the harvest of refuge fish populations in accordance with agency regulations as a continuing commitment through 1994.	Task I.2.1 Regulate and monitor commercial salmon harvests by district and season.	ADF&G - Commercial Fish Division	Continuing Effort

Goals	Objectives	Tasks	Responsible Office	Date/Funding/FTE
		Task I.2.2. Regulate and monitor sport fish harvests.	ADF&G - Sport Fish Division	Continuing Effort
		Task I.2.3. Regulate and monitor subsistence fisheries harvests.	ADF&G - Commercial & Subsistence Div.	Continuing Effort
		Task I.2.4. Present formal proposals to Alaska Board of Fisheries.	ADF&G	Continuing Effort
		Task I.2.5. Review and comment on proposals to Fish and Game Advisory Board.	Yukon Flats NWR	Continuing Effort
		Task I.2.6. Conduct fishery law enforcement activities.	FWP	Continuing Effort
	Objective I.3 To monitor escapement of refuge salmon stocks as a continuing commitment through 1994.	Task I.3.1. Monitor fall chum salmon escapement in the Chandalar River using side-scan sonar for one complete life cycle (four years) at a minimum and develop an annual escapement goal.	Fairbanks, FAO	1990/50,000/0.8 1991/50,000/0.8 1992/50,000/0.8 1993/50,000/0.8 1994/50,000/0.8

Goals	Objectives	Tasks	Responsible Office	Date/Funding/FTE
		Task I.3.2. Conduct low level aerial surveys during peak spawning periods to develop an accurate expansion factor of aerial/sonar counts for Chandalar River fall chum salmon.	Fairbanks, FAO	1990/5,000/0.1 1991/5,000/0.1 1992/5,000/0.1 1993/5,000/0.1 1994/5,000/0.1
		Task I.3.3. Conduct a side scan sonar operation on the Sheenjek River for purposes of enumerating fall chum salmon escapement.	ADF&G - Commercial Fish Division	Continuing Effort
		Task I.3.4. Conduct low level aerial surveys during peak spawning periods to develop an accurate expansion factor of aerial/sonar counts for Sheeenjek River fall chum salmon.	ADF&G - Commercial Fish Division	Continuing Effort
	Objective I.4 To determine the spawning and rearing areas for coho, chinook, and chum salmon on five refuge tributaries by 1994.	Task I.4.1. Conduct radio telemetry and followup aerial surveys to determine key spawning areas for chinook salmon on the Sheenjek, and Christian rivers, and Beaver and Birch creeks.	Fairbanks, FAO	1990/25,000/0.4 1991/25,000/0.4 1992/15,000/0.3 1993/15,000/0.3 1994/15,000/0.3

Goals	Objectives	Tasks	Responsible Office	Date/Funding/FTE
		Task I.4.2. Conduct radio telemetry and followup aerial surveys to determine key spawning areas for coho salmon in the Black River.	Fairbanks, FAO	1990/15,000/0.2 1991/10,000/0.2 1992/10,000/0.2
		Task I.4.3. Conduct radio telemetry and followup aerial surveys to determine key spawning areas for chum salmon in the Black and Hodzana rivers, and Beaver and Bircn creeks.	Fairbanks, FAO	1990/15,000/0.2 1991/25,000/0.4 1992/25,000/0.4 1993/10,000/0.2 1994/10,000/0.2
		Task I.4.4. Sample likely downstream rearing areas for species abundance of rearing juvenile salmon and collect and analyze tissue sample for electrophoretic stock i.d. in conjunction with Tasks I.4.1, I.4.2., and I.4.3.	Fairbanks, FAO/ USFWS - Research Division	1990/20,000/0.4 1991/20,000/0.4 1992/10,000/0.2 1993/10,000/0.2 1994/10,000/0.2
		Task I.4.5. Determine the extent that beaver dams and log jams interfere with upstream movement of salmon on the Christian River. Actions will be developed to alleviate major barriers.	Fairbanks, FAO/ Yukon Flats NWR	1991/10,000/0.2 1992/20,000/0.4 1993/10,000/0.2 1994/ 5,000/0.3

Goals	Objectives	Tasks	Responsible Office	Date/Funding/FTE
	Objective I.5. Evaluate the impact of off-refuge mining to the fish populations of Beaver, Preacher, and Birch creeks by 1993.	Task I.5.1. Conduct a comprehensive fishery inventory and water quality study on Beaver and Birch creeks. Recommendations will be made upon completion of the project regarding habitat improvement and enforcement efforts to improve refuge fish stocks.	Fairbanks, FAO/ Yukon Flats NWR	1990/40,000/0.6 1991/40,000/0.6 1992/40,000/0.6 1993/20,000/0.6 1994/ 5,000/0.2
	Objective I.6 To complete fish population and habitat studies for three refuge tributaries and three refuge slough systems by 1993.	Task I.6.1 Conduct resident fish population studies on the Dall and Hadweenzic rivers and Preacher Creek.	Fairbanks, FAO ADF&G-Sport Fish	1990/15,000/0.3 1991/15,000/0.3 1992/15,000/0.3 1993/15,000/0.3
		Task I.6.2 Conduct fish population and habitat utilization studies in Crazy, Hodzana, and Beaver sloughs.	Fairbanks, FAO	1990/20,000/0.5 1991/20,000/0.5 1992/20,000/0.5 1993/20,000/0.5
	Objective I.7 To complete fish population studies on three refuge lakes by 1994.	Task I.7.1 Examine age structure and length frequency distribution of exploited fish populations on Vundik, Graphite, and Burman lakes.		1990/20,000/0.5 1991/20,000/0.5 1992/20,000/0.5 1993/20,000/0.5 1994/20,000/0.5

Goals	Objectives	Tasks	Responsible Office	Date/Funding/FTE
Goal II: TO FULFILL INTERNATIONAL TREATY OBLIGATIONS OF THE UNITED STATES WITH RESPECT TO FISH AND THEIR HABITATS.				
	Objective II.1 To provide baseline information on locations and size of spawning stocks of fall chum and chinook salmon by 1993.	Task II.1.1 Conduct annual aerial surveys of salmon spawning grounds on refuge streams to determine relative escapement indices as outlined in Tasks I.3.2, I.3.4, I.4.1, I.4.2, I.4.3, and I.4.5.	ADF&G - Commercial Fish Division/ Fairbanks, FAO	Continuing Effort
Goal III: PROVIDE THE OPPORTUNITY FOR CONTINUED SUBSISTENCE USES OF FISH RESOURCES BY LOCAL RESIDENTS.				
	Objective III.1 To cooperate with ADF&G in monitoring and evaluating subsistence harvest of all fish species within the refuge as a continuing commitment through 1994.	Task III.1.1. Conduct annual surveys of the villages located within refuge boundaries for salmon and resident fish harvested for subsistence purposes.	ADF&G - Commercial and Subsistence Divisions	Continuing Effort

Goals	Objectives	Tasks	Responsible Office	Date/Funding/FTE
	Objective III.2. To determine if sportfishing harvest in the Dall River is adversely impacting the northern pike population by 1994.	Task III.2.1. Conduct a fish population and creel census study for northern pike in the Dall River.	ADF&G - Sport Fish Division	New Effort
Goal IV: ENSURE TO THE MAXIMUM EXTENT POSSIBLE THAT THE WATER QUALITY AND THE WATER QUANTITY WITHIN THE REFUGE IS MAINTAINED.				
	Objective IV.1. To collect and analyze baseline water quality and quantity data for refuge streams affected by upstream mining commitment through 1994.	Task IV.1.1. Collect water quality and quantity data from established monitoring stations on Beaver, Birch, and Preacher creeks and Chandalar River.	Yukon Flats NWR	Continuing Effort

SECTION IX. PRIORITY OF TASKS (USFWS)

The priority of tasks identified by the refuge and to be conducted by the Service are listed below. Administrative tasks are considered to be highest priority for each year.

PRIORITY	TASK	FUNDING	CUMULATIVE TOTAL	RESPONSIBLE OFFICE
		FY 1990		
1. (I.1.1)	Fishery program administration	10,000	10,000	YFNWR
2. (I.1.2)	Provide technical advise to refuge	10,000	20,000	FAO
3. (I.3.1)	Chandalar River sonar	50,000	70,000	FAO
4. (I.3.2)	Chandalar River aerial survey	5,000	75,000	FAO
5. (I.5.1)	Beaver and Birch creek inventory	40,000	115,000	FAO
6. (I.4.1)	Chinook telemetry surveys	25,000	140,000	FAO
7. (I.4.3)	Fall chum telemetry surveys	15,000	155,000	FAO
8. (I.4.4)	Juvenile salmon rearing areas	20,000	175,000	FAO
9. (I.6.1)	Resident fish tributary studies	15,000	190,000	FAO
10. (I.7.1)	Lake population studies	20,000	210,000	FAO
11. (I.6.2)	Slough population studies	20,000	230,000	FAO
12. (I.4.2)	Black River coho telemetry study	15,000	245,000	FAO
		FY 1991		
1. (I.1.1)	Fishery program administration	10,000	10,000	YFNWR
2. (I.1.2)	Provide technical advise to refuge	10,000	20,000	FAO
3. (I.3.1)	Chandalar River sonar	50,000	70,000	FAO
4. (I.3.2)	Chandalar River aerial survey	5,000	75,000	FAO
5. (I.5.1)	Beaver and Birch creek inventory	40,000	115,000	FAO
6. (I.4.1)	Chinook telemetry surveys	25,000	140,000	FAO
7. (I.4.3)	Fall chum telemetry surveys	25,000	165,000	FAO
8. (I.4.4)	Juvenile salmon rearing areas	20,000	185,000	FAO
9. (I.6.1)	Resident fish tributary studies	15,000	200,000	FAO
10. (I.7.1)	Lake population studies	20,000	220,000	FAO
11. (I.6.2)	Slough population studies	20,000	240,000	FAO
12. (I.4.2)	Black River coho telemetry study	10,000	250,000	FAO
13. (I.4.5)	Christian River salmon barriers	10,000	260,000	FAO

PRIORITY	TASK	FUNDING	CUMULATIVE TOTAL	RESPONSIBLE OFFICE
		FY 1992		
1. (I.1.1)	Fishery program administration	10,000	10,000	YFNWR
2. (I.1.2)	Provide technical advise to refuge	10,000	20,000	FAO
3. (I.3.1)	Chandalar River sonar	50,000	70,000	FAO
4. (I.3.2)	Chandalar River aerial survey	5,000	75,000	FAO
5. (I.5.1)	Beaver and Birch creek inventory	40,000	115,000	FAO
6. (I.4.1)	Chinook telemetry surveys	15,000	130,000	FAO
7. (I.4.3)	Fall chum telemetry surveys	25,000	155,000	FAO
8. (I.4.4)	Juvenile salmon rearing areas	10,000	165,000	FAO
9. (I.6.1)	Resident fish tributary studies	15,000	180,000	FAO
10. (I.7.1)	Lake population studies	20,000	200,000	FAO
11. (I.6.2)	Slough population studies	20,000	220,000	FAO
12. (I.4.2)	Black River coho telemetry study	10,000	230,000	FAO
13. (I.4.5)	Christian River salmon barriers	20,000	250,000	FAO
		FY 1993		
1. (I.1.1)	Fishery program administration	10,000	10,000	YFNWR
2. (I.1.2)	Provide technical advise to refuge	10,000	20,000	FAO
3. (I.3.1)	Chandalar River sonar	50,000	70,000	FAO
4. (I.3.2)	Chandalar River aerial survey	5,000	75,000	FAO
5. (I.5.1)	Beaver and Birch creek inventory	20,000	95,000	FAO
6. (I.4.1)	Chinook telemetry surveys	10,000	110,000	FAO
7. (I.4.3)	Fall chum telemetry surveys	15,000	120,000	FAO
8. (I.4.4)	Juvenile salmon rearing areas	10,000	130,000	FAO
9. (I.6.1)	Resident fish tributary studies	15,000	145,000	FAO
10. (I.7.1)	Lake population studies	20,000	165,000	FAO
11. (I.6.2)	Slough population studies	20,000	185,000	FAO
12. (I.4.5)	Christian River salmon barriers	10,000	195,000	FAO

PRIORITY	TASK	FUNDING	CUMULATIVE TOTAL	RESPONSIBLE OFFICE
		FY 1994		
1. (I.1.1)	Fishery program administration	10,000	10,000	YFNWR
2. (I.1.2)	Provide technical advise to refuge	10,000	20,000	FAO
3. (I.3.1)	Chandalar River sonar	50,000	70,000	FAO
4. (I.3.2)	Chandalar River aerial survey	5,000	75,000	FAO
5. (I.5.1)	Beaver and Birch creek inventory	5,000	80,000	FAO
6. (I.4.1)	Chinook telemetry surveys	15,000	95,000	FAO
7. (I.4.3)	Fall chum telemetry surveys	10,000	105,000	FAO
8. (I.4.4)	Juvenile salmon rearing areas	10,000	115,000	FAO
9. (I.7.1)	Lake population studies	20,000	135,000	FAO
10. (I.4.5)	Christian River salmon barriers	5,000	140,000	FAO

PRIORITY OF TASKS
ADF&G

PRIORITY	TASK	FY	RESPONSIBLE OFFICE
1.	Regulate commercial, subsistence and sport fisheries harvests including interaction with the Board of Fisheries on regulatory issues.	Continuing Commitment	Comm. Fish Sport Fish
2.	Sheenjek R. fall chum sonar enumeration	Continuing Commitment	Comm. Fish Sport Fish
3.	Subsistence fishery surveys	Continuing Commitment	Comm. Fish Subsist.
4.	Aerial salmon surveys	Continuing Commitment	Comm. Fish

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APPENDIX A
MASTER MEMORANDUM OF UNDERSTANDING
BETWEEN
THE ALASKA DEPARTMENT OF FISH AND GAME
Juneau, Alaska
AND
THE U.S. FISH AND WILDLIFE SERVICE
DEPARTMENT OF INTERIOR
Anchorage, Alaska

This Master Memorandum of Understanding between the State of Alaaska, Department Fish and Game, hereinafter referred to as the Department, and the U.S. Fish and Wildlife Service, hereinafter referred to as the Service, reflects the general policy guidelines within which the two agencies agree to operate.

WHEREAS, the Department, under the Constitution, laws and regulations of the State of Alaska (Appendix I), is responsible for the management, protection, maintenance, enhancement, rehabilitation, and extension of the fish and wildlife resources of the State on a sustained yield principle, subject to preferences among beneficial uses; and

WHEREAS, the Service, by authority of the Constitution, laws of Congress and regulations of the U.S. Department of Interior (Appendix II) has a mandated management responsibility for certain species or classes of wildlife and is responsible for the management of Service lands in Alaska, and the conservation of fish and wildlife resources on these lands; and

WHEREAS, the Department and the Service share a mutual concern for fish and wildlife resources and their habitats and both are engaged in extensive fish and wildlife conservation, management, and protection programs and desire to develop and maintain a cooperative relationship which will be in the best interests of both parties, the concerned fish and wildlife resources and their habitats, and produce the greatest public benefit: and

WHEREAS, it has been recognized in the Alaska National Interest Lands Conservation Act and subsequent implementing Federal regulations that the resources and use of Service lands in Alaska are substantially different than those of other states; and

WHEREAS, the Department and the Service recognize the increasing need to coordinate resource planning and policy development;

NOW, THEREFORE, the parties hereto do hereby agree as follows:

THE DEPARTMENT OF FISH AND GAME AGREES:

1. To recognize the Service as the agency with the responsibility to manage migratory birds, endangered species, and other species mandated by Federal law, and on Service lands in Alaska to conserve fish and wildlife and their habitats and regulate human use.

2. To manage fish and resident wildlife populations in their natural species diversity on Service lands.

3. To consult with the Regional Director in a timely manner and comply with applicable Federal laws and regulations before embarking on enhancement or construction activities on Service lands.

THE FISH AND WILDLIFE SERVICE AGREES:

1. To recognize the Department as the agency with the primary responsibility to manage fish and resident wildlife within the State of Alaska.

2. To recognize the right of the Department to enter onto Service lands at any time to conduct routine management activities which do not involve construction, disturbance to the land, or alterations of ecosystems.

3. To cooperate with the Department in planning for enhancement or development activities on Service lands which require permits, environmental assessments, compatibility assessments, or similar regulatory documents by responding to the Department in a timely manner with requirements, time tables, and any other necessary input.

4. To manage the fish and wildlife habitat on Service lands so as to insure conservation of fish and wildlife populations and their habitats in their natural diversity.

5. To consider carefully the impact of any proposed treaties or international agreements relating to fish and wildlife resources on the State of Alaska which could diminish the jurisdictional authority of the State and to consult freely with the State when these treaties or agreements have a primary impact on the State.

6. To review present U.S. Fish and Wildlife Service policies and any future proposed changes in those policies in consultation with the Department to determine ;if modified or special policies are needed for Alaska.

7. To adopt refuge management plans whose provisions--including provision for animal damage control--are in substantial agreement with the Department's fish and wildlife management plans, unless such plans are determined formally to be incompatible with the purposes for which the respective refuges were established.

8. To utilize the State's regulatory process to maximum extent allowed by Federal law in developing new or modifying existing Federal regulations or proposing changes in existing State regulations governing or affecting the taking of fish and wildlife on Service lands in Alaska.

THE DEPARTMENT OF FISH AND GAME AND THE FISH AND WILDLIFE SERVICE MUTUALLY AGREE:

1. To coordinate planning for management of fish and wildlife resources on Service lands so that conflicts arising from differing legal mandates, objectives, and policies either do not arise or are minimized.

2. To consult with each other when developing policy and legislation which affects the attainment of wildlife resource management goals and objectives, or management plans.

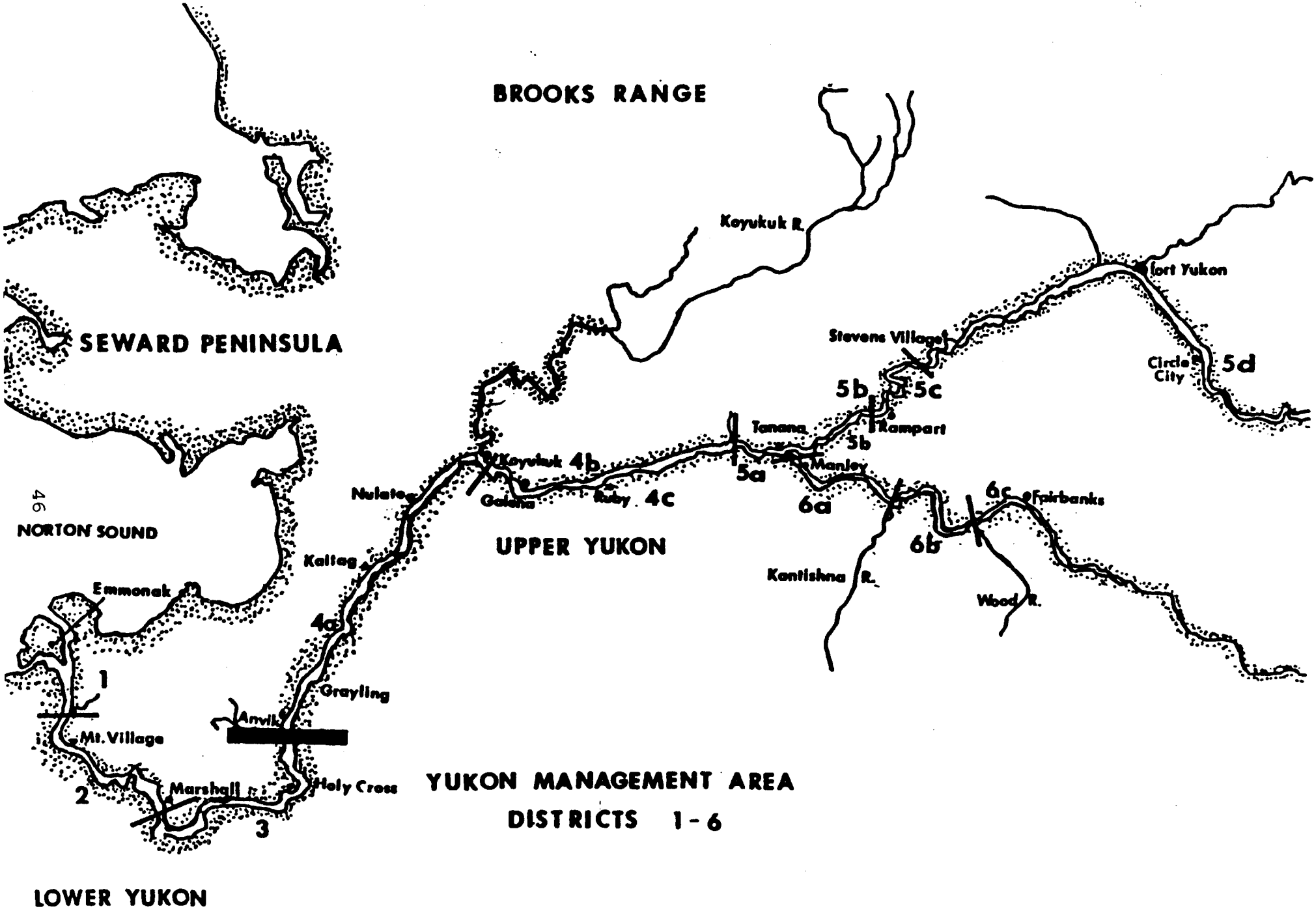
3. To recognize that the taking of fish and wildlife by hunting, trapping, or fishing on Service lands in Alaska is authorized in accordance with applicable State and Federal law unless State regulations are found to be incompatible with documented Refuge goals, objectives, or management plans.

4. To develop such supplemental memoranda of understanding between the Commissioner and the Regional Director as may bes required to implemetn the policies contained herein.

5. That this Master Memorandum of Understanding shall become effective when signed by the Commissioner of the Alaska Department of Fish and Game and the Alaska Regional Director of the U.S. Fish and Wildlife Service and shall continue in force until terminated by either party by providing notice in writing 120 days in advance of the intended date of termination.

6. That amendments to this Master Memorandum of Understanding may be proposed by either party and shall become effective upon approval by both parties.

STATE OF ALASKA	U.S. DEPARTMENT OF THE INTERIOR
Department of Fish and Game	Fish and Wildlife Service
Ronald O. Skoog Commissioner	Keith M. Schreiner Regional Director, Alaska
March 13, 1982 Date	March 13, 1982 Date



Appendix B ADF&G management districts along the Yukon River within Alaska, Source: Whitmore et al 1986.

CONCURRENCE AND APPROVAL

RECOMMEND APPROVAL:

Jack Millard 3-1-90
Project Leader, Date
Fishery Assistance Office

Randy Bailey 4/19/90
Supervisor, Date
Fisheries Management Services

CONCUR:

Louis A. Swenson 3/1/90
Refuge Manager, Date
Yukon Flats National Wildlife Refuge

George M. Carter 4/19/90
Associate Manager, Date
Wildlife and Refuges

PROGRAM APPROVALS:

Rowan W. Gould 4/20/90
Assistant Regional Director, Date
Fish and Wildlife Enhancement

Arthur P. Rogers 4-27-90
Assistant Regional Director, Date
Wildlife and Refuges

APPROVAL:

Walter O. Sleghitz 4/30/90
Regional Director, Region 7 Date