Statement on Fishery Resources

A Supplement to the Special Report
Downstream Effects of Rampart Project on Fish and Wildlife Resources

WITHOUT THE PROJECT

Species present

1. The species of fish that occur in the Yukon River and its tributaries are known in general. Similar qualitative information is also available for some of the lakes within the proposed reservoir area as a result of limited reconnaissance work conducted in July 1962. Virtually the only quantitative data available on the Yukon fish resources, however, relate to the abundance and timing of chinook and chum salmon runs past the damsite and to catches of the subsistence and commercial fisheries.

2. The following fish species were found in waters within the proposed reservoir area. This list appears in the Fish and Wildlife report on the project[1/].

Large whitefish spp.
Least cisco
Chum salmon
Coho salmon
Chinook salmon
Round whitefish
Inconnu
Arctic grayling
Northern pike
Lake chub
Longnose sucker
Burbot
Trout-perch
Sculpin

3. Although similar information is not available for waters of the Yukon basin downstream from the Rampart damsite, all of the species listed above probably occur in that area also. In addition, the lower Yukon basin is known

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1/ U.S. Fish and Wildlife Service
1964. Rampart Canyon Dam and Reservoir Project, Yukon River, Alaska. A Report on fish and wildlife resources, Juneau, Alaska (processed) p. 34.

to sustain populations of Dolly Varden, ninespine stickleback, Alaska blackfish, lampreys, smelt, and sockeye and pink salmon. Most of these species occur in the mainstem river and many have also been found in the tributary streams and in lakes lying on the floodplain.

Fish habitat

4. The earlier Service report on the effects of the Rampart project listed four general types of fish habitat occurring within the Rampart impoundment area[1/]: (1) the mainstem Yukon River; (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. All of these habitat types also occur downstream from the damsite, although the floodplain of the Yukon is much narrower there and the number of lakes and ponds per mile of river valley is therefore much smaller. It appears that downstream effects of Rampart project on fish habitat would operate primarily on habitat present in: (1) the mainstem Yukon and (2) the sloughs, backwaters, lakes and ponds that are connected periodically to the Yukon at times of high water. The following paragraphs describe these two habitat types.

Mainstem Yukon River

5. The mainstem Yukon River appears to be a highly unstable, formidable habitat during the open-water period. Water velocities range up to 10 feet per second, and much turbulence is present. The water is extremely turbid, primarily from glacial silt and from bank and streambed erosion.

6. Although primary production by planktonic plants is believed to be virtually lacking in the mainstem Yukon River owing to high turbidity, much organic matter is nonetheless present in its waters. Traps fished for young salmon in the vicinity of the Hodzana River within the impoundment area rapidly became clogged by vegetative debris borne by the swift current. This material is most abundant in the river during the high water that follows breakup, and it declines in abundance as the summer progresses. The necessity of frequent cleaning of the inclined plane fish traps indicates the abundance of this material; early in the season the traps had to be cleaned about every 10 minutes to avoid overflow and subsequent sinking. Later in the season a trap could be fished several hours without cleaning. The most obvious component of the drift is plant root material which may not be directly used as food by the fish species present. Insect parts, larval cases and some living insect larvae however are also present. Live Diptera larva have been noted in particular.

1/ U.S. Fish and Wildlife Service
op cit p. 26.

7. Small fish of several species are abundant in the main river within the impoundment area, at least during summer. Aside from chum and chinook salmon fry the inclined plane traps took many small whitefish and lesser numbers of burbot and lamprey.

8. These observations indicate that even though primary production may not occur in the turbid mainstem Yukon River, the natural streamflow nonetheless carries an abundance of material usable as fish food. Most of this material probably is produced in the tributary streams and in ponds and backwaters periodically connected with the main river. Small fish are also produced both in the tributaries and in the ponds and backwaters wherever suitable spawning and incubation areas occur.

9. Although fish food is present in the mainstem Yukon, utilization of it by fish would appear difficult. It seems unlikely that sight feeders, including grayling, pike and inconnu, would be able to feed effectively on small fish and drifting insects owing to the high turbidity of the mainstem river. It would also appear that fish which locate their food by the senses of touch and smell would have difficulty taking food here because of the swift, turbulent streamflow. Although feeding would appear to be impeded in these waters, several observations have been made of fish feeding actively in areas of reduced turbidity off the mouths of major tributaries and in the standing, partially cleared waters of sloughs and lakes that connect with the main river.

10. The extent of fish spawning that occurs in the mainstem Yukon River is unknown. Because of the stream's heavy silt load and its scouring action, the importance of the mainstem Yukon River as a spawning area is considered to be minor. Most of the salmon spawn in tributaries to the Yukon, primarily, it has been conjectured, in gravels permeated by spring flow[1/]. There is, however, a report of whitefish spawning on a gravel shoal in the main stream near the village of Rampart[2/].

11. Fish wheels, gillnets and willow fence traps are fished in the mainstem Yukon River. Probably the greater portion of the fishing effort is for salmon, but some effort is directed at species other than salmon, particularly during winter. No quantitative data are available concerning subsistence catches of fish other than salmon from the mainstem Yukon River downstream from the Rampart damsite.

1/ U.S. Fish and Wildlife Service
op cit p. 43

2/ U.S. Fish and Wildlife Service
op cit p. 28

12. It appears likely that the primary value of the Yukon River itself to fish is as a migration route and as a reservoir for stocks to repopulate adjacent waters depleted through winter-kill or other factors.

Periodically connected waters

13. Many of the sloughs, backwaters, lakes and ponds that are connected with the Yukon River during periods of high water are believed to be relatively productive of fish food. Bottom materials are primarily silt and organic matter sedimented from the river water. Without current, much of the silt load is rapidly deposited and turbidity is therefore much reduced, although some of the finer materials may remain in suspension for long periods. Midsummer temperatures range well up into the high 60's F. and in some cases exceed 70° F. Emergent plants are generally present in shallows of such waters, and primary production by plankton is probably fairly high. The rich, warm, partially cleared waters sustain an abundance of insect life and other organisms used as food by fish. It appears that the primary value of this habitat to fish is as nursery area for small fish that enter from the Yukon or which are produced from local spawning.

14. Substrate and water conditions suitable for salmon spawning are believed to be virtually absent in the periodically connected waters. Several species of fish other than salmon do spawn in this habitat, however. Indication of this is provided by an observation in mid-October, 1962 of fingerlings moving into the Yukon River from semi-permanent lakes in the proposed reservoir area. These small fish included two species of whitefish, burbot and northern pike. They were present in such numbers that local people were able to scoop them up for use as food[1/].

15. Although some fish are locally produced and some must enter from the mainstem Yukon, their fate within the periodically connected waters is uncertain. Some of these waters dry up as the seasons progress; others become so shallow that fish populations may be decimated by winter kill. On the other hand, if conditions for survival prevail throughout the year, small fish may grow rapidly owing to the abundance of food. No quantitative data are available on the significance of entrapment versus the value of these waters as nursery area.

16. Whether subsistence fishing occurs on a particular backwater or lake is largely determined by its proximity to a native village. Some waters of this habitat type located near villages receive winter fishing pressure. Others,

1/ Letter from Jay Eisenhart, resident of Beaver, Alaska, to Calvin J. Lensink dated October 19, 1962.

distant from centers of human population, may not be fished at all even though they possess abundant fish populations. Quantitative data concerning subsistence fishing in these waters are lacking.

Bering Sea waters off the Yukon Delta

17. Yukon River waters undoubtedly influence the marine environment off the delta. The delta is constantly growing through deposition of silt carried down by the river, and the adjacent ocean bottom is probably fairly productive. The near-shore waters are shallow, for the 10 meter (39.4 foot) depth contour lies about fifteen miles offshore[1/]. The bottom is well-leveled and appears to represent submerged alluvial Yukon lowland. The surface current pattern between the Yukon Delta and St. Lawrence Island shows a northward flow during summer[2/]. Whether this condition prevails close inshore is not known. Waters over the continental shelf in this part of the Bering Sea have relatively low salinities, a feature which may influence which species occur here.

18. In the northern shelf area of the Bering Sea, which includes the waters off the Yukon Delta, Pacific cod, Alaska pollock, flounders and rockfishes are not abundant, although benthic food organisms are abundant in these regions, and summer hydrographic regimes are favorable for bottom-dwelling fish. It has been postulated that such fish apparently do not enter these regions because of the protracted and severe winter[2/]. It is considered significant that the massive fishing effort of the Japanese and Russians has not extended as far east as these waters, although this could be primarily a result of logistic problems, including the difficulties associated with the pack ice.

WITH THE PROJECT

Hydrological effects

19. Major hydrological effects of the Rampart project downstream from the dam would include the following: (a) nearly complete regulation of flows at the damsite; (b) withholding in the reservoir of ice that normally is borne downstream by the river flow at breakup; (c) greatly lessened turbidity of the tailrace flows of the open water period compared to the natural streamflow; and (d) radically altered temperature regime owing to thermal stratification of the reservoir and withdrawal of water at depth for power generation.

1/ Academy of Sciences of the USSR
1959. Geographical Description of the Bering Sea - Bottom Relief and Sediments. Translated from Russian by the Israel Program for Scientific Translations, Jerusalem 1964.

2/ Alverson, D. L., A. T. Pruter, and L. L. Ronholt
1964. A Study of Demersal Fishes and Fisheries of the Northeastern Pacific Ocean. University of British Columbia, Vancouver, B.C.

20. Reduced turbidity during the open water period would persist as a marked change only as far as the confluence with the turbid Tanana River 36 miles downstream from the dam, although a transitional zone would extend some distance beyond the Tanana. Temperature alterations would be most evident in Unit 1, but might persist an unknown distance into Unit 2. Although the distance necessary for Yukon waters to reach equilibrium would vary seasonally, it appears probable that virtually all trace of the tailwater temperature influence would be dissipated at Kaltag about 200 miles downstream from the dam. Therefore, primary effects of altered turbidity and temperature regime would occur in Unit 1. These changes would be progressively less evident with increasing distance downstream. The remaining two factors, streamflow regulation and withholding of river ice, would reduce flooding of the two types recognized by the Corps of Engineers: (a) that caused by ice jams, and (b) that caused by high water from spring snowmelt.

Fish habitat

21. Of the fish habitat types listed previously, the greatest impact resulting from the project would occur on the mainstem Yukon River and upon sloughs, backwaters, lakes and ponds that are periodically connected with the Yukon River during high water. Tributary streams entering the Yukon downstream from the damsite would be little affected by the changes resulting from the project. Also, lakes and ponds located on the floodplain that do not lie within the reach of Yukon River flooding would be unaffected. Therefore, evaluation of the downstream effects of the project on fish resources requires consideration of the changes that would be produced in the habitat afforded by the mainstem Yukon River and by the periodically connected sloughs and backwaters.

Mainstem Yukon River

a. Rampart Dam to confluence with Tanana River (Unit 1)

22. In Unit 1, the habitat of the mainstem Yukon would be radically altered by tailrace flows. Storage afforded by the project would regulate flows within the range of 70,000 to 150,000 c.f.s. throughout the year. Temperatures here would depend on which outlets in the dam were used for power production; any outlet deeper than 100 feet (elevation 560) would discharge water of fairly constant temperature (from about 40° to 44° F.) throughout the year. The outlets at elevation 600 (60 feet below the normal operating pool level) would discharge water as warm as 46° F. during August and about 36° F. from about December through early June. Thus, discharge from even the shallowest outlets (elevation 600 feet) would significantly lower water temperatures in Unit 1 during summer. Winter temperatures under the ice in the mainstem Yukon now range very little above 32° F. Under conditions of project operation, and using the elevation 600 outlets, tailrace waters

would range between 36 °F. and 39 °F. during winter. This water would, however, lose heat rapidly, form surface ice, and decline nearly to freezing temperature. Tailrace waters would be relatively clear owing to sedimentation in the reservoir.

23. Feeding conditions in Unit 1 would change. Drifting fish food, including insects and small fish now carried past the damsite by the swift current of the Yukon, would be withheld in the reservoir. Primary production by planktonic plants would occur in the reservoir, however, and populations of animal plankton, notably small crustaceans, would develop. Numbers of these organisms would be carried through the turbines and would replace in part the fish food material deposited in the reservoir.

24. The standing crop of plankton in Great Slave Lake is regarded as indicative of plankton production that could be expected at Rampart. The average dry weight of plankton secured in the main body of Great Slave using a standard fine mesh plankton net over a period of seven years was about 20 pounds per acre (21.8 kilograms per hectare)[1/]. This standing crop was termed "light" in relation to that of a series of other natural lakes.

25. The abundance of plankton in Rampart reservoir would fluctuate seasonally. If its cycle paralleled that observed in many northern lakes, there would be two summer periods of high production. In Great Slave Lake, the highest pulse in plankton production occurs about mid-July, followed by an early August low. A second peak occurs late in the summer, but does not reach the level of the first peak. Most of the plankton in Rampart reservoir could be expected to occur in the surface strata down to approximately 80 feet in depth. The depth at which water was drawn for power production would determine in part the amount of plankton released in the tailrace, the deeper outlets releasing lesser amounts. It appears unlikely that planktonic organisms produced in the reservoir and released in the tailrace would compensate fully for the abundant fish food now borne along by the mainstem Yukon River. Conditions for effective feeding downstream from the dam, however, would be greatly improved, owing to the clarity of the tailrace waters.

26. Conditions in Unit 1 with the project might be suitable for the spawning of some species of fish. Whether fish occur in the Yukon capable of utilizing

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1/ Rawson, D. C.
1956. The Net Plankton of Great Slave Lake.
Journal of the Fisheries Research Board of Canada 13 (1) p. 73.

this area with its relatively cold summer water temperatures, generally poor bottom materials, and fairly deep water is not known.

27. It is anticipated that good sportfishing would develop in Unit 1, owing to the improved water clarity here. Chinook salmon would be available if measures and facilities recommended for their conservation were provided. Sport harvest of this species, however, might not be desirable in the light of the concerted effort that would be required to save the runs with the project. The lake trout population of the reservoir would also contribute fish to this section, and other desirable species such as rainbow trout and walleye might become established here through natural and artificial means.

b. Downstream from Tanana River (Units 2 to 6)

28. The major impact of the turbid Tanana River waters on the mainstem Yukon River would occur during summer. Regarding without the project conditions, both streams would be turbid during the open water portion of the year; under conditions of project operation, however, tailrace waters from the Rampart Dam would be clear while waters of the Tanana River would remain turbid. The relationship during summer of clear tailrace water to turbid Tanana River waters would be roughly as follows:

	Mean discharge in c.f.s.				
	May	June	July	August	September
Yukon River (Tailrace)(1)	100,000	95,000	98,000	102,000	106,000
Tanana River(2)	67,300	111,700	105,900	97,900	65,500
Ratio, Tanana: Yukon	1:1.5	1:0.9	1:0.9	1:1.0	1:1.6

(1) Provided by U.S. Army Corps of Engineers' Office, Anchorage, Alaska
(2) Derived from U.S. Geological Survey records for Nenana gaging site; discharge data were expanded on an area basis to include the lower drainage.

29. It therefore appears that, with the project, the mainstem Yukon River downstream from the Tanana would be moderately turbid with respect to conditions without the project. In winter, both streams would be clear, as is now the case. The significant effect during winter, however, would be the high flows resulting from project regulation. Winter flows with the

project would range from about 107,000 c.f.s. to 136,000 c.f.s. This compares to the range of flows without the project of 19,000 c.f.s. to 66,000 c.f.s. Primary effects of Rampart project on the section of mainstem Yukon River downstream from Tanana would therefore be (a) moderation of high summer turbidity, (b) substantial augmentation of winter flows, and (c) great reduction in flood peaks of spring and early summer. With increasing distance downstream from the damsite and with downstream increment flows, these effects would be progressively less obvious and conditions would more nearly approach those without the project.

30. Fish food in this part of the Yukon River would include the plankton discharged in the tailrace waters plus organic materials and insect larvae contributed by the Tanana River. It would appear that fish food abundance would probably be somewhat reduced over natural conditions but conditions for feeding would be somewhat improved owing to reduced turbidity.

31. Conditions for fish spawning in this section of the mainstem Yukon River would probably not improve significantly. The silt load of the river, while reduced, would still be substantial and would in no way approximate the very light silt load carried by typical tributaries wherein spawning does occur.

32. The migration route afforded by the Yukon River in this section for fish movement might be slightly altered by the project. Observations elsewhere have shown that migration is more rapid in clear waters than in turbid waters. This effect would be most marked in Unit 1. Such effects would probably be minor, particularly when these possible alterations are viewed in relation to the total obstruction that the dam would produce.

33. Personal use and commercial fishing in the mainstem river might be somewhat simplified by project operation in that flooding would be alleviated and fishing gear might require somewhat less attention. Also, substantial reduction of turbidity would reduce the effectiveness of fish wheels in this section of the river.

Periodically connected waters

34. The major impact upon the sloughs, backwaters, lakes and ponds that are connected with the Yukon River during high water periods of the year would result from regulation of flows. Turbidity might be altered in such waters that receive substantial influx of water from the mainstem Yukon, and reduced quantities of silt in flood waters would result in lowered rates of sedimentation and filling. For some of the waters influenced by Yukon River flooding

however, the impact is not one of influx of Yukon River waters. Rather, it is an impounding of normal runoff flow through the lake or backwater, resulting in elevated water levels. The area of influence of Yukon River flooding would be reduced by the project because the high peaks in spring and early summer discharge would be greatly damped. High water at this time of year would nonetheless occur, and the influence of project regulation would be progressively less obvious with increasing distance downstream from the dam.

35. Although the area of influence of Yukon River flooding would be reduced, the smaller area of flooding would possess more stable water levels throughout the year owing to regulation of the Yukon River flow. Winter would no longer be a time of extremely low flow in the mainstem river. Under natural conditions, low winter flows in the Yukon result in the drying up and freezing out of many periodically connected bodies of waters. Also, these low winter flows can result in reduced water levels that promote oxygen depletion and winter-kill in some of these waters.

36. The influence of stabilized water levels in periodically connected sloughs, backwaters, ponds, and lakes is difficult to evaluate. Some invertebrate organisms must have a dry period in order to complete their life cycle. On the other hand, a great many invertebrates are destroyed under natural conditions, by dewatering, freezing and lack of oxygen. Based only on speculation it would seem that stabilized water levels in the periodically connected waters would produce some favorable effects on the aquatic life, including small fish, that reside here. Whether these favorable effects would compensate for the loss resulting from the reduced area of Yukon River flooding cannot be forecast. The most significant facet of any alteration in habitat afforded by periodically connected waters would be its impact on any nursery area used by young salmon. Even though the importance of these nursery areas in the life cycle of the Yukon River salmon has not been evaluated, it appears that any effect on the salmon would be of greater significance than effects on fish other than salmon. This conclusion is based on the fact that non-salmon stocks are now virtually unutilized. Further, because these stocks are so broadly dispersed and would be fairly uneconomic to harvest intensively, it seems likely that their utilization would be expected to continue at only a very low level for many years.

37. Fish spawning in waters that lie within the area of Yukon River flooding would not be significantly changed. Some spawning habitat of non-salmonid fish in these waters would be lost as a result of the reduction in the area of Yukon River flooding.

38. The amount of fishing effort applied to the periodically connected waters would not be expected to change significantly. A slight reduction in turbidity might possibly occur in these waters and this could lead to improved sportfishing. This effect would not be significant except in the very few such waters near villages where fishing effort now occurs or will develop in the future.

Bering Sea waters off the Yukon Delta

39. Very little information is available on the biology of near-shore waters off the Yukon Delta. Some effects would probably be produced by the project on the marine habitats here, although forecasting such effects or even determining whether they would be significant is not possible based on available knowledge. The Corps of Engineers has forecast that the effects of the project on flooding downstream from Kaltag (Units 3 to 6) would be modest. They also predict that silt deposition at the river mouth would be reduced by 20 percent. This would slow the growth of the Yukon Delta somewhat, but its biological impact cannot now be evaluated.

DISCUSSIONS AND CONCLUSIONS

40. Because of the lack of biological information concerning the role of affected habitats in the life cycles of fish species involved, very few conclusions regarding downstream effects on fish resources can be made at this time. The influence of the project on the major downstream habitat types can, however, be forecast in general terms. Certain of the effects of the project would be compensated in some degree by other effects, i.e. - although the area affected by Yukon River flooding would be reduced, the high winter flows in the Yukon would tend to stabilize and perhaps improve some of the periodically connected adjacent waters that would lie within the reduced area of flooding. Therefore, without specific studies of such problems, conclusions of a quantitative nature are infeasible.

41. It appears that the two areas of major impact would be (1) the 36-mile section between the damsite and the mouth of the Tanana River (Unit 1) and (2) the possible loss in nursery habitat afforded by periodically connected sloughs, backwaters, ponds and lakes downstream. In the case of Unit 1, improved water clarity would probably result in development of a sportfishery here, and might produce some spawning habitat. The changes in the periodically connected waters are difficult to evaluate, but in general, concern has been expressed that the reduced scope of Yukon River flooding would decrease the available nursery area for salmon and other species. Whether this concern is justified cannot be determined without additional study.

42. In summary, it appears likely that downstream effects of Rampart project on fish resources would be insignificant in comparison with its overall impact in obstructing anadromous fish runs and inundating thousands of lakes and ponds and many miles of stream.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
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BOX 6123
ANCHORAGE, ALASKA 99502

November 9, 1965

Mr. Robert A. Rausch
Leader, Big Game Project
Alaska Department of Fish and Game
604 Barnette Street, Room 116
Fairbanks, Alaska

Dear Bob:

I am enclosing a copy of the Rampart Canyon report and am requesting Bob McVey to forward you a copy of "A Special Report on Downstream Effects of Rampart Project on Fish and Wildlife Resources, Yukon River, Alaska" dated October 1965.

Sincerely,

Donald B. Thurston

Donald B. Thurston
Acting Fish & Wildlife Administrator

Encl: as cited

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

BOX 2481
JUNEAU, ALASKA

March 2, 1966

Mr. Robert A. Rausch
Alaska Department of Fish and Game
604 Barnett, Rm. 116
Fairbanks, Alaska 99701

Dear Bob:

Enclosed for your files are copies of the following releases:

A Special Report, Fish, Wildlife and Recreational Potentials of the Rampart Project Reservoir, October 1965,

A Special Report, Downstream Effects of Rampart Project on Fish and Wildlife Resources, October 1965,

A Supplement to the Special Report, Downstream Effects of Rampart Project on Fish and Wildlife Resources, December 1965.

These reports were prepared for use by a review committee in response to a request from our Washington office, and we did not print a sufficient supply for general distribution, so please guard these carefully.

Sincerely yours,

Dale

Dale R. Evans
Acting Regional Fish and Wildlife
Administrator