

Provisional Evaluation of the Status of Westslope Cutthroat Trout in Canada

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ABSTRACT

I surveyed existing publications, reports, historical documents, and selected agency files, conducted field surveys, and interviewed reliable observers knowledgeable about selected waters to determine the native and present distribution of westslope cutthroat trout (*Oncorhynchus clarki lewisi*) in Canada. I evaluated this information in the light of existing knowledge of potential threats to arrive at provisional determinations of risk status. In British Columbia, westslope cutthroats once occupied: the mainstem of the upper Kootenay River and its major tributaries below impassable barriers; certain Columbia River headwaters; and some small, disjunct headwaters, mostly above barrier falls in the lower Kootenay, Columbia, and South Thompson drainages. Most of the apparently genetically pure native stocks still extant in several upper Kootenay tributaries are vulnerable to hybridization with, or replacement by, accessible nonnative salmonids now widespread in that drainage. The population and genetic status of most British Columbia stocks, including many introduced populations, remains undocumented. In Alberta, westslope cutthroats once occupied the mainstems of the Bow and Oldman rivers and their major tributaries below impassable barriers, downstream far into the plains. Except in the upper Oldman and Castle river basins, native stocks are now rare in Alberta, existing only in short reaches of a few isolated headwaters. Genetically pure native stocks are endangered due to their limited and highly fragmented distribution, continued exposure to introgressive hybridization, probable competition from introduced salmonids, continued habitat damage and loss, inadequate legislation and enforcement, and continued exposure to overfishing of some small populations. Already-introgressed stocks are more common, but are threatened for the same reasons. The numerous introduced populations are vulnerable. All but a few are small, isolated, originate from a single stock, and may lack the genetic resources to adapt to future environmental change. Population and genetic surveys are urgently required throughout the Canadian range.

Key words: Alberta, Columbia River, Kootenay River, *Oncorhynchus clarki lewisi*, westslope cutthroat trout.

The present wave of human-induced extinction of plants and animals, comparable in magnitude to the great natural extinctions in the fossil record (Reid and Miller 1989) has not spared the fishes of North America (Ono et al. 1983). Three genera, 27 species, and 13 subspecies have gone extinct in the last century on this continent (Miller et al. 1989). As of 1990, 292 fish species, or 28% of the North American fauna in fresh water, were in various categories of risk: indeterminate, rare, vulnerable, endangered, or extinct (Williams and Miller 1990). A total of 364 North American freshwater fishes are deemed to warrant protection because of their rarity (Williams et al. 1989). Presently in Canada, 57 species, subspecies, and special populations of freshwater fishes are officially recognized as either in some category of risk or have

already been declared extinct (Campbell 1997).

These statistics touch only on the surface of the problem. Many North American fishes at risk are not yet officially recognized as such. The westslope cutthroat trout (*Oncorhynchus clarki lewisi*) is an example (Behnke 1992, American Wildlands et al. 1998). This subspecies—native to southeastern British Columbia, southwestern Alberta, western Montana, northern Idaho, and small parts of Wyoming, Oregon, and Washington—has only recently been proposed for listing under the United States Endangered Species Act. According to extensive evidence cited by the petitioners (American Wildlands et al. 1998), westslope cutthroats occupy just 19% of their native range, are represented by viable populations in 8% of the native range, and are abundant in just 2% of that range in Montana. In Idaho, viable populations remain in 36% of the native range, and are strong in just 11% of that range. Native populations on the periphery

of the native distribution in Wyoming, Oregon, and Washington have been similarly devastated. Most U.S. stocks have hybridized introgressively with other black-spotted trouts, especially rainbow trout (*O. mykiss*) and Yellowstone cutthroat trout (*O. c. bouvieri*).

As yet there has been no comprehensive assessment of the status of this fish in Canada. Recently, cutthroat trout were recognized as being at high risk with regard to forestry considerations in British Columbia, and research on the species was recommended as a high priority (Haas 1998). The westslope subspecies is not included on the Red or Blue lists in British Columbia (Cannings and Ptolemy 1998) or Alberta, and is not presently being considered for listing in Canada (Campbell 1997). I assessed the status of westslope cutthroat trout in parts of Alberta and British Columbia (Mayhood 1995, Mayhood et al. 1997a, 1998), but these analyses considered only parts of the range, or considered the whole range at a scale too coarse to support a reasonable overall assessment of conservation status. This paper summarizes the status of westslope cutthroat trout within its native range in this country. The assessment is provisional until up-to-date population surveys, and surveys of the true extent of hybridization using reliable biochemical genetic techniques, are completed throughout the Canadian range.

METHODS

I reviewed and surveyed existing information in historical documents, technical publications and reports, agency files, and, in some cases, interviewed people with reliable first-hand knowledge of certain local waters. Principal sources of information have been listed elsewhere (Mayhood 1995, Mayhood et al. 1997a, 1998). The survey was substantially more complete in Alberta than in British Columbia. This material was supplemented with my own direct field observations of westslope cutthroats during my work in the Alberta portion of the native range from 1972 to the present. The number of data sources reviewed is too large to provide a comprehensive analysis in this paper, and only a brief overview is supplied here.

STOCK CHANGES AND PRESENT STATUS

ALBERTA

Native Stocks

Westslope cutthroat trout originally occupied the Bow and Oldman river drainages and accessible tributaries (i.e., below waterfalls and other impassable barriers), and may have extended downstream into the upper Milk River drainage of Alberta from the Montana headwaters (Prince et al. 1912, Behnke 1992). More specifically, in the Bow drainage westslope cutthroats originally were found from the extreme headwaters above Bow Lake in Banff National Park, down-

stream to the plains well below the city of Calgary, and from the headwaters to the mouths of its major tributaries: the Spray, Cascade, Kananaskis, Ghost, Elbow, and Highwood rivers, and Jumpingpound Creek (Prince et al. 1912, Mayhood 1995). In the Oldman drainage the subspecies was native from the falls in the headwaters below Cache Creek, downstream far out onto the plains, and from the headwaters to the mouths of the major Oldman tributaries: the Livingstone, Crowsnest, Castle, and Belly rivers, and Willow Creek. Cutthroats were excluded from almost all high mountain lakes, most of which were formed in hanging valleys and cirques by waterfalls and steep torrential reaches on the glacially steepened sides of the main valleys. Accordingly, the westslope cutthroat as a native trout in Alberta was primarily a fish of mainstem rivers and their accessible tributaries, which were mostly at low elevations. There are numerous historical records indicating that these trout were abundant throughout most of the native range in Alberta.

Present Status of Native Stocks

Westslope cutthroat now occupy considerably less than 5% of the native range in the Bow drainage, being restricted to the extreme headwaters of a few of the major tributaries and the upper mainstem (Mayhood 1995). More specifically, westslope cutthroat trout are now absent from the Bow mainstem below Lake Louise; from all but the headwaters of the Spray River; from all but the extreme headwaters of the Cascade River; from the Kananaskis River mainstem and all but 3 of its small tributaries; from all but the upper reaches and small upper tributaries of the Ghost River; from the Elbow River and all but the upper parts of 5 tributaries above the Forest Reserve boundary (1 population is known to be in decline; J. Stelfox, Alberta Fish and Wildlife, pers. comm.); from the Highwood River below the Forest Reserve boundary and from all but short, highly isolated reaches of a few tributaries; and from Jumpingpound Creek below the Forest Reserve boundary. Most remaining Bow drainage populations within the native range are tiny and isolated.

In the Oldman River drainage westslope cutthroats still occupy most of the native range in the upper Oldman basin, but have been lost from native waters in the mainstem east of the mountain front and most of its fish-accessible tributaries (Radford 1977a, Fitch 1977–80, Mayhood et al. 1997a). Most remaining populations within the native range in the upper Oldman, Livingstone, and Castle river basins appear to be reasonably large. Cutthroat trout are uncommon to rare in the St. Mary and Belly drainages (including the Waterton drainage), and have been extirpated from their native waters in the Crowsnest drainage (Fitch 1977–80, Mayhood et al. 1997a).

Several dozen stream populations in the Bow and Oldman systems have been examined; all but 2 show evidence of introgressive hybridization with introduced black-spotted

trouts (based mainly on examination of colouration and spotting patterns in colour photographs collected during routine fish surveys; Radford 1977a, Fitch 1977–80, McAllister et al. 1981, Mayhood unpubl. data). Several lake populations tested by appropriate biochemical techniques have been shown to be genetically pure (McAllister et al. 1981, Carl and Stelfox 1989), but there is reason to believe that most of these represent stocks transplanted to the lakes from local stream populations (Mayhood 1995), some of which have since been extirpated. Even if so, founder and selective effects are likely, and the present populations may no longer accurately represent the original local native stream stocks.

Introduced Stocks

Westslope cutthroats have been widely transplanted outside the native range within Alberta, including the Torrens River (Peace drainage; Nelson and Paetz 1992), some Athabasca drainage lakes and headwater streams (Ward 1974, Nelson and Paetz 1992, Barton et al. 1993), and the North Saskatchewan and Red Deer drainages (Nelson and Paetz 1992). Both genetically pure stocks and those of uncertain origin have been introduced, sometimes with other species, into formerly fishless habitat above barrier falls in several streams in the Oldman and Bow river systems. Although transplanted stocks are widespread, most individual populations appear to be small and localized. An exception is that of the Ram River (North Saskatchewan) drainage, where westslope cutthroats are widespread and abundant.

The Alberta government has transplanted westslope cutthroat trout into about 36 small, formerly fishless, high mountain lakes in the North Saskatchewan, Red Deer, Bow, and Oldman river basins. The ultimate source of nearly all of these stocks was a single population in the Spray Lakes, which no longer exists as a result of flooding from a hydroelectric reservoir constructed in the early 1950s. This stock was first introduced into Marvel Lake (Rawson 1947) and thence into Job Lake (Carl and Stelfox 1989). The latter is now the source of all westslope cutthroat trout used in Alberta's stocking programs.

BRITISH COLUMBIA

Native Stocks

In British Columbia, the known contiguous native range of westslope cutthroat trout is the upper Kootenay River (Behnke 1992). The subspecies may also have been native in the Kicking Horse River drainage above Wapta Falls (Columbia basin), gaining access there by headwater transfer from the upper Kootenay over a low, swampy divide (M. Pole, Parks Canada, 1991, pers. comm.; Mayhood 1995), and in a few small headwater tributaries of the Columbia near Windermere and Columbia lakes (Prince 1912). There were also several small, disjunct, native populations in the South Thompson (Fraser River basin), Columbia mainstem (near

Revelstoke), and Kootenay Lake basins in south-central British Columbia, mostly above barrier falls (Dymond 1932, Behnke 1992). Historical records indicate that trout, presumably of this species, were abundant throughout the contiguous native range, as were at least some of the disjunct populations (e.g., Lees and Clutterbuck 1888, Dymond 1932).

Present Status of Native Stocks

Most of the presumptive native range in the Kicking Horse drainage above Wapta Falls in Yoho National Park now lacks cutthroats (M. Pole, Parks Canada, 1991, pers. comm., Mayhood 1995). Cutthroats (mainly hybrids with introduced black-spotted trouts) still occupy all native range within the Kootenay drainage of Kootenay National Park (Alger and Donald 1984), and within the White River watershed, a large upper Kootenay tributary (Leary et al. 1987). Nevertheless, several genetically-pure westslope cutthroat trout populations are known to exist in small headwater streams within the native range in the upper Kootenay drainage in British Columbia (Leary et al. 1987). The status of most other British Columbia stocks remains undocumented, including that of most disjunct populations.

Introduced Stocks

Westslope cutthroats have been transplanted outside the native range within British Columbia, including the Pine and Narraway watersheds (Peace drainage; Nelson and Paetz 1992, Department of Fisheries and Oceans n.d.). Stocks of uncertain origin have been introduced, sometimes with other species, into formerly fishless habitat above barrier falls in several streams in the Kootenay and Columbia systems (Mayhood 1995). I presently do not have information on the status of these stocks.

THREATS

HABITAT LOSS/DAMAGE

Habitat damage and loss in the Alberta range of westslope cutthroat trout began concurrently with extensive European settlement, made possible by the arrival of the Canadian Pacific Railway in the mid-1880s. By 1890 there were reports of fish-kills from sawdust pollution in the Bow River (McIlrie and White-Fraser 1983), and by 1910, concerns were voiced about the effect of dams and irrigation diversions on native trout stocks (Prince et al. 1912).

Many dams now exist within the Alberta native range of westslope cutthroat trout. These are known or suspected to be both directly and indirectly implicated in major losses of native cutthroat stocks from the Kananaskis, Spray, Cascade, Elbow, Ghost, Bow River mainstem, Belly (including the Waterton), and St. Mary rivers. A new dam on the Oldman River probably precludes restoration of native stocks within its zone of influence (Mayhood 1991). Within the British

Columbia native range, westslope cutthroats now form a negligible part of the angling catch in Lake Kookanusa (Parnell 1997), the hydroelectric reservoir formed on the Kootenay mainstem by the Libby dam in Montana. There are other smaller dams within the British Columbia native range, but I do not know their effects on westslope cutthroats.

Other major habitat problems faced by westslope cutthroat trout within the native range in Canada include: habitat damage attributable to forestry operations (British Columbia and Alberta); intensive oil and gas exploration and development (Alberta); grazing (especially in Alberta); heavy off-road vehicle use (local in British Columbia and Alberta); local urbanization (especially in Calgary, the Banff-Canmore corridor, and the Crowsnest Pass); coal mining (Crowsnest Pass and Elk River valley); and a dense network of roads throughout the range (except in the most remote parts of Banff, Yoho, Kootenay, and Waterton Lakes national parks). Cumulative impact assessments of 98 watersheds of fourth order or higher on Alberta's Eastern Slopes in the upper Oldman, Crowsnest, and Carbondale (Castle drainage) basins found that more than two-thirds are at moderate risk, and all but 3 of the remainder are at high risk, of damage from the combined effects of increased peak flows and surface erosion (sediment loading) caused by extensive clearcutting and road development (Mayhood et al. 1997b, Sawyer and Mayhood 1998). The extent of the existing habitat damage and the threat of continued habitat damage are both strongly affected by negligible enforcement of existing protective legislation (see below). The structure-based habitat restoration attempted so far has been generally unsuccessful, except as a short-term measure (Pattenden et al. 1998). Approaches employing improvements in land-use practices show more promise, but have not been used extensively so far (Adams and Fitch 1995).

OVERFISHING

Overfishing in the Alberta range of westslope cutthroat trout, like habitat damage, began concurrently with extensive European settlement, made possible by the arrival of the Canadian Pacific Railway in the mid-1880s. Obvious overfishing by means of wasteful fishing methods encompassed almost every conceivable means of capture, including netting, trapping, liming, shooting, blasting, and angling (Whiteher 1887, McIlrrie and White-Fraser 1983 [regarding 1890], Prince et al. 1912). Wagonloads of trout were reportedly removed from the Castle drainage every spring by some individuals as recently as the 1920s and 1930s. It is very likely that such heavy exploitation rates contributed to rapid declines in native stocks.

Generous catch limits were introduced, then were gradually reduced over the years, but remained high for many decades in Alberta (e.g., Radford 1977b). These have been replaced more recently by extensive catch-and-release or

large minimum-size limits (which often have an effect identical to catch and release) throughout the present westslope cutthroat range in both Alberta and British Columbia (Alberta Environmental Protection 1998, B.C. Ministry of Environment, Lands and Parks 1997). Current exploitation rates, therefore, are not likely to be a serious threat to strong remaining westslope cutthroat stocks. There are, however, many tiny remnant populations in isolated tributaries that might be adversely affected even by the low exploitation rates permitted by the new regulations.

DISEASE/PREDATION/COMPETITION

Whirling disease is perhaps the most serious potential disease problem for wild stocks. The disease has not yet been found in Alberta (Alberta Environmental Protection 1998:20), but remains a threat to salmonid stocks throughout North America. I have no information on disease problems in British Columbia.

Introduced species of salmonids, primarily rainbow, brook (*Salvelinus fontinalis*), and (in Alberta only) brown trout (*Salmo trutta*), presently occupy most of the native range of westslope cutthroat trout where the cutthroats are now absent (Mayhood 1995, Mayhood et al. 1997a). The mechanism of replacement is debatable, but could include elements of differential susceptibility to angling and habitat change, competition, predation, and (in the case of rainbow trout) hybridization. This replacement process is ongoing and can be observed today, for example, in Alberta Fish and Wildlife fish survey data for the Ghost River drainage (1978 vs. 1995–96, replacement by brook trout; R. Sloan, Mount Royal College, pers. comm.) and for Quirk Creek (1978 vs. 1997–98, replacement by brook trout; J. Stelfox, Alberta Fish and Wildlife, pers. comm.).

INADEQUATE PROTECTIVE LEGISLATION

Canada lacks federal legislation to protect endangered species. Previously proposed legislation lacked any provisions to protect habitat of endangered species except on federal lands (mainly national parks and native reserves), which incorporate only a small part of the westslope cutthroat trout range in Canada. Future promised legislation is unlikely to improve much on this situation owing to strong resistance from the provinces of Alberta and British Columbia, among others. Alberta also lacks endangered species legislation, and is generally hostile to the concept. British Columbia can protect endangered vertebrates under its Wildlife Act and Fish Protection Act; however, its own Ministry of Environment, Lands and Parks concluded that the British Columbia government would find it difficult to argue against an "F" grade for its actual performance (Jones 1997).

The federal Fisheries Act does not provide for special protection for endangered fishes, but its habitat protection provisions, if enforced, might be strong enough to be used to

protect the habitat of fish species considered to be at risk. Unfortunately, Canada does not enforce these provisions of the Act, especially in inland waters such as those frequented by westslope cutthroat trout. The most recent parliamentary report on the government's enforcement of these parts of the Act show that the Department of Fisheries' Central and Northern Region, which includes the most severely-damaged and at-risk habitat within the westslope cutthroat's native Canadian range, has launched only 2 prosecutions in the past 3 years, and none at all in the past 2 years (Department of Fisheries and Oceans 1998). There is a complaint now before the Council on Environmental Cooperation (CEC) set up in connection with the North American Free Trade Agreement, alleging that Canada refuses to enforce the Fisheries Act. The complainants, represented by Sierra Legal Defence Fund and its U.S. equivalent, document in meticulous detail 39 separate instances of nonenforcement of clear, unquestionable, serious violations of the habitat provisions of the Fisheries Act in British Columbia alone. The CEC has decided in favour of the complainants, and is now preparing a review of Fisheries Act nonenforcement in Canada (Council on Environmental Cooperation 1998).

HYBRIDIZATION/TRANSLOCATION

Several nonnative black-spotted trouts (genus *Oncorhynchus*) have been widely and repeatedly introduced over many years throughout the native range of westslope cutthroat trout in Canada (Scott and Crossman 1973, Ward 1974, Nelson and Paetz 1992). Rainbow trout were especially widely stocked, but Yellowstone cutthroats were often used in the national parks, and golden trout have been stocked in a few isolated headwater lakes in Yoho and Banff parks and along Alberta's Eastern Slopes. Few biochemical genetic studies have been conducted, and those few have concentrated on assessing the genetic identity of stocks suspected to be pure (McAllister et al. 1981; Leary et al. 1985, 1987; Carl and Stelfox 1989). As noted under "Present Status" above, obvious hybrids are almost ubiquitous among the remaining stream stocks in the Oldman and Bow river basins in Alberta, and are widespread in the Kootenay watershed in British Columbia. Introduced rainbows continue to be common in the lower Bow, lower Oldman, and their lower tributaries, and are widespread in the Kootenay and Kicking Horse drainages. Yellowstone cutthroats still exist within the westslope cutthroat range in the national parks. For many years, hybrids of rainbow and local cutthroat trout were deliberately produced at the Cranbrook hatchery (Dymond 1932, Carl et al. 1959). In nearly all of the above drainages, westslope cutthroat stocks are accessible to the introduced fish. Introgressive hybridization thus continues to be a serious threat to the genetic integrity of the remaining stocks of westslope cutthroats in Canada.

The single stock used for transplanting in Alberta, the Spray-Marvel-Job Lake stock, is genetically homogeneous (McAllister et al. 1981, Carl and Stelfox 1989). The source of most westslope cutthroat trout for stocking in British Columbia is the Connor Lake population, a pure-strain but genetically uniform stock (McAllister et al. 1981, Leary et al. 1987). In many instances these stocks have been transplanted into drainages upstream of possible remnant native westslope cutthroat stocks, where they pose an introgression threat to those stocks.

PROVISIONAL CONSERVATION STATUS

Native westslope cutthroats were once widespread and abundant in the Bow, Oldman, Kootenay, and possibly the Kicking Horse drainages in Canada. Disjunct populations were native in several other small drainages of south-central British Columbia, mostly above waterfall barriers. Presently in Alberta the subspecies exists mainly as highly fragmented, isolated headwater populations (especially in the Bow basin), many of these derived from a single introduced, genetically uniform stock. Strong, but apparently hybridized, populations are common in the upper Oldman and Castle basins. Westslope cutthroats are rare in, or extirpated from, the lower Bow and many major tributaries, the lower Oldman, the St. Mary, Belly-Waterton, and Crowsnest basins. Introgressive hybridization appears to be widespread, if not almost ubiquitous among Alberta populations within the native range. In British Columbia, genetically pure native stream populations are known in a few small headwater streams of the Kootenay drainage, but apparent and confirmed introgressively hybridized stocks are widespread. The subspecies is now rare in the Kicking Horse watershed. The status of the native disjunct populations in British Columbia is not known. Canadian stocks continue to be under serious pressure from ongoing habitat damage, competitive/predative replacement from introduced species, inadequate legislation, lack of enforcement of what protective legislation does exist, and introgressive hybridization from introduced black-spotted trouts. Unless these factors are reversed, westslope cutthroat trout will continue to trend toward extinction in Canada, and should be classified as a threatened subspecies in this country. In particular, the only known genetically pure native stocks in their native habitats are rare, isolated, and subject to all of the threats cited above. These populations are in imminent danger of extinction, and should be classified as endangered in Canada. These provisional status designations should be re-evaluated when extensive, reliable population and biochemical genetic surveys have been completed throughout the Canadian range of the subspecies.

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Appendix

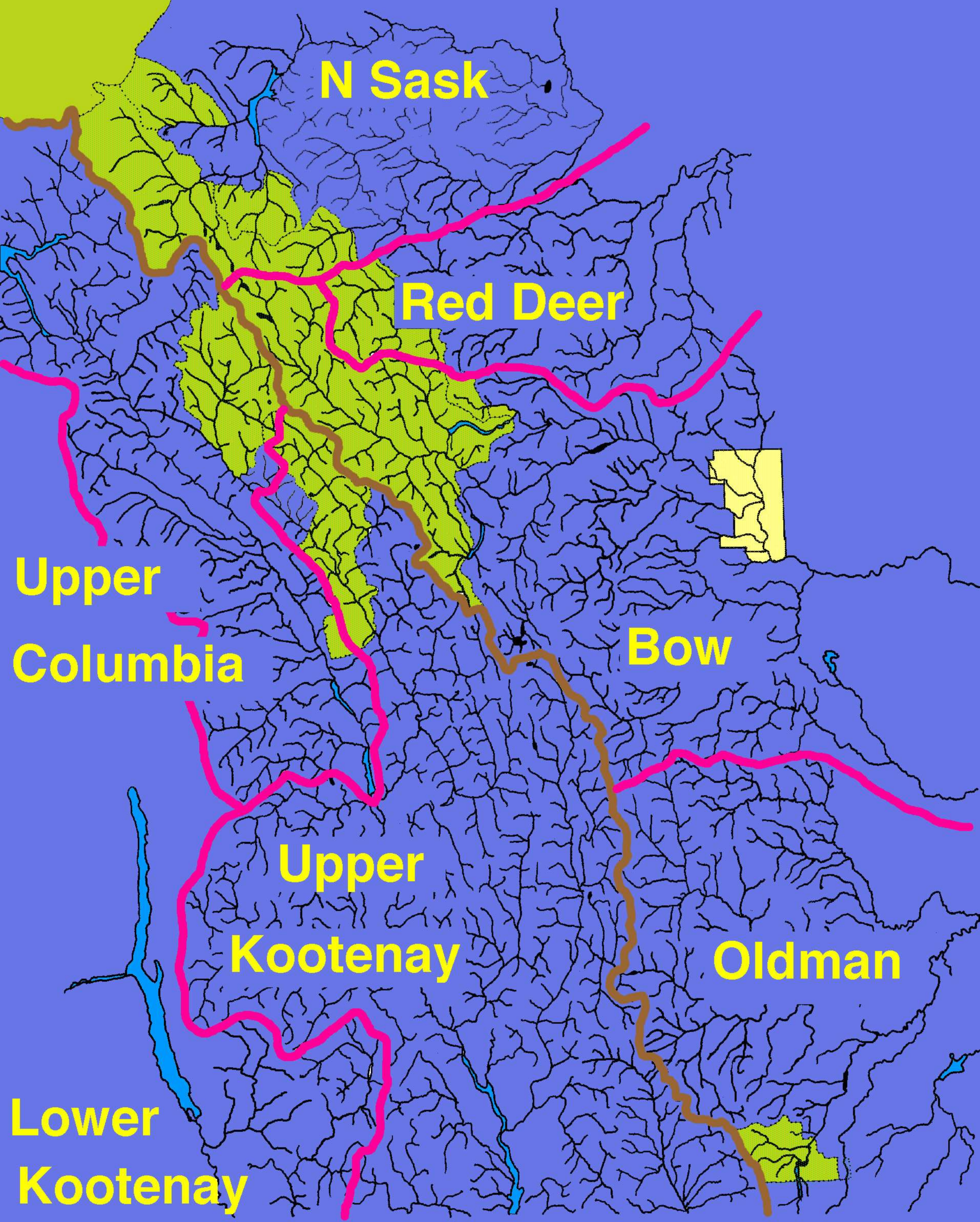
Maps of historical and present westslope cutthroat trout distribution in southern Canada presented with this paper by the author at the Conference on the Biology and Management of Species and Habitats at Risk, Kamloops, B.C., 15 - 19 Feb., 1999. These maps are included here because they were not published with the paper in the Proceedings. On all copies, the brown line is the Continental Divide, green represents national parks and wilderness areas, and yellow indicates the location of Calgary, the major city in the region..

Figure 1. The study area, showing major drainage basins and hydrography.

Figure 2. Historical distribution of westslope cutthroat trout in Canada as it would have been sometime prior to 1900, before widespread stocking and habitat destruction.

Figure 3. Present distribution (circa 1999) of cutthroat trout of all subspecies and genetic lines, whether native or introduced. Non-native stocks introduced on top of native stocks within the native range are not shown, although such instances are common.

Figure 4. Present distribution (circa 1999) of all cutthroat known stocks as above, but distinguishing those populations that are known or suspected hybrids with other black-spotted western trouts (*Oncorhynchus* spp.). Evidence for classifying populations as hybrid included published or unpublished molecular and biochemical genetic data, irregular spotting and colouration patterns in the field or in photographs by the author and others, and the sympatric existence in any water of cutthroats and introduced rainbow or non-native cutthroat trout over a long period.



N Sask

Red Deer

**Upper
Columbia**

Bow

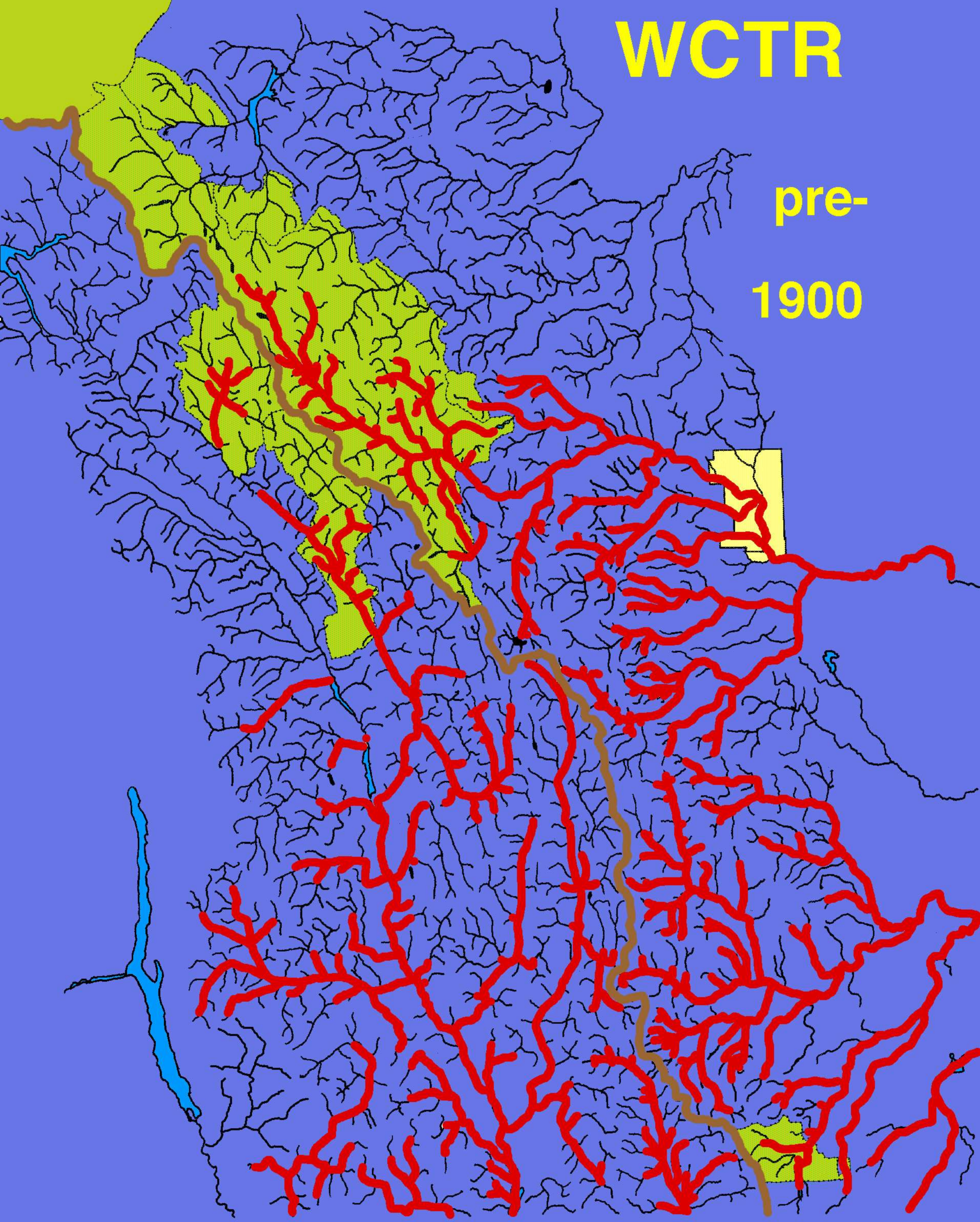
**Upper
Kootenay**

Oldman

**Lower
Kootenay**

WCTR

pre-
1900

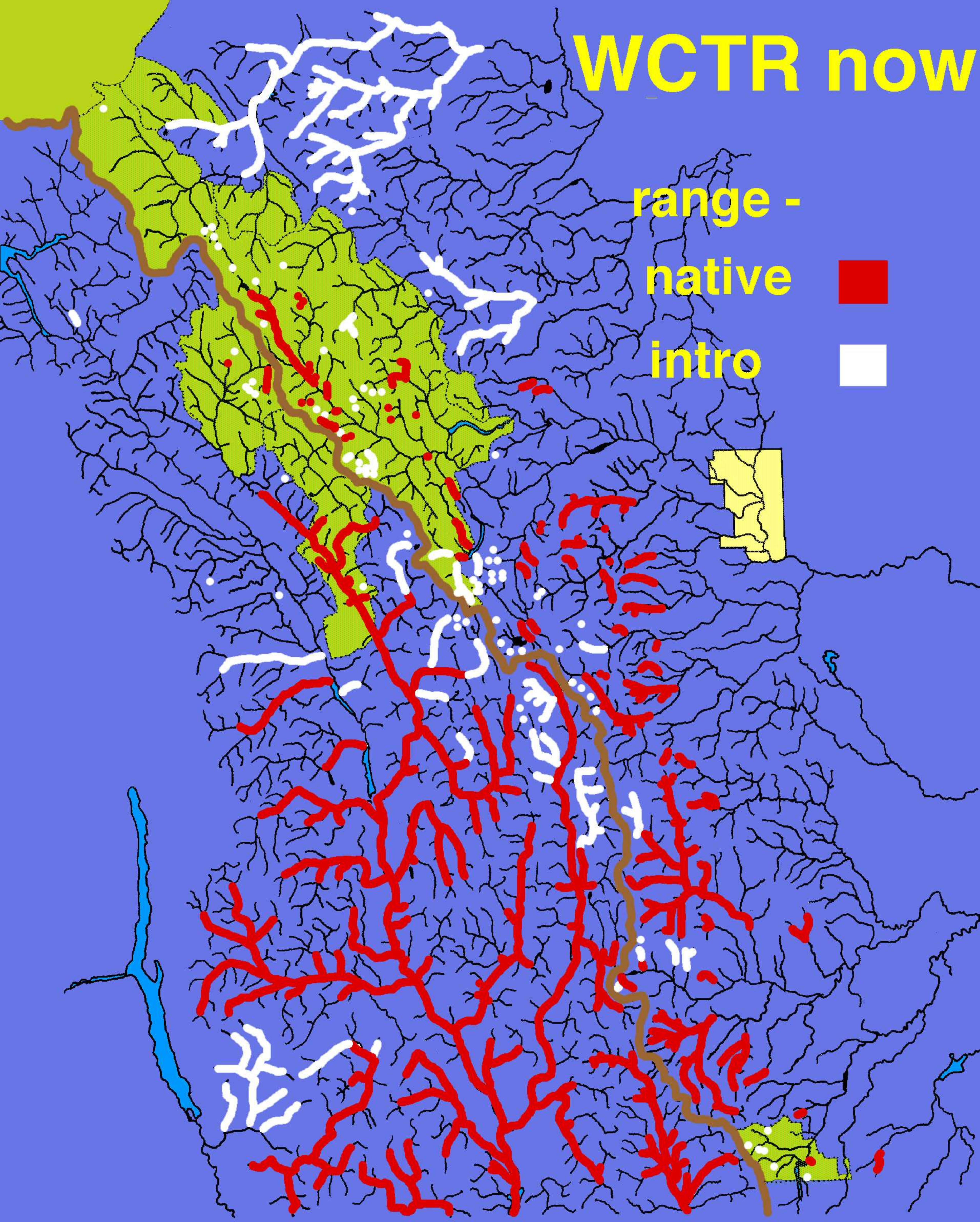


WCTR now

range -

native

intro



WCTR

native? ■

hybrid? ■

intro ■

