COSEWIC
Assessment and Status Report

on the

Umatilla Dace
Rhinichthys umatilla

in Canada

THREATENED
2010

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Previous report(s):

Hughes, G.M. and Peden, A.E. 1988. COSEWIC status report on the Umatilla Dace, *Rhinichthys umatilla* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-13 pp.

Production note:
COSEWIC acknowledges Susan Pollard for writing the updated status report on the Umatilla Dace, *Rhinichthys umatilla*, prepared under contract with Environment Canada. The contractor's involvement with the writing of the status report ended with the acceptance of the provisional report. Any modifications to the status report during the subsequent preparation of the 6-month interim and 2-month interim status reports were overseen by Eric Taylor, Freshwater Fishes Specialist Subcommittee Co-chair.

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Umatilla Dace — collected from the Similkameen River in 2006 (photo provided by G. Hanke, Royal BC Museum).

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COSEWIC
Assessment Summary

Assessment Summary – April 2010

Common name
Umatilla Dace

Scientific name
Rhinichthys umatilla

Status
Threatened

Reason for designation
This small freshwater fish has a limited distribution in Canada encompassing habitats that have been extensively modified by widespread hydroelectric developments (change from riverine to reservoir habitats, altered flow regimes). It is likely that habitat will continue to be lost and degraded owing to hydroelectric operations, climate change, and increased water extraction. This species is also susceptible to aquatic invasive species that are widespread in the Columbia-Kootenay Rivers' portion of the species' range. Proposed additional hydroelectric and water storage development in the Similkameen River drainage is a potential major threat to habitat quality.

Occurrence
British Columbia

Status history
Designated Special Concern in April 1988. Status re-examined and designated Threatened in April 2010.

COSEWIC
Executive Summary

Umatilla Dace
Rhinichthys umatilla

Wildlife species information

The Umatilla Dace is a freshwater fish from the family Cyprinidae (“minnows”). Although its origin and evolutionary relations are incompletely known, the Umatilla Dace is recognized as a valid species and thought to have originated via historical hybridization between Speckled Dace and Leopard Dace. This conclusion is based on the intermediate appearance and ecology of Umatilla Dace relative to the two parent species, as well as preliminary molecular genetic evidence. It is a small minnow (< 100 mm fork length) with a body that is deepest near the dorsal fin and tapering towards the head and tail. The adult is usually heavily marked with dark and irregular markings on the sides and back. The species is of great scientific interest given its proposed hybrid origin.

Distribution

The Umatilla Dace is endemic to the Columbia River basin, specifically the upper and middle mainstem sections and associated large tributaries. In Canada, its known distribution is restricted to British Columbia within the Columbia River mainstem below Arrow Lakes, Kootenay River downstream of Bonnington Falls, the lower Slocan River, the Similkameen River downstream of Wolfe Creek, and the very lowest section of the Kettle River downstream of Cascade Falls.

The Columbia, Similkameen and Kettle rivers are all trans-boundary rivers between the US and Canada. Movement by fishes both upstream and downstream of the international border probably occurs although the extent of movement is unknown. Historical collections (i.e., > 20 years ago) were also obtained from the Pend d’Oreille River and Otter Creek (a tributary to the Tulameen River in the upper Similkameen River watershed). While the Otter Creek population is probably extirpated, the current status of Pend d’Oreille River population is unknown.

Habitat

The Umatilla Dace is a benthic, riverine species that, as an adult, appears to prefer silt-free sections of large- to medium-sized rivers with cobble and boulder substrates where the fish shelter during the day. Juveniles may be found among smaller substrates along stream margins. There is little detailed information regarding specific habitat requirements for the species, but recent studies indicate that selected habitats vary diurnally, seasonally, and with life history stage.

Biology

Spawning occurs in late spring to early summer. Maturity is thought to be attained in the second year for males and by the third year for females. Fecundity is positively related to body size with a maximum fecundity of about 2,000 eggs. Longevity is unknown, but a female 5+ years has been reported. Diet studies suggest the Umatilla Dace is an opportunistic forager, feeding on periphyton, detritus and insects. The extent of movement is unknown, but probably similar to other dace species, juveniles tend to get displaced downstream due to limited swimming capabilities while maturing fish may move up river.

Population sizes and trends

To date, sampling efforts for Umatilla Dace have provided no indication of abundance or population size. Qualitative assessments suggest that Umatilla Dace remain present where they were historically reported, except for Otter Creek where they are extirpated and the Pend d'Oreille River where their continued presence is uncertain. The largest numbers of fish have been reported in the Columbia River mainstem, but the Umatilla Dace appears to be less abundant in the Similkameen River.

Threats and limiting factors

The Columbia River basin has a long history of hydroelectric and water storage development resulting in numerous dams and reservoirs. Such large-scale habitat alteration has undoubtedly affected the distribution of riverine specialists like Umatilla Dace. Ongoing maintenance and expansion of these facilities are the greatest threats to persistence for Umatilla Dace, particularly in the Columbia and Kootenay River where hydrological regimes may be altered daily, weekly and seasonally, sometimes resulting in major scouring or de-watering events. In the Similkameen River, the greatest ongoing threat is water diversion associated with irrigation and community use. A potential major impact, should it get approved, is the development of an additional dam on the Similkameen River mainstem south of the international border. One development option will flood most of the habitat for the Umatilla Dace in the lower Similkameen River in British Columbia. Other threats throughout the range of the species include climate change (warmer and drier conditions) and impacts on habitat associated with forestry, mining and agriculture, as well as invasive aquatic species.

Existing protection, status, and ranks

The Umatilla Dace is included on Schedule 3 of the *Species at Risk Act* as a species of Special Concern. It was re-examined and designated Special Concern by COSEWIC in April 2010. Although this status does not afford any legal protection, the federal *Fisheries Act* contains provisions that can be applied to regulate flow needs for fish, fish passage, the pollution of fish-bearing waters, and harm to fish habitat. The BC Conservation Data Centre ranks this species as S2 and it is provincially red-listed (i.e., threatened or endangered). Globally it is ranked as G4.

TECHNICAL SUMMARY

Rhinichthys umatilla
Umatilla Dace naseux d'Umatilla
Range of occurrence in Canada: British Columbia (Columbia River Basin)

Demographic Information

Generation time (usually average age of parents in the population; indicate if another method of estimating generation time indicated in the IUCN guidelines(2008) is being used)	~3 yrs
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?	Unknown, although two populations have likely been extirpated since 1992.
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations]	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations].	Unknown, although two populations have likely been extirpated since 1992.
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations].	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future.	Unknown, although two populations have likely been extirpated since 1992.
Are the causes of the decline clearly reversible and understood and ceased?	Yes, but not clearly reversible
Are there extreme fluctuations in number of mature individuals?	Unknown

Extent and Occupancy Information

Estimated extent of occurrence	12,425 km²
Index of area of occupancy (IAO) (Always report 2x2 grid value; other values may also be listed if they are clearly indicated (e.g., 1x1 grid, biological AO)).	AO: 27.3 km² 1 x 1: 342 km² 2 x 2: 608 km²

Is the total population severely fragmented? Many hydroelectric dams "fragment" the total population, but there is no severe fragmentation as defined by the IUCN	No
Number of "locations*"- Assuming the greatest threat is alteration of hydrological regime related to hydro-electric developments and extraction 1. Similkameen River 2. Kettle River 3. Columbia River downstream of Hugh Keenleyside Dam and lower Kootenay River downstream of Brilliant Dam 4. Brilliant Dam Reservoir 5. Slocan Dam Reservoir 6. Slocan River Note: • Otter Creek excluded, assumed extirpated • Pend D'Oreille River upstream of Seven Mile and Waneta dams excluded, assumed extirpated (only one fish was ever sampled there and the habitat has been altered from large river to a reservoir)	6
Is there an [observed, inferred, or projected] continuing decline in extent of occurrence? Probable extirpation of two populations at the eastern and western extremes of the range.	No (decline in recent past)
Is there an [observed, inferred, or projected] continuing decline in index of area of occupancy? Probable extirpation of two populations at the eastern and western extremes of the range.	No (decline in recent past)
Is there an [observed, inferred, or projected] continuing decline in number of populations? Probable extirpation of two populations at the eastern and western extremes of the range.	No (decline in recent past)
Is there an [observed, inferred, or projected] continuing decline in number of locations? Probable extirpation of two populations at the eastern and western extremes of the range.	No (decline in recent past)
Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat? Based on probable loss of two populations (Otter Creek and Pend d'Oreille) and substantial hydroelectric developments and operations, water extraction, and projected increasing drought conditions.	Yes
Are there extreme fluctuations in number of populations?	No
Are there extreme fluctuations in number of locations*?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

* See definition of location in O&P Manual.

Number of Mature Individuals (in each population)

Population	N Mature Individuals
Number of populations: Population structure is unknown, but there may be a minimum of six populations	Unknown
Total	Unknown

Quantitative Analysis

Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years].	Not available

Threats (actual or imminent, to populations or habitats)

Actual

- alteration of hydrology (i.e., flow delivery) associated with major hydro-electric facilities (all rivers except Kettle) – actual and ongoing in the Columbia/Kootenay rivers,
- water diversion for agriculture and community use (Similkameen River, Kettle River) – actual, expected to increase in some areas associated with climate change and population growth
- invasive species interactions – ongoing though magnitude not known, expected to increase. Columbia River has the highest number and proportion of invasive species among BC freshwater aquatic ecoregions

Potential

- water quality declines associated with mining contamination, agriculture, forestry
- proposed impoundment developments in US portions of the Similkameen River that will impact habitat in Canada

Rescue Effect (immigration from outside Canada)

Status of outside population(s)? USA: S2 (WA), SNR (OR, ID)	
Is immigration known or possible?	No (but suspected)
Would immigrants be adapted to survive in Canada?	Probably
Is there sufficient habitat for immigrants in Canada?	Yes
Is rescue from outside populations likely? • Similkameen River – yes, potential sources are limited to 30 km downstream of Canadian populations • Kettle River – unknown, but likely • Columbia River – unknown, but likely • Pend d'Oreille River – unknown, but unlikely Status of US populations is for these transboundary systems is listed as "Vulnerable" by American Fisheries Society.	Probably

Current Status

COSEWIC: Threatened (April 2010) *SARA*, Special Concern, Schedule 3

Recommended Status and Reasons for Designation

Recommended Status: Threatened	**Alpha-numeric code:** B1ab(iii)+2ab(iii)

Reasons for designation:
This small freshwater fish has a limited distribution in Canada encompassing habitats that have been extensively modified by widespread hydroelectric developments (change from riverine to reservoir habitats, altered flow regimes). It is likely that habitat will continue to be lost and degraded owing to hydroelectric operations, climate change, and increased water extraction. This species is also susceptible to aquatic invasive species that are widespread in the Columbia-Kootenay Rivers' portion of the species' range. Proposed additional hydroelectric and water storage development in the Similkameen River drainage is a potential major threat to habitat quality.

Applicability of Criteria

Criterion A:
Not applicable. No quantitative data on trends in population sizes.

Criterion B:
Meets Threatened B1ab(iii)+2ab(iii). EO is < 20,000 km², IAO is < 2000 km², the species exists at < 10 locations (6), and habitat area or quality is projected to decline owing to increased drought from climate change and increased pressures from water extraction, hydroelectric operations, urbanization, and agriculture in the Similkameen River and from invasive species in other parts of the range.

Criterion C:
Not applicable. No estimates of past or present population sizes available.

Criterion D:
Not applicable. Population sizes unknown and distribution exceeds criterion.

Criterion E:
Not available.

PREFACE

The Umatilla Dace is small-bodied member of the Cyprinidae with a restricted distribution in Canada in British Columbia's lower Columbia River drainage. The species was last assessed as Special Concern in 1988 and placed on Schedule 3 of *SARA* in 2004. The report that follows is the first assessment under revised criteria that are required to be applied to all species assessed by COSEWIC before 1999. Since the last (and first) assessment, there have been two principal research and inventory initiatives relative to status of the Umatilla Dace. The first was the completion of a PhD thesis in 1991 by G.R. Hass of the University of British Columbia that explored the systematics, biogeography, and ecology of the Umatilla Dace. In particular, this thesis explored these issues relative to two closely related species, the Speckled Dace (*Rhinichthys osculus*) and the Leopard Dace (*R. falcatus*), and presented evidence consistent with the idea that the Umatilla Dace evolved as a result of repeated and independent episodes of hybridization between the Speckled Dace and the Leopard Dace, but that it is now a self-sustaining biological species—a phenomenon of considerable scientific interest. The second major initiative has been increased efforts towards inventory and understanding the species' biology and habitat requirements, particularly with respect to flow regimes. These efforts have been especially notable because about 50% of the geographic range of the Umatilla Dace in Canada is contained within areas that have seen massive habitat alteration (conversion of large riverine habitats to slow moving or reservoir habitats) associated with the long history of hydroelectric and water storage impoundments in the Canada's Columbia River basin. In addition, the original assessment (1988) reported a total of fewer than 40 fish collected in Canada. Subsequently, however, much larger numbers of adults (and other life stages) have been reported by several researchers and fisheries consultants in the Columbia and Similkameen rivers. Furthermore, one population (Otter Creek) appears to have been extirpated by the mid-1990s as several sampling attempts since this time have not been successful in collecting any additional specimens. Both of these research foci have contributed to a more informed assessment in the report that follows.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS
(2010)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

Environment Canada / Environnement Canada
Canadian Wildlife Service / Service canadien de la faune

Canada

The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

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2010

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WILDLIFE SPECIES INFORMATION

Name and classification

Phylum: Chordata
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: *Rhinichthys*
Species: *Rhinichthys umatilla* (Gilbert and Evermann, 1895)

Common Name:
English: Umatilla Dace
French: *naseux d'Umatilla*

The Umatilla Dace (*Rhinichthys umatilla),* is a small freshwater fish from the family Cyprinidae (minnows and carps). Gilbert and Evermann (1895) first described this species from specimens taken in the Columbia River at Umatilla, Oregon (Carl *et al*. 1959; Hughes and Peden 1989; Cannings and Ptolemy 1998).

The taxonomy of the Umatilla Dace has been contentious. Gilbert and Evermann (1895) originally described the Umatilla Dace, but also noted that it was morphologically intermediate between the Speckled Dace (*R. osculus*) and the Leopard Dace (*R. falcatus*) and suggested that it might be a hybrid between these two species (McPhail 2007). Since that original description, the status of the Umatilla Dace has ranged from full species (Schultz 1936), to a subspecies of the Speckled Dace (Bond 1973), to being ignored (Wydoski and Whitney 1979). Recent opinions suggest that the Umatilla Dace is a valid biological species, persisting as a stable and independent entity that originated from historical hybridization between Speckled Dace and Leopard Dace (Troffe 1999; McPhail 2007). The Umatilla Dace is thought to have persisted because its morphology is intermediate between the two parental species such that it is adapted to under-utilized habitat in the Columbia River drainage, promoting ecological segregation among the three taxa (Haas 2001). The biological species status of the Umatilla Dace and its origin via historical hybridization between Leopard and Speckled Dace is supported by several lines of evidence:

1) It is morphologically distinct from both its putative parent species, and breeding experiments in the lab produce similar results and indicate a genetic basis to morphological distinction (Peden and Hughes 1988; Haas 2001);
2) It is intermediate morphologically and ecologically, and frequently co-occurs with either putative parent species, but also maintains self-perpetuating populations in allopatry (Haas 2001);
3) Ongoing hybridization is not apparent when in sympatry with either parent species (Peden and Hughes 1988);
4) Its range broadly overlaps that of the two putative parent species (Haas 2001); and

5) Despite its apparent hybrid origin, preliminary molecular genetic data suggest that Umatilla Dace is distinct from both Speckled Dace and Leopard Dace (Haas 2001; McPhail 2007).

Morphological description

The Umatilla Dace is a small fish, intermediate in appearance between Leopard Dace and Speckled Dace and shares some characteristics with both species (Fig 1, Haas 2001). The snout overhangs a sub-terminal mouth, and the upper lip is free from the snout. The mouth is horizontal with small barbels that are often hidden in the maxillary groove (McPhail 2007). The caudal peduncle of the Umatilla Dace is moderately narrow, the dorsal and anal fins are falcate (sickle-shaped) and the caudal fin lobes are pointed with a deep caudal fork (McPhail 2001, 2007). There are 9-10 dorsal rays and 56-72 scales along the lateral line (McPhail 2007). Umatilla Dace are light-coloured, with creamy sides and a darker head and back; irregular dark spots may cover the sides and back (Hughes and Peden 1989). The largest Umatilla Dace reported in Canada is 119 mm standard length (128 mm fork length) from the Similkameen River (Peden and Orchard 1993).

Umatilla Dace can be distinguished from both putative parental species in allopatry and sympatry (Table 2 in Hughes and Peden 1989), but are most similar to, and most likely to be mistaken for, Leopard Dace (Hughes and Peden; 1989, McPhail 2007). In sympatry with Speckled Dace below Cascade Falls in the Kettle River, the Umatilla Dace is differentiated by its sub-terminal mouth and visible barbels at the corner of the mouth; Speckled Dace have a terminal mouth and no barbels (McPhail 2007). Where they co-occur with Leopard Dace in the Kootenay, Columbia and Similkameen rivers, Umatilla Dace have a noticeably deeper caudal peduncle, shorter snout and small barbels often hidden in the maxillary groove; barbels are exposed in the Leopard Dace (McPhail 2007). Pelvic stays (membranes connecting the 5^{th}, 6^{th} and 7^{th} pelvic fin rays to the body) have also been used to differentiate species: stays are weakly developed or absent in Umatilla Dace and Speckled Dace; whereas they are well developed in Leopard Dace (Peden and Hughes 1988, McPhail 2001, Figure 1). Finally, Hughes and Peden (1989) note that pigmentation and scale counts along the lateral line of Umatilla Dace also differ from those of Leopard Dace.

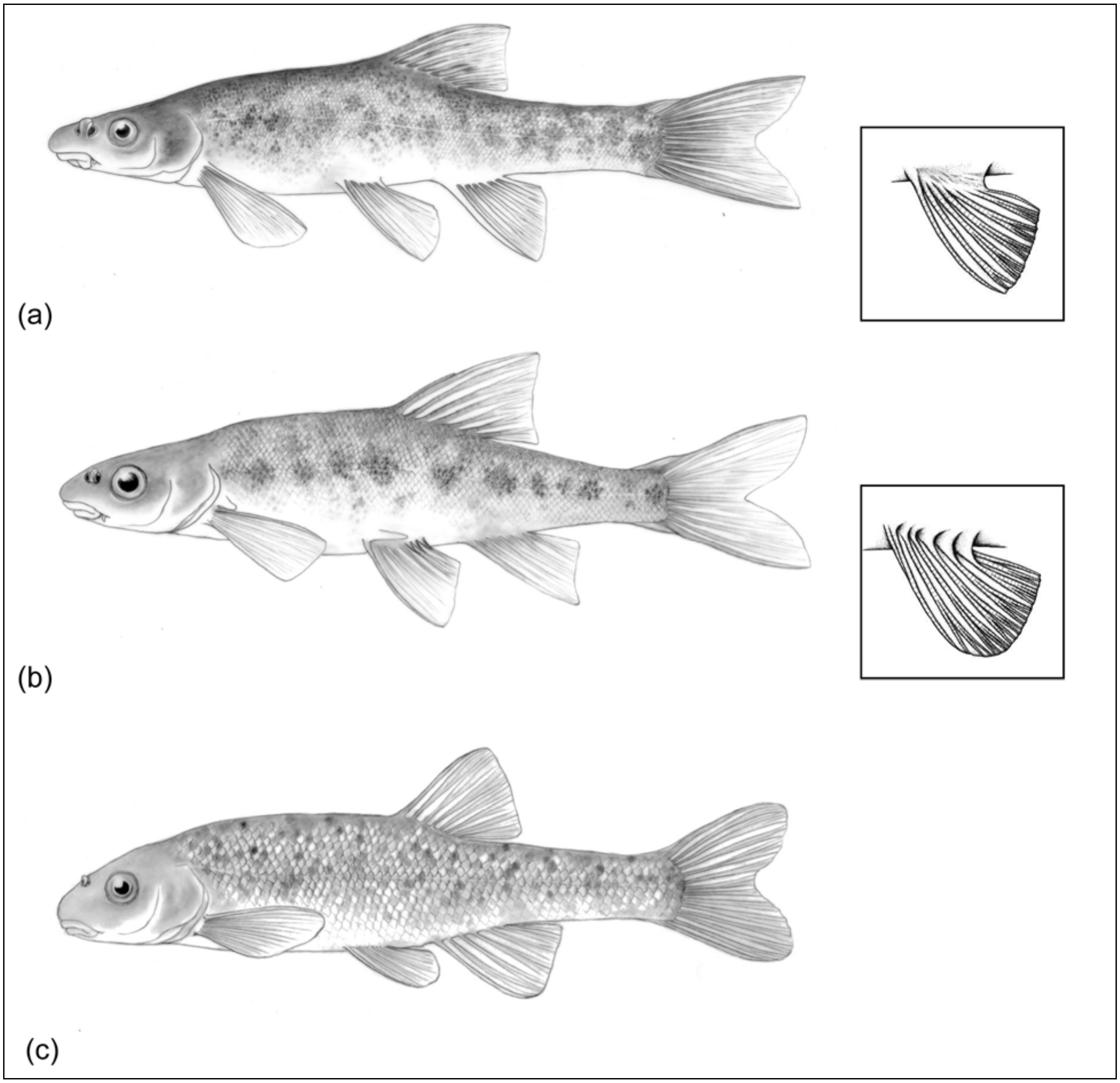

Figure 1. Comparative images of (a) Umatilla Dace from the Kettle River, (b) Leopard Dace from Nazko River in the Fraser River Drainage and (c) Speckled Dace from Kettle River (full body images provided by Diana McPhail). Pelvic fin ray insets for Umatilla and Leopard Dace demonstrate the absence and presence, respectively, of fleshy pelvic stays, one of the key features to distinguish Umatilla and Leopard Dace (provided by G. Hanke).

Spatial population structure and variability

Umatilla Dace have been the subject of several studies of morphological and meristic variation (e.g. Peden and Hughes 1988; Hughes and Peden 1989; Haas 2001). These studies suggest that Umatilla Dace from different areas are morphologically different from one another. For example, Umatilla Dace from the Kettle River differ in lateral line scale counts from those collected from the mainstem Columbia River and the

Similkameen River (Peden and Hughes 1988; Hughes and Peden 1989). In fact, such morphological variation among localities has been used as an argument that Umatilla Dace from different areas have evolved through independent bouts of hybridization between Leopard and Speckled Dace (Peden and Hughes 1988; Hughes and Peden 1989). This argument assumes that the morphological differences are inherited and reflect phyletic differences, an as yet untested hypothesis.

In a similar vein, Haas (2001) used sequence variation from mitochondrial DNA (mtDNA) and ribosomal DNA (rDNA) to conclude that the Umatilla Dace is a valid species, distinct both from Speckled and Leopard Dace, and that it may have arisen by repeated hybridization between these two species. Specifically, 306 base pairs of the cytochrome-*b* gene in mtDNA were sequenced in 29 fish and resolved two major genetic groups of Umatilla Dace (where a group is defined as an assemblage of fish with DNA sequences that are more similar to each other than they are to sequences from fish in other groups) with a high degree of confidence both of which contained some Umatilla Dace. The first group (with 87% bootstrap support) consisted of Umatilla Dace from the Similkameen River, and Leopard Dace from the lower and upper Fraser River, Kootenay and Slocan rivers in BC, Yakima River (southern Washington, WA), Grand Ronde and Willamette rivers (Oregon, OR) and Snake River (Idaho, ID). This group of fish was nested within a larger group of fish (99% bootstrap support) that included Speckled Dace from a variety of areas in BC, WA, and OR. The second group (89% bootstrap support) consisted of Umatilla and Speckled Dace from the Yakima River. Consequently, Umatilla Dace in group 1 were more similar genetically to Leopard Dace and Umatilla Dace from group 2 were more similar to Speckled Dace.

In addition, sequence differences in the D3B 28s region of rDNA (80 base pairs) also distinguished the three dace species from each other. At this locus, sample size was much smaller (N = 7 fish), but showed similar general patterns; Umatilla Dace from the Similkameen River were more similar to Leopard Dace from the Fraser River than they were to Speckled Dace from the Kettle River (bootstrap score of 93%, Haas 2001).

Finally, sequence analysis of the Internal Transcribed Spacer Region 1 (N = 14 fish, 255 base pairs) also indicated that Umatilla Dace had mixed affinities; fish from the lower Columbia River and Kootenay River in BC and from the Grande Ronde and Snake rivers were more similar to Speckled Dace from the Yakima River, but Umatilla Dace from the Similkameen River in BC were more similar to Speckled and Leopard dace from regions as diverse as the Fraser River and the Willamette River (Haas 2001).

The preliminary data of Haas (2001) and the morphological data (Peden and Hughes 1988; Hass 2001) are consistent with the idea of multiple and recent (post-Pleistocene) origins of Umatilla Dace in different geographic areas (as reflected by the differing degrees of affinity of Umatilla Dace with one or the other putative parental species in different areas, McPhail 2007). The idea of multiple origins is supported by the present distribution of Umatilla Dace in drainages now separated by a range of barriers, including distance and velocity. This argument is further supported by the fact that morphological differences correspond to different areas of the Columbia River drainage. Specifically, Umatilla Dace are found in three principal, geographically distinct groups that may have originated independently (Haas 2001; McPhail 2007). These are:

1) The Similkameen River group above and below the international border;
2) The group found in the remainder of the Columbia River drainage and Snake River. Two possible sub-groups structured around glaciation events are found in the central Columbia River Basin, and in the southern areas including the Snake and Grande Ronde rivers; and
3) The Yakima River group inhabiting tributaries of the north-central region of the Columbia River in Washington State.

The suggestion of multiple hybrid origins of a taxon and the genetic relationships described above are problematic for recognition of the Umatilla Dace as a distinct species under at least one species concept; the phylogenetic species concept. That being said, for the reasons described above under the **Name and classification** section, the Umatilla Dace satisfies the criteria for distinct species status under the biological species concept which emphasizes reproductive isolation in sympatry and is arguably the most widely accepted species concept.

Designatable units

Independent speciation events warrant separate biological species status. Thus, the two geographic groups of Umatilla Dace that occur in Canada (groups 1 and 2 above) may actually represent separate biological species. The data, however, are too limited at present to assess this hypothesis. Therefore, pending more rigorous morphological and genetic research, the Umatilla Dace is conservatively assessed as a designatable unit, *Rhinichthys umatilla,* following Wydowski and Whitney (2003), Nelson *et al*. (2004), and McPhail (2007).

Special significance

The Umatilla Dace is a Columbia River Basin endemic in British Columbia and contributes to the faunal distinctiveness of the Columbia River Basin within a Canadian context (Taylor 2004). It is thought to have evolved via hybridization between two other dace species, the Speckled Dace and Leopard Dace, a phenomenon (“hybrid speciation”) of great scientific interest (e.g., Mallet 2007). Some uncertainty still exists in terms of whether it is the result of a single or multiple, independent hybridization events, which makes for a biologically interesting dilemma—are one or more biological species involved? In addition, as part of its water use planning in the lower Columbia River, BC Hydro uses the Umatilla Dace as an indicator species to evaluate fish stranding associated with hydroelectric dam operations.

DISTRIBUTION

Global range

The Umatilla Dace is endemic to the upper and middle Columbia River basin and its large tributaries (McPhail 2007) (Figure 2). Similar to many other Columbia River basin endemic fishes, Umatilla Dace do not occur upstream of Shoshone Falls on the Snake River in Idaho (McPhail 2007). The northern boundary of the species' distribution closely matches the southern extreme of ice cover during the last (Wisconsinan) Pleistocene glaciation and the species has not advanced far north beyond this boundary (Haas 2001).

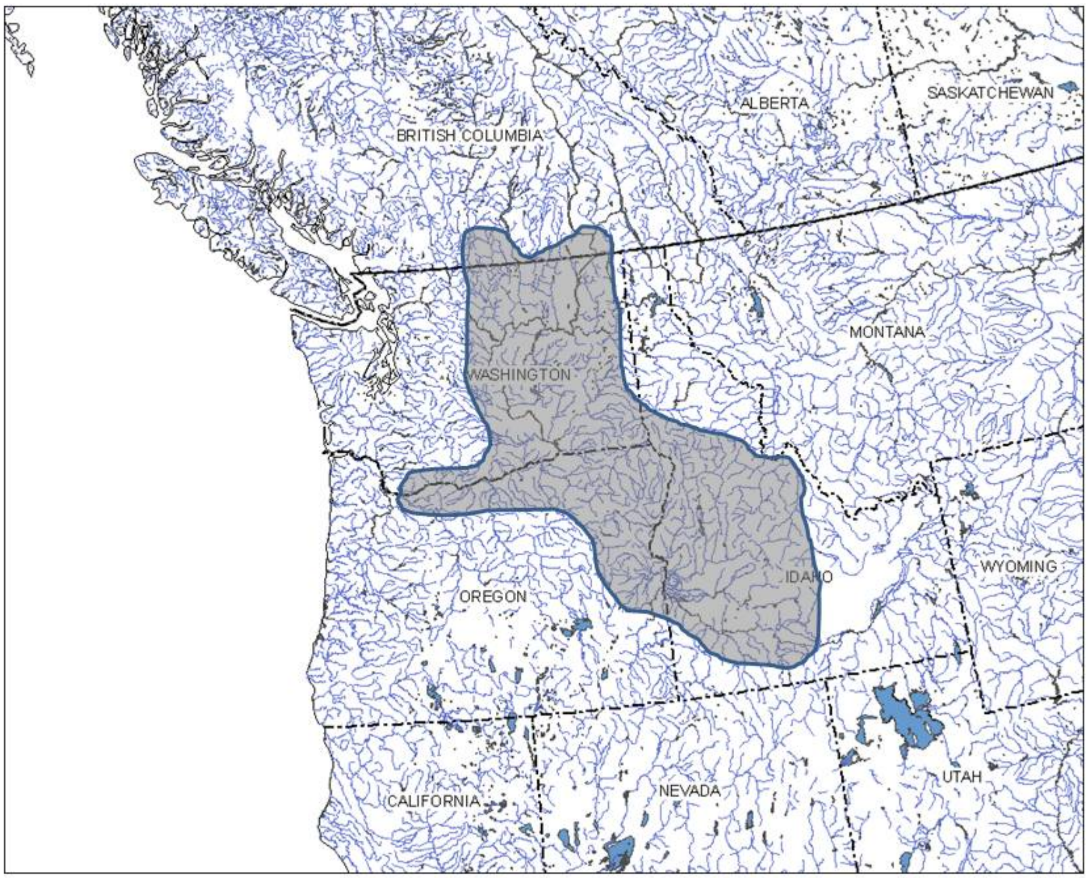

Figure 2. The global distribution of the Umatilla Dace in western North America.

Umatilla Dace are reported from Washington, Oregon, Idaho and British Columbia. They are present in both the Canadian and American portions of the Columbia River basin, where they are found in the mainstem and larger tributary rivers downstream to at least Bonneville Dam (in Oregon) and east of the Cascade Mountains (Troffe 1999). They have been collected from Canadian and US sections of several large streams including the Similkameen, Kettle and Okanagan rivers (Troffe 1999; Hughes and Peden 1989). Additional information on the distribution of Umatilla Dace in the United States is, however, still needed, particularly in Idaho and northern Oregon where its occurrence in the Snake River is unconfirmed (Hughes and Peden 1989; Haas 2001). Umatilla Dace have not been reported above present-day barriers on tributary streams in BC (McPhail 2007).

Canadian range

The Canadian range of the Umatilla Dace is not without dispute, largely because of the difficulty of differentiating Umatilla Dace both from the Leopard Dace and the Speckled Dace, especially for juvenile fish. In this report, determination of extent of occurrence is limited to specimens validated by taxonomic experts and based on museum records (Figure 3). Where validated records confirm presence, distribution and habitat information may be supplemented with data from other reports. Furthermore, the lack of recent survey data (i.e., within the last 20 years) in some highly altered watersheds creates uncertainty as to whether or not Umatilla Dace have persisted under new conditions (e.g., Pend d'Oreille River where there are now several hydroelectric dams).

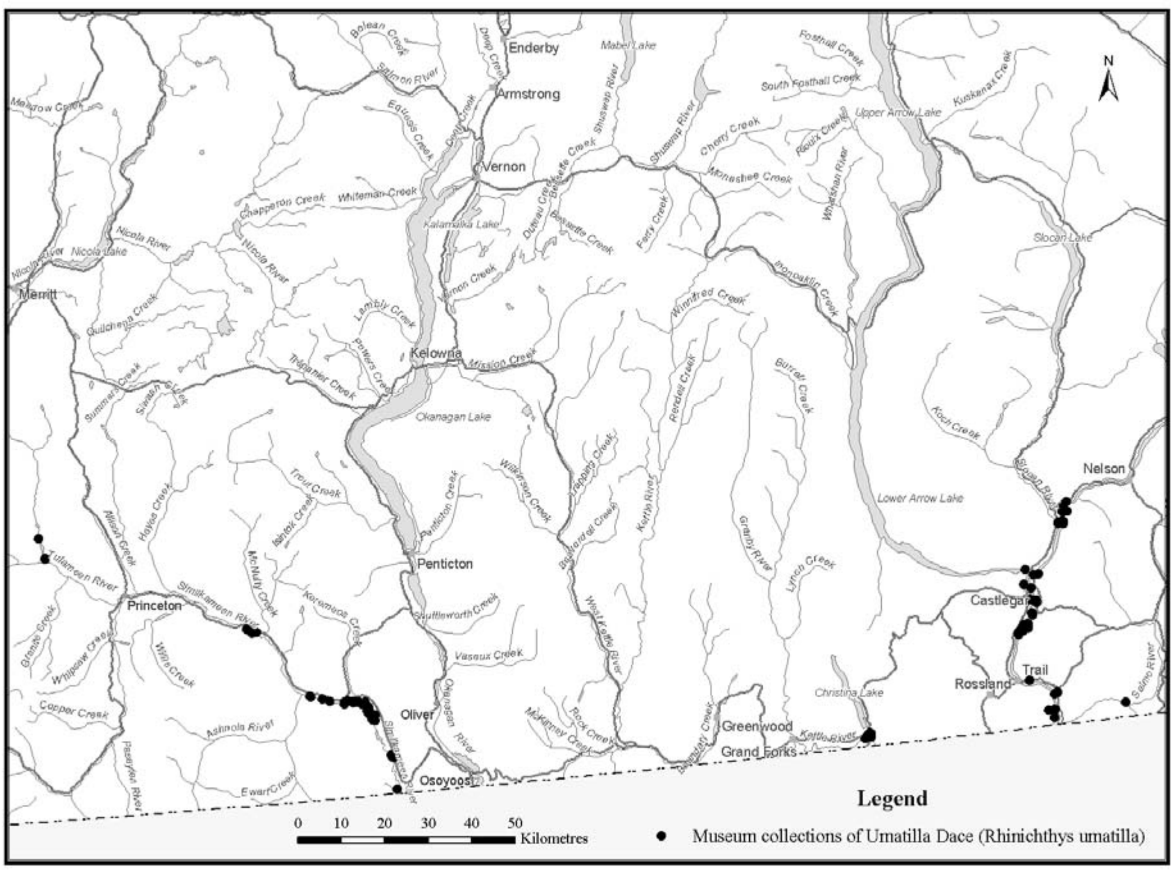

Figure 3. Collection sites of the Umatilla Dace within the Canadian range.

The Canadian range of the Umatilla Dace corresponds to roughly 5% of the global range (Figure 2). Based on occurrence data, Umatilla Dace appear to be limited to larger rivers where flows are adequate to maintain riffle habitat year round. The presence of Umatilla Dace in the lower Columbia River mainstem (i.e., below Hugh Keenleyside Dam) is undisputed. The species has also been reported in the Kootenay, Slocan, Kettle and Similkameen rivers (Figure 4, 5). Umatilla Dace may be present in the Pend d'Oreille River where a single specimen was collected in 1983 (Peden and Hughes 1988) from Seven Mile Dam reservoir about 8 km upstream of the Canada-US border, but there have been no subsequent directed sampling efforts for the species in the Pend d'Oreille River. Given the alterations to this watercourse (including 12 hydroelectric facilities, two of which are dams occurring in Canadian waters) the continued presence of this riverine species in the Pend d'Oreille River is questionable.

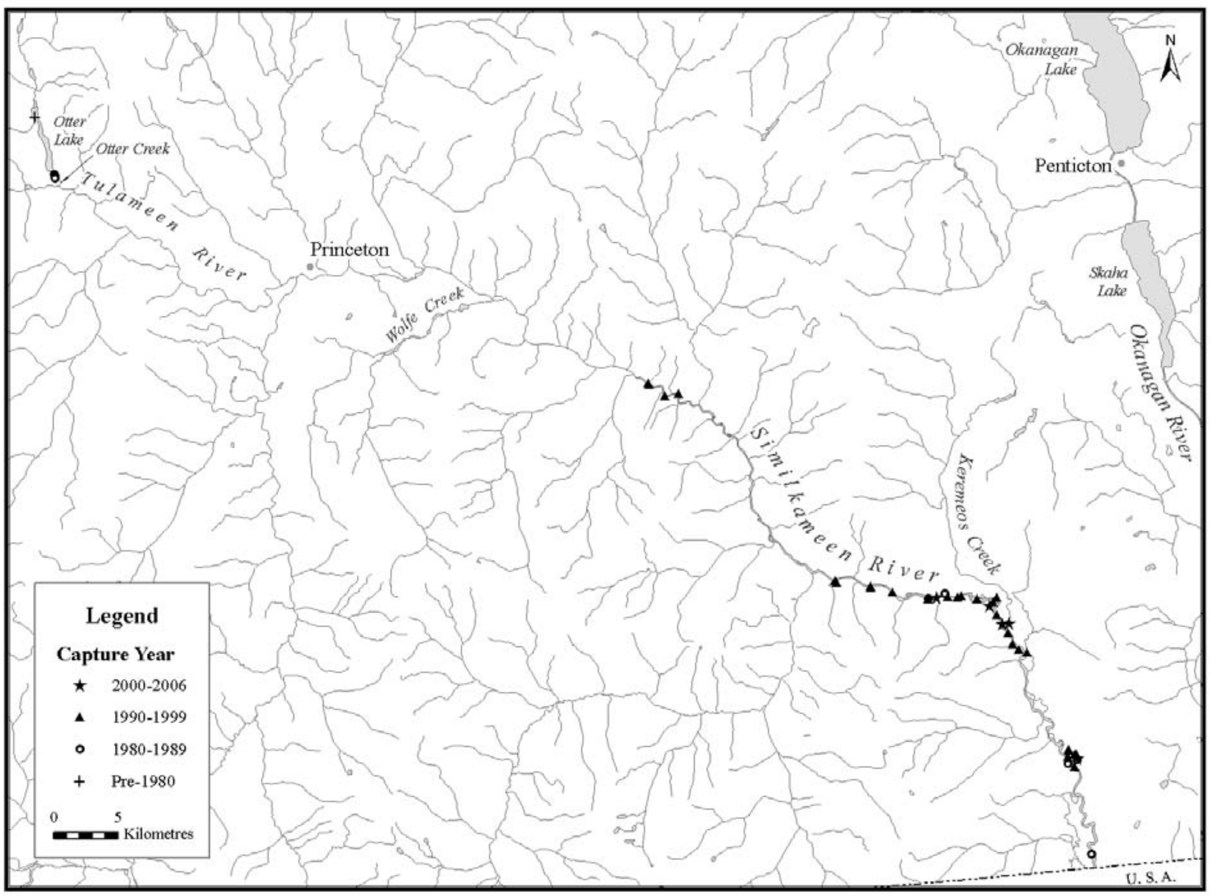

Figure 4. Collection sites for Umatilla Dace within the Similkameen River drainage over time.

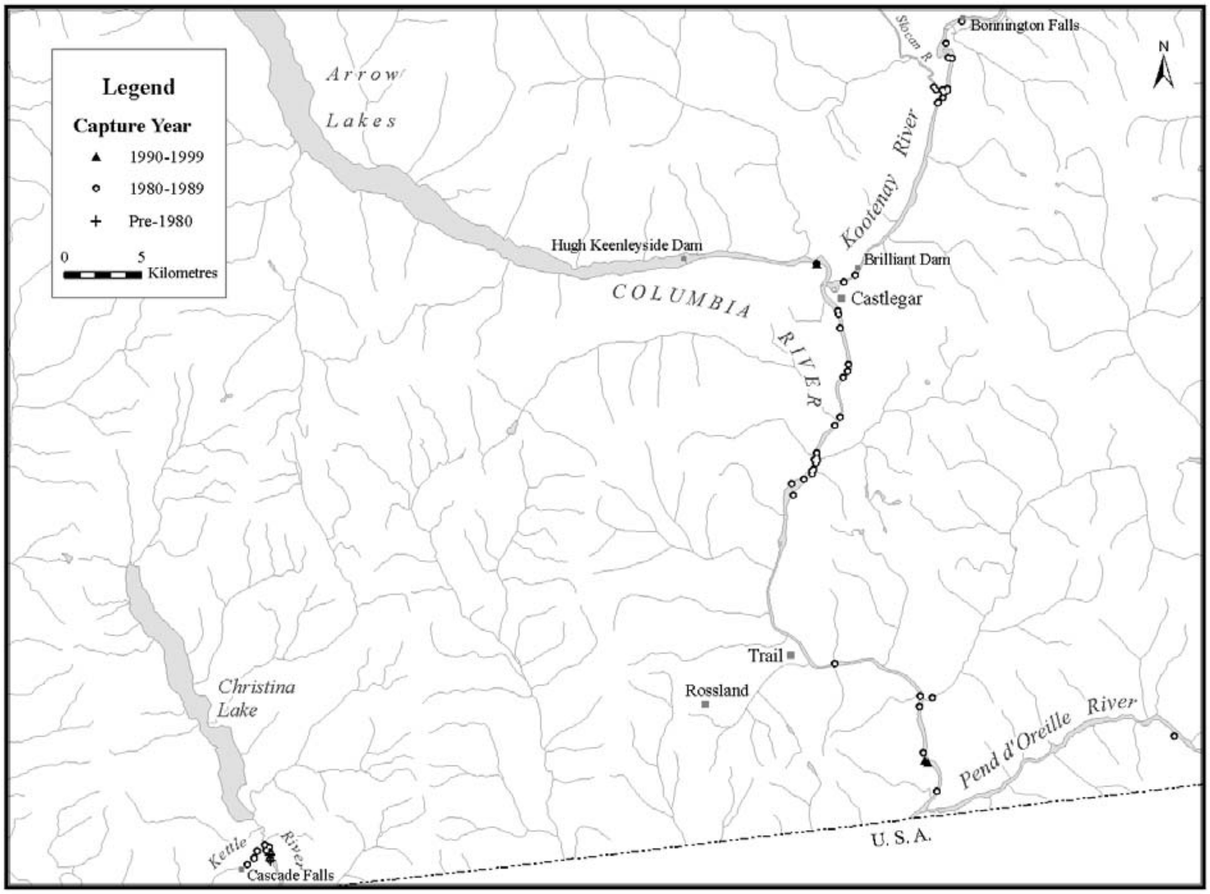

Figure 5. Collection sites for Umatilla Dace within the Columbia/Kootenay drainage over time.

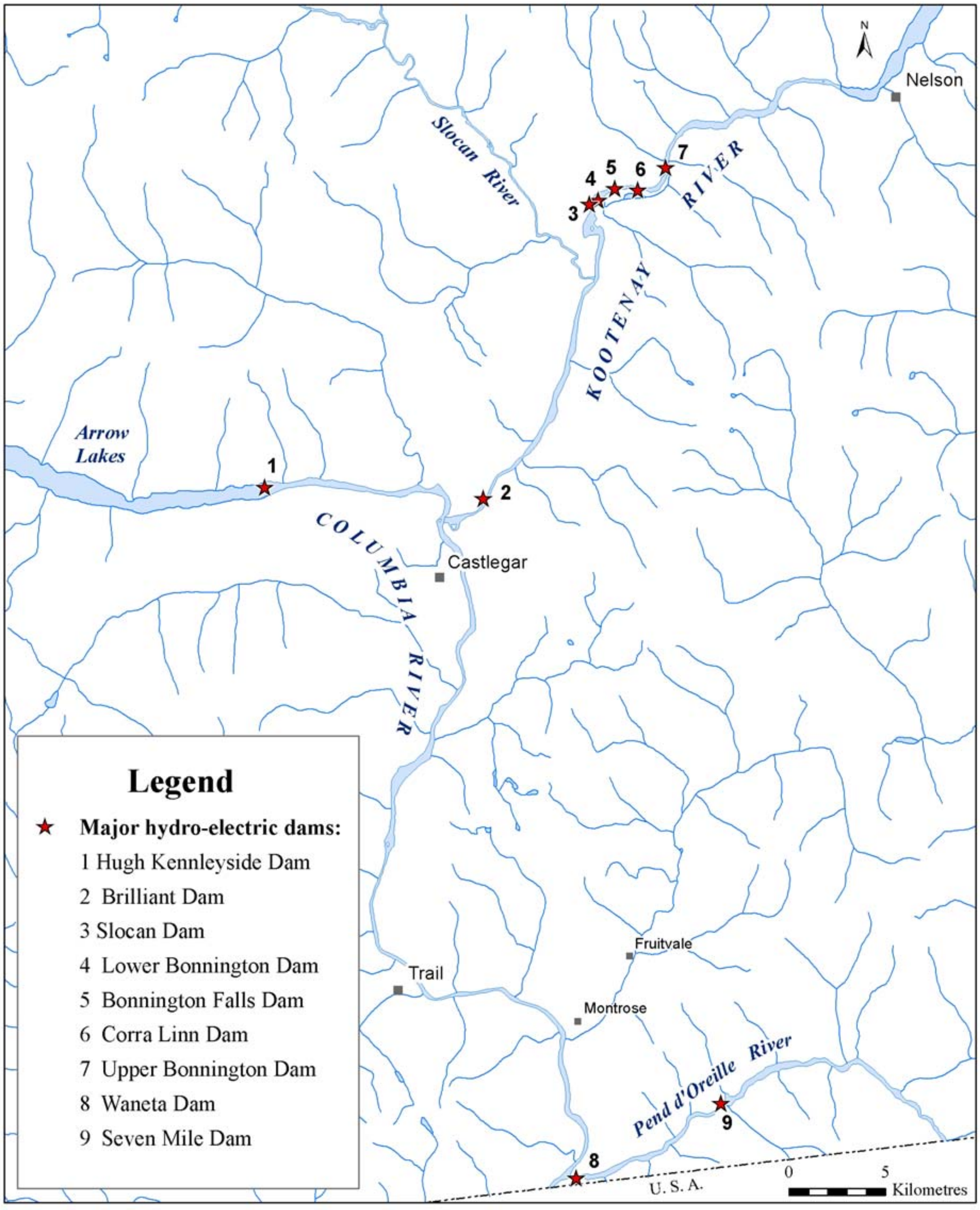

Figure 6. Major hydroelectric dams on the lower Columbia, Kootenay and Pend d'Oreille River systems relevant to Umatilla Dace.

In the Columbia River, Umatilla Dace are restricted to locations below the Hugh Keenleyside Dam, with specimens being identified near Castlegar, BC, and south to the international border (Peden and Hughes 1988); prior to the construction of the Hugh Keenleyside Dam, the Arrow Lakes may have provided an ecological barrier to upstream dispersal of this species although this is not the case for *R. falcatus* (Hughes and Peden 1989). In the Kootenay River, Umatilla Dace are present below the original site of Bonnington Falls to the confluence with the Columbia River, including substantial populations in the reservoir above Brilliant Dam and in the reservoir above South Slocan Dam (Peden and Hughes 1988). More recent surveys in the mainstem both of the lower Columbia and Kootenay rivers indicate that Umatilla Dace were not uniformly distributed, but rather were concentrated in a few key areas. Highest numbers of Umatilla Dace were noted in the lower Kootenay River and in the Columbia River approximately 40-56 km downstream of Hugh Keenleyside Dam (R.L. & L. 1995). Lower numbers were observed in sections 20-40 km downstream of the Hugh Keenleyside Dam, but were rare within the first 20 km below the dam (R.L. & L. 1995). Umatilla Dace were encountered at the Kootenay River confluence (winter and summer sampling) and at Kinnaird Rapids (about 3 km downstream from the confluence) of the Columbia River (summer) (Golder Associates Ltd. 2005).

The Umatilla Dace in the Slocan River were found close to the confluence with the Kootenay River and up to near the outlet of Slocan Lake at the town of Slocan (McPhail 2007, and pers. comm. 2010). There are no physical barriers to Umatilla Dace dispersal in this region, but they do not appear to have penetrated farther upstream to Slocan Lake possibly owing to higher temperature within the lake (Hughes and Peden 1989).

In the Kettle River, Umatilla Dace are known only below Cascade Falls, approximately 2 km north of the international border; upstream dispersal is prevented by these impassable falls (Peden and Hughes 1988). The Similkameen River is the largest stretch of relatively intact habitat for Umatilla Dace in Canada (i.e., free of major hydroelectric developments), although the species was reported to be rare here (Hughes and Peden 1989). Umatilla Dace are known from the Wolfe Creek outlet downstream to Nighthawk immediately south of the international border. Farther upstream, Otter Creek, a tributary of the Tulameen River which flows into the Similkameen River, contained a morphologically distinct form of Umatilla Dace (Peden and Hughes 1988). A single small Umatilla Dace was captured in 1992 (Peden and Orchard 1992) and none have been found since (McPhail 2007, G. Hanke, unpublished data), thus this population is probably extirpated (McPhail 2007). Upstream of the Tulameen River, the cooler water of the Similkameen River mainstem is thought to limit dispersal of Umatilla Dace (Hughes and Peden 1989). One report lists Umatilla Dace in Keremeos Creek, a small, short stream that drains from the north into the Similkameen River at the town of Keremeos, although species identity is somewhat uncertain (Long 2003). In addition, 35 juvenile Umatilla Dace were captured in an isolated backwater area at the mouth of Keremeos Creek in 2005 (G. Hanke, unpublished data).

The presence of Umatilla Dace in the Canadian portion of the Okanagan River (specifically, Mission Creek, a tributary flowing into Okanagan Lake) was reported by (Long 2003), but subsequent examination of the specimen indicated that it was not an Umatilla Dace (J.D. McPhail, pers. comm. 2010).

Extent of occurrence and area of occupancy

Occurrence data is based on historic and/or recent museum specimens whose identification has been verified by experts. The extent of occurrence (EO) as calculated from the polygon method (COSEWIC 2009), which includes terrestrial as well as aquatic habitat, is approximately 12,425 km^2 (estimate provided by COSEWIC Secretariat). The IAO (index of area of occupancy) using the 1 km x 1 km grid method is calculated to be 342 km^2 and includes both terrestrial and aquatic habitats (Table 1 summarizes IAO and AO calculations). Similarly, a 2 km x 2 km grid application produces an IAO of 608 km^2 (all IAO estimates provided by COSEWIC Secretariat). The area of occupancy based on linear lengths of rivers x approximate river widths and reservoir surface areas for all waterbodies is approximately 27.3 km^2. All these estimates excluded the Otter Creek based on the conclusion that this population is now extirpated.

Table 1. Streams and reservoirs included in area of occupation calculations for the Umatilla Dace. Note that Otter Creek was excluded from the area of occupancy calculations because the population is considered extirpated (approx. area is 5.22 km^2). Index of area of occupancy (IAO) values include the areas of the grids that fell outside of the extent of area (values provided by COSEWIC Secretariat).

Streams and Lakes/Reservoirs	AO based on stream length (km^2)	IAO based on 1x1 km grid (km^2)	IAO based on 2x2 km grid (km^2)
Similkameen River – Wolfe Creek to international border (approx. width=0.05km x 86.8 km length)	4.34	112	200
Kettle River – Cascade Falls to international border (approx. width=0.02km x 5.7 km length)	0.11	10	24
Columbia River – Hugh Keenleyside Dam to international border (approx. width=0.2 km x 56.4 km length)	11.28	93	160
Kootenay River – Brilliant Dam to confluence with Columbia (approx. width =0.1 km x 1 km length)	0.10		
Kootenay River – Reservoir area between Bonnington Falls and Brilliant Dam	2.04	33	56
Slocan River – outlet of Slocan Lake to confluence with Kootenay (approx. width=0.035km x 57.3 km length)	2.01	62	112
Pend d'Oreille River – full Canadian length (approx. width=0.1km x 2.8 km length)	0.28	37	76
Pend d'Oreille reservoirs – Waneta + 7 Mile (0.3 km width x 23.7 km length)	7.11		
TOTAL Area of Occupancy	27.3	342	608

HABITAT

Habitat requirements

The Umatilla Dace is a benthic riverine species that occurs in large- to medium-sized tributaries and the mainstem of rivers. Hughes and Peden (1993) concluded that the Umatilla Dace prefers fairly productive, low-elevation waters over colder, higher elevation streams and, in the Columbia River, in habitats with gentle bank slopes (5-19%, R.L. & L. 1995). Although the Similkameen River is considered a cold, low productivity river with limited nutrient inputs (Rae 2005), the lowest section of the river, where Umatilla Dace occur, is relatively warm and more productive relative to upstream sections.

The species has been reported from a variety of habitats (i.e., pool versus riffle areas in rivers and streams), but specific requirements are poorly understood. Hughes and Peden (1989) suggested that sampling techniques have limited the ability to refine habitat requirements or obtain reliable abundance estimates. It is generally agreed, however, that Umatilla Dace habitat use shifts occur diurnally, seasonally, and with life history stage (R.R&L. 1995; AMEC 2003; McPhail 2007). In addition, Peden and Orchard (1993) noticed highly skewed sex ratios at some sites in the lower Similkameen River, possibly reflecting habitat preference differences between males and females.

Temperature

Umatilla Dace inhabit streams with relatively warm summer water temperatures (18 – 20°C). Haas (2001) found that at 18°C, fish came into optimal reproductive condition under laboratory conditions, and noted that this reflected temperatures found under natural conditions in May and June. Umatilla Dace, however, may live in areas with varying temperatures. Between August and late September in the Similkameen River, Umatilla Dace were living in waters where the surface temperature ranged from 8 °C to 21 °C (Peden and Orchard 1993).

There is some evidence that this species retreats to interstitial spaces within the substrate and is less mobile at lower water temperatures (Haas 1998). Umatilla Dace also survive in colder waters, as demonstrated by their presence in rivers and backwaters such as the Slocan River as well as Kettle River and Otter Creek, which can freeze over in the winter.

Substrate

Adult Umatilla Dace are found in silt-free, riverine habitats and use very coarse gravel, cobbles, and larger boulders (> 0.8 m diameter) for cover (Hughes and Peden 1989; Peden and Orchard 1993; Haas 2001). In the Kootenay and Columbia rivers, Umatilla Dace were found among stones that were rounded and polished, with enough space between the rocks to hide (Hughes and Peden 1989). Young-of-the-year Umatilla Dace were found in shallow water (< 10 cm deep) with small cobble, sand or silt substrate (Peden and Orchard 1993, R.L. & L. 1995; McPhail 2001), while mature or larger Umatilla Dace have been found in areas with deeper water, under or between larger rocks (Hughes and Peden 1989; R.L. & L. 1995). Adults are more bottom-oriented than the juveniles, which are often observed in mid-water during the summer, behind structures that break the current (R.L. & L. 1995).

In the Canadian section of the Kettle River downstream of Cascade Falls, there is little suitable habitat due to a lack of cobble and stone cover, except for a 100 m length of river characterized by large boulder substrate at the base of Cascade Falls (Peden and Hughes 1981; Hughes and Peden 1989).

Water Velocity

Umatilla Dace are found in habitats where the water velocity is strong enough to prevent siltation (Hughes and Peden 1989). Adults sampled from the Columbia River mainstem are usually found in glide (smooth-flowing) habitats with velocities < 0.5 m/s (R. L. & L. 1995). Water velocities selected by Umatilla Dace appear to be intermediate to those favoured by Leopard and Speckled Dace, which tend to utilize higher and lower velocities, respectively (Haas 2001). Within glide sections, Umatilla Dace shelter on the bottom between rocks where the water velocity is slower (McPhail 2007). Winter surveys indicated that Umatilla Dace utilize velocity refuges that may be in close association with fast run habitats (R.L. & L. 1995; AMEC 2003).

Depth

In the Kootenay River and middle to lower sections of the Columbia River, Umatilla Dace were found in shallow water habitat, usually at depths of less than 1 m (Hughes and Peden 1989, R. L. & L.1995). Haas (2001) found that their median depth preference was about 0.5 m under laboratory conditions, almost identical to that of Leopard Dace. Large Umatilla Dace, however, were observed in water depths greater than 1 m in the Similkameen River (Peden and Orchard 1993). Electroshocking sampling equipment has depth limitations; therefore, adult Umatilla Dace may be found in deeper habitats than museum collections indicate (Peden and Orchard 1993).

Peden and Orchard (1993) found juveniles in quiet, shallow (< 0.10 m) water in the Similkameen River and McPhail (2001) reported a similar result for fry along edges of the Slocan River and noted that juveniles sought refuge in shallow quiet sections with flooded vegetation during the freshet, but used similar habitats to adults under less severe flow conditions. In the Columbia River, young-of-year and small juveniles used shallow water habitats throughout the year while adults were only noted in these habitats during the summer and fall suggesting a shift by adults into deeper habitats in winter and spring (R.L. & L. 1995). Similarly, nearshore shallow areas had greater dace numbers during the day than night during summer sampling suggesting that habitat also varies diurnally depending on season.

As is common in stream fishes, Umatilla Dace show ontogenetic shifts in habitat use. For instance, juvenile Umatilla Dace (1+ years) were abundant in shallow nearshore areas in the Columbia River between Hugh Keenleyside Dam and the US border during the summer (R.L. & L. 1995). By autumn, however, they had shifted to adult-type habitat with deeper, faster waters (McPhail 2007). Further, Peden and Orchard (1993) found a positive correlation between fish size and depth occupied in the Columbia River. Finally, in addition to age-related habitat use changes, seasonal variation in depth selection has been noted (R.L. & L. 1995).

Habitat trends

Alterations associated with hydroelectric development

The construction and maintenance of large hydroelectric facilities in the Columbia River basin has dramatically changed the hydrology of almost all habitats available to Umatilla Dace in the Columbia and Kootenay river mainstems since the early 1900s (R.L. &L. 1995, see also Figure 5). Many changes can be considered historic and permanent, originating at the time the dams were constructed. Alterations to aquatic habitats occur both upstream and downstream of dam locations, but potential effects on Umatilla Dace habitat depend on the distribution of the species in these rivers. In general, the operation of dams results in regulated flows downstream of the facility affecting flow and temperature regimes, as well as water quality and substrate movement (e.g. loss of gravel) and thus represents ongoing habitat alteration. Upstream, the obvious impact is a conversion of riverine to lake-like conditions for the extent of the reservoir with associated changes in temperature and water quality. The dams themselves act as impassible barriers at least to upstream movement, and may result in the fragmentation of originally connected habitats. The degree to which habitat has been altered will, however, vary according to the specific dam associated, but overall, about 41% of the linear stream length habitat of the Umatilla Dace has been altered in some fashion by hydroelectric developments (S. Pollard, BC Ministry of Environment, unpubl. data).

The Kootenay River flows into the Columbia River approximately 10.5 km downstream of the Hugh Kennleyside Dam (Golder Associates Ltd. 2005). Between 1897 and the mid-1940s, six dams and associated reservoirs were constructed on this river between its confluence with the Columbia River and the outlet of Kootenay Lake, although facility expansions have occurred as recently as 2006 (Figure 5). The Kootenay River enters the Columbia River 2.8 km downstream from Brilliant Dam at Castlegar. Bonnington Falls dam (the fourth dam up from the confluence) is situated at the original natural barrier to further upstream movement for Umatilla Dace; thus, potential alterations to habitat are limited to sections downstream of this site. The operation of the dams upstream of this location, however, may still affect downstream flow and substrate movement. Given that the Umatilla Dace appears to prefer fairly productive, silt-free riverine conditions, the shift from a free-flowing river to a series of reservoirs in the lower Kootenay River has undoubtedly affected the fish's distribution to some degree. In addition, the three dams below the original Bonnington Falls site also represent barriers to upstream movement. While it is unclear to what extent dace move about in a river (see **Dispersal and migration**), these dams have likely led to fragmentation of the total population in this river. Interestingly, Hughes and Peden (1989) reported substantial populations in the reservoir above the Brilliant Dam, as well as four juveniles in the reservoir above South Slocan dam. This observation suggested that these altered sections may still support the species although more recent surveys could not confirm presence of the Umatilla Dace (see **Population sizes and trends**). Downstream of Brilliant Dam, the flows are regulated throughout the year, again potentially affecting both habitat quality and quantity for dace (**Threats and limiting factors** discusses the specific issues related to ongoing flow regulation).

The Hugh Keenleyside Dam, located on the Columbia River, 10 km upstream of Castlegar, was completed in 1968 and created the 240 km long Arrow Lakes Reservoir (formally Upper and Lower Arrow lakes). Given that Umatilla Dace were not thought to occur upstream of the dam location (see **Canadian range**), any impacts to habitat are limited to those associated with flow regulation below the dam (discussed in **Threats and limiting factors**).

Another major tributary of the Columbia River, Pend d'Oreille River, was purported to contain Umatilla Dace and has been altered by several hydroelectric facilities constructed prior to 1980 (Figure 5). The result of these dams is a series of reservoirs throughout most of the Canadian portion of the river. This magnitude of habitat conversion is similar to that in the lower Kootenay River and may also have affected the distribution of Umatilla Dace although this is speculative given the lack of evidence confirming current presence of Umatilla Dace in the river (the last survey was in 1983 and recorded only a single Umatilla Dace).

The Similkameen River was dammed between 1916 and 1923 just south of the Canada/US border. Prior to construction of this dam, the Enloe Falls at 7 m in height posed an impassable upstream barrier for most fish including Umatilla Dace (Hughes and Peden 1989). The original dam, therefore, would not have affected habitat connectivity or the riverine conditions for the Canadian portion of the Similkameen Umatilla Dace population. In contrast, proposed dam options south of the international border may potentially have major impacts to Umatilla Dace habitat in the lower Similkameen River (see **Threats and limiting factors**).

In summary, existing habitat alterations associated with hydroelectric facilities occur in the Columbia, Kootenay and Pend d'Oreille rivers. Some alterations have been in place since the original construction of the facilities (e.g. habitat fragmentation and conversion of river to lake conditions). Continued observations of Umatilla Dace in at least some river sections impacted by the construction and maintenance of hydroelectric facilities on the Columbia and Kootenay rivers suggest that this fish may have some degree of adaptability to habitat perturbations or that it is not particularly sensitive to changes associated with hydroelectric developments. All dace observations until very recently have been strictly qualitative in nature, however, with no ability to observe changes in abundance over time. Other impacts to habitats downstream of dams are relatively new or ongoing, and are associated with operations and recent facility expansions to generate additional power. In particular, sections of river downstream of Hugh Kennleyside and Brilliant dams experience daily to seasonal fluctuations in water flow delivery with demonstrated impacts to both quantity and quality of habitat available to Umatilla Dace. In fact, seasonal operations have led to a number of recent stranding events in the lower Columbia River resulting in fish mortality (see **Threats and limiting factors** section below).

Alterations associated with other human activities

A number of small urban centres are situated within the native range of Umatilla Dace (e.g., Princeton, Keremeos, Castlegar, Trail, BC). In addition, extensive agriculture (especially fruit and forage crops) is found throughout the valley bottoms of the major rivers especially in the Similkameen, Slocan and Kettle river valleys; these same areas are also prone to increasing summer drought conditions. Water withdrawals are predicted to increase over time to meet increasing watering demands in the region. Some sections of the Similkameen River are diked heavily to prevent flooding around urban centres, and banks are reinforced in sections to reduce erosion and contain 200-yr flood flows. Interestingly, Peden and Orchard (1993) noted that larger-sized Umatilla Dace in the Similkameen River appeared to utilize the many diked sections of the river near Keremeos, BC, many of which have only been in place since 1970 or later. Natural habitats utilized by adult Umatilla Dace often include substrates of the size used for diking and as such may have caused a shift of Umatilla Dace downstream into sections of the Similkameen River previously dominated by Leopard Dace (Peden and Orchard 1993).

Mining- and forestry-related activities have also occurred within many portions of the Similkameen watershed. In the headwaters and tributaries of the Similkameen River, Mountain Pine Beetle (*Dendroctonus ponderosae*) infestations have impacted extensive areas of forest (T. White, pers. comm., 2009); associated potential impacts to mainstem fish habitat could include sedimentation, contamination, and altered temperature and hydrology regimes. There are four historic copper or gold mine sites within the Similkameen River watershed, one of which is still operational (T. White, pers. comm., 2009). Two coal beds in the upper Similkameen watershed (one in the Tulameen basin and one in the Princeton area) have generated interest by industry as future mining prospects; however, there is currently no active mining here. On the Columbia River, a large smelter has operated in Trail for over 100 years with episodes of contaminant spills into the river reported. These cumulative effects may all affect habitat quality and availability as follows: increased sedimentation, increased nutrient loading and contamination, altered temperature regimes, altered riparian areas and altered hydrology. It is difficult, however, to determine to what extent these impacts may have affected dace habitat if at all, particularly given the lack of abundance data over time.

Habitat protection/Ownership

No legislation explicitly protects the habitat of this species in British Columbia, although general fish habitat protection provisions exist under the federal *Fisheries Act* that can be applied to regulate flow needs for fish, fish passage, killing of fish by means other than fishing, the pollution of fish bearing waters, and harm to fish habitat. The Riparian Areas Regulation (B.C. Reg. 148/2006) under the provincial *Fish Protection Act* (Bill 25 – 1997) provides directives to municipalities to ensure adequate streamside habitat protection in areas under development. This applies to a number of regional districts including Okanagan-Similkameen and Columbia-Shuswap, but given the distribution of Umatilla Dace, is probably only relevant in developed areas of the Similkameen River system (i.e., within Hedley, Keremeos and Cawston) and to a lesser extent the Columbia River mainstem (near Trail and Castlegar). These areas tend to have significant diking and channelization associated to protect municipal areas from flooding.

Almost all of the lands adjacent to the Columbia, Kootenay, Pend d'Oreille, Slocan, mid-Similkameen, Otter and Kettle rivers are privately owned. As many of these lands also occur within the Agricultural Land Reserve, they are undoubtedly used for various types of agriculture. The provincial *Forest and Range Practices Act* (Bill 74 — 2002) requires a government-approved range use or stewardship plan to allow livestock forage on Crown land but does not apply to private lands. Provincial parks including South Okanagan Grasslands (Lower Similkameen River), Bromley Rock (mid-Similkameen River), Beaver and Erie creeks (Columbia River) offer limited, localized protection to Umatilla Dace habitat in terms of limited shoreline development. Much of the lower to mid-Similkameen River mainstem (~20 km of stream length downstream of Keremeos and ~25 km of stream length upstream of Keremeos) is contained or partly contained (one shore) within federally designated Indian Reserve land. These particular areas tend to have less shoreline or adjacent development associated with them. Peden and Orchard (1993) proposed that the river section in the Ashnola Reserve contained some of the best natural habitat for Umatilla Dace in the Similkameen River.

BIOLOGY

Life cycle and reproduction

Specific life history information for Umatilla Dace is very limited. Most information comes from two studies, one in the Similkameen River (Peden and Orchard 1993) and one in the Columbia River (R.L. & L. 1995), as well as observations reported in McPhail (2007) and inferences based on closely related Leopard and Speckled Dace. The recently developed Columbia River Water Use Plan (BC Hydro 2007) includes the requirement for a Lower Columbia River dace life history assessment to enable a proper assessment of threats posed by the seasonal operations of Hugh Keenleyside Dam. This study, which includes Umatilla Dace, is currently underway (Columbia River Project Water Use Plan — project CLBMON-43).

Like Speckled and Leopard Dace, Umatilla Dace probably spawn in the late spring and summer (Hughes and Peden 1989). This assumption is supported by the observation of near-ripe eggs in females in early July (McPhail 2007). Temperature, rising water levels and increasing photoperiod trigger spawning behaviour in Speckled Dace (references in McPhail 2007); similar environmental cues may also be important for Umatilla Dace. There is no specific information on spawning site selection, but when a female enters a site, she is swarmed by males and may enter nest sites repeatedly, depositing a few eggs each visit (McPhail 2007). Eggs of Umatilla Dace produced in laboratory conditions were demersal and adhesive (Haas 2001).

Fecundity varies with size and reported values ranged from 300 to 2,000 eggs (based on five females ranging from 80 to115 mm in fork length) (McPhail 2007). These eggs were not fully ripe and averaged 1.6 mm in diameter (McPhail 2007). In the laboratory, fertilized eggs (from Similkameen River Umatilla Dace) were about 2.0 mm in diameter, adhesive and fragile (Haas 2001). At 18^{o}C, they hatched in six days, and fry were about 7 mm in total length (Haas 2001). The fry likely spend about a week in the gravel before emerging to start feeding (McPhail 2007).

Umatilla Dace rarely reach 30 mm by the end of their first growth season (McPhail 2007). Most males reach maturity by the end of their second summer (1+ years) while females mature a year later (2+ years) (McPhail 2007). Adults rarely surpass 120 mm in fork length (Peden and Orchard 1993), and the largest Umatilla Dace in the Similkameen River were females, a pattern frequently observed in cyprinid fishes (Peden and Hughes 1989).

There is currently little information on natural mortality or population age structure. Large numbers of dace between 50 – 59 mm standard length were found in the Similkameen River; however, their exact age was not confirmed and they may have been second-year fish (Peden and Orchard 1993). Longevity is not known; however, a female fish of 5+ years (based on aging using otoliths) reached 119 mm standard length in her sixth summer (McPhail 2007), but most dace species appear to live for 3 to 4 years of age and generation time is about 3 years (Scott and Crossman 1973).

Predation

Main predators are likely piscivorous fishes that also occur in riverine conditions within the range of Umatilla Dace. As described in **Interspecific interactions** below, probable predators include Northern Pikeminnow (*Ptychocheilus oregonensis)* and Rainbow Trout (*Oncorhynchus mykiss*), as well as a number of sculpin (*Cottus* spp.) species, particularly the Torrent Sculpin (*C. rhotheus*) which is abundant in streams. Hughes and Peden (1989) did not consider predation to be a limiting factor for population growth of Umatilla Dace. These researchers, however, did not consider impacts associated with introduced predatory fishes; these species are discussed in more detail under **Threats and limiting factors**.

Physiology

Water temperature is likely to be a physiological limiting factor for Umatilla Dace. These fish appear to be limited to downstream and mainstem sections of rivers where temperatures are warmer, supporting a more productive environment. Peden and Orchard (1993) also noted, however, that these fish can tolerate a wide diurnal range in temperatures; August temperatures in the region can range from 13 ^{o}C to 21^{o}C within a 24-hour period.

Dispersal and migration

The extent to which Umatilla Dace are able to disperse or undergo any type of migration is unknown. Studies in the lower Columbia River (in BC) indicate that post-hatch pelagic and early juveniles stages seem to exhibit limited swimming abilities (R.L. & L. 1995), which would indicate restricted capacity of young-of-the-year to disperse upstream. This would leave this species vulnerable to sudden changes in their environment during this period. Juveniles tend to be displaced downstream to areas of slower water, while larger juveniles and adults may move upriver into stronger current areas (R L. & L. 1995).

Interspecific interactions

Studies in Canadian waters of the lower Columbia River indicated that the diversity of food ingested by Umatilla Dace is low, and varies with season and prey availability (R.L. & L 1995). The diet includes mayflies (Ephemeroptera), midges (Chironomidae), periphyton (benthic algae and associated materials), and detritus. In winter, they eat significant amounts of periphyton and detritus. These results support previous studies of the feeding habits of other dace species (Scott and Crossman 1973).

Umatilla Dace diet has been shown to vary with location, suggesting that they are opportunistic foragers, feeding on whatever is available (R.L. & L. 1995). In the upper Columbia River, their diet is mostly mayflies, while in the middle reach periphyton and detritus replace insects as the major food item. In the lower reach, stomach content include 36% detritus and 64% insects by volume. Midges are the dominant food source in the lower Columbia River and made up more of their diet here (R.L. & L. 1995). Their diet is likely different in the Similkameen River, as there were no signs of algae at the sites studied (Peden and Orchard 1993). Based on a small number of juveniles and young-of-the-year examined for stomach contents, the diet of small Umatilla Dace appears to be similar to that of adults (McPhail 2007).

Umatilla Dace occur in sympatry with Leopard Dace in the Similkameen and Kootenay rivers where they appear to be more numerous and select areas with stronger currents (Peden and Hughes 1993). Haas (2001) reported that where sympatry occurred between Umatilla Dace and parental species, within-species variation for morphological and ecological attributes appeared narrower, suggesting niche partitioning from competition.

A number of other fish species were recorded during Umatilla Dace sampling in the Similkameen River including Mountain Whitefish (*Prosopium williamsoni*), Rainbow Trout, Northern Pikeminnow, Redside Shiner (*Richardsonius balteatus*), Largescale Sucker (*Catostomus macrocheilus*), Bridgelip Sucker (*Catostomus columbianus*), Torrent Sculpin and Mountain Sucker (*Catostomus platyrhynchus*) (Peden and Orchard 1993). Their interactions with Umatilla Dace were not noted but possible competitors include small benthic species such as sculpins and Longnose Dace (*Rhinichthys cataractae*) which are far more abundant in the river (Peden and Orchard 1993). In the Columbia River, a study focusing on dace and sculpin species found Umatilla Dace occurring with Longnose Dace and various sculpins (R.L. & L. 1995), as well as Northern Pikeminnow, whitefish species, Redside Shiner, Peamouth Chub (*Mylocheilus caurinus*), Rainbow Trout and suckers (AMEC 2003). Piscivorous fishes such as Northern Pikeminnow and Rainbow Trout may prey on Umatilla Dace, but impacts to populations are unknown. The Chiselmouth (*Acrocheilus alutaceus)* is also present in the Columbia and Similkameen rivers but its algivorous diet probably limits competitive interactions.

There is no evidence that competition negatively affects Umatilla Dace populations (Hughes and Peden 1989); however, sampling has been sporadic and any competitive effects would be hard to detect. Potential competitors include sculpins and other dace species (Cannings and Ptolemy 1998).

Adaptability

Winter surveys in the Columbia River mainstem noted that Umatilla Dace tend to be more active at night, moving into the substrate during the day (AMEC 2003). Densities of fish were also lower during the night, suggesting fish are more apt to evade observation at this time (AMEC 2003).

Umatilla Dace may be able to tolerate and even take advantage of some level of human disturbance to habitat (see **Habitat trends** section). The extent to which they may be able to adapt, however, will depend on a much greater understanding of habitat requirements.

POPULATION SIZES AND TRENDS

Sampling effort

To date, no effort to assess population size has been undertaken for Umatilla Dace in British Columbia. In the past, surveys have been limited to qualitative habitat preference considerations in the Similkameen River (Peden and Orchard 1993), seasonal habitat use in the Columbia (AMEC 2003, R.L. & L. 1995), and species composition, relative abundance and habitat use in the lower Kootenay and associated reservoirs (R.L. & L. 1999). Recent surveys in the Columbia River were limited to fish stranding studies related to dam operations in the Columbia River mainstem although abundance studies for dace species including Umatilla Dace have been initiated here (Golder and Associates 2005). Given the paucity of data, all abundance and trend observations have been combined by watershed. In addition, possible misidentifications result in uncertainty regarding population sizes or even the presence of Umatilla Dace in some regions and can make inferences on trends uncertain (Haas 1998).

Abundance and trends

Otter Creek

Collections of Umatilla Dace in 1958 and in the mid-1980s indicated the presence of larger-sized individuals in Otter Creek (i.e., > 45 mm standard length), but no data on population sizes and trends were available (Hughes and Peden 1989). Hughes and Peden (1989) were unable to find any males or juveniles in their (1980s) collections, and only a single juvenile was collected in 1992 (Peden and Orchard 1993). A recent qualitative survey in 2006 used electroshocking over about one-third of the creek below Otter Lake and failed to find any Umatilla Dace although several other species were collected (S. Pollard and G. Hanke, unpublished data). McPhail (2007) concluded that this population is probably extirpated for reasons unknown.

Similkameen River

During summer (August-September) surveys in 1992 of the Similkameen River, Peden and Orchard (1993) found that young-of-year and yearling dace were abundant, providing a strong indication of good reproductive success in the river. Furthermore, the authors concluded based on this study that Umatilla Dace were more abundant than previously known for this river, but were difficult to sample given access limitations. They found that the largest individuals tended to be females, which was also true for the US portion of the Kettle River (Peden and Hughes 1988). In 1995, a survey of 50 sites targeting a broad range of species in the Similkameen River watershed produced only two Umatilla Dace, and the fish was considered a rare species in the watershed (Rosenfeld 1996). Many of the sample sites, however, were unsuitable for the species or outside its known range within the watershed. A 2006 collection trip captured 35 Umatilla Dace in a single backwater area in the lower Similkameen River during very low flow conditions (G. Hanke, unpublished data), whereas under high flow conditions, only a few dace were collected in scattered locations including a few juveniles (G. Hanke, unpublished data). In conclusion, very little can be said about the status of the Similkameen River population except that recruitment appears to be successful, fish are still present at sites where they have been repeatedly sampled since the 1980s, and catchability may be affected by flow conditions.

Kettle River

Hughes and Peden (1989) reported Umatilla Dace in the Kettle River, but they were restricted to the short section downstream of Cascade Falls to the international border. Downstream of the border, they found a large reproducing population of

Umatilla Dace. As no breeding individuals were found in Canadian portions of the river (most fish collected were < 40 mm standard length), these authors concluded that a Canadian population may be unsustainable without recruitment from American waters downstream. Haas (1998) did not collect any specimens in the Kettle River below Cascade Falls in the late fall of 1995. Similarly, Umatilla dace were not found during field investigations between October 1999 and September 2002 in preferred habitats previously identified downstream of Cascade Falls (Powerhouse Developments Inc. 2003) although this project focused on sport fish (e.g., trout) presence. The current status of downstream (US) populations is undetermined. In conclusion, it is difficult to determine the current status of this population or degree to which immigration from U.S. populations may be sustaining it.

Columbia, Kootenay and Slocan Rivers

The greatest numbers of Umatilla Dace in Canada have been reported in the Columbia River and Kootenay River mainstems below Hugh Keenleyside Dam and Brilliant Dam, respectively. During studies in 1993-1994, dace species (Longnose Dace and Umatilla Dace) represented the largest percentage of fish species captured (i.e., 58.9% of total); of the dace identified to species level, Umatilla Dace represented 23.3% (R.L. & L. 1995).

The highest densities of Umatilla Dace in this section were reported in the lower portion of the Columbia River mainstem (i.e., sites >15 km downstream of Keenleyside Dam) (1.2 fish/m^2) and the lower Kootenay River (1.3 fish/m^2); whereas they were only infrequently reported in sections closer to Keenleyside Dam (R.L. & L. 1995). Density estimates varied with season, suggesting seasonal shifts in habitat use (R.L. & L. 1995). A more recent winter habitat study (October-March 2001/2002) in the Columbia River mainstem noted that densities of dace varied according to time of day and sampling methodology (snorkelling, electroshocking, overturning substrate) (AMEC 2003). Sampling fish by overturning rocks during the day produced the highest densities reflecting the nocturnal nature of the species. In the combined sampling effort of 2,257 minutes covering 24,620 m^2 of variable habitat, 200 dace were collected; however, this value included Longnose Dace (AMEC 2003). Most recently (2004), a study assessing ramping rates associated with water releases from Keenleyside Dam used juvenile Umatilla Dace as one of the main fish species to consider (Golder and Associates 2005). Thus, while population size and trends cannot be evaluated in this section of the Columbia drainage, the above study suggests that Umatilla Dace is still considered a dominant species here, with ongoing recruitment evident.

Upstream of Brilliant Dam, Umatilla Dace were found in both the Brilliant Dam and South Slocan Dam reservoirs during surveys conducted in 1987 (Hughes and Peden 1989). Another series of surveys (1990-1993, 1997) noted that Umatilla Dace had not been captured in Brilliant Dam reservoir since 1990 (R.L. & L. 1999). More recent observations in these reservoirs have not been reported; the current status of populations here is unknown.

In the Slocan River, confirmed reports of Umatilla Dace come from Peden and Hughes (1988), who collected more than 30 specimens during 1984-1987 from Slocan River just upstream of its confluence with Kootenay River (Royal BC Museum records), and McPhail (pers. comm. 2010) who collected fish farther upstream near Vallican, BC. Given the scarcity of survey data, no conclusions regarding the status of this population can be made.

Pend d'Oreille River

Hughes and Peden (1989) reported a single Umatilla Dace from the Pend d'Oreille River, collected near its confluence with the Salmo River. No other reports before or after this time are known, but given that the majority of habitat in Canada is now inundated due to the presence of several hydroelectric facilities, it may no longer be suitable for dace. No directed sampling efforts have been made in this area for the species; as such, conclusions cannot be drawn as to the status of the population here.

In summary across all localities, one population (Otter Creek) appears to be extirpated, another is probably extirpated (Pend d'Oreille River) and presence and abundance of Umatilla Dace in the other areas appear to be relatively stable and no clear trends are apparent.

Rescue effect

Most Canadian populations of Umatilla Dace are probably isolated from downstream US populations by dams limiting rescue to a large extent (Hughes and Peden 1989). The Similkameen River population is isolated from the lower US population by the presence of the Enloe Dam approximately 30 km downstream of the international border in Washington. The dam blocks upstream dispersal but before the dam was built, an impassable waterfall at this site was also likely a barrier to upstream movement. Umatilla Dace occur in the Okanagan River in Washington State below its junction with the Similkameen River. Dispersal into the Canadian portion of the Okanagan River is possible if conditions are favourable, but Umatilla Dace have not been confirmed in the river to date. In the Columbia River, the Grand Coulee Dam (built in 1942) approximately 243 km downstream of the international border prevents any upstream movement of dace. The extensive reservoir upstream of the dam impounds much of this 243 km stretch of river and may not be suitable for dace regardless of whether or not they could bypass the dam. The population in the Canadian portion of the Kettle River appears to be mainly juvenile fish and this population may be sustained by sizable populations in Washington State (Hughes and Peden 1989). The Kettle River enters the impounded Columbia River near Kettle Falls on Columbia River (in the US).

Finally, the status of Umatilla Dace anywhere in the Pend d'Oreille River is unknown and most of the river within Canada is now impounded. It is possible that an upstream population in the United States could pass downstream through the three dams (Waneta, Seven Mile and Boundary Dam) into the sections of river in Canada. In summary, rescue is probable on the Similkameen, Columbia and Kettle rivers but in all cases, is limited to varying degrees by the presence of downstream dams. It is also difficult to imagine a scenario where an impact resulting in the loss of a Canadian population would not also result in loss of some or all individuals in downstream populations in the United States. Finally, populations of Umatilla Dace in the US are classified as “Vulnerable” (defined as being in “imminent danger of becoming Threatened”) by the American Fisheries Society (Jelks *et al*. 2008) which compromises their potential rescue potential.

THREATS AND LIMITING FACTORS

Major hydroelectric facilities

The Columbia River has a long history of major hydroelectric development (see **Habitat trends** section). Dam construction results in considerable alteration of habitat including connectivity, water temperature, hydrology (flow) and water quality (clarity and sediment loading). Dams can result in increased fish mortality associated with entrainment, and indirect effects on fish via altered aquatic communities associated with altered hydrologic regime. Riverine species like Umatilla Dace have adapted to natural flow regimes. Artificial changes to flow delivery and temperature cues could affect breeding behaviour as well as survival, particularly of early developmental stages. Population fragmentation associated with dams can reduce or eliminate the potential for rescue from neighbouring populations. The following sections describe the greatest threats to Umatilla Dace in British Columbia associated with operation of hydroelectric facilities.

Stranding and scouring

Operational requirements of the dams on the Columbia River have resulted in unnatural flow ramping rates (i.e. rates of water level increase/decrease). In the case of Brilliant Dam, flow ramping or fluctuations can happen on a daily basis; slightly more stable conditions are associated with Hugh Keenleyside Dam where fluctuations tend to be on a weekly or monthly basis (D. DeRosa, pers. comm. 2009). Sudden changes in flow during June, July and August may disrupt spawning and reduce egg survival (McPhail 2001). Given that young-of-year and juvenile dace species in these systems prefer shallow waters along river margins and often hide under rocks, they are more at risk for interstitial stranding during reductions in water flow below certain flow thresholds as dictated by channel geometry (R.L. & L. 1995).

The combined flow regulation associated with Hugh Keenleyside Dam and Kootenay River hydro facilities may impact fish populations downstream (Golder Associates Ltd. 2005). This, in addition to a major stranding event below Hugh Keenleyside Dam in 2001, prompted a multi-year stranding study to determine vulnerability of various fish species, including Umatilla Dace, to ramping rates associated with changes in flow delivery. Two main conclusions based on these studies were: (1) Umatilla Dace are one of the dominant species in these shallow water habitats (i.e. sites with high wetted width to mean depth ratios) and are likely to be stranded during late winter and early spring flow reductions on the lower Kootenay and Columbia rivers, especially during the night; and (2) fish mortality associated with stranding was related to duration of exposure; mortality rapidly increased after five hours of exposure (Golder Associates Ltd. 2005). This seasonal variation in vulnerability may not seem consistent with suggested habitat preferences outlined (see **Habitat** section), but it should be noted that stranding studies have focused on shallow, nearshore habitats typically used by small juveniles. While Umatilla Dace made up a significant portion of the species composition (> 20%) in these studies, most fish were young (mean fork length was 39.4 mm with 23-65 mm range).

Similar concerns associated with hydroelectric facilities have been identified for fish populations in the Pend d'Oreille River. In particular, the reservoirs at both Waneta and Seven Mile dams experience large daily fluctuations in reservoir depths (can be up to several metres) (BC Hydro 2003). These factors may all have significant impacts on small fish like Umatilla Dace that utilize habitat along shorelines.

Stranding is one of the greatest concerns regarding dace populations downstream of the dams. Species like Umatilla Dace that use shallow water margins are particularly vulnerable to low flows that expose channel substrates, regardless of stream size. With respect to the threat of stranding, the Columbia/Kootenay system downstream of Hugh Keenleyside and Brilliant dams could be assessed as one or more locations depending on the timing of ramping schedules (P. Higgins, pers. comm. 2009). Stranding events in either river can result in some degree of stranding in the other due to the reliance of both rivers on backflow from the other river (D. DeRosa, pers. comm. 2009). In addition, stranding events in the Columbia River downstream of the Kootenay River confluence may occur if either the Kootenay River or Columbia River upstream of the confluence experienced stranding conditions (D. DeRosa, pers. comm. 2009). Ramping schedules, however, are not synchronized and may produce very different water level states for each river (P. Higgins, pers. comm. 2009).

Flooding

In addition to current facilities operating within the native range of Umatilla Dace, two additional hydroelectric projects are proposed for the Similkameen River immediately south of the international border (OSLRMP 2009). The first proposal involves ongoing efforts to re-license the Enloe Dam for power production. This dam was constructed on the Similkameen River approximately 30 km downstream of the international border in the early 1900s and decommissioned in 1958. The proposed Enloe Dam east bank redevelopment (submitted in the fall of 2008) would be a run-of-the-river facility that does not alter the existing conditions at the dam site. As such, it represents a low risk to resident fish species in the Canadian portion of the Similkameen River drainage, including Umatilla Dace (T. White, pers. comm. 2009).

The second proposal involves a dam 2.5 km upstream of the existing Enloe Dam site at a location commonly referred to as Shanker's Bend. Specifically, a preliminary permit was issued by the Federal Energy Regulatory Commission (FERC) in the United States to allow the study of three proposals for the construction of a water storage and hydroelectric dam at Shanker's Bend. Three configurations are being considered: a run-off-the-river project (dam height 35 m), a low height dam (48 m) and 80 m high dam. The 80 m proposal is the only option that would result in the inundation of part of the BC portion of the Similkameen River. At this height, the dam would result in the flooding of 3,650 hectares in BC, flooding the river upstream to about Cawston Creek (~24 km of river length in BC) and covering much of the known Umatilla Dace habitat in this river. The 48 m option would inundate the river to the international border, and the 35 m option would inundate a significantly shorter length of the river 17 km downstream of the border (T. White, pers. comm. 2009). All options will affect Umatilla Dace habitat south of the international border with varying impacts on the Canadian portion.

Non-native species interactions

The introduction of non-native fish species is extensive in southern British Columbia, including watersheds occupied by Umatilla Dace. For example, of the 43 fish species reported in the Columbia River Basin, 37% are considered non-native (Troffe 1999). Taylor (2004) indicated that the Columbia River ecoregion had the highest number (16) and proportion (38%) of exotic freshwater fishes in BC. Conversion of riverine habitat to lake-like conditions associated with reservoirs often puts native species at a disadvantage, and introduced visual predators such as Largemouth Bass (*Micropterus salmoides*), Smallmouth Bass (*M. dolomieu*), Yellow Perch (*Perca flavescens*) and Walleye (*Sander vitreus*) may flourish (e.g., Runciman and Leaf 2009).

In particular, Walleye appear to have increased significantly in abundance (~35-fold) in the Columbia and Kootenay rivers downstream of Keenleyside and Brilliant dams, respectively, between the 1980s and 1995 (R.L. & L. 1999). It is thought that the population has stabilized and now only shows minor annual fluctuations (J. Burrows, pers. comm. 2009). Regardless, Walleye population estimates in the Canadian portion of the river exceed 10,000 (Golder Associates Ltd. 2008) where historically there were none. Both juvenile and adult Walleye are piscivorous (Scott and Crossman 1973; McPhail 2007) and can reduce prey species of fish and cause large shifts in community composition (MacMahon and Bennett 1996). Walleye are not native to the Columbia River basin of British Columbia and are believed to have migrated north in transboundary waters from the United States where they were originally introduced. In the clear waters (resulting from dam operation) of the lower Columbia and Kootenay rivers, Walleye are likely highly effective predators (R.L. & L. 1999). The increase in Walleye since the 1980s coincides with the decreased abundance, over the same period, of several resident fish species that are utilized as prey by Walleye (R.L. & L. 1999). There is no reason to think that Umatilla Dace would not be prey to Walleye and, as mentioned, they have decreased in qualitative surveys during this period (R.L. & L. 1999).

Other non-native species such as Yellow Perch, Pumpkinseed Sunfish (*Lepomis gibbosus*), Bluegill Sunfish (*L. macrochirus*), Tench (*Tinca tinca*), Common Carp (*Cyprinus carpio*) and catfish (*Ameiurus spp*.) also find favourable habitat in impounded waters. All have the potential to impact native aquatic ecosystems and all have been reported within the Canadian range of Umatilla Dace (Taylor 2004; McPhail 2007).

Climate change and water use

A significant threat to riffle habitat specialists like the Umatilla Dace is surface water diversion and groundwater pumping during low flow months, particularly in areas where drought-like conditions are common. The Similkameen River and its tributaries occur in the Northern Cascade Ranges Ecoregion, a region characterized by some of the warmest, driest summers in British Columbia. A recent analysis of HYDAT water survey data (Environment Canada) over a 40 year time period suggested that almost all streams in this ecoregion are highly sensitive to any water withdrawal outside a short spring period when snowmelt increases discharge significantly (R. Ptolemy, unpublished data). During summer low flows, 11 of 20 water gauge sites on the Similkameen River mainstem and tributaries fell below 20% mean annual discharge (MAD) at a frequency of about once every other year ("1 of 2 yr frequency"); 20% MAD is the generic threshold at which riffle quality (depth-velocity) begins to be reduced below aquatic life needs (R. Ptolemy, unpublished data). In fact, during major droughts, some tributaries with high water demands run dry within the basin; however, the Similkameen River mainstem near Hedley maintains a summer baseflow of at least 18% MAD, with a record low of 8% MAD (R. Ptolemy, pers. comm. 2009). The Similkameen River drainage has long experienced conflicts for water between agriculture and the needs of aquatic life (Ptolemy 2009). The approximately 80 km stretch of the Similkameen River between Princeton and the US border already has an estimated 150 "points of diversion" for water extraction (iMAPBC 2010).

Problems for current and expanding demands for water along the Similkameen River valley will probably be exacerbated by climate change. A recent analysis of climate change indicators suggests that the Northern Cascade Ranges Ecoregion of British Columbia has seen an estimated 1.5-2.0^{o}C increase in annual temperature over the past century with increases occurring in all seasons, and this trend is predicted to continue (Rodenhuis *et al*. 2007). Also observed was a reduction in the average amount of snow on the ground on April 1 (snow Water Equivalent or SWE) over the past 50 years in many areas of southern British Columbia, depending on elevation and average temperature. Given that snowmelt runoff contributes 50-80% of total flow in snowmelt-dominated rivers like the Similkameen River, this variable will affect water levels significantly. A study examining water flows in the 1970s to those in the 1980s and 1990s for the Similkameen River basin noted that for later periods the snow melted earlier, summer flows were lower and summer low-flow periods lasted longer (Rae 2005). Combined, these observed trends are expected to lead to increased agricultural growth opportunities (associated with longer, warmer growing season), which will increase water demands and extend the period of drought conditions already predicted to increase (BC Ministry of Environment 1993; Rae 2005). In addition, the Development

Region of Thompson-Okanagan is expected to see continued growth in urban, residential, and industrial activities associated with a projected ~30% increase in population to 2036 (BCStats 2010). Thus, drought conditions as a function of the combined effects of climate change and human development will probably be more significant to Umatilla Dace in the near future.

Other limiting factors

Patchily-distributed populations of fish species at low densities, like Umatilla Dace, can be vulnerable to many different kinds of disturbances (Rosenfeld 1996). There are many factors in addition to those identified above that could have a negative impact on this species including: urbanization/development (e.g. Otter Creek) (Haas 1998); agricultural and industrial pollution (Haas 1998); channel modifications and forest harvest (Haas 1998). The land along the Similkameen River mainstem and low-elevation tributaries is mostly agricultural and urban, in addition to a major highway which follows much of the lower river. Higher-elevation tributaries are considered to have received medium to high impacts to fish habitat associated with forestry (Rae 2005). There is also a long history of mining in the immediate vicinity of the mainstem for gold, copper and platinum mostly around the turn of the twentieth century near Hedley, BC, although some limited mining continues (Rae 2005). Monitoring of water quality on the Similkameen River indicated that while drinking water standards were met for the period of 1979-1997, some metal concentrations were exceeded for aquatic life (Rae 2005). The largest non-ferrous lead and zinc smelter in the world has been in operation since 1896 in Trail, BC, a small, riverside city of 8,000 inhabitants on the Columbia River mainstem. This refinery has a long history of chemical leaks and contamination including extensive slag build-up downstream. The most recent chemical leak involved 950 kg of lead in an acid solution released into the Columbia River mainstem approximately 11 km north of the international border in May 2008 (reported in *Canadian Press*, May 30, 2008). While no fish kill was reported in this instance, there are major concerns on both sides of the international border that water and fish may be highly contaminated.

In British Columbia, a 25MW run-of-the-river dam has been approved for the Kettle River, 2 km south of Christina Lake, but it is still in the early development stage. This involves the use of a rubber dam above the Cascade Canyon which will have some significant upstream effects. It will create a backflow effect 750 m in length and a surface water elevation of 0.7 m higher at the dam than is present under natural conditions (Powerhouse Developments Inc. 2003). This project, however, is not expected to have any significant implications for fish habitat downstream of the dam (R. Ptolemy, pers. comm. 2009) and Umatilla Dace do not occur upstream of this site.

Independent power production (IPP) proposals have increased significantly in British Columbia in recent years due to a change in policy. The policy recognizes increasing power demands and adoption of “clean energy” options. These projects can range widely in magnitude of power generation, as well as potential to impact fish habitat. There should be minimal impacts to fish if IPPs are adequately designed to meet requirements under the Canada *Fisheries Act* and provincial *Water Act* including supporting regulations. They tend to be either run-of-river type projects with small impoundments involving a low weir to back water into penstocks. No IPPs are either in operation or approved stages within the range of Umatilla Dace as of 2007 (Independent Power Producers' Association 2007). There are, however, a number of high-gradient streams within the range of the Umatilla Dace that might be suitable (R. Ptolemy, pers. comm. 2009). Compliance and cumulative effects associated with multiple projects are difficult to evaluate in terms of potential risk to Umatilla Dace, however, as this initiative is still in its infancy.

Finally, it has been suggested that scientific over-sampling may be at least partially responsible for the extirpation of Umatilla Dace in Otter Creek (McPhail 2001).

ABORIGINAL TRADITIONAL KNOWLEDGE

The COSEWIC ATK Coordinator was contacted for advice on obtaining ATK for the report. As protocols for ATK are not yet in place no contacts were available to the report writer at the time of writing.

EXISTING PROTECTION, STATUS, AND RANKS

The Umatilla Dace was assessed in 1988 as Special Concern by COSEWIC. It was included on Schedule 3 of the *Species at Risk Act* (*SARA*) in 2004, which means that while it has no legal protection as yet, it was flagged as a species requiring re-assessment under COSEWIC qualitative criteria. It was re-examined and designated Threatened by COSEWIC in April 2010. The Umatilla Dace receives heightened consideration in water and land use planning in British Columbia. No prohibitions under *SARA* currently apply, however, and no management plan for the species has been developed. In the United States, the Umatilla Dace is not listed under the United Sates *Endangered Species Act*.

Non-legal status and ranks

The Umatilla Dace is recognized by the Natural Heritage Network and given a global rank of globally secure (G4) and a National Conservation Status Rank of N4 in the United States. Idaho and Oregon have given it a rank of SNR, while Washington ranks it as S2. It is listed as "Vulnerable" in the American Fisheries Society status of imperiled North American fishes (Jelks *et al*. 2008).

In Canada, Umatilla Dace hold a National Conservation Status Rank of N2. British Columbia has given the species a provincial conservation status rank of S2; and it is red listed (used for species considered threatened or endangered) provincially by the BC Conservation Data Centre.

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BIOGRAPHICAL SUMMARY OF REPORT WRITER

Susan Pollard received her M.Sc. from the University of Guelph in 1992 specializing in salmonid population genetics. She has worked for the Province of British Columbia for 12 years, first in the role of Fish Geneticist and, more recently, as the Aquatic Species at Risk Specialist. Both roles have required a solid foundation in conservation biology particularly as they apply to freshwater fisheries management. Susan is responsible for coordinating freshwater fish priorities for federal/provincial SAR planning purposes (including research and information needs, recovery activities and management planning), as well as ensuring the status of fish under provincial jurisdiction is correctly represented by the BC Conservation Data Centre. Susan has been a jurisdictional member of COSEWIC since 2006.

COLLECTIONS EXAMINED

All collections of Umatilla Dace held at the Royal Museum of British Columbia, Victoria, were assessed by Dr. Gavin Hanke to confirm database accuracy, specifically to confirm species identification (visually), number of specimens and location.