## Supplemental Information

## Web of Science search to determine the global distribution of cold-water refuge (CWR) literature

## To determine the global distribution of CWR literature (Figure S1), we did a search in the Web of Science database (WOS 2022). We queried peer-reviewed articles, book chapters, and proceeding papers from 1900 to 2022 with the following terms: “cold-water”, “cold water”, “thermal refuge”, “thermal refugia”, “fish”, “cold-water species”, “cold water species”. The following Web of Science categories were excluded from the analysis: Oceanography or Food Science Technology, Biotechnology Applied Microbiology, Microbiology or Agriculture Dairy Animal Science, Veterinary Sciences, Parasitology, Toxicology, Paleontology, Agricultural Engineering, Chemistry Analytical, Imaging Science Photographic Technology, Plant Sciences, and Biophysics. Although a large proportion of the research was published in English, we recognize that searching only in the English language may underrepresent research published in other languages.

WOS (2022). Web of Science (WOS) Core Collection (ver. 5.35): http://apps.webofknowledge.com Accessed 10.01.2022. Clarivate Analytics, London, UK.

Figure S1. Total percentage of cold-water refuge (CWR) literature in English by country. Locations of case studies are indicated with purple ovals and photographs. Map lines delineate study areas and do not necessarily depict accepted national boundaries.

## Map  Description automatically generated

**Text analysis**

Table S1. Environmental documents used to create the corpus for performing text mining analysis.

|  |  |  |  |
| --- | --- | --- | --- |
| Doc. no. | Case study | Document | URL (Uniform Resource Locator) |
| 1 | Columbia | Oregon state requirements of agricultural water quality management area plan and rules. Oregon Department of Agriculture, Chapter 603 - Division 90 Agricultural Water Quality Management Program | https://secure.sos.state.or.us/oard/viewSingleRule.action?ruleVrsnRsn=159715 |
| 2 | Columbia | Oregon state requirements of agricultural water quality management area plan and rules. Oregon Department of Agriculture, Chapter 603 - Division 95 Agricultural Water Quality Management Program | https://secure.sos.state.or.us/oard/viewSingleRule.action?ruleVrsnRsn=159878 |
| 3 | Columbia | Oregon state water protection rules: Purpose, goals, classification, and riparian management areas. Department of Forestry Chapter 629, Division 635 | https://secure.sos.state.or.us/oard/viewSingleRule.action?ruleVrsnRsn=162676 |
| 4 | Columbia | Oregon state water protection rules vegetation retention along streams. Department of Forestry Chapter 629 Division 642. | https://oregon.public.law/rules/oar\_chapter\_629\_division\_642 |
| 5 | Columbia | Oregon state water protection rules: riparian management areas and protection measures for significant wetlands. Department of Forestry Chapter 629 Division 645 | https://oregon.public.law/rules/oar\_chapter\_629\_division\_645 |
| 6 | Columbia | Oregon state water protection rules: riparian management areas and protection measures for significant lakes. Department of Forestry 629 Division 650 | https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=2874 |
| 7 | Columbia | Oregon state water protection rules: protection measures for "other wetlands", seeps and springs. Department of Forestry. Chapter 629 Division 655 | https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=2875 |
| 8 | Columbia | Oregon state water protection rules: specific rules for operations near waters of the state. Department of Forestry. Chapter 629 Division 660 | https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=2876 |
| 9 | Columbia | Oregon State Department of Environmental Quality Groundwater Quality Protection. Chapter 340. Division 40 | https://secure.sos.state.or.us/oard/viewSingleRule.action?ruleVrsnRsn=244160 |
| 10 | Columbia | Nadeau, T-L., D. Hicks, C. Trowbridge, N. Maness, R. Coulombe, N. Czarnomski. 2020. Stream Function Assessment Method for Oregon (SFAM, Version 1.1). Oregon Dept. of State Lands, Salem, OR, EPA 910-R-20-002, U.S. Environmental Protection Agency, Region 10, Seattle, WA. | https://www.oregon.gov/dsl/WW/Documents/SFAM-scientific-rationale-v1-1.pdf |
| 11 | Columbia | Oregon State Department of Environmental Quality water quality standards: beneficial uses, policies, and criteria for Oregon. Chapter 340 Division 41 | https://www.oregon.gov/deq/Regulations/Pages/OARDiv41.aspx |
| 12 | Columbia | Adamus, P., K. Verble, and M. Rudenko. 2016. Manual for the Oregon Rapid Wetland Assessment Protocol (ORWAP, revised). Version 3.1. Oregon Dept. of State Lands, Salem, OR. | https://www.oregon.gov/dsl/WW/Documents/ORWAP\_3\_1\_Manual\_Nov\_2016.pdf |
| 13 | Columbia | 2021-22 Oregon Fishing Regulations, Columbia Zone | https://www.eregulations.com/assets/docs/guides/22ORFW.pdf |
| 1 | Restigouche | Island Nature Trust (2005) Beneficial Management Practices for Riparian Zones in Atlantic Canada. Agriculture and Agri-Food Canada, Ottawa. | https://nsefp.ca/wp-content/uploads/2019/09/BMP-Atlantic-riparian\_zones.pdf |
| 2 | Restigouche | Canada Water Act | https://laws-lois.justice.gc.ca/eng/acts/c-11/index.html |
| 3 | Restigouche | Clean Water Act | https://www.canlii.org/en/nb/laws/stat/snb-1989-c-c-6.1/latest/snb-1989-c-c-6.1.html |
| 4 | Restigouche | Fish and fish habitat protection policy statement (2019) | https://www.dfo-mpo.gc.ca/pnw-ppe/policy-politique-eng.html |
| 5 | Restigouche | New Brunswick Coastal Areas Protection Policy | https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Water-Eau/CoastalAreasProtectionPolicy.pdf |
| 6 | Restigouche | New Brunswick Protocol for Wetland Delineation | https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Wetlands-TerreHumides/ProtocolForWetlandDelineation.pdf |
| 7 | Restigouche | New Brunswick Warm Water Protocol | https://0201.nccdn.net/4\_2/000/000/017/e75/warm-water-protocol-v5.0.pdf |
| 8 | Restigouche | New Brunswick Watercourse and Wetland Alteration | https://www.canlii.org/en/nb/laws/regu/nb-reg-90-80/latest/nb-reg-90-80.html |
| 9 | Restigouche | New Brunswick Watercourse and Wetland Permitting Guidelines | https://www.energy.gov/sites/prod/files/2015/06/f22/WWAPA.pdf |
| 10 | Restigouche | New Brunswick Wetland Ecosystem Services Protocol | https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Wetlands-TerreHumides/WetlandEcosystemServicesProtocol.pdf |
| 11 | Restigouche | New Brunswick Wetland Guidelines | https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Wetlands-TerreHumides/WetlandGuidelines.pdf |
| 12 | Restigouche | Quebec Environment Quality Act | http://www.legisquebec.gouv.qc.ca/en/document/cs/Q-2/ |
| 13 | Restigouche | Quebec Protection Policy for Lakeshores Riverbanks Littoral Zones and Floodplains | http://www.legisquebec.gouv.qc.ca/en/document/cr/Q-2,%20r.%2035 |
| 14 | Restigouche | Quebec Regulation respecting activities in wetlands, bodies of water and sensitive areas | http://www.legisquebec.gouv.qc.ca/en/document/cr/Q-2,%20r.%200.1 |
| 15 | Restigouche | Quebec Water Withdrawal and Protection Regulation | http://www.legisquebec.gouv.qc.ca/en/document/cr/Q-2,%20r.%2035.2#:~:text=The%20object%20of%20this%20Regulation,consumption%20or%20food%20processing%20purposes. |
| 16 | Restigouche | Species At Risk Act | https://laws.justice.gc.ca/eng/acts/S-15.3/ |
| 1 | Ovens | Australia Water Act 2007  | https://www.awe.gov.au/water/policy/policy/legislation/water-act-review |
| 2 | Ovens | Australia Water Amendment Act 2008 | https://www.legislation.gov.au/Details/C2008A00139 |
| 3 | Ovens | NECMA Ovens River Environmental Management Plan | https://www.water.vic.gov.au/\_\_data/assets/pdf\_file/0028/403939/Ovens-River-EWMP-Final-Report-3-July-2015.pdf |
| 4 | Ovens | NECMA Ovens River Management Summary | https://www.necma.vic.gov.au/Portals/0/necma\_ovens\_river\_newsletter\_s03.pdf |
| 5 | Ovens | North East Waterway Strategy 2014 | https://www.necma.vic.gov.au/Portals/0/files/Pdf/Plan%20Documents/North%20East%20Waterway%20Strategy%202014.pdf |
| 6 | Ovens | Upper Ovens River Water Supply Protection Area 2012 | https://www.g-mwater.com.au/downloads/gmw/Groundwater/Upper\_Ovens\_River\_WSPA\_Water\_Management\_Plan.pdf |
| 7 | Ovens | Victoria Heritage Rivers Act 1992 | http://www.environment.gov.au/epbc/notices/assessments/2010/5477/ref-2.pdf |
| 8 | Ovens | Pollution of Waters by Oil and Noxious substances Regulations | https://www.vgls.vic.gov.au/client/en\_AU/search/asset/1145735/0 |
| 9 | Ovens | Victoria Water Act- 1989 | http://classic.austlii.edu.au/cgi-bin/download.cgi/au/legis/vic/consol\_act/wa198983 |
| 10 | Ovens | Victoria Water Management Strategy 2013 | https://www.water.vic.gov.au/\_\_data/assets/pdf\_file/0019/52543/VWMS-Summary\_FINAL\_WEB-ready.pdf |
| 11 | Ovens | CSIRO (2008). Water availability in the Ovens. A report to the Australian Government from the CSIRO Murray-Darling BasinSustainable Yields Project. CSIRO, Australia. 100pp. | https://publications.csiro.au/rpr/download?pid=procite:2f8b4c76-21e1-4e3f-8429-d654527d661b&dsid=DS1 |
| 1 | Housatonic | Connecticut Chapter 440 Wetlands and Watercourses Act | https://www.cga.ct.gov/current/pub/chap\_440.htm |
| 2 | Housatonic | Connecticut Freshwater Fishing Regulations | https://portal.ct.gov/-/media/DEEP/fishing/anglers\_guide/2021-fishing-guide.pdf |
| 3 | Housatonic | Inland Wetlands and Water Courses Regulations of the Connecticut Department of Environmental Protection | https://eltownhall.com/wp-content/uploads/2020/07/Item-II-Exhibit-I-CT-DEEP-IWWR-22a-39.pdf |
| 4 | Housatonic | Connecticut Water Quality Standards CT\_wqs.pdf | https://www.epa.gov/sites/default/files/2014-12/documents/ctwqs.pdf |
| 1 | Rhône | Convention on Wetlands of International Importance especially as Waterfowl Habitat | https://www.ramsar.org/sites/default/files/documents/library/current\_convention\_text\_f.pdf |
| 2 | Rhône | Rhône Mediterranean Basin Water Development and Management Master Plan - Supplemental Information 2016-2021.pdf | https://www.Rhône-mediterranee.eaufrance.fr/sites/sierm/files/content/migrate\_documents/20151221-DocAccompagnement-2016-2021.pdf |
| 3 | Rhône | Rhône Mediterranean Basin Water Development and Management Master Plan - Program of Measures in Force.pdf | https://www.Rhône-mediterranee.eaufrance.fr/sites/sierm/files/content/migrate\_documents/20151221-PDM-RMed-2016-2021.pdf |
| 4 | Rhône | Rhône Mediterranean Basin Water Development and Management Master Plan - SDAGE | https://www.Rhône-mediterranee.eaufrance.fr/sites/sierm/files/content/migrate\_documents/20151221-SDAGE-RMed-2016-2021.pdf |
| 5 | Rhône | Presentation of Water Resources and Aquatic Environments Articles 1-44 (LOI 2006-1772) | https://www.legifrance.gouv.fr/loda/id/JORFTEXT000000649171/ |
| 6 | Rhône | Law for the recovery of biodiversity, nature and landscapes (LOI 2016-1087) | https://www.legifrance.gouv.fr/loda/id/JORFTEXT000033016237/ |
| 7 | Rhône | Council Directive 78/659/EEC of 18 July 1978 on the quality of fresh waters needing protection or improvement in order to support fish life (Lex 31978L0659) | https://eur-lex.europa.eu/legal-content/GA/TXT/?uri=CELEX%3A31978L0659 |
| 8 | Rhône | Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment (Lex 31991L0271) | https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A31991L0271 |
| 9 | Rhône | Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Lex 31992L0043) | https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31992L0043 |
| 10 | Rhône | Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Lex 32000L0060) | https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:32000L0060 |
| 11 | Rhône | Decision No 2455/2001/EC of the European Parliament and of the Council of 20 November 2001 establishing the list of priority substances in the field of water policy and amending Directive 2000/60/EC (Text with EEA relevance) Lex 32001D2455 | https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex:32001D2455 |
| 12 | Rhône | Good-quality water in Europe (EU water directive) Lex l28002b | https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Al28002b |
| 13 | Rhône | DIRECTIVE 2006/113/EC Of The European Parliament and of the Council December 12, 2006 on the required quality of shellfish waters (L\_2006376FR.01001401) | https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006L0113:FR:HTML |
| 14 | Rhône | Fishing Guide Area 69 Edition 2022 (Rhône) | http://www.peche69.fr/1985-guide-de-la-peche-69.htm |

Table S2. Words used to create the dictionary for word association analysis in the English and French languages. English words are black. French words are blue.

|  |  |
| --- | --- |
| **Keyword** | **Set of words**  |
| Temperature | temperatur\*, therm\*, températur\* |
| Warmwater | hot\*, warm\*,chaud\* |
| Coldwater | cold\*, cold water, coldwater, cool water, cool-water, froid\* |
| Confluence | tributary, confluence, plume, tributaire, confluence, plume |
| Pool | pool\*, fosse, mouille  |
| 1Spring and seep | seep, spring, springbrook, groundwater, source, infiltr, résurgence |
| 1Cold side channel | side channel, canal, latéral |
| 1Hyporheic upwelling | hyporhe\*, hyporhe\* |
| 1Alcove | alcove, alcôve |
| Salmonids  | salmon, brown, cutthroat, trout, rainbow, bull, Chinook, atlantic salmon, brook trout, saumon, brune, truite, arc-en-ciel, atlantique, omble, fardée, tête |
| 2Native fish | cod, perch |
| Refuge | refug\*, sanct\*, refug\* |

1Words that did not appear in most documents were removed from analysis.

2 Australia case study only.

Table S3. Frequency (fq) of the five most common words in each case study. The asterisk (\*) represents word stems (suffixes and prefixes have been removed). Case studies: Lower Columbia River in Oregon, USA (Columbia), Restigouche River in Quebec and New Brunswick, Canada (Restigouche), Upper Housatonic River in Connecticut, USA (Housatonic), streams within the Rhône basin in the Southeast of France (Rhône), and Ovens River in the Murray Darling basin (Ovens).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **rank** | **Columbia** | **Restigouche** | **Housatonic** | **Rhône** | **Ovens** |
|   | ***word*** | ***fq*** | ***word*** | ***fq*** | ***word*** | ***fq*** | ***word*** | ***fq*** | ***word*** | ***fq*** |
| 1 | water | 2243 | ministry | 1669 | water | 894 | d'eau (water) | 6729 | water | 8955 |
| 2 | area | 1354 | water | 1600 | fish | 772 | bon (good) | 4477 | act | 3544 |
| 3 | manag\* | 1164 | section | 1316 | regul\* | 507 | état (state) | 4406 | author | 2918 |
| 4 | use | 1143 | person | 1026 | trout | 501 | cour (heart) | 3512 | manag\* | 2417 |
| 5 | depart\* | 1090 | act | 929 | section | 498 | bassin (basin) | 2616 | river | 2402 |

Table S4. Frequency of keywords found in each document and percentage of keywords in text.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Doc. no** | **Case Study** | **Tem-perature** | **Warmwater** | **Cold-water** | **Confluence** | **Pool** | **Spring and seep** | **Salmonids** | **Ref-uge** | **Native fish** | **Word associations**  | **All tokens (words)** | **Percentage of keywords** |
| 1 | Columbia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | N | 5488 | 0.0 |
| 2 | Columbia | 6 | 2 | 1 | 0 | 1 | 4 | 8 | 1 | NA | Y | 66418 | 0.0 |
| 3 | Columbia | 1 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | NA | Y | 5071 | 0.1 |
| 4 | Columbia | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | NA | Y | 11047 | 0.0 |
| 5 | Columbia | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | NA | Y | 2187 | 0.6 |
| 6 | Columbia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | N | 1071 | 0.0 |
| 7 | Columbia | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | NA | Y | 467 | 1.7 |
| 8 | Columbia | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | Y | 565 | 0.2 |
| 9 | Columbia | 1 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | NA | Y | 16015 | 0.1 |
| 10 | Columbia | 9 | 0 | 5 | 0 | 12 | 7 | 4 | 1 | NA | Y | 52764 | 0.1 |
| 11 | Columbia | 144 | 11 | 13 | 0 | 0 | 0 | 23 | 1 | NA | Y | 3179 | 6.0 |
| 12 | Columbia | 11 | 8 | 0 | 0 | 7 | 8 | 25 | 2 | NA | Y | 43332 | 0.1 |
| 13 | Columbia | 4 | 0 | 0 | 0 | 11 | 0 | 10 | 7 | NA | Y | 1355 | 2.4 |
| 1 | Restigouche | 10 | 3 | 0 | 0 | 1 | 13 | 4 | 0 | NA | Y | 25986 | 0.12 |
| 2 | Restigouche | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | N | 20424 | 0.00 |
| 3 | Restigouche | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | NA | Y | 41009 | 0.00 |
| 4 | Restigouche | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | Y | 15661 | 0.01 |
| 5 | Restigouche | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | N | 3881 | 0.00 |
| 6 | Restigouche | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | NA | Y | 3691 | 0.03 |
| 7 | Restigouche | 228 | 32 | 0 | 0 | 7 | 5 | 138 | 5 | NA | Y | 8152 | 5.09 |
| 8 | Restigouche | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | N | 11193 | 0.00 |
| 9 | Restigouche | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | N | 1086 | 0.00 |
| 10 | Restigouche | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | N | 1325 | 0.00 |
| 11 | Restigouche | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | N | 1415 | 0.00 |
| 12 | Restigouche | 3 | 3 | 0 | 0 | 1 | 1 | 0 | 0 | NA | Y | 115759 | 0.01 |
| 13 | Restigouche | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | NA | N | 9076 | 0.01 |
| 14 | Restigouche | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | N | 11783 | 0.00 |
| 15 | Restigouche | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | NA | Y | 22614 | 0.02 |
| 16 | Restigouche | 0 | 4 | 0 | 0 | 0 | 10 | 34 | 3 | NA | Y | 77466 | 0.07 |
| 1 | Ovens | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | N | 224787 | 0.00 |
| 2 | Ovens | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | Y | 99453 | 0.01 |
| 3 | Ovens | 13 | 7 | 4 | 1 | 20 | 9 | 21 | 11 | 65 | Y | 33428 | 0.45 |
| 4 | Ovens | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | N | 1316 | 0.15 |
| 5 | Ovens | 1 | 6 | 1 | 0 | 6 | 12 | 32 | 27 | 76 | Y | 59361 | 0.27 |
| 6 | Ovens | 0 | 1 | 0 | 0 | 19 | 12 | 1 | 0 | 1 | Y | 53893 | 0.06 |
| 7 | Ovens | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | Y | 10678 | 0.01 |
| 8 | Ovens | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | Y | 143858 | 0.01 |
| 9 | Ovens | 1 | 0 | 0 | 0 | 0 | 29 | 0 | 0 | 0 | Y | 270476 | 0.01 |
| 10 | Ovens | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | Y | 4991 | 0.10 |
| 11 | Ovens | 0 | 9 | 0 | 0 | 1 | 16 | 0 | 0 | 1 | Y | 6118 | 0.44 |
| 1 | Housatonic | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | N | 30486 | 0.00 |
| 2 | Housatonic | 7 | 4 | 7 | 0 | 0 | 13 | 195 | 8 | NA | Y | 60120 | 0.38 |
| 3 | Housatonic | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | N | 10413 | 0.00 |
| 4 | Housatonic |  8 | 1 | 9 | 3 | 1 | 9 | 2 | 1 | NA | Y | 22322 | 0.12 |
| 1 | Rhône | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | N | 2648 | 0.00 |
| 2 | Rhône | 3 | 0 | 0 | 3 | 0 | 0 | 5 | 0 | NA | N | 88961 | 0.01 |
| 3 | Rhône | 3 | 0 | 0 | 53 | 0 | 1 | 0 | 6 | NA | N | 121779 | 0.05 |
| 4 | Rhône | 22 | 10 | 3 | 987 | 0 | 59 | 10 | 8 | NA | N | 251183 | 0.44 |
| 5 | Rhône | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | N | 8740 | 0.00 |
| 6 | Rhône | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | NA | N | 54745 | 0.01 |
| 7 | Rhône | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | NA | N | 2906 | 0.07 |
| 8 | Rhône | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | N | 4577 | 0.00 |
| 9 | Rhône | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | NA | N | 14733 | 0.03 |
| 10 | Rhône | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | NA | N | 28575 | 0.02 |
| 11 | Rhône | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | NA | N | 3208 | 0.03 |
| 12 | Rhône | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | N | 985 | 0.00 |
| 13 | Rhône | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | N | 3789 | 0.13 |
| 14 | Rhône | 0 | 0 | 0 | 10 | 0 | 0 | 2 | 0 | NA | N | 3964 | 0.30 |

Figure S2. Cosine similarity scores for case studies in (a) Lower Columbia River (USA), (b) Upper Housatonic River (USA), (c) Restigouche River (Canada), and (d) Ovens River (Australia).

