

Figure S1. Design of studies evaluated in the meta-analysis. The first design (I) followed an upstream-impoundment-downstream approach, where a system either included one (Ia) or multiple impoundments (Ib) and one (U_1 and D_1 , respectively) or several (U_n and D_n , respectively) up- and downstream sites. The second design (II) included at least two systems that are either paired (streams part of the same stream network; IIa) or unpaired (streams not part of the same stream network; IIb). The third type of studies followed a temporal approach that studied the effect of impoundment either before and after the establishment of an impoundment (IIIa) or before and after removal/collapse of a dam (IIIb). n_B and n_A give the number of effect ratios calculated for beaver and artificial systems, respectively.

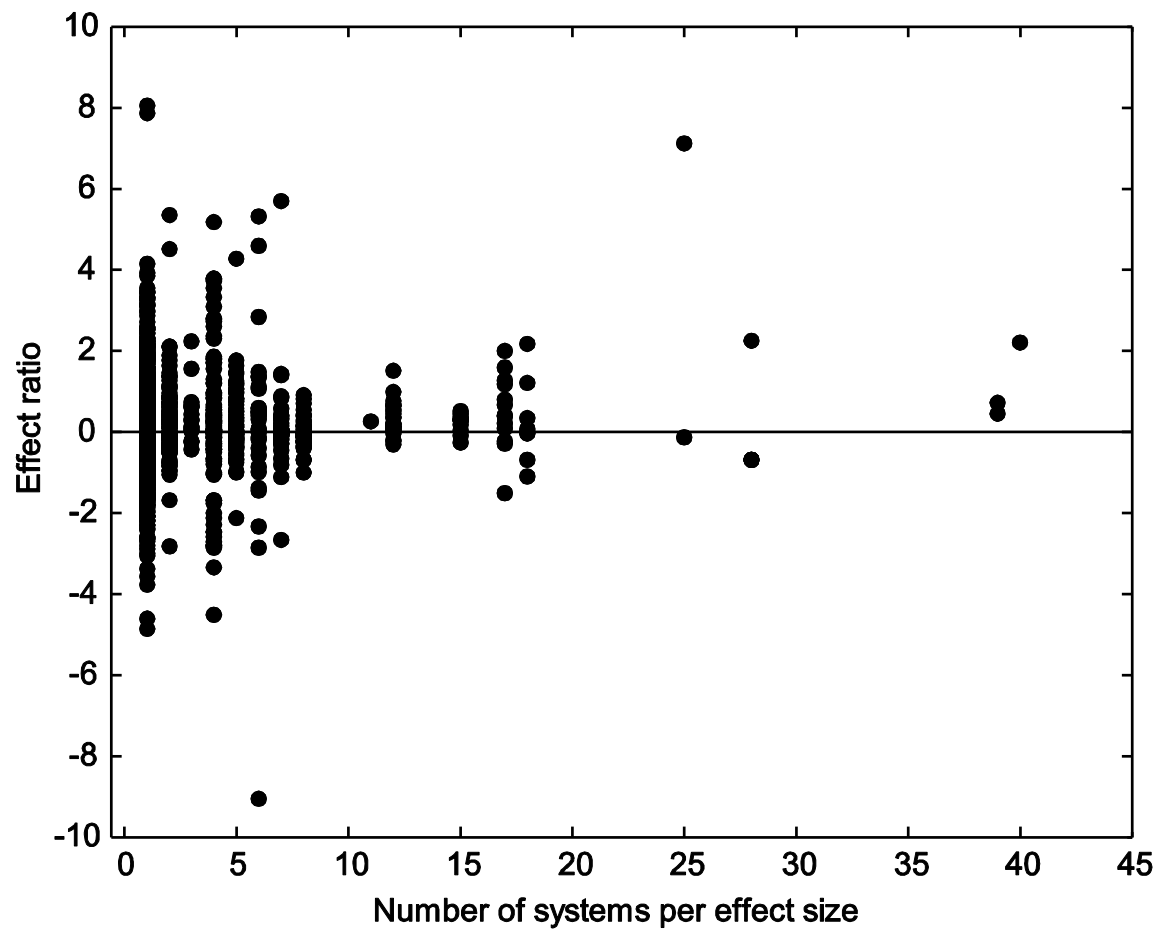


Figure S3. Funnel plot on the relationship between effect ratio and number of studied systems per effect size.

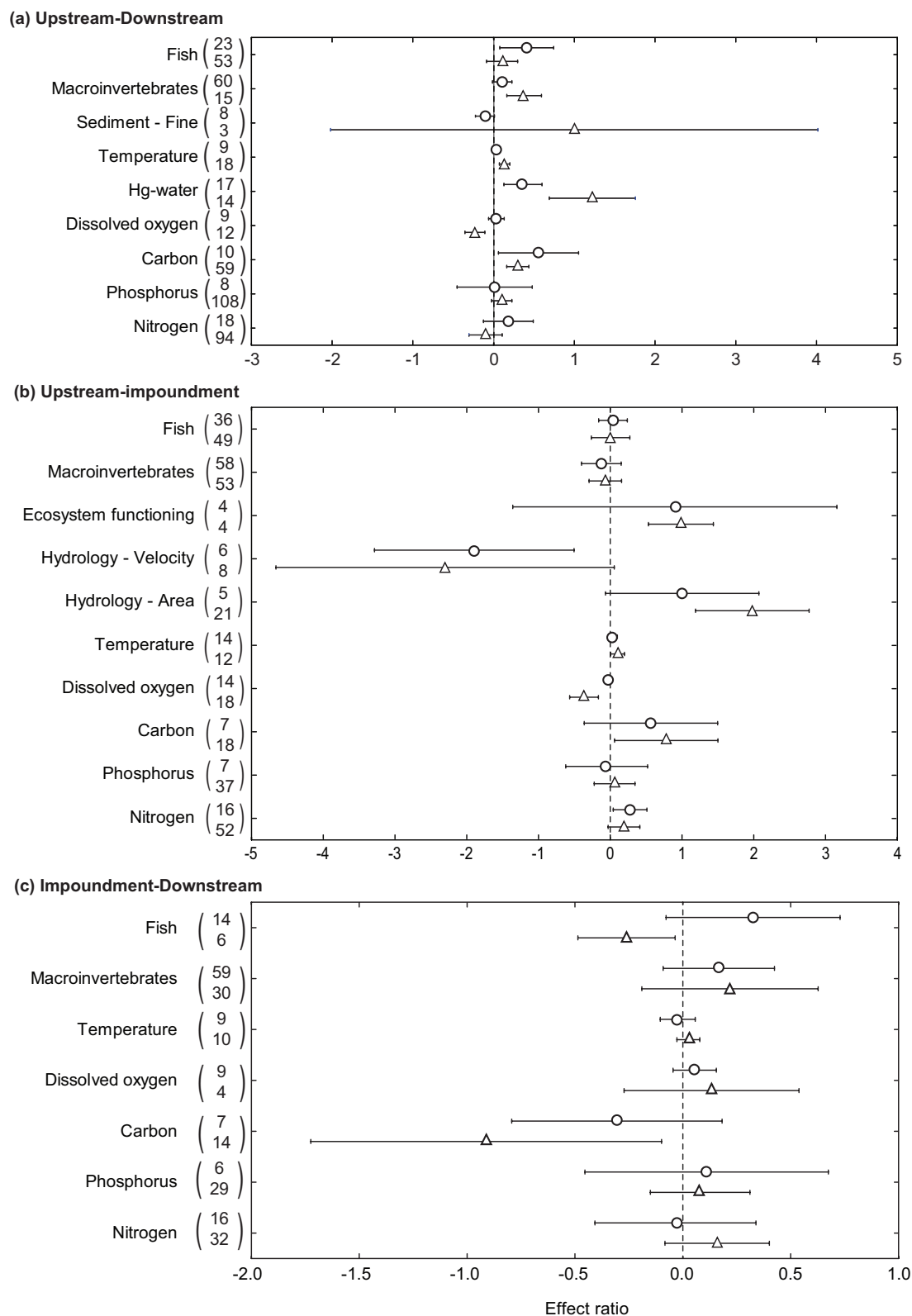


Figure S4. Effect ratios (means \pm 95 % CI) for the effect of damming by *C. fiber* (circles) and *C. canadensis* (triangles) on environmental factors and comparing (a) upstream with downstream sites (positive ratios indicate higher factor values downstream), (b) upstream/reference sites with impoundments (positive ratios indicate higher factor values downstream), and (c) impoundments with downstream sites (positive ratios indicate higher factor values downstream). The number of calculated effect ratios is given in parentheses.

Interpretation

The environmental effect of the two beaver species was similar for all studied factors except for dissolved oxygen and Hg in water when studying net effects (figure S4a). When comparing upstream/reference sites with impoundments, differences in dissolved oxygen were larger in systems with *C. canadensis* compared to *C. fiber* (figure S4b). The overall difference for dissolved oxygen and macroinvertebrates (figure 1(a)) were mainly due to the damming by *C. canadensis*, while the net effect for fish was mainly related to *C. fiber* (figure S4a). For carbon concentrations in water, the overall differences between impoundments and downstream sites (figure 1(c)) were more pronounced in *C. canadensis* systems, even though both system types showed the same trend (figure S4c).

It is however unclear if these identified differences are actually due to differences between the two species or if they are caused by differences between systems, i.e. environmental differences between North America and Eurasia. According to Parker et al. (2012) true differences in the ecological impact of the species can only be assessed in systems where both species are sympatric.

Reference

Parker H, Nummi P, Hartman G, Rosell F (2012) Invasive North American beaver *Castor canadensis* in Eurasia: a review of potential consequences and a strategy for eradication. *Wildlife Biology*, **18**, 354-365.

Table S2. Studies included in the meta-analysis divided by system type, studied beaver species and investigated environmental factors.

Reference	System type	Beaver species ¹	Factor ²
Agostinho AA <i>et al</i> (2007) Fish ladder of Lajeado Dam: migrations on one-way routes? Neotropical Ichthyology, 5,121-130.	Artificial		Fish
Alaoui-Mhai and Aleya (1995) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.	Artificial		P
Alaoui-Mhai <i>et al</i> (1996) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.	Artificial		P
Alexander MD (1998) Effects of beaver (<i>Castor canadensis</i>) impoundments on stream temperature and fish community species composition and growth in selected tributaries of Miramichi River, New Brunswick. Canadian Technical Report of Fisheries and Aquatic Sciences, 2227, i-ix, 1-4.	Beaver	CC	Fish, Temp.
Andersen DC and Shafroth PB (2010) Beaver dams, hydrological thresholds, and controlled floods as a management tool in a desert riverine ecosystem, Bill Williams River, Arizona Ecohydrology, 3, 325-338.	Beaver	CC	Hydrology
Anderson CB and Rosemond AD (2007) Ecosystem engineering by invasive exotic beavers reduces in-stream diversity and enhances ecosystem function in Cape Horn, Chile. Oecologia, 154, 141-153.	Beaver	CC	Carbon, DO, MI, N, Sediment, Temp.
Arndt E and Doej J (2011) Influence of beaver ponds on the macroinvertebrate benthic community in lowland brooks. Polish Journal of Ecology, 59, 799-811.	Beaver	CF	MI
Arroita M, Aristi I, Díez J, Martinez M, Oyarzun G and Elozegi A (2015) Impact of water abstraction on storage and breakdown of coarse organic matter in mountain streams. Science of the Total Environment, 503–504, 233-240.	Artificial		ES
Baldini UA, Oltremari AJ, and Ramirez M (2008) Impact of American beaver (<i>Castor canadensis</i> , Rodentia) in lenga (<i>Nothofagus pumilio</i>) forests of Tierra del Fuego, Chile. Bosque, 29, 162-169.	Beaver	CC	Dead wood

Reference	System type	Beaver species ¹	Factor ²
Bledzki LA, Bubier JL, Moulton LA and Kyker-Snowman TD (2011) Downstream effects of beaver ponds on the water quality of New England first- and second-order streams. <i>Ecohydrology</i> , 4, 698-707.	Beaver	CC	Carbon, DO, ES, N, P, Temp.
Bodaly RA and Fudge RJP (1999) Uptake of mercury by fish in an experimental boreal reservoir. <i>Archives of Environmental Contamination and Toxicology</i> , 37, 103-109.	Artificial		Hg-biota
Bodaly RAD, Jansen WA, Majewski AR, Fudge RJP, Strange NE, Derksen AJ and Green DJ (2007) Postimpoundment time course of increased mercury concentrations in fish in hydroelectric reservoirs of northern Manitoba, Canada. <i>Archives of Environmental Contamination and Toxicology</i> , 53, 379-89.	Artificial		Hg-biota
Brandl (1973) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR and Van Cappellen P (2015) Global phosphorus retention by river damming. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 112, 15603-15608.	Artificial		P
Brigault and Ruban (1999); Ruban and Demare (1998) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 112, 15603-15608.	Artificial		P
Brigham ME, Krabbenhoft DP, Olson ML, DeWild JF (2002) Methylmercury in flood-control impoundments and natural waters of northwestern Minnesota, 1997-99. <i>Water, Air and Soil Pollution</i> , 138, 61-78.	Artificial		Hg-water
Bromley CK and Hood GA (2013) Beavers (<i>Castor canadensis</i>) facilitate early access by Canada geese (<i>Branta canadensis</i>) to nesting habitat and areas of open water in Canada's boreal wetlands. <i>Mammalian Biology</i> , 78, 73-77.	Beaver	CC	Hydrology
Bubier JL, Moore TR and Roulet NT (1993) Methane Emissions from Wetlands in the Midboreal Region of Northern Ontario, Canada. <i>Ecology</i> , 2240-2254.	Beaver	CC	Methane
Burchsted D and Daniels MD (2014) Classification of the alterations of beaver dams to headwater	Beaver	CC	Sediment

Reference	System type	Beaver species ¹	Factor ²
streams in northeastern Connecticut, USA. <i>Geomorphology</i> , 205, 36-50.			
Burford <i>et al</i> (2012) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 112, 15603-15608.	Artificial		P
Bylak A, Kukula K and Mitka J (2014) Beaver impact on stream fish life histories: the role of landscape and local attributes. <i>Canadian Journal of Fisheries and Aquatic Sciences</i> 71, 1603-1615.	Beaver	CF	DO, Fish, N, P, Temp.
Chalar and Tundisi (2001) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 112, 15603-15608.	Artificial		P
Chiu M-C, Yeh C-H, Sun Y-H and Kuo M-H (2013) Short-term effects of dam removal on macroinvertebrates in a Taiwan stream. <i>Aquatic Ecology</i> , 47, 245-252.	Artificial		MI
Cirno CP and Driscoll CT (1993) Beaver pond biogeochemistry - acid neutralizing capacity generation in a headwater wetland. <i>Wetlands</i> , 13, 277-292.	Beaver	CC	C, DO, N, Temp.
Claeson SM and Coffin B (2015) Physical and Biological Responses to an Alternative Removal Strategy of a Moderate-Sized Dam in Washington, USA. <i>River Research and Applications</i> , 32, 1143-1152.	Artificial		MI
Colas F, Baudoin J-M, Chauvet E, Clivot H, Danger M, Guérol F, Devin S (2016) Dam-associated multiple-stressor impacts on fungal biomass and richness reveal the initial signs of ecosystem functioning impairment. <i>Ecological Indicators</i> , 60, 1077-1090.	Artificial		ES
Cook <i>et al</i> (2010) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 112, 15603-15608.	Artificial		P
Correll DL, Jordan TE and Weller DE (2000) Beaver pond biogeochemical effects in the	Beaver	CC	C, N, P

Reference	System type	Beaver species ¹	Factor ²
Maryland Coastal Plain. Biogeochemistry, 49, 217-239.			
Cunha <i>et al</i> (2014) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.	Artificial		P
Cunha <i>et al</i> (2014); Walker (1985) (Hejzlar) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.	Artificial		P
Curran JC and Cannatelli KM (2014) The impact of beaver dams on the morphology of a river in the eastern United States with implications for river restoration. Earth Surface Processes and Landforms, 39, 1236-1244.	Beaver	CC	Hydrology
De Visscher M, Nyssen J, Pontzele J, Billi P and Frankl A (2013) Spatio-temporal sedimentation patterns in beaver ponds along the Chevral river, Ardennes, Belgium. Hydrological Processes, 28, 1602-1615.	Beaver	CF	Hydrology, Sediment
Death RG, Dewson ZS, James ABW (2009) Is structure or function a better measure of the effects of water abstraction on ecosystem integrity? Freshwater Biology, 54, 2037-2050.	Artificial		ES
Devito KJ and PJ Dillon (1993) Importance of runoff and winter anoxia to the P and N dynamics of a beaver pond. Canadian Journal of Fisheries and Aquatic Sciences, 50, 2222-2234.	Beaver	CC	N, P
Dewson ZS, James ABW and Death RG (2007) Stream ecosystem functioning under reduced flow conditions. Ecological Applications, 17, 1797-1808.	Artificial		ES
Domagala J, Czerniawski R, Pilecka-Rapacz M and Kesminas V (2013) Do Beaver Dams on Small Streams Influence the Effects of Trout (<i>Salmo trutta trutta</i>) Stocking? Rocznik Ochrona Srodowiska, 15, 96-106	Beaver	CF	Fish
Donald <i>et al</i> (2015) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming.	Artificial		P

Reference	System type	Beaver species ¹	Factor ²
Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.			
Duras and Hejzlar (2001) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.	Artificial		P
Ford TE and Naiman RJ (1988) Alteration of carbon cycling by beaver: methane evasion rates from boreal forest streams and rivers. Canadian Journal of Zoology, 66, 529-533.	Beaver	CC	Methane
Fracz A and Chow-Fraser P (2013) Changes in water chemistry associated with beaver-impounded coastal marshes of eastern Georgian Bay. Canadian Journal of Fisheries and Aquatic Sciences, 70, 834-840.	Beaver	CC	C, N, P, ES
Francis MM, Naiman RJ and Melillo JM (1985) Nitrogen-fixation in subarctic streams influenced by beaver (<i>Castor-canadensis</i>). Hydrobiologia, 121, 193-202.	Beaver	CC	N, Sediment
French KJ, Anderson MR, Scruton DA and Ledrew LJ (1998) Fish mercury levels in relation to characteristics of hydroelectric reservoirs in Newfoundland, Canada. Biogeochemistry, 40, 217-233.	Artificial		Hg-biota
Fuller MR and Peckarsky BL (2011) Does the morphology of beaver ponds alter downstream ecosystems? Hydrobiologia, 668, 35-48.	Beaver	CC	N, P
Galicka (1992) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.	Artificial		P
Garnier <i>et al</i> (1999) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.	Artificial		P
Gehrke PC, Gilligan DM and Barwick M (2002) Changes in fish communities of the Shoalhaven River 20 years after construction of Tallowa Dam,	Artificial		Fish

Reference	System type	Beaver species ¹	Factor ²
Australia. River Research and Applications, 18, 265-286.			
Gerrard PM and St Louis VL (2001) The effects of experimental reservoir creation on the bioaccumulation of methylmercury and reproductive success of tree swallows (<i>Tachycineta bicolor</i>). Environmental Science & Technology, 35, 1329-1338.	Artificial		Hg-biota
Gibson PP, Olden JD, and O'Neill MW (2015) Beaver dams shift desert fish assemblages toward dominance by non-native species (Verde River, Arizona, USA). Ecology of Freshwater Fish, 24, 355-372.	Beaver	CC	Fish
Gillette <i>et al</i> (2016) Fish and benthic macroinvertebrate assemblage response to removal of a partially breached lowhead dam. River Research and Applications, 32, 1776-1789.	Artificial		MI
Giriat D, Gorczyca E, and Sobucki M (2016) Beaver ponds' impact on fluvial processes (Beskid Niski Mts., SE Poland). Science of the Total Environment, 544, 339-353.	Beaver	CF	Sediment
Grygoruk M and Nowak M (2014) Spatial and Temporal Variability of Channel Retention in a Lowland Temperate Forest Stream Settled by European Beaver (<i>Castor fiber</i>). Forests, 5, 2276-2288.	Beaver	CF	Hydrology
Hägglund A and Sjöberg G (1999) Effects of beaver dams on the fish fauna of forest streams. Forest Ecology and Management, 115, 259-266.	Beaver	CF	Fish
Hall BD, Cherewyk KA, Paterson MJ and Bodaly RA (2009) Changes in methyl mercury concentrations in zooplankton from four experimental reservoirs with differing amounts of carbon in the flooded catchments. Canadian Journal of Fisheries and Aquatic Sciences, 2009, 66, 1910-1919.	Artificial		Hg-biota
Hall BD, Rosenberg DM and Wiens AP (1998) Methyl mercury in aquatic insects from an experimental reservoir. Canadian Journal of Fisheries and Aquatic Sciences, 55, 2036-2047.	Beaver	CF	C, N, P, DO, Temp., Hydrology
Hall, BD, Louis VLS, Rolffhus KR, Bodaly RA, Beaty KG, Paterson MJ, Cherewyk KAP (2005) Impacts of Reservoir Creation on the Biogeochemical Cycling of Methyl Mercury and Total Mercury in Boreal Upland Forests. Ecosystems, 8, 248-266.	Artificial		Hg-water

Reference	System type	Beaver species ¹	Factor ²
Harkonen S (1999) Forest damage caused by the Canadian beaver (<i>Castor canadensis</i>) in South Savo, Finland. <i>Silva Fennica</i> , 33, 247-259.	Beaver	CC	Dead wood
Hart <i>et al</i> (2002) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 112, 15603-15608.	Artificial		P
Harthun M (2000) Influence of the damming-up by beavers (<i>Castor fiber albicus</i>) on physical and chemical parameters of highland brooks (Hesse, Germany). <i>Limnologica</i> , 30, 21-35.	Beaver	CF	C, DO, N, P, Temp., Hydro_Velo
Harthun M (1999) The influence of the European beaver (<i>Castor fiber albicus</i>) on the biodiversity (Odonata, Mollusca, Trichoptera, Ephemeroptera, Diptera) of brooks in Hesse (Germany). <i>Limnologica</i> , 29, 449-464.	Beaver	CF	MI
Hejzlar, unpublished extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 112, 15603-15608.	Artificial		P
Higgins and Kim (1981) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 112, 15603-15608.	Artificial		P
Hill AR and Duval TP (2009) Beaver dams along an agricultural stream in southern Ontario, Canada: their impact on riparian zone hydrology and nitrogen chemistry. <i>Hydrological Processes</i> , 23, 1324-1336.	Beaver	CC	N, DO, Hydrology
Holmquist JG, Schmidt-Gengenbach JM and Yoshioka BB (1998) High dams and marine-freshwater linkages: Effects on native and introduced fauna in the Caribbean. <i>Conservation Biology</i> , 12, 621-630.	Artificial		Fish
Hood GA and Bayley SE (2008) Beaver (<i>Castor canadensis</i>) mitigate the effects of climate on the area of open water in boreal wetlands in western Canada. <i>Biological Conservation</i> , 141, 556-567.	Beaver	CC	Hydrology
Hood GA, Larson DG (2015) Ecological engineering and aquatic connectivity: a new	Beaver	CC	Hydrology

Reference	System type	Beaver species ¹	Factor ²
perspective from beaver-modified wetlands. <i>Freshwater Biology</i> , 60, 198-208.			
Hood WG (2012) Beaver in Tidal Marshes: Dam Effects on Low-Tide Channel Pools and Fish Use of Estuarine Habitat. <i>Wetlands</i> , 32, 401-410.	Beaver	CC	Hydrology, Fish
Hood, GA and Larson DG (2014) Beaver-Created Habitat Heterogeneity Influences Aquatic Invertebrate Assemblages in Boreal Canada. <i>Wetlands</i> , 34, 19-29.	Beaver	CC	MI
Huguet L, Castelle S, Schafer J, Blanc G, Maury-Brachet R, Reynouard C and Jorand F (2010) Mercury methylation rates of biofilm and plankton microorganisms from a hydroelectric reservoir in French Guiana. <i>Science of the Total Environment</i> , 408, 1338-1348.	Artificial		Hg-biota
Hylander LD, Grohn J, Tropp M, Vikstrom A, Wolpher H, Silva EDE, Meili M and Oliveira LJ (2006) Fish mercury increase in Lago Manso, a new hydroelectric reservoir in tropical Brazil. <i>Journal of Environmental Management</i> , 81, 155-166.	Artificial		Hg-biota
Hyvonen T and Nummi P (2008) Habitat dynamics of beaver <i>Castor canadensis</i> at two spatial scales. <i>Wildlife Biology</i> , 14, 302-308.	Beaver	CC	Hydrology
James and Barko (1997) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 112, 15603-15608.	Artificial		P
Jin L, Siegel DI, Lautz LK and Otz MH (2009) Transient storage and downstream solute transport in nested stream reaches affected by beaver dams. <i>Hydrological Processes</i> , 23, 2438-2449.	Beaver	CC	Hydrology
John S and Klein A (2004) Hydrogeomorphic effects of beaver dams on floodplain morphology: avulsion processes and sediment fluxes in upland valley floors (Spessart, Germany). <i>Quaternaire</i> , 15, 219-231.	Beaver	CF	Hydrology
Johnston CA (2014) Beaver pond effects on carbon storage in soils. <i>Geoderma</i> , 213, 371-378.	Beaver	CC	Sediment
Kasper D, Palermo EFA, Branco CWC and Malm O (2012) Evidence of elevated mercury levels in carnivorous and omnivorous fishes downstream from an Amazon reservoir. <i>Hydrobiologia</i> , 694, 87-98.	Artificial		Hg-biota

Reference	System type	Beaver species ¹	Factor ²
Kelly CA, Rudd JWM, Bodaly RA, Roulet NP, StLouis VL, Heyes A, Moore TR, Schiff S, Aravena R, Scott KJ, Dyck B, Harris R, Warner B and Edwards G (1997) Increases in Fluxes of Greenhouse Gases and Methyl Mercury following Flooding of an Experimental Reservoir. Environmental Science & Technology, 31, 1334-44.	Artificial		Hg-water
Kesminas V, Steponenas A, Pliuraite V, and Virbickas T (2013) Ecological Impact of Eurasian Beaver (<i>Castor fiber</i>) Activity on Fish Communities in Lithuanian Trout Streams. Rocznik Ochrona Srodowiska, 15, 59-80.	Beaver	CF	DO, Temp., Hydrology, Fish
Kil HK and Bae YJ (2012) Effects of low-head dam removal on benthic macroinvertebrate communities in a Korean stream. Animal Cells and Systems, 16, 69-76.	Artificial		MI
Klotz RL (1998) Influence of beaver ponds on the phosphorus concentration of stream water. Canadian Journal of Fisheries and Aquatic Sciences, 55, 1228-1235.	Beaver	CC	P, Sediment
Klotz RL (2010) Reduction of High Nitrate Concentrations in a Central New York State Stream Impounded by Beaver. Northeastern Naturalist, 17, 349-356.	Beaver	CC	N
Kroes DE and Bason CW (2015) Sediment-trapping by Beaver Ponds in Streams of the Mid-Atlantic Piedmont and Coastal Plain, USA. Southeastern Naturalist, 14, 577-595.	Beaver	CC	C
Kulmbusch, TAJ and Zepp RG (1999) Carbon trace gases in lake and beaver pond ice near Thompson, Manitoba, Canada. Journal of Geophysical Research-Atmospheres, 104, 27693-27698.	Beaver	CC	C, Methane
LaBaugh (1985) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.	Artificial		P
LaBaugh and Winter (1984) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.	Artificial		P

Reference	System type	Beaver species ¹	Factor ²
Lasne E, Sabatie MR, Jeannot N, and Cucherousset J (2015) The Effects of Dam Removal on River Colonization by Sea Lamprey <i>Petromyzon marinus</i> . River Research and Applications, 31, 904-911.	Artificial		Fish
Law A, McLean F and Willby NJ (2016) Habitat engineering by beaver benefits aquatic biodiversity and ecosystem processes in agricultural streams. Freshwater Biology, 61, 486-499.	Beaver	CF	C, N, P, Hydrology, ES, MI
Le Thi Phuong <i>et al</i> (2010) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.	Artificial		P
Leidholtbruner K, Hibbs DE and McComb WC (1992) Beaver dam locations and their effects on distribution and abundance of Coho salmon fry in 2 coastal Oregon streams. Northwest Science, 66, 218-223.	Beaver	CC	Fish
Levanoni O, Bishop K, McKie BG, Hartman G, Eklöf K and Ecke F (2015) Impact of Beaver Pond Colonization History on Methylmercury Concentrations in Surface Water. Environmental Science & Technology, 49, 12679-12687.	Beaver	CF	C, N, P, DO, Hg-water, Temp., ES
Levine R and Meyer GA (2014) Beaver dams and channel sediment dynamics on Odell Creek, Centennial Valley, Montana, USA. Geomorphology, 205, 51-64.	Beaver	CC	Hydrology, Sediment
Li SX, Zhou LF, Wang HJ, Xiong MH, Yang Z, Hu JX, Liang YG and Chang JB (2013) Short-term impact of reservoir impoundment on the patterns of mercury distribution in a subtropical aquatic ecosystem, Wujiang River, southwest China. Environmental Science and Pollution Research, 20, 4396-404.	Artificial		Hg-water
Little AM, Guntenspergen GR, and Allen TFH (2012) Wetland vegetation dynamics in response to beaver (<i>Castor canadensis</i>) activity at multiple scales. Ecoscience, 19, 246-257.	Beaver	CC	Hydrology
Lizarralde MS (1993) Current Status of the Introduced Beaver (<i>Castor canadensis</i>) Population in Tierra-Del-Fuego, Argentina. Ambio, 22, 351-358.	Beaver	CC	Dead wood
Lodenius M, Seppänen A and Herranen M (1983) Accumulation of mercury in fish and man from	Artificial		Hg-biota

Reference	System type	Beaver species ¹	Factor ²
reservoirs in Northern Finland. <i>Water, Air, and Soil Pollution</i> , 19, 237-246.			
Majerova M, Neilson BT, Schmadel NM, Wheaton JM and Snow CJ (2015) Impacts of beaver dams on hydrologic and temperature regimes in a mountain stream. <i>Hydrology and Earth System Sciences</i> , 19, 3541-3556.	Beaver	CC	Temp., Hydrology
Maloney KO, Dodd HR, Butler SE and Wahl DH (2008) Changes in macroinvertebrate and fish assemblages in a medium-sized river following a breach of a low-head dam. <i>Freshwater Biology</i> , 53, 1055-1068.	Artificial		MI
Maret TJ, Parker M and Fannin TE (1987) The effect of beaver ponds on the nonpoint source water-quality of a stream in Southwestern Wyoming. <i>Water Research</i> , 21, 263-268.	Beaver	CC	C, N, P
Margolis BE, Castro MS and Raesly RL (2001) The impact of beaver impoundments on the water chemistry of two Appalachian streams. <i>Canadian Journal of Fisheries and Aquatic Sciences</i> , 58, 2271-2283.	Beaver	CC	C, N, Temp.
Margolis BE, Raesly RL and Shumway DL (2001) The effects of beaver-created wetlands on the benthic macroinvertebrate assemblages of two Appalachian streams. <i>Wetlands</i> , 21, 554-563.	Beaver	CC	MI
Martínez A, Larrañaga A, Basaguren A, Pérez J, Mendoza-Lera C and Pozo J (2013) Stream regulation by small dams affects benthic macroinvertebrate communities: from structural changes to functional implications. <i>Hydrobiologia</i> , 711, 31-42.	Artificial		ES
Mazuer D, Williams RJ, Wen L, Saintilan N and Walsh CT (2016) Impoundment constraint of fish niche diversity in a temperate Australian river. <i>Hydrobiologia</i> , 771, 195-206.	Artificial		Fish
Mbaka JG and Schäfer RB (2016) Effect of Small Impoundments on Leaf Litter Decomposition in Streams. <i>River Research and Applications</i> , 32, 907-913.	Artificial		ES
McCaffery M and Eby L (2016) Beaver activity increases aquatic subsidies to terrestrial consumers. <i>Freshwater Biology</i> , 61, 518-532	Beaver	CC	MI
Meentemeyer RK and Butler DR (1999) Hydrogeomorphic effects of beaver dams in Glacier	Beaver	CC	Hydrology

Reference	System type	Beaver species ¹	Factor ²
National Park, Montana. Physical Geography, 20, 436-446.			
Mendoza-Lera C, Larrañaga A, Pérez J, Descals E, Martínez A, Moya O, Arostegui I and Pozo J (2012) Headwater reservoirs weaken terrestrial-aquatic linkage by slowing leaf-litter processing in downstream regulated reaches. River Research and Applications, 28, 13-22.	Artificial		ES
Menéndez M, Descals E, Riera T and Moya O (2012) Effect of small reservoirs on leaf litter decomposition in Mediterranean headwater streams. Hydrobiologia, 691, 135-146.	Artificial		ES
Miranda and Matvienko (2003) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.	Artificial		P
Montgomery S, Lucotte M and Rheault I (2000) Temporal and spatial influences of flooding on dissolved mercury in boreal reservoirs. Science of the Total Environment, 260, 147-157.	Artificial		Hg-water
Moorman MC, Eggleston DB, Anderson CB, Mansilla A and Szejner P (2009) Implications of Beaver <i>Castor canadensis</i> and Trout Introductions on Native Fish in the Cape Horn Biosphere Reserve, Chile. Transactions of the American Fisheries Society, 138, 306-313.	Beaver	CC	Fish
Muehlbauer JD, Leroy CJ, Lovett JM, Flaccus KK, Vlieg JK and Marks JC (2009) Short-term responses of decomposers to flow restoration in Fossil Creek, Arizona, USA. Hydrobiologia, 618, 35-45.	Artificial		MI
Naiman RJ, Manning T and Johnston CA (1991) Beaver population fluctuations and tropospheric methane emissions in boreal wetlands. Biogeochemistry, 12, 1-15.	Beaver	CC	Methane
Nyssen J, Pontzele J and Billi P (2011) Effect of beaver dams on the hydrology of small mountain streams: Example from the Chevral in the Ourthe Orientale basin, Ardennes, Belgium. Journal of Hydrology, 402, 92-102.	Beaver	CF	Hydrology
Orr CH, Kroiss SJ, Rogers KL and Stanley EH (2008) Downstream benthic responses to small dam removal in a coldwater stream. River Research and Applications, 24, 804-822.	Artificial		MI

Reference	System type	Beaver species ¹	Factor ²
Ortiz and Pena (1984) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.	Artificial		P
Oskam (1995) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.	Artificial		P
Painter KJ, Westbrook CJ, Hall BD, O'Driscoll NJ and Jardine TD (2015) Effects of in-channel beaver impoundments on mercury bioaccumulation in Rocky Mountain stream food webs. Ecosphere 6, Article 194.	Beaver	CC	C, N, P, Hg-water, Hg-biota
Peczula W and Szczurowska A (2013) Long-term changes in phytoplankton in a humic lake in response to the water level rising: the effects of beaver engineering on a freshwater ecosystem. Knowledge and Management of Aquatic Ecosystems, 410, 67-79.	Beaver	CF	P, ES, Hydrology
Pliuraite V and Kesminas V (2012) Ecological impact of Eurasian beaver (<i>Castor fiber</i>) activity on macroinvertebrate communities in Lithuanian trout streams. Central European Journal of Biology, 7, 101-114.	Beaver	CF	DO, Temp., MI
Pollard AI and Reed T (2004) Benthic invertebrate assemblage change following dam removal in a Wisconsin stream. Hydrobiologia, 513, 51-58.	Artificial		MI
Pomogyi (1993) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.	Artificial		P
Pompeu PS, Nogueira LB, Godinho HP and Martinez CB (2011) Downstream passage of fish larvae and eggs through a small-sized reservoir, Mucuri River, Brazil. Zoologia, 28, 739-746.	Artificial		Fish
Ponsatí L, Acuña V, Aristi I, Arroita M, García-Berthou E, Von Schiller D, Elozegi A and Sabater S (2015) Biofilm Responses to Flow Regulation by Dams in Mediterranean Rivers. River Research and Applications, 31, 1003-1016.	Artificial		ES

Reference	System type	Beaver species ¹	Factor ²
Porvari P (1998) Development of fish mercury concentrations in Finnish reservoirs from 1979 to 1994. <i>Science of the Total Environment</i> , 213, 279-290.	Artificial		Hg-biota
Ramirez-Zierold <i>et al</i> (2010) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 112, 15603-15608.	Artificial		P
Renöfält BM, Lejon AGC, Jonsson M and Nilsson C (2013). Long-term taxon-specific responses of macroinvertebrates to dam removal in a mid-sized Swedish stream. <i>River Research and Applications</i> , 29, 1082-1089.	Artificial		MI
Rolauffs P, Hering D and Lohse S (2001) Composition, invertebrate community and productivity of a beaver dam in comparison to other stream habitat types. <i>Hydrobiologia</i> , 459, 201-212.	Artificial		MI
Roy V, Amyot M and Carignan R (2009) Seasonal methylmercury dynamics in water draining three beaver impoundments of varying age. <i>Journal of Geophysical Research-Biogeosciences</i> 114.	Beaver	CC	C, N, DO, Hg-water
Roy V, Amyot M and Carignan R (2009). Beaver Ponds Increase Methylmercury Concentrations in Canadian Shield Streams along Vegetation and Pond-Age Gradients. <i>Environmental Science & Technology</i> , 43, 5605-5611.	Beaver	CC	C, N, P, DO, Temp., Hg-water
Rydin <i>et al</i> (2008) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 112, 15603-15608.	Artificial		P
Salvia-Castelvi <i>et al</i> (2001) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 112, 15603-15608.	Artificial		P
Sas H (1989) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 112, 15603-15608.	Artificial		P

Reference	System type	Beaver species ¹	Factor ²
Schreiber and Rausch (1979) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.	Artificial		P
Sigourney DB, Letcher BH and Cunjak RA (2006) Influence of beaver activity on summer growth and condition of age-2 Atlantic salmon parr. Transactions of the American Fisheries Society, 135, 1068-1075.	Beaver	CC	Fish
Skinner QD, Speck JE, Smith M and Adams JC (1984) Stream water-quality as influenced by beaver within grazing systems in Wyoming. Journal of Range Management, 37, 142-146.	Beaver	CC	ES
Smith ME, Driscoll CT, Wysłowski BJ, Brooks CM and Cosentini CC (1991) Modification of stream ecosystem structure and function by beaver (<i>Castor canadensis</i>) in the Adirondack Mountains, New York. Canadian Journal of Zoology, 69, 55-61.	Beaver	CC	C, N, DO, Temp.
Snodgrass JW and Meffe GK (1998) Influence of beavers on stream fish assemblages: Effects of pond age and watershed position. Ecology, 79, 928-942.	Beaver	CC	DO, Hydrology, Fish
Snodgrass JW and Meffe GK (1999) Habitat use and temporal dynamics of blackwater stream fishes in and adjacent to beaver ponds. Copeia, 628-639.	Beaver	CC	Fish
St.Louis VL, Rudd JWM, Kelly CA, Bodaly RA, Paterson MJ, Beaty KG, Hesslein RH, Heyes A and Majewski AR (2004) The Rise and Fall of Mercury Methylation in an Experimental Reservoir. Environmental Science & Technology 2004, 38, 1348-1358.	Artificial		Hg-water
Stanley EH, Luebke MA, Doyle MW and Marshall DW (2002) Short-term changes in channel form and macro invertebrate communities following low-head dam removal. Journal of the North American Benthological Society, 21, 172-187.	Artificial		MI
Stock JD and Schlosser IJ (1991) Short-term effects of a catastrophic beaver dam collapse on a stream fish community. Environmental Biology of Fishes, 31, 123-129.	Beaver	CC	Fish
Syphard AD and Garcia MW (2001) Human- and beaver-induced wetland changes in the Chickahominy River watershed from 1953 to 1994. Wetlands, 21, 342-353.	Beaver	CC	Hydrology

Reference	System type	Beaver species ¹	Factor ²
Taylor BR, Macinnis C and Floyd TA (2010) Influence of rainfall and beaver dams on upstream movement of spawning Atlantic salmon in a restored brook in Nova scotia, Canada. River Research and Applications, 26, 183-193.	Beaver	CC	Fish
Teodoru and Wehrli (2005) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.	Artificial		P
Thompson S, Vehkaoja M and Nummi P (2016) Beaver-created deadwood dynamics in the boreal forest. Forest Ecology and Management, 360, 1-8.	Beaver	CC	Dead wood
Thomson JR, Hart DD, Charles DF, Nightengale TL and Winter DM (2005). Effects of removal of a small dam on downstream macroinvertebrate and algal assemblages in a Pennsylvania stream. Journal of the North American Benthological Society, 24, 192-207.	Artificial		MI
Thornton and Ashton (1989) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. Proceedings of the National Academy of Sciences of the United States of America, 112, 15603-15608.	Artificial		P
Tremblay A and Lucotte M (1997) Accumulation of total mercury and methyl mercury in insect larvae of hydroelectric reservoirs. Canadian Journal of Fisheries and Aquatic Sciences, 54, 832-841.	Artificial		Hg-biota
Tremblay A, Cloutier L and Lucotte M (1998) Total mercury and methylmercury fluxes via emerging insects in recently flooded hydroelectric reservoirs and a natural lake. Science of the Total Environment 1998, 219, 209-221.	Artificial		Hg-biota
Tremblay A, Lucotte M and Rheault I (1996) Methylmercury in a benthic food web of two hydroelectric reservoirs and a natural lake of Northern Quebec (Canada). Water Air and Soil Pollution, 91, 255-269.	Artificial		Hg-biota
Tullos DD, Finn DS and Walter C (2014) Geomorphic and Ecological Disturbance and Recovery from Two Small Dams and Their Removal. Plos One, 9, e108091.	Artificial		MI
Tuomola L, Niklasson T, Silva EDE and Hylander LD (2008) Fish mercury development in relation to	Artificial		Hg-biota

Reference	System type	Beaver species ¹	Factor ²
abiotic characteristics and carbon sources in a six-year-old, Brazilian reservoir. <i>Science of the Total Environment</i> , 390, 177-187.			
Turner <i>et al</i> (1983) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 112, 15603-15608.	Artificial		P
Ulloa E, Anderson CB, Ardon M, Murcia S and Valenzuela AEJ (2012) Organic matter characterization and decomposition dynamics in sub-Antarctic streams impacted by invasive beavers. <i>Latin American Journal of Aquatic Research</i> , 40, 881-892.	Beaver	CC	C, DO, ES, MI
Vani <i>et al</i> (2011) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 112, 15603-15608.	Artificial		P
Vehkaoja M, Nummi P, Rask M, Tulonen T and Arvola L (2015) Spatiotemporal dynamics of boreal landscapes with ecosystem engineers: beavers influence the biogeochemistry of small lakes. <i>Biogeochemistry</i> , 124, 405-415.	Beaver	CC	C, N, P, DO
Verdon R, Brouard D, Demers C, Lalumiere R, Laperle M and Schetagne R (1991) Mercury evolution (1978–1988) in fishes of the La Grande hydroelectric complex, Quebec, Canada. <i>Water, Air and Soil Pollution</i> , 56, 405-417.	Artificial		Hg-biota
Virbickas T, Stakenas S and Steponenas A (2015) Impact of Beaver Dams on Abundance and Distribution of Anadromous Salmonids in Two Lowland Streams in Lithuania. <i>Plos One</i> , 10, e0123107.	Beaver	CF	Fish
Wagner (1996) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 112, 15603-15608.	Artificial		P
Walker (1985) extracted from Maavara T, Parsons CT, Ridenour C, Stojanovic S, Duerr HH, Powley HR, Van Cappellen P (2015) Global phosphorus retention by river damming. <i>Proceedings of the</i>	Artificial		P

Reference	System type	Beaver species ¹	Factor ²
National Academy of Sciences of the United States of America, 112, 15603-15608.			
Wanner SC, Ockenfeld K, Brunke M, Fischer H and Pusch M (2002) The distribution and turnover of benthic organic matter in a lowland river: influence of hydrology, seston load and impoundment. <i>River Research and Applications</i> , 18, 107-122.	Artificial		ES
Westbrook CJ, Cooper DJ and Baker BW (2006) Beaver dams and overbank floods influence groundwater-surface water interactions of a Rocky Mountain riparian area. <i>Water Resources Research</i> , 42, W06404.	Beaver	CC	Hydro_Area
Yao H, Feng XB, Guo YN, Yan HY, Fu XW, Li ZG and Meng B (2011) Mercury and methylmercury concentrations in two newly constructed reservoirs in the Wujiang river Guizhou, China. <i>Environmental Toxicology and Chemistry</i> , 30, 530-537.	Artificial		Hg-water
Yavitt JB, Angell LL, Fahey TJ, Cirimo CP and Driscoll CT (1992) Methane fluxes, concentrations, and production in 2 Adirondack beaver impoundments. <i>Limnology and Oceanography</i> , 37, 1057-1066.	Beaver	CC	Methane
Yavitt JB, Lang GE and Sexstone AJ (1990) Beaver impoundments in temperate forests as sources of atmospheric CO ₂ . <i>Journal of Geophysical Research-Atmospheres</i> , 95, 22463-22474.	Beaver	CC	Methane

¹ CC *C. canadensis*, CF *C. fiber*

² C Carbon, DO Dissolved oxygen, ES Ecosystem functioning, Hydro_Area Hydrology – Area, Hydro_Velo Hydrology – Velocity, MI Macroinvertebrates, N Nitrogen, P Phosphorous, Temp. Temperature