

# Curriculum Vitae

Guillaume Guénard

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## Interests

- Modelling the outcomes of spatial, temporal, and phylogenetic processes in aquatic ecology (lakes, rivers, wetlands and shores), ecotoxicology and ecohydraulics, and using that knowledge to make predictions.
- Developing of computational methods and making them available to people as (open-source) computer software.
- Estimation of bioenergetics and behaviour in space and time using, for example, video-cameras, chemical tracers, etc.
- Development and validation of field sampling material and methods.

ResearchGate

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## Work experience

**Biologist II [2022-09 – *nunc*]** Fisheries and Océans Canada, Institut Maurice-Lamontagne, Mont-Joli QC, Canada – Fish and Fish Habitat Protection, Regulatory review, Regional Ecosystems Management Branch – Mining projects. – Supervisor(s): Simon Trépanier

**Aquatic biologist II [2020-09 – 2021-05]** Fisheries and Océans Canada, Institut Maurice-Lamontagne, Mont-Joli QC, Canada – Project SPERA: valuation of data sets from commercial stock assessment surveys towards ecosystem-based modelling. – Supervisor(s): Cédric Juillet

**Research agent [2017-09 – 12, 2019-07 – 2020-09]** Département de sciences biologiques, Université de Montréal, Montreal QC, Canada – Development in numerical ecology: artificial intelligence and remote sensing to take up the challenges of observational ecology; reticulated trait evolution for species and ecosystem conservation, paleontology, and ecotoxicology. – Supervisor(s): Pierre Legendre

**Project leader in environmental modelling [2016-01 – 2017-09, 2018-01 – 2019-07]** Environment and Climate Change Canada, Canadian Weather Service, Hydrology and Ecohydraulics Section, Quebec City QC, Canada – Development of numerical habitat models to assess the impact of river flow management practices on animal and plant species. – Supervisor(s): Jean Morin

**Research Associate [2015-05 – 2016-01]** Département de sciences biologiques, Université de Montréal, Montreal QC, Canada – Development of multiple species and spatially-explicit fish habitat models to assess the influence of hydro-electric dam operation on freshwater fishes. – Supervisor(s): Daniel Boisclair & Pierre Legendre

**Post-doctoral fellow [2013-03 – 2015-04]** Département de sciences biologiques, Université de Montréal, Montreal QC, Canada – Development and evaluation of analysis methods in phylogenetics modelling and landscape genetics. – Supervisor(s): Daniel Boisclair

**Post-doctoral fellow [2010-05 – 2013-02]** Département de sciences biologiques, Université de Montréal, Montreal QC, Canada – Development and evaluation of analysis methods in phylogenetics modelling and landscape genetics. – Supervisor(s): Pierre Legendre

**Post-doctoral fellow [2008-04 – 2010-03]** Université Paul-Sabatier, Toulouse, France– Development and application of methods to incorporate spatial and phylogenetic processes in assessing the impact of toxic stress on aquatic community structure and biodiversity. Involved in a European research training network (Keybioeffects) whose goal is to study the relationships between key pollutants on the biodiversity of European rivers. – Supervisor(s): Sovanarath Lek

**Field work assistant [1999-05 – 08]** Département de sciences biologiques, Université de Montréal, Montréal QC, Canada – Sampling the distribution of juvenile Atlantic salmon and physical habitat variables in Les Escoumins River (QC, Canada). The purpose of that study was to model the effect of fluctuating water flow on the availability of suitable habitat for juvenile Atlantic salmon. – Supervisor(s): Daniel Boisclair

**Field work assistant [1998-05 – 08]** Département de sciences biologiques, Université de Montréal, Montréal QC, Canada – Sampling the daytime and nighttime distribution of fish communities inhabiting three lakes of the Laurentian region (QC, Canada), and post-processing the data. The purpose of that study was to quantify the influence of the moon phase on the intensity of the daily onshore-offshore fish migrations across different communities. – Supervisor(s): Daniel Boisclair

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## Education

**2008-08 — Doctor of Philosophy (*Ph. D.*) in Biology** Université de Montréal – Thesis: Utilisation de l'énergie chez l'omble chevalier (*Salvelinus alpinus*): importance relative des mécanismes dépendants de la densité, de la diversité intra-spécifique et de la présence de compétiteurs. *English*: Bioenergetics of Arctic charr (*Salvelinus alpinus*): relative importance of density-dependant mechanisms, among-populations diversity, and inter-specific competition (LINK). Director: Daniel Boisclair

**2002-01 — Master of science (*M. Sc.*) in Biology** Université de Montréal – Transferred to a *Ph. D.* program. Director: Daniel Boisclair

**2000-05 — Bachelor of science (*B. Sc.*) in Biology** Université de Montréal

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## Achievements (see the last section for exhaustive listings)

**Articles** Publication of **20** articles (**14** as a first author) in **15** peer-reviewed scientific journals: Canadian Journal of Fisheries and Aquatic Sciences, Ecography, Ecohydrology, Ecological Applications, Ecology, Ecophere, Ecosphere, Ecotoxicology and Environmental Safety, Estuarine Coastal and Shelf Science, Journal of Fish Biology, Journal of Statistical Software, Limnology and Oceanography: Methods, Methods in Ecology and Evolution, Proceedings of the Royal Society B: Biological Sciences, and Systematic Biology; with contributions from a total of **34** fellow scientists.

**Presentations** **24** authored conference presentations (in English and French; **17** as the speaker) in **13** national and international symposia: American Fisheries Society Annual Meeting, Biophysical Coupling Workshop of the Great Lakes Fisheries Commission, Canadian Conference for Fisheries Research, Canadian Society for Ecology and Evolution, Ecological Society of America (ESA) Annual Conference, Ecological Society of America / INTECOL joint meeting, Final Modelkey conference, International Rainy-Lake of the Woods Watershed Forum, International Symposium for Toxicity Assessment, ISE Ecohydraulics conference, Keybioeffect workshop, Symposium du Groupe de Recherche Inter-universitaire en Limnologie, and Symposium of the Society for Environmental Toxicology and Chemistry; with contributions from a total of **22** fellow scientists.

**Research report** **5** research reports published by different institutions and outlets (Département de sciences biologiques, Hydrology and Ecohydraulics Section, Environment and Climate Change Canada, NINA Temahefte, Science Advisory Secretariat Research Document, and Water Quality Monitoring and Surveillance Division, Environment and climate changes Canada).

**Software** contribution in **5** R language packages; maintainer for **3** of them (constr.hclust, MPSEM, and codep).

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## Awards

NSERC Postgraduate Scholarship D (2003-05 – 2005-04; 21 000 \$/a)

NSERC Postgraduate Scholarship M (2000-05 – 2002-04; 19 500 \$/a)

NSERC Undergraduate research student award (1999-05 – 08; 5 000 \$)

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## Teaching experience

**2002 – 2006** Chief laboratory/field work instructor (BIO-2476: Ichthyology) – Université de Montréal, Montreal, Canada *Laboratory lecture/instruction, organization and supervision of the laboratory and field works. Supervision of instructor teams (4 to 6 persons). Preparing and correcting examinations.* Supervisor(s): Daniel Boisclair

**2002 – 2003** Chief laboratory instructor (BIO-1434: Zoology) – Université de Montréal, Montreal, Canada *Laboratory lecture/instruction, organization and supervision of the laboratory works. Supervision of instructor teams (3 to 4 persons). Preparing and correcting examinations.* Supervisor(s): Bernard Angers

**2000** Laboratory instructor (BIO-1334: Phycology, Mycology, and Botany and BIO-1154: Cell Biology) – Université de Montréal, Montreal, Canada *Assisting undergraduate students in their laboratory works, correcting works and examinations.*

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## Professional activities, qualifications, and services

- Programming (C/C++, R); development of R package (used for statistical analysis), including computer code (R, C/C++) and documentation; implementation and usage of relational databases using MySQL. I am familiar with POSIX compliant operating systems (e.g. Linux, MacOS X, Unix).
  - Electronics: designing circuits and printed circuit boards (Eagle CAD), programming controller boards (Arduino environment <http://www.arduino.cc/>), self construction of personal computers from separate components, using Computer Assisted Design (CAD) software, 3D printing.
  - Organization comity member for the “15<sup>ième</sup> Symposium du Département de Sciences Biologiques de l’Université de Montréal” (Biology department symposium: 60 oral presentations) 27 Jan. 2005.
  - President of the Association des Étudiants Chercheurs en Biologie de l’Université de Montréal (AECBUM; english: Association of Student Researchers in Biology), Oct. 2002 – Sept. 2003.
  - Scientific adviser and treasurer of the Société des Amis du Biodôme de Montréal (SABM; Biodôme de Montréal is a zoological garden devoted to ecosystems, website, Sept. 2000 – August 2002.
  - Scuba diver certifications (CMAS since 15-05-2000, PADI Lake since 17-03-2000).
  - Class 5 (car) driver license (Québec, since 1993).
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# List of achievements

## Peer-reviewed journal articles

- Guénard, G. & Legendre, P. 2022. *Hierarchical Clustering with Contiguity Constraint in R*. Journal of Statistical Software 103(7): 1–26 doi: 10.18637/jss.v103.i07
- Guénard, G., Morin, J., Matte, P., Secretan, Y., Valiquette E. & Mingelbier, M. 2020. *Deep learning habitat modeling for moving organisms in rapidly changing estuarine environments: A case of two fishes*. Estuarine Coastal and Shelf Science 238(106713): 1–10 doi: 10.1016/j.ecss.2020.106713
- Guénard, G. & Legendre, P. 2018. *Bringing multivariate support to multiscale codependence analysis: assessing the drivers of community structure across spatial scales*. Methods in Ecology and Evolution 9(2): 292–304 doi: 10.1111/2041-210X.12864
- Guénard, G., Lanthier, G., Harvey-Lavoie, S., Macnaughton, C. J., Senay, C., Lapointe, M., Legendre, P. & Boisclair, D. 2017. *Modelling habitat distribution for multiple species using phylogenetics*. Ecography 40(9): 1088–1097 doi: 10.1111/ecog.02423
- Harvey-Lavoie, S., Cooke, S. J., Guénard, G. & Boisclair, D. 2016. *Differences in movements of northern pike inhabiting rivers with contrasting flow regimes*. Ecohydrology 9(8): 1687–1699 doi: 10.1002/eco.1758
- Guénard, G., Lanthier, G., Harvey-Lavoie, S., Macnaughton, C. J., Senay, C., Lapointe, M., Legendre, P. & Boisclair, D. 2016. *A spatially-explicit assessment of the fish population response to flow management in a heterogeneous landscape*. Ecosphere 7(e01252): 1–13 doi: 10.1002/ecs2.1252
- Legendre, L. J., Guénard, G., Botha-Brink, J. & Cubo, J. 2016. *Palaeohistological evidence for ancestral endothermy in Archosaurs*. Systematic Biology 65(6): 989–996 doi: 10.1093/sysbio/syw033
- Majal, E., Guénard, G., Schäfer, R. B. & von der Ohe, P. C. 2016. *Evolutionary patterns and physicochemical properties explain macroinvertebrate sensitivity to heavy metals*. Ecological Applications 26(4): 1249–1259 doi: 10.1890/15-0346
- Guénard, G., Boisclair, D. & Legendre, P. 2015. *Phylogenetics to help predict active metabolism*. Ecosphere 6(62): 1–11 doi: 10.1890/ES14-00479.1
- Guénard, G., von der Ohe, P. C., Walker, S. C., Lek, S. & Legendre, P. 2014. *Using phylogenetic information and chemical properties to predict species tolerances to pesticides*. Proceedings of the Royal Society B: Biological Sciences 281(20133239): 1–9 doi: 10.1098/rspb.2013.3239
- Guénard, G., Legendre, P. & Peres-Neto, P. 2013. *Phylogenetic eigenvector maps (PEM): a framework to model and predict species traits using directed graphs*. Methods in Ecology and Evolution 4(12): 1120–1131 doi: 10.1111/2041-210X.12111
- Guénard, G., Boisclair, D., Ugedal, O., Forseth, T., Flemming, I. A. & Jonsson, B. 2012. *The bioenergetics of density-dependent growth in Arctic char*. Canadian Journal of Fisheries and Aquatic Sciences 69(10): 1651–1662 doi: 10.1139/F2012-093
- Guénard, G., Boisclair, D., Ugedal, O., Forseth, T., Flemming, I. A. & Jonsson, B. 2012. *An experimental study of the multiple effects of brown trout, *Salmo trutta*, on the bioenergetics of two Arctic char, *Salvelinus alpinus*, morphs*. Journal of Fish Biology 81(4): 1248–1270 doi: 10.1111/j.1095-8649.2012.03414.x
- Walker, S. C., Guénard, G., Sólymos, P. & Legendre, P. 2012. *Multiple-Table Data in R with the multitable Package*. Journal of Statistical Software 51(8): 1–38 doi: 10.18637/jss.v051.i08
- Guénard, G., von der Ohe, P. C., de Zwart, D., Legendre, P. & Lek, S. 2011. *Using phylogenetic information to predict tolerance to toxic chemicals*. Ecological Applications 21(8): 3178–3190 doi: 10.1890/10-2242.1

- Guénard, G., Legendre, P., Boisclair, D. & Bilodeau, M. 2010. *Multiscale codependence analysis: an integrated approach to analyse relationships across scales*. Ecology 91(10): 2952–2964 doi: 10.1890/09-0460.1
- Guénard, G., Boisclair, D., Ugedal, O., Forseth, T., Flemming, I. A. & Jonsson, B. 2010. *Bioenergetic and behavioural differences between two morphologically distinct Arctic charr populations*. Canadian Journal of Fisheries and Aquatic Sciences 67(3): 580–595 doi: 10.1139/F10-004
- Shinn, C., Dauba, F., Grenouillet, G., Guénard, G. & Lek, S. 2009. *Temporal Variation of Heavy Metal Contamination in Fish of the River Lot in Southern France*. Ecotoxicology and Environmental Safety 72(7): 1957–1965 doi: 10.1016/j.ecoenv.2009.06.007
- Guénard, G., Boisclair, D., Ugedal, O., Forseth, T. & Jonsson, B. 2008. *Comparison between activity estimates obtained using bioenergetic and behavioural analyses*. Canadian Journal of Fisheries and Aquatic Sciences 65(8): 1705–1720 doi: 10.1139/F08-080
- Chidami, S., Guénard, G. & Amyot, M. 2007. *Underwater infrared video system for behavioral studies in lakes*. Limnology and Oceanography: Methods 5(10): 571–578 doi: 10.4319/lom.2007.5.371

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## Authored conference presentations

- Morin, J., Bachand, M., Guénard, G. & Werick, B. 2017. *An ecosystem-friendly rule curve for the Rainy-Namakan system*. International Rainy-Lake of the Woods Watershed Forum – International Falls, MN, USA
- Guénard, G., Lanthier, G., Harvey-Lavoie, S., Macnaughton, C. J., Senay, C., Lapointe, M., Legendre, P. & Boisclair, D. 2017. *Community-wide habitat modelling with phylogenetic and spatial eigenvector maps: river fishes distribution*. Canadian Conference for Fisheries Research – Montreal, QC, Canada
- Guénard, G., Harvey-Lavoie, S., Macnaughton, C. J., Senay, C. & Boisclair, D. 2015. *Cartographie de l'effet de différents régimes de débit sur la densité et la diversité des poissons*. Symposium du Groupe de Recherche Inter-universitaire en Limnologie – St-Hypolite, QC, Canada
- Guénard, G., Harvey-Lavoie, S., Macnaughton, C. J., Senay, C. & Boisclair, D. 2014. *Assessing the effect of flow regimes on fish density*. American Fisheries Society Annual Meeting – Quebec City, QC, Canada
- Harvey-Lavoie, S., Guénard, G., Wheeland, L., Cooke, S. J. & Boisclair, D. 2014. *Modelling northern pike habitat selection in a river subject to hydropowering*. ISE Ecohydraulics conference – Trondheim, Norway
- Boisclair, D., Cooke, S. J., McLaughlin, R. & Guénard, G. 2014. *An ecosystemic approach to assess the effects of flow modifications related to hydropower on fish populations*. ISE Ecohydraulics conference – Trondheim, Norway
- Boisclair, D., Cooke, S. J., McLaughlin, R. & Guénard, G. 2013. *A framework to assess the consequences of the fragmentation of aquatic ecosystems on fisheries productivity*. Biophysical Coupling Workshop of the Great Lakes Fisheries Commission – Huron, Ohio, USA
- Guénard, G., Walker, S. C., von der Ohe, P. C. & Legendre, P. 2013. *Phylogenetics to help predicting fish swimming costs*. Canadian Conference for Fisheries Research – Windsor, ON, Canada
- Guénard, G., Walker, S. C., von der Ohe, P. C. & Legendre, P. 2012. *Predicting the tolerance of animal species to chemical using phylogenetics and linear solvation energy parameters*. Symposium of the Society for Environmental Toxicology and Chemistry – Long Beach, CA, USA
- Guénard, G., von der Ohe, P. C., Walker, S. C. & Legendre, P. 2012. *Adding phylogenetic information to predicting tolerance to chemicals*. Canadian Conference for Fisheries Research – Moncton, NB, Canada

- Walker, S. C., Guénard, G. & Legendre, P. 2011. *Community ecology with multiple data tables: the interface between data management and analysis*. Ecological Society of America (ESA) Annual Conference – Austin, TX, USA
- Guénard, G., Walker, S. C., von der Ohe, P. C. & Legendre, P. 2011. *Predicting tolerance to pesticides using phylogeny and compound properties*. Symposium du Groupe de Recherche Inter-universitaire en Limnologie – St-Hypolite, QC, Canada
- Faggiano, L., Guénard, G., Gevrey, M. & Lek, S. 2010. *Improving data sampling for better ecosystem diagnostic*. Keybioeffect workshop – Girona, Spain
- Guénard, G., von der Ohe, P. C. & Lek, S. 2009. *A spatially-explicit assessment of pollutants impact and macro-invertebrates diversity and community structure in Danube river*. Final Modelkey conference – Leipzig, Germany
- Guénard, G., von der Ohe, P. C. & Lek, S. 2009. *Spatial correspondence of chemical status and macro-invertebrates diversity in Danube river*. Symposium of the Society for Environmental Toxicology and Chemistry – New-Orleans, LA, USA
- Guénard, G., de Zwart, D., von der Ohe, P. C. & Lek, S. 2009. *Predicting sensitivity to pollutants using molecular characters*. International Symposium for Toxicity Assessment – Metz, France
- Guénard, G. & Boisclair, D. 2008. *Différences morphologiques, comportementales chez deux populations d'omble chevalier et leurs impact sur la croissance, la consommation et l'activité*. Symposium du Groupe de Recherche Inter-universitaire en Limnologie – Harrington, QC, Canada
- Guénard, G. & Boisclair, D. 2008. *Differences in morphology, energy budget, and activity patterns between arctic charr from two contrasting populations*. Canadian Conference for Fisheries Research – Halifax, NS, Canada
- Chidami, S., Guénard, G. & Amyot, M. 2007. *Fish decomposition in boreal lakes and biogeochemical implications*. Canadian Society for Ecology and Evolution – Toronto, ON, Canada
- Guénard, G., Legendre, P., Boisclair, D. & Bilodeau, M. 2007. *Une méthode multi-échelle pour décrire la dépendance spatiale commune entre l'abondance des tacs de saumon de l'At-lantique (Salmo salar, L.) et les variables environnementales utilisées comme descripteurs de leur habitat en rivière*. Symposium du Groupe de Recherche Inter-universitaire en Limnologie – Harrington, QC, Canada
- Guénard, G. & Boisclair, D. 2006. *Assessing the effect of fish density on the consumption and activity rate of Arctic charr*. Canadian Conference for Fisheries Research – Calgary, AB, Canada
- Guénard, G. & Boisclair, D. 2005. *Experimental comparison of activity measurements made using spontaneous swimming models and caesium bio-accumulation in fish*. Canadian Conference for Fisheries Research – Windsor, ON, Canada
- Guénard, G., Legendre, P. & Boisclair, D. 2005. *Describing the habitat of Atlantic salmon parr (Salmo salar) using the common spatial dependence between fish abundance and environmental variables: validation and application of a new multi-scale method*. Ecological Society of America / INTECOL joint meeting – Montreal, QC, Canada
- Guénard, G. & Boisclair, D. 2001. *Perspective of the predator-prey relationship through different spatial scales using horizontal hydro-acoustic scanning approach*. Canadian Conference for Fisheries Research – Toronto, ON, Canada

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## Research reports

- Guénard, G. 2018. *Environmental conditions structuring benthic invertebrate communities in the St. Lawrence River: evidencing the effect of chemical pollution* (in French). Water Quality Monitoring

and Surveillance Division, Environment and climate changes Canada. Contract #3000656770. Montreal, QC, Canada. 20 pp. [LINK](#)

- Morin, J., Bachand, M., Richard, J. H., Champoux, O., Martin, S. & Guénard, G. 2016. *Habitat modeling of the Lake Sturgeon and Walleye spawning habitat of the Rainy River*. Prepared for the International Joint Commission (IJC). Hydrology and Ecohydraulics Section, Environment and Climate Change Canada. Scientific Report SR111 MSC. Quebec City, QC, Canada. 132 pp. [LINK](#)
- Boisclair, D., Lapointe, M., Saint-Hilaire, A., Rasmussen, J. B., Senay, C., Lanthier, G., Bourque, G., Guénard, G., Macnaughton, C. J. & Harvey-Lavoie, S. 2016. *Modelling the effects of chemical and physical drivers on fisheries productivity metrics across rivers of varying hydrological regimes: lessons learned from NSERC HydroNet 2009-2015*. Science Advisory Secretariat Research Document. 2016/033. Department of Fisheries and Oceans Canada. viii + 61 p. [LINK](#)
- Guénard, G. & Boisclair, D. 2015. *Data and literature review on the bioenergetics of Salmoninae for Mid Columbia River Adult Habitat use Assessment (CLBMON-18)*. Prepared for BC Hydro, P.O. Box 8910 Vancouver, B.C. V6B 4N1, Canada. Département de sciences biologiques. . Université de Montréal C.P. 6128 succ. centre-ville Montreal QC, Canada. 25 pp. [LINK](#)
- Ugedal, O., Forseth, T., Jonsson, B., Dæverdin, R., Einum, S., Fleming, I., Saksgård, R., Boisclair, D. & Guénard, G. 2005. *Competition within and between fish species – preliminary research* (In Norwegian). Page 67–69 in Jonsson, B. & Yoccoz, N. G. (eds.) *Ecosystem dynamics: human impact on biodiversity. NINA's strategic institute programs 2001–2005* (In Norwegian). NINA Temahefte. 33. Norsk Institutt for Naturforskning, Trondheim, Norway. 89 pp. [LINK](#)

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## Software packages

- adespatial** Dray, S., Bauman, D., Blanchet, G., Borcard, D., Clappe, S., Guenard, G., Jombart, T., Larocque, G., Legendre, P., Madi, N. & Wagner, H. 2022. *adespatial: Multivariate Multiscale Spatial Analysis*. Description: Tools for the multiscale spatial analysis of multivariate data. Several methods are based on the use of a spatial weighting matrix and its eigenvector decomposition (Moran's Eigenvectors Maps, MEM). R package version 0.3-20
- constr.hclust** Legendre, P. & Guénard, G. 2022. Space- And Time-Constrained Clustering Package. Description: Space-constrained or time-constrained agglomerative clustering from a multivariate dissimilarity matrix. R package version 1.6-2
- MPSEM** Guénard, G. & Legendre, P. 2022. MPSEM: Modeling Phylogenetic Signals using Eigenvector Maps. Description: Computational tools to represent phylogenetic signals using adapted eigenvector maps. R package version 0.4-1
- codep** Guénard, G., Legendre, P. & Pages B. 2018. Multiscale Codependence Analysis. Description: Computation of Multiscale Codependence Analysis and spatial eigenvector maps, as an additional feature. R package version 0.9-1
- WR** Legendre, P. & Guénard, G. 2018. Whittaker-Robinson Periodogram Through a C Function Description: Whittaker-Robinson periodogram for univariate series of quantitative data, with permutation tests. R package version 1.0-1

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## Work in progress

- Guénard, G., Harvey-Lavoie, S., Wheeland, L., Cooke, S. J. & Boisclair, D. *A novel analytic framework to integrate the effect of a contextual variable into habitat use models using presence-only data*. [Article]
- Guénard, G., Harvey-Lavoie, S., MacNaughton, C. J., Senay, C., Boisclair, D. & Legendre, P. *An spatially-explicit assessment of the physical drivers of fish community assemblages in regulated and unregulated rivers*. [Article]

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