

Héloïse FROUIN-MOUY

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🇫🇷🇨🇦 Citizenships: French, Canadian

EDUCATION

- Sep 2006 – Jan 2010 Ph.D. in Biology (with distinction)**
Institut National de la Recherche Scientifique (INRS), Institut Armand-Frappier (IAF), Laval, Canada.
Doctoral thesis: Contamination and immunological impact in three seal species (harbour, grey, and harp seals) of St. Lawrence (Canada)
- Sep 2004 – Jun 2006 M.Sc. in Oceanography (with distinction)**
University of Québec at Rimouski, Institute of ocean sciences (ISMER), Rimouski, Canada.
Master's thesis: Physiological effects of polycyclic aromatic hydrocarbons on soft-shell clam
- Sep 2001 – Jun 2004 B.Sc. in Marine Biology**
University of La Rochelle, La Rochelle, France.
- Licence de Biologie
- DEUG de Sciences, mention Sciences de la vie

PROFESSIONAL APPOINTMENTS

- Jul 2019 – Present Visiting Scientist,** Department of Biology, University of Victoria (British Columbia, Canada)
- Jul 2012 – Present Project Scientist, Bio-Acoustician**
JASCO Applied Sciences (Victoria, British Columbia, Canada) from 2012 to present
JASCO Applied Sciences (Halifax, Nova Scotia, Canada) from 2009 to 2012 (as contractor)
Responsibilities:
- Manage technical and scientific components of applied science programs for acoustic monitoring and marine mammal detection
 - Analyze underwater noise
 - Project management - liaise with clients and regulators, mentor teams
 - Write scientific reports and articles
 - Principal investigator on several research projects about acoustic ecology of Arctic seals
 - Graduate committee member of a Master student (K. Nikolich, Western Washington University, 2015)
 - Perform deployment and retrieval of underwater recorders including in remote locations (e.g.; Chukchi Sea)
- Selected projects:
- *Double drone approach (2019):* developed a novel approach using two drones (one acoustic drone and one visual drone) to simultaneously monitor visual and acoustic behaviour of gray whales in Baja California, Mexico. Collaboration with Scripps Institute
 - *Vocal repertoire of hooded seal (2018):* Collecting in-air and underwater calls produced by hooded seals in the Gulf of St. Lawrence. Collaboration with DFO
 - *Narwhals and vessels in Nunavut (2018-2019):* Passive acoustic monitoring program. Investigation into the acoustic presence of narwhals and the potential impacts of vessels in Nunavut. Collaboration with Golder and the University of New Brunswick
 - *Ribbon seal in the Arctic (2015-2018):* Principal investigator in a program in collaboration with JASCO, NOAA, University of Washington and Greeneridge Sciences, Inc on the spatio-temporal distribution of ribbon seals in the Bering, Chukchi and Beaufort Seas using passive acoustics

- *Grey whale off Sakhalin Island (2015/2018)*: Real-time monitoring of acoustic levels during seismic surveys at Sakhalin Island near a feeding area for the critically endangered Western grey whales. Consulting for the marine mammal observation program.
- *Port of Vancouver Listening Station (2016-present)*: Uni- and multi-variate analyses on source level from vessels transiting in the Strait of Georgia. Develop an acoustic ranking system for vessels
- *Marine mammals in British Columbia (2012-present)*: Investigation into the presence of pinnipeds and cetaceans in British Columbia (Canada)
- *Chukchi Sea Acoustic Monitoring Program (2012-2016)*: Analysis and report writing about the ambient noise and spatio-temporal distribution of vocalizing marine mammals in the Chukchi Sea

Jan 2010 – Jun 2012 Post-Doctoral Fellow / Research Associate

Department of Fisheries and Oceans Canada (Sidney, British Columbia, Canada).

Responsibilities:

- Manage technical and scientific components of applied science programs for marine contaminant monitoring and marine mammal immunology
- Project management - liaise with field teams, aquarium teams, laboratory teams, mentor teams
- Write scientific reports and articles
- Perform seal capture and biopsies
- Perform laboratory analysis on seal and beluga tissues
- Mentor Master and PhD students in their laboratory analysis of immunotoxicological endpoints

Projects:

- *Rehabilitated harbor seals (2011-2012)*: Examined immune system, hematology and serum chemistry in harbor seal pups being admitted to rehabilitation center to enhance understanding of health and indices of survival
- *Beluga whale toxicology (2010-2011)*: Studied contaminant-related health effects in beluga whales from the western Canadian Arctic using *in vitro* study approaches
- *Plankton-water partitioning of PBDEs and PCBs (2011-2012)*: Quantified PCB and PBDE levels in water and lowest trophic level (plankton)

Jul – Sep 2009

Marine Mammalogist

Mingan Island Cetacean Study (Longue-Pointe-de-Mingan, Québec, Canada).

Responsibilities:

- Member of a scientific team involving up to 3 research boats (zodiac)
- Visual monitoring of marine mammals in the area
- Photo-identification of marine mammals (blue, fin and humpback whales)

Projects:

- Define mammal species occurrence, habitat use and distribution
- Investigate of the visual health assessment of blue, fin and humpback whales using photographs

Mar – Jun 2005

Internship

Department of Fisheries and Oceans Canada (Mont-Joli, Québec, Canada)

Project:

- Evaluated stratification of POPs in the blubber of beluga whale

Jul – Aug 2004

Internship

Institut Français de la Mer (IFREMER) (La Tremblade, France)

Project:

- Evaluated salinity effect on immune functions of the pacific oyster using flow cytometry

PEER-REVIEWED PUBLICATIONS

Arranged chronologically.

Frouin-Mouy H., M. Hammill. In-air and underwater sounds of hooded seals during the breeding season in the Gulf of St. Lawrence. *Submitted* to The Journal of the Acoustical Society of America.

Heimrich, A.F., W.D. Halliday, **H. Frouin-Mouy**, M.K. Pine, F. Juanes, S.J. Insley, 2020. Vocalizations of bearded seals (*Erignathus barbatus*) and their influence on the soundscape of the western Canadian Arctic. *Published* in Marine Mammal Science. <https://doi.org/10.1111/mms.12732>

Frouin-Mouy H., L. Tenorio-Hallé, A. Thode, S. Swartz, J. Urbán. 2020. Using two drones to collect simultaneous visual observations and underwater acoustic data from gray whales (*Eschrichtius robustus*) in Baja California, Mexico. *Journal of Experimental Marine Biology and Ecology* 525: 151321. <https://doi.org/10.1016/j.jembe.2020.151321>

Frouin-Mouy H., X. Mouy, C.L. Berchok, S.B. Blackwell, K.M. Stafford. 2019. Acoustic occurrence and behavior of ribbon seals (*Histiophoca fasciata*) in the Bering, Chukchi, and Beaufort Seas. *Polar Biology* 42: 657-674. <https://doi.org/10.1007/s00300-019-02462-y>

Nikolich, K., **H. Frouin-Mouy**, and A. Acevedo-Gutierrez. 2018. Clear diel patterns in breeding calls of harbor seals (*Phoca vitulina*) at Hornby Island, British Columbia, Canada. *Canadian Journal of Zoology* 96: 1236-1243. <https://doi.org/10.1139/cjz-2018-0018>

Frouin H., P. Jackman, N.D. Dangerfield, P.S. Ross. 2017. Effects of feeding strategy, sediment characteristics, and chemical properties on polychlorinated biphenyl and polybrominated diphenyl ether bioaccumulation from marine sediments in two invertebrates. *Archives of Environmental Contamination and Toxicology* 73: 256-269. <https://doi.org/10.1007/s00244-016-0361-x>

Frouin-Mouy H., K. Kowarksi, B. Martin, K. Bröker. 2017. Seasonal trends in acoustic detection of marine mammals in Baffin Bay and Melville Bay, northwest Greenland. *Arctic* 70: 59-76. <http://dx.doi.org/10.14430/arctic4632>

Nikolich K., **H. Frouin-Mouy**, A., Acevedo-Gutierrez. 2016. Quantitative classification of harbor seal breeding calls in Georgia Strait, Canada. *Journal of Acoustical Society of America* 140: 1300-1308. <http://dx.doi.org/10.1121/1.4961008>

Frouin-Mouy H., X. Mouy, B. Martin, and D. Hannay. 2016. Underwater acoustic behavior of bearded seals (*Erignathus barbatus*) in the northeastern Chukchi Sea, 2007–2010. *Marine Mammal Science* 32(1): 141-160. <http://dx.doi.org/10.1111/mms.12246>

Scheuhammer A., B. Braune, H. M. Chan, **H. Frouin**, A. Krey, R. Letcher, L. Loseto, M. Noël, S. Ostertag, P. Ross, and M. Wayland. 2015. Recent progress on our understanding of the biological effects of mercury in fish and wildlife in the Canadian Arctic. *Science of The Total Environment*, 509–510: 91-103. <http://dx.doi.org/10.1016/j.scitotenv.2014.05.142>

Bergman Å., G. Becher, B. Blumberg, P. Bjerregaard, R. Bornman, I. Brandt, S.C. Casey., **H. Frouin**, L.C. Giudice, J.J. Heindel, T. Iguchi, S. Jobling, K.A. Kidd, A. Kortenkamp, P.M. Lind, D. Muir, R. Ochieng, E. Ropstad, P.S. Ross, N.E. Skakkebaek, J. Toppari, L.N. Vandenberg, T.J. Woodruff and R.T. Zoeller. 2015. Manufacturing doubt about endocrine disrupter science – A rebuttal of industry-sponsored critical comments on the UNEP/WHO report “State of the Science of Endocrine Disrupting Chemicals 2012”, *Regulatory Toxicology and Pharmacology* 73(3): 1007-1017. <http://dx.doi.org/10.1016/j.yrtph.2015.07.026>

Frouin H., N. Dangerfield, R.W. Macdonald, M. Galbraith, N. Crewe, P. Shaw, D. Mackas, and P.S. Ross. 2013a. Partitioning and bioaccumulation of PCBs and PBDEs in marine plankton from the Strait of Georgia, British Columbia, Canada. *Progress in Oceanography* 115: 65-75. <http://dx.doi.org/10.1016/j.pocean.2013.05.023>

Frouin H., M. Haulena, L.M.F. Akhurst, S. Raverty, and P.S. Ross. 2013b. Immune status and function in harbor seal pups during the course of rehabilitation. *Veterinary Immunology and Immunopathology* 155(1–2): 98-109. <http://dx.doi.org/10.1016/j.vetimm.2013.06.011>

Frouin H., M. Lebeuf, M. Hammill, and M. Fournier. 2012a. Transfer of PBDEs and chlorinated POPs from mother to pup during lactation in harp seals *Phoca groenlandica*. *Science of the Total Environment* 417–418: 98-107. <http://dx.doi.org/10.1016/j.scitotenv.2011.11.084>

Frouin H., L.L. Loseto, G.A. Stern, M. Haulena, and P.S. Ross. 2012b. Mercury toxicity in beluga whale lymphocytes: Limited effects of selenium protection. *Aquatic Toxicology* 109: 185-193. <http://dx.doi.org/10.1016/j.aquatox.2011.09.021>

Frouin H., M. Lebeuf, M. Hammill, B. Sjare, and M. Fournier. 2011. PBDEs in serum and blubber of harbor, grey and harp seal pups from Eastern Canada. *Chemosphere* 82(5): 663-669. <http://dx.doi.org/10.1016/j.chemosphere.2010.11.007>

Dufresne M.M., **H. Frouin**, S. Pillet, V. Lesage, S. De Guise, and M. Fournier. 2010. Comparative sensitivity of harbour and grey seals to several environmental contaminants using *in vitro* exposure. *Marine Pollution Bulletin* 60(3): 344-349. <http://dx.doi.org/10.1016/j.marpolbul.2009.10.019>

Fortier M., **H. Frouin**, A. Cloutier, M. Arseneault, C. Ramassamy, B. Badiwa-Bizowe, R. St-Louis, E. Pelletier, and M. Fournier. 2010. Toxicological effects of mouse diet contaminated with tributyltin on the immune and neurological systems of C57BL/6 mice. *Toxicological & Environmental Chemistry* 92(5): 927-945. <http://dx.doi.org/10.1080/02772240903092298>

Frouin H., M. Fortier, and M. Fournier. 2010a. Toxic effects of various pollutants in 11B7501 lymphoma B cell line from harbour seal (*Phoca vitulina*). *Toxicology* 270(2–3): 66-76. <http://dx.doi.org/10.1016/j.tox.2010.01.014>

Frouin H., M. Lebeuf, M. Hammill, and M. Fournier. 2010b. Phagocytosis in pup and adult harbour, grey and harp seals. *Veterinary Immunology and Immunopathology* 134(3–4): 160-168. <http://dx.doi.org/10.1016/j.vetimm.2009.08.017>

Frouin H., M. Lebeuf, M. Hammill, S. Masson, and M. Fournier. 2010c. Effects of individual polybrominated diphenyl ether (PBDE) congeners on harbour seal immune cells *in vitro*. *Marine Pollution Bulletin* 60(2): 291-298. <http://dx.doi.org/10.1016/j.marpolbul.2009.09.006>

Frouin H., L. Menard, L. Measures, P. Brousseau, and M. Fournier. 2010d. T Lymphocyte-Proliferative Responses of a Grey Seal (*Halichoerus grypus*) Exposed to Heavy Metals and PCBs *in Vitro*. *Aquatic Mammals* 36(4): 365-371. <http://dx.doi.org/10.1578/am.36.4.2010.365>

Frouin H., M. Lebeuf, R. Saint-Louis, M. Hammill, É. Pelletier, and M. Fournier. 2008. Toxic effects of tributyltin and its metabolites on harbour seal (*Phoca vitulina*) immune cells *in vitro*. *Aquatic Toxicology* 90(3): 243-251. <http://dx.doi.org/10.1016/j.aquatox.2008.09.005>

Frouin H., J. Pellerin, M. Fournier, E. Pelletier, P. Richard, N. Pichaud, C. Rouleau, and F. Garnerot. 2007. Physiological effects of polycyclic aromatic hydrocarbons on soft-shell clam *Mya arenaria*. *Aquatic Toxicology* 82(2): 120-134. <http://dx.doi.org/10.1016/j.aquatox.2007.02.005>

Gagnaire B., **H. Frouin**, K. Moreau, H. Thomas-Guyon, and T. Renault. 2006. Effects of temperature and salinity on haemocyte activities of the Pacific oyster, *Crassostrea gigas* (Thunberg). *Fish & Shellfish Immunology* 20(4): 536-547. <http://dx.doi.org/10.1016/j.fsi.2005.07.003>

BOOK CHAPTER / INTERNATIONAL REPORT

Brousseau P., S. Pillet, **H. Frouin**, M. Auffret, F. Gagne, and M. Fournier. 2013. Linking immunotoxicity and ecotoxicological effects at higher biological levels. In Amiard-Triquet, C., J.-C. Amiard, and P.S. Rainbow (eds.). *Ecological Biomarkers: Indicators of Ecotoxicological Effects*. CRC Press, Boca Raton, FL. 131-154 pp.

Jobling S., P. Bjerregaard, B. Blumberg, I. Brandt, J.V. Brian, S.C. Casey, **H. Frouin**, L.C. Giudice, J.J. Heindel, T. Iguchi, K.A. Kidd, A. Kortenkamp, M. Lind, E. Ropstad, P.S. Ross, N.E. Skakkebaek, J. Toppari, T.J. Woodruff and R.T. Zoeller. 2013. In Bergman, Å., J.J. Heindel, S. Jobling, K.A. Hidd and R.T. Zoeller. *WHO/UNEP. State of the Science of Endocrine Disrupting Chemicals – 2012. An assessment of the state of the science of*

endocrine disruptors prepared by a group of experts for the United Nations Environment Programme (UNEP) and WHO. 23-188 pp. <http://www.who.int/ceh/publications/endocrine/en/>

Frouin H., E. Pelletier, R. Saint-Louis, M. Lebeuf, and M. Fournier. 2010. Toxicology of organotins in marine organisms: a review. In Chin, H.F. (ed.). Organometallic compounds: Preparation, Structure and Properties. Nova Publishers, New York. 1-47 pp.

SELECTED CONFERENCE PRESENTATIONS

Frouin-Mouy H., L. Tenorio-Hallé, A. Thode, S. Swartz, J. Urbán, 2019. Double Drone Drama: Using two drones to collect simultaneous visual and underwater acoustic behavioral data from gray whales in Baja California, Mexico. World Marine Mammal Conference, Barcelona, Spain, 7–12 December.

Frouin-Mouy H., M. Hammill, 2019. Airborne and underwater acoustic repertoire of hooded seals (*Cystophora cristata*): new perspectives for population monitoring. ArcticNet, Halifax, Canada, 1–5 December.

Frouin-Mouy H., M. Hammill, 2018. Airborne and underwater acoustic repertoire of hooded seals (*Cystophora cristata*): Cornerstone for acoustic monitoring. 176th Acoustical Society of America Meeting, Victoria, Canada, 5–9 November.

Frouin-Mouy H., X. Mouy, C. Berchok, K. Stafford, S. Blackwell, and D. Hannay, 2017. Vocal behavior and spatio-temporal distribution of ribbon seal (*Histiophoca fasciata*) in the Bering, Chukchi, and Beaufort Seas. 22th Biennial Conference on the Biology of Marine Mammals, Halifax, Canada, 23–27 October.

Frouin-Mouy H., C. Berchok, X. Mouy and D. Hannay, 2015. Ribbon seal (*Histiophoca fasciata*) in the Bering Sea: Seasonal presence. 21th Biennial Conference on the Biology of Marine Mammals, San Francisco, USA, 13–18 December.

Frouin-Mouy H., X. Mouy, J. Delarue, B. Martin and D. Hannay, 2013. Male bearded seal: Underwater singing lover. 20th Biennial Conference on the Biology of Marine Mammals, Dunedin, New Zealand, 9–13 December.

Frouin-Mouy H., X. Mouy, J. Delarue, B. Martin and D. Hannay, 2012. Spatio-Temporal distribution of ice seals in the Chukchi Sea using underwater vocalizations: Special focus on male bearded seals. 164th Meeting of the Acoustical Society of America, Kansas City, Missouri, 22–26 October.

Frouin H., M. Haulena, L. Loseto, G. Stern, and P.S. Ross. 2011. Mercury and climate change: a worst-case combination for arctic beluga whales (*Delphinapterus leucas*)? 19th Biennial Conference on the Biology of Marine Mammals, Tampa, USA. 28 November–2 December.

Frouin, H., N. Dangerfield, R.W. Macdonald, N. Crewe, P. Shaw, and P.S. Ross. 2011. Bioaccumulation of PCBs and PBDEs in marine plankton from Strait of Georgia, British Columbia, Canada. SETAC North America 32nd Annual Meeting, Boston, USA. 13-17 November.

TRAINING

2020 – Marine Emergency Duties – Domestic Vessel Safety, Transport Canada

2019 – Pilot Certificate Small Remotely Piloted Aircraft System, Visual line-of-sight, Transport Canada

2019 – Marine Medical Certificate, Transport Canada

2018 – Emergency First Aid for Industry (OFA Level 1 Equivalent), St. John Ambulance

2015 – R Bootcamp - 4-day workshop on data analysis with R, Bamfield Marine Sciences Centre, UVic

2015 – Basic Offshore Safety Induction & Emergency Training (BOSIET), including HUET with EBS, Survival Systems Training Limited

2013 – Marine Emergency Duties A1, Transport Canada

2011 – Passive Acoustic Technology Training, Bio-Waves

2011 – Joint Nature Conservation Committee Marine Mammal Observer Training, Intelligent Ocean

2011 – Bureau of Ocean Energy Management, Regulation and Enforcement Protected Species Observer Training, Intelligent Ocean

2009 – Canadian Restricted Radio Operator's certificate, Industry Canada

2004 – Powerboat driving licence (France)

SELECTED RELEVANT ACTIVITIES

Serve as **Reviewer** for various journals including: *The Journal of the Acoustical Society of America*, *Marine Mammal Science*, *Marine Ecology Progress Series*, *Animal Behavior*, *Polar Biology*, *Polar Research*, *Journal of Geophysical Research*, *Aquatic Mammals*, *Marine Biology Research*, *Global Challenge Biology*, *Toxicology*, *Aquatic Toxicology*, *Biology Letters*, *Marine Pollution Bulletin*, *Environmental Pollution*, *Environmental Research*.

Co-chair at the ArcticNet Conference (2019) [Session IT03-Applications of underwater acoustic in Arctic Studies].

Participation as an **expert to the Walrus Expert Elicitation Workshop** 2-4 April 2019 (Anchorage, Alaska).

Biology Seminar at the University of Victoria "Calling in the cold: acoustic behaviour of Arctic pinnipeds" 23 November, 2018.

Participation at several **public outreaches** ("Pint of Science", guest speaker for the Consulate General of France in Vancouver, Ocean Day, schools, and youth organizations)

SUPERVISION OF STUDENT RESEARCH

M.Sc. Student

- Katrina Nikolich, M.Sc. of Science, Western Washington University, 2015 (committee)

CURRENT COLLABORATIONS

- Dr. Francis Juanes (University of Victoria) – acoustic interactions between harbor seal and fish.
- Dr. Aaron Thode (University of California, San Diego, Scripps Institution of Oceanography Department) – research on vocal behavior of gray whale (developing a new acoustic tool).
- Dr. Mike Hammill (Fisheries and Oceans Canada) (IML) – research on acoustic ecology of Eastern Canadian pinnipeds.

RELATED PROFESSIONAL SKILLS

Science:

- Acoustics: underwater acoustic measurements and analysis
- Ecotoxicology: Laboratory and analysis. Skilled in flow cytometry, *in vitro* and *in vivo* exposure
- Understanding and application of US and Canadian environmental regulations in underwater acoustics and ecotoxicology

Field work:

- Organization and management of field measurement campaigns in remote locations (e.g. Arctic, Russia, Mexico) on water or on land
- Health, Safety, Security and Environment (HSSE) duties and reporting
- Design, deployment, retrieval, and maintenance of oceanographic moorings
- Extensive experience with acoustic recorders
- Seal capture (e.g. entanglement or pole nets) on ice, sand, rock and in water
- Sampling of pinniped biological tissue (e.g. blood, skin, blubber, milk, vibrissae, teeth)
- Marine mammal observer/Protected species observer (JNCC / BOEM certified)
- Photo-identification of marine mammals
- Small boat operations
- Use of 7x50 range finding binoculars, laser range finders
- Drone operator

Computer:

- R
- ArcGis, GlobalMapper
- Pythagoras, Mysticetus
- PAMLab
- Endnote, Microsoft Office Suite

LANGUAGES

- English (fluent)
- French (fluent, native language)
- Russian (basic)
- German (scholastic)

PROFESSIONAL MEMBERSHIPS/AFFILIATIONS

- Registered Professional Biologist at the College of Applied Biology of British Columbia
- Member of the Acoustical Society of America (also member of the Animal Bioacoustics Technical Committee)
- Member of the Society for Marine Mammalogy