

Current Position

Professor
Ocean Sciences Centre
Memorial University of Newfoundland

Academic/Research Positions Held

- 2004- Cross appointment, Department of Biology, Memorial University of Newfoundland
2001- Scientific Adviser/Adjunct Professor, Norwegian Institute for Nature Research (NINA), Tungasletta 2, NO-7485 Trondheim, Norway.
- 2004-09. Director, Ocean Sciences Centre, Memorial University of Newfoundland.
2004-06. Associate Professor, Ocean Sciences Centre, Memorial University of Newfoundland.
2004-10. Courtesy Faculty, Department of Fisheries and Wildlife, Oregon State University, 104 Nash Hall, Corvallis, Oregon 97331-3803, USA.
2004-07. Scientific Advisor, Section of Applied Ecology, Department of Environmental Science, University of Siena, via Mattioli 4, 53100 Siena, Italy.
2001-04. Associate Professor (tenured 2003), Coastal Oregon Marine Experiment Station and Department of Fisheries and Wildlife, Oregon State University.
1999-02. Adjunct Professor, Department of Biology, University of Waterloo, Waterloo, Canada.
1999-01. Research Scientist (I), Division for Aquatic Ecology, Norwegian Institute for Nature Research.
1998. Guest Researcher. Institute of Ecology, Department of Zoology, University of Göteborg, Sweden.
1994-98. Research Scientist (II), Norwegian Institute for Nature Research.
1991-93. Postdoctoral Visiting Scientist, Norwegian Institute for Nature Research.

Education

Ph.D.	Department of Zoology, University of Toronto, Toronto, Canada.	1991
M.Sc.	Department of Biological Sciences, Simon Fraser University, Burnaby, Canada.	1986
B.Sc.	Honours, First Class, Queen's University, Kingston, Canada.	1983

Refereed Journal Publications (Students, postdoctoral fellows and technicians underlined)

(Citation *h*-index [ISI Web of Science]: 28)

- Moreau, D.T.R., Conway, C. and **Fleming, I.A.** Reproductive performance of alternative male phenotypes of growth hormone transgenic Atlantic salmon (*Salmo salar*). **Evolutionary Applications**, *in press*.
- Reddin, D.G., **Fleming, I.A.**, Hansen, L.P. and Dowton, P. 2011. Behavioural ecology of Atlantic salmon (*Salmo salar*) kelts at sea in relation to depth and temperature. **Fisheries Oceanography**, *in press*.
- Westley, P.A.H. and **Fleming, I.A.** 2011. Landscape factors that shape a slow and persistent aquatic invasion: brown trout in Newfoundland 1883-2010. **Diversity and Distributions** 17:566-579.
- Larsen, L.-K., Pélabon, C., Bolstad, G.H., Viken, Å., **Fleming, I.A.**, and Rosenqvist, G. 2011. Temporal change in inbreeding depression in life history traits in captive populations of guppy (*Poecilia reticulata*): evidence for purging. **Journal of Evolutionary Biology** 24: 823-834.
- Moreau, D.T.R., Fleming, I.A., Fletcher, G.L., and Brown, J.A. 2011. Growth hormone transgenesis does not influence territorial dominance or growth and survival of first-feeding Atlantic salmon *Salmo salar* in food-limited stream microcosms. **Journal of Fish Biology** 78: 726-740.
- Guénard, G., Boisclair, D., Ugedal, O., Forseth, T., Jonsson, B. and **Fleming, I.A.** 2010. Experimental assessment of the bioenergetic and behavioural differences between two morphologically distinct populations of Arctic char (*Salvelinus alpinus*). **Canadian Journal of Fisheries and Aquatic Sciences** 67: 580-595.

- Hering, D.K., Bottom, D.L., Prentice, E.F., Jones, K.K. and **Fleming, I.A.** 2010. Tidal movements and residency of subyearling Chinook salmon (*Oncorhynchus tshawytscha*) in an Oregon salt marsh channel. **Canadian Journal of Fisheries and Aquatic Sciences** 67: 524-533.
- Yeates, S.E., Einum, S., **Fleming, I.A.**, Megens, H.J., Stet, R., Hindar, K., Holt, W.V., van Look, K. and Gage, M.J.G. 2009 Atlantic salmon eggs favour sperm in competition that have similar Major Histocompatibility alleles. **Proceedings of the Royal Society, London B** 276: 559-566.
- Einum, S., Robertsen, G. and **Fleming, I.A.** 2008. Adaptive landscapes in declining salmonid populations. **Evolutionary Applications**, 1: 239-251.
- Neregård, L., Sundt-Hansen, L., Hindar, K., Einum, S., Johnsson, J.I., Devlin, R.H., **Fleming, I.A.** and Björnsson, B.Th. 2008. Selective breeding of Atlantic salmon affects growth hormone action. **Journal of Fish Biology** 73: 79-85.
- Uglem, I., Bjørn, P.A., Dale, T., Kerwath, S., Økland, F., Nilsen, R., Aas, K., **Fleming, I.A.** and McKinley, R.S. 2008. Movements and spatiotemporal distribution of escaped farmed and local wild Atlantic cod (*Gadus morhua* L.). **Aquaculture Research** 39: 158-170.
- Koseki, Y. and **Fleming, I.A.** 2007. Large-scale frequency dynamics of alternative male phenotypes in natural populations of coho salmon (*Oncorhynchus kisutch*): patterns, processes, and implications. **Canadian Journal of Fisheries and Aquatic Sciences** 64: 743-753.
- Einum, S. and **Fleming, I.A.** 2007. Of chickens and eggs: diverging egg size of iteroparous and semelparous organisms. **Evolution**, 61: 232-238.
- Sundt-Hansen, L., Sundström, L.F., Einum, S., Hindar, K., **Fleming, I.A.** and Devlin, R.H. 2007. Genetically enhanced growth causes increased mortality in hypoxic environments. **Biology Letters** 3: 163-168.
- Garcia de Leaniz, C., **Fleming, I.A.**, Einum, S., Verspoor, E., Jordan, W.C., Consuegra, S., Aubin-Horth, N., Lajus, D., Letcher, B.H., Youngson, A.F., Webb, J., Vøllestad, L.A., Villanueva, B., Ferguson, A. and Quinn, T.P. 2007. A critical review of inherited adaptive variation in Atlantic salmon. **Biological Reviews** 82: 173-211.
- Henning, J.A., Gresswell, R.E. and **Fleming, I.A.** 2007. Use of seasonal freshwater wetlands by fishes in a temperate river-floodplain. **Journal of Fish Biology** 71: 476-492.
- Hallerman, E.M., MacLean, E. and **Fleming, I.A.** 2007. Effects of growth hormone transgenes on the behavior and welfare of aquacultured fishes: a review identifying research needs. **Applied Animal Behaviour Science** 104: 265-294.
- Hindar, K., **Fleming, I.A.**, McGinnity, P. and Diserud, O. 2006. Genetic and ecological effects of salmon aquaculture on wild salmon: review and perspective. **ICES Journal of Marine Science** 63: 1234-1247.
- Viken, Å., **Fleming, I.A.** and Rosenqvist, G. 2006. Premating avoidance of inbreeding absent in female guppies (*Poecilia reticulata*). **Ethology** 112: 716-723.
- Henning, J.A., Gresswell, R.E. and **Fleming, I.A.** 2006. Floodplain emergent wetlands as a rearing habitat for juvenile salmonids. **North American Journal of Fisheries Management** 26: 367-376.
- Koseki, Y. and **Fleming, I.A.** 2006. Spatio-temporal dynamics of alternative male phenotypes in coho salmon populations in response to ocean environment. **Journal of Animal Ecology** 75: 445-455.
- Weir, L.K., Hutchings, J.A., **Fleming, I.A.** and Einum, S. 2005. The influence of genetic origin on the spawning behaviour and fertilisation success of mature male Atlantic salmon parr. **Canadian Journal of Fisheries and Aquatic Sciences** 62:1153-1160.
- Naylor, R. Hindar, K., **Fleming, I.A.**, Goldberg, R., Mangel, M., Williams, S., Volpe, J., Whoriskey, F., Eagle, J. and Kelso, D. 2005. Fugitive salmon: assessing risks of escaped fish from aquaculture. **BioScience** 55: 427-437.
- Weir, L.K., Hutchings, J.A., **Fleming, I.A.** and Einum, S. 2004. Dominance relationships and behavioural correlates of individual spawning success in farmed and wild male Atlantic salmon, *Salmo salar*. **Journal of Animal Ecology** 73:1069-1079.

- Einum, S. and **Fleming, I.A.** 2004. Environmental unpredictability and offspring size: conservative vs. diversified bet-hedging. **Evolutionary Ecology Research** 6:443-455.
- Einum, S. and **Fleming, I.A.** 2004. Does within-population variation in egg size reduce intraspecific competition in Atlantic salmon (*Salmo salar*)? **Functional Ecology** 18:110-115.
- Fleming, I.A.**, Einum, S., Jonsson, B. and Jonsson, N. 2003. Comment on "Rapid Evolution of Egg Size in Captive Salmon". **Science** 302: 59b.
- Einum, S., **Fleming, I.A.**, Côté, I.M. and Reynolds, J.D. 2003. Population stability in salmon species: effects of population size and female reproductive allocation. **Journal of Animal Ecology** 72: 811-821.
- Garant, D., **Fleming, I.A.**, Einum, S. and Bernatchez, L. 2003. Alternative male life-history tactics as potential vehicles for speeding introgression of farm salmon traits into wild populations. **Ecology Letters** 6: 541-549.
- Forseth, T., Ugedal, O., Jonsson, B. and **Fleming, I.A.** 2003. Ecological character displacement in Arctic charr caused by competition from brown trout. **Oikos** 101: 467-478.
- Einum, S. and **Fleming, I.A.** 2002. Does within-population variation in fish egg size reflect maternal influences on optimal values? **American Naturalist** 160: 756-765.
- Lembo, G., Spedicato, M.T., Økland, F., Carbonara, P., **Fleming, I.A.**, McKinley, R.S., Thorstad, E.B., Sisak, M. and Ragonese, S. 2002. A wireless communication system for determining site fidelity of juvenile dusky groupers, *Epinephelus marginatus* (Lowe, 1834), using coded acoustic transmitters. **Hydrobiologia** 483: 249-257.
- Einum, S., Hendry, A.P. and **Fleming, I.A.** 2002. Egg size evolution in aquatic environments: does oxygen availability constrain size? **Proceedings of the Royal Society, London B** 269: 2325-2330.
- Fleming, I.A.**, Agustsson, T., Finstad, B., Johnsson, J. and Björnsson, B.Th. 2002. Effects of domestication on growth physiology and endocrinology of Atlantic salmon. **Canadian Journal of Fisheries and Aquatic Sciences** 59: 1323-1330.
- Singer, T.D., Clements, K.M., Semple, J., Schulte, P.M., Bystriansky, J., Finstad, B., **Fleming, I.A.** and McKinley, R.S. 2002. Seawater tolerance and gene expression in Atlantic salmon smolts: a comparison of hatchery-reared farm and native strains. **Canadian Journal of Fisheries and Aquatic Sciences** 59: 125-135.
- Armstrong, J.D., Einum, S., **Fleming, I.A.** and Rycroft, P. 2001. A method for tracking the behaviour of mature and immature parr around nests during spawning. **Journal of Fish Biology** 59: 1023-1032.
- Fleming, I.A.** and Petersson, E. 2001. The ability of released, hatchery salmonids to breed and contribute to the natural productivity of wild populations. **Nordic Journal of Freshwater Research** 75: 71-98.
- Einum, S. and **Fleming, I.A.** 2001. Implications of stocking: ecological interactions between wild and released salmonids. **Nordic Journal of Freshwater Research** 75: 56-70.
- Johnsson, J.I., Höjesjö, J. and **Fleming, I.A.** 2001. Behavioural and heart rate responses to predation risk in wild and domesticated Atlantic salmon. **Canadian Journal of Fisheries and Aquatic Sciences** 58: 788-794.
- Fleming, I.A.**, Hindar, K., Mjølnerød, I.B., Jonsson, B., Balstad, T. and Lamberg, A. 2000. Lifetime success and interactions of farm salmon invading a native population. **Proceedings of the Royal Society, London B** 267: 1517-1524.
- Einum, S. and **Fleming, I.A.** 2000. Highly fecund mothers sacrifice offspring survival to maximise fitness. **Nature** 405: 565-567.
- Einum, S. and **Fleming, I.A.** 2000. Selection against late emergence and small offspring in Atlantic salmon. **Evolution** 54: 628-639.
- Lembo, G., **Fleming, I.A.**, Økland, F., Carbonara, P. and Spedicato, M.T. 1999. Site fidelity of the dusky grouper *Epinephelus marginatus* (Lowe, 1834) studied by hydroacoustic telemetry. **Marine Life** 9(2): 37-43.
- Einum, S. and **Fleming, I.A.** 1999. Maternal effects of egg size in brown trout (*Salmo trutta*): norms of reaction to environmental quality. **Proceedings of the Royal Society, London B** 266: 1995-2000.

- Lembo, G., **Fleming, I.A.**, Økland, F., Carbonara, P. and Spedicato, M.T. 1999. Homing behaviour and site fidelity of *Epinephelus marginatus* around the island of Ustica: preliminary results from a telemetry study. **Biologia Marina Mediterranea** 6: 90-99.
- Fleming, I.A.** 1998. Pattern and variability in the breeding system of Atlantic salmon, with comparisons to other salmonids. **Canadian Journal of Fisheries and Aquatic Sciences** 55(Suppl. 1): 59-76.
- Armstrong, J.D., Grant, J.W.A., Forsgren, H.L., Fausch, K.D., DeGraaf, R.M., **Fleming, I.A.**, Prowse, T.D. and Schlosser, I.J. 1998. The application of science to the management of Atlantic salmon: integration across scales. **Canadian Journal of Fisheries and Aquatic Sciences** 55(Suppl. 1): 303-311.
- Lembo, G., **Fleming, I.A.**, Økland, F., Carbonara, P., Ragonese, S. and Spedicato, M.T. 1998. Design of a telemetry study for the dusky grouper (*Epinephelus marginatus*, Lowe 1834). **Biologia Marina Mediterranea** 5: 1258-1265.
- Mjølnerød, I.B., **Fleming, I.A.**, Refseth, U.H. and Hindar, K. 1998. Mate and sperm competition during multiple-male spawnings of Atlantic salmon. **Canadian Journal of Zoology** 76: 70-75.
- Fleming, I.A.**, Lamberg, A. and Jonsson, B. 1997. Effects of early experience on the reproductive performance of Atlantic salmon. **Behavioral Ecology** 8: 470-480.
- Fleming, I.A.** and Einum, S. 1997. Experimental tests of genetic divergence of farmed from wild Atlantic salmon due to domestication. **ICES Journal of Marine Science** 54: 1051-1063.
- Einum, S. and **Fleming, I.A.** 1997. Genetic divergence and interactions in the wild among native, farmed and hybrid Atlantic salmon. **Journal of Fish Biology** 50: 634-651.
- Fleming, I.A.** 1996. Reproductive strategies of Atlantic salmon: ecology and evolution. **Reviews in Fish Biology and Fisheries** 6: 379-416.
- Fleming, I.A.**, Jonsson, B., Gross, M.R. and Lamberg, A. 1996. An experimental study of the reproductive behaviour and success of farmed and wild Atlantic salmon (*Salmo salar*). **Journal of Applied Ecology** 33: 893-905.
- Jonsson, N., Jonsson, B. and **Fleming, I.A.** 1996. Phenotypically plastic response of egg production to early growth in Atlantic salmon, *Salmo salar*. **Functional Ecology** 10: 89-96.
- Fleming, I.A.** 1994. Captive breeding and the conservation of wild salmon populations. **Conservation Biology** 8: 886-888.
- Fleming, I.A.**, and Gross, M.R. 1994. Breeding competition in a Pacific salmon (coho: *Oncorhynchus kisutch*): measures of natural and sexual selection. **Evolution** 48: 637-657. [Paper awarded the W.F. Thompson Award, American Institute of Fishery Research Biologists.]
- Fleming, I.A.**, Jonsson, B. and Gross, M.R. 1994. Phenotypic divergence of sea-ranched, farmed and wild salmon. **Canadian Journal of Fisheries and Aquatic Sciences** 51: 2808-2824.
- Fleming, I.A.** and Gross, M.R. 1993. Breeding success of hatchery and wild coho salmon (*Oncorhynchus kisutch*) in competition. **Ecological Applications** 3: 230-245.
- Fleming, I.A.** and Gross, M.R. 1992. Reproductive behaviour of hatchery and wild coho salmon (*Oncorhynchus kisutch*): does it differ? **Aquaculture** 103: 101-121.
- Fleming, I.A.** and Gross, M.R. 1990. Latitudinal clines: a tradeoff between egg number and size in Pacific salmon. **Ecology** 71: 1-11.
- Fleming, I.A.** and Gross, M.R. 1989. Evolution of adult female life history and morphology in a Pacific salmon (Coho: *Oncorhynchus kisutch*). **Evolution** 43: 141-157.
- Fleming, I.A.** and Ng, S. 1987. Evaluation of techniques for fixing, preserving and measuring salmon eggs. **Canadian Journal of Fisheries and Aquatic Sciences** 44: 1957-1962.
- Fleming, I.A.** and Johansen, P.H. 1984. Density and aggressive behaviour in young-of-the-year largemouth bass (*Micropterus salmoides*). **Canadian Journal of Zoology** 62: 1454-1455.

Book Chapters (peer reviewed)

- Moreau, D.T.R. and **Fleming, I.A.** The potential ecological and genetic impacts of aquaculture biotechnologies: Evolutionary considerations for managing the blue revolution. *In*: G.L. Fletcher and M.L. Rise (eds.) Aquaculture Biotechnology. Wiley-Blackwell, Iowa, *in press*.
- Fleming, I.A.** and Einum, S. 2011. Reproductive Ecology: a tale of two sexes, pp 33-65. *In*: Ø. Aas, S. Einum, A. Klemetsen and J. Skurdal (eds.) Atlantic salmon ecology. Wiley-Blackwell, Oxford, UK. (ISBN 978-1-4051-9769-4)
- Brodeur, R.D., **Fleming, I.A.**, Bennett, J.M. and Campbell, M.A. 2009. Summer distribution and feeding of spiny dogfish off the Washington and Oregon coasts, pp 39-51. *In* V.F. Callucci, G.A. McFarland and G.G. Bargmann (eds.) Management and Biology of Dogfish Sharks, Special Volume of the American Fisheries Society. (ISBN 978-1-934874-07-3)
- Jones, D.S., **Fleming, I.A.**, Krentz, L.K. and Jones, K.K. 2008. Feeding ecology of cutthroat trout in the Salmon River Estuary, Oregon, pp. 144-151. *In* P. J. Connolly, T. H. Williams, and R. E. Gresswell (eds.) The 2005 coastal cutthroat trout symposium: status, management, biology, and conservation. Oregon Chapter, American Fisheries Society, Portland, OR.
- Kapuscinski, A., Hard, J., Neira, R., Paulson, K., Ponniah, A., Kamonrat, W., Mwanja, W., **Fleming, I.A.**, Gallardo, J., Devlin, R. and Trisak, J. 2007. Approaches to assessing gene flow, pp. 112-150. *In*: A.R. Kapuscinski, K.R. Hayes, S. Li and G. Dana (eds.) Environmental Risk Assessment of Genetically Modified Organisms, Volume 3: Methodologies for Transgenic Fish. CABI Publishing, Oxfordshire, UK. (ISBN-13:9781 84593 2961)
- Devlin, R.H., Sundstrom, L.F., Johnsson, J.I., **Fleming, I.A.**, Hayes, K.R., Ojwang, W.O., Bambaradeniya, C. and Zakaraia-Ismail, M. 2007. Assessing phenotypic and ecological effects of transgenic fish prior to entry into nature, pp. 151-187. *In*: A.R. Kapuscinski, K.R. Hayes, S. Li and G. Dana (eds.) Environmental Risk Assessment of Genetically Modified Organisms, Volume 3: Methodologies for Transgenic Fish. CABI Publishing, Oxfordshire, UK. (ISBN-13:9781 84593 2961)
- Ferguson, A., **Fleming, I.A.**, Hindar, K., Skaala, Ø., McGinnity, P., Cross, T. and Prodöhl, P. 2007 Farm escapes, pp. 367-409. *In*: E. Verspoor, L. Stradmeyer and J. Nielsen (eds.) The Atlantic salmon: Genetics, Conservation and Management. Blackwell, Oxford. (ISBN-13:978-1-4051-1582-7)
- Garcia de Leaniz, C., **Fleming, I.A.**, Einum, S., Verspoor, E., Jordan, W.C., Consuegra, S., Aubin-Horth, N., Lajus, D., Villanueva, B., Ferguson, A., Youngson, A.F. and Quinn, T.P. 2007. Local adaptation, pp. 200-240. *In*: E. Verspoor, L. Stradmeyer and J. Nielsen (eds.) The Atlantic salmon: Genetics, Conservation and Management. Blackwell, Oxford. (ISBN-13:978-1-4051-1582-7)
- Jordan, W.C., **Fleming, I.A.** and Garant, D. 2007. Mating system and social structure, pp 172-199. *In*: E. Verspoor, L. Stradmeyer and J. Nielsen (eds.) The Atlantic salmon: Genetics, Conservation and Management. Blackwell, Oxford. (ISBN-13:978-1-4051-1582-7)
- Hindar, K. and **Fleming, I.A.** 2007. Behavioural and genetic interactions between escaped farm and wild Atlantic salmon, pp. 115-122. *In* T.M. Bert (ed.) Ecological and Genetic Implications of Aquaculture Activities. Kluwer Academic, New York.
- Koseki, Y. and **Fleming, I.A.** 2004. The evolution of alternative life histories as reproductive strategies: sexual selection and alternative reproductive phenotypes, pp. 71-106. *In* K. Maekawa (ed.) Ecology and Evolution of Salmonids. Bun-ichi Sogo Shyuppan, Tokyo, Japan. (In Japanese)
- Fleming, I.A.** and Reynolds, J.D. 2004. Salmonid breeding systems, pp. 264-294. *In* A.P. Hendry and S.C. Stearns (eds) **Evolution Illuminated, Salmon and Their Relatives**. Oxford University Press, Oxford. (ISBN 0-19-514385-X)
- Fleming, I.A.** and Jensen, A.J. 2001. Fisheries: Effects of climate change on the life cycles of salmon, pp. 309-312. *In* I. Douglas (ed.) **Causes and consequences of global environmental change**. Volume 3. Encyclopedia of Global Environmental Change. Wiley, Chichester. (ISBN 0-471-97796-9)

- Fleming, R.A., Fleming, R.L. and **Fleming, I.A.** 2001. Life cycles, pp. 385-389. *In* H.A. Mooney and J. Canadell (eds.) **The Earth System: biological and ecological dimensions of global environmental change**. Volume 2. Encyclopedia of Global Environmental Change. Wiley, Chichester. 625 p. (ISBN 0-471-97796-9)
- Fleming, I.A.** 1998. Spawning of Atlantic salmon, pp. 127-141. *In* R.V. Kazakov (ed.) **Atlantic salmon**. Nauka, St. Petersburg, Russia. 575 p. (ISBN 5-02-026113-0) (in Russian)
- Økland, F., **Fleming, I.A.**, Thorstad, E.B., Finstad, B., Einum, S. and McKinley, R.S. 2000. EMG telemetry to record the intensity of swimming- and breeding-related behaviour in Atlantic salmon, pp. 51-58. *In* Moore, A. and Russell, I.A. (eds.) **Advances in Fish Telemetry**. Centre for Environment, Fisheries and Aquaculture Science, Lowestoft, U.K., 264 p.
- McNeely, J.A. et al. (Contributor). 1995. Human influences on biodiversity, pp. 711-821. *In* V.H. Heywood (ed.) **Global Biodiversity Assessment**. United Nations Environmental Programme and Cambridge University Press, Cambridge. (ISBN 0-521-56481-6)
- Fleming, I.A.** 1995. Reproductive success and the genetic threat of cultured fish to wild populations, pp. 117-135. *In* D.P. Philipp, J.M. Epifanio, J.E. Marsden and J.E. Claussen (eds.) **Protection of aquatic biodiversity**. Proceedings of the World Fisheries Congress, Theme 3. Oxford and IBH Publishing, New Delhi, India. (ISBN 81-204-0971-X)
- Jonsson, B., and **Fleming, I.A.** 1993. Enhancement of wild salmon populations, pp. 209-242. *In* G. Sundnes (ed.) **Human Impact on Self-recruiting Populations**. An International Symposium of the Royal Norwegian Society of Sciences and Letters, Kongsvoll, Norway, 7-11 June 1993. Tapir Press, Trondheim, Norway. (ISBN 82-519-1455-8)

Other Peer Reviewed Articles

- Westley, P.A.H., Ings, D. and **Fleming, I.A.** A review and annotated bibliography of the impacts of invasive brown trout (*Salmo trutta*) on native salmonids, with an emphasis on Newfoundland waters. Canadian Technical Report of Fisheries and Aquatic Sciences, *in press*.
- Thorstad, E.B., **Fleming, I.A.**, McGinnity, P., Soto, D., Wennevik, V. and Whoriskey, F. 2008. Incidence and impacts of escaped farmed Atlantic salmon, *Salmo salar*, in nature. **Report from the Technical Working Group on Escapes of the Salmon Aquaculture Dialogue, World Wildlife Fund**. 108 p.
- Weir, L.K. and **Fleming, I.A.** 2006. Behavioural interactions between farm and wild salmon: potential for effects on wild populations, pp 1-29. *In*: A Scientific Review of the Potential Environmental Effects of Aquaculture in Aquatic Ecosystems, Volume V. **Canadian Technical Report of Fisheries and Aquatic Sciences** 2450.
- Lacroix, G.L. and **Fleming, I.A.** 1998. Ecological and behavioural interactions between farmed and wild Atlantic salmon: consequences for wild salmon. **Canadian Stock Assessment Secretariat Research Document** 98/162.
- Fleming, I.A.** and Aagaard, K. 1993. Documentation and measurement of biodiversity. **Report to the United Nations Environmental Program Expert Conference on Biodiversity, Norway, May 1993**. NINA Utredning 50: 1-23.
- Jonsson, B., Andersen, R., Hansen, L.P, **Fleming, I.A.** and Bjørge, A. 1993. Sustainable use of biodiversity. **Report to the United Nations Environmental Program Expert Conference on Biodiversity, Norway, May**. NINA Utredning 48: 1-22.

Papers Submitted for Review

- Sundt-Hansen, L., Einum, S., Neregård, L., Björnsson, B.T., Johnsson, J.I., **Fleming, I.A.**, Devlin, R.H. and Hindar, K. Growth hormone treatment of Atlantic salmon fry reduces growth in nature. *Functional Ecology*, *submitted 30 March 2011*.

30 March 2011.

Bachan, M.M., Fleming, I.A. and Trippel, E.A. Maternal allocation of lipid classes and fatty acids with seasonal egg production in Atlantic cod (*Gadus morhua*) of wild origin. *Marine Biology*, submitted 11 June 2011 (in revision).

Moreau, D.T.R. and **Fleming, I.A.** Enhanced growth reduces precocial male maturation in Atlantic salmon (*Salmo salar*). *Functional Ecology*, submitted 13 July 2011.

Moreau, D.T.R., Fletcher, G.L. Gamperl, A.K. and Fleming, I.A. Delayed phenotypic expression of growth hormone transgenesis during early ontogeny in Atlantic salmon (*Salmo salar*). *Ecological Applications*, submitted 12 July 2011.

Books & Edited Volumes

National Research Council, USA (co-author). 2004. **Atlantic Salmon in Maine: A Challenge in Conservation and Ecosystem Management**. Final Report from the Committee on Atlantic Salmon in Maine. National Academy Press, Washington, DC, 276 pp. (ISBN 0-309-09135-7)

National Research Council, USA (co-author). 2002. **Genetic Status of Atlantic Salmon in Maine**. Interim Report from the Committee on Atlantic Salmon in Maine. National Academy Press, Washington, DC. 62 pp. (ISBN 0-309-08311-7)

Thorstad, E., **Fleming, I.A.** and Næsje, T. (eds.) 2002. **Aquatic Telemetry**. Proceedings of the Fourth Conference on Fish Telemetry in Europe. Kluwer Academic. (ISBN 1-4020-0877-5) (reprinted from **Hydrobiologia** volume 483: 1-292; ISSN 0018-8)

Fleming, I.A. (ed.) 2001. Proceedings of the Workshop on the Release of Salmonid Fishes in Norway. **Nordic Journal of Freshwater Research** 75(1): 1-152. (ISSN 1100-4096)

Published Proceedings

Fleming, I.A. 2004. Interactions between farmed and wild fish: experiences from Norway. *In* Sustentabilidad de al industria salmonera en Chile y el Mundo. Proceedings of the International Workshop on Salmon Farming in Chile: Keys to Sustainable Management, Puerto Montt, Chile, June 5-6, 2002. Terram Foundation, Santiago, Chile.

Finstad, B., McKinley, R.S., **Fleming, I.A.**, Bjørnsson, B.Th., Augustsson, T. and Johnsson, J.I. 2002. Comparisons of wild and cultured Atlantic salmon: a case study from Norway. *In* McKinley, R.S., Driedzic, W.R. and MacKinlay, D. (eds.) **Behavioral and Physiological Comparisons of Cultured and Wild Fish**. Proceedings of the International Congress on the Biology of Fish, University of British Columbia, Canada, July 21-26, 2002. American Fisheries Society.

- Fleming, I.A.** 2002. Can hatchery fish contribute to the natural productivity of wild populations? pp. 32-56. *In* C. Orr, P. Gallagher and J. Penikett (eds.) **Speaking for the Salmon. Workshop Proceedings on Hatcheries and the Protection of Wild Salmon.** Continuing Studies in Science, Simon Fraser University, Burnaby, Canada. (ISBN 0-86491-230-7)
- Fleming, I.A.** and **Einum, S.** 2000. The implications of maternal decisions for offspring growth and survival, pp. 63-66. *In* Letcher, B. and MacKinlay, D. (eds.) **Consequences of Salmonid Growth Variability.** Proceedings of the International Congress on the Biology of Fish, University of Aberdeen, Scotland, July 23-27, 2000. American Fisheries Society. (ISBN 1-894337-16-6).
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Technical Reports / News & Comments / Book Reviews / Popular Science Articles

- Anonymous (I.A. Fleming co-author). Consensus Document on the Biology of Atlantic salmon (*Salmo salar*). Organisation for Economic Co-operation and Development (OECD) Series on Harmonisation of Regulatory Oversight of Biotechnology, *in press*.
- Ings, D.W., Westley, P.A.H. and Fleming, I.A. 2008. Impacts of invasive brown trout (*Salmo trutta*) on native salmonids: A review of competitive interactions of brown trout and Atlantic (*Salmo salar*) or brook trout (*Salvelinus fontinalis*) with an emphasis on Newfoundland waters. Report submitted to Fisheries and Oceans Canada.
- Reddin, D.G., **Fleming, I.A.**, Hansen, L.P. and Dowton, P. 2008. Ecological aspects of thermal habitat and depth experienced by Atlantic salmon kelts (*Salmo salar*) in Newfoundland. ICES Working Group on North Atlantic salmon, working paper 26.
- Courtney, S., Blankenship, L., Bronsnan, D., **Fleming, I.A.**, McKinley, S., Naish, K. and Secor, D. 2007. Review of Atlantic salmon hatchery protocols, production, and product assessment. Sustainable Ecosystem Institute report submitted to the Maine Atlantic Salmon Commission.
- Ugedal, O., Forseth, T., Jonsson, B., Daverdin, R., Einum, S., **Fleming, I.A.**, Saksgård, Boisclair, D. and Guénard, G. 2005. Competition within and between fish species – enclosure research, pp. 67-69. *In* B. Jonsson and N.G. Yoccoz (eds.) Ecosystem dynamics: human impacts on biological diversity. NINA's strategic institute programs 2001-2005. NINA Temahefte 33.
- Hey, J., Brannon, E.L., Campton, D.E., Doyle, R.W., **Fleming, I.A.**, Kinnison, M.T., Lande, R., Olsen, J., Philipp, D.P., Travis, J., Wood, C.C. and Doremus, H. 2005. Considering Life History, Behavioral, and Ecological Complexity in Defining Conservation Units for Pacific Salmon. An independent panel report, requested by NOAA Fisheries. 32 p.
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- Morbrand, L., McConnaha, C., Barr, J., Costello, R., **Fleming, I.A.**, Harrison, J. Huppert, D., Lichatowich, J., Malone, K., Marsh, J., Norman, G., Parkin, D., Smith, S. and Suzumoto, B. 2003. Artificial Production Review and Evaluation: Basin-level Report. Northwest Power and Conservation Council Document 2003-17.
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- Forseth, T., Ugedal, O., Jonsson, B., **Fleming, I.A.** and Gåsdal, O. 2002. How do we get large fish? pp. 27-31. *In* H.C. Pedersen and B. Jonsson (eds.) NINAs Strategic Institute Programmes 1996-2000: Sustainable exploitation of populations. Final Report. NINA Temahefte 18, 92 p. (ISBN 82-426-1285-4) (In Norwegian with an English abstract).
- Fleming, I.A.** 2001. Captive breeding: conflict between conserving genetic variation and natural behaviour, pp. 34-35. *In* K. Hindar and B. Jonsson (eds.) NINAs Strategic Institute Programmes 1996-2000: Conservation of biodiversity – from genes to landscapes. Final Report. NINA Temahefte 17, 125 p. (ISBN 82-426-1176-9) (In Norwegian with an English abstract).
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- Fleming, I.A.**, Hindar, K., Jonsson, B. and Hansen, L.P. 2001. Effects of escape salmon on wild salmon, pp. 94-97. *In* K. Hindar and B. Jonsson (eds.) NINAs Strategic Institute Programmes 1996-2000: Conservation of biodiversity – from genes to landscapes. Final Report. NINA Temahefte 17, 125 p. (ISBN 82-426-1176-9) (In Norwegian with an English abstract).
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- Strand, R., **Fleming, I.A.** and Johnsen, B.O. 2001. Releases of salmonid fishes. Kongsvoll Workshop 2000. NINA Fagrapport 045: 1-49. (ISBN 82-426-1185-8) (In Norwegian with an English abstract)
- Berger, H.M., Lamberg, A., **Fleming, I.A.**, Hindar, K. and Fjeldstad, H.-P. 2001. Reconstruction of spawning sites for anadromous brown trout (*Salmo trutta* L.) and Atlantic salmon (*Salmo salar*) in the river Gråelva, Stjørdalselva watershed in central Norway during 1999-2000. NINA Oppdragsmelding 678, 27 p. (ISBN 82-426-1202-1) (In Norwegian with an English abstract).
- Fleming, I.A.** 1999. Behavioural studies in salmonid fishes. *In* M.M. Hansen (ed.) Proceedings of the Second Workshop of the European Concerted Action on Identification, Management and Exploitation of Genetic Resources in Brown Trout (*Salmo trutta*), St. Feliu de Guixols, Spain, 28 June – 4 July 1999.
- Lund, R.A., Finstad, B., **Fleming, I.A.** and Hindar, K. 1999. Oppdrettslaks og ville bestander av laksefisk. (Farmed salmon and wild populations of salmonid fishes), pp. 133-147. *In* K.H. Brox (ed.) Brennpunkt Natur: Aktuelt om natur og miljø. (Focal Point Nature: news about nature and environment) Tapir, Trondheim (in Norwegian) ISBN 82-519-1551-1.
- Fleming, I.A.**, Hindar, K. and Jonsson, B. 1998. Ecological and genetic consequences of escaped farmed salmon for wild populations. **Norges Forskningsråd, Forskningsprogrammet Produksjon av laksefisk Fakta-ark.**
- Fleming, I.A.** 1997. Evolution and the Aquatic Ecosystem: Defining Unique Units in Population Conservation. J.L. Nielsen (ed.). **Fisheries Management and Ecology** 4: 253-254.
- Forseth, T., Halvorsen, G.A., Ugedal, O., **Fleming, I.A.**, Schartau, A.K.L., Nøst, T., Hartvigsen, R., Raddum, G., Mooji, W. and Kleiven, E. 1997. Biological status of limed lakes. **NINA Oppdragsmelding** 508: 1-52. (In Norwegian with an English abstract)
- Forseth, T., Halvorsen, G.A., Ugedal, O., **Fleming, I.A.**, Schartau, A.K.L., Nøst, T., Hartvigsen, R., Raddum, G., Mooji, W. and Kleiven, E. 1997. Biological status of limed lakes — report for the individual lakes. **NINA Oppdragsmelding** 509: 1-232.
- Fleming, I.A.**, Hartvigsen, R. and Grimnes, A. 1997. Review of Key Issue B: Fish Health. Prepared for the British Columbia Environmental Assessment of Salmon Aquaculture. Victoria, Canada.
- Fleming, I.A.** 1997. A review of Net Gain, The Salmon Farming Industry in British Columbia. Prepared for the T. Buck Suzuki Foundation, Vancouver, Canada.

- Hindar, K., Ferguson, A., Youngson, A.F., Poole, W.R., **Fleming, I.A.**, Thompson, C., Webb, J.H., Mathews, M. and Hansen, L.P. 1997. Hybridisation between escaped farmed Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta*): frequency, distribution, behavioural mechanisms and effects on fitness. **EU Final Report**. 168 p.
- Hindar, K., **Fleming, I.A.**, Jonsson, N., Breistein, J., Sægrov, H., Karlsbakk, E., Gammelsæter, M. and Dønnum, B.O. 1996. Rainbow trout in Norway: occurrence, reproduction and establishment. **NINA Research Report 454**: 1-32. (In Norwegian with an English abstract)
- Jonsson, N., Jonsson, B. and **Fleming, I.A.** 1996. Growth rate of juvenile salmon influences their egg production as adults. **Naturen** 120: 255-258. (In Norwegian)
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- Jonsson, B. (Ed.), Balstad, T., **Fleming, I.A.**, Hansen, L.P., Heggberget, T.G., Hindar, K., Lund, R., Mjølnerød, I.B., Økland, F., Lura, H., Grahl-Nielsen, O. and Skaala, Ø. 1995. Escaped farmed salmon - effects on wild populations. pp. 5-13. In **Environmental effects of fish farming: final report 1990-1994**. Norwegian Research Council, Oslo. (In Norwegian with an English summary).
- NINA-NIKU. 1995. Farming alters salmon morphology. NINA-NIKU Fakta No. 21 – 1995. (In Norwegian)
- Anonymous (I.A. Fleming co-author). 1994. Report of the Study Group on Interactions of Wild, Ranched (enhanced), and Reared Salmon. I.C.E.S. C.M. 1994/M:3
- Fleming, I.A.** and Hindar, K. 1992. When hot geology meets cold climate on an island. **Trends in Ecology and Evolution** 7: 360-361.

Awards

2007. Mercer Patriarche Award for the Best Paper in the North American Journal of Fisheries Management (see Henning, Gresswell & Fleming 2006 above)
2002. Outstanding Service Award, Department of Fisheries and Wildlife, Oregon State University University (co-recipient for revamping Marine Science teaching program).
1998. Mobility Fellowship for Senior, Established Researcher, Nordic Academy for Advanced Study.
1996. W.F. Thompson Award, American Institute of Fishery Research Biologists. (Outstanding student publication in fisheries for 1994 [see Fleming and Gross 1994 above].)

Research Grants and Contracts Awarded (last 10 years)

- 2010-16. Strategic Network Grant, Natural Sciences and Engineering Research Council of Canada. (**\$9,950,812**; Fleming sub-project ca. **\$189,000**)
Principal Investigators – S. Iverson and 28 co-applicants. **Title** – Understanding Species Movements, Interactions, and Environmental Variability across Canada's Three Oceans.
- 2010-15. Discovery Grant, Natural Sciences and Engineering Research Council of Canada. (**\$170,000**)
Principal Investigator – I.A. Fleming. **Title** – Evolutionary ecology of breeding systems and life history: from individual to population responses in fish.
- 2010-14. Marine Institute Norway, Strategic Institute Program. (**20,520,000 NOK**; Fleming participation ca. **50,000 NOK**)
Principal Investigators – K.A. Glover, 10 co-applicants and 4 external partners. **Title** – Farmed escapees and interactions with wild conspecifics: quantification of genetic differences and simulating the long-term fitness consequences post-interaction.
- 2010-13. FORMAS, Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning. (**20,000,000 SEK**; Fleming participation ca. **1,200,000 SEK**).
Principal Investigators – J. Johnsson and 10 co-applicants. **Title** – Sustainable smolt production – an integrated approach.

2010. Research Tools and Instruments, Natural Sciences and Engineering Research Council of Canada. (**\$97,722**)
Principal Investigator – G.L. Fletcher and 9 co-applicants. **Title** – Customized research support vehicle.
2010. New Brunswick Wildlife Trust Fund. (**\$16,200**)
Principal Investigator – I.A. Fleming. **Title** – Effectiveness of different release strategies for adult Atlantic salmon in the restoration of endangered populations in the Bay of Fundy and beyond.
2010. Mathematics of Information Technology and Complex Systems, Network Centre of Excellence, Natural Sciences and Engineering Research Council of Canada. (**\$15,000**)
Principal Investigator – I.A. Fleming. **Title** – Effectiveness of different release strategies for adult Atlantic salmon in the restoration of endangered populations.
- 2010-12. Industrial Research and Innovation Fund, Research and Development Corporation of Newfoundland and Labrador. (**\$8,325,477**)
Principal Investigators – I.A. Fleming and A.K. Gamperl (on behalf of the Ocean Sciences Centre). **Title** – Infrastructure for cold-water and deep-sea research.
- 2009-12. Leading Edge Fund, Canada Foundation for Innovation. (**\$6,525,570**)
Principal Investigators – I.A. Fleming and A.K. Gamperl (on behalf of the Ocean Sciences Centre). **Title** – Infrastructure for cold-water and deep-sea research.
- 2009-12. European Commission Shared-Cost Research Grant, 7th Framework Programme. (**2,970,648 Euro**)
Principal Investigators – T. Dempster (Coordinator: SINTEFF, Norway) and 10 partner institutions from Norway, Greece, Spain, UK, Ireland, Malta (subcontract I.A. Fleming, Canada; ca. 1% of project total).
Title – Assessing the causes and developing measures to prevent the escape of fish from sea-cage aquaculture.
- 2009-10. Major Resource Support Grant, Natural Sciences and Engineering Research Council of Canada. (**\$158,300**)
Principal Investigators – I.A. Fleming (PI), D. Deibel, W.R. Driedzic, P. Gagnon, A.K. Gamperl, A. Mercier, C.C. Parrish, M. Rise, R.B. Rivkin, P.V.R. Snelgrove, R.J. Thompson. **Title** – Cold Ocean Sciences
2009. Research Tools and Instruments, Natural Sciences and Engineering Research Council of Canada. (**\$28,135**)
Principal Investigators – D. Deibel, P. Snelgrove, I.A. Fleming and P. Pepin. **Title** – State-of-the-art tool for digitization, image analysis and archiving of zooplankton and ichthyoplankton samples.
- 2008-11. Strategic Grant, Natural Sciences and Engineering Research Council of Canada. (**\$433,800**)
Principal Investigators – I.A. Fleming, C.F. Purchase, E. Trippel and J. Bratley. **Title** – Assessing and mitigating risk from a diversifying aquaculture industry: the potential for interaction between escapee and wild Atlantic cod.
2008. Research Tools and Instruments, Natural Sciences and Engineering Research Council of Canada. (**\$52,502**)
Principal Investigators – C.C. Parrish and I.A. Fleming. **Title** – Thin-layer chromatography - flame ionization / flame photometric dual detection system.
- 2007-12. Community-University Research Alliances, Social Sciences and Humanities Research Council of Canada (**\$1,000,000**; Fleming sub-project **\$58,000**)
Principal Investigators – Barbara Neis et al. **Title** – Community-University Research for Recovery Alliance (CURRA).
- 2007-08. Mountain Equipment Co-op Research Grant (**\$18,891**)
Principal Investigators – I.A. Fleming, N. Wilke. **Title** – New Brunswick's endangered Atlantic salmon (*Salmo salar*): the effects of captive rearing on the conservation, recovery and restoration of a native resource.
2007. Northern Scientific Training Program. (**\$3,000**)
Principal Investigators – I.A. Fleming, R. Poole. **Title** – Lacustrine and fluvial habitat use by Atlantic salmon parr in Labrador.
- 2007-11. Institute for Biodiversity Ecosystem Science & Sustainability, Department of Environment and Conservation, Newfoundland (**\$80,000**).
Principal Investigators – I.A. Fleming. **Title** – Invasion and impacts of exotic brown trout in Newfoundland.
- 2007-08. Contract, Fisheries and Oceans Canada (**\$9,750**)
Principal Investigators – I.A. Fleming, M. Bachan, E.A. Trippel. **Title** – Atlantic cod egg quality assessment (phase 3).
2007. Contract, Fisheries and Oceans Canada (**\$40,000**)
Principal Investigators – I.A. Fleming, D.A. Scruton. **Title** – Effects of exotic brown trout on wild Atlantic salmon and brook trout in Newfoundland.

2007. Research Tools and Instruments, Natural Sciences and Engineering Research Council of Canada. (**\$19,343**)
Principal Investigators – A.K. Garmperl, W. Driedzic, I.A. Fleming, A. Mercier. **Title** – Fiber optic measurement system for ecophysiology and metabolic research.
2007. Industrial Research & Innovation Fund (**\$167,370**)
Principal Investigator – I.A. Fleming. **Title** – Equipment for Fish Evolutionary and Conservation Biology Research.
- 2006-07. Contract, Fisheries and Oceans Canada (**\$9,750**)
Principal Investigators – I.A. Fleming, M. Bachan, E.A. Trippel. **Title** – Atlantic cod egg quality assessment (phase 2).
- 2006-07. New Brunswick Wildlife Trust Fund. (**\$25,000**)
Principal Investigators – I.A. Fleming (PI). **Title** – Towards successful conservation and re-establishment of Atlantic salmon in New Brunswick.
- 2006-09. Major Facility Access Grant, Natural Sciences and Engineering Research Council of Canada. (**\$837,000**)
Principal Investigators – I.A. Fleming (PI), D. Deibel, W.R. Driedzic, G.L. Fletcher, A.K. Garmperl, A. Mercier, C.C. Parrish, R.B. Rivkin, P.V.R. Snelgrove, R.J. Thompson. **Title** – Cold Ocean Sciences.
2006. Leaders Opportunity Fund, Canadian Foundation for Innovation. (**\$164,060**)
Principal Investigator – I.A. Fleming. **Title** – Equipment for Fish Evolutionary and Conservation Biology Research.
2006. Contract, Fisheries and Oceans Canada (**\$4,000**)
Principal Investigators – I.A. Fleming, M. Bachan, E.A. Trippel. **Title** – Atlantic cod egg quality assessment (phase 1).
- 2006-09. Strategic Grant, Natural Sciences and Engineering Research Council of Canada. (**\$517,126**)
Principal Investigators – E.G. Boulding, I.A. Fleming, P.M. Schulte. **Title** – Conservation genomics of Atlantic salmon towards understanding adaptive trait differences for the management of endangered populations.
2006. Harris Centre Applied Research Fund (**\$14,760**)
Principal Investigators – I.A. Fleming, B. Adams, D. Cote. **Title** – Building the road to proactive and scientifically sound management of exploited fish populations in Newfoundland.
- 2005-08. Biotechnology Risk Assessment Grants Program, US Department of Agriculture. (**\$494,000**)
Principal Investigators – E.M. Hallerman, I.A. Fleming, J.A. Brown, G.L. Fletcher, E. McLean. **Title** – Environmental risk assessment parameters for growth hormone transgenic Atlantic salmon, *Salmo salar*.
- 2005-08. Parks Canada Ecological Integrity Innovation and Leadership Funds. (subcontract **\$75,000**)
Principal Investigators – D. Cote (overall project leader) - I.A. Fleming, B. Adams (subcontract). **Title** – Building the road to proactive and scientifically sound management of fish populations in Canada's National Parks.
2005. Research Tools and Instruments, Natural Sciences and Engineering Research Council of Canada. (**\$38,609**)
Principal Investigators – A.K. Garmperl, J.A. Brown, I.A. Fleming, P.V.R. Snelgrove. **Title** – Infrastructure for the study of marine eggs and larvae.
- 2004-09. Discovery Grant, Natural Sciences and Engineering Research Council of Canada. (**\$160,000**)
Principal Investigator – I.A. Fleming. **Title** – Behavioural and life history diversity in the dynamics of fish populations.
- 2003-06. North Pacific Research Board. (**\$230,250**)
Principal Investigators – I.A. Fleming, C.H. Ryer, A.A. Abookire, A.W. Stoner. **Title** – Evaluation of emergent structure in low-relief benthic habitats as a criterion for defining the essential habitat of juvenile Alaskan flatfishes.
- 2003-06. Norwegian Research Council. (**\$1,200,00**)
Principal Investigators – K. Hindar, S. Einum, B.Th. Bjornsson, J.I. Johnsson; Associates – J. Tufto, I.A. Fleming and R.H. Devlin. **Title** – Quantifying biological risks of growth-enhanced transgenic salmon.
- 2003-06. Norwegian Research Council. (**\$133,000**)
Principal Investigators – T. Forseth, O. Ugedal, P. Fiske, B.M. Larsen, S. Einum, P. Eklöv and I.A. Fleming. **Title** – Evolutionary and cascading ecological effects of translocation of native species into new ecosystems.
- 2003-05. Oregon Sea Grant. (**\$464,710**)

- Principal Investigators** – D.L. Bottom, K.K. Jones, C.A. Simenstad and IA. Fleming. **Title** – Salmonid use of restored estuarine wetlands: regional application of the Salmon River Estuary Study.
- 2002-03. Norwegian University of Science and Technology, subcontract of Norwegian Research Council grant. (\$11,330)
- Principal Investigators** – I.A. Fleming and M.A. Banks. **Title** – Captive breeding: conflict between maintaining genetic variation and loss of behavioural fitness.
- 2002-03. Oregon Sea Grant, Program Development Proposal. (\$13,361)
- Principal Investigators** – I.A. Fleming, D.L. Bottom, K.K. Jones, C.A. Simenstad. **Title** – A pilot study for evaluating individual behavior, residency, and growth of juvenile chinook salmon in estuarine marsh-channel networks.
- 2003-04. Western Regional Aquaculture Center (USDA). (\$75,594)
- Principal Investigator** – I.A. Fleming. **Title** – Potential impacts of molluscan shellfish culture on salmon in estuaries.
2002. Oregon State University Research Equipment Reserves Fund. (\$9,281)
- Principal Investigator** – I.A. Fleming. **Title** – Stereomicroscope with digital image analysis camera.
- 2002-03. Mamie Markham Research Awards. (\$13,300)
- Principal Investigators** – I.A. Fleming and M. Mann. **Title** – Defining micro-habitat for juvenile rockfish off the Oregon coast: the role of abiotic and biotic structure.
- 2002-03. Cooperative Institute for Marine Resource Studies. (\$47,300)
- Principal Investigators** – M.A. Banks, B.A. Shields, I.A. Fleming, D.S. Fox. **Title** – Genetic and ecological inference on ranges and limits of stock structure among four rockfish life-history types.
2002. Oregon State University Building Use Credit. (\$21,000)
- Principal Investigator** – I.A. Fleming. **Title** – Construction of Aquarium Mechanical Building.
- 2001-04. European Commission Shared-Cost Research Grant. (Norwegian Institute for Nature Research: 355,855 Euro or \$427,000)
- Partner** – R. Stete (Coordinator: Wageningen University, The Netherlands), K. Hindar (Norwegian Institute for Nature Research) and I.A. Fleming (one of five partner institutes). **Title** – Impact of aquaculture on the immune response genes of natural salmonid populations: spatial and temporal genetic signatures and potential fitness consequences.
- 2001-03. Norwegian Research Council (2,289,000 NOK or \$338,600)
- Project Leader** – I.A. Fleming (Partners: S. Einum, P. Fiske, L.P. Hansen, K. Hindar, H. Sægrov). **Title** – Quantifying long-term ecological and genetic effects of interactions between farm and wild salmon.
- 2000-03. Networks of Centres of Excellence, Canada (\$360,500)
- Partner** – W.R. Driedzic (Program Leader: Memorial University, Newfoundland), J.A. Hutchings (Dalhousie University, Canada) and I.A. Fleming (one of 31 Network Projects). **Title** – Genetic and ecological interactions between farm and wild Atlantic salmon. Canadian Network in Aquaculture (AquaNet).
- Project Leader** – I.A. Fleming. **Title** – Workshop on hatchery releases of anadromous salmonids.
- 2000-02. European Commission Concerted Action Grant. (990,040 Euro or \$1,188,048)
- Partner** – W. Crozier (Coordinator: Queen's University Belfast), I.A. Fleming (one of 10 partner institutes from England, Finland, France, Northern Ireland, Norway, Republic of Ireland, Scotland, Sweden & Canada). **Title** – A coordinated approach towards development of a scientific basis for management of wild Atlantic salmon in the North-east Atlantic.
- 1998-01. European Commission Shared-Cost Research Grant. (880,000 Euro or \$1,056,000)
- Partner** – T. Jarvi (Coordinator: Swedish National Board of Fisheries), I.A. Fleming (Team Leader for one of seven partner institutes from Norway, Scotland, Spain and Sweden). **Title** – Performance and ecological impacts of introduced and escaped fish: physiological and behavioural mechanisms.
- 1998-01. Norwegian Research Council. (1,224,600 NOK or \$181,422)
- Project Leader** – I.A. Fleming & G. Rosenqvist. **Title** – Captive breeding: conflict between maintaining genetic variation and behavioural fitness.
- Project Leader** – I.A. Fleming. **Title** – Reproductive and life history strategies of salmonid fishes.
- 1997-01. Norwegian Research Council. (1,295,000 NOK or \$191,8512)
- Investigators** – S. Einum (stipend) & I.A. Fleming (supervisor). **Title** – Evolution of egg size and breeding time in relation to the life history of fishes, with special reference to Atlantic salmon.

Graduate Student Supervision*Ph.D.*

- 2009- Brendan Wringle, Department of Biology, Memorial University of Newfoundland, St. John's, Canada. (co-supervision Craig Purchase)
- 2007- Peter Westley, Department of Biology, Memorial University of Newfoundland, St. John's, Canada.
- 2006- Nathan Wilke, Department of Biology, Memorial University of Newfoundland, St. John's, Canada. (co-supervision Patrick O'Reilly)
- 2005- Darek Moreau, Cognitive and Behavioural Ecology Program, Memorial University of Newfoundland, St. John's, Canada. (co-supervision Garth Fletcher)
- 2005- Kathryn Morton, Department of Biology, Memorial University of Newfoundland, St. John's, Canada. (co-supervision Pierre Pepin)
2005. Åslaug Viken, Zoological Institute, Norwegian University of Science and Technology, Trondheim, Norway. (co-supervision Gunilla Rosenqvist)
2000. Sigurd Einum, Zoological Institute, Norwegian University of Science and Technology, Trondheim, Norway.

M.Sc.

- 2011- Ian Hamilton, Department of Biology, Memorial University of Newfoundland, St. John's, Canada. (co-supervision Mark Abrahams)
- 2011- John Winkowski, Department of Biology, Memorial University of Newfoundland, St. John's, Canada.
- 2010- Emily Zimmerman, Cognitive and Behavioural Ecology Programme, Memorial University of Newfoundland, St. John's, Canada. (co-supervision Craig Purchase)
- 2009- Becky Graham, Cognitive and Behavioural Ecology Programme, Memorial University of Newfoundland, St. John's, Canada.
- 2008- Michelle Caputo, Department of Biology, Memorial University of Newfoundland, St. John's, Canada.
- 2005- Rebecca Poole, Department of Biology, Memorial University of Newfoundland, St. John's, Canada.
- 2005- Sarah Ross, Department of Biology, Memorial University of Newfoundland, St. John's, Canada. (co-supervision Bob Gregory)
- 2004- Michelle Simms, Cognitive and Behavioural Ecology Graduate Program, Memorial University of Newfoundland, St. John's, Canada. (2/3 year maternity leave)
2011. Michelle Bachan, Department of Biology, Memorial University of Newfoundland, St. John's, Canada.
2010. Lance Campbell, Department of Fisheries and Wildlife, Oregon State University, Corvallis, USA. (co-supervision Dan Bottom, NOAA Fisheries)
2009. David Hering, Department of Fisheries and Wildlife, Oregon State University, Corvallis, USA. (co-supervision Dan Bottom, NOAA Fisheries)
2008. Marion Mann, Department of Fisheries and Wildlife, Oregon State University, Corvallis, USA.
2007. Christopher Lewis, Cognitive and Behavioural Ecology Programme, Memorial University of Newfoundland, St. John's, Canada. (co-supervision Bob Gregory)
2007. Lisa Krentz, Department of Fisheries and Wildlife, Oregon State University, Corvallis, USA. (co-supervision Hiram Li, US Geological Survey)
2005. Megan Petrie, Department of Fisheries and Wildlife, Oregon State University, Corvallis, USA. (co-supervision Cliff Ryer, NOAA Fisheries)
2005. Julie Henning, Department of Fisheries and Wildlife, Oregon State University, Corvallis, USA. (co-supervision Bob Gresswell, US Geological Survey)
2004. Jaclyn Bennett (nee Richards), Department of Fisheries and Wildlife, Oregon State University, Corvallis, USA.
1999. Sean Gillard, Zoological Institute, Norwegian University of Science and Technology, Trondheim, Norway.
1996. Sigurd Einum, Zoological Institute, Norwegian University of Science and Technology, Trondheim, Norway.

Undergraduate Student Supervision (Honours thesis)

2011. Krista Oke, Department of Biology, Memorial University of Newfoundland.

Visiting Professors/Postdoctoral Fellows/Graduate Students in the Laboratory

- 2011. Marie Vaugeois, MSc student, Université Paris-Sud 11, Paris, France (6 weeks)
- 2010. Ciar O'Toole, PhD student, University College Cork, Ireland (2 months)
- 2005-08. Blair Adams, Postdoctoral Fellow, supported by Parks Canada contract (3 year).
- 2006-07. Erik Heibo, Postdoctoral Fellowship, supported by the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning.
- 2006. Jörgen Johnsson, Professor, Department of Zoology, Göteborg University, Sweden (2 months)
- 2004-06. Yusuke Koseki, Postdoctoral Fellow, supported by Japanese Society for the Promotion of Science (2 year)
- 2002-03. Yusuke Koseki, Postdoctoral Scientist, Hokkaido University, Japan (1 year)
- 2001. Sigurd Einum, Professor, Norwegian University of Science and Technology, Trondheim, Norway (3 months).
- 2000. Dany Garant, PhD student, University of Laval, Canada (4 months).

Undergraduate and High School Students in the Laboratory

- 2009-10. Krista Oke, Department of Biology, Memorial University of Newfoundland – NSERC Undergraduate Student Research Awardee.
- 2008-09. Adam Fitzpatrick, Department of Biology, Memorial University of Newfoundland – Memorial's Undergraduate Career Experience Program.
- 2008-09. Michael Greeley, Holy Heart High School, Student Coop Program.
- 2008. Kendra Clarke, St. Lawrence, Women in Science and Engineering, Summer Student Employment Program.
- 2008. Adam Fitzpatrick, Canada Summer Jobs, Department of Biology, Memorial University of Newfoundland.
- 2007-08. Julia Pantin, Department of Biology, Memorial University of Newfoundland – Memorial's Undergraduate Career Experience Program.
- 2007. Clare Lewis, King's Cove, Women in Science and Engineering, Summer Student Employment Program.
- 2006-07. Gary Pardy, Department of Biology, Memorial University of Newfoundland – Memorial's Undergraduate Career Experience Program.
- 2005-06. Dominic Foley, Department of Biology, Memorial University of Newfoundland – Memorial's Undergraduate Career Experience Program.
- 2003. Daniel Jones, Department of Fisheries & Wildlife, Oregon State University - Howard Hughes Medical Institute Undergraduate Research Award.

Invited Presentations (last 10 years)

- 2011. *Plenary* Symposium on Escapees – Environmental Effects and Methods to Trace, Mitigate and Prevent Escapes. Aquaculture Europe 2011, Rhodes, Greece. (October)
- 2010. Department of Animal Ecology, Göteborg University, Sweden (9 February)
- 2009. *Keynote*, Workshop on Atlantic salmon stocking as a tool in the restoration toolbox. St. Francis Xavier University, Canada. (9 Feb)
- 2008. Department of Biology, University of Montreal, Canada (22 April)
- 2008. *Keynote*, Joint Atlantic Provinces Council of the Sciences Conference - Atlantic Undergraduate Biology Conference (AUBC) & Atlantic Universities Aquaculture Conference (AUAC), St John's, Canada (8 March).
- 2008. Department of Integrative Biology, University of Guelph, Canada. (24 January)
- 2007. 2nd Darwin Workshop on the Molecular Ecology of Salmonid Invasions, Vina del Mar, Chile (17-19 December)
- 2007. *Plenary*, 31st Annual Larval Fish Conference. St. John's, NL, Canada. (9-12 July)
- 2007. Symposium on Gamete Evolution and Ecology, Meeting of the Canadian Society of Ecology and Evolution. University of Toronto, Canada. (17-20 May)
- 2007. *Keynote*, Darwin Initiative, First International Workshop on Reducing the Impact of Exotic Aquaculture on Native Aquatic Biodiversity. Puerto Montt, Chile. (January 15-21)
- 2006. Norwegian Institute for Nature Research, Trondheim, Norway. (December 4)
- 2005. *Keynote*, International Workshop on Evaluating Methods for Improving the Quality of Fish Reared for Stocking, Älvkarleby, Sweden. (14-16 September)

2005. American River Watershed Conference, Sacramento, CA, USA. (April 21-23)
2005. Symposium on Defining Complex Conservation Units, Seattle, WA, USA. (March 29-31)
2005. Saving Salmon: Does the Nature Conservancy have a special role that warrants multi-chapter collaboration? San Francisco, CA, USA (March 9-11)
2005. Department of Biology, Dalhousie University, Halifax, Canada (Feb 3)
2004. Department of Environmental Science, University of Siena, Italy. (December)
2004. Department of Biology, Memorial University of Newfoundland, St. John's, Canada. (October)
2004. *Keynote*, Behaviour and ecology of freshwater fish: linking ecology and individual behaviour. Silkeborg, Denmark (August 22-26)
2004. *Keynote*, Fisheries Society of the British Isles Symposium, London, UK. (19-23 July)
2004. Salmon Aquaculture Dialogue. World Wildlife Fund, Washington, DC. (February 13-14)
2003. University of Bari, Bari, Italy.
2003. University of Siena, Siena, Italy.
2003. Uppsala University, Uppsala, Sweden.
2003. Columbia Forum, Astoria, Oregon, USA.
2003. Swedish University of Agricultural Sciences, Umeå, Sweden.
2003. Symposium on Environmental issues surrounding salmon aquaculture. Pacific Fisheries Management Council, Seattle, USA.
2003. Ocean Sciences Centre, Memorial University, St. John's, Canada.
2003. Centre for Ecology, Evolution and Conservation. University of East Anglia, Norwich, UK.
2002. Department of Biology, University of Aarhus, Aarhus, Denmark.
2002. National Marine Fisheries Service, Seattle, USA.
2002. International Workshop on Salmon Farming in Chile: Keys to Sustainable Management. Puerto Montt, Chile.
2002. Taking stock in 2002: the state of the science on hatchery and wild fish issues. Toward ecosystem-based management: breaking down the barriers in the Columbia River Basin and beyond. Annual Meeting of the North Pacific International Chapter, American Fisheries Society. Spokane, WA, USA.
2002. Symposium on Hatcheries: What have we learned from our past practices? Where do we go from here? Annual Meeting of the Oregon Chapter, American Fisheries Society, Sun River, OR, USA.
2001. Department of Zoology, Oregon State University, Corvallis, OR, USA.
2001. School of Aquatic and Fisheries Sciences, University of Washington, Seattle, WA, USA.
2001. Workshop on Hatcheries & the Protection of Wild Salmon. Simon Fraser University, Vancouver, Canada.

Editorial Positions

- 2009- Associate Editor, Canadian Journal of Fisheries and Aquatic Sciences.
- 2009- Contributing Editor, Aquaculture Environment Interactions.
- 2004-07. Associate Editor, Transactions of the American Fisheries Society.
2001. Co-editor, Proceedings of the Fourth Conference on Fish Telemetry in Europe.
2000. Editor, Proceedings of the Kongsvald Workshop on Releases of Salmonid Fishes in Norway. Nordic Journal of Freshwater Research.

Academic Activities (outside Memorial during the last 10 years)

2011. External Examiner. Ignacio Serrano, PhD dissertation, Umeå University, Sweden.
2011. External Examiner. Elina Halttunen, PhD dissertation, University of Tromsø, Norway.
2011. Co-organizer symposium on *Environmental effects and methods to trace, mitigate and prevent escapes*. European Aquaculture Society Annual Meeting, Rhodes, Greece.
2011. Co-organizer of symposium on *Factors Contributing to the Population Resilience of Anadromous and Resident Salmonids*. American Fisheries Society Annual Meeting, Seattle, USA.
2010. Invited Expert. Fraser River sockeye 2010. Simon Fraser University, Vancouver.
2010. Steering Committee. State of the Salmon conference on the Ecological Interactions between Wild & Hatchery Salmon. Portland, OR, USA.
- 2010-16. Atlantic representative. Ocean Tracking Network Canada Scientific Advisory Committee.

- 2010-11. Expert Panel on Ocean Climate Change and Marine Biodiversity, Royal Society of Canada.
- 2010-12. IUCN Salmonid Specialist Group.
2010. External Examiner. Inês Braga Gonçalves, PhD dissertation, University of Göteborg, Sweden.
2009. Invited Expert. Aquaculture Pathway of Effects Workshop, Fisheries & Oceans Canada, Ottawa.
2009. External Examiner. Shawn Garner, PhD dissertation, University of Western Ontario, London, Canada.
2009. Expert Reviewer. Center for Independent Experts (CIE), 2009 National Marine Fisheries Service's Southern Oregon/Northern California Coast Coho Salmon Recovery Plan.
2009. Expert Reviewer. Center for Independent Experts (CIE), 2008 National Marine Fisheries Service's Biological Opinion on the Long-term Central Valley Project and State Water Project Operations, Criteria and Plan.
2009. Ecosystem Science and Management Program Review Panel Member. University of Northern British Columbia.
2009. Ecology and Environmental Sciences Review Panel Member. Swedish University of Agricultural Sciences, Uppsala, Sweden.
- 2008-10. Scientific Advisory Team. State of the Salmon Program, Portland, OR, USA.
2008. External Examiner. Atso Romakkaniemi, PhD dissertation, University of Helsinki, Finland.
2008. Invited Participant. Biodiversity Facility Review, Fisheries and Oceans Canada, Ottawa.
- 2008-09. Steering Committee. Cod Genome Project, Genome Atlantic.
2007. Invited Participant. National Academies workshop on Genetically Engineered Organisms, Wildlife, and Habitats, Irvine, USA.
2007. Panel Member. Atlantic Salmon Review, Sustainable Ecosystems Institute.
2007. Co-organizer. 31st Annual Larval Fish Conference, St. John's.
2007. Invited Expert. Speaking for Salmon – Summit of Scientists on Aquaculture and the Protection of Wild Salmon on the British Columbia Coast. Alert Bay, BC.
- 2006-07. Invited Panel Member. Technical Working Group on Escapes, Salmon Aquaculture Dialogue, World Wildlife Fund.
2006. External Examiner. Linda Anett Hansen, PhD dissertation, University of Tromsø, Norway.
2006. Expert Reviewer. Center for Independent Experts (CIE), Status Review for Anadromous Atlantic Salmon (*Salmo salar*) in the United States.
- 2006-08. Aquaculture Collaborative Research and Development Program Regional Committee of the Department of Fisheries and Oceans Canada.
2006. Organizer. Symposium on *From Individual to Population Processes in Fish* at the International Congress on the Biology of Fish. St. John's.
2006. Invited External Reviewer. Department of Fisheries and Oceans Workshop on Conservation Status Report for Atlantic Salmon. Moncton.
2005. Invited Expert. Workshop on *Environmental Risk Assessment of Genetically Modified Organisms*, Worldfish Center, Penang, Malaysia.
2005. Canadian representative. Organisation for Economic Co-operation and Development (OECD) Expert Workshop on the Biology of Atlantic salmon, Trondheim, Norway.
2005. Panel Member. Defining Complex Conservation Units Under the Endangered Species Act, NOAA Fisheries, Seattle, USA.
2005. Invited Expert. Changing Currents: Charting a Course of Action for the Future of Oceans. Simon Fraser University, Vancouver, BC.
2004. Selection Committee. Brockhouse Canada Prize, Natural Sciences and Engineering Research Council of Canada.
2004. Chair. Symposia on Escapes from Salmon Aquaculture, World Aquaculture Society Meeting, Hawaii, USA.
2003. External Examiner. Johan Dannewitz, PhD dissertation, Uppsala University, Sweden.
2003. External Examiner. Erik Heibo, PhD dissertation, Swedish University of Agricultural Sciences, Umeå, Sweden.
2003. Co-organizer. Symposium on *Maternal Effects in Fish*. Early Life History Section of the American Fisheries Society, Santa Cruz, USA.
2003. Co-organizer. Symposium on *Interactions of Hatchery and Wild Fishes in Marine and Estuarine Environments*. Western Division American Fisheries Society, San Diego, USA.
2003. Steering Committee. Quantitative/Experimental Genetics Workshop, European Union funded SALGEN project.

- 2003. Scientific Committee. Fifth Conference on Fish Telemetry held in Europe, Ustica, Italy.
- 2002-03. Co-chair. Scientific Advisory Board, Cooperative Institute for Marine Resources Studies, Oregon State University, Corvallis, OR, USA.
- 2002. Invited Expert. Workshop on *How do Aquaculture and Capture Fisheries Interact? The Ecological, Economic and Policy Implications of Aquaculture Escapes*, Communication Partnership for Science and the Sea, Stanford University, CA, USA.
- 2002. External Examiner. Dorte Bekkevold, PhD dissertation, Aarhus University, Denmark.
- 2002. Invited Participant. Workshop on *Measurable Salmonid Recovery Criteria*, Corvallis, OR, USA.
- 2002. Invited Expert. Information Systems for Biotechnology (ISB) workshop on *Environmental Risk Assessment Modeling*, Virginia Beach, VA, USA.
- 2002. Promotion Review Committee. Cooperative Institute for Marine Resources, Oregon State University, Corvallis, OR, USA.
- 2001-03. Panel Member. National Academy of Sciences Review Panel for the Status of Atlantic Salmon Populations in Maine, MA, USA.
- 2001-03. Independent Science Community Member. Northwest Power and Conservation Council, Artificial Production Advisory Committee, Pacific Northwest, USA.
- 2001-02. Scientific Advisory Board Member. Cooperative Institute for Marine Resources Studies, Oregon State University, OR, USA.
- 2001. Co-organiser. Symposium on *Research Linking Marine and Freshwater Events in Salmon Ecology and Genetics*. Hatfield Marine Science Center, Newport, OR, USA.
- 2001. External Examiner. Drew Hoysak, PhD dissertation, University of British Columbia, Vancouver.
- 2001. Invited Expert. Salmon Aquaculture Assessment Workshop, Washington, DC, USA – organized by SeaWeb and sponsored by Rockefeller Brothers Fund.

University Activities

Memorial University of Newfoundland

- 2011-14. Co-chair, Cognitive and Behavioural Ecology Interdisciplinary Graduate Programme.
- 2011. CFI LOF Selection Committee.
- 2010. Co-chair. Memorial University Research Plan workshop on the Fishery and Aquaculture Research Cluster.
- 2009. University Research Professorships Selection Committee.
- 2007. Dean of Science Search Committee.
- 2004-09. Director, Ocean Sciences Centre.

Oregon State University

- 2003-04. Chair. Peer Teaching Review, Department of Fisheries and Wildlife.
- 2003-04. Promotion and Tenure Mentoring Committee, Department of Fisheries and Wildlife.
- 2002-04. Graduate Committee, Department of Fisheries and Wildlife.
- 2002-03. Small Boat Committee. Hatfield Marine Science Center, Oregon State University.
- 2001-02. HMSC Curriculum Committee. Department of Fisheries and Wildlife, Oregon State University.
- 2001-04. Scholarship and Endowment Committee. Department of Fisheries and Wildlife, Oregon State University.