Grey Seals, Cod and Culling

Notes for a presentation to the Standing Senate Committee on Fisheries and Oceans, Ottawa[1,2]

by

David M. Lavigne PhD, Dr philos
Science Advisor
International Fund for Animal Welfare
40 Norwich Street East, Guelph, Ontario, Canada NIH 2G6

Tuesday, 14 February 2012

Original: English **Check against delivery**

Aussi disponible en français

Re: "Study on The Management of the Grey Seal Population off Canada's East coast"

[1] As background to this presentation, I refer you to an open letter that I co-signed to the Minister of Fisheries, dated 26 September 2011, available at http://media3.marketwire.com/docs/letter-ifaw.pdf; and my email of 27 October 2011, addressed to the Chair of this committee.

[2] I thank Kati Radziszewska for assistance locating various papers, and several colleagues who provided comments and suggestions on earlier drafts.

Introduction

My name is David Lavigne, and I am science advisor to the International Fund for Animal Welfare (IFAW). I have been conducting research on seals since 1969. Much of my work has dealt with questions related to seals and fisheries, and proposals to cull marine mammals ostensibly to benefit fish stocks and commercial fisheries.[3]

Seals & Fisheries; Science & Politics

Let me begin by saying that debates over culling seals (and other wildlife populations) – like all debates in modern conservation[4] – are NOT fundamentally about science or "facts". Rather they are debates arising from differing attitudes, values and societal objectives, and differing views about what is right and wrong. The on-going debate about culling grey seals (*Halichoerus grypus*) is typical. It is not a scientific debate; it is essentially a political debate, with ethical overtones. And, as in any political debate, scientific data – the "facts" as we currently understand them – often become misrepresented, misquoted, or fabricated, by some of the participants.[5]

When both values and "facts" are in conflict – and that is certainly the case when it comes to grey seals, cod and culling – we are faced with what has been termed a "cultural

[3] A brief resumé is attached as Appendix 1.

[4] Lavigne, D.M. 2003. Marine Mammals and Fisheries: The Role of Science in the Culling Debate. pp 31-47. *In* N. Gales, M. Hindell, and R. Kirkwood (eds.). *Marine Mammals: Fisheries, Tourism and Management Issues.* CSIRO Publishing, Collingwood, Victoria, Australia. Also see Lavigne, D.M., R. Kidman Cox, V. Menon, and M. Wamithi. 2006. Reinventing wildlife conservation for the 21st Century. pp 379-425. *In* D.M. Lavigne (ed.). *Gaining Ground: In Pursuit of Ecological Sustainability*. International Fund for Animal Welfare, Guelph, Canada, and University of Limerick, Limerick, Ireland.

[5] Donovan, J.C., R.E. Morgan, and C.P. Potholm. 1981. *People, Power, and Politics: An Introduction to Political Science*. Addison-Wesley Publishing Company, Don Mills, Ontario.

conflict".[6] Such conflicts are never-ending and they are impossible to resolve, unless you can find some common agreement – either on the values, or on the "facts".[7] Which, if nothing else, explains why the culling debate simply won't go away and why, for example, some fishers continue to kill highly endangered monk seals (*Monachus monachus*) in the Mediterranean Sea. They still *believe* that the few remaining seals are eating all the fish.

The Role of Science in the Culling Debate

While the decision to cull or not to cull is a political choice, it is the role of science (and scientists) to inform the debate,[8] educate the public,[9] "illuminate the political choices",[10] and provide options for policy makers.[11]

In that spirit, I would like to spend a few minutes discussing what we actually know and do not know about grey seals and fisheries (particularly cod), and what science and the lessons of history tell us about culls.

[6] Berry, J.K. 1993. Distinguishing data from information and understanding. GIS World. October, pp 22, 24. Also see Lavigne 2003.
[7] *Ibid.*
[8] Berry 1993.
[9] Lavigne, D.M. 1996. Ecological interactions between marine mammals, commercial fisheries and their prey: unravelling the tangled web. pp 59-97. *In* W.A. Montevecchi (ed.). *Studies of high-latitude seabirds. 4. Trophic relationships and energetics of endotherms in cold ocean systems.* Occasional Paper 91. Canadian Wildlife Service, Ottawa, Canada.
[10] Butler, D. 2000. The role of science is to illuminate political choices, not enforce them. Nature 403:6.
[11] Lavigne *et al.* 2006.

Background

There have been a number of recent proposals to cull grey seals in eastern Canada.[12] Background to the most recent ones is provided in the open letter I co-authored to the Minister of Fisheries in September 2011..[13] Suffice it to say that the scientific consultative process preceding these proposals was badly flawed. It began in 2009, with the Minister of Fisheries directing the Department of Fisheries and Oceans to "*ensure* the targeted removal [= cull] of grey seals that are preying on southern Gulf cod as part of its conservation approach [*sic*]".[14] Following this ministerial direction, DFO then organized a Canadian Science Advisory Secretariat (CSAS) workshop in October 2010 to consider the impacts of grey seals on fisheries.

At the workshop, a major problem arose because the participating scientists, myself included, were asked to examine only the negative impacts of grey seals on cod (and a few other fish species). It is nothing more than a self-fulfilling prophesy, therefore, that

[12] e.g. CBCL Limited. 2009. Logistical evaluation of options to manage the grey seal population on Sable Island. Prepared for Fisheries and Oceans Canada, October 2009. CBCL Limited, Halifax, NS, also see http://www.thecoast.ca/RealityBites/archives/2010/05/26/how-to-kill-220000-seals-on-sable-island-the-dfo-plan; DFO. 2011. Impacts of Grey Seals on Fish Populations in Eastern Canada. DFO Canadian Science Advisory Secretariat, Canadian Science Advisory Report, 2010/071. available at http://www.dfo-mpo.gc.ca/CSAS/Csas/publications/sar-as/2010/2010_071_e.pdf; Fisheries Resource Conservation Council. 2011. Towards Recovered and Sustainable Groundfish Fisheries in Eastern Canada, A Report to the Minister of Fisheries and Oceans September 2011. Available at http://www.frcc-ccrh.ca/2011/FRCC2011.pdf; Hammill, M.O. and Swain, D. 2011. A Controlled Experiment (Strawman draft) to Test the Impact of Removals of Grey Seals on the Mortality of Southern Gulf Cod. DFO Canadian Science Advisory. Secretariat Research Document 2011/013.

[13] Open letter to The Hon. Keith Ashfield, Minister of Fisheries and Oceans Canada, 26 September 2011. Signed by me and 5 colleagues. Available at http://media3.marketwire.com/docs/letter-ifaw.pdf.

[14] See DFO 2011, p. 2. Also see http://www.dfo-mpo.gc.ca/media/back-fiche/2009/hq-ac31a-eng.htm.

the Science Advisory Report (SAR) resulting from that workshop concluded that grey seals have a negative impact on cod.[15]

Positive impacts of predators on ecosystems

Entirely neglected during the DFO workshop were any positive impacts that predators like grey seals have on marine ecosystems, a point already raised in your committee by Senator Harb. Positive impacts of predators – often referred to as "beneficial predation"[16] – are well documented in the scientific literature. For example, predators, including grey seals, play a role in the structuring and stabilizing of marine ecosytems.[17,18] Scientists have known for decades that if predators are removed, the ecosystem changes, sometimes in ways that are neither anticipated[19] nor desired. The effects of predator removal can reverberate throughout the system, resulting in what scientists call "trophic cascades".[20]

[15] DFO 2011.

[16] Kaschner, K. and D. Pauly. 2005. Competition between Marine Mammals and Fisheries. Food for Thought. Humane Society of the United States. Washington, DC. Available at http://www.seaaroundus.org/researcher/dpauly/PDF/2005/Books&Chapters/CompetitionBetweenMarineMammalsAndFisheries.pdf. p. 15.

[17] e.g. Morissette, L. 2007. Complexity, cost and quality of ecosystem models and their impact on resilience: a comparative analysis, with emphasis on marine mammals and the Gulf of St. Lawrence. PhD Thesis. University of British Columbia, Vancouver, B.C.

[18] e.g. Morissette, L., M.O. Hammill and C. Savenkoff. 2006. The trophic role of marine mammals in the northern Gulf of St. Lawrence. Marine Mammal Science 22(1):74-103. These authors conclude that the "beneficial predation effect is even greater than the predation itself leading to an overall positive impact of the predator on the system" (p. 98).

[19] Bowen, W.D. and D. Lidgard. 2011. Vertebrate predator control: Effects on prey populations in terrestrial and aquatic ecosystems. Canadian Science Advisory Secretariat Research Document 2011/028.

[20] e.g. Frank, K.T., B. Petrie, J.S. Choi, and W.C. Leggett. 2005. Trophic cascades in a formerly cod-dominated ecosystem. Science 308: 1621-1623; Bundy, A., J.J. Heymans, L. Morissette, and C. Savenkoff. 2009. Seals, cod and forage fish: A comparative exploration of variations in the theme of stock collapse and ecosystem change in four Northwest Atlantic Ecosystems. Progress in Oceanography 81:188-206; Frank, K.T., B. Petrie, J.A.D. Fisher, and W.C. Leggett. 2011. Transient dynamics of an altered large marine ecosystem. Nature, doi:10.1038/nature 110285.

Solely from a utilitarian perspective, the very existence of predators can actually provide benefits to preferred fish stocks and the fisheries that are supported by them.[21]

Problems notwithstanding, what does the SAR actually say?

Although I am critical of how DFO conducted its workshop, and of how the workshop report has been represented by some DFO officials, and by the now disbanded Fisheries Research Conservation Council (FRCC), the SAR nonetheless contains some information with which I agree.

For example, contrary to the pleadings in the FRCC report,[22] the implementation of a grey seal cull represents the antithesis of a precautionary management approach. It is well documented in the scientific literature that a grey seal cull could produce a number of unintended consequences.[23] The SAR correctly speaks to this uncertainty, saying "…although widely practiced, the extent of seal population reduction and the response of targeted prey populations to culls have rarely been evaluated, such that their effectiveness is poorly understood".[24] Further, results from other predator control programs indicate that unintended consequences in food webs – including the trophic cascades that I

[21] Reviewed in Lavigne 2003; also see Kaschner and Pauly 2005.
[22] FRCC 2011.
[23] e.g. Bowen and Lidgard 2011; Bundy, A. and P. Fanning. 2005. Can Atlantic cod (*Gadus morhua*) recover? Exploring trophic explanations for the non-recovery of the cod stock on the eastern Scotian Shelf, Canada. Canadian Journal of Fisheries and Aquatic Sciences 62:1474-1489.
[24] DFO 2010, p. 4.

mentioned earlier – are, nonetheless, commonly observed and will be difficult (if not impossible) to predict in advance of a cull.

The SAR continues, "…any intervention in the southern Gulf would first require a thorough investigation of the likely multi-species impacts of a cod-seal interaction in this ecosystem, and second would require a carefully designed program that would include clearly-stated objectives and rigorous monitoring of the seal and cod populations and the ecosystem to evaluate the consequences".[25]

To this point, the investigation of multi-species impacts has not been undertaken, nor has a program been designed that includes clearly-stated objectives and a feasible way of monitoring seals, cod and other ecosystem components. Needless to say, it will require considerable time and budget to conduct a proper scientific assessment of any proposal to cull grey seals[26] *before* worrying about how to design a cull and monitor its consequences, if such a proposal were ever to be implemented.

To cull or not to cull grey seals in Atlantic Canada

For the fisheries minister and the government of Canada, the question today is whether or not to implement the various recommendations to cull grey seals. For his part, the Minister of Fisheries has already been quoted in the press as saying that proposals to cull

[25] *Ibid*., p. 6.
[26] Such an evaluation was undertaken by South Africa to evaluate a proposal to cull Cape fur seals *Arctocephalus pusillus pusillus* (briefly reviewed in Lavigne 2003). A more detailed protocol for the scientific evaluation of proposals to cull marine mammals was developed by the United Nations Environment Programme in 1997. Available at http://www.ifaw.net/ Publications /Program_Publications/Seals/asset_upload_file777_61691.pdf.

grey seals are based on science.[27] While clearly bits and pieces of the science can be selected to support a grey seal cull,[28] when all the scientific evidence is considered, any apparent support vanishes.

The reasons for my conclusion are as follows:

1. Grey seals have undoubtedly increased in recent decades as they recover from near extirpation in the late 1940s[29]. In some circles this recovery is actually regarded as a conservation success story.
2. Cod populations off eastern Canada were seriously depleted by over-fishing in the late 1960s, and further in the mid-to late 1980s, which resulted in the imposition of a moratorium on the cod fishery in 1992.

[27] Available at: http://www.ctv.ca/CTVNews/Canada/2http://www.ifaw.net/Publications/Program_Publications/Seals/asset_upload_file777_61691.pdf0111108/seal-cull-science-111108/.

[28] The situation was nicely described a few years ago by the well-known Canadian academic and author, Thomas Homer-Dixon, and colleagues, writing about another "complex" and controversial issue, global warming.

"*Complex issues*", they wrote, "*are surrounded by a dense tangle of scientific theory and evidence that is difficult for any non-specialist to verify or understand. Because countless bits of evidence are available, it's possible – by selecting and connecting the bits carefully – to construct practically any picture of the world and make it seem real.*

But just because we can connect dots in very different ways, we shouldn't assume that every resulting picture is equally valid. Some pictures are better than others. And some are severe distortions of reality."

See Homer-Dixon, T., K. Braganza, D. Karoly, and J. Risbey. 2002. Response to Baliunas *et al. The Globe and Mail*, Toronto. 25 November. Available at http://www.homerdixon.com/2002/11/25/response-to-baliunas-et-al/.

[29] Lavigne, D.M. and K.M. Kovacs. 1988. *Harps & Hoods: Ice-breeding seals of the Northwest Atlantic*. University of Waterloo Press. Waterloo, Canada. Also see O'Boyle, R. and M. Sinclair. *In press*. Seal-cod interactions on the Eastern Scotian Shelf: Reconsideration of modelling assumptions. Fisheries Research (2010), doi:10.1016/j.fishres.2011.10.006.

3. Since then, cod populations have been slow to recover[30] but a number of stocks are now showing positive signs of recovery, even in the presence of a number of seal species.[31]
4. Nonetheless, the question remains whether their recovery has been or is being impeded by seals, in particular by grey seals in the Gulf of St. Lawrence and on the Eastern Scotian Shelf.
5. Recently, much scientific attention has been directed to the issue of grey seals and cod. Most of the resulting papers conclude that grey seals have little impact on cod stocks.[32] A recent manuscript suggests, however, "that seals have contributed to both natural mortality increase and lack of cod stock recovery".[33] That claim has been publicized in the press, most recently, yesterday.[34] What the media has not reported is that the "Model predictions [in that paper] are not consistent with *recent observed cod increase* in trawl surveys".[35] This admission by the authors of the paper – O'Boyle & Sinclair – seems to suggest that there are problems with their modeling. Instead, the authors suggest that the observations, rather than their

[30] For some suggestions as to the reasons why, see Bundy and Fanning 2005; Bundy *et al.* 2009, p. 202.
[31] Frank *et al.* 2011; NAFO. 2011. Scientific Council Working Group on Ecosystem Approaches to Fisheries Management. Scientific Council Reports. 2010. Dartmouth, NS. March 2011; Clark, D., J. Emberley, C. Clark, and B. Peppard. 2010. Update of the 2009 Summer Scotian Shelf and Bay of Fundy Research Vessel Survey. DFO Canadian Science Advisory Secretariat. Research Document 2010/008; also see Grand Banks cod stocks grow 69% since 2007, available at http://wwf.panda.org/wwf_news /?uNewsID=201689; O'Boyle and Sinclair *in press*.
[32] Reviewed in O'Boyle and Sinclair *in press.*
[33] O'Boyle and Sinclair *in press* (p. 1)
[34] e.g. Brean, J. 2011. Atlantic cod study renews debate over grey seal cull. *National Post*, 16 January 2012. Available at http://news.nationalpost.com/2012/01/16/atlantic-cod-study-stokes-debate-over-government-sanctioned-seal-killing/.
[35] O'Boyle and Sinclair *in press,* p. 2.

models, "need to be confirmed". I have to say that is not the way science is normally conducted. Elsewhere in the paper, they are more circumspect.[36]

6. Regardless, taken at face value, the conflicting scientific results highlighted in the DFO SAR and O'Boyle/Sinclair manuscript, simply remind us that marine systems and interactions between seals and fisheries are complex[37] and difficult to study. As always there is scientific uncertainty in the data and analyses associated with trying to figure out what has really been going on with grey seals and cod, and how that relationship will unfold in the future.
7. Of course, as soon as one mentions the future, I am reminded that we are in the midst of a period of environmental uncertainty – resulting from climate change and global warming – that is already having an impact on ice-breeding seals across the North Atlantic.[38] Some grey seals reproduce on ice and, if that ice fails to form in the coming years, it may have implications for them as well. To the uncertainties mentioned previously, we must therefore add environmental uncertainty.

---

[36] O'Boyle and Sinclair, p. 33.

[37] There seems to be general agreement on this point. e.g. Siddika Mithani, Assistant Deputy Minister, Ecosystems and Oceans Science Sector, Fisheries and Oceans Canada, testifying before your committee on 25 October 2011, stated, "Before I get into the science being done in the department, it is important to remember that the ecosystem is a very complex one." Available at http://www.parl.gc.ca/Content/SEN/Committee/411/pofo/49128e.htm?Language=E&Parl=41& Ses=1&comm_id=7; Patrice Simon, Director, Environment and Biodiversity Science, Fisheries and Oceans Canada also told your committee on 25 October, that, "..it is a very complex ecosystem", available at http://www.parl.gc.ca/Content/SEN/Committee/411/pofo/49128-e.htm?Language=E&Parl=41&Ses=1&comm_id=7; also see DFO's The Canadian Seal Harvest – At a Glance, which tells us, "We know that seals exist in a highly complex ecosystem", available at http://www.dfo-mpo.gc.ca/fm-gp/seal-phoque/seal_hunt-chasse_phoque-eng.htm; and DFO's The Canadian Seal Hunt – A Way of Life, which says, "Seals eat large quantities of a variety of fish and are part of a complex ecosystem." Available at http://www.canadainternational.gc.ca/eu-ue/assets/pdfs/seal_hunt-chasse-phoques-eng.pdf

[38] Johnston, D.W., M.T. Bowers, A.S. Friedlaender, and D.M. Lavigne. 2012. The effects of climate change on harp seals (*Pagophilus groenlandicus*). PLoS ONE January 2012, Vol. 7, Issue 1. Available at www.plosone.org.

8. All of this uncertainty has not resulted in any noticeable abatement in calls for undertaking a massive cull of grey seals.
9. Nonetheless, undertaking a cull of grey seals at this time is a risky business. Scientists have repeatedly said over the past three decades that it is impossible to predict the effects of increasing or decreasing the size of a seal population on exploited fish stocks and future fishery yields from them.[39] More uncertainty.
10. After more than 30 years of trying to understand the impacts of culling seals it would be fair to ask why the scientists still can't provide definitive answers. Of course, the answer to that question brings us back to the issue of complexity.[40]
11. And, as noted previously, scientists – including DFO scientists – have also warned that culls can have unintended consequences.[41] Science tells us, for example, that culling a predator like grey seals could actually result in a reduction of preferred fish stocks, the antithesis of the intended outcome. It all depends on the complex (that word again) interactions in a particular marine ecosystem.[42]
12. All of the uncertainty associated with interactions between grey seals and cod, environmental change, and the various uncertainties associated with culling, call for the rigorous application of the precautionary approach.[43,44]

[39] Reviewed in Lavigne 2003, p. 39ff
[40] See Lavigne 2003, Figure 4.
[41] Bundy and Fanning 2005; Bowen and Lidgard 2011.
[42] Reviewed in Lavigne 2003
[43] For a discussion of the precautionary approach, see Campbell, M. and V.G. Thomas. 2006. Implementing the precautionary approach towards enabling legislation for marine mammal conservation in Canada. pp 321-333. *In* D.M. Lavigne (ed.). *Gaining Ground: In Pursuit of Ecological Sustainability*. International Fund for Animal Welfare, Guelph, Canada, and University of Limerick, Limerick, Ireland.
[44] Years ago, Professor Deane Renouf, my late colleague from Memorial University in Newfoundland said, in response to a proposed harp seal cull: "*The message is, we do not know enough to institute a cull ... I really think that [culling seals], without the correct information, could be deadly*." A remarkably similar opinion was offered by a DFO scientist during the DFO workshop – expressing a view shared by a number of other scientists, myself included – that

Taken in the aggregate, the scientific information currently available does not allow us to reject the hypothesis that seals generally, and grey seals in particular, are NOT impeding the recovery of cod and other groundfish stocks. Nor does it allow us to reject the hypothesis that a massive grey seal cull could be detrimental, not only to grey seals, but to the ecosystem and to the interests of commercial fisheries.

Finally, I note again that the current proposals to cull grey seals are just the latest in a series of similar proposals and recommendations spanning at least three decades, most notably a recommendation from the Royal Commission on Seals and Sealing in the mid-1980s.[45] In the past, following some sober second thought, a succession of fisheries ministers has rejected previous calls for culling grey seals. Why? Because they were not adequately supported by the science. We are in exactly the same position today.

The body of scientific evidence simply does not support or justify a decision to cull tens of thousands of grey seals off the East coast of Canada.

Aside from being a profoundly risky and expensive undertaking, a grey seal cull, if it were to proceed, would undoubtedly raise serious animal welfare issues. In particular, some animals would be shot in the water and every veterinary panel that has looked at killing methods for seals (including the panel the Canadian government prefers to cite as

---

"*Anthropogenic interference [meaning a cull] would be irresponsible*". That comment, like many others, was simply ignored by the workshop Chair and not recorded in the workshop report.

[45] Malouf, A. 1986. Seals and Sealing in Canada. Report of the Royal Commission. Vol. 1. Minister of Supply and Services Canada, Ottawa. p. 55.

the ultimate authority) has recommended that such practice be banned, because it is inherently inhumane.[46]

And, if the scientific evidence is not sufficient for you to reject a call for a massive grey seal cull, then I would suggest that there are ethical considerations to think about as well.[47] As one DFO scientist commented, following the DFO workshop, there is "A general principle the meeting never addressed: How certain do we have to be before asking other intelligent beings to die for our beliefs?"

Closing Remarks

Over the past few months, you have heard a variety of opinions, reflecting different attitudes, values and objectives, about grey seals, cod and culling. You have heard, and will continue to hear some quite different interpretations, misinterpretations, and misrepresentations of the available evidence, scientific and otherwise.[48]

In closing, therefore, I would simply ask that if you have any questions about my presentation, or any of the other presentations you have received, seek clarification, examine the source material, talk to independent scientists, and attempt to verify to the extent possible the information presented to you, before coming to any firm conclusions.

[46] For a recent discussion of animal welfare issues associated with killing seals, see Kirkman, S.P. and D.M. Lavigne. 2009. Assessing the hunting practices of Namibia's commercial seal hunt. South African Journal of Science 106(3/4) Article 166. Available at www.saja.co.za .

[47] Lavigne, D.M. and W.S. Lynn. 2011. Canada's commercial seal hunt. It's more than a question of humane killing. Journal of Animal Ethics 1(1):1-5.

[48] Again, see Homer Dixon *et al.* 2002 (footnote 28).

David M. Lavigne PhD, Dr philos

David Lavigne is science advisor to the International Fund for Animal Welfare (IFAW). From 1973-1996, he was a professor in the Department of Zoology, University of Guelph, Guelph, Ontario, Canada. He was also executive director of the International Marine Mammal Association (IMMA), a not-for-profit organization concerned with the global conservation of marine mammals from 1990-1999. After receiving a BSc in Zoology from the University of Western Ontario in 1968, he taught high school for one year before entering graduate school at the University of Guelph, completing an MSc in 1972 and a PhD in 1974, both for work on vision in seals. Remaining at Guelph as a faculty member, his research interests shifted to problems of censusing harp seals to estimate annual pup production and population size. By 1975, the focus of his research was pinniped bioenergetics. For the latter work he earned a *Dr philos* degree from the University of Oslo in 1988. Currently, his major interests are in the areas of conservation biology, wildlife management, and natural resources policy.

During his years at the University of Guelph, David taught numerous undergraduate and graduate courses including mammalogy, ecology and marine biology, wildlife conservation and management, and natural resources policy. The author of more than 100 papers and technical reports on various aspects of marine mammal biology, wildlife management, and conservation, he is also, co-editor (with J. Beddington and R.J.H. Beverton) of *Marine Mammals and Fisheries* (George Allen & Unwin, 1985), and co-author (with W.M. Johnston) of *The Mediterranean Monk Seal: Conservation Guidelines* (IMMA, 1998) and *Monk Seals in Antiquity* (The Netherlands Commission for International Nature Protection, 1999). From 1988-1992, he served on the editorial advisory board of the *Canadian Journal of Zoology*.

In addition to his published papers on various aspects of pinniped biology and conservation, he is also the co-author (with Kit Kovacs) of *Harps & Hoods: Ice-breeding Seals of the Northwest Atlantic* (University of Waterloo Press, 1988). In the mid-1980s, his laboratory at the University of Guelph submitted a number of briefs to Canada's Royal Commission on Seals and Sealing and he appeared before the Commission as an expert witness on two occasions. He has also testified as an expert witness before Canada's Standing Committee on Fisheries and Oceans (SCOFO), in 1999 and again in 2006. He has made a number of submissions to the Canadian government's Regulatory Review Process regarding changes to Canada's Marine Mammal Regulations, and to the Eminent Panel on Seal Management, appointed by the Canadian government to review Canada's commercial seal hunt, which reported in 2001. He has also been an invited participant in meetings of the Canadian government's National Marine Mammal Review Committee on a number of occasions. In October 2010, he was an invited participant in the Department of Fisheries and Oceans Canadian Science Advisory Secretariat (CSAS) workshop on the impacts of grey seals on fisheries.

Over the years, David has been a member of a number of international scientific committees, including: the Seal Specialist Group of the World Conservation Union (IUCN); the U.S. government's Pinniped-Fishery Interaction Task Force on the Sea Lion/Steelhead Conflict at the Ballard Locks, Seattle; the International Scientific Advisory Committee to the Hellenic Society for the Study and Protection of the Mediterranean Monk Seal (HSSPMS, now MOm), the Scientific Advisory Committee of the United Nations Environment Programme's Marine Mammals Action Plan; and the European Commission/IUCN Steering Committee for the 'Spanish Monk Seal Project'. He has also appeared before European parliamentary committees on a number of occasions and, in 2005, he testified in the Council of Europe and in the Belgian parliament when both bodies were conducting hearings into animal welfare and other aspects of Canada's commercial seal hunt. In 2007, he served as a member of the European Food Safety Authority's (EFSA) Working Group on the Animal Welfare Aspects of Sealing.

In 2001, he presented the invited keynote address – Marine mammals and fisheries: The role of science in the culling debate – at the *Southern Hemisphere Marine Mammal Conference 2001*, Philip Island, Victoria, Australia. He also was an invited speaker in the University of Guelph's 2001 *The Kenneth Hammond Lectures on Environment, Energy and Resources*, entitled "Sustainable Development: Mandate or Mantra." His lecture, "Ecological footprints, doublespeak, and the evolution of the Machiavellian mind" was broadcast on CBC Radio's *Ideas* in May 2002.

In January 2003, he spent a week at the University of Alberta in Edmonton as a "Distinguished Visitor" in the Environmental Research and Studies Centre. He was an invited participant in a consultation on future directions of marine mammal research, organized by the United States Marine Mammal Commission, in collaboration with the National Fish and Wildlife Foundation, and held in Portland, Oregon in August 2003. Later that year, he delivered the invited closing lecture to the World Wolf Congress 2003, held in Banff, Alberta. In 2004, he presented invited lectures at the Annual Meeting of the American Association for the Advancement of Science in Seattle (on the role of science in the formulation of public policy), and at the annual meeting of the National Agricultural Biotechnology Council (NABC) in Guelph (on reducing the agricultural eco-footprint). On behalf of IFAW, he organized an international forum entitled "Wildlife Conservation: In Pursuit of Ecological Sustainability" at the University of Limerick, Ireland, in June 2004. He also edited the book arising from that conference: *Gaining Ground: In Pursuit of Ecological Sustainability* (IFAW and the University of Limerick, 2006). In July 2011, he was an invited speaker at the 6th International Conference on Environmental Future, held at Newcastle University, Newcastle, UK, where he spoke on the topic "Environmental conservation needs a new, interdisciplinary paradigm." Most recently, he has been invited to speak on the topic of marine mammals and fisheries at the World Congress of Ocean – 2012, to be held in China in September.

February 2012