

Professor Tony J. Pitcher

Curriculum Vitae 2016

Contents

One-page Resumé	page 2
Research - Publications	 3
<i>Founding Editor of Journals 1 & 2</i>	
<i>Textbook</i>	
<i>Book Series Editor 1 and 2</i>	
<i>Multi-authored texts</i>	
<i>Other Editorial Work</i>	
Research - Achievements	 4
<i>Research on Fisheries Ecosystems</i>	
<i>Research on Rapid Appraisal</i>	
<i>Research on Fish Shoaling</i>	
<i>Previous Research on Fisheries</i>	
Administrative Experience	 7
<i>The UBC Fisheries Centre</i>	
<i>Research Project Management</i>	
<i>Development of Research Groups</i>	
<i>Conferences and Seminars</i>	
<i>Masters Degree in Fisheries Biology & Management</i>	
<i>Examinations & Other Administrative Experience</i>	
Teaching Experience	 9
<i>Undergraduate</i>	
<i>Postgraduate</i>	
<i>Professional</i>	
<i>Adult & Extramural</i>	
Community Service	 9
Appendices	
1. Conference Presentations	 11
1a. <i>Invited Papers & Keynotes</i>	
1b. <i>Contributed Papers</i>	
1c. <i>Poster Papers</i>	
2. <i>Professional Workshops and Training Courses</i>	 13
3. <i>Evaluation Panels & Consultancy</i>	 14
4. <i>Research Visits, Cruises and Seminars</i>	 15
5. <i>Research Group Members</i>	 16
6. <i>Research Grants & Contracts</i>	 20
7. <i>Summary of African Experience</i>	 22
8. <i>Summary of Asian and Latin American Experience</i>	 23
List of Publications	 24 – 43

Tony J. Pitcher - One-Page Resumé - 2015

Qualifications	M.A., D.Phil., (Oxford), 1971; B.A., Zoology, (Oxford), 1966
Work Address	Institute for the Oceans and Fisheries (formerly the Fisheries Centre), 2202 Main Mall, University of British Columbia, Vancouver, Canada <i>phone:</i> 604 822-2368 <i>fax:</i> 604 822-8934 <i>e-mail:</i> pitcher.t@gmail.com
Current Appointments	Professor of Fisheries , University of British Columbia, Vancouver, Canada (<i>from 1993</i>) Founding Editor, <i>Fish and Fisheries</i> , quarterly journal, Wiley-Blackwell, Oxford (<i>from 2000</i>) Series Editor, <i>Fish Biology & Aquatic Resources Series</i> , Wiley, Oxford (<i>from 1998</i>) Faculty Associate , Institute for Resources, Environment and Sustainability, UBC (<i>from 2005</i>) Member , Pacific Fisheries Monitoring & Compliance Panel (<i>from 2015</i>) Advisory Board , Marine and Environmental Science Centre (MARE), Portugal (<i>from 2016</i>)
Awards	The Beverton Medal 2003 : The Fisheries Society of British Isles, for lifetime contributions to the field. Distinguished Service Award 2005 : American Fisheries Society, for role as Programme Chair of the 4 th World Fisheries Congress, 2004. Distinguished Scholar-In-Residence 2008 : Peter Wall Institute for Advanced Studies, UBC Honorary Lifetime Member 2009 : The Fisheries Society of British Isles, for distinction in the field. Hjort Scholar 2016 , Hjort Centre for Marine Ecosystem Dynamics, Bergen, Norway, for gifted scientists deemed to promote innovative understanding of marine ecosystem dynamics.
Career Achievements	1 Multidisciplinary research in a wide range of fisheries fields producing over 500 publications including 17 books: h-factor 66, i10 is 225 from over 19,300 citations. 2 3 Trained 42 PhDs from 17 nations Founded two new international journals for synthesis in fish and fisheries, both gaining the highest impact and influence factors in the field. 4 Founding Director, UBC Fisheries Centre for 10 years, recognized as the world leader in its field. 5 Authored well-regarded textbooks on fisheries ecology and fish behaviour. 6 Set up and ran an international Masters course in fisheries, now with influential alumni 7 Set up and managed international fisheries development and assessment projects.
Previous Appointments	2011-2014 Haida Gwaii Marine Advisory Committee (2011-2014) 2006 - 2008 Chair of Scientific Advisory Board , Sustainable Fisheries Partnership: FishSource 2005— 2006 Science Evaluation Panel , CEFAS Laboratory, Lowestoft, UK. 2004— 2006 External Examiner in Biology , University of Hong Kong. 1994 — 2003 Visiting Professor , University of Concepción, Chile. 2003—2004 Visiting Expert : Food and Agriculture Organization of the United Nations, Rome, Italy 2001—2006 Scientific Advisory Board , Max Planck Institut für Limnologie, Plön, Germany 1993—2003 Founding Director of the Fisheries Centre : University of British Columbia, Vancouver. 1989—1999 Founding Editor : <i>Reviews in Fish Biology and Fisheries</i> , published by Chapman & Hall 1996—1999 Co-Director : Pacific Fisheries Think Tank, Vancouver. 1990—1993 Special Research Fellow : Renewable Resources Assessment Group, Imperial College, London. 1987—1998 Series Editor : The Fish and Fisheries Book Series, published by Chapman & Hall. 1988—1990 Reader in Biology : University of Wales, Bangor, UK. 1987—1987 Professor of Fisheries: Institut für Meereskunde, Christian-Albrechts University of Kiel, Germany 1984—1987 Senior Lecturer in Zoology: University of Wales, Bangor, UK. 1982—1987 Course Director : M.Sc. in Fisheries Biology and Management, University of Wales, Bangor, UK. 1981—1987 Assistant Editor : Journal of Fish Biology (Academic Press, UK). 1978—1984 Lecturer in Zoology: University of Wales, Bangor, UK. 1970—1978 Lecturer in Biology: New University of Ulster, Coleraine, Northern Ireland. 1966—1970 NERC Graduate Research Student : Department of Zoology, Oxford University, UK. 1963—1966 Postmaster (Open Undergraduate Scholarship): Merton College, Oxford University, UK.

Research Publications

Currently, I have produced a lifetime total of over 500 research publications, including an international textbook, 17 books and volumes, about 250 peer-reviewed papers and about 250 other published items. Publication details are listed below: in a career of 45 years since obtaining my Ph.D. I have published an average of over 11 items per year. According to Google Scholar, my current 'h' factor is 66, with 225 papers having more than 10 citations, and total citations about 19,500 giving an average citation rate of about 34 per contribution.

FOUNDING EDITOR OF JOURNAL: 1

In 1989 I founded *Reviews in Fish Biology and Fisheries (RFBF)*, an international quarterly review journal published by Chapman & Hall. The journal met a need for a synoptic review journal in the field and its aim was to mitigate the literature explosion by publishing short, well-focused, peer-reviewed articles that synthesise recent advances in fisheries, fish ecology, fish physiology, evolutionary biology, taxonomy, zoogeography and behaviour. *RFBF* produced special issues on *Molecular Genetics in Fisheries*, *Individual Transferable Quotas*, and *The Beverton and Holt Jubilee*. From 1995 through 1999, it was listed by ISI as having the highest impact factor all journals in the fish and fisheries field (1999 value: 4.5). In 1999 I resigned to start another journal (see below). The journal is now published by Springer and is doing well. My previous journal experience includes six years as an Assistant Editor on *Journal of Fish Biology* published by Academic Press.

FOUNDING EDITOR OF JOURNAL: 2

In 2000 I founded a second journal, *Fish and Fisheries* published by Wiley-Blackwell. The journal publishes synthesis and synoptic research throughout the multidisciplinary field of fish and fisheries, and includes free PDF reprints for authors, has no page charges, full electronic submission and an interdisciplinary perspective section termed 'Ghoti' (George Bernard Shaw: 'gh' = 'f' as in enough; 'o' = 'i' as in women; 'ti' = 'sh' in nation). *Fish and Fisheries* is listed in *ASFA* and *Current Contents*, and among 49 fisheries journals its ISI impact factor is the highest by a wide margin (2006, 4.974; 2007, 4.3; 2008: 3.4; 2009, 4.4; 2010: 6.4; 2011: 5.8; 2012: 5.9). It also has the highest influence rating in its field (eigenfactor.org), and is 4/350 among all ecology journals.

TEXTBOOK

My textbook with Dr Paul Hart, *Fisheries Ecology* was published in 1982, and was well-received world-wide. The book was issued in paperback in 1983 and has been reprinted over a dozen times. Although primarily an

advanced student text, it helped to pioneer concepts such as the assessment of risk, multiple objectives in fishery management and the precautionary use of models.

BOOK SERIES EDITOR: 1

As Series Editor for the Chapman & Hall *Fish and Fisheries Series* from 1987 to 1998 my task was to solicit, appraise and edit research books across a wide field. When I left, the Series comprised 24 volumes and established a reputation as the premier peer-reviewed book series in the field. I left soon after the publisher was taken over by Kluwer in 1998.

1. *Ecology of Teleost Fishes* (Bob Wootton)
2. *Cyprinid Fishes* (eds Ian Winfield & Joe Nelson)
3. *Cichlid Fishes* (ed Miles Keenleyside)
4. *Early Life History of Fishes* (Eva Kamler)
5. *Fisheries Acoustics* (David MacLennan & John Simmonds)
6. *Fish Chemoreception* (ed Toshiaki Hara)
7. *Behaviour of Teleost Fishes* (ed Tony Pitcher)
8. *Genetics and Fish Breeding* (Colin Purdom)
9. *Fish Ecophysiology* (ed Cliff Rankin & Frank Jensen)
10. *Fish Swimming* (John Videler)
11. *On the Dynamics of Exploited Fish Populations* facsimile reprint (Ray Beverton & Sidney Holt)
12. *Sea Bass* (Graham Pickett & Mike Pawson)
13. *Fish Bioenergetics* (Malcom Jobling)
14. *On the Sex of Fish and the Gender of Scientists* (Daniel Pauly)
15. *Hake: Fisheries, Ecology & Markets* (eds Jürgen Alheit & Tony Pitcher)
16. *Environmental Biology of Fishes* (Malcom Jobling)
17. *Electric Fishes* (Peter Möller)
18. *The Impact of Species Changes in African Lakes* (eds Tony Pitcher & Paul Hart)
19. *Pike* (John Craig)
20. *Reef Fisheries* (eds Nick Polunin & Calum Roberts)
21. *Early Life History and Recruitment in Fish Populations* (ed Christopher Chambers & Edward Tripple)
22. *Fish & Fisheries of Tropical Estuaries* (Stephen Blaber)
23. *Reinventing Fisheries Management* (eds Tony Pitcher, Paul Hart & Daniel Pauly)
24. *Ecology of Teleost Fishes* 2nd edition (Bob Wootton)

BOOK SERIES EDITOR: 2

In 1998 I agreed to be the Series Editor of a new Wiley-Blackwell's book series, *Fish and Aquatic Resources*, and publication commenced in 1999.

1. *The Impact of Fishing on Marine Ecosystems* (Steve Hall). 1999.
2. *Salmonid Fishes* (eds Altukhov et al.) 2000.
3. *The Biology of the Percid Fishes* (John Craig). 2000.
4. *Fisheries Oceanography* (Paul Harrison). 2000.
5. *Sustainable Fisheries Systems* (Tony Charles) 2000.
6. *Krill* (ed. Inigo Everson) 2000.
7. *Tropical Estuarine Fisheries* (Steve Blaber) 2000.
8. *Evaluating Recreational Fisheries* (eds Tony Pitcher and Chuck Hollingworth). 2002.
9. *Flatfish: Biology and Conservation* (ed. Robin Gibson). 2005.
10. *Fisheries Acoustics* (John Simmonds and David MacLennan). 2005.
11. *Fish Cognition and Behaviour* (eds Colum Brown, Kevin Laland and Jens Krause). 2006.
12. *Seamounts: Ecology, Fisheries and Conservation* (eds

- Tony Pitcher, Telmo Morato, Paul Hart, Malcolm Clark, Nigel Haggan and Ricardo Santos). 2007.
13. *Sharks of the Open Ocean* (eds M. Camhi, E. Pikitch and E. Babcock). 2008.
 14. *World Fisheries: a Social-Ecological Analysis*. (eds Rosemary Ommer, Ian Perry, Kevern Cochrane and Philippe Cury). 2011.
 15. *Fish Cognition and Behaviour: 2nd edition* (eds Colum Brown, Kevin Laland and Jens Krause). 2011.
 16. *Hake: Biology and Exploitation*. (ed. Hugo Arancibia). 2015.

MULTI-AUTHOR EDITED TEXTS

Multi-author edited texts serve a valuable function in allowing leading experts in a field to address common themes, and pinpoint areas of agreement and of controversy. In this way they establish the ground for new research directions and fresh synthesis. The editor's task is to pick a good stable of authors and ensure that such volumes achieve these aims. At best, such books can identify themes, examine topics from different perspectives and stimulate productive new insights. I have commissioned and edited seven texts of this type, in each case contributing some of my own new work to the volume. Each of these volumes has been quite influential in establishing new directions science in its field.

Seamounts: Ecology, Fisheries and Conservation edited by Tony Pitcher (Canada), Telmo Morato (Azores), Paul Hart (UK), Malcolm Clark (New Zealand), Nigel Haggan (Canada) and Ricardo Santos (Azores), was published by Blackwells in 2008. This was the first synoptic book that covers all aspects of seamounts from geology and the history of their discovery, to mesopelagics, distant water fleets (including unpublished material from Russia), small-scale artisanal fisheries on seamounts and management issues including mooted high seas marine protected areas. It includes discussion of the controversy over the enhancement of biodiversity by seamounts and presents new Ecosystem Evaluation Framework that shows the extent of knowledge and the status of threats to conservation. The book is fully peer-reviewed and is authored by over 30 of the world leaders in seamount science, all of whom attended a planning workshop in the Azores in 2005.

Evaluating Recreational Fisheries, edited jointly with Charles Hollingworth, was published in the new Blackwell's Series early in 2002. This book is one of the first to set out the interdisciplinary ecological, economic, social and ethical basis of sport fishing. It is hoped that the book will stimulate the drawing up of a Code of Conduct for sport fishing, and stimulated sessions on this topic at the 3rd World Congress on Recreational Fishing held in Darwin, Australia in May 2002, and at which I was the Keynote speaker (150).

Just Fish, an output from a major Canadian interdisciplinary research project, was published by ISER press, Newfoundland, in 2000 and was jointly

edited by myself, Rosemary Ommer and Harold Coward. The project included humanists, natural scientists and social scientists who came together to examine the question of ethics in fisheries. *Just Fish* argues that fisheries management institutions must protect the interests of both fish and the fishers who depend upon aquatic resources. Five modes of justice are distinguished: ecosystem, distributive, productive, restorative and creative justice. The book describes an ethical framework that can aid fisheries policies and decision-making in the future.

Reinventing Fisheries Management, edited jointly with Daniel Pauly and Paul Hart, was published in the Kluwer Series in late 1998. This book examines the current rationale of fisheries management and looks for new ways to ground the science in oceanography and the human dimension. Major ills beset the science, and so the book includes several contributions that analyse innovative policy goals for fisheries that can make management more robust.

The Impact of Species Changes in African Lakes (1995) addresses ecological, economic and social issues engendered by fisheries for introduced Nile perch and freshwater sardines in African lakes. An important section of the book focuses on Lake Victoria, where introduced piscivorous Nile perch have had a major impact on biodiversity but have in parallel brought considerable economic benefits. Benefits have also accrued from the introduction of planktivorous sardines to human-made lakes like Kariba. The book also includes reviews of species changes caused by fishing in lakes, such as Lake Malawi, that have suffered no introductions. The key feature of this book is an attempt to address the difficult and controversial trade-offs that have to be made to reconcile development with conservation, including mitigation of the undesirable effects of introduced species.

Hake: Fisheries Ecology and Markets, also published in 1995, is the only book focusing on this important commercial group of fish. Each of the major hake fisheries of the world is covered in a separate chapter that describes oceanographic features, reproduction, early life history, feeding and growth, migration, population dynamics, stock assessment, fleet structure, exploitation status and future prospects. Economics, markets and product quality are surveyed in separate chapters. The book puts forward a new theory for the remarkable resilience of hake fisheries in the face of heavy exploitation.

In 1993 a completely revised second edition of my 1986 text on *The Behaviour of Teleost Fishes* was published. This 19-chapter volume covers the genetic, motivational, developmental, sensory basis and the evolutionary ecology of the behaviour of fishes. The book is regarded as one of the leading advanced student texts in the field.

OTHER EDITORIAL WORK

Following my 2008 book on *Seamounts*, recently I have been one of four guest editors on a 2010 special issue of *Oceanography* on Seamounts, which has been a most interesting challenge working with leading marine geophysicists, geochemists and physical oceanographers in order to represent the research of a wide community of biological oceanographers and fishery experts. In recent years I have edited over thirty of the volumes in the *Fisheries Centre Research Report Series*. With Professor Gary Carvalho, I jointly planned and edited *Molecular Genetics in Fisheries* in 1995. In 1990, I edited and desk-top published the first volume of papers from the British Government's development programme in Central Africa with Dr Chuck Hollingworth. Developing world authors often experience considerable difficulties in publishing, and so one of the aims of this volume was to revise papers with more help from international peer-review than is normal. Among the contributions were two important papers on 'usipa', a commercially valuable pelagic cyprinid in Lake Malawi. In 1986 I edited a *Special Issue* of the *Journal of Fish Biology* on *The Behaviour of Fishes*.

Research Achievements

During my research career I have trained 42 PhD students. In 2003 I was awarded the Beverton Medal by the Fisheries Society of the British Isles for outstanding lifetime contributions to the field; I was awarded life membership in 2009. In 2005 I was awarded the American Fisheries Society's Distinguished Service Award.

My current research, which has changed focus over the past 20 years, encompasses: (a) the use of ecosystem simulations to address the history, ecological impacts and future policy goals of fisheries embedded in aquatic ecosystems; (b) multidisciplinary rapid appraisal of fishery status. The long-term goal in each field is to improve the assessment and management of fisheries over what is now available. Model predictions are challenged with data in order to distinguish among alternate hypotheses. This section aims to provide a brief synopsis of my research work, and includes an overview of my previous work on fisheries and fish schooling.

(NOTE: A list of research grants and contracts is given in Appendix 6; past and present members of my research group are listed in Appendix 5; numbers in the following sections refer to publications listed on pages 23-42 below.)

RESEARCH ON FISHERIES ECOSYSTEMS

Ecosystem impacts of harvesting and policy evaluation are of critical importance to sustainability (147, 111, 112, book 12). Much of the recent work by my research group employs new techniques for ecosystem simulations. Currently, my principal research effort is directed at innovative research on historically-based

reconstruction (*The Sea Before Us*, formerly termed *Back to the Future*), which aims to embed policy decisions in ecosystem management which has community consent (169, 165, 119, 111, 110, C41, C42, C43, C46). The aim is to use past ecosystems, reconstructed using historical, archeological and traditional information with mass-balance modelling, as draft policy goals for the future (170, 158, 149, 138, 133). Evaluations of alternative future systems are carried out using innovative ecological economics that takes account of the preservation of intergenerational equity, using an analysis developed by Dr Rashid Sumaila (138). Community inputs, both to the model construction and to the policy exploration, are an integral part of the process. *Back to the Future* case studies in northern BC (190), in Newfoundland (C86) and in Hong Kong (142) have been published.

The ecological and socio-economic methodology was developed as part of the MCRI *Coasts Under Stress* project (Major Collaborative Research Initiative = an interdisciplinary project scheme in Canada). In addition, I have worked with my students on ecosystem simulations for the Azores, Newfoundland, New South Wales (Australia), the English Channel, the South China Sea and Indonesia, and some recent work on trade-offs of policy objectives in Lake Malawi.

Working with Cameron Ainsworth (Univ. Florida, this work has recently been developed to look at bioeconomic restoration optima for future policy (189), and has been applied to evaluating the resilience (or dexterity) of coastal communities in the face of overfishing and climate change (198).

With a research colleagues Dr Daniela Kalikoski (Univ. Rio Grande, Brazil), Dr David Agnew (MRAG, London, UK), Dr Kaija Metuzals (DFO, Ottawa) and graduate student Pramod Ganapathiraju (India), I have endeavoured to make quantitative estimates of unreported catches in a number of case study regions, using a semi-bayesian anchor and influence factor technique (141). A number of case studies (C77, C74) and peer-reviewed papers on this work have been published (201, 200, 199, 175, 161), recently culminating in a paper that made a global estimate (193, C222).

Following a project that analysed data gathered by research partners in Hong Kong and provided stock and ecosystem assessment (C54), I have led two projects that aim to restore the heavily-depleted marine ecosystem of the South China Sea. These have entailed forecasts of the costs and benefits to different fleet sectors of the deployment of human-made reefs (129) using spatial ecosystem simulation (145, 137, 132, C85). Similar work has examined policy options for coral reefs and artisanal fisheries in Indonesia (189).

RAPID APPRAISAL OF THE STATUS OF FISHERIES AND AQUATIC ECOSYSTEMS

Over the past ten years, I have developed an innovative

set of techniques for conflating measures of fisheries status from different ecological, economic and social disciplines. The aim is to devise simple decision support tools that may be used in management. A novel quantitative method, *Rapfish*, ordinales the status of fisheries in a way that is robust against disciplinary criticism while tracking their 'health' (109,116,122). For example, two papers (89, 83) examine the sustainability of fisheries in relation to economic and social pressures. The method may be applied to both artisanal and large-scale commercial fisheries. By analysing ranked scores of attributes serving as indicators, the goal of the *Rapfish* technique is to quantify fishery status in ecological, economic, technological, social (134) and ethical evaluation fields (130), compliance with the FAO Code of Conduct for Responsible Fisheries (FAO Technical Paper, C67), the status of recreational (150) fisheries and MPAs (146), and the status of implementation of ecosystem based fishery management (191). Dr Melanie Power (Canada, SSHRC scholarship) used *Rapfish* ordinations as a quantitative hypothesis-testing tool for BC salmon fisheries (167, 130).

For each field, 6-12 transformed attribute scores are subjected to multidimensional scaling (MDS) ordination. To enable quantitative comparison of results, the method includes fixed anchor points (the best and worst possible scores, together with a fixed grid designed to lock the MDS ordination plane). Its significance is that it quantifies trade-offs among alternative policies. *Rapfish* was originally developed from 1998 to 2003 by myself and J.Alder, A.Bundy, T.Hutton, S.Mackinson, M.Vasconcellos, L.Nottestad, M.Nsiku and D.Preikshot. Four recent advances are (a) uncertainty addressed with Monte Carlo simulations; (b) hierarchical analysis of gear types, sectors and geographical areas; (c) results presented as polygonal kite diagrams; (d) human dimension fields updated and augmented by Katrina Nakamura, Trevor Ward, Andrew Martindale, Ian Perry and Mimi Lam during a Martha Piper Research Fund project that sponsored an international workshop at UBC in 2011 and led to a paper published from the 6th World Fisheries Congress in 2012. Working with a professional software engineers (Dr Pat Kavanagh and Ken Lockhart) the procedure was coded into Visual Basic Excel add-in software for a PC (C134), and has recently been developed into a cross platform "R" application that is available on a website.

One of the most interesting applications for *Rapfish* is in comparing self-evaluation of status among different stakeholder groups. When different perceptions are made explicit and focused, constructive dialogue and the resolution of conflicts may be aided. In 2003-2006, I made a study of this type with New South Wales Fisheries for self-evaluation of performance of their Management Advisory Committees (awaiting publication).

Working with Katherine Short (WWF, Switzerland) Daniela Kalikoski (Brazil) and Pramod Ganapathiraju

(India), I employed the *Rapfish* technique in a global evaluation of compliance with the FAO (UN) Code of Conduct for Responsible Fishing for 53 countries representing 96% of the world fish catch (192, C227). This was an extensive piece of work taking four years to complete (C157). The *Rapfish* technique was also used in a recent evaluation of fishery management performance of over 120 countries world-wide (195) and has recently been developed into a technique for evaluating the success of coastal restoration projects

RESEARCH ON FISH SHOALING

Although I am no longer active in this research field, I still find myself involved in joint work on the evolutionary aspects of fish schools (105, 149, 152, 172). My most recent behavioural work attempted to provide insight of shoal dynamics in the wild (recent reviews: 139, 101). Joint work with Norwegian colleagues has led to a series of papers (95, 102, 122, 145) on herring schools visualized with new high-tech side-scan sonar. Together with three graduate students, I was invited to take part in a further sonar/herring cruise in April 1996 and 1998. I have been able to link my behavioural work on shoaling in applied studies (24) with sonar stock assessment work jointly with Scottish (43,45,48,71) and Norwegian (100, 95) sonar scientists. This work is leading to dramatic new insight of adaptive changes in the spatial dynamics of herring with life history stage, fish, mammal and bird predators and food regimes (see 149).

This recent work on fish schools in the wild builds on my earlier achievements in the laboratory. Centred on the functions and physiology of shoaling behaviour in the light of insight from theory, over twenty years my research on shoaling has led to significant advances in the understanding of fish social behaviour and ecology (reviews: 114,101,80). In 1986 the status of my former research group in fish shoaling at Bangor was acknowledged by the appointment of a Royal Society University Research Fellow.

From the late 1970s, the realisation that individual fish constantly re-appraise decisions to join, leave or remain with social groups (17,29) proved a fruitful line of research with which to augment my earlier work on the three-dimensional structure of shoals (4,10,11,20,21,25). The synthesis, now widely accepted, is that the behaviour of shoaling fish intimately reflects the balance of costs and benefits to fitness through join, leave and stay decisions (49,53,80). In shoaling fish, behaviour thus can shift rapidly in response to trade offs between foraging opportunities and predator risk as a consequence of social interaction (29,31,32,35,42, 44,54,59,60,77,95,114).

My work has encompassed empirical fieldwork (33,48,95) and theoretical studies (34,52,80) as well as experimental tests of hypotheses. My laboratory research on shoaling examined the trade-off between foraging and risk of predation (60); size (54); light intensity (55); spatial heterogeneity and time in

shaping behaviour in multispecies shoals (51); the role of hunger in shifting behavioural decisions in shoals (59,63,68); the influence of hormonal state on individual behaviour in shoals (37,47), and pioneering work on the genetic basis of shoaling (57). Genetic and developmental aspects were later thoroughly partitioned using laboratory-raised fish by a senior worker in my group; anti-predator behaviour fitted Konrad Lorenz 'innate schoolmistress' paradigm.

From an evolutionary viewpoint, one of the most interesting parts of the work was the discovery of predator inspection behaviour by fish in shoals, a behaviour first analysed in my group in Bangor in the 1980s (50). Work has confirmed that information is passed from inspectors to other shoal members, reduces the effectiveness of predator attack and allows attack anticipation. Quantitatively, inspection carries a risk of attack (77). Inspection behaviour may support the 'tit-for-tat' hypothesis, a simple route to the evolution of cooperation which is not dependent on kinship or long-term reciprocal altruism. But some recent experiments do not support this explanation (78) and there is evidence that inspection aids anticipation of attack (99).

PREVIOUS RESEARCH ON FISHERIES

One theme in my research has been the factors that determine resilience in fisheries (120) and this field brings together my experience in both the fisheries and behavioural fields. My initial publication in this area (93) examines the role of individual fish behaviour in catchability-led stock collapse through shoal-driven instabilities and through range collapse (79). The resilient hake (84) provide a contrast on account of cannibalism. A paper with a graduate student and a fisheries economist (103) examined the consequences of stock collapse and further work simulated range-collapse in fisheries (105), and easily-measured behavioural diagnostics that may provide early warning. Recent collapses of stocks of major food fishes (cod, anchovy, sardine, herring) make of direct relevance to responsible and sustainable fish harvesting.

A link with South Africa stimulated me to work on the extension of equity to disadvantaged groups of stakeholders through co-management (106,121) and in Mexico, how artisanal fishers take decisions (151). An analysis of the impact of first-world fishers on 3rd world fisheries was presented at an American Fisheries Society symposium in 1994.

My broad interest in the ecology and management of commercial fisheries stemmed from my early research on new methods of growth analysis (6,7), ageing using length-based methods (22,67), age-based methods (91), and simulation modelling (46). I was involved in developing and testing an innovative length-based assessment package (LFDA) at Imperial College, sponsored by ODA. Recently, I have completed a review of length-based methods (142).

I have carried out work on a wide variety of other fisheries topics, including environmental and physiological aspects of daily ageing in fish otoliths (61,66,74), artisanal fishing effort (56), and multispecies assessment using simulation (72,102). I have been concerned with all aspects of the ecology and assessment of important tropical fish stocks, both freshwater (46,56,83,87) and marine (58,62,70,79,84), including innovative approximate techniques (70,89, 96,102,108), marine reserves (124), and socio-economic aspects (110, 121, 117).

At RRAG I directed a joint two-year investigation with two Italian laboratories (IRPEM, Ancona and ITTP, Sicily) aimed at providing an assessment of Adriatic sardine and anchovy fisheries, which have suffered a serious decline in recent years. An EC-funded project aimed at determining stock structure in this fishery using molecular techniques was linked to this project (94, 97, 98).

I collaborated in the fisheries aspects of work using biochemical methods to identify stock structure (64,81,92,97,98 & Book 7). Unexpectedly, Adriatic anchovies show genetic relatedness within schools. The implications of this finding for resilience in mitigating stock collapse are being explored and may reveal an illustrative difference between anchovies and sardines, where no evidence of relatedness was found. Previous work using mtDNA, allozymes and nuclear DNA single-locus probes to investigate shoal structure and integrity in freshwater minnows found no evidence of relatedness (81), so there are clear differences among species. I have also worked on stock structure using morphometric methods, for example on Indian Ocean yellowfin tuna (in prep) and commercial Lake Malawi cichlids (65, 85).

In the developing countries of Africa and South America, I have considerable experience of fisheries research, having been involved in work in Malawi, Zimbabwe, Kenya, Uganda, Angola, South Africa, Chile, Ecuador and Mexico. I also have some experience working on floodplain fisheries in Thailand and Sumatra that did not lead to publications, and have recently been involved in work on the assessment and mitigation of impacts in Hong Kong fisheries. (*Appendices 7 & 8 summarise my overseas experience.*)

I ran a major research project on Lake Malawi for the UK Overseas Development Administration (ODA). The target species was a pelagic herbivorous cichlid known as chambo and the aim was to assess the suitability of this commercial food fish for introductions to man-made impoundments. Work on the diet in the wild (75), experiments on diet selection (73,85), taxonomy (65), and reproduction (76) has been published.

While in London, I directed a large ODA development project aimed at a synthesis of ecological information on species changes in African lakes, including the effects of introduction of species like kapenta and the

Nile perch. A symposium workshop was held in March 1991 and the synthesis volume was published in 1995 (Book 9, and see 107).

My research interests in Lake Kariba developed from establishing a British Council university link with Zimbabwe in 1987. I was also involved in a NORAD-sponsored project with the Lake Kariba Fisheries Research Institute (LKfri), and a Ph.D. student from that laboratory has completed his thesis. I have taken part in three acoustic and sampling research cruises for juvenile sardine: *Limnothrissa* introduced from Lake Tanganyika. I have published an assessment of the Lake Kariba sardine (82) and have a further analysis of that fishery in preparation.

I was co-investigator in an ODA-funded project on pelagic clupeids in Central Africa jointly with Dr Carvalho when he was at the Fish Genetics Unit at Swansea, UK. The project evaluated genetic diversity and stock structure of introduced populations of sardine in Lake Kivu and Lake Kariba to compare with original stocks at the northern (Burundi) and southern (Zambia) ends of Lake Tanganyika (92,113). I was also involved in a similar project on Nile perch that has showed dramatic genetic divergence in the introduced Lake Victoria population (118).

Following six visits to Chile, I reinforced my interest in Chilean fisheries (sardines & anchovies in the central and northern zones; demersal, sublittoral and salmon fisheries in the southern zone) by establishing more formal links with the fisheries group at the Austral University, Valdivia and Puerto Montt (Dr Carlos Moreno). In Mexico, I have worked with fisheries groups at EPOMEX (Campeche), CINVESTAV (Merida), CICIMAR (La Paz) and UNAM (M. City & Mazatlan). Since my sabbatical in Cronulla, New South Wales in 1998, I have developed a similar range of links with major fisheries laboratories in Australia (Perth, Darwin, CSIRO Hobart and CCAMLR) and South Africa (Cape Town SFRi).

Administrative Experience

I believe in team effort and in promoting ways of harnessing individual talents and enthusiasm to achieve commonly-agreed goals. My objective in each project that I direct is delivery of a research product that meets the highest international standards of excellence and innovation, provides stimulating training for young research workers, while remaining cost-effective within the constraints of a planned budget. This aspiration was both fulfilled and challenged by my role as the founding Director of the interdisciplinary Fisheries Centre, located at one of North America's premier universities, the University of British Columbia.

In 1996 I became the Co-Director of the *Pacific Fisheries Think Tank*, a cooperative venture between

Simon Fraser University's Institute of Fisheries Analysis and the UBC Fisheries Centre. The Tank facilitated several workshops with the BC fishing industry and government, is involved in international industry-environmental partnership with the Marine Stewardship Council, and has worked towards improving fishery relations between Canada and the USA.

As a model for these cooperative ventures, much of my best research work has been carried out jointly. My work in the London MRAG group augmented my considerable previous experience of team management. For example, while in Bangor the publication rate of my group averaged 11.2 papers per year over ten years and we made a conscious attempt to maximize the potential of research contracts. Wherever possible, I have taken the science forward while creating valuable employment for young fishery scientists in the process.

A full list of scientists who are, or have been, members of my research group is given in Appendix 5.

THE UBC FISHERIES CENTRE

I was appointed as the first Director of the new interdisciplinary Fisheries Centre at UBC in January 1993. Early on, I worked actively to establish a sound cooperative research agenda because I believed that the Fisheries Centre could make a difference to the parlous state of fisheries both in Canada and world-wide. We initiated an ambitious workshop and symposium series that is published in our own research reports that are abstracted in ASFA; established a seminar programme for visitors, our own staff and students; and set up World Wide Web/Internet system and information server. Initially with 4 faculty, the Fisheries Centre has now more than doubled in size: for example we have attracted two international stars in fisheries science and conservation, Drs Daniel Pauly (*Sea Around Us project*) and Amanda Vincent (*Project Seahorse*), as well as three more junior faculty. In 2009 the Centre has a complement of around 70 graduate students, 25 research associates postdocs, research assistants, staff and 10 Professors. My ten-year term as Director ended in June 2003, the Director is now Dr Rashid Sumaila, an economist.

Among our achievements, the Fisheries Centre set up major research programmes focusing on estimating the impact of harvest on aquatic ecosystems, the true world fish catch, the resilience of fisheries, the importance of marine reserves, and (jointly with a consortium of research partners) FISHBASE, an electronic inventory of the ecological data on the world's fishes, and a very successful marine mammal group under Dr Andrew Trites. The Fisheries Centre has received very positive external evaluations on its research in 1996, 2003 and 2008.

I took the lead on behalf of the Fisheries Centre in several major proposals, the most successful of which has been a \$16 million dollar project for new Aquatic

Ecosystems Research Laboratory, primarily funded by the federal Canadian Foundation for Innovation. Other successful proposals include a Canadian Research Chair, which gave a home to the well-known Project Seahorse, a new Professor of Fisheries Economics, and a Chair of Aboriginal fisheries (in partnership with the First Nations House of Learning at UBC), and an NSERC Women's Chair in Coastal Zone Management.

RESEARCH PROJECT MANAGEMENT

Many challenging logistic and administrative problems present themselves in today's research climate, especially in work that involves developing countries. In my post at the Fisheries Centre at UBC I have learned how to bring my previous experience, based in the UK, to bear in the Canadian arena.

In the past twenty years in Canada I have acted as PI on a 3-year NSERC Strategic grant on the ecosystem role of herring northern British Columbia, PI and Project Director in a 3-year study on Ecosystem-based management in Raja Ampat, Papua, Indonesia, PI of a 3-year project on fisheries and the ecosystem in Mille Lacs lake in northern Minnesota, a 3-year SSHRC *Fisheries Ethics* project; as PI on a 2-year, *BC Groundfish* research project; as leader of a 3-year project on the *Rapid Appraisal* of fisheries, as PI and Research Director of the *Back to the Future* research team. Between 1999 and 2002, I acted as Chair of the Steering Committee for Dr Daniel Pauly's large *Sea Around Us* project.

Approaches developed in pure strategic research can often be invaluable for more focused research in fisheries. Following considerable contract research at Bangor, including running an UK Government (ODA) Fisheries survey of the EEZ around St Helena, I gained valuable experience in managing contract work at the Renewable Resources Assessment Group (RRAG) and its associated consultancy company, the Marine Resources Assessment Group (MRAG). Based at Imperial College in London, we comprised the foremost fishery consultancy group in Europe. Meeting the clear deadlines of contract research with a high-quality scientific product can help to build staff motivation and morale. Moreover such well-focussed experience helps graduating students to capture worthwhile jobs. Bringing the fruits of this entrepreneurial experience, however, onto UBC's somewhat conservative campus was not easy.

DEVELOPMENT OF RESEARCH GROUPS

At the Fisheries Centre I attempted to create a new interdisciplinary research unit where "the whole becomes more than just the sum of its parts". I feel that I have gained considerable experience in research logistics: the gathering of resources, money and staff for research and training in a difficult funding environment.

While in Bangor, UK, I built up extensive research

groups and facilities: two fisheries research laboratories and seven research aquarium rooms, including a tropical air-conditioned lab. and large arena tanks. The equipment included microcomputer and video apparatus, algal culture units, and equipment for otolith work. At its peak, over ten students and postdocs worked in this group. In my first appointment at the University of Ulster, which was the most recent of the new 1960s UK universities, I had considerable experience of planning and setting up research facilities, including animal houses, teaching laboratories and aquaria.

CONFERENCES AND SEMINARS

In 2001 I was asked to become the Chair of the 8-person Programme Committee for the Fourth World Fisheries Congress held in Vancouver in 2004, the major world conference in the fisheries field. The committee's work was to choose ten keynote speakers, identify 39 session topics and chairs, issue the call for papers and review over 1200 submitted abstracts. Although I had organised many meetings and conferences, this position proved a major responsibility and challenge. Over 1500 delegates attended and the Congress made a profit of over \$100,000, most of which was passed on to next World Congress to support attendance by fishery scientists from the developing world. I was awarded an *American Fisheries Society Distinguished Service Award* for this task.

In 2001 I helped to organise an international conference on *Putting Fishers Knowledge to Work*, aimed at analysing TEK and LEK in fisheries world-wide. In 2000, I ran *Evaluating the Benefits of Recreational Fishing*, the 2nd world conference on the science of sport fisheries. In February 1996, I organised an international Symposium on *Reinventing Fisheries Management*. I was on the organising committee for *The New Pacific Community*, the 5th Pan-Pacific University Presidents Conference at UBC in 1995. In London in March 1992, I organised an international workshop and symposium for the ODA on *The Impact of Species Changes in African Lakes*. In November 1991, I helped to organise an international workshop on *Hake Fisheries* at Bremerhaven, Germany. In July 1986 I organised a major international conference on *Fish Behaviour* for the Fisheries Society of the British Isles. In 1982 I helped to organise an international conference on *Fish Physiology*.

In the Fisheries Centre at UBC I have organised a series of workshops: *Modelling Antarctic Ecosystems*, *The Reconstruction of Past Ecosystems as Policy Goals for the Future*; *Issues Surrounding the Resumption of Commercial Whaling*; *the Impact of Fisherman's Behaviour in Fisheries*; *the Problems of By-Catch*; *the Impact of Ocean Change on Fisheries*; *The Harvesting of Krill* and *The Design and Monitoring of Marine Reserves*. Workshop proceedings are published in the Fisheries Centre's own Report series. In the past, I have organised departmental seminar programmes. For

example, a substantial number of visitors from within the UK and overseas were brought to speak in Bangor, UK, during the 1980s.

MASTERS COURSE IN FISHERIES BIOLOGY & MANAGEMENT

At Bangor, as founding Course Director for the M.Sc. in Fisheries Biology and Management for five years, I had major administrative responsibility which involved planning, budgeting, timetabling and organising all aspects of the course, including examinations and the delegation of responsibilities to other staff and demonstrators. The course was intensive, the work being completed in just one year. A great deal of practical and quantitative material was covered, including the biological, mathematical and economic bases to the assessment and management of commercial fisheries. The course was recognised by national and international funding bodies such as ODA, British Council, NERC, Commonwealth Secretariat, FAO, NORAD and UNESCO. In six years this course enrolled over 130 students, most of whom were from overseas: job capture was over 80%. Many alumni from this Masters course are now in senior fisheries positions throughout the world.

EXAMINATIONS

For five years in the 1980s in Bangor, I was departmental examinations officer, and introduced computerised student performance profiles, an innovation for the University at the time.

OTHER ADMINISTRATIVE EXPERIENCE

I have served on a wide range of University committees including Promotions and Tenure, Library, Financial Planning, Computer Services and Staff-Student Relations. While at the University of Ulster in Coleraine in the 1970s, Britain's newest University, I enjoyed rather more experience in planning and administration than would have been usual for junior staff.

Teaching Experience

UNDERGRADUATE

At present I teach a new 4th level interdisciplinary 3-credit course on the History of Fisheries that covers ecological, technological and human aspects and has attracted student from arts and science backgrounds. I also teach a 4th level course on Introduction to Fishery Science for oceanography students. Formerly I taught a 4th level course in fish behaviour for the Zoology Dept. at UBC. Student evaluations of my courses are always in excess of 90%. Formerly, my main undergraduate teaching responsibilities were in courses at 1st, 2nd & 3rd year level in Animal Behaviour, Behavioural Ecology, Evolutionary Biology, and Fisheries Ecology.

In addition, I have taught a very wide range of zoological topics, computer programming, and statistics for biologists. In Coleraine during the 1970s I played a large part in designing and implementing a B.Sc. course in Ecology, one of the first degree courses of its kind in Europe.

GRADUATE

I currently teach about 6 credits worth of graduate courses at the Fisheries Centre, including an interdisciplinary course on evaluating the status of fisheries and aquatic ecosystems. Formerly, I taught about twice that amount for the Fisheries Masters course that I designed in Bangor, UK. Over my career, I have acted as External Examiner for over 40 Ph.D. students, most recently in Norway and New Zealand, and a large number of Masters students.

PROFESSIONAL

I have run a number of training courses for fisheries professionals (Appendix 2). Although these have been founded on my master's course background, they generally involve detailed work at a high level. I have written workshop manuals for the courses: in particular I developed a 70-page manual for length-based assessment methods.

ADULT

Early in my career, I worked in adult education *via* the Open University from 1969 to 1978 (Ecology and Behaviour), and in the 1970s ran courses on Statistics and Ecology for the Field Studies Council at Field Centres in the UK.

EXTRAMURAL

I have given talks at a number of open public meetings in BC on interdisciplinary fisheries science and sustainable fisheries. Formerly, I gave extramural 'evening' courses for the general public on The Biology of Fishes in Oxford and in Northern Ireland.

Community Service

Outside the university sphere, I was for 3 years on the Marine Advisory Committee for Haida Gwaii (Queen Charlotte Islands). I have been a Director of the Institute of Pacific Ocean Sciences and Technology, a member of the Board of Governors of the Vancouver Aquarium, a Director of the Sustainable Ocean Resources Society of BC, the leader of the Fish Stock Assessment team in the Canadian Ocean Frontiers Initiative (COFRI), and was involved in the establishment of the Northwest Maritime Institute in Prince Rupert, BC. I served on the Council of the Fisheries Society of the British Isles (1981-89), the Council of the Association for the Study of Animal

Behaviour (1980-84), and the Zoological Society of Wales (1979-83). My principal hobbies are archaeology, history, photography and DIY, and I enjoy swimming, bird and game watching, big game fishing and exploring historic sites.

**Conference Presentations
APPENDIX 1A
Invited & Keynote Papers**

- Busan, Korea, May 2016. **Keynote paper** on *Vanquishing the Four Seahorsemen of the Aquacalypse*. Multidisciplinary session, 7th World Fisheries Congress.
- Porto Galhinas, Recife, Brazil, April 2015. **Keynote paper** on *Hope or Despair: the Future of Fisheries* at 5th Brazilian Marine Biology Congress.
- Barcelona, Spain, November 2014. **Keynote Paper** on *Spatial Ecosystem Modelling in Support of Policy Change*. Ecopath at 30 Years Conference.
- Glasgow, Scotland, August 2014. **Invited Paper** on *Conserving Fish by Evaluating the Ethics and Sustainability of Fisheries*. International Marine Conservation Conference.
- Edinburgh, Scotland, May 2012. **Invited paper** on *Impact of warming and fisheries on the Antarctic Peninsula*. Hotspots session, 6th World Fisheries Congress.
- Vancouver, Canada, October 2011. **Invited paper** on *The Sea Ahead and the Sea Before Us: Reconstructing the Salish Sea*. Salish Sea Ecosystem Conference.
- Austin, Texas, August 2011. **Invited paper** on *Changing Places: Local Knowledge and Shifting Baselines in Marine Ecosystems*. Ecological Society of America Annual Conference.
- Ottawa, Canada, October 2009. **Invited paper** on *Net costs: estimating unreported fishing locally and globally*. OMRN National Conference and IUU workshop.
- Vancouver, Canada, May 2009. **Keynote Paper** on *The Sea Before Us and The Sea Ahead*. History of Marine Animal Populations (HMAP) "Oceans Past 2" conference.
- San Diego, USA, March 2009. **Theme Paper** on *Seamount Fisheries: Do They Have A Future?* Seamounts Biogeosciences Network Workshop, Scripps Institute for Oceanography.
- Rome, Italy, July 2008. **Invited Paper** on *Socio-Ecological Responses To Climate Change In Two Coastal Communities: Dexterity In The Optimal Fleet*. FAO/GLOBEC conference 'Coping with global change in marine socio-ecological systems'.
- Cork, Ireland, September 2006. **Keynote speaker**. *The Sea Ahead: Challenges to Marine Biology from Seafood Sustainability*. 41st European Marine Biology Symposium.
- Aberdeen, UK, September 2005. **Invited Speaker**. *Evaluating the Role of Climate, Fisheries and Parameter Uncertainty using Ecosystem-Based Viability Analysis*. ICES Annual Science Conference.
- Monterey, California, USA, August 2005. **Invited Speaker**: Benthic-Pelagic coupling and the management of MPAs.
- Princeton, New Jersey, USA, March 2005. **Invited Speaker**: Ecosystem-Based Management Workshop.
- Vancouver, Canada, May 2004. **Invited Session Leader** on *Lessons from History*, at 4th World Fisheries Congress.
- Nice, France October 2003 (10 days). Invited papers on **Back to the Future** and **Ecosystem modelling** at NATO Advanced Study Institute, **Strategic Management of Aquatic Ecosystems**. Nice, France.
- Chicago, USA, June 2003. **Keynote paper** *Trade-offs between biodiversity and sustainable fisheries in lakes*. Population Viability in Lakes, AFS symposium, Chicago, USA.
- Darwin, Australia, June 2002. **Keynote Paper** *The Compleat Angler and the Management of Aquatic Ecosystems* at 3rd World Conference on Recreational Fishing.
- Phoenix, Arizona, August 2001. **Invited Paper** on *Opening the Lost Valley: reconstructing ocean ecosystems and fisheries* at American Fisheries Society symposium.
- Vancouver, August 2001. Invited **Keynote Paper** on *Cognitive Maps and the reconstruction ecology of the oceans* at 'Putting Fishers Knowledge to Work', International Conference, Vancouver, Canada.
- Fisheries Week Seminar, Horta, Azores, Portugal, March 2001, **Keynote paper** on *Back to the Future: the historical reconstruction of marine ecosystems as policy signposts for the future*.
- Opening of the Centre for Wildlife and Fish Research, Umeå, Sweden, October 2000. **Keynote paper** on *Back to the Future*.
- Symposium of the International Institute for Fisheries Economists, July 2000. **Keynote paper** on *Back to the Future: economic and social synergies*. Corvallis, Oregon, USA
- Workshop on Economics of Marine Protected Areas, July 2000. Keynote paper on *Analysing the bioeconomic impacts of no-take artificial reefs using spatial ecosystem simulation*. Vancouver, BC
- Washington, DC, USA, February 2000. **Session Organiser** and **Keynote paper** on *Back to the Future* at AAAS Annual Conference.
- San Remo, Italy, September 1999, **Keynote Paper**. *Forecasting the Benefits of No-take Artificial Reefs Using Spatial Ecosystem Simulation*. 7th International Artificial Reefs Conference.
- Vancouver, February 1999, **Keynote Paper**. *Rebuilding as a new policy goal for fisheries management: reconstructing the past to salvage the future*. American Fisheries Society, Canadian Chapter, Annual Conference.
- Sarasota, Florida, November 1998, **Keynote Paper**. *Marine Reserves and the Restoration of Fisheries and Marine Ecosystems in the South China Sea*. William R. & Lenore Mote International Symposium in Fisheries Ecology, Sarasota, Florida, November 1998.
- Florence, Italy, July 1998. **Keynote Paper**. *Rebuilding as a new policy goal for fisheries management: reconstructing the past to salvage the future*: at 7th International Ecological Congress.
- Boston, December 1997. **Invited Paper**. *Ecosystem approaches to herring research*. New England Aquarium Aquatic Forum – Herring Fisheries. Boston, Dec 8-9, 1998.
- St Johns, Newfoundland, Canada, October 1997. **Invited paper** on the *Ecosystem goals and needs of fishery management*. DFO Panel discussion at the John Cabot 'Summit of the Sea' congress.
- Brisbane, Australia, August 1996. **Invited Paper** on *Resilience in Fisheries* at 2nd World Fisheries Congress.
- Cairo, Egypt, September 1995. **Invited Paper** on *Fisheries in the African Lakes* at ICLARM planning workshop for the Abassa facility.
- Nairobi, Kenya, August, 1995. **Keynote paper** on *A new family of approximate models for the estimation of potential yield of African lake fisheries* at First African Fisheries Congress.
- Las Palmas, Gran Canaria 1994. **Keynote address** on

- Impact of Pelagic Fish Behaviour on Fisheries* at Symposium on Pelagic Fish, Spain.
- Rhodes, Greece, April 1993. **Keynote address** on *Adriatic Pelagic Fisheries: an integrated approach to assessment* at Greek national symposium of fisheries and Oceanography.
- Stykkisholmur, Iceland, September 1992. **Keynote papers** on *Predation on and by fish shoals* at Nordic Council workshop on Predation processes.
- Bremerhaven, December, 1991. **Keynote paper** on *What makes a Hake: biology and global fisheries for hake?* (with Dr J. Alheit) at Hake Fisheries Workshop.
- Monterey, California, October 1991. **Invited paper** on *Structure and Dynamics of Fish Shoals* at Workshop on Animal Aggregations
- The Hague, Netherlands, August 1991. **Session Organiser** on Behavioural Ecology and **Keynote paper** on *The Evolution And Function of Predator Inspection Behaviour* at International Ichthyological Congress.
- Salzburg, Austria, September 1989. **Invited paper** on *Decision rules and exploitation in multispecies cyprinid shoals* at International Symposium on the Environmental Biology of Cyprinid Fishes.
- Grygynog, Wales, July 1989. **Invited paper** on *The Role of the Optimal Diet Predator in Multispecies Fishery Assessment*. (with G.F.Turner) at NATO Advanced Study Institute, **Workshop on Foraging Behaviour**.
- Hamburg, FRG, September 1986. **Invited Keynote paper** on *The functions of shoaling behaviour* at Annual meeting of the German Society of Ethologists.
- Quebec, Canada, November 1985. **Invited Keynote paper** on *Predators and food as the keys to understanding fish shoals*. At International Symposium on The Advantages Conferred by Life in Groups.
- Liverpool, March 1983. **Invited paper** on *Shifts of behaviour with shoal size in cyprinids*. (with Dr J.R.Allan) at British Freshwater fisheries conference.
- Liverpool, March 1979. **Invited paper** on *Links between the behaviour and ecology of fishes* at British Freshwater fisheries conference.

APPENDIX 1B Contributed Papers

- Barcelona, Spain, November 2014. Contributed paper on *Simulation of zebra mussel invasion and evaluation of impacts on Mille Lacs Lake, Minnesota: An ecosystem model*. Jointly with Rajeev Kumar. Ecopath at 30 Years Conference.
- Upsala, Sweden, September 2013. Contributed paper on *Rapfish evaluation of the ethical status of fisheries*. Eursafe Congress.
- Minnesota, USA, August 2013. Contributed paper on *Ecosystem modeling of Mille Lac Lake*. Jointly with Rajeev Kumar. Ecological Society of America Annual Conference.
- Minnesota, USA, August 2013. Contributed paper on *temperature changes in Coregonus in Mille Lac Lake*. Jointly with Rajeev Kumar. Ecological Society of America Annual Conference.
- Edinburgh, Scotland, May 2012. Contributed paper on *Recent improvements to the 'Rapfish' rapid evaluation technique for fisheries: integrating ecological and human dimensions*. 6th World Fisheries Congress.
- Edinburgh, Scotland, May 2012. Contributed paper Jointly. on *A tool for global seamount conservation and management*. 6th World Fisheries Congress. (with Dr

- Telmo Morato).
- Vancouver, Canada, May 2009. Contributed paper on *Lost in Translation: the First Trawl*. History of Marine Animal Populations (HMAP) "Oceans Past 2" conference. (with Susanna Braund and C.W. Marshall)
- Copenhagen, Denmark, October 2002. Contributed paper on *Ecosystem simulations of seamounts to determine sustainable fisheries*. ICES Centenary Symposium. (with T. Morato).
- Paihia, New Zealand, October 2001. Contributed paper on *Why fisheries needs fish remains archeologists: historical ecosystems as policy goals for the restoration of the oceans*, at International Congress of Fish Remains Archeologists.
- Anchorage, October 1997. Contributed paper on *Rapid appraisal of the 'health' of fisheries for small pelagics using multivariate, multidisciplinary ordination* (with S. Mackinson, M. Vasconcellos, L. Nottestad & D.Preikshot).
- Anchorage, November 1996. Contributed paper on *Ecosystem Impacts of Harvesting Small Pelagic Fish*. Alaska Sea Grant Symposium on Trophic Impacts of Forage Fishes. (with Steve Mackinson, Marcello Vasconcellos, Katherine Sloman & Carl Walters)
- Vancouver, BC. February 1996. Contributed paper on *Measuring the unmeasurable: an interdisciplinary ordination technique for assessing fisheries health* (with D. Pauly, A. Bundy & D. Preikshot). Symposium on Reinventing Fisheries Management.
- Aberdeen, UK, June, 1995. Contributed paper on *Adaptive Behaviour of herring schools*. ICES Fisheries Acoustics Symposium (with O.A.Misund)
- Portland, Oregon, August 1993. Contributed paper on *Third World Fisheries and First World Fishers*. American Fisheries Society Sociology Group Symposium. (with A.Bundy)
- Anchorage, Alaska, October 1992. Contributed paper on *Management of introduced species in the African Lakes*. Alaska Sea Grant Symposium. (with A. Bundy)
- London, March 1992. ODA Symposium on the Impact of Species Changes in the African Lakes. Contributed paper on *An analysis of species changes in Lake Victoria and an assessment of the potential yield of Nile Perch*. (with A.Bundy).
- Bangor, July 1986. FSBI International Symposium on the Behaviour of Fishes. Contributed paper on *Size segregation in minnow shoals*.
- Brisbane, August 1983. International Ethological Conference. Contributed paper on *Costs and benefits in shoaling behaviour*. (with A.E.Magurran).
- Reading, April 1981. ASAB conference. Contributed paper on *Foraging benefits in fish shoals*. (with A.E.Magurran).
- Glasgow, July 1980. ASAB Conference on predators and prey. Contributed paper on *Information and foraging in fish shoals*.
- Vancouver, September 1979. International Ethological Conference. Contributed paper on *The consequences of fish shoal volumes*.

APPENDIX 1C Poster Papers

- Queenstown, New Zealand, November 2003. *Sustainability of Seamount Fisheries*. Deep Sea conference. (with Telmo Morato) [2nd prize in poster competition].
- San Remo, Italy, September 1999. *Ecospace modelling of Hong Kong fisheries*. 7th International Artificial Reefs Conference. (with Eny Buchary and Trevor Hutton)

Anchorage, November 1997, Poster paper on *Harvest control for schooling fish stocks under cyclic oceanographic regimes: a case for precaution and gathering auxiliary information.* (with Marcello Vasconcellos.)

Brisbane, Australia, August 1996. 4 posters
An approximate model for assessing African lake fisheries
Measuring the 'health' of fisheries
The benefits of recreational fisheries
An individually based model of fish schooling
 2nd World Fisheries Congress.

Nairobi, Kenya, August 1995. *Assessment of the Nile Perch fishery in Lake Victoria.* (With A. Bundy).

Utrecht, Netherlands, August 1989. International Ethological Conference. *New findings about Predator Inspection Behaviour in Fish shoals.* (with K. Murphy).

Aberdeen, July 1989. FSBI International Symposium on Fish Population Biology. *Assessment of Indian Ocean Yellowfin Tuna using Data from a Sport Fishery.* (with S. Hemphill, Kenya).

Bangor, July 1989. ASAB conference on Predation. *Conditional approach and tit-for-tat during inspection behaviour in minnow shoals* (with K. Murphy).

Bangor, July 1986. FSBI International Symposium on the Behaviour of Fishes. *Danger at dawn* (with J.R. Turner).

APPENDIX 2 Professional Workshops and Training Courses

June 2016. **Visiting Professor** (2 days) for masters course in fisheries. **Review of assessment methods for the potential yield** of fisheries. National University of Korea, Busan, Korea.

March 2015. Workshop (4 days) on **Sustainability of Hake and Hoki fisheries** of southern Chile. Univ. Concepcion, Chile.

August 2014. Workshop (1 day) **70th Birthday Symposium** for Profs Tony Pitcher and Paul Hart. Bangor, Wales, UK.

November 2011. Workshop (5 days) on **Sustainability of Hake and Hoki fisheries** of southern Chile. Univ. Concepcion, Chile.

April 2011. Workshop (2 weeks) on **Development of a seamount ecosystem evaluation framework.** Horta, Azores, Portugal.

January 2010. Workshop (2 days) **State of the Strait:** DFO workshop, Institute for Ocean Sciences, Sidney, BC.

January 2010. Workshop (1 day) **Ecosystem Services.** Seattle

December 2009. Scripps Institute for Oceanography. **Seamounts** Oceanography guest editors workshop.

May 2009. Peter Wall Institute of Advanced Studies Exploratory Workshop, **The Sea Ahead: Reconstructing of the Strait of Georgia** [Organiser and co-PI with Dr C. Thrush], UBC, Vancouver, Canada.

Vancouver, Canada, May 2009. History of Marine Animal Populations (HMAP) **"Oceans Past 2"** conference: co-organiser.

San Diego, USA. March 2009. **Seamounts Biogeosciences Network Workshop**, Scripps Institute for Oceanography. [co-organiser with Hubert Staudigel]

December 2008. Workshop (1day) **Ecosystem Modelling of the Strait of Georgia.** DFO Institute for Ocean Sciences, Sydney, Canada.

October 2008. Workshop (2 days) **The Sea Ahead:** Peter Wall Institute for Advanced Studies, UBC, Canada.

September 2008. Workshop (2 days) **Interdisciplinary seamount research initiatives.** Scripps Institute for Oceanography, San Diego, USA.

February 2008. Workshop (1 Day). **Biogeochemical and other ecosystem simulation modelling.** DFO Pacific Biological Station, Nanaimo, Canada.

January 2008. Workshop (3 days). **IUU estimation in the Arafura Sea.** FAO (UN) and Indonesian government. Peter Wall Institute for Advanced Studies, UBC, Canada

January 2008. Workshop (4 days). **Global IUU estimation.** MRAG, London UK and UK Government (DEFRA). Peter Wall Institute for Advanced Studies, UBC, Canada.

June 2007. Workshop (2 days) Comparison of EwE and Atlantis **ecosystem modelling** of the New South Wales coast. With CSIRO and NSW Fisheries, Cronulla, NSW, Australia.

May 2007. **IUU estimation in the Arafura Sea.** FAO (UN) and Indonesian government (DKP). Jakarta, Indonesia.

February 2007. Workshop (3 days) **Sources of data and policy for ecosystem-based management in Mille Lacs lake, Minnesota.** Aitken, Minnesota, USA.

November 2006. Workshop (3 days) on **IUU Fishing.** London. Chatham House and MRAG, UK.

August 2006. Project inception workshop (3 days). **Species Diversity and Ecosystem Health in Lakes.** Stone Laboratory, Ohio State University, Put-in-Bay, Ohio, USA.

July 2006. Project inception workshop (3 days). **Taking Stock: historical reconstruction of coastal marine ecosystems in New Zealand.** Wellington, New Zealand.

April 2006. Project Inception Workshop (1 day), **Estimating IUU in the Arafura Sea.** Jakarta, Indonesia.

April 2006. Project workshop (4 days). **Modelling in support of Ecosystem-based management for Raja Ampat, Indonesia.** Sanur, Bali, Indonesia.

February 2006. Training Course (5 days). **Ecosystem-based Management:** course for Visiting Fellows Program. United Nations University, Fisheries Department, Reykjavik, Iceland.

May 2005. Workshop (6 days). **Seamounts: ecology, fisheries and conservation.** Revision of book chapter drafts. Horta, Azores, Portugal.

May 2005. Workshop (1day) **Introduction to rapid appraisal techniques for fisheries.** Economics Dept, Basque University, Bilbao, Spain.

April 2005. Workshop (3 days) **New Techniques In Support Of Ecosystem-Based Fishery Management.** Hellenic Center for Marine Research, Athens, Greece.

April 2005. Workshop (3 days) **New Techniques In Support Of Ecosystem-Based Fishery Management.** Institute of Marine Biology, Crete, Greece.

September 2004 Workshop (3 days) **Simulation modelling of marine protected areas and human-made reefs** in Western Scotland. SAMS, Oban, Scotland.

December 2003. Workshop (3 days) **Ecosystem simulations in support of ecosystem-based management.** New South Wales fisheries, Cronulla, NSW, Australia.

November 2003. Workshop (1 day). **Back to the Future research.** NIWA, Wellington, New Zealand.

April 2002. **DFO Artificial Reefs Working Group,** St Catharines, Ontario, Canada.

February 2002. Workshop (3 days). **Back to the Future:**

results, issues and discussion. Coasts Under Stress MCRI, Vancouver, Canada.

December 2001. Workshop (3 days). **Community Input Workshop.** Back to the Future: policy consultation and simulations. Prince Rupert, BC, Canada. Coasts Under Stress MCRI.

December 2000. Training course (2 weeks). **Towards Ecosystem management.** University of Concepcion, Chile (with E. Buchary).

September 2000. Workshop (3 days). **Back the Future on the Newfoundland shelf.** Coasts Under Stress MCRI, St. Johns, Canada.

September 2000. Workshop (3 days). **Back the Future in the Hecate Strait, BC.** Coasts Under Stress MCRI, Vancouver.

July 2000. **Multispecies management using Ecosim.** FAO workshop. Vancouver BC.

May 2000. **Methodologies for evaluating the ecosystem impacts of fisheries in the North Atlantic.** Sea Around Us Workshop, Victoria, BC.

June 1998. **Maximising the benefits from Lake Nasser's Fisheries.** Aswan, Egypt, ICLARM workshop.

March 1998. **Ecosystem simulation models for multispecies management.** Vancouver, Canada, FAO-Sponsored Workshop.

January 1997. Vancouver, BC. Pacific Northwest regional panel. **Marine Stewardship Council** workshop.

December 1996. **Canadian Code of Conduct for Responsible Fisheries.** Facilitator: Pacific Fisheries Think Tank workshop. Vancouver.

September 1996. **Marine Stewardship Council.** (WWF/Unilever) Inaugural workshop drafting Criteria for Sustainable Fishing. London, UK.

June 1996. **Skeena Watershed Committee.** Workshop on Decision Analysis techniques. Vancouver

September 1995. **Planning Group Workshop.** New ICLARM facility for Africa at Abassa, Cairo, Egypt.

December 1994. **Training Course** (3 weeks). New Developments in Fisheries Management, University of Concepcion, Chile.

April 1994 **Workshop** (5 days) on Fish Schooling Behaviour and Dynamic Programming techniques. University of Bergen, Norway.

September 1993 **Workshop Session Chair** (5 days) on Tropical Groupers and Snappers at EPOMEX, Campeche, Mexico.

March 1992. **Workshop** (4 days) on multivariate methods in Fish Community Analysis, Imperial College, London.

January 1992. **Training Course** (1 day) on *Developments in Length-Frequency Analysis* for the SADACC Zambia/Zimbabwe Fisheries Project, Kariba, Zimbabwe.

December 1991. **Training course** (2 days) on *Non-parametric length-frequency analysis and Virtual Population Analysis*, for Bangor University.

November 1991. **Training course** (1 day) on *Aims and strategy in fishery Management*, for University of Cork, Ireland.

October and December 1991. **Training course** (5 days) on *Approximate assessment methods and length-frequency analysis*, for ODA, at RRAG, London. (UK Govt.).

July 1991. **Training course** (5 days) on *Approximate assessment methods and length-frequency analysis*, for ODA, at RRAG, London. (UK Govt.).

April 1991. **Training course** (5 days) on *length frequency analysis*, for ODA, at RRAG, London. (UK Govt.).

February 1991. **Training course** (1 day) on *Fisheries for Economists: an Introduction*. Overseas Development Administration, London. (UK Govt.)

February 1991. **Workshop** (2 days) on the ecosystem effects

of fisheries at Instituto de Ciencias del Mar y Limnología, Autonomous University of Mexico, Mexico City, Mexico. (UNAM)

January 1991. **Workshop** (2 days) on the assessment of Southern Chilean fish stocks, at the Austral University of Chile, Valdivia, Chile. (British Council)

January 1991. **Training course** (5 days) on *length frequency analysis*, University of Concepcion, Chile. (UNDP)

November 1990. **Training course** (1 day) on *Fisheries for Economists: an Introduction*. At Overseas Development Administration, London. (ODA)

September 1990. **Training course** (5 days) on *length frequency analysis and approximate assessment methods*, Polarmar GmbH, Bremerhaven, Germany. (German Govt.)

August 1990. **Training course** (2 days) on *non-parametric length frequency analysis methods*, Lake Kariba Fisheries Research Institute, Zimbabwe. (NORAD)

July 1990. **Training course** (10 days) on *length frequency analysis methods*, Luanda, Angola. (Swedish Govt., SIDA)

December 1989. **Workshop** (10 days) on *Behavioural Ecology and Trophodynamics of Fishes* (with Dr P.J.B.Hart), at University of Concepcion Marine Field Station, Dichato, Chile. (Fundacion Andes)

May 1989. **Training course** (2 days) on *fisheries assessment methods*, University Lake Kariba Research Station, Zimbabwe. (British Council)

May 1988. **Training course** (4 days) on *fisheries assessment methods*, held in Bangor for students of the University of Bremen, Alfred Wegener Institut für Polar-und Meeresforschung, Bremerhaven, West Germany.

APPENDIX 3 Evaluation Advisory Panels, Consultancy

July 2016. **Advisory Board** for MARE (Marine and Environmental Science Centre), new 6-university centre in Portugal.

May 2012. **Advisory Panel** on Obtaining Better Fisheries Data. HRH Prince Charles Environmental Sustainability Unit (ESU). Holyrood House, Edinburgh.

September 2011 – 2014. **Marine Advisory Committee**, for Haida Gwaii. Council of the Haida Nation, Skidegate, BC, Canada.

August 2007. **Consultancy.** Sustainable Fisheries Partnership and FishSource.

November 2006. **Consultancy.** Evaluating survey of attitudes to new fishery management options in Hong Kong. Hong Kong Government.

April 2006-2007. **Consultancy** on Estimating IUU in the Arafura Sea. FAO, Rome.

December 2005. **Consultancy.** Evaluation of Determination of optimal harvesting strategies for the hake trawl and longline fisheries in Namibia and South Africa. BCLME analysis. Namibian Govt/World Bank.

October 2005. **Evaluation Panel.** CEFAS Laboratory, Lowestoft, UK.

September 2005. **Scientific Advisory Board**, Max-Planck-Institut für Limnologie, Plön, Germany.

August 2004. **Consultancy** on proposal to Packard Foundation for Ecosystem-based Management in Eastern Indonesia. (WWF, CI, TNC).

April 2004. **Evaluation** of Climate Change and Fisheries research proposals. NRC, Canada.

January-December 2004. **Consultancy** on Evaluation of compliance with the FAO Code of Conduct, WWF International, Switzerland, and WWF USA.

January 2003–January 2004. **Consultancy** on a Rapid Appraisal technique for evaluation of fisheries

management committee performance, New South Wales, Australia.

September 2003. **Scientific Advisory Board**, Max-Planck-Institut für Limnologie, Plön, Germany.

March 2003. **Evaluation** of Directorship and Full Professor at Bern, Switzerland.

February 2003. **Evaluation** of major CSIRO ecosystems research proposal. **Hobart, Australia.**

January 2003. **Evaluation** of green paper South Australia Fisheries Act.

September 2001. **Scientific Advisory Board**, Max-Planck-Institut für Limnologie, Plön, Germany.

June 2000. **DFO** Oceans Policy Review Panel; Ottawa, Canada

October 1994. **Evaluation Panel**, for South Africa's new interdisciplinary research programme in fisheries and marine science (SANCOR).

April 1994 **Consultancy** (with Dr G. Polovina) to evaluate the fisheries research programme at ICLARM, Manila, Philippines.

January 1993 - Sept. 1994, **Consultancy** on African Lakes, MRAG Ltd., London.

November 1992. **Consultancy** (MRAG) to appraise and report on the Assessment of Floodplain Fisheries in South East Asia.

September 1992. **Consultancy** (Head of MRAG group of 3) to appraise and report on the Assessment of Adriatic Sardine and Anchovy Fisheries, ITPP, Mazara del Vallo, Sicily.

May-Dec. 1991. **Consultancy** (Head of MRAG group of 2-5) to assist in the Assessment of Adriatic Sardine and Anchovy Fisheries.

November-August 1991. **Consultancy** (MRAG) to advise on development of length-based fisheries analysis software package (LFDA).

August 1990. **Consultancy** to appraise growth and mortality estimates of introduced *Limnothrissa miodon* (kapenta) in Lake Kariba, for NORAD Zambia Zimbabwe Fisheries Project, NORAD.

May 1990. **Consultancy** (with Dr K.Stokes) to appraise ODA project on *Commercial pelagic fisheries* at the Instituto Nacional de Pesca, Guayaquil, Ecuador.

July 1983. **Consultancy** to appraise field experiments on shoaling and sonar for DAFS Marine Laboratory, Aberdeen.

APPENDIX 4 Invited research visits, research cruises and seminars

June 2015. **Visiting Scientist**, Department of Oceanography and Fisheries, University of the Azores, Horta, Faial, Portugal.

April-May 2011. **Visiting Scientist**, Department of Oceanography and Fisheries, University of the Azores, Horta, Faial, Portugal.

April-May 2005. **Visiting Scientist**, Department of Oceanography and Fisheries, University of the Azores, Horta, Faial, Portugal.

May-June 2004. **Visiting Scientist**, Department of Oceanography and Fisheries, University of the Azores, Horta, Faial, Portugal.

November 2003. **Visiting Scientist**, Restoration Ecology for Fisheries and Oceans. NIWA, Wellington, New Zealand.

July 2003 - March 2004. **Collaborative Research Fellowship**. FAO, Rome, Italy. The ecosystem approach to management and rapid appraisal techniques.

October 2002. Artificial Reefs and Ecosystem Simulation. **Florida Sea Grant** collaboration, Gainesville,

Florida, USA.

April-May 1999. **Collaborative Research Fellowship**. FAO, Rome, Italy. Application of the Rapfish rapid appraisal technique to the Code of Conduct for Responsible Fisheries.

July 1998. **Research Visit** and seminar on comparative ecosystem evaluation as fisheries policy. FAO, Rome,

June 1998. **Research Visit**. Cape Town. Sea Fisheries Research Institute. Recreational and line fish fisheries.

May 1998. **Research Visit**. West Australia Fisheries, Perth, Rapid appraisal and policy seminars.

April 1998. **Research Visit**. Jakarta & Ambon, Indonesia. Policy objectives for development of Indonesian aquatic resources. CIDA.

April 1998. **Research Visit**, Darwin seminar on comparative ecosystem evaluation as fisheries policy.

March 1998. **Research Visit**. To CCAMLR and CSIRO, Hobart. Ecosystem modelling, policy and rapid appraisal seminars.

March 1998. **Research Visit**. Hong Kong Artificial Reefs. With ERM Ltd., Hong Kong.

December 1997 to June 1998. **Residential Research Fellowship** at New South Wales Fisheries Research Laboratory, Cronulla, Australia.

April 1997. **Research Visit**, Hong Kong Inshore Waters. With ERM Ltd., Hong Kong.

January 1997. **Invited seminar** Three Visions for the Future of Fisheries. DFO Managers workshop, Richmond BC.

August 1996. **Invited Seminar**. Cronulla, New South Wales Fisheries Research Institute. Australia.

April 1996. **Research Cruise**, Bergen, Norway, (RV G.O. Sars) Sonar evaluation of herring school dynamics and on-board workshop on shoaling behaviour (with 3 graduate students).

April 1996. **Research Visit** and field sampling, Hong Kong Inshore Waters. With ERM & Furano Ltd, Hong Kong.

August 1995. **Research visit** to Pemba Channel Fisheries, Shimoni, Kenya. (*yellowfin tuna ecology*)

December 1994. **Invited Seminar** and research visit on Fish Behaviour as a key determinant of resilience in fisheries. Austral University, Valdivia and Puerto Montte, Chile.

May 1994. **Research Cruise** (invited) on RV G.O.Sars, in the Barentz and Norwegian seas on rebuilding Arcto-Norwegian herring and high-resolution & assessing schools using sidescan sonar.

April 1994. **Research Visit** on fish stock genetics and **Invited seminar** on Pelagic fish behaviour, University of Swansea, UK.

April 1994. **Research visit** to IRPEM, Ancona, Italy. (Adriatic bluefish).

May 1993. **Research Cruise** and acoustic sampling in RV *Pelican* at Lake Kariba Fisheries Research Station, recruitment in sardine fishery.

April 1993. **Research visit** to IRPEM, Ancona, Italy. (Adriatic bluefish and stock structure).

July 1992. **Research visit** and seminar at CIEA, Mérida, Yucatán; EPOMEX, Campeche; and UNAM, México City, México.

May 1992. **Research visit** to IRPEM, Ancona, Italy. (Adriatic bluefish).

February 1992. **Research visit** to Pemba Channel Fisheries, Shimoni, Kenya. (*yellowfin tuna ecology*)

February 1992. **ODA Scientific Observer** at FAO-CIFA 6th Subcommittee on Fisheries in Lake Victoria, Jinja, Uganda.

February 1992. **Research Visit** to FAO Chambo Research Project visit at Monkey Bay and Mangochi, Malawi.

February 1992. **Research visit** to SADACC Usipa project at Salima, Malawi.

January 1992. **Research Cruise** and sampling cruise in *RV Pelican* to Lake Kariba Fisheries Research Station, recruitment in kapenta fishery.

February 1991. **Research visit** and seminar at CIEA, Mérida, Yucatán, México.

January 1991. **Research visit** and invited seminar to IFOP, Santiago, Chile.

April 1990. **Invited seminar** on *Shoaling behaviour in Fishes* at the Marine Biology Department, Groningen, Netherlands.

October 1989. **Invited seminar** on *New findings about Predator Inspection Behaviour in fish shoals* at the Austrian Academy of Sciences, Vienna.

May 1989. **Research visit** and sampling cruise in *RV Pelican* to Lake Kariba Fisheries Research Station, recruitment in kapenta fishery.

May 1989. **Invited seminar** on *Shoaling behaviour in Fishes* at the University of Zimbabwe, Harare (British Council Link).

May 1989. **Research visit** (ODA) to Cape Maclear Research Station, Malawi. (*sampling chambo for mt-DNA analysis*)

March 1989. **Research visit** to Pemba Channel Fisheries, Shimonzi, Kenya. (*yellowfin tuna ecology*)

February 1989. **Research visit** (ODA) to Cape Maclear Research Station, Malawi. (*Behavioural ecology of chambo and usipa*) (*with Dr G.Turner*).

November 1987. Establishment of **research link** (ODA) with Malawi Fisheries Laboratory at Monkey Bay and Cape Maclear, Malawi (*with Dr A.S.Grimm*)

August 1987. Establishment of **British Council Link** between University of Zimbabwe Lake Kariba Research Station and Bangor.

July 1987. **Invited seminar** on *Fundamental and Applied aspects of Shoaling Behaviour* at the Alfred-Wegener Institut für Polar- und Meeresforschung, Bremerhaven, West Germany.

May 1987. **British Council Exchange Fellowship**: Seminars on *The Functions of Shoaling Behaviour* delivered at the Universities of Vienna, Salzburg and Innsbruck, Austria in association with the Austrian Royal Academy.

Other Invited Research Seminars given since 1980: 2013 Tromsø, Norway; Stockholm Resilience Centre, Sweden. 2012 UW Seattle (USA), Bangor (UK); 2011: Concepcion (Chile); Horta (Portugal). 2010 Tromsø, Norway; 2008 Nanaimo. 2006 Reykjavik. 2005 Horta, Azores, Portugal. 2004 Hull, Oban, UK. 2003 Ploen, Germany; Wellington, New Zealand; FAO, Rome; 2000 Davis, Bodega Bay; 1998 Rome, Cape Town, Darwin, Perth, Macquarie Uni (2), Sydney Uni., Cronulla (3). 1997 Seattle; 1996 Bamfield, SFU (Vancouver); 1995 Vancouver, Swansea (UK); 1994 Seattle (USA), Bergen (Norway) Swansea (UK); 1993 Nanaimo (Canada); 1992 Vancouver (Canada), Newcastle (UK); 1991 Bergen (Norway), Cork (Ireland), Valdivia (Chile), Merida (Yucatan, Mexico), London; 1990 Swansea; 1989 Berne (Switzerland), Bangor; 1988 Liverpool; 1987 Maryland (USA), Bremerhaven, Hamburg, Kiel (West Germany); 1986 Dundee; 1985 Lowestoft; 1983 Stirling, Manchester, Nottingham; 1982 Newcastle, Reading; 1980 Cardiff, Aberystwyth, Leicester.

Appendix 5a Former Members of Research Group

This list includes all graduate students, assistants and postdocs under my supervision during my career to date, with the exception of over 50 Masters students in the UK (taught course students).

POSTDOCTORAL RESEARCHERS

Dr Daniela Kalikoski (Brazil, 2003-2010). Research partner on estimating illegal, unreported and unmandated fishing (Sea Around Us funding), and evaluating compliance with the FAO Code of Conduct for Responsible Fisheries (WWF).

Dr Cameron Ainsworth (Canada, 2006-2007) Modelling in support of ecosystem-based management in Raja Ampat, Papua province, Indonesia. (TNC/CI/WWF - Packard).

Dr Hector Lozano (Mexico, 2001-2006) Historical simulation modelling of marine ecosystems (CSIRO).

Dr Tonny Wagey (Indonesia, 2002-2004) Ecosystem simulation models of Indonesian seas. (left to become science advisor to the Indonesian fisheries minister).

Dr Sheila Heymans (Namibia, 2001-2003) Back to the Future simulation modeling in Newfoundland and BC. (CUS-MCRI). *Now Researcher at SAMS, Oban, Scotland.*

Dr Marcello Vasconcellas (Brazil, 2000-2001, and 2004) Research partner on Evaluating compliance with FAO Code of Conduct; Back to the Future in Newfoundland and BC. (MCRI). (left to join FAO).

Dr Dirk Zeller (1999-2002) Australia Postdoctoral Research Officer. Now with Sea Around Us Project.

Dr Sylvie Guénette (1999-2002) Postdoctoral Research Officer. Sea Around Us Project. (left to become research fellow).

Dr Lore Ruttan (1999-2000) Postdoctoral Research Officer. USA. Sea Around Us Project, Fisheries of the North Atlantic. (left to become research fellow).

Dr Jaqueline Alder (2000-2002) Postdoctoral Research Officer. Australia. Development of the Rapfish technique and its application to fisheries of the North Atlantic. *Currently at FAO, Rome.*

Dr Reg Watson (1997-8 and 1999-2002) Postdoctoral Research Officer. Australia. Fisheries of the North Atlantic. Evaluation of Hong Kong Fisheries. *Currently, Senior Research Fellow with Sea Around Us project.*

Dr Tony Courtney (1996-7) Postdoctoral Research Officer. Australia. Evaluation of Hong Kong Fisheries. (left to join Queensland Fisheries).

Dr Ramon Bonfil (Mexico) (1996-98) Postdoctoral Research Officer. World Wildlife Fund Project on Distant Water Fleets. and Groundfish Assessment Project. (left to join New York Conservation Trust)

Dr Charles E. Hollingworth (Canada: 1986-date). Research assistant, then editorial assistant. Currently Assistant Editor for Fish & Fisheries. [deceased 2007]

Dr Daniel Hoggarth (1986-87 and 91-93). Postdoctoral Research Assistant on Sumatra/Thailand project, formerly Research Assistant and Demonstrator on Masters course. Left for Operation Raleigh, then research posts at Imperial College, National Rivers Authority, and MRAG Ltd. London. *Currently in West Indies.*

Professor Gary Carvalho (1988-90) Postdoctoral Fellow. Left for Postdoctoral Research Post in Southampton. *Now Professor of Molecular Ecology at Bangor, UK.*

Professor George F. Turner (1985-1990) Postdoctoral Research Assistant on Malawi project. Formerly, Ph.D. research student, Left for FAO Research Officer post in Malawi. *Currently Prof. of Biology and Department Chair, at Bangor, UK.*

Professor Anne E. Magurran (1979-1988) Postdoctoral Research assistant on fish shoaling functions project, then SERC Postdoctoral Fellow, then Royal Society

University Research Fellow. Left for research post at Oxford. Currently Chair in Zoology, University of St Andrews, Scotland, UK.

Dr John Turner (1985-87) NERC Postdoctoral Research assistant on multispecies project. Currently Lecturer in Marine Biology, Bangor, UK.

PH.D. STUDENTS COMPLETED

42. Dr Jamie Slogan (Canada, 2008 - 2015). PhD on restoration ecology of Canada Place in the Strait of Georgia. (company funding: NSERC Industrial Scholarship). *PhD awarded September 2015: now consultant with local BC environmental assessment company.*

41. Dr Rajeev Kumar (India, 2006 - 2014) PhD on lake ecosystem modelling in relation to ecosystem-based management, invasion of zebra mussels (Minnesota DNR funding). *PhD awarded January 2015. Now postdoctoral researcher with TJP research group.*

40. Lingbo Li (China, 2008 - 2013) PhD on Strait of Georgia food web modelling of zooplankton, transgenic salmon and marine mammals. (NSERC scholarship, Partial DFO funding and logistic support). *PhD awarded January 2013. Now postdoctoral researcher with UW, Seattle.*

39. Dr Dawit Tesfamichael (Eritrea, 2002 - 2012) PhD. The status of the Red Sea fisheries and ecosystem. (Fisheries Centre scholarship). *jointly supervised with D.Pauly. PhD awarded June 2012. Now postdoctoral researcher, SAU project.*

38. Dr Carie Hoover (USA, 2006 - 2012) PhD on ecosystem modelling of arctic and antarctic ecosystems, with a focus on marine mammals. (DFO Funding). *PhD awarded - April 2012. Now postdoctoral researcher, DFO, Winnipeg.*

37. Dr Pramod Ganapathiraju (India, 2005 - 2012) PhD. IUU fishing and Factors affecting compliance with the FAO Code of Conduct. (DFID/MRAG UK, and Sea Around Us funding). *PhD awarded Feb 2012. Now Research Asst. with SFP and independent Consultant.*

36. Dr Lydia Teh (Malaysia/Canada, 2007 - 2011) PhD. Evaluation and modelling of Sabah marine reserves using fuzzy logic. *PhD awarded December 2011. Now postdoctoral researcher, UBC*

35. Dr Divya Varkey (India, 2005-2010) PhD. Ecosystem-based management in Raja Ampat (TNC/CI/WWF – Packard, UGF Scholarship). *PhD Awarded February 2010: Now Postdoctoral researcher, BC Government.*

34. Dr Eny Buchary (Indonesia, 2001-2010) PhD. Policy options for the sardine fishery in the Bali Strait, Indonesia. (IDRC scholarship). *PhD Awarded Feb 2010. Became Deputy Director of Policy Research for The Nature Conservancy, Jakarta. Now postdoc researcher, Resilience Centre, University of Stockholm.*

33. Dr Robyn Forrest (Australia, 2002-2008) PhD. New South Wales NSW ecosystem-based management and modelling (Univ of Sydney Scholarship, and NSW Govt). *PhD awarded Dec 2008. Now Research Officer with DFO, Nanaimo, BC.*

32. Dr William Wai-Lung Cheung (Hong Kong, 2002-2007) PhD. Restoration and risks for conservation in the South China Sea and its fisheries. (UBC and Hong Kong scholarships). *Postdoc at UBC, then Lecturer in University of East Anglia, UK. Now Assoc. Professor, UBC, Canada*

31. Dr Telmo Morato Gomes (Azores, Portugal, 2002-2007) PhD on Seamount Ecosystem and their Fisheries. (European Union Scholarship). *Postdoc in*

Noumea, now EU Research Fellow, University of the Azores, Portugal.

30. Dr Hector Lozano (Mexico, 2001-2006) PhD. Historical reconstruction of ecosystem and fisheries of the northern Sea of California. (CONACYT scholarship). *Now Research Officer with CSIRO, Australia*

29. Dr Cameron Ainsworth (Canada, 2001-2006) PhD. Quantitative restoration ecology using simulation modelling in northern British Columbia. (UBC Graduate Scholarship). *Postdoc at UBC, then researcher with NOAA, Seattle. Now Asst. Professor, University of South Florida.*

28. Dr Melanie Power (Canada) 1997-2003. PhD. Ethical analysis of fisheries, rapid appraisal and policy options for the BC salmon fleet. (SSHRC scholarship). *Currently part-time Postdoc in Ethical Analysis, University of Victoria.*

27. Dr Nathaniel Newlands (Canada) 1997-2002. PhD. Jointly with Boston Aquarium - Blue fin tuna schooling and assessment. (Boston Aquarium Scholarship). *Currently Senior Research Scientist with Agriculture Canada, Lethbridge, Alberta.*

26. Dr Trevor Hutton (South Africa) 1994-2000 PhD Research on allocation and property rights in fisheries. (SANCOR – SA scholarship) *Research Officer at CEFAS, Lowestoft, UK. Now Senior Research Officer with CSIRO, Australia*

25. Dr Sylvia Salas (Mexico) 1994-2000 PhD Factors determining decisions by artisanal fishers in Yucatan. (CONACYT scholarship). *Postdoc at St Mary's Univ. Halifax, now a senior fisheries research officer in Merida, Mexico.*

24. Dr Sylvie Guénette (Canada) 1995-2000 PhD. on could marine reserves have saved the Newfoundland cod? (NSERC scholarship). *Now Faculty member in Quebec.*

23. Dr Marcelo Vasconcelas (Brazil) 1996 – 2000. PhD research on collapse in pelagic fisheries, ecosystem and single species analysis of the Brazilian sardine. (Brazilian Govt. scholarship). *Now a Senior Fisheries Officer at FAO, Rome.*

22. Dr Steve Mackinson (UK) 1995-1999. PhD research on social aggregation models in shoaling fishes. (Commonwealth scholarship.) *Now Senior Research Officer at CEFAS, Lowestoft, UK.*

21. Dr Alida Bundy (UK) 1997. Interactions of artisanal and industrial fisheries. Ph.D. student. *(Transferred from Imperial College London to UBC) (Transferred to Dr Pauly 1995). Now Research Scientist with DFO, Nova Scotia, Canada.*

20. Dr Ratana Chuenpagdee (Thailand) 1998. Ph.D. Research and Technical Assistant responsible for professional training courses, seminars and workshops. *(transferred to Dr Pauly 1995). Faculty member in VIMS, Virginia, USA; now Asst. Prof., Memorial University, Newfoundland, Canada.*

19. Dr Lorenz Hauser (Austria) January 1997 Research Assistant (jointly, for part of his time, with Prof G, Carvalho, Hull, UK). Status of exploited and introduced Kapenta stocks and biochemical genetics and introduced Nile Perch. *Now Assoc. Prof., University of Washington, Seattle.*

18. Dr Morris Mtsambiwa (Zimbabwe) March 1996. (since 1991) PhD. Pre-recruit ecology and recruitment in Lake Kariba kapenta. *(Transferred from Imperial College London to UBC), Retired Director General of Parks and Wildlife Service, Zimbabwe, Currently CEO of new multinational park.*

17. Dr Ramon Bonfil Sanders (Mexico) 1992-1996. The assessment and management of fisheries for

elasmobranchs. Ph.D. student. (*Transferred with me from Imperial College London to UBC*). Now *Research Officer at Marine Conservation Trust, New York, USA*.

16. **Dr Simon Hemphill** (Kenya). 1985-1995. The use of sport fishery data in the assessment of the Indian Ocean yellowfin tuna stock. External (part time) Ph.D. Student. Now *Director of fishing company and consultant for Kenyan fisheries policy*.
15. **Dr Alejandro Gallego** (Spain) Shoaling in larval and juvenile herring and anchovy. (jointly with the Marine Laboratory, DAFS, Aberdeen). Ph.D. 1993. *Currently research officer at same Institute*.
14. **Dr Kim E. Murphy** (UK; previously research assistant) Information and inspection behaviour in shoaling fish. Ph.D. 1993. Now *Faculty Member at Oceanography Institute, University of Ensenada, Mexico*.
13. **Dr Kerry-Anne Naish** (Zimbabwe: Beit scholar) Fish shoal and fish stock structure using molecular techniques. (jointly with Centre for Fish Genetics, Swansea): Ph.D. 1993. Prize for Best Student Paper, FSBI Conference, Conwy, UK, 1993. Now *Assoc. Prof. at University of Washington, Seattle*
12. **Dr Francisco Arreguin Sanchez** (Mexico) Length-based assessment methods and the management of a grouper fishery in Yucatan. External supervisor for Technical University of Mexico. Ph.D. (Transferred supervision from the late John Gulland at MRAG, Imperial College, London, UK.) Awarded Ph.D. December 1992. Now *Director of CICIMAR, La Paz, BC, Mexico*.
11. **Dr Theodore Djama** (Cameroon) (1985-92, part time Ph.D.). Interaction of artisanal and industrial rivermouth fisheries in Cameroon. *Director of Fisheries Lab. at Limbe, Cameroon [deceased 2007]*.
10. **Dr Carlos Robinson Mendoza** (Mexico:1987-91) Research student. Now *on Faculty at UNAM, Mexico*.
9. **Dr Ziyang Zhang** (China: 1987-90) Research student. Left for postdoctoral in Bergen, Norway. Now *senior researcher at PBS-DFO, Nanaimo, Canada*.
8. **Dr Qun Liu** (China: 1987-90) Research student. Now *Senior Lecturer at Qingdao University, China*.
7. **Dr George Turner** (1984-1987) Research student on cichlid fish behaviour. Later Postdoc in Lake Malawi project. Now *Head of Department, Dept of Biology, Bangor University, UK*.
6. **Dr John R. Allan** (1983-88) Research student, research assistant. Now *with UK Ministry of Agriculture and Fisheries, UK*.
5. **Dr Moshin Al Hossaini** (Kuwait: 1986-89) Research Student. Now *Director of research section at KISR, Kuwait*.
4. **Dr Christopher Wyche** (1982-85) Research student (joint with DAFS, Marine Laboratory, Aberdeen). *Left for research contract post with DAFS, became a game park warden in Africa*.
3. **Dr John Wilson** (Ireland: 1975-78) Research Student. Left for research post with Dept. of Agriculture and Fisheries, Scotland. *Currently computer systems consultant, Antibes, France*.
2. **Dr Soetikno Wirjoatmodo** (Indonesia: 1975-78) Research Student. Now *retired, was Director of Ichthyology Section, LIPI, Bogor, Indonesia*.
1. **Dr Gersham Kennedy** (1973-76) Research Student. Now *retired, was Deputy Director of Dept. Agriculture, Northern Ireland*.

MASTERS STUDENTS, RESEARCH ASSISTANTS, VISITORS AND OTHERS

- Yago Coll** (Spain, 2012 - 2013). Rivers Inlet Sockeye stable isotope analysis. [Transferred to Dr Evgeny Pakhomov, Oceanography].
- Dr Longgen Lu** (China, 2014) Lake plankton control by stocked carp.
- Chloe Orland** (France, 2014) Rappfish programming in R; herring otolith microchemistry. Now PhD student at Cambridge, UK.
- Nicole Mermoud** (Chile, 2013) Fuzzy logic estimation of Humboldt squid abundance. Now PhD student in Univ. Concepcion, Chile.
- William Hunt** (Ireland, Jan – Sept 2012). University of the Basque country. Global herring fisheries analysis using Rappfish. Now independent researcher.
- Renan Veras** (Brazil, 2010) Amazonian catfish trawl fishery.
- Megan Moody** (Nuxalk Nation and Canada) MSc on eulachon in Pacific coastal marine ecosystems. (Scotia Bank Scholarship and Nuxalk Nation funding). 2003-2008. Now *researcher for Central Coast First Nations, BC*.
- Nedjad Ajanovic** (Bosnia) Evaluation of hatchery for grayling and endemic Huchen (Danube salmon), and sport fishery management in Bosnia. 2006/7. Now *manager for regional fisheries development, FAO, Budapest*.
- Professor Paul J B Hart** (Univ Leicester, UK) Research Visitor, 7-2005 to 12-2005.
- Feiyan Du** (South China Sea Fisheries Institute, Guangzhou, China) 9-2006 to 12-2006.
- Georg Skaret** (Univ Bergen, Norway) Research Visitor, 3-2005 to 9-2005.
- Dr Wengui Cheng** (South China Sea Fisheries Institute, Guangzhou, China) Research Visitor, 3-2005 to 9-2005.
- Dr Jihua Cai** (Fisheries Research institute, Shanghai, China) Research Visitor, 3-2005 to 9-2005.
- Nigel Haggan** (Canada, 1995-2006). Research Associate, Aboriginal fisheries, fishing communities.
- Patricia Rojo-Diaz** (Mexico) Evaluating compliance with the FAO Code of Conduct for Responsible Fisheries (WWF).
- Pablo Trujillo** (Chile, 2001-2005) MSc on ecosystem impacts of aquaculture in Chile and British Columbia. (TA, Zoology and Sea Around Us funding).
- Richard Stanford** (United Kingdom) 2000-2002. M.Sc. on ecosystem models and rapid appraisal of English Channel fisheries. (Fisheries Centre Scholarship). *Worked for Devon Conservation Trust in UK., now in Indonesia*.
- Louisa Wood** (UK) 2002-2003 Research Assistant on Sea Around Us project on estimating illegal and unreported fishing. *Currently working on MPAs with Sea Around Us project*.
- Aftab Erfan** (Canada). 2001-date. Undergraduate research assistant on Antarctic modelling, and Back to the Future project in Northern British Columbia (2x NSERC summer research assistant and SAU funding).
- Robyn Forrest** (Australia) 2001-3. Research Assistant on Sea Around Us project on estimating illegal and unreported fishing. (Currently DFO scientist).
- Erin Foulkes** (Canada). 2001/2. Undergraduate research assistant on Back to the Future project in Northern British Columbia.
- Teresa Ryan** (Canada and Tsimshian Nation). 2000. Ecosystem modelling of herring and eulachon and 'Back to the Future' in the Hecate Strait, BC (UBC Aboriginal scholarship). Left to work for management agency.
- Dorothee Schrieber** (Canada) 2000. Ecosystem modelling of halibut and groundfish and 'Back to the Future' in the Hecate Strait, BC (UBC scholarship). Left to join

social science group.

Manuel Martinez (Mexico) 2000. Ecosystem analysis of the tuna fisheries of Western Mexico and their by-catch problems. Left to work in Mexico.

Eny Buchary (Indonesia) 1999-2001. Research Asst. on Hong Kong and Indonesian simulation modelling. Left to become PhD student.

Hreidar Valtysson (Iceland) 1996-8. MSc. Multispecies Icelandic fisheries. (transferred to Dr Carl Walters) (Icelandic Govt. scholarship). Teaching fisheries in Icelandic college.

Taja Lee (Canada). 1994-8 Masters student. Modelling fish school dynamics. (NSERC scholarship)

John Kelson (Canada) Masters student 1995-6. Left to become fishery biologist with the Haisla nation in Northern BC. (Haisla Nation)

Judson Vanier (Canada) 1994-5 Masters student (transferred to Dr D. Pauly 1995)

James Njiru (Kenya) M.Sc. Student. 1993-95. Use of otoliths to assess age and mortality rates in the Lake Victoria pelagic cyprinid fishery. Currently Fisheries Research Officer with KMFRI, Kenya.

Martin Esseen (UK) 1994-5. (Formerly M.Sc. and contract research assistant) An ex-commercial fisherman, M.Sc. work on measurement of fishing effort for shoaling fish using fishermen's log books in the Adriatic. Left for contract work in Saudi Arabia 1995

Portia Chifamba (1990-91) (Zimbabwe). M.Sc. on the measurement and standardisation of fishing effort in the Lake Kariba kapenta fishery. Left to become acting Director, LKFRI, Kariba, Zimbabwe.

Dr Rosannah Robinson (1988-89) Research Assistant. left for research studentship in Southern Africa. Ph.D. gained 1995.

Pia Geisel (Australia: 1986-88) Research assistant and demonstrator on Masters course in Fisheries Biology and Management. Left for research studentship in Australia.

Jan Hoogesteger (1986-1988). ODA Research Officer. Left for research post with ODA in Tanzania.

Kate Hughes (1987-88) Research Assistant and Demonstrator on Masters course. Awarded *UK Young Science Journalist of the Year 1988*. Left for teaching post.

Paul Levesley (1986-88) Research assistant. Left for unknown post.

Helen Loney (1987-88) Research assistant. Left for research technician post.

Douglas Graham (1987-88) Research Assistant. Left for research studentship at Pitlochry, UK.

Deborah Green (1986) Research assistant. Left for technical post in Oxford.

Dr Ian Winfield (1979-80) Honours research student. Left for post in UEA, then Royal Society Postdoctoral in Sweden, then Lectureship in University of Ulster. Now Senior Researcher at Institute for Freshwater Ecology, Lancaster, UK, and President of the Fisheries Society of the British Isles

ecosystem modelling in relation to ecosystem-based management (Minnesota DNR funding). Postdoc (NSERC) on spatial herring ecosystem modelling. (NSERC funding)

PhD students

Nicolas Talloni (Chile 2013-) PhD on human dimensions of fisheries in Chile using the Rapfish technique. (Concyt funding & Awarded UBC Public Scholarship 2015 and 2016)

Szymon Surma (Canada, 2012-). Ecosystem modeling of herring and whales in Haida Gwaii. (upgrade from Masters 2014; NSERC project funding).

Sahir Advani (India, 2014 -) Andaman and Nicobar Islands fisheries (awarded UBC scholarship & IDRC funding 2015).

Masters students

Jeff Scott (USA. 2014 -) Fisheries ethics and herring. (NSERC funding)

Current Visitors

Appendix 5b

Current Members of Research Group

Postdoctoral Researchers & Research Associates

Dr Mimi Lam (Canada, 2009-date), Research Associate; cognitive and human dimensions aspects of fisheries research. (Peter Wall and NSERC funding)

Dr Wade Smith (USA, 2014 -). Postdoc (Hakai) on otolith microchemistry to reveal spatial aspects of herring life history. (Hakai funding)

Dr Rajeev Kumar (India, 2006 - 2014) PhD on lake

APPENDIX 6A: RESEARCH GRANTS AND CONTRACTS (UK)

<i>Sponsor</i>	<i>Dates</i>	<i>Topic</i>	<i>£</i>
1. SRC	1973–76	3–d structure fish schools	1500
2. RSoc	1976	Sensory basis & structure of fish schools	600
3. NUU	1976	Experiments on school structure and volume	280
4. NERC	1979–82	Antipredator tactics in fish schools	53875
5. NERC	1982–83	Shoal size, predation and provenance	11198
6. RSoc	1982	Sea-caged fish behaviour	720
7. DAFS	1982	Shoaling and sonar echos	2636
8. DAFS	1983	Shoaling in sea-caged gadoids	2590
9. DAFS	1984	Shoaling in sea-caged mackerel	2827
10. DAFS	1984	Shoaling in sea-caged herring	3615
11. DAFS	1985	Computer analysis of shoaling fish images	1700
12. DAFS	1985	Sea-caged cod & mackerel behaviour	4910
13. NERC	1985–88	Space & time in fish shoals	39019
14. ODA	1985–86	St.Helena fisheries evaluation	19950
15. DAFS	1985	3–D calibrations for sea cage	590
16. MAFF	1986	Fish image analysis using automated methods	11690
17. EEC	1986	Lake Malawi fish taxonomy	5850
18. DAFS	1986	Sea-caged herring behaviour	3764
19. ODA	1986–87	St. Helena fisheries evaluation	8590
20. UCNW	1987–88	Hormones and shoaling behaviour	2250
21. ODA	1987–88	St. Helena fisheries evaluation	9936
22. FIG	1987	Biochemical stock identification of Falklands squid	9490
23. ODA	1987–90	Malawi <i>Oreochromis lidole</i> as a candidate for introductions	205000
24. ODA	1988	Biochemical stock identification of Falklands squid	15964
25. DAFS	1988	Herring shoal dimensions using digital sonar	3828
26. ODA	1989	Malawi chambo biochemical (mtDNA) taxonomy	10842
27. ODA	1990	Malawi fish research publications	3115
28. FAO	1990	Malawi chambo biochemical (mtDNA) taxonomy	15000
29. NORAD	1990	Kariba: introduced kapenta growth	1250
30. UNDP	1991	<i>Trachurus</i> fishery in Chile	600
31. ODA	1991–93	Species changes in African Lakes	148000
32. Italy	1991–92	Adriatic clupeid assessment	38000
33. ODA	1991–93	<i>Limnothrissa</i> stocks & diversity	62473
34. ODA	1991–94	S.E. Asian artisanal fisheries	72000
35. EC	1992–4	Adriatic clupeid stocks & shoals	28647
36. ODA	1992	Malawi fish research publications	15294
Total Grant Capture UK career			£ 817,593

BC = British Council; C&H = Chapman & Hall; DAFS = Dept. for Agriculture and Fisheries Scotland; EEC = European Economic Community; FAO = Food and Agriculture Organisation of the United Nations; FIG = Falklands Island Government; MAFF = Ministry of Agriculture Fisheries and Food; NERC = Natural Environment Research Council (UK); NORAD = Norwegian Overseas Aid; ODA = Overseas Development Administration; RSoc = Royal Society; SERC/SRC = Science and Engineering Research Council (UK); UCNW = University College of North Wales.

APPENDIX 6B: RESEARCH GRANTS AND CONTRACTS(CANADA)

Sponsor	Dates	Topic	CAN \$
37. NSERC	1993/4	UBC Start up grant	25000
38. MAE	1993/4	Fisheries Centre Support	150000
39. DFO	1993	Common Ground conflict resolution	15000
40. C&H	1993-6	Reviews in Fish Biology & Fisheries support	4500
41. MELP	1994	Fisheries Centre Support	60000
42. UBC	1994	Common Ground conflict resolution	10000
43. MELP	1994	Monitoring Watershed Restoration	11575
44. DFO	1994	Salmonid Enhancement Evaluation	10968
45. France	1994	Bangladesh Fisheries Liaison	2000
46. MELP	1995	Fisheries Centre Support	40000
47. MELP	1995	Watershed restoration database	5816
48. MELP	1995	Watershed restoration Training Liaison	71184
49. SANCOR	1995-7	Artisanal Fisheries Equity & Allocation - Cape Town	19000
50. MELP	1996	Fisheries Centre Communications Syem	30000
51. MELP	1996	Fisheries Centre Support	80000
52. FRBC	1996	Biodiversity in Fisheries and Forests	35000
53. HKAFD	1996-7	Assessment of Hong Kong Fisheries	161000
54. NSERC	1996-9	Fisheries Resilience and Shoaling Behaviour	97600
55. DFO	1996	Demonstration Logical Decision analysis to facilitate multi sector agreement	10000
56. GRCS	1996-8	BC Groundfish assessment and research project	221472
57. MELP/MAF	1997-03	Fisheries Centre Support	230000
58. COFRI	1997	Marine Reserves study	10000
59. PWIAS	1997	Reconstruction of past ecosystems - St of Georgia	20000
60. UBC	1997	Ethical Analysis of fishery management (to augment SSHRCC project)	10000
61. ERMHK	1997/8	Evaluating the impact of artificial reefs and marine reserves in Hong Kong	155000
62. WWF	1998	Impact of Distant Water Fleets on Fisheries	25000
63. FAO	1998	Multispecies and ecosystem modelling	9600
64. DFO	1997/8	Newfoundland ecosystem model data	10000
65. BA	1999/00	Bluefin tuna schooling and assessment	30000
66. FAO	1999	Rapid Appraisal techniques in Fisheries	15040
67. PCT	1999/01	Phase 1 <i>Sea Around Us</i> project (joint with D. Pauly)	3100000
68. HK-AFCD	2000	Forecasting the benefits of artificial reefs in Hong Kong	85500
69. FAO	2000	Ecosystem modelling for multispecies management	9000
70. NSERC	2000/1	Ecosystems and appraisal research	28800
71. MCRI	2000/03	Back to the Future in BC and Newfoundland fisheries	400000
72. CFI/KDF	2000/03	Fisheries Ecosystem Research Laboratory (building & infrastructure)	12000000
73. NSERC	2002/5	Ecosystem research	88000
74. NSWf	2002/4	Rapid appraisal	17000
75. NSWf	2002/5	Spatial Ecosystem modelling of New South Wales	150000
76. WWF	2004/5	Compliance of selected countries with Code of Conduct for Responsible Fisheries	37000
77. FAO	2003/4	Ecosystem approach to management & Rapid Appraisal	40000
78. SAMS	2004/5	Preliminary ecosystem model of Scotland's west coast	53000
79. HK-AFCD	2005	Further simulations of management zones and artificial reefs in Hong Kong	22000
80. TNC/CI	2005/7	Modeling in support of ecosystem-based management in Raja Ampat, Papua, Indonesia	140000
81. FAO	2006/7	IUU estimation in the Arafura Sea	13000
82. MDNR	2006/8	Modelling lake ecosystems for ecosystem-based management	100000
83. NIWA	2006/9	Historical reconstruction of New Zealand coastal marine ecosystems	10000
84. Cons.	2004/6	Seamount ecology, management and conservation: workshop and book sponsors	139000
85. NSERC	2007/11	Ecosystem research	97000
86. DEFRA	2007	IUU estimations and database	47000
87. IPY/DFO	2007/9	Hudson Bay ecosystem modeling	30000
88. PWIAS	2008	Historical reconstructions and the Sea Ahead	20000
89. MRAG	2008	IUU estimation in the Bay of Bengal, India	5000
90. PWIAS	2009	Exploratory Workshop Grant: The Sea Before Us	20000
91. CFI	2009	A new BC Research vessel (consortium, infrastructure)	13582555
92. MP	2010	An interdisciplinary fishery evaluation tool	25000
93. DFO	2011	Modeling transgenic salmon in the Strait of Georgia ecosystem	9900
94. NSERC	2012/16	Ecosystem research	130000
95. HOTT	2013	Spatial Ecosystem Modelling of Haida Gwaii	40000
96. NSERC	2013	Role of herring in northern BC marine ecosystem	682355
97. TULA	2014	Herring otolith microchemistry	152000
98. PWIAS	2014/16	Haida Gwaii herring solutions	100000
99. PWIAS	2015	Round Table on herring fishery ethics	10000
Total Grant Capture Canada 1993 - to date			\$32,961,865

BA = New England (Boston) Aquarium; C&H = Chapman & Hall; CFI = Canadian Foundation for Innovation; CI = Conservation International; COFRI = Canadian Ocean Frontiers Research Initiative; Cons = Consortium of sponsors (comprising Azores Government, CANSEAM Census of Marine Life Seamounts project, Luso-American Foundation, EU MARMAC project, Portuguese National Science Foundation); DEFRA Dept of Fisheries and Rural Affairs, UK Government; DFO = Department of Fisheries & Oceans, Canada. ERMHK = ERM (Hong Kong) Ltd; FAO = Food and Agriculture Organization United Nations; GRCS = BC Groundfish Research and Conservation Society; HOTT = Haida Oceans Technical Team; HKAFD = Hong Kong Agriculture and Fisheries Department; IPY = International Polar Year (Canada); KDF = BC Knowledge Development Fund; MAE = Ministry of Advanced Education, BC; MELP = Ministry of Environment Lands and Parks of BC; MDNR = Minnesota Dept Natural Resources Department; MCRI = Major Collaborative Research Initiative; MP = Martha Piper Research Fund, UBC; MRAG Marine Resources Assessment Group, London, UK; NIWA = New Zealand Institute for Water and Atmospheric research; NSERC = National Science and Engineering Research Council (Canada); NSWf = New South Wales Fisheries; PCT = Pew Charitable Trusts; PWIAS = Peter Wall Institute of Advanced Studies, UBC; SANCOR = South African Network for Ocean Research; SAMS = Scottish Association for Marine Science Oban, Scotland; TNC = The Nature Conservancy, USA; TULA = Tula Foundation, BC.

Professor Tony J. Pitcher — Summary of African Experience

1. South Africa

Topic: Social, economic and biological issues in South African Fisheries Research
Issues: multi-disciplinary assessment; modelling; extension of equity
Aims: training & research
Duration: 1994 - date: 2 visits
Sponsors: SANCOR
Outputs: 2 sets of seminars and workshops. 2 Ph.D. students: 5 papers; 1 Report.

2. Zimbabwe & Zambia

Topic: Lake Kariba commercial fishery for introduced sardines
Issues: assessment; modelling; recruitment ecology; extension of equity
Aims: training, research
Duration: 1986 - date: 8 visits
Sponsors: NORAD, ODA, British Council
Outputs: 1 Ph.D. student: 3 Masters Students
 3 Training Courses; 3 Research Cruises
 3 Reports; 2 publications

3. Malawi

Topic: Artisanal & commercial fisheries
Issues: sectoral conflict, conservation of endemic species, assessment,
Aims : training, research; new local journal
Duration: 1987-1991 and 2002: 7 visits
Sponsors: ODA, FAO, Malawi Govt.
Outputs: 5 Masters students; 1 UK Postdoc
 3 training courses
 8 publications

4. Uganda, Tanzania, Zaire, Kenya, Zambia, Zimbabwe, Malawi, Mozambique, Burundi, Rwanda: (20 lakes)

Topic: Impact of Species Changes in the African Lakes
Issues: Introduced Nile Perch and sardine fisheries, heavy exploitation: ecological, social and economic impacts, mitigation, new introductions to man-made lakes; Sub-project: genetic and conservation and genetics. In Canada: Lake Victoria small pelagic artisanal fishery
Aims: research, putative new introductions, training
Duration: 1990-1993; 1 visit (Genetics sub-project to 1995)
Sponsors: ODA, FAO; UK Royal Society (genetics); CIDA
Outputs: International Conference London 1991 (120: 50 from Africa); Book: 24 Chapters (refereed): 1995 (Chapman & Hall); FAO - CIFA Committee; 6 other publications; 6 reports; 6 papers; 1 UK Ph.D. student: 1 Masters student (CIDA); 3 training courses

5. Kenya

Topic: Large marine and small freshwater pelagics, especially Yellowfin Tuna
Issues: dagaa fishery assessment, sportfishing impact, multi-species Lake Victoria assessment
Aims: research, training
Duration: 1988-date: 3 visits
Sponsors: Kenya,
Outputs: 1 Ph.D. student
 1 Masters student
 4 publications

6. Angola

Topic: Length-based Assessment of artisanal and commercial fisheries
Issues: assessment
Aims: training
Duration: 1990: 1 visit
Sponsors: SIDA (Swedish Govt)
Outputs: 1 Training Course

7. Cameroon

Topic: Conflict between small and large-scale coastal fisheries
Issues: economic and biological evaluation and modelling
Aims: research, training
Duration: 1989-1992
Sponsors: World Bank
Outputs: 1 Ph.D. student, 3 publications

8. Ghana

Topic: Coastal artisanal fishery for sea-bream
Issues: length-based assessments; modelling
Aims: training, research
Duration: 1986
Sponsors: Commonwealth
Outputs: 1 Masters Student; 1 publication

9. Zanzibar

Topic pelagic fisheries
Issues assessment, sampling, growth estimation
Aims research, training
Duration 2 years
Sponsors CIDA
Outputs 1 PhD student

10. Egypt

Topic Fisheries in Lake Nasser
Issues assessment, sampling, policy
Aims research, training
Duration 4 years; 2 visits
Sponsors ICLARM
Outputs 2 papers

10. Eritrea

Topic Fisheries in Red SEea
Issues assessment, IUU, policy
Aims research, training
Duration 4 years
Outputs 1 PhD student; 3 papers

Masters students from: Cameroon; Egypt; Eritrea; Ethiopia; Ghana; Kenya; Liberia; Malawi; Mozambique; Nigeria; Sierra Leone; Tanzania; Uganda; Zaire; Zambia; Zanzibar; Zimbabwe.

PhD students from: Zimbabwe (2), South Africa (2), Kenya, Cameroon.

1. Chile

Topic: Ecosystem, economic and biological issues in Chilean Fisheries
Issues: fisheries modelling & assessment; decision analysis; shoaling behaviour; ecosystem modelling; rapid appraisal
Aims: teaching, training & research
Duration: 1989 - date: 7 visits
Sponsors: British Council, Fondation Andes, Canadian Govt.
Outputs: 2 PhD students; 3 Masters students; 5 training courses; 7 workshops.

2. Mexico

Topic: Groupers and artisanal fisheries in Yucatan & Campeche. Tuna & Sardines in Baja.
Issues: assessment & modelling; shoaling behaviour
Aims: training, research
Duration: 1990 - date: 3 visits
Sponsors: British Council, Mexican govt.
Outputs: 5 Ph.D. students: 3 Masters Students
 2 Training Courses, 3 publications

3. Ecuador

Topic: assessment of pelagic commercial fisheries
Issues: assessment and collapse
Aims: research, project evaluation
Duration: 1989: 1 visit
Sponsors: ODA.
Outputs: 1 Masters student
 1 report
 1 publication

4. Indonesia

Topic: Ecosystem-based management projects in Ambon, Bogor, Menado, Bali, Papua. Floodplain fisheries in Sumatra; estuarine fishes in Java; Java Sea; *Sardinella* fishery in Bali Strait;
Issues: ecosystem-based management; IUU (3 sites); fishers knowledge and self-governance; floodplain sustainable catch
Aims: research, training, sustainable development, conservation, IUU.
Duration: 1979-80; 1993, 1998-2 visits; 2004; 2006: 2 visits' 2007: 2 visits
Sponsors: ODA, British Council, CIDA, IDRC, Packard, CI, FAO
Outputs: 3 Ph.D. students; 2 Postdocs; 3 masters students; many reports.

5. Thailand

Topic: Floodplain fisheries
Issues: fishers self-governance; floodplain sustainable catch
Aims: research, training
Duration: 1993: 1 visit
Sponsors: ODA
Outputs: 1 PhD student (joint). 1 report

6. Philippines

Topic: Evaluation of artisanal & commercial fisheries research.
Issues: management, aquaculture
Aims: evaluation
Duration: 1994- date; 2 visits
Sponsors: ICLARM/ UBC
Outputs: 2 reports

7. Sri Lanka

Topic: Length-based Assessment of artisanal & commercial fisheries
Issues: assessment
Aims: training
Duration: 1987

Sponsors: British Council
Outputs: 1 Masters student 1 publication

8. Malaysia

Topic: Length-based Assessment of artisanal and commercial fisheries
Issues: Fisheries Assessment and population dynamics
Aims: training
Duration: 1990:
Sponsors: Malaysian Govt.
Outputs: 1 PhD student; 1 training course

9. Hong Kong

Topic: Assessment of artisanal and commercial fisheries. Artificial reefs
Issues: Fisheries assessment, ecosystem modelling
Aims: Research. 8 visits
Duration: 1996-2005
Sponsors: HK Govt (usually via ERM Ltd.)
Outputs: 1 PhD student. 4 contracts; 9 reports; 7 publications

10. Brazil

Topic: Assessment of pelagic commercial fisheries
Issues: Fisheries Assessment, stock collapse
Aims: research and training
Duration: 1996-9; 1 visit
Sponsors: Brazilian Govt.
Outputs: 1 PhD student

11. India

Topics: ecological and socioeconomic impacts of fisheries
Issues: IUU fishing, aftermath of 2004 tsunami; lake ecosystems
Aims: research and training
Duration: 2004-date
Sponsors: own funding
Outputs: 5 PhD students

Masters students from: Sri Lanka, Indonesia, Malaysia, Ecuador, Chile, Mexico, Costa Rica, Argentina, Uruguay, Brazil, Belize, Kiribati, Vanuatu
PhD students from: Mexico (5), Thailand, Indonesia (3) Brazil, Hong Kong, China (3), India (4).