
PROFESSOR ANNE SMITH (BROWN)

BSc, PhD, AIEEM (Associate of the Institute of Ecology and Environmental Management)

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Nationality: British
Year of Birth: 1951
Marital Status: Married, one daughter and one son

AREAS OF EXPERTISE

Anne Smith has 35 years of experience in assessing the impacts of the environment and in particular the effects of water quality on the health of fish. Her research has followed two main strands. First, how fish respond to the natural variables in the environment, and their tolerances. Second how fish respond to pollutants.

Anne has expertise in assessing the distress of fish in the wild in response to environmental events, including both lethal and sub-lethal impacts. This expertise includes assessment of the extent of any distress, and the investigation of structural and functional changes in key organs such as the gills and the kidney. She also has expertise in assessing the health and welfare of farmed fish in aquaculture, including development of practical welfare indices.

Specific studies of the impacts of acidification and mobilised aluminium extended over a period of more than 12 years with continuous, competitive funding from the Natural Environment Research Council (NERC). Anne participated in the project funded by the Countryside Council for Wales and NERC, among others to investigate acidification in Wales, under the Llyne Brianne Project.

With Aquatronics, Anne specialises in contracts dealing with fish, including their responses to the natural environment, the possible effects of engineering works, advice for planning applications, fish surveys, the welfare of fish in captivity (aquaculture), and providing ecological inputs on fish required for Special Areas of Conservation and Special Protection Areas.

She is an associate member of the Institute of Ecology and Environmental Management and has expertise in ecological surveys and environmental impacts on protected species.

Principle areas of specialist expertise:

- Assessment of impacts of pollutants and water quality on health and functioning of fish
- Assessment of stress responses of fish to pollutants, salinity, hypoxia, parasites
- Development of welfare indices and assessing health of farmed fish and shellfish
- Assessment of impacts of oil and gas fields on fish and fisheries
- Osmoregulation and salinity adaptations in migratory and non-migratory fish
- Assessment of structure and function of gill and kidneys of fish: normal changes and impacts of pollutants
- Assessing risk of dispersal of non-native fish species from behavioural and physiological studies
- Ecological inputs for screening of potential impacts under Habitats Regulations and Appropriate Assessment of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs)

ACADEMIC QUALIFICATIONS

1976	PhD University of Sheffield
1972	BSc Hons Zoology, First Class, UCNW, Bangor

CAREER

2000 - present	Director of Aquatronics Ltd
2005 (continuing)	Emeritus Professor, School of Biosciences, University of Exeter
2000 -2005	Professor of Fish Physiology, School of Biological Sciences, University of Exeter
1988 -2001	Lecturer, then Reader in Department of Biological Sciences, University of Exeter
1979 -1988	Lecturer, Department of Zoology, University of Hull.
1976 -1979	Research Fellow, Department of Zoology, University of Sheffield

MEMBERSHIP OF PROFESSIONAL GROUPS

Associate Member of the Institute of Ecology & Environmental Management
Member of Fisheries Society
Member of the Estuarine, Coastal and Shelf Science Association
Member of the Marine Biological Association

CONSULTANCY WORK SINCE 2005

1. Contracts related to fish

Commercial Client (2005)

Expert opinion related to fish health and cause of fish deaths at a trout farm, linked to an insurance claim

PB World & Cornwall Council (2010-2012)

Fish population surveys (baseline, during and post development) to assess impacts of North Quay development at Copperhouse Pool, Hayle.

Monitoring the impacts of tidal exclusion on water quality and effects on fish in Copperhouse Pool, Hayle.

Report on potential impacts on water quality and effects on fish resulting from proposed alteration to tidal regime.

Report on monitoring of suspended solids during construction activities and potential impacts on fish.

Water Company (2011-ongoing)

Advice and investigations relating to an alleged pollution incident and fish kill.

Seafield Partnership Ltd (2011)

Advice and report on fish issues for Addendum to the Environmental Statement for a proposed new Power Station at Hunterston, Ayrshire Power

Scottish Aquaculture Research Forum (SARF), Defra and NoCatch Ltd (2006-2010)

Development of practical and meaningful welfare indices for farmed cod by on-farm assessments and laboratory analyses of blood samples.

Andrew Jackson & Hill Dickinson (solicitors) (2008 - 2012 & continuing)

Assessment of cockle condition in the Thames fishery; potential impacts of dredging

Environmental Sciences Ltd, Trinidad (2010)

Advice on development of a Fisheries Complex in Trinidad

Assistance with fisheries aspects of EIAs for oil and gas industry in Trinidad

Enfusion (2007)

Advice on potential impacts of protected fish species (salmonids and lampreys) in River Avon SAC for Habitats Regulations, Appropriate Assessment of Wiltshire County Council and Swindon Borough Council, Minerals and Waste Core Strategies

2. Ecological surveys, impact assessment, statistical analyses

PB World & Cornwall Council (2010-2012)

Ecological surveys of intertidal mudflats, hard substrates, wader prey and contaminants in Copperhouse Pool, Carnsew and Lelant at Hayle, Cornwall.

Algal identifications linked to hard substrate surveys and surveys of the boundaries of selected biotopes.

Commercial Client in NW England (2009, 2010, 2011 & 2012)

Ecological and chemical survey of a river (team participant).

Waterman Energy & Design Ltd (2010)

Ecological appraisal and advice of site in Devon for potential development.

Marine Bio-images (2007, 2011)

Statistical analysis of biological data.

Falmouth Boat Construction (2009)

Assistance with ecological surveys for proposed pontoon development, Fal estuary.

AECOM (2009)

Ecological survey of an intertidal site near a proposed marina on the Torridge estuary, Devon.

Buro Happold (2009)

Surveys of intertidal and subtidal habitats at Mill Bay, Plymouth.

EAD & Dart Harbour & Navigation Authority (2009)

Ecological survey of intertidal site at Hoo Down, near Kingswear on the Dart estuary.

ING Real Estate & Buro Happold (2008)

Assistance with Biotope mapping of the Hayle estuary complex, Cornwall. Algal identifications.

The Marine Hotel, Salcombe (2008)

Ecological surveys to assess possible impacts of a proposed pontoon.

Enfusion (2007)

Ecological inputs for Appropriate Assessments

Dartford and Gravesham Borough Councils, Local Development Framework Core Strategies (relating to Thames Estuary and Marshes and Medway Estuary and Marshes SPAs).

Wiltshire County Council and Swindon Borough Council, Minerals and Waste Core Strategies (River Avon SAC and North Meadow and Clattinger Farm SAC).

URS Corporation Ltd/BioLab Ltd (2007)

Repeat ecological survey of an English river following a fire and chemical spill (team member)

Environmental Perspectives (2007)

Strand line survey and protected species' surveys of tidal habitat at Brentford, Thames.

The Environment Practice and ING Real Estate (2007)

Intertidal survey of Carnsew Pool and Penpol, for the Hayle Harbour development, Cornwall.

URS Corporation Ltd (2006).

Survey of an English river following fire and release of contaminants.

Ecological Planning and Research (EPR) (2006)

Ecological impact assessment of Phase IV of the sea defence programme (team member in survey of intertidal habitats at Lyme Regis).

Environmental Resources Management (ERM) (2006)

Ecological survey of a stream and river affected by a diesel spill (team member).

APPOINTMENTS BY PROFESSIONAL BODIES

2004 -2008	Fisheries Society Council & Studentship Awards Committee
2006 -2007	Convenor for Fisheries Society Symposium on Non-Native Fishes
2002 -2005	Marine Biological Association - Council & Education Committee
1998 -2005	Editorial Board & Sub-Editor - General & Comparative Endocrinology
1996 -1997	Environment Agency, South West Regional Fisheries Advisory Committee
1992 -1995	Natural Environment Research Council: (i) Marine & Atmospheric Grant Committee;

	(ii) Aquatic Life Sciences Grant Committee
1992 -1993	British Council: Joint Research Programmes Adviser
1990 -1993	Nuffield Foundation, Bursaries Review Panel
1985 -1991	Society for Experimental Biology, Council Member; Osmoregulation Group Convenor

PAPERS AT CONFERENCES

Research results have been presented in International and European conferences and workshops including:

Estuarine and Coastal and Shelf Science (Venice, 2012), Defra Review of the Animal Welfare R & D programme (London 2010), EU COST 867 Fish Welfare Workshop (Varese, Italy 2007), International Congress on the Biology of Fishes (St John's Newfoundland: 2006; Vancouver, 2002), SETAC-Europe (Prague 2004), International Workshop on Biological Invasions (Florence, 2005), International Symposia on Fish Endocrinology (Spain, 2004; Seattle, 2000; Japan, 1996; Saint Malo, 1992), International Symposia on Comparative Endocrinology (Japan, 1997; Spain, 1989; Hong Kong, 1981); Society for Experimental Biology Symposia on Welfare (Glasgow, 2007) Society for Experimental Biology Symposia on Stress (Canterbury, 2001), European Comparative Endocrinology Conferences (Portugal, 2000; UK, 1983); International Symposium on Produced Waters (Norway, 1995) American Physiological Society (San Diego, 1994; Orlando, 1990); International Union of Biological Sciences, (Japan, 1991); Fish Physiology Symposia (Denmark, 1991; UK, 1981); Symposium on Ecophysiology of Acid Stress in Aquatic Organisms, (Belgium, 1987).

POSTGRADUATES SUPERVISION

Almost 30 postgraduate students have been supervised during their research. Some are listed below, with their funding.

Endocrine and physiological responses to acid stress in brown trout. Denise Edwards (NERC)

Branchial toxicity of aluminium in brown trout. Simon Collins (NERC)

The effects of water-soluble fraction of crude oil on fish. Abdulaziz AlKindi (Sultan Qaboos Univ., Oman).

The effects of petroleum hydrocarbons on early life stages of turbot. Susan Stephens (NERC & Amerada Hess)

Impact of environmental contaminants on thyroid function in fish. Helen Crane (NERC & Astra Zeneca)

Stress sensitivity of eels parasitised with *Anguillicola crassus*. Matt Gollock (NERC)

Integrative regulation of trout renal function. Shaun Pope (BBSRC)

Physiological stress responses of European eels parasitised with *Anguillicola crassus*. Cheryl Kelly (NERC)

Endocrine control of perfused fish kidney. Shehla Amer (ORS award, Pakistan)

Molecular analysis of the renin-angiotensin system in the trout. Richard Paley (SERC)

Molecular physiological investigation of trout renin-angiotensin system Jonathan Aust (BBSRC)

Integrated non-invasive investigations of captive Abyssinian colobus monkeys (*Colobus guereza*): behaviour, stress and parasitism. Jo Rabineau

Physiological monitoring of welfare for conservation of Arabian oryx, *Oryx leucoryx*. Mansoor AlJahdhami (Diwan of the Royal Court, Sultanate of Oman)

RESEARCH

Research by 40 grants funded by UK Research Councils, EU, Defra, Nuffield Foundation, Leverhulme Trust and appropriate industries, totalled almost £1 million between 1983 and 2007. This work focussed on understanding the impact of environmental changes, water quality and environmental pollutants on fish, their tolerances and their stress responses. Work on saline tolerances and behaviour of fishes included investigation of the risk of dispersal of non-indigenous (alien) fish species. Practical welfare indices were developed for use in assessing the welfare of farmed fish. More than 100 journal papers or book chapters have been published (as J. Anne Brown). Selected examples (since 2000) are listed below:

SELECTED SCIENTIFIC PAPERS IN JOURNALS, BOOK CHAPTERS

Smith P., Snook, D., Muscutt, A. and **Smith, A.** (2010). Effects of a diesel spill on freshwater macroinvertebrates in two urban watercourses, Wiltshire, U.K. *Water and Environment Journal* 24: 249-260.

Brown, J. A., Watson, J., Bourhill, A., Wall, T. (2010). Physiological welfare of commercially reared cod and effects of crowding for harvesting. *Aquaculture* 298: 315-324.

Brown, J. A., Bourhill, A., Watson, J., Hodgson, D. (2009). Development of practical on-farm cod welfare indices (SARF 021). *Scottish Aquaculture Research Forum*

<http://www.sarf.org.uk/Project%20Final%20Reports/SARF021%20-%20Final%20Report.pdf>

Brown, J. A., Bourhill, A., Watson, J. (2009). Atlantic cod (*Gadus morhua*) fin erosion key. *Scottish Aquaculture Research Forum*

<http://www.sarf.org.uk/Project%20Final%20Reports/SARF021%20Atlantic%20cod%20fin%20erosion%20key.pdf>

Brown, J. A., Watson, J., Bourhill, A., Wall, T. (2008). Evaluation and use of the Lactate Pro, a portable lactate meter, in monitoring the physiological well-being of farmed Atlantic cod (*Gadus morhua*). *Aquaculture* 285: 135-140.

Scott, D. M., Rabineau, J., Wilson, R. W., Hodgson, D. J., and **Brown, J. A.** (2008). Can pikeperch colonise new freshwater systems via estuaries? Evidence from behavioural salinity tests. *Marine and Freshwater Research* 58: 694-702.

Scott, D. M., Wilson R.W., **Brown J. A.** (2007). Can sunbleak *Leucaspilus delineatus* or topmouth gudgeon *Pseudorasbora parva* disperse through saline waters? *Journal of Fish Biology* 71: Supplement D: Non-native Fishes: Integrated Biology of Establishment Success and Dispersal 70-86.

Brown, J. A., Scott, D. M., Wilson, R.W. (2007). Do estuaries act as saline bridges to allow invasion of new freshwater systems by non-indigenous fish species? Chapter 21 In: *Biological Invaders in Inland Waters: Profiles, Distribution and Threats. Invading Nature - Springer Series in Invasion Ecology Vol 2.* Ed. F. Gherardi. Springer

Brown A., Bourhill, A., Watson, J., Wall, T., Ellis, T., Zuur, A., Ieno, E. N. (2007). Understanding the welfare of farmed cod under commercial conditions: integration of physiological, behavioural and physical approaches. *Comparative Biochemistry and Physiology Part A* 146: S75-86

Scott, D. M., Wilson, R. W., **Brown, J. A.** (2007). The osmoregulatory ability of the invasive species sunbleak *Leucaspilus delineatus* and topmouth gudgeon *Pseudorasbora parva* at elevated salinities, and their likely dispersal via brackish waters. *Journal of Fish Biology* 70: 1606-1614

Scott, D. M., **Brown, J. A.**, Stakenas, S., Wilson, R. W., Copp, G. H. (2007). Pikeperch (*Sander lucioperca*) dispersion through brackish waters - can they and do they? *Comparative Biochemistry and Physiology Part A* 146 S77.

Brown, J. A., Hazon, N. (2007). The renin-angiotensin system of fish and their role in osmoregulation. In *Fish Osmoregulation*. Eds. B. Baldisserotto, J. M. Mancera & B.G. Kapoor. Science Publishers, Inc. Enfield NH, USA & Plymouth, UK.

Crane, H. M., Pickford, D. B., Hutchinson, T. H., **Brown, J. A.** (2006). The effects of methimazole on development of the fathead minnow, *Pimephales promelas*, from embryo to adult. *Toxicological Sciences* 93: 278-285.

Crane, H. M., Pickford, D. B., Hutchinson, T. H., **Brown, J. A.** (2005). Effects of ammonium perchlorate on thyroid function in developing fathead minnows, *Pimephales promelas*. *Environmental Health Perspectives* 113, 396-401

Gollock, M. J., Kennedy, C. R., **Brown, J. A.** (2005). European eels, *Anguilla anguilla* (L.), infected with *Anguillicola crassus* exhibit a more pronounced physiological stress response to severe hypoxia than uninfected eels. *Journal of Fish Diseases* 28: 429-436.

Gollock, M. J., Kennedy, C. R., **Brown, J. A.** (2005). Physiological responses to acute temperature increase in European eels (*Anguilla anguilla* L.) infected with *Anguillicola crassus*. *Diseases of Aquatic Organisms* 64: 223-228.

- Brown, J. A.**, Cobb, C. S., Frankling, S. C., Rankin, J. C. (2005). Activation of the newly-discovered cyclostome renin-angiotensin system in the river lamprey, *Lampetra fluviatilis*. *Journal of Experimental Biology*. 208: 223-232
- Gollock, M. J., Kennedy, C. R., Quabius, E. S., **Brown, J. A.** (2004). The effect of parasitism of European eels with the nematode, *Anguillicola crassus* on the impact of netting and aerial exposure. *Aquaculture* 233: 45-54
- Crane, H. M., Pickford, D. B., Hutchinson, T. H., **Brown, J. A.** (2004). Developmental changes of thyroid hormones in the fathead minnow, *Pimephales promelas*. *General and Comparative Endocrinology*. 139: 55-60.
- Quabius, E. S., **Brown, J. A.**, Nolan, D. T., Wendelaar Bonga, S. E. (2002). Organic pollutants and their effects on the stress response in fish. *Comparative Biochemistry & Physiology Part A*. 132: S3.
- Quabius, E. S., **Brown, J. A.**, Nolan, D. T., Wendelaar Bonga, S. E. (2002). Dietary exposure to PCB 126 and B(a)P interferes with the stress response of teleost fish at the pituitary level of the HPI axis. *Proceedings of the International Congress on Biology of Fishes. Endocrine Disruptors: Mechanisms and Impacts* (Eds. M. Vijayan, A. Hontela, D. MacKinlay) American Fisheries Soc.
- Brown, J. A.**, Moore, W. M., Quabius, E. S. (2001). Physiological effects of saline waters on zander. *Journal of Fish Biology* 59: 1544-1555.
- Kelly, C. E., Kennedy, C. R., **Brown, J. A.** (2000). Physiological status of wild European eels (*Anguilla anguilla*) infected with the parasitic nematode, *Anguillicola crassus*. *Parasitology* 120: 195-202.
- Stephens, S. M., Frankling, S. C., Stagg, R. M., **Brown J. A.** (2000). Sub-lethal effects of exposure of juvenile turbot to oil produced water. *Marine Pollution Bulletin* 40: 928-937.
- Brown, J. A.**, Rankin, J. C. (1999). Lack of glomerular intermittency in the river lamprey, *Lampetra fluviatilis* acclimated to seawater and following acute transfer to iso-osmotic brackish water. *Journal of Experimental Biology* 202: 939-946
- Waring, C. P., **Brown, J. A.** (1997). Plasma and tissue thyroxine and triiodothyronine contents in sublethally stressed, aluminium-exposed brown trout (*Salmo trutta*). *General and Comparative Endocrinology* 106: 120-126.
- Stephens, S. M., AlKindi, A. Y. A., Waring, C. P., **Brown, J. A.** (1997). Corticosteroid and thyroid responses of larval and juvenile turbot, *Scophthalmus maximus* L. exposed to the water soluble fraction of crude oil. *Journal of Fish Biology* 50: 953-964.
- Stephens, S. M., **Brown, J. A.**, Frankling, S. C. (1997). Stress responses of larval turbot, *Scophthalmus maximus* L., exposed to sub-lethal concentrations of petroleum hydrocarbons. *Fish Physiology & Biochemistry* 17: 433-439.

AlKindi, A., **Brown, J. A.**, Waring, C. P., Collins, J. E. (1996). Endocrine, osmoregulatory, respiratory and haematological parameters in flounder *Pleuronectes flesus* exposed to the water soluble fraction of crude oil. *Journal of Fish Biology* 49: 1291-1305.

Brown, J. A., Waring, C. P. (1996). The physiological status of brown trout exposed to aluminium in acidic soft waters. In: *Toxicology of Aquatic Pollution. Physiological, Cellular and Molecular Approaches*. Ed. E. W. Taylor, Society for Experimental Biology Seminar Series Vol 57, pp 115-143, Cambridge University Press.

Stephens, S. M., **Brown, J. A.**, Ferguson, M. A. (1996). Sub-lethal effects of oil-produced water on the early life stages of turbot. In: *Produced Water 2: Environmental Issues and Mitigation Technologies* Eds. M. Reed & S. Johnsen, pp. 101-112, Plenum Press, New York.

Waring, C. P., **Brown, J. A.**, Collins, J. E., Prunet, P. (1996). Plasma prolactin, cortisol and thyroid responses of the brown trout (*Salmo trutta*) exposed to lethal and sublethal aluminium in acidic soft waters. *General and Comparative Endocrinology* 102: 377-385.

Brown, J. A., Whitehead C. (1995). Catecholamine release and interrenal response of brown trout, *Salmo trutta* exposed to aluminium in acidic water. *Journal of Fish Biology* 46: 524-535.

Waring, C. P., **Brown, J. A.** (1995). Ionoregulatory and respiratory responses of brown trout, *Salmo trutta*, exposed to lethal and sublethal levels of aluminium in acidic soft waters. *Fish Physiology & Biochemistry* 14: 81-91.

Brown, J. A. (1993). Endocrine Responses to Environmental Pollutants. In 'Fish Ecophysiology' (Ed. J C Rankin & F B Jensen) pp 274-294. Chapman & Hall, London.

Brown, J. A., Tytler, P. (1993). Hypoosmoregulation of larvae of the turbot, *Scophthalmus maximus*: drinking and gut function in relation to environmental salinity. *Fish Physiology & Biochemistry* 10: 475-483.

Brown, J. A., Whitehead, C., Edwards, D. (1989). Cortisol and thyroid responses to acid stress in the brown trout, *Salmo trutta*. *Journal of Fish Biology* 35: 73-84.

Whitehead, C., **Brown J. A.** (1989). Endocrine responses to acid stress in brown trout held in a soft water Welsh stream. *Journal of Fish Biology* 35: 59-71.