Advances in Invertebrates and Fish Telemetry

Developments in Hydrobiology 130

Series editor

H. J. Dumont

Advances in Invertebrates and Fish Telemetry

Proceedings of the Second Conference on Fish Telemetry in Europe,
held in La Rochelle, France, 5–9 April 1997

Edited by

Jean-Paul Lagardère, Marie-Laure Bégout Anras & Guy Claireaux

Reprinted from Hydrobiologia, volumes 371/372 (1998)

SPRINGER-SCIENCE+BUSINESS MEDIA, B.V.

Library of Congress Cataloging-in-Publication Data

A C.I.P. Catalogue record for this book is available from the Library of Congress.

ISBN 978-94-010-6138-4 ISBN 978-94-011-5090-3 (eBook)
DOI 10.1007/978-94-011-5090-3

Printed on acid-free paper

All rights reserved

©1998 Springer Science+Business Media Dordrecht

Originally published by Kluwer Academic Publishers in 1998

Softcover reprint of the hardcover 1st edition

No part of the material protected by this copyright notice may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, recording or by any information storage and retrieval system, without written permission from the copyright owner.

Contents

Introduction	ix
Scientific Committee/Editorial Board/List of Sponsors	x
List of Participants	xi

1. Methodology and New Developments

Applications and performance of Radio-Acoustic Positioning and Telemetry (RAPT) systems by R.K. O'Dor, Y. Andrade, D.M. Webber, W.H.H. Sauer, M.J. Roberts, M.J. Smale & F.M. Voegeli	1–8
A comparison of theoretical estimates of the errors associated with ultrasonic tracking using a fixed hydrophone array and field measurements by G.W. Smith, G.G. Urquhart, D.N. MacLennan & B. Sarno	9–17
Selection of optimal positioning intervals in fish tracking: an experimental study on <i>Barbus barbus</i> by E. Baras	19–28
Inland migration study of sea trout (<i>Salmo trutta</i>) into the rivers Rhine and Meuse (The Netherlands), based on inductive coupling radio telemetry by A.W. Breukelaar, A. bij de Vaate & K.T.W. Fockens	29–33
Development of miniature pingers for tracking Atlantic salmon smolts at sea by F.A. Voegeli, G.L. Lacroix & J.M. Anderson	35–46
A dynamic combined acoustic and radio-transmitting tag for diadromous fish by G.H. Niezgodá, R.S. McKinley, D. White, G. Anderson & D. Cote	47–52
Frequency choice for radio telemetry: the HF vs. VHF conundrum by M.M. Sisak & J.S. Lotimer	53–59
Simultaneous observations of tuna movements and their prey by sonic tracking and acoustic surveys by E. Josse, P. Bach & L. Dagorn	61–69
A data logger tag for the study of slaughter procedures in aquacultured salmon by O.A. Olsen, P.O. Skjervold & O. Fjaera	71–77

2. Tagging Procedures

Growth and physiological responses to surgical and gastric radio transmitter implantation techniques in subyearling chinook salmon (<i>Oncorhynchus tshawytscha</i>) by T.L. Martinelli, H.C. Hansel & R.S. Shively	79–87
Use of miniature radio-transmitters to track the movements of dace, <i>Leuciscus leuciscus</i> (L.) in the River Frome, Dorset by S. Clough & W.R.C. Beaumont	89–97

The effects of Passive Integrated Transponder tags on survival and growth of juvenile brown trout (<i>Salmo trutta</i> L.) and their use for studying movements in a small river by D. Ombredane, J.L. Baglinière & F. Marchand	99–106
Evaluation of surgery procedures for tagging eel <i>Anguilla anguilla</i> (L.) with biotelemetry transmitters by E. Baras & D. Jeandrain	107–111
A method for the external attachment of acoustic tags on roundfish by G. Claireaux & C. Lefrançois	113–116
Regurgitation rates of intragastric transmitters by adult Atlantic salmon (<i>Salmo salar</i> L.) during riverine migration by G.W. Smith, R.N.B. Campbell & J.S. MacLaine	117–121

3. Behavioural and Physiological Ecology

New approaches to the behavioural ecology of decapod crustaceans using telemetry and electronic tags by J. Freire & E. González-Gurriarán	123–132
Electromagnetic telemetry of lobster (<i>Homarus gammarus</i> (L.)) movements and activity: preliminary results by I.P. Smith, K.J. Collins & A.C. Jensen	133–142
Basic movement pattern and chemo-oriented search towards baited pots in edible crab (<i>Cancer pagurus</i> L.) by K. Skajaa, A. Fernö, S. Løkkeborg & E.K. Haugland	143–153
Telemetry applied to behaviour analysis of yellowfin tuna (<i>Thunnus albacares</i> , Bonnaterre, 1788) movements in a network of fish-aggregating devices by F. Marsac & P. Cayré	155–171
Spawning migration of radio-tagged landlocked Arctic Charr, <i>Salvelinus alpinus</i> L. in Ennerdale Lake, the English Lake District by D.J.F. McCubbing, B.D. Bayliss & V.M. Locke	173–180
Acoustic tracking of the dispersal of organic matter by scavenging fishes in the deep-sea by M.A. Collins, I.G. Priede, S. Addison, A. Smith & P.M. Bagley	181–186
Seasonal variations in time and space utilization by radio-tagged yellow eels <i>Anguilla anguilla</i> (L.) in a small stream by E. Baras, D. Jeandrain, B. Serouge & J.C. Philippart	187–198
Reactions of cod (<i>Gadus morhua</i> L.) in the pre-vessel zone to an approaching trawler under different light conditions: preliminary results by A. Engås, E.K. Haugland & J.T. Øvredal	199–206
Changes in vertical distribution of sea bass (<i>Dicentrarchus labrax</i> L.) during a hypoxic episode by H. Schurmann, G. Claireaux & H. Chartois	207–213
Heart rate telemetry to study environmental influences on fish metabolic expenditure by C. Lefrançois, G. Claireaux & J-P. Lagardère	215–224
Effects of thermal environment on electromyographical signals obtained from Atlantic salmon (<i>Salmo salar</i> L.) during forced swimming by T.A. Beddow & R.S. McKinley	225–232

Remote monitoring of heart rate as a measure of recovery in angled Atlantic salmon, <i>Salmo salar</i> (L.)	
by W.G. Anderson, R. Booth, T.A. Beddow, R.S. McKinley, B. Finstad, F. Økland & D. Scruton	233–240
Using speed-sensing transmitters to construct a bioenergetics model for subadult lemon sharks, <i>Negaprion brevirostris</i> (Poey), in the field	
by L.F. Sundström & S.H. Gruber	241–247
 4. Fish Migration and Stock Management	
Migratory and reproductive activity of radio-tagged Arctic char (<i>Salvelinus alpinus</i> L.) in northern Labrador	
by T.A. Beddow, C. Deary & R.S. McKinley	249–262
Environmental unpredictability rules the autumn migration of brown trout (<i>Salmo trutta</i> L.) in the Belgian Ardennes	
by M. Ovidio, E. Baras, D. Goffaux, C. Birtles & J.C. Philippart	263–274
Spawning migration of sea trout (<i>Salmo trutta</i> (L.)) in a Danish river	
by K. Aarestrup & N. Jepsen	275–281
A radio telemetry study of the migration of Atlantic salmon (<i>Salmo salar</i> L.) and sea trout (<i>Salmo trutta trutta</i> L.) in the upper Rhine	
by M. Gerlier & P. Roche	283–293
The migratory behaviour of wild Atlantic salmon (<i>Salmo salar</i> L.) smolts in the River Test and Southampton Water, southern England	
by A. Moore, S. Ives, T.A. Mead & L. Talks	295–304
Movements of a bream (<i>Abramis brama</i> (L.)), rudd × bream hybrid, tench (<i>Tinca tinca</i> (L.)) and pike (<i>Esox lucius</i> (L.)) in an Irish canal habitat	
by R.E. Donnelly, J.M. Caffrey & D.M. Tierney	305–308
Radio telemetry as a tool to study habitat use of nase (<i>Chondrostoma nasus</i> L.) in medium-sized rivers	
by M. Huber & A. Kirchhofer	309–319
The migratory behaviour of juvenile and adult salmonids in relation to an estuarine barrage	
by I.C. Russell, A. Moore, S. Ives, L.T. Kell, M.J. Ives & R.O. Stonehewer	321–334
Movements of adult sea trout <i>Salmo trutta</i> L. in the tailrace of a low-head dam at Włocławek hydroelectric station on the Vistula River, Poland	
by V.D. Linnik, L.K. Malinin, M. Wozniowski, R. Sych & P. Dembowski	335–338
Migration of adult Atlantic salmon (<i>Salmo salar</i> (L.)); the effects of artificial freshets	
by E.B. Thorstad & T.G. Heggberget	339–346
Survival of radio-tagged Atlantic salmon (<i>Salmo salar</i> (L.)) and trout (<i>Salmo trutta</i> L.) smolts passing a reservoir during seaward migration	
by N. Jepsen, K. Aarestrup, G. Rasmussen & F. Økland	347–353
The efficiency of a nature-like bypass channel for pike-perch (<i>Stizostedion lucioperca</i> (L.)) in the Marchfeldkanalsystem	
by S. Schmutz, C. Giefing & C. Wiesner	355–360

Introduction

The Second Conference on Fish Telemetry in Europe was held in La Rochelle, France, from 5 to 9 April 1997. The aim of this conference was to facilitate exchanges between groups of researchers working on different compartments of marine or freshwater ecosystems and sharing telemetry techniques as investigating tools. This kind of conference also allows us to be informed of the most recent technical advances and associated conceptual developments.

After the success of the First Conference on Fish Telemetry held in Liège, Belgium, April 4–6, 1995, the presence of 110 participants from 17 countries attending this second conference confirmed that telemetry is establishing itself as a major technique for the analysis and management of aquatic ecosystems. With 57 oral and posted contributions presented, we can observe:

- a fast instrumental progression based on electronic and signal treatment advances,
- an enlargement of continuous investigation on aquatic animals tracked over wider areas (lakes, estuaries and coastal areas) and longer periods of time,
- a developing use of telemetry for aquatic animal stock management and the conservation and protection of their environment.

Forty manuscripts were selected by the organizing committee after being reviewed by members of the Editorial Board. They provide the material for this book and are organized into four sections:

1. Methodology and New Developments,
2. Tagging Procedures,
3. Behavioural and Physiological Ecology,
4. Fish Migration and Stock Management.

The organization of the Second Conference on Fish Telemetry in Europe was made possible by the support of Maurice Héral, Director, and the staff of the Centre de Recherche en Ecologie Marine et Aquaculture de l'Houmeau (CREMA). Special thanks are due to Miss A. Bonpain, Mrs A. L. Monteragioni and Mrs E. Travers, who undertook the secretarial work. We also thank Henri J. Dumont, Editor-in-Chief of *Hydrobiologia* and René Mijs, Kluwer Academic Publishers, for their interest in the production of this special issue.

CREMA (CNRS – Ifremer)
B.P. 5, 17137 L'Houmeau, France

J.-P. LAGARDÈRE
M.-L. BÉGOUT ANRAS
G. CLAIREAUX

Scientific Committee

J. L. BAGLINIÈRE, INRA Rennes, France
 E. BARAS, University of Liège, Belgium
 G. CLAIREAUX, CREMA L'Houmeau, France
 K. COLLINS, University of Southampton, U.K.
 J. FREIRE, University of Coruna, Spain
 T. HEGGBERGET, NINA Trondheim, Norway
 J.-P. LAGARDÈRE, CREMA L'Houmeau, France
 A. MOORE, MAFF Lowestoft, U.K.
 I. G. PRIEDE, University of Aberdeen, U.K.
 G. URQUHART, SOAFD Aberdeen, U.K.
 H. WESTERBERG, National Board of Fisheries, Sweden

Editorial Board

J. ARMSTRONG, Freshwater Fisheries Laboratory, U.K.
 J. L. BAGLINIÈRE, INRA Rennes, France
 E. BARAS, University of Liège, Belgium
 M.-L. BÉGOUT ANRAS, CREMA L'Houmeau, France
 G. CLAIREAUX, CREMA L'Houmeau, France
 K. J. COLLINS, University of Southampton, U.K.
 J. FREIRE, University of Coruna, Spain
 T. G. HEGGBERGET, NINA Trondheim, Norway
 J. P. LAGARDÈRE, CREMA L'Houmeau, France
 S. LOKKEBORG, Institute of Marine Research, Norway
 A. MOORE, MAFF Lowestoft, U.K.
 I. G. PRIEDE, University of Aberdeen, U.K.
 G. W. SMITH, Freshwater Fisheries Laboratory, U.K.
 I. P. SMITH, Southampton Oceanography, U.K.
 G. G. URQUHART, SOAFD Aberdeen, U.K.
 D. M. WEBBER, Dalhousie University, Canada
 H. WESTERBERG, National Board of Fisheries, Sweden

List of sponsors

Tutorial organisms

Centre National de la Recherche Scientifique, CNRS
 Institut Français de Recherche pour l'Exploitation de la Mer, IFREMER
 Région Poitou Charentes, Programme Com'Sciences

Other sponsors

- Institut National de la Recherche Agronomique, INRA
- Institut Français de Recherche Scientifique pour le Développement en Coopération, ORSTOM
- Conseil Supérieur de la Pêche, CSP
- Conseil Général de la Charente Maritime
- Ville de La Rochelle
- Muséum d'Histoires Naturelles de La Rochelle
- Aquarium de La Rochelle
- Fish Eagle
- Lotek
- Vemco Ltd.

List of Participants

Kim AARESTRUP	Denmark	François LAUTERS	France
Gary ANDERSON	Canada	Cheryl LE DREW	Canada
Marie-Laure BÉGOUT ANRAS	France	Christel LEFRANÇOIS	France
John ARMSTRONG	U.K.	Mario LEPAGE	France
Bjorn Erik AXELSEN	Norway	Jeffrey LINES	U.K.
Jean-Luc BAGLINIÈRE	France	Vladimir LINNIK	Russia
Etienne BARAS	Belgium	Svein LOKKEBORG	Norway
Toni BEDDOW	Canada	Pierre LOONIS	France
Vincent BENECH	Mali	Don MacCUBBING	U.K.
Stephen BLACK	Ireland	Ridha MALLEKH	France
Drew BODALY	Canada	Gerd MARMULLA	Italy
Gunnbjorn BREMSET	Norway	Francis MARSAC	Seychelles
Andre BREUKELAAR	The Netherlands	Theresa MARTINELLI	U.S.A.
Catherine BRUGEL	France	Andy MOORE	U.K.
Eilif BRODTKORB	Norway	George NIEZGODA	Canada
Patrice CAYRE	France	Mark John O'CONNELL	U.K.
Guy CLAIREAUX	France	Ron O'DOR	Canada
Stuart CLOUGH	U.K.	Odd Arild OLSEN	Norway
Johan COECK	Belgium	Dominique OMBREDANE	France
Sandra COLAZZO	Belgium	Michael OVIDIO	Belgium
Martin COLLINS	U.K.	Armin PETER	Switzerland
Gabriel EDEL	France	Pascal ROCHE	France
Bruno ERNANDE	France	Ian RUSSELL	U.K.
Koos FOCKENS	The Netherlands	Richard SABATIE	France
Frank FREDRICH	Germany	Stefan SCHMUTZ	Austria
Mathieu GERLIER	France	Henrik SCHURMANN	Denmark
Eduardo GONZALEZ-		David SCRUTON	Canada
GURRIARAN	Spain	Mitchell SISAK	Canada
Juliette GUET	Norway	Per Olav SKJERVOLD	Norway
Eli Kyrkjebo HAUGLAND	Norway	Gordon SMITH	U.K.
Tor HEGGBERGET	Norway	Philip SMITH	U.K.
Cyril HERISSE	France	Kim SUN	The Netherlands
Marianne HOLM	Norway	Fredrik SUNDSTROM	Sweden
Martin HUBER	Switzerland	Dany SUREAU	France
George JACKSON	Australia	John TAYLOR	U.K.
Niels JEPSEN	Denmark	Eva THORSTAD	Norway
David JOHNSTON	Canada	François TRAVADE	France
Erwan JOSSE	French Polynesia	Gordon URQUHART	U.K.
Adrian JOWITT	U.K.	Fred VOEGELI	Canada
Anders KOED	Denmark	Magnus WAHLBERG	Sweden
Françoise LAGARDÈRE	France	Dale WEBBER	Canada
Jean-Paul LAGARDÈRE	France	Hakan WESTERBERG	Sweden