International Fish Screening Techniques
PROCEEDINGS OF THE
INTERNATIONAL FISH SCREENING TECHNIQUES
CONFERENCE 2011

Sponsored by

TURNPENNY HORSFIELD ASSOCIATES
Fisheries Engineering & Aquatic Consultants

BEAUDREY

OVIVO

PASSAVANT GEIGER
A Weatherford Company

Johnson screens™
International Fish Screening Techniques

Edited by
A.W.H. Turnpenny
&
A. Horsfield
Turnpenny Horsfield Associates, UK
Editors:

A.W.H. Turnpenny & A. Horsfield
Turnpenny Horsfield Associates, UK

Published by

WIT Press
Ashurst Lodge, Ashurst, Southampton, SO40 7AA, UK
Tel: 44 (0) 238 029 3223; Fax: 44 (0) 238 029 2853
E-Mail: witpress@witpress.com
http://www.witpress.com

For USA, Canada and Mexico

WIT Press
25 Bridge Street, Billerica, MA 01821, USA
Tel: 978 667 5841; Fax: 978 667 7582
E-Mail: infousa@witpress.com
http://www.witpress.com

British Library Cataloguing-in-Publication Data
A Catalogue record for this book is available
from the British Library


Library of Congress Catalog Card Number: 2013952834

No responsibility is assumed by the Publisher, the Editors and Authors for any
injury and/or damage to persons or property as a matter of products liability,
negligence or otherwise, or from any use or operation of any methods, products,
instructions or ideas contained in the material herein. The Publisher does not
necessarily endorse the ideas held, or views expressed by the Editors or Authors of
the material contained in its publications.

© WIT Press 2014

Printed by Lightning Source, UK.

All rights reserved. No part of this publication may be reproduced, stored
in a retrieval system, or transmitted in any form or by any means, electronic,
mechanical, photocopying, recording, or otherwise, without the prior written
permission of the Publisher.
Preface

The proceedings presented here represent the majority of presentations made to the UK’s Institute of Fisheries Management (IFM) International Fish Screening Conference. This was a two-day meeting held at Hampshire’s New Forest town of Lyndhurst, and an example of the IFMs topical specialist meetings in fisheries science and management that have now become a feature of the Institute’s annual technical programme.

As you will see from the contents of this book, the meeting attracted speakers from the UK, Europe and North America. Never has the subject of fish screening been more lively or topical. Increased interest in the subject has largely driven the introduction of environmental legislation, in Europe, notably the Habitats Directive, the Water Framework Directive and Eel Management Directive, and in the USA the Endangered Species Act and s.316(b) of the Clean Water Act. Consequently the meeting attracted participants from universities and research laboratories, consultancies, power and water companies and from regulatory bodies. A number of the papers presented describe how individual countries are dealing with this growing body of legislation.

The contents of the book also describe the wide variety of techniques that have been developed or are emerging to provide cost-effective solutions to the problem of fish screening at water intakes and outfalls, whether they be for industrial and potable water supply, irrigation, power plant cooling, hydropower generation or other purposes. Conventional physical positive-exclusion techniques are generally effective from the point of view of fish protection, but loss of hydraulic head and blockage risk often make them impractical in many applications. Fortunately, there has been much progress in travelling screen design and in developing behavioural barrier techniques that are particularly suited to applications requiring large water flows. Developers are rapidly providing users with a suite of options that can provide cost-effective solutions suited to all kinds of applications. Just as a bridge must be designed to only just stand up, it is incumbent upon
fish screen and barrier developers to avoid over-engineering fish screening solutions, ensuring that the level of fish protection is adequate but does not lead to unnecessary economic constraints.

Andy Turnpenny BSc PhD MIFM C Biol FSB
Ashurst Lodge, Hampshire, UK
Contents

Section 1: Planning and regulation

Meeting best practice at river intakes: observations from the field
R. A. Horsfield ........................................................................................................ 3

Screening at intakes and outfalls: measures to protect eel (Anguilla anguilla)
S. Sheridan, A. Turnpenny, R. Horsfield, D. Solomon, D. Bamford,
B. Bayliss, S. Coates, I. Dolben, P. Frear, E. Hazard, I. Tavner,
N. Trudgill, R. Wright & M. Aprahamian.......................................................... 17

Fish protection in Germany: first steps on a long and rocky road
M. Redeker ........................................................................................................ 31

Fish impingement at cooling water intakes in The Netherlands: current developments in effect – evaluation, regulations and technical measures
M. C. M. Bruijs, F. T. Vriese & D. Bijstra........................................................ 41

Even finer bar spacing, how low can you go?
S. C. Clough, N. Teague & H. Webb ................................................................. 57

Implications of the Eel Regulations on the design of a pumping plant
D. Jackson ........................................................................................................ 67

Section 2: Positive exclusion screening techniques

WIP screens: a new technology for fish protection at water intakes
M. Fillon, P. Jackson & J. Lindsay ................................................................. 79
UK Best Practice fish screening trials study
R. Bromley, S. Coyle, K. Hawley, K. Anderson & A. W. H. Turnpenny

The survival of lamprey on travelling screens at potable water intakes
N. Teague & S. C. Clough

Trials and tribulations of fish recovery and return
A. Turnpenny

Section 3: Non-physical barriers and guidance devices

Planning and design of the UK’s largest acoustic and light-based fish deterrent system
D. Lambert

Research at IJmuiden lock complex provides unique insight in fish guidance
G. Kruitwagen

Investigations into the response of 0+ twaite shad (Alosa fallax) to ultrasound and its potential as an entrainment deterrent
N. Teague & S. C. Clough

Blocking or guiding upstream-migrating fish: a commentary on the success of the graduated field electric fish barrier
M. O’Farrell, C. Burger, R. Crump & K. Smith

Section 4: Behaviour modelling and performance testing

Modelling fish in hydrodynamic models: an example using the Severn Barrage SEA
J. Willis & N. N. Teague

A review of technologies employed on some recent UK power plant projects to mitigate the impact of the cooling water intake on aquatic life
N. R. Rogers

Author index