

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/45950807>

Taking account of fish welfare: Lessons from aquaculture

Article in *Journal of Fish Biology* · December 2009

DOI: 10.1111/j.1095-8649.2009.02465.x · Source: PubMed

CITATIONS

50

READS

1,296

2 authors, including:



[Sunil Kadri](#)

Charles Darwin University

57 PUBLICATIONS 3,013 CITATIONS

[SEE PROFILE](#)



Journal of Fish Biology (2009) **75**, 2862–2867

doi:10.1111/j.1095-8649.2009.02465.x, available online at www.interscience.wiley.com

Taking account of fish welfare: lessons from aquaculture

F. A. HUNTINGFORD*† AND S. KADRI‡

*Fish Biology Group, Faculty of Biomedical & Life Sciences, University of Glasgow,
Glasgow G12 8QQ, U.K. and ‡Aquaculture Innovation, 34 Lawrence St. 1/L,
Glasgow G11 5HD, U.K.

(Received 29 July 2009, Accepted 10 September 2009)

This paper explores the possibility that lessons learned from aquaculture might contribute to current debate on welfare and fisheries. After looking briefly at the history of research interest in the welfare of farmed fishes, some implications of using different definitions of and approaches to the concept of welfare are discussed. Consideration is given to the way in which the aquaculture industry has responded to public concern about fish welfare and, for cases where these responses have been effective, why this might be the case. Finally, possible cross-over points between aquaculture and fisheries in the context of fish welfare, as well as experience and expertise that might be shared between these two areas, are identified.

© 2009 The Authors

Journal compilation © 2009 The Fisheries Society of the British Isles

Key words: definitions of welfare; fisheries.

INTRODUCTION

This paper arises from a workshop sponsored by the Fisheries Society of the British Isles (FSBI) on the topic of welfare and commercial fisheries, at the 5th World Fisheries Congress, Yokahama, October 2008. The aims of the presentation at that workshop, which are also the aims of this paper were: (1) to give some history of research interest in the welfare of farmed fishes. (2) To explore briefly some implications of using different definitions of and approaches to the concept of welfare in this context. (3) To discuss how the aquaculture industry has responded to concern about fish welfare. (4) Where these responses have been effective, to consider why this might be the case. (5) To identify points of possible cross-over between aquaculture and fisheries in the context of fish welfare and also experience and expertise that might be shared between these two areas.

HISTORY OF RESEARCH INTEREST IN THE WELFARE OF FARMED FISHES

The results of a very simple analysis of the published literature, based on a search in the Web of Science using the keywords welfare and aquaculture, are shown in Fig. 1: Fig. 1(a) shows the number of papers with these two keywords published

†Author to whom correspondence should be addressed. Tel.: +44 (0) 141 330 6643; fax: + 44 (0) 141 330 5871; email: f.huntingford@bio.gla.ac.uk

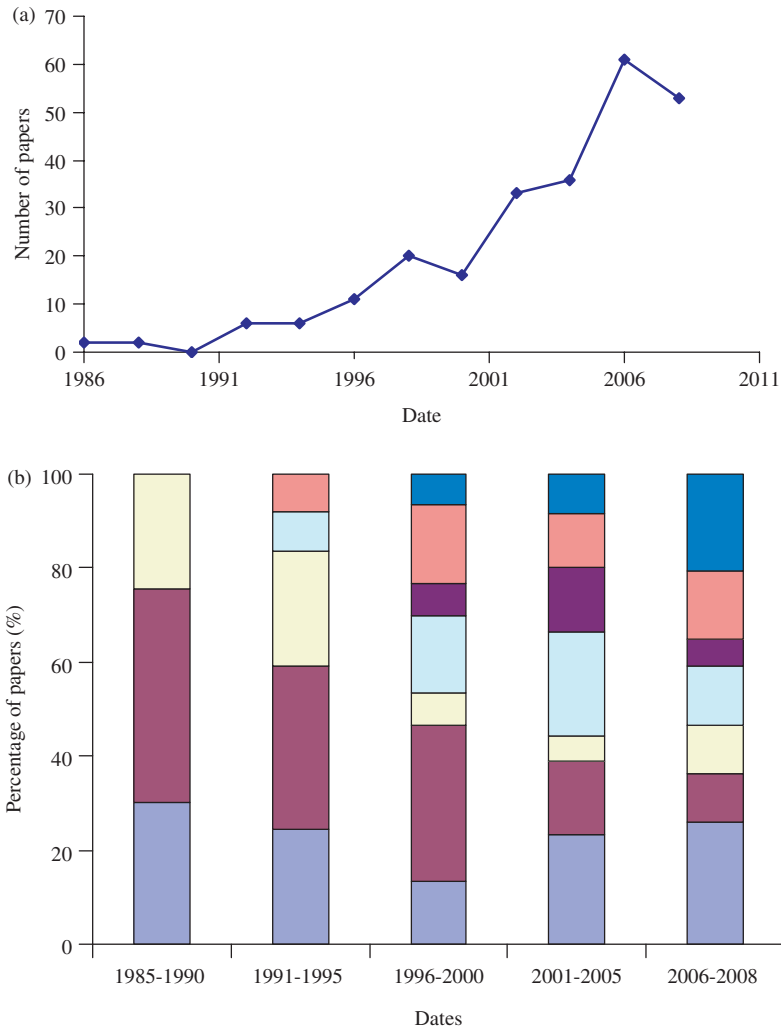


FIG. 1. (a) The number of papers published with the keywords welfare and aquaculture in 3 year time bins, from a Web of Science search. (b) The percentage of papers with the keywords welfare and aquaculture published in 5 year blocks that fall into the subject areas welfare indicators (■), welfare-friendly husbandry systems (■), effects of stocking density (■), welfare at slaughter (■) and during transport (■) and health and disease (■), as well as general commentaries on principles and concept (■).

in 3 year time bins and Fig. 1(b) gives a breakdown by broad subject matter of published papers in 5 year time bins. The categories used are disease and health, effects of transport and slaughter on welfare, development of welfare-friendly husbandry systems, establishment of on-farm welfare indicators and, finally, discussion of issues and concepts. For the early periods, sample sizes are small, so the percentage figures should be interpreted with caution.

From the early 1990s, there has been a steady increase in the number of published papers that include these two terms as keywords. As far as subject matter is concerned, initially most papers on welfare and aquaculture concerned fish health or

the effects of transport, reflecting the main concerns of the time. Stocking density became an issue in the late 1990s and early 2000s, prompted in the U.K. at least by the Farm Animal Welfare Commission report on farmed fishes (FAWC, 1996). In addition, there has been sustained and growing interest in the welfare of fishes at slaughter and in developing husbandry systems that promote the welfare of farmed fishes. Finally, the search is now on for welfare indicators, following recognition that the best way forward is not to try to identify conditions that will guarantee welfare, but instead to find simple, accurate welfare indicators for use on working farms (McKinley, 2006).

IMPLICATIONS OF USING DIFFERENT DEFINITIONS OF WELFARE

From the start, there has been a succession of papers commenting on general issues, reflecting the fact that welfare is a complex and controversial topic. One issue that has proved particularly difficult and contentious is the question of how welfare should be defined. To repeat briefly what has been discussed many times (Huntingford *et al.*, 2006, 2007; Arlinghaus *et al.*, 2007; Ashley, 2007), an animal's welfare may be deemed to be good if it can adapt to its environment and is in good health, with all its biological systems working appropriately. In other words, a function-based definition might be used. Secondly, an animal's welfare might be considered good if it is able to lead a natural life, expressing the same kinds of behaviour as it would in the wild, taking a nature-based approach. Finally, welfare might be considered to be good if the animal is free of negative experiences such as pain, fear and hunger and has access to positive experiences, such as social companionship; this would be to take a feeling-based approach. These different definitions are not mutually exclusive, but reflect different facets of the complex phenomenon of animal welfare. As discussed by Kaiser & Huntingford (2009), there is still disagreement about which is the most appropriate definition to use when discussing fish welfare. Here, the wish is simply to draw attention to some ways in which using one or other of these definitions will make a difference to conclusions and actions in the context of aquaculture and aquaculture research.

How welfare is defined will determine how it is measured, whether by farmers, by regulators monitoring farmed fishes or by researchers. For example, using nature-based definitions in this context would require assessment of the extent to which farmed fishes show a similar behavioural repertoire to their wild counterparts. In contrast, assessment of welfare based on proper function might involve measuring physiological status, growth rates or reproductive function. Definitions also matter when it comes to responding to what some members of the public are concerned about, which tends to be whether farmed fishes are suffering. This is more difficult, but far from impossible, to measure objectively. Finally, how welfare is defined will determine the extent to which there is scope for mitigation of any adverse effects of farming on welfare. Thus, if good welfare requires fishes to lead a completely natural life, aquaculture (or any other kind of farming) can never be welfare friendly.

The contributors to this discussion disagree about which definition is most appropriate (Arlinghaus *et al.*, 2007; Huntingford *et al.*, 2007). Ideally, and in the long term, one way to deal with such a disagreement is to carry out the research needed to map the different frameworks for welfare onto each other, especially 'feeling'

onto 'function'. Studies of what animals find reinforcing can be used in scientific studies of positive and negative emotional states in animals (Dawkins, 2008) and could potentially be used to link feeling-based and function-based approaches to fish welfare. For example, an operant approach could be used to determine whether fishes will work to gain a small cortisol injection and if so, how hard they will work and in what circumstances. Pragmatically and in the shorter term, people with different views on how best to define welfare agree to differ, to respect each others' factually based views and to recognize that for many commonly held goals exactly how welfare is defined will not alter what action is required.

HOW THE AQUACULTURE INDUSTRY HAS RESPONDED TO CONCERN ABOUT FISH WELFARE

Broadly speaking, the aquaculture industry, while recognizing the danger of simply providing 'occupational therapy for fish biologists' (to quote an anonymous discussant at a fish farming conference), has responded to public concern about fish welfare by participation in debate and by developing strategies for improvement. Debate has taken the form of sessions at international conferences dedicated to the welfare of farmed fishes (*e.g.* at the European Aquaculture Society Conference in 2002), developing internal guidelines for good practice (*e.g.* those produced by the Federation of European Aquaculture Producers, FEAP, 2000) and working with regulators and policy makers to produce agreed standards (*e.g.* regulations produced by the European Food Safety Agency, the Norwegian Food Standards Agency and other national authorities).

As far as strategies for improving the welfare of farmed fishes are concerned, one possibility is to use the right kind of fishes, in the sense that some species, strains and individuals may react better to intensive husbandry systems. For example, plasma cortisol measurements suggest that cod *Gadus morhua* L. may be less easily stressed than are Atlantic salmon *Salmo salar* L. (B. Damsgaard, pers. comm.); should this prove to be the case, *G. morhua* may be a more appropriate species to farm than other more easily stressed fishes. Research on husbandry systems for the aquaculture industry that minimize various measures of impaired well-being include studies of transport systems (Iversen *et al.*, 2009) and slaughter (Roth *et al.*, 2007; Knowles *et al.*, 2008), various systems for feeding fishes according to their current appetite (Noble *et al.*, 2008), video-based size estimation (Lines *et al.*, 2001) and passive grading (Pfeiffer & Freeman, 2004). An alternative to trying to define housing conditions that guarantee good welfare (which is almost impossible to do, even if species and life-history stage is taken into account) is to develop easily measured variables that reflect the general well-being of fishes (or welfare indicators) and can be used on working farms, both by farmers and regulators. Possible candidates include food intake, fin condition and even something as indirect as water quality. Many of these candidate indicators are exactly what good fish farmers already use when monitoring their stock.

WHY THIS MIGHT BE THE CASE WHERE THESE RESPONSES HAVE BEEN EFFECTIVE

In the interests of extrapolation to other spheres in which fishes are used, it is worth considering why such welfare interventions have proved successful, in cases

where this has indeed been the case. One possible reason is that intensive aquaculture is a relatively new sector, so is not set in traditional ways and is receptive to innovation. Also in part because intensive aquaculture is relatively new, aquaculture technology and the process of domestication are still at the stage where welfare and production usually co-vary. In other words, interventions that promote welfare often also promote production and farmers can carry on in business even with tight welfare regulation. Finally, there is a valuable niche market for premium brands based on welfare; the Royal Society for the Prevention of Cruelty to Animals' Freedom Foods Scheme (under which up to 80% Scottish *S. salar* is sold) is a case in point (www.rspca.org.uk). This is not to imply that all welfare problems in aquaculture have been solved, since this is not the case. For example, production-related diseases are on the rise and technologies that improve some aspects of welfare can compromise others; vaccination may be a case in point with an intervention designed to protect fish health causing handling stress, which may or may not be acceptable.

POINTS OF POSSIBLE CROSS-OVER BETWEEN AQUACULTURE AND FISHERIES

One aim of the workshop at the 5th World Fisheries Congress was to explore whether any of experiences and expertise gained from discussions of welfare in aquaculture and recreational fisheries are relevant and useful to the question of welfare and commercial fisheries. Other papers discuss specific welfare issues surrounding capture fisheries. Relating commercial fisheries to aquaculture in terms of general concepts and comparison of the ethical framework in which fisheries and aquaculture are discussed throws up informative differences. In aquaculture debate has concentrated on the welfare of individual fishes. The environmental effects of fish farming has certainly been a topic of active concern, but this has been almost completely separate from the welfare debate. In contrast, for commercial fisheries, the ethical emphasis has been on environmental effects, including the interaction of fishing gear on the habitat and status of wild populations, and incidental damage to non-target fishes. Although concern is not usually couched in terms of welfare, damage to the environment and gear-induced injury are likely to affect negatively the well-being of fishes and steps taken to protect the environment are likely to improve the condition of individual fishes as well as protecting fish populations and the environment. 'Commitment to better management of natural resources a better ethical framework for fisheries' (P. Hart, pers. comm.) than a concern for fish welfare.

In terms of more specific experience, there might well be scope for a useful exchange between fisheries (commercial and recreational) and aquaculture about ways of incentivising stakeholders, since in both cases, there is an ethical premium. In addition, aquaculture researches have collected a considerable amount of information on practices that compromise fish welfare, some of which (especially those pertaining to crowding and slaughter) may be directly applied to commercial fisheries. Finally, some of the technologies developed for aquaculture, particularly those concerned with humane slaughter, might be applicable in commercial fisheries. The hope is that debate stimulated by the workshop at the 5th World Fish Conference and the present set of short articles might promote constructive exchange on these issues.

We would like to thank the 5th World Fisheries Congress and the FSBI for hosting the workshop from which this article originated, the participants in that debate and two anonymous referees for incisive comments on an earlier version of this manuscript.

References

- Arlinghaus, R., Cooke, S. J., Schwab, A. & Cowx, I. G. (2007). Fish welfare: a challenge to the feelings-based approach, with implications for recreational fishing. *Fish and Fisheries* **8**, 57–71.
- Ashley, P. J. (2007). Fish welfare: current issues in aquaculture. *Applied Animal Behaviour Science* **104**, 199–235.
- Dawkins, M. S. (2008). The science of animal suffering. *Ethology* **114**, 937–945.
- FAWC (1996). *Report on the Welfare of Farmed Fish*. Surbiton: Farm Animal Welfare Council.
- Huntingford, F. A., Adams, C. E., Braithwaite, V. A., Kadri, S., Pottinger, T. G., Sandoe, P. & Turnbull, J. F. (2006). Current issues in fish welfare. *Journal of Fish Biology* **68**, 332–372.
- Huntingford, F. A., Adams, C. E., Braithwaite, V. A., Kadri, S., Pottinger, T. G., Sandoe, P. & Turnbull, J. F. (2007). The implications of a feelings-based approach to fish welfare: a reply to Arlinghaus *et al.* *Fish and Fisheries* **8**, 277–280.
- Iversen, M., Eliassen, R. A. & Finstad, B. (2009). Potential benefits of clove oil sedation on animal welfare during salmon smolt, *Salmo salar* L, transport and transfer to sea. *Aquaculture Research* **40**, 233–241.
- Kaiser, M. J. & Huntingford, F. A. (2009). Introduction to papers on fish welfare in commercial fisheries. *Journal of Fish Biology* **75**, 2852–2854. doi: 10.1111/j.1095-8649.2009.02464.x
- Knowles, T. G., Brown, S. N., Wariss, P. D., Lines, J., Tinarwo, A. & Sendon, M. (2008). Effects of electrical stunning at slaughter on the quality of farmed turbot (*Psetta maxmilla*). *Aquaculture Research* **39**, 1731–1738.
- Lines, J. A., Tillet, R. D., Ross, L. G., Chan, D., Hockaday S. & McFarlane, N. J. B. (2001). An automatic image-based system for estimating the mass of free-swimming fish. *Computers and Electronics in Agriculture* **31**, 151–168.
- McKinley, R. S. (2006). Importance of a quantifiable measure of fish welfare to fish and farmer. *Biologia Marina Mediterranea* **13**, 3–5.
- Noble, C., Kadri, S., Mitchell, D. F. & Huntingford, F. A. (2008). Growth, production and fin damage in cage-held 0+ Atlantic salmon pre-smolts (*Salmo salar* L.) fed either a) on-demand or b) to a fixed satiation-restriction regime: data from a commercial farm. *Aquaculture* **275**, 163–168.
- Pfeiffer, T. J. & Freeman, D. W. (2004). The effects of water temperature on stock grading of sub-marketable catfish, *Ictalurus punctatus*, in earthen ponds. *Journal of Applied Aquaculture* **16**, 95–103.
- Roth, B., Slinde, E. & Robb, D. H. F. (2007). Percussive stunning of Atlantic salmon (*Salmo salar*) and the relation between force and stunning. *Aquaculture Engineering* **36**, 192–197.

Electronic Reference

FEAP (2000). *A Code of Conduct for European Aquaculture*. Available at www.feap.com