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***Two hearts are better than one: encouraging collaboration between freshwater fish conservation and freshwater fisheries management***

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**TWO HEARTS ARE BETTER THAN ONE**

“Two hearts are better than one

Two hearts girl get the job done

Two hearts are better than one”

from the Bruce Springsteen composition entitled “Two Hearts”

Our increasingly joined-up research and management world is awash with collaborations, crossovers, interdisciplinarity, multidisciplinary, partnerships, synergies and many other multisyllabic terms which fall into my ears and onto my retinas with great regularity. It is easy to develop a fatigue to these melding innovations, in part because they usually have an appreciable initial cost due to a steep learning curve as one ventures out of one's comfort zone to meet potentially distant (either geographically or more likely intellectually as, for example, when a fish biologist gets to know a sociologist) colleagues (Mooney *et al.*, 2013). However, my argument here is that such engagements are well worth investment and there is one area of collaboration which is particularly worthy of development at this time. The fields of freshwater fish conservation and freshwater fisheries management are closely related for obvious reasons, although they are not completely congruent. Notably, fish species usually differ in their importance for conservation and fisheries interests to the extent that in some circumstances fisheries management may actually compromise fish or wider conservation management. A notorious species in this context is the common carp (*Cyprinus carpio*) which has been widely introduced outside its native range for recreational fisheries purposes, but which can have marked negative impacts on the conservation value of receiving water bodies (e.g. Williams and Moss, 2001). Even for the limited subset of fish species such as the Atlantic salmon (*Salmo salar*) which have both high conservation and high fisheries importance, fisheries management actions such as stocking using fish of non-local origins aimed at quickly increasing catches may have adverse effects for fundamental conservation concerns (e.g. Young, 2013). As a result, fisheries management is in fact frequently identified as a threat to freshwater fish conservation in both the older (e.g. Maitland and

Lyle, 1991) and current (e.g. Arthington *et al.*, 2016) literature. In addition to these sometimes conflicting interactions, it is also notable that the two fields of freshwater fish conservation and freshwater fisheries management have had largely discrete histories with a relatively small number of researchers and managers effectively crossing the divide.

However, in addition to their closely-related taxonomic subjects and despite their largely discrete histories these two fields are now asking increasingly similar research questions. Consequently, both parties would benefit greatly from a better awareness of the findings being produced by the other field and by getting to know who within it is doing what and where. I have attempted to illustrate this commonality of interest in Figure 1 which shows the recent numbers of papers in the journals *Aquatic Conservation: Marine and Freshwater Ecosystems* (hereafter *AQC*, to represent the conservation field) and *Fisheries Management and Ecology* (hereafter *FME*, to represent the fisheries field) that hold a common interest for both freshwater fish conservation and freshwater fisheries management. Note that any detailed comparison of the absolute numbers of such selected papers published in these two journals must take into account the fact that over the analysis period of 2006 to 2015 *AQC* and *FME* published significantly differing totals of 754 and 540 papers, respectively. Nevertheless, this simple analysis clearly shows that readers from the conservation and fisheries fields will find much to interest them in the ‘other’ journal and that this journey is particularly fruitful for those approaching from the conservation perspective. More importantly, while today’s powerful literature search tools can quickly locate individual papers for an enquirer whatever his or her native field, there is also much to be gained from discovering as yet unpublished work still in progress. Such

contemporary awareness is much harder to develop through online searches and generally requires more direct contacts and dialogue.

Incidentally, I hope that my quotation of the term ‘girl’ in the above song lyrics by Bruce Springsteen does not offend anyone’s sensitivities and I shall make positive political use of it here. When I began my research career in the early 1980s, my personal observations suggested that the male:female ratio in the conservation field was something like 3:1, but amongst fisheries professionals it appeared to be more like 10:1. As we approach the late 2010s, it is my impression that the conservation field has now got close to a 1:1 ratio while the fisheries field has progressed to the ratio found in conservation 35 years ago.

### **LET’S BE FRIENDS**

“I been watchin' you a long time  
Trying to figure out where and when  
We been moving down that same line  
Time is now maybe we could get skin to skin”

from the Bruce Springsteen composition entitled “*Let's be Friends (Skin to Skin)*”

A more detailed analysis of the papers shown in Figure 1 confirms that the time is right for freshwater fish conservation and freshwater fisheries management to get a little more intimate. Table 1 shows how these 77 papers of common interest fall into eight subject

categories of my own devising. It is remarkable that only eight reasonably narrow categories are needed to capture all of the papers and that all but one of these categories are covered (to varying extents) by both journals. Several other interesting observations emerge. As one might expect, papers addressing fisheries catch management feature more prominently in *FME* (e.g. Aprahamian *et al.*, 2006) but they do also occur in *AQC* (e.g. Masters *et al.*, 2006). Stocking management is similarly largely the domain of *FME* (e.g. Young, 2013) and it looks like research into this branch of often controversial fisheries science is set to continue for many years to come. In contrast, the management of introduced species is very clearly the category with most overlap between the two journals and accounts for 52% of the papers in *AQC* (e.g. Clavero *et al.*, 2015) and 21% of those in *FME* (e.g. Tricarico, 2012). Papers on population or community monitoring using fisheries data appeared only in *AQC* (e.g. Pinder *et al.*, 2015), which although counter-intuitive at first sight is most probably a reflection of the fact that such monitoring is so commonplace and established in the fisheries field that it now attracts relatively little research in such quarters. Finally, papers that I placed into a category of socio-economic management, in which the focus is very much on humans and human systems rather than on the ‘natural world’, were much more prevalent in *FME* (e.g. Almeida *et al.*, 2009) than in *AQC* (e.g. Everard and Kataria, 2011). In *FME*, such papers were similar in frequency to those on fisheries catch management or introduced species management. Indeed, much of contemporary freshwater fisheries management now addresses the fisher rather than the fish. This socio-economic inclusion has not always been the case and I distinctly remember the late Ron Edwards bemoaning the overly ‘piscocentric’ nature of U.K. freshwater fisheries management as late as the mid-1990s, following a keynote address a decade

earlier in which he first (to the best of my knowledge) raised this issue at a national level (Edwards, 1985). The subsequent common inclusion of socio-economic issues by the fisheries field as evidenced by the prevalence of such papers in *FME* is a significant expansion in scope from which the conservation field could also benefit.

Although space does not permit too much consideration here of why freshwater fish conservation and freshwater fisheries management have shown such a degree of convergence in two of these fields' leading journals, my opinion is that it is largely because both fields have developed from their original 'reductionist' approaches primarily addressing single species into much more habitat- or ecosystem-based approaches. Such holistic perspectives serendipitously promote much higher degrees of overlap. Whatever the reason behind the convergence, it is clearly now a very opportune time for more crossover between the two fields.

## **ON THE TWIN HOLY GRAILS OF MSY AND VALUING NATURE**

"Einstein and Shakespeare, sittin' havin' a beer

Einstein tryin' to figure out the number that adds up to bliss

Shakespeare says, "Man, it all starts with a kiss"

Einstein is scratchin', numbers on his napkin

Shakespeare says, "Man, it's just one and one makes three,

That's why it's poetry"

from the Bruce Springsteen composition entitled “*Frankie Fell in Love*”

In departing from largely single-species approaches and moving to much more habitat- or ecosystem-based frameworks, freshwater fish conservation and freshwater fisheries management have also begun to ask much more of themselves in terms of addressing what really matters to society. As considered in the previous section, fisheries managers now have an extensive history of dealing with such non-piscocentric approaches. For example, the key fisheries concept of Maximum Sustainable Yield (MSY), which attempts to calculate the maximum amount of fish that can be caught without compromising future catches, was hatched in the 1940s, matured in the 1950s and broadened to include a strong socio-economic component in the 1970s (Larkin, 1977). This holy grail of fisheries management is exceedingly data- and computation-hungry and I like to think (wrongly, I know) that in the above song lyrics, Einstein is in fact trying to calculate the blissful MSY of some unspecified fish population.

If achieving MSY with its combination of fish population biology, fisheries catch management and socio-economics is difficult, then I fancy that putting numbers on the somewhat corresponding conservation field ambition of ‘valuing nature’, which attempts to calculate the monetary value of aspects of nature such as an enjoyable walk in the countryside (Turner *et al.*, 2003), is even more challenging because it includes in addition a good deal of human philosophy and psychology. If Einstein is struggling with MSY in the above song lyrics, then Shakespeare’s comments and mathematics illustrate some of

the difficulties of putting a price on a kingfisher (*Alcedo atthis*). Incidentally, Shakespeare also covered the piscatorial side of life and his collected works make approximately 200 references to fish or fishing (Winfield, 2016).

Aye, there's the rub. Both freshwater fish conservation and freshwater fisheries management have now moved on significantly from their 'simple' biological beginnings and both currently seek to incorporate the complexities of human economies and human philosophies. Surely, both fields would and should benefit immensely from an improved sharing of lessons learned and mistakes made.

### **FACING ALL THAT OTHER STUFF TOGETHER**

“Then the lights go out and it's just the three of us

You me and all that stuff we're so scared of”

from the Bruce Springsteen composition entitled “Tunnel of Love”

Although freshwater fish conservation and freshwater fisheries management do have some significant dissimilarities and specific objectives which at certain times and in certain places precipitate confrontations, these differences are minor when viewed in the context of a lot of other stuff from which the two fields have much more to fear. Fresh water is an increasingly contested resource around the world, with conservation and fisheries interests often well down society's priority list (Brummett *et al.*, 2012). Moreover, a wide range of

environmental problems including chemical pollution, climate change, connectivity loss, eutrophication and reckless species introductions pose massive threats to both conservation and fisheries. Enhanced dialogue and understanding between these two fish-focussed endeavours are essential if we are to present a robust and effective common front to these and other challenges, particularly if the lights go out.

### **MEET ME IN A LAND OF HOPE AND DREAMS**

“Big wheels roll through fields

Where sunlight streams

Meet me in a land of hope and dreams”

from the Bruce Springsteen composition entitled “Land of Hope and Dreams”

I expect that most readers of this editorial (assuming that there are some) will be from the field of fish (or at least aquatic) conservation, rather than fisheries management. In addition, as most are operating in a working environment challenged by increasingly limited resources I fear that they may also feel that being encouraged to make new or additional efforts towards their fisheries cousins is a luxury that they can presently ill afford. However, I have managed to straddle this divide over the course of most of my professional life and I have no doubt that it has both benefitted my research and improved what impact I have had in both fields. I am not advocating an overnight transition in approach because substantial change is rarely abrupt in human endeavours, rather the best

kind of change usually comes as the result of many small changes impacting a large body of established practice or experience. With respect to the Bruce Springsteen song “Land of Hope and Dreams” with which I opened this final section, its writer readily acknowledges that it originates in a traditional American gospel song first recorded as “Dis Train” by the Florida and Industrial Institute Quartette in 1922. This simple but evocative composition was subsequently recorded or performed as “This Train” or “This Train is Bound for Glory” through following decades by many others, including most recently (to the best of my knowledge) in 2011 by a colourful assemblage of Mumford & Sons, Edward Sharpe and the Magnetic Zeros and Old Crow Medicine Show during the inaugural Railroad Revival Tour of that year. Despite approaching its recorded centenary, this remarkable song has managed to maintain its vitality and relevance in part by rejuvenation through repeated collaborations between musical genres. I believe that such cross-fertilisation is and will continue to be a similarly invigorating and productive process for freshwater fish conservation and freshwater fisheries management and, living in my personal world of hope and dreams, I heartily encourage and anticipate such activities.

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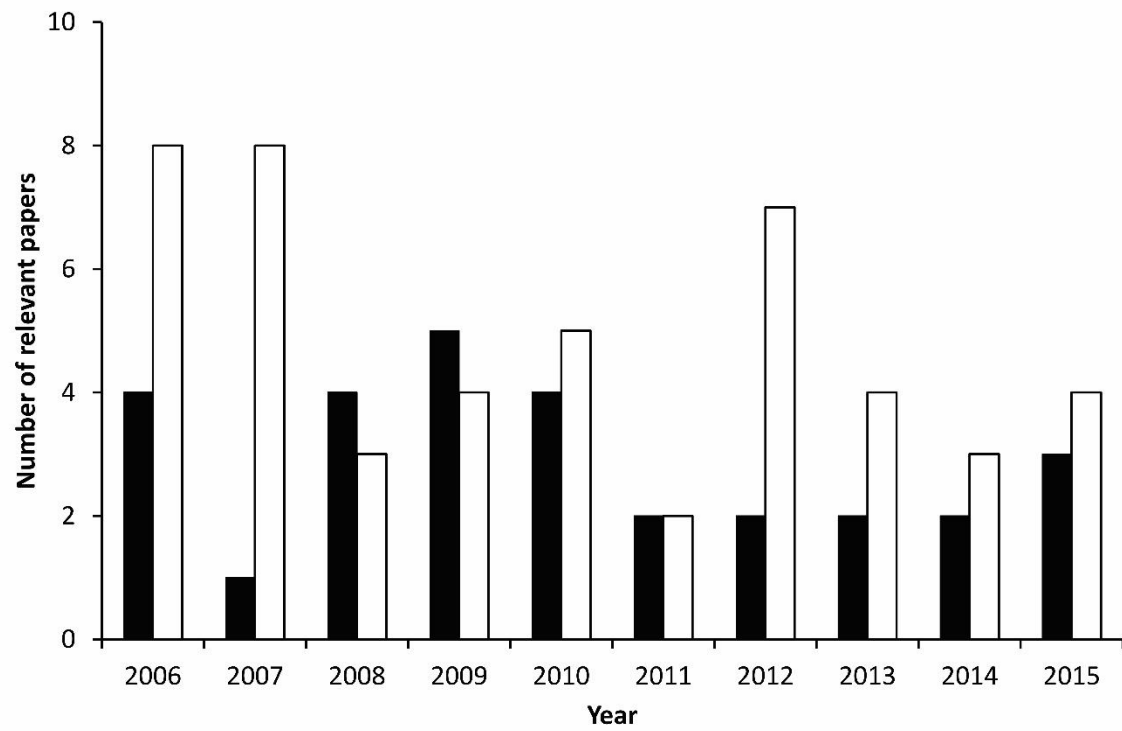
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## FIGURE LEGEND

Figure 1. Numbers of papers relevant to collaboration between freshwater fish conservation and freshwater fisheries management published annually in the journals *Aquatic Conservation: Marine and Freshwater Ecosystems* (closed columns, N = 29 papers) and *Fisheries Management and Ecology* (open columns, N = 48 papers) between 2006 and 2015.



## TABLE LEGEND

Table 1. Numbers of papers by category relevant to collaboration between freshwater fish conservation and freshwater fisheries management published in the journals *Aquatic Conservation: Marine and Freshwater Ecosystems* (AQC, N = 29 papers) and *Fisheries Management and Ecology* (FME, N = 48 papers) between 2006 and 2015.

Category	Journal	
	<i>AQC</i>	<i>FME</i>
Fisheries catch management	3	11
Stocking management	1	8
Introduced species management	15	10
Reintroduced species management	1	1
Predator species management	1	4
Habitat management	4	4
Population or community monitoring	3	0
Socio-economic management	1	10