Inter-Research Science Publisher
Aquaculture Environment Interactions
Volume 17:21–26
Published February 6, 2025
https://doi.org/10.3354/aei00491

OPEN ACCESS

COMMENT

River Erriff sea trout *Salmo trutta* revisited: Comment on Gargan et al. (2016)

Martin O'Farrell*

Aztec Management Consultants, Killiney, Co. Dublin A96 YR29, Ireland

ABSTRACT: I point out errors in data presentation and interpretation and weaknesses in the methods used by Gargan et al. (2016; Aquacult Environ Interact 8:675–689) to describe sea trout and fisheries in the Erriff River system, Ireland. Based on my findings, 13 of the 15 response variables which relate to sea trout are compromised. As a result of these failures, the overall findings and conclusions by Gargan et al. (2016) may also be compromised and invalidate their assessment of the characteristics of sea trout in the Erriff system, especially for the years 1985–2004. There are also serious chronological errors in Gargan et al. (2016), some of which have recently been corrected (see https://www.int-res.com/abstracts/aei/v8/c_p675-689/). Their analysis concerns the structure of sea trout populations before and after the widely reported collapse of West of Ireland sea trout stocks in 1989/1990 — but not before and after the commencement of salmon farming in Killary Harbour as originally alleged in Gargan et al. (2016). With regard to the remaining 2 response variables, which relate to sea lice, no attempt has been made in Gargan et al. (2016) to link sea lice to changes in the Erriff sea trout population.

KEY WORDS: Fish · Sea trout · Fisheries · Western Ireland

1. INTRODUCTION

Gargan et al. (2016) described sea trout and their fisheries in the Erriff River system, Ireland, based on rod catch and downstream trap counts in terms of their characteristics (length and sea age distributions, spawning histories, egg deposition and smolt age and length). Since I am familiar with this river system from working on the River Erriff Research Programme in 1983–1988 and 1990, I noticed several errors in the data presented in the article, as well as in some of the authors' interpretations, and detail these in the following sections. These errors may compromise the overall findings and conclusions of Gargan et al. (2016). A re-presentation and re-interpretation of the data may eliminate these discrepancies and likely lead to different conclusions.

2. SALMON FARMING IN KILLARY HARBOUR, NEAR THE ERRIFF RIVER SYSTEM

Gargan et al. (2016, p. 675) claim that results of this long-term monitoring programme on the Erriff 'suggest that the introduction of salmon farming into the local estuary [Killary Harbour] most likely contributed to the observed changes in sea trout population dynamics'. The content of their article does not deal with this suggestion at all. While salmon farming commenced in 1986, the first information on sea lice (*Lepeophtheirus salmonis*) levels on farmed salmon in Killary Harbour and on sea trout post-smolt in the Erriff River presented in Gargan et al. (2016) was obtained in 1991, 2 yr after the sea trout collapse in the West of Ireland (Anonymous 1993) and 5 yr after the commencement of salmon farming in Killary Harbour.

*Corresponding author: martin@azteconsultants.ie

Publisher: Inter-Research · www.int-res.com

Thus, the most obvious flaw in Gargan et al. (2016) is that sea trout population characteristics since 1990 were compared with those during the period 1985–1988, which was originally defined as pre-dating salmon farming in Killary Harbour, close to the Erriff system. But as Gargan et al. (2016) pointed out themselves, salmon farming in Killary Harbour commenced in 1986. Thus, the sea trout population characteristics pertaining to 1985–1988 apply to a period that is at least partly contemporaneous with salmon farming, making comparisons meaningless. What Gargan et al. (2016) actually do is describe differences in Erriff sea trout characteristics before and after the widely recognised 1989/1990 sea trout collapse in the West of Ireland. Accordingly, I see no basis for the suggested relationship between the introduction of salmon farming in Killary Harbour and sea trout population dynamics in Gargan et al. (2016).

If sea lice infestation data for wild Erriff sea trout were meaningful for the sea trout population, a correlation should exist between these sea lice infestation levels and, e.g., sea trout rod catches in the same year, sea trout kelt numbers the following year, or perhaps sea trout runs into the Erriff the same year. However, no significant relationships are apparent in Table 1 of Gargan et al. (2016) for the years 1991–2004 (see my Table 1) between Killary salmon mean lice numbers for April, May, or the average for April and May, and (1) the number of Tawnyard Lough sea trout kelts per year (1991–2003), (2) the annual Erriff Fishery sea trout rod catch (1991–2004), and (3) the annual Erriff sea trout run (1998–2004) (Erriff River sea trout counts for these years from Millane et al. 2017). Similarly, no significant relationship is apparent between mean lice numbers on Erriff sea trout post-smolt (1 May–30 June; no data for 1992 and 2002) and (1) the number of Tawnyard Lough sea trout kelts per year (1991–2004), (2) the annual Erriff Fishery sea trout rod catch (1991–2004), and (3) the annual Erriff sea trout run (1998–2004).

3. SEA AGE, LENGTH FREQUENCY DISTRIBUTION AND SPAWNING HISTORY OF TAWNYARD LOUGH SEA TROUT KELTS

The results of 4 yr (1985–1988) of sea trout kelt census work at the Tawnyard Lough downstream trap were published by O'Farrell & Whelan (1991) as shown in Table 2. Table 4 of Gargan et al. (2016) contains many errors and is not in agreement with O'Farrell & Whelan (1991) with regard to the sea age distribution of sea trout kelts for the years 1985–1988. These discrepancies are examined in Texts S1 & S2 of

Table 1. Relationships between mean salmon lice levels on farmed salmon or on wild sea trout post-smolt and various sea trout population parameters. As the variables are all independent, Pearson product-moment correlation coefficient was used to measure the strength and direction of association between the pairs of variables measured. Significant correlations (2-tailed *t*-test, $p < 0.05$) are indicated in **bold**. Number of Tawnyard Lough sea trout kelts (yr^{-1}) indicates that the variables highlighted in **bold** below were compared with the number of sea trout kelts recorded the following year

	Pearson's *r*	*t*	n	p
Killary salmon mean lice level (April) AND:				
Erriff sea trout mean lice level	0.682	2.951	12	**0.014**
Number of Tawnyard Lough sea trout kelts (yr^{-1})	−0.399	−1.446	13	0.175
Erriff sea trout rod catch (1991–2004)	−0.278	−1.003	14	0.335
Erriff sea trout run (1998–2004)	−0.574	−1.569	7	0.177
Killary salmon mean lice level (May) AND:				
Erriff sea trout mean lice level	0.584	2.278	12	**0.045**
Number of Tawnyard Lough sea trout kelts (yr^{-1})	−0.422	−1.546	13	0.150
Erriff sea trout rod catch (1991–2004)	−0.305	−1.113	14	0.287
Erriff sea trout run (1998–2004)	0.314	0.741	7	0.491
Killary salmon mean lice level [(April + May)/2] AND:				
Erriff sea trout mean lice level	0.642	2.515	11	**0.032**
Number of Tawnyard Lough sea trout kelts (yr^{-1})	−0.590	−2.197	11	0.055
Erriff sea trout rod catch (1991–2004)	−0.297	−1.078	14	0.301
Erriff sea trout run (1998–2004)	−0.349	−0.834	7	0.442
Erriff sea trout mean lice level AND:				
Delphi sea trout lice level	0.593	1.805	8	0.121
Number of Tawnyard Lough sea trout kelts ($yr^{-1}1$)	−0.337	−1.074	11	0.310
Erriff sea trout rod catch (1991–2004)	−0.189	−0.611	12	0.554
Erriff sea trout run (1998–2004)	0.574	1.403	6	0.233

Table 2. Sea age structure (%) of migratory trout kelts (1985–1988) from (A) Table 4 in O'Farrell & Whelan (1991) and (B) Table 4 in Gargan et al. (2016)

Sea age	1985	1986	1987	1988
(A)	(n = 412)	(n = 499)	(n = 489)	(n = 610)
0	55.5	66.9	55.8	43.1
1	29.8	21.0	33.9	35.7
2	12.1	8.4	7.9	16.7
3	1.7	2.6	2.0	3.8
4	0.7	1.0	0.2	0.5
(B)	(n = 409)	(n = 422)	(n = 423)	(n = 242)
0	56.0	79.4	65.5	42.6
1	30.1	18.0	32.6	39.7
2	12.2	2.6	1.9	16.1
3	0	0	0	1.7
4	0.7	0	0	0

the Supplement to this Comment at www.int-res.com/articles/suppl/q017p021_supp.pdf.

4. SEA TROUT EGG DEPOSITION IN THE TAWNYARD LOUGH SUBCATCHMENT OF THE ERRIFF RIVER SYSTEM

Gargan et al. (2016; their Fig. 6) estimated sea trout egg deposition using the lengths of sea trout kelts recorded in the Tawnyard Lough trap each year (typically March–May), the 1985 fork length–fecundity linear regression equation for Erriff sea trout (from O'Farrell et al. 1989), the maturation patterns of female sea trout in Tawnyard Lough in 1983 and 1984 based on O'Farrell (1986) (data for the years 1983–1985 are presented in Table S1 of the Supplement to this Comment), an estimate of overwinter mortality (36%) and inclusion of sea trout taken on rod and line in Tawnyard Lough the previous year. Using ImageJ software to measure each column in their Fig. 6 for the 1984–1987 egg deposition years, the estimated values averaged 269 705 for each of those 4 yr. There are several errors and omissions in the methodology deployed in Gargan et al. (2016). For the sake of brevity, these are detailed in Texts S1 & S2. The most obvious omission in Gargan et al. (2016) is the absence of any reference to sea trout sex ratio in their calculation of population fecundity.

5. SEA TROUT SMOLT AGE AND LENGTH

Gargan et al. (2016) present information in their Table 3 on age distributions and lengths of sea trout

Table 3. Comparison of Tawnyard Lough sea trout smolt fork-length statistics from Gargan et al. (2016) and O'Farrell (unpubl. data) for the years 1988 and 1990

	Gargan et al. (2016)			O'Farrell (unpubl. data)		
	Mean length (cm)	95% CI	n	Mean length (cm)	95% CI	n
1988	20.00	0.344	83	19.73	0.119	874
1990	20.06	0.392	64	19.83	0.064	2362

smolt migrating from Tawnyard Lough for the years 1985–2004, but in all years except 1986 (when 251 smolt were examined), the numbers of smolt aged and measured for length (28–95 fish) are inadequate to define the percentage contribution made by smolt of 2, 3 and 4 yr of age or the mean lengths of migrating smolt. For example, the data from 1990 show that there are many instances where daily mean lengths are significantly different (based on non-overlapping 95% CI; Fig. 1). Accordingly, smolt length distribution cannot be reliably described using small sample sizes as in Gargan et al. (2016). By coincidence, length data from small and large data sets may sometimes agree (e.g. in 1988 and 1990; Table 3), but this does not negate the unreliability of using small sample sizes. The same weakness likely applies to smolt age profiles presented in Table 3 of Gargan et al. (2016).

6. ROD CATCH AND ROD EFFORT INFORMATION FOR THE ERRIFF FISHERY AND CONNEMARA DISTRICT SINCE 1990

Fig. 2 of Gargan et al. (2016) presents information on sea trout rod catches for the Erriff Fishery and Connemara District for the years 1975–2004 (a similar graphic for Connemara District sea trout fisheries was included as Fig. 3.3 for the years 1974–2003 in Gargan et al. 2006). Both the Erriff Fishery and Connemara District show a collapse in rod catches in 1989. Gargan et al. (2016, p. 679) also state that 'After 1990, a bylaw was enforced, which permitted angling only on a catch-and-release basis in both the Erriff and Connemara fisheries. The introduction of the catch-and-release bylaw may have reduced fishing effort in Connemara and Erriff fisheries'. In my view, there was a significant reduction in sea trout angling effort in the Erriff and other Connemara and south Mayo sea trout fisheries post-1990. For the Costello & Fermoyle Fishery, one of the most productive sea trout fisheries in south Connemara, the average number of rod days fished during the years 1985–

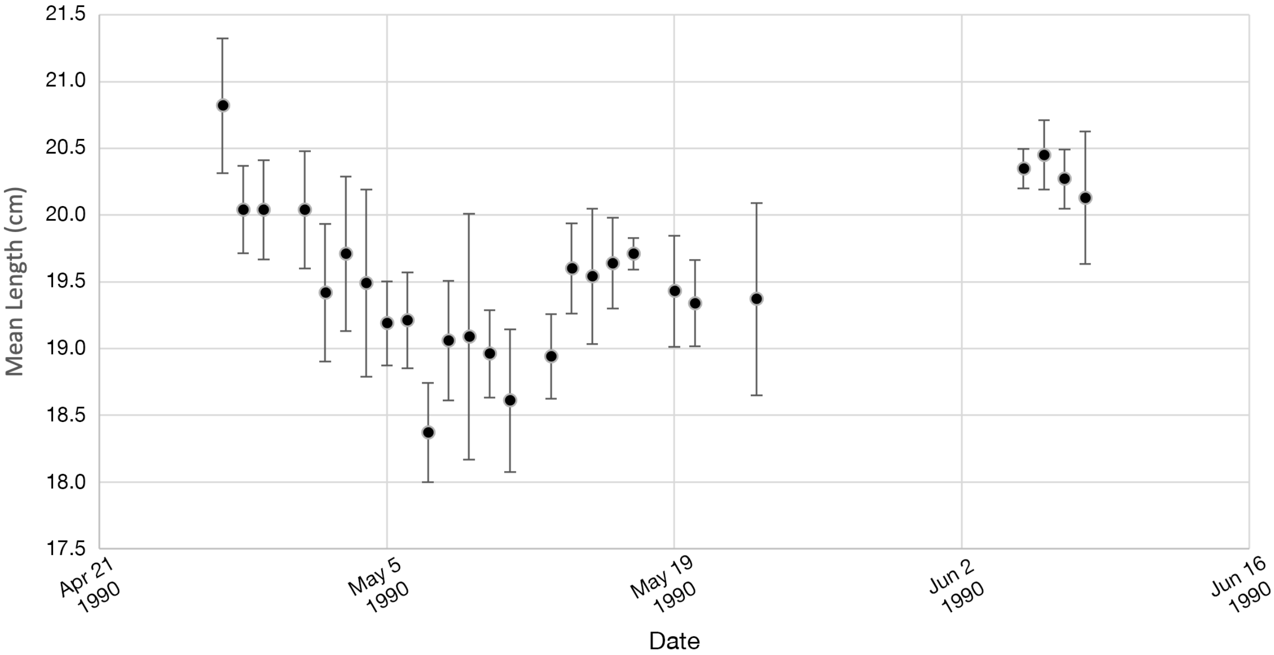

Fig. 1. Daily mean fork-lengths (±95% CI) of sea trout smolt recorded at the Tawnyard Lough trap in 1990 (n = 2342) (O'Farrell unpubl. data). Note: 20 additional sea trout smolt were measured but are not included in this figure, because they migrated on days when low numbers were recorded

1988 was 1442, while the average number of rod days fished during the years 1993–1996 was 322, which represents a 78% reduction in fishing effort (O'Farrell 1996). No angling occurred on the Burrishoole Fishery in south Mayo between 1997 and 2007 (Millane et al. 2017). According to the Erriff Fishery Newsletter for 1998 (Anonymous 1999), Tawnyard Lough on the Erriff Fishery was closed to all angling during the years 1989–1993, inclusive. With regard to the Erriff River, which is essentially a salmon fishery where sea trout represent a bycatch (although sea trout are the main quarry for anglers on Tawnyard Lough), there is the added complication that the annual salmon and sea trout rod catches tend to be inversely related (Fig. 2); this implies that in years of high salmon rod catch (mainly 1SW fish), anglers are perhaps less interested in catching sea trout, of which approximately 80% are 0SW fish (O'Farrell & Whelan 1991).

Finally, Gargan et al. (2016) also state that Tawnyard Lough is the principal sea trout fishery on the Erriff Fishery. Fig. 3 shows that this is not the case, with the vast majority of the annual sea trout catch on the fishery coming from the Erriff River. I have estimated that for the years 1998–2003, an average of

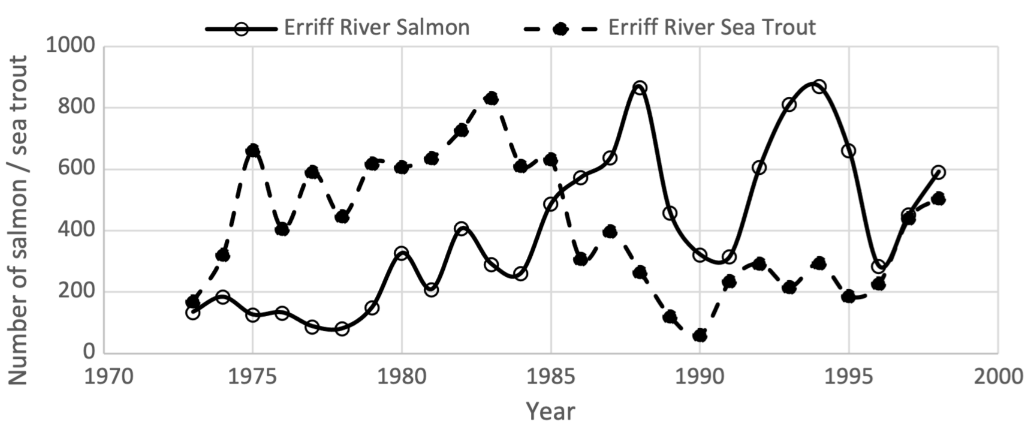

Fig. 2. Relationship between numbers of salmon and sea trout taken by anglers on the Erriff River (1973–1998). Data for 1973–1983 from O'Farrell & Whelan (1984), data for 1984–1988 from O'Farrell et al. (1990) and O'Farrell (1996), and data for 1989–1998 from Anonymous (1999)

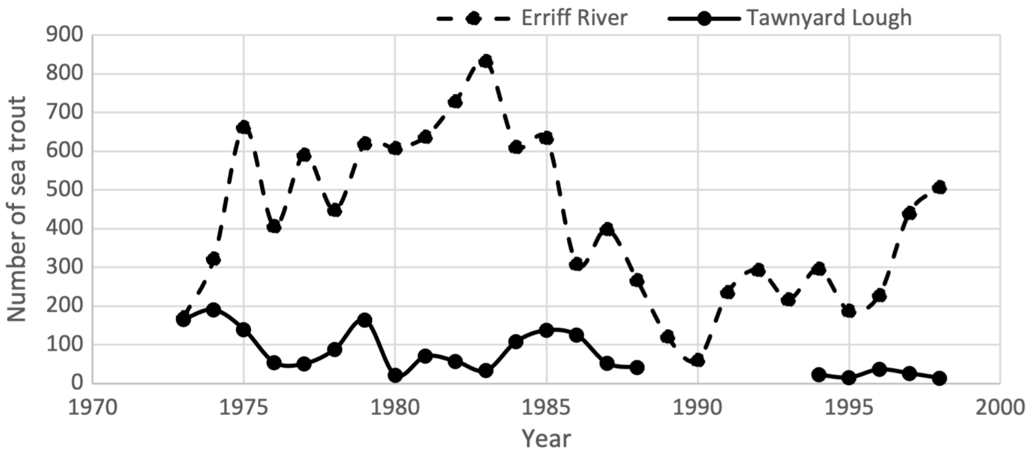

Fig. 3. Numbers of sea trout taken by anglers on the Erriff River and on Tawnyard Lough (1973–1998). Note Tawnyard Lough closed to angling from 1989–1993, inclusive. Data for 1973–1983 from O'Farrell & Whelan (1984), data for 1984–1988 from O'Farrell (1996), and data for 1989–1998 from Anonymous (1999)

29.7% (95% CI 11.5) of sea trout that entered the Erriff River ascended into Tawnyard Lough annually. This estimate is based on upstream counts of sea trout ascending the Erriff River (Millane et al. 2017; data extracted using ImageJ software from their Fig. 2) and downstream counts of sea trout kelt in the Tawnyard Lough trap, assuming a 30% overwintering mortality in Tawnyard Lough. Thus, Tawnyard Lough is a sea trout fishery on the Erriff system, but not the principal one.

It is also clear that there has been a large reduction in angling effort on Tawnyard Lough since the 1989/1990 sea trout collapse. For example, the average number of rod days on Tawnyard Lough during the years 1984–1988 was 153 (95% CI = 37) (O'Farrell 1996), while total fishing effort on the lough during the years 1989–1993 inclusive was zero, and in 1998 it was 11 rod days (Anonymous 1999). Accordingly, sea trout rod catch on the Erriff Fishery is an unsuitable and unreliable response variable, because fishing effort for sea trout after the 1989 stock collapse was significantly lower than that which applied prior to the stock collapse.

7. CONCLUSION

In summary, 13 of the 15 sea trout response variables examined in Gargan et al. (2016) are compromised and therefore invalidate the statistical model results presented by the authors. Gargan et al. (2016) have not attempted to relate the 2 sea lice response variables to sea trout populations in the Erriff system yet claim in their abstract (p. 675) that their findings 'suggest that the introduction of salmon farming into the local estuary [Killary Harbour] most likely contributed to the observed changes in sea trout population dynamics', a claim which is not based on the content of their article. Many of the issues I have pointed out in this Comment are a result of the nuances of sea trout biology in the West of Ireland (Text S3) receiving inadequate consideration or incorrect interpretation by Gargan et al. (2016). As a consequence, the overall conclusions arrived at by Gargan et al. (2016) may not be valid.

Acknowledgements. I thank Dr James Forde for assistance with statistical analysis.

LITERATURE CITED

Anonymous (1993) Report of the Sea Trout Working Group. Department of the Marine, Dublin

Anonymous (1999) Erriff Fishery Newsletter. Central Fisheries Board, Dublin

Gargan PG, Poole WR, Forde GP (2006) A review of the status of Irish sea trout stocks. In: Harris GS, Milner NJ (eds) Sea trout: biology, conservation and management. Proc 1st International Sea Trout Symposium, July 2004. Blackwell Publishing, Oxford, p 25–44

Gargan PG, Kelly FL, Shephard S, Whelan KF (2016) Temporal variation in sea trout *Salmo trutta* life history traits in the Erriff River, western Ireland. Aquacult Environ Interact 8:675–689

Millane M, Shephard S, White J, O'Maoileidigh N and others (2017) Estimating salmonid angling exploitation rates from systems monitored by fish counters, and potential application to fisheries management in Ireland. In: Harris GS (ed) Sea trout: science and management. Proc 2nd International Sea Trout Symposium, 20–22 October 2015, Dundalk, Ireland. Matador, Leicestershire, p 167–184

O'Farrell MM (1986) River Erriff Research Programme: Report 2 (A report prepared for the Central Fisheries Board, Dublin). Aztec Management Consultants, Dublin

O'Farrell MM (1996) 1996 sea trout angling survey of selected fisheries in the West of Ireland. A report commissioned by Killary Salmon Company and Emerald Fisheries Ltd. Aztec Management Consultants, Dublin

O'Farrell MM, Whelan KF (1984) River Erriff Research Programme: Report 1. Central Fisheries Board, Dublin

O'Farrell MM, Whelan KF (1991) Management of migratory trout (*Salmo trutta* L.) populations in the Erriff and other catchments in Western Ireland. In: Steer MW (ed) Irish rivers: biology and management. Royal Irish Academy, Dublin, p 99–112

O'Farrell MM, Whelan KF, Whelan BJ (1989) A preliminary appraisal of the fecundity of migratory trout (*Salmo trutta*) in the Erriff catchment, Western Ireland. Pol Arch Hydrobiol 36:273–281

O'Farrell MM, Whelan KF, Joyce T, Whelan BJ (1990) The performance of the River Erriff salmon fishery (1984–1988). In: Cross T, Ottway B (eds) Institute of Fisheries Management Annual Study Course, 11–13 September 1989, Galway

Editorial responsibility: Christine Paetzold, Oldendorf/Luhe, Germany
Submitted: November 21, 2021; Accepted: December 12, 2024
Proofs received from author(s): January 24, 2025