Some problems for Sea trout in and around Wester Ross

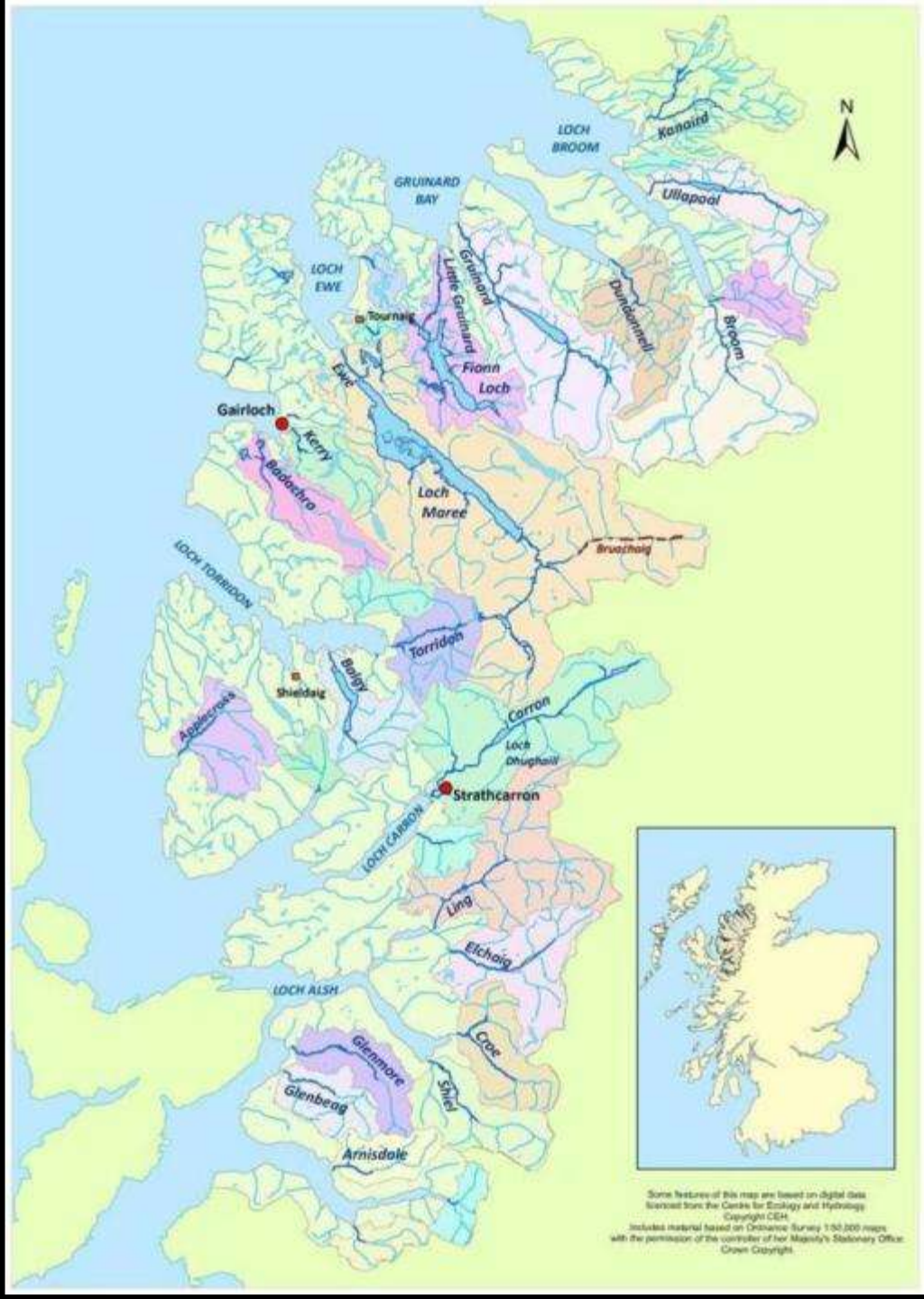
Adapted from presentation given at Sea trout and Sea lice Management workshop, Aultbea, 20th February 2014

Peter Cunningham
info@wrft.org.uk

with support from
Wester Ross Area Salmon Fishery Board

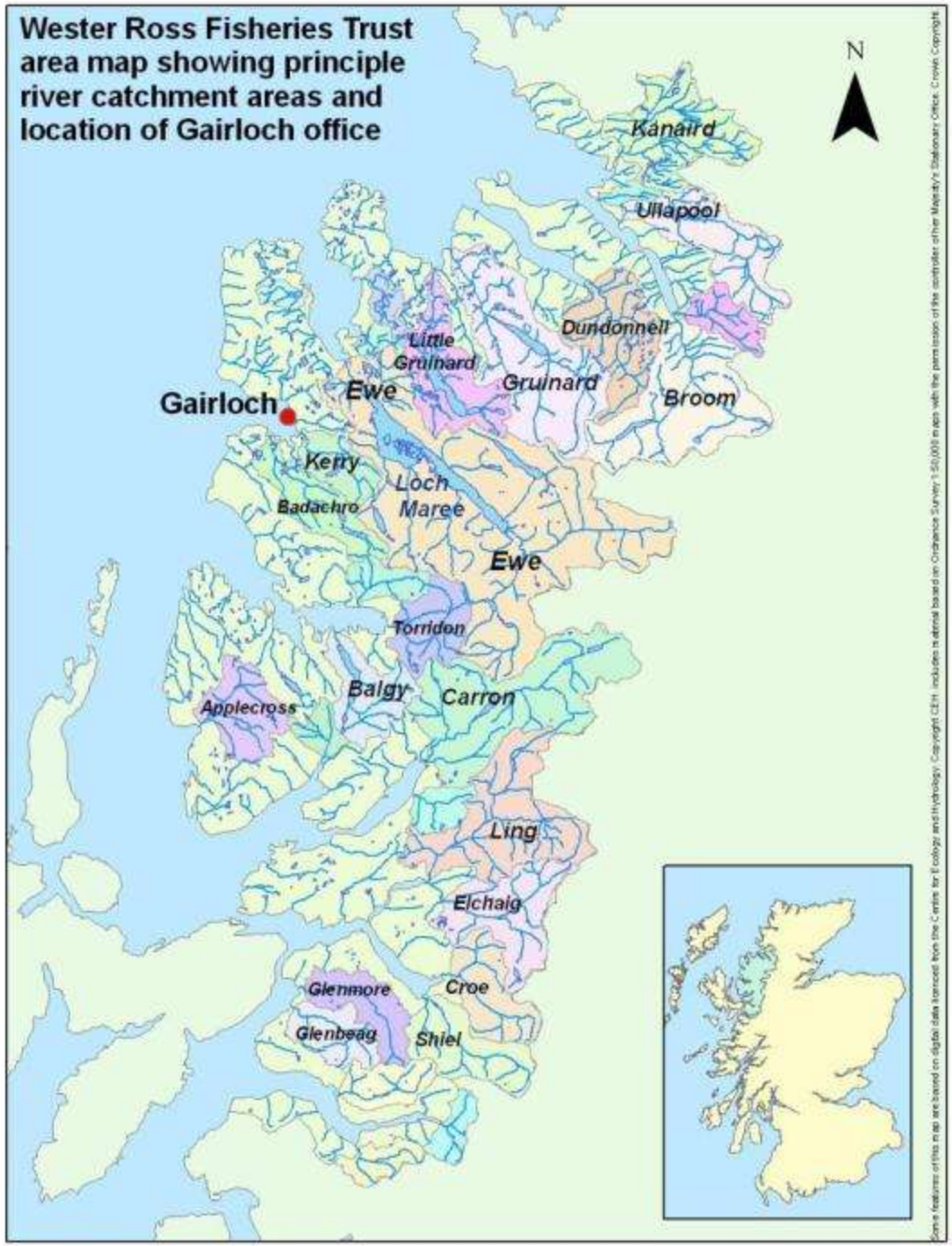
The Wester Ross Fisheries Trust was set up in 1996

To maximise and sustain the natural productivity of wild salmonid fisheries in the rivers and lochs of Wester Ross.



Summary

1. Sea trout and sea lice in Wester Ross
2. Other factors affecting sea trout populations in Wester Ross
3. Proposal for a Scottish Sea Trout Project aimed at improving our understanding for sea trout conservation and management purposes



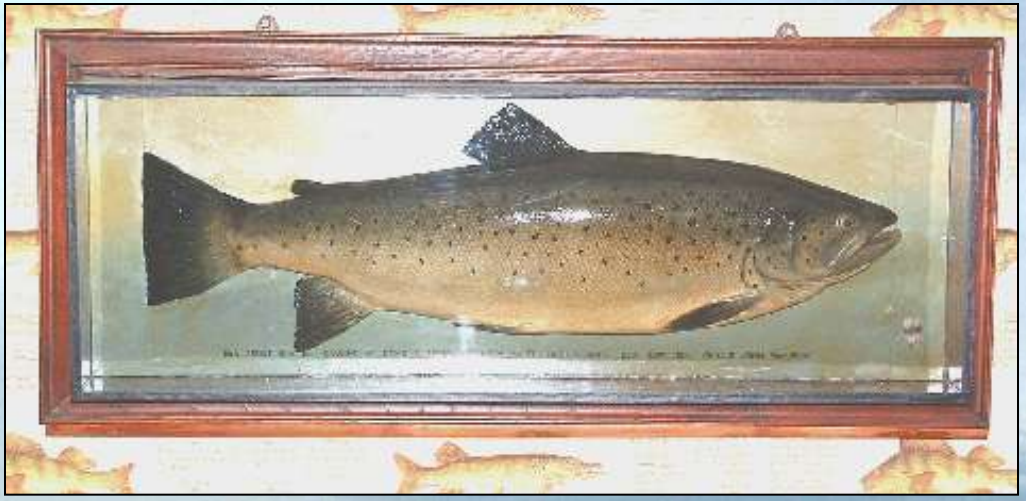
Loch Maree

Formerly the most productive sea trout fishery within the northwest of Scotland.

The Loch Maree Sea trout Fishery

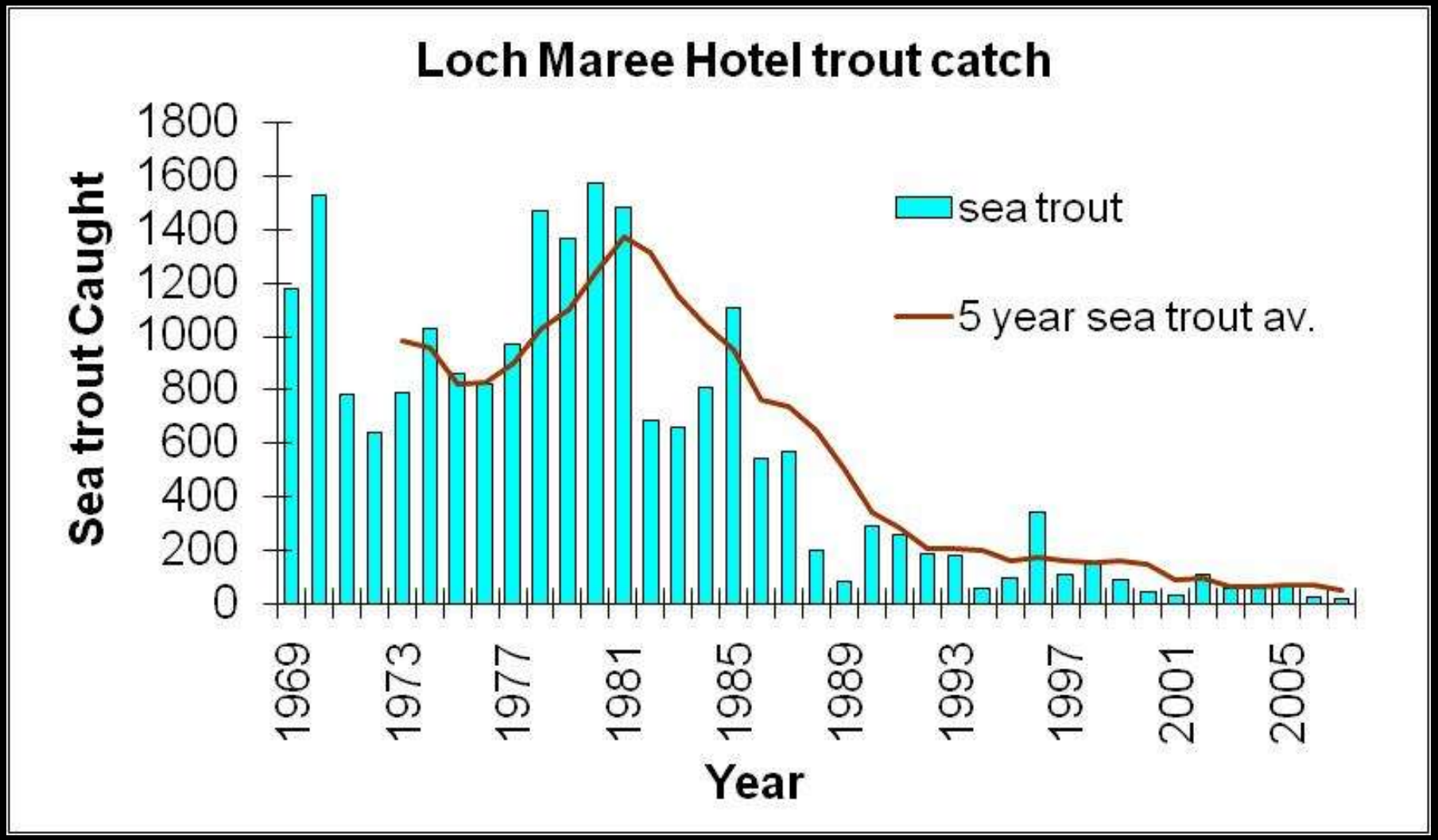
18+ boats with ghillies through summer and early autumn


The art of dapping
was developed on
Loch Maree. . .

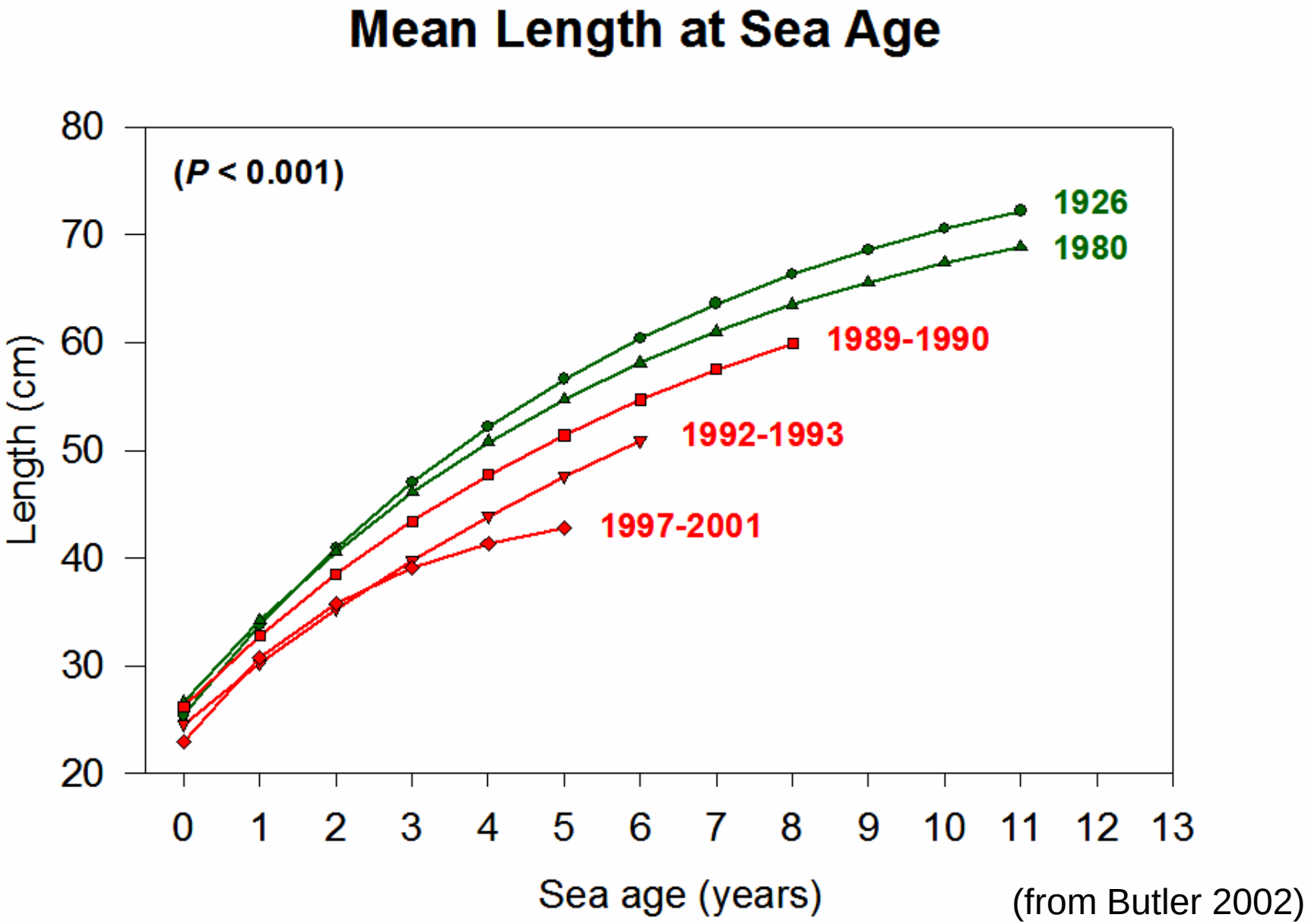


Former British record rod caught sea trout

The Loch Maree sea trout fishery collapsed at the end of the 1980s

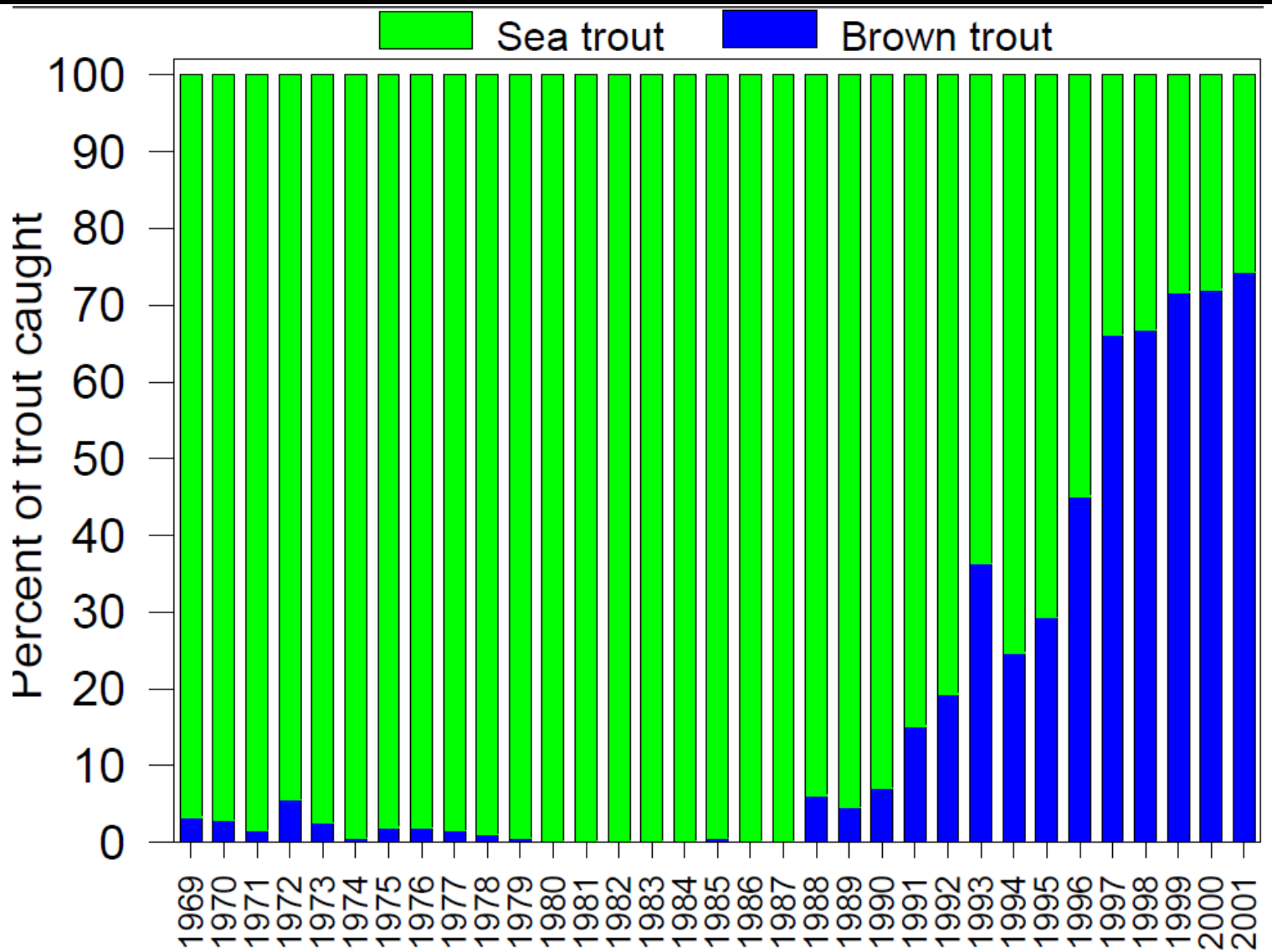


Marine growth rates and survival of Loch Maree sea trout declined . . .



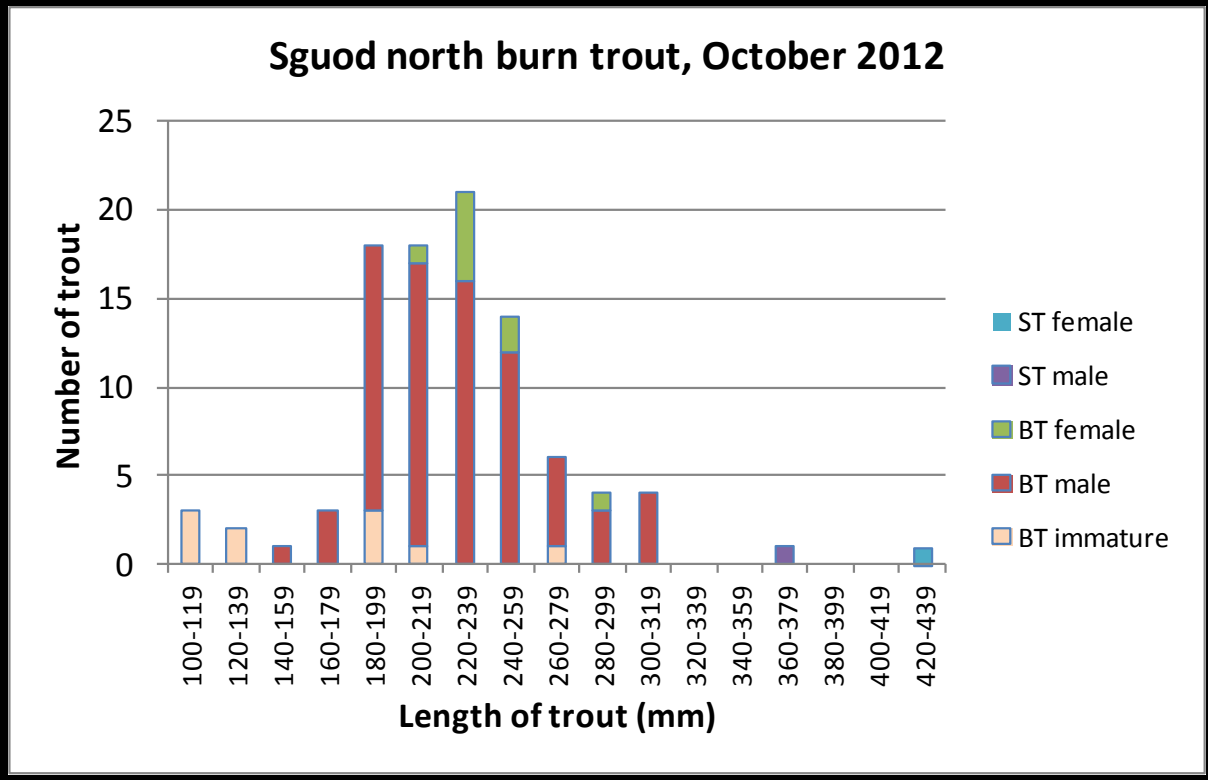
(from Butler 2002)

The proportion of brown trout in the Loch Maree rod catch of trout increased in the early 1990s.



In recent years sea trout have been very scarce in some spawning burns . . .

Sguod spawning burn by Loch Ewe, October 2012



Mature female trout

Mature male trout

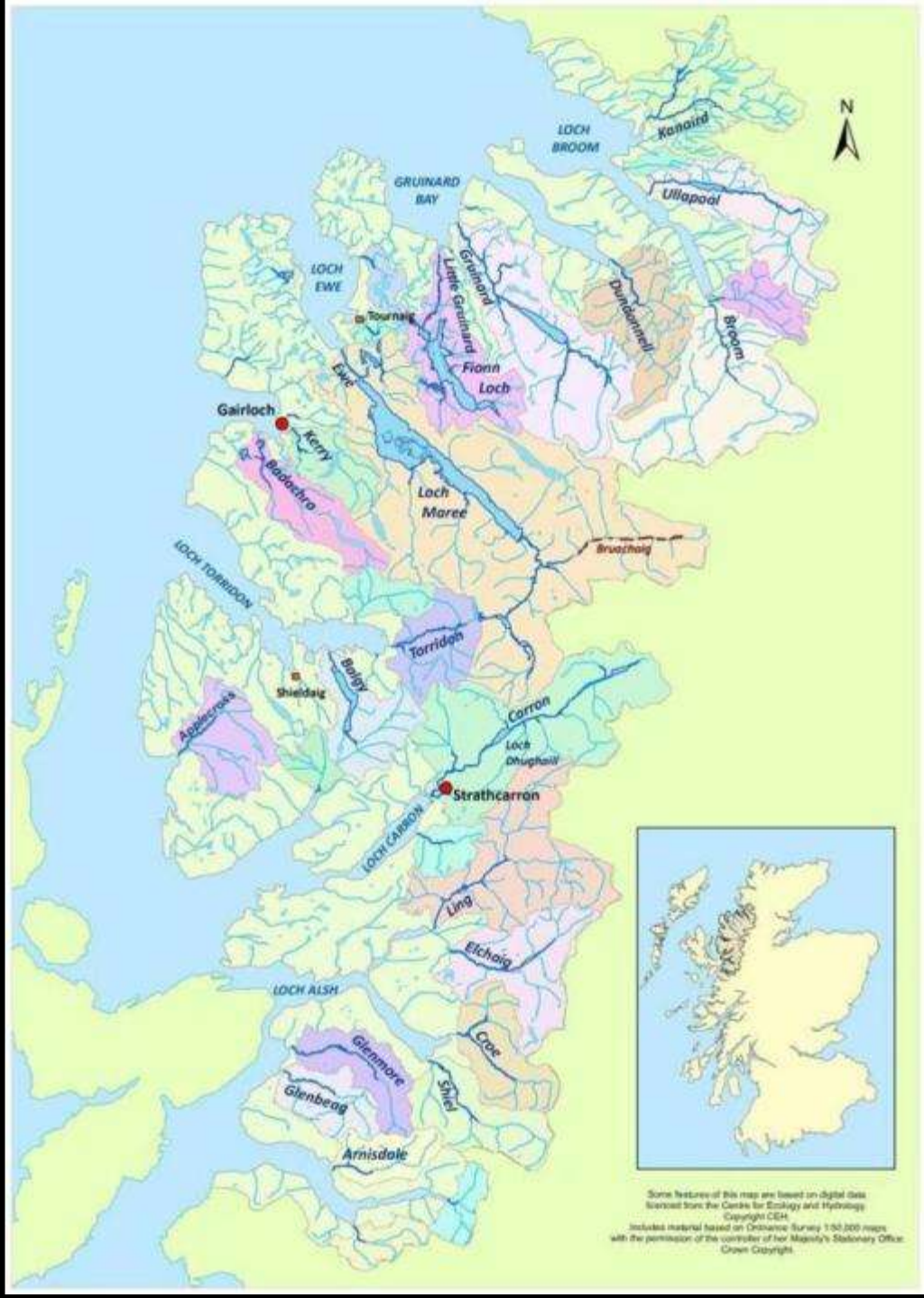
Brown trout, male, 700mm, Ewe system, 27th October 2011, aged at 12 years old.

The Wester Ross Fisheries Trust was set up in 1996 . . .

Objective 2

Restoration of sea trout production in the River Ewe – Loch Maree system.

WRFT Fisheries Management Plan 2009+



Problems for sea trout in the marine environment include parasitic sea lice infection . . .

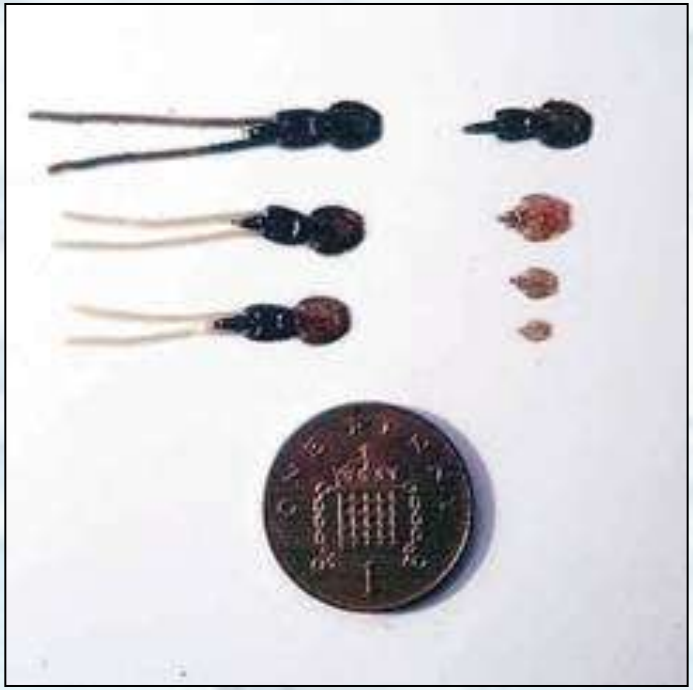
Sea trout monitoring in the sea

- to find out about sea louse burdens.

RAFTS

The Scottish Government

Boor Bay, Loch Ewe
31st August 2011



Lepeophtheirus salmonis

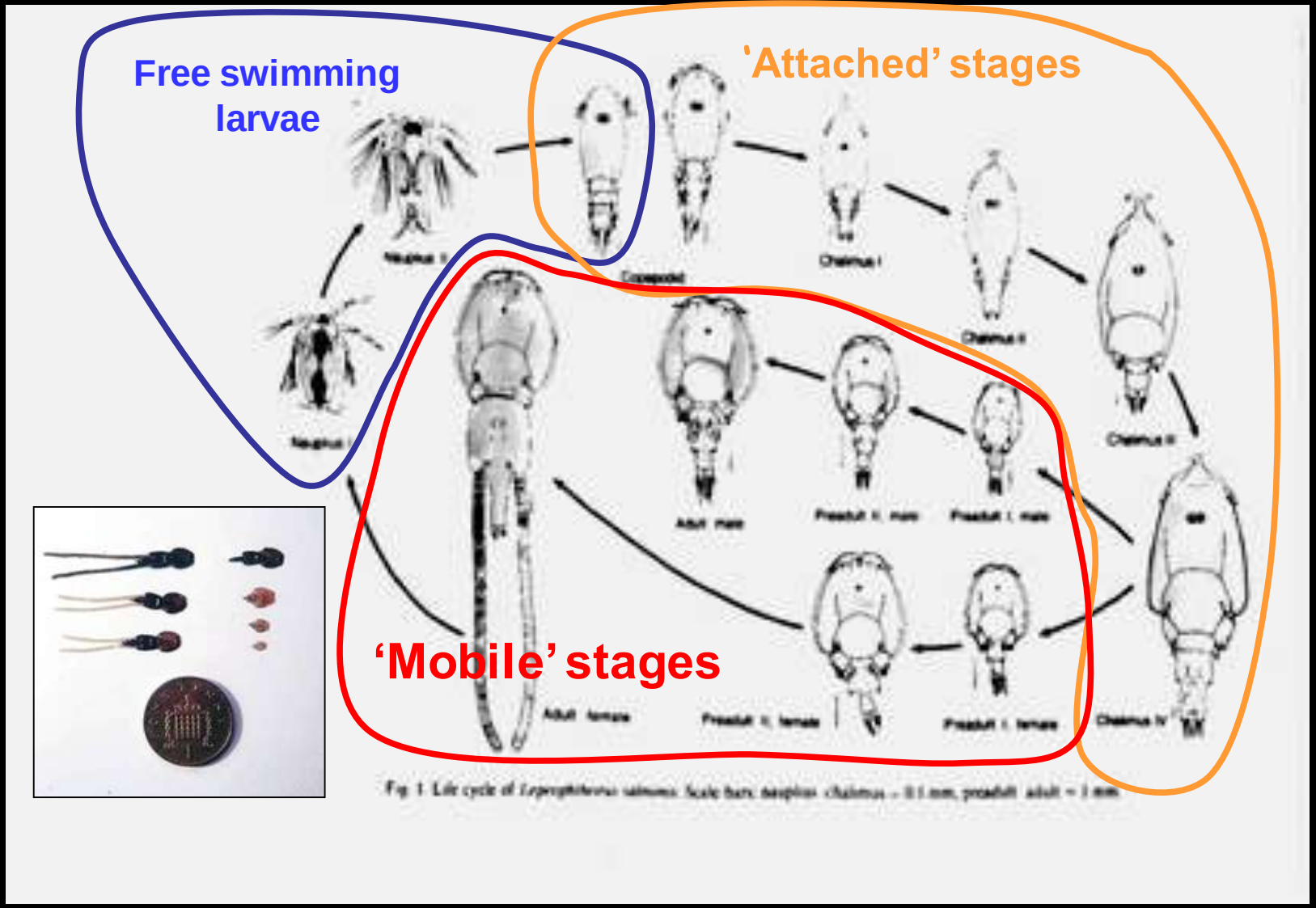
(James Butler)

- Sea lice are naturally occurring parasites of fish.

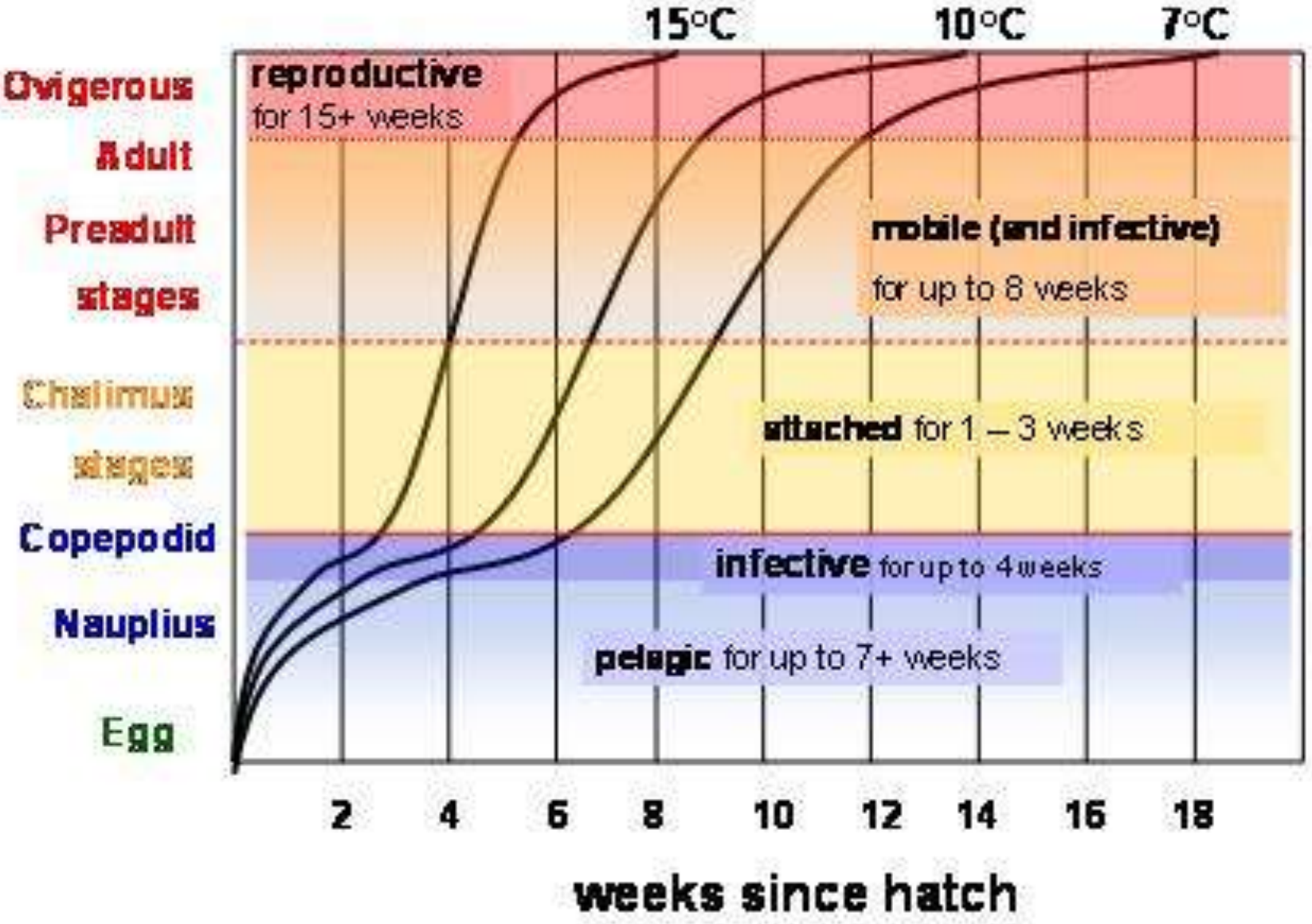
- Larval *Lepeophtheirus salmonis* attach to salmon and sea trout and grow by eating the mucus, blood and skin of their host fish.

Lepeophtheirus salmonis : life cycle [to be corrected!]

[PS: the 4 Chalimus stages shown are now known to represent 2 male and 2 female Chalimus stages]



Lepeophtheirus salmonis : rates of development



Based on 'EWOS guide', Heuch et al. (2005), Boxaspen (2006), Revie et al (2009)

Sweep netting for sea trout (February to October . . .)

RAFTS

The Scottish Government

Kildonan Bay,

Little Loch Broom,

2nd May 2008

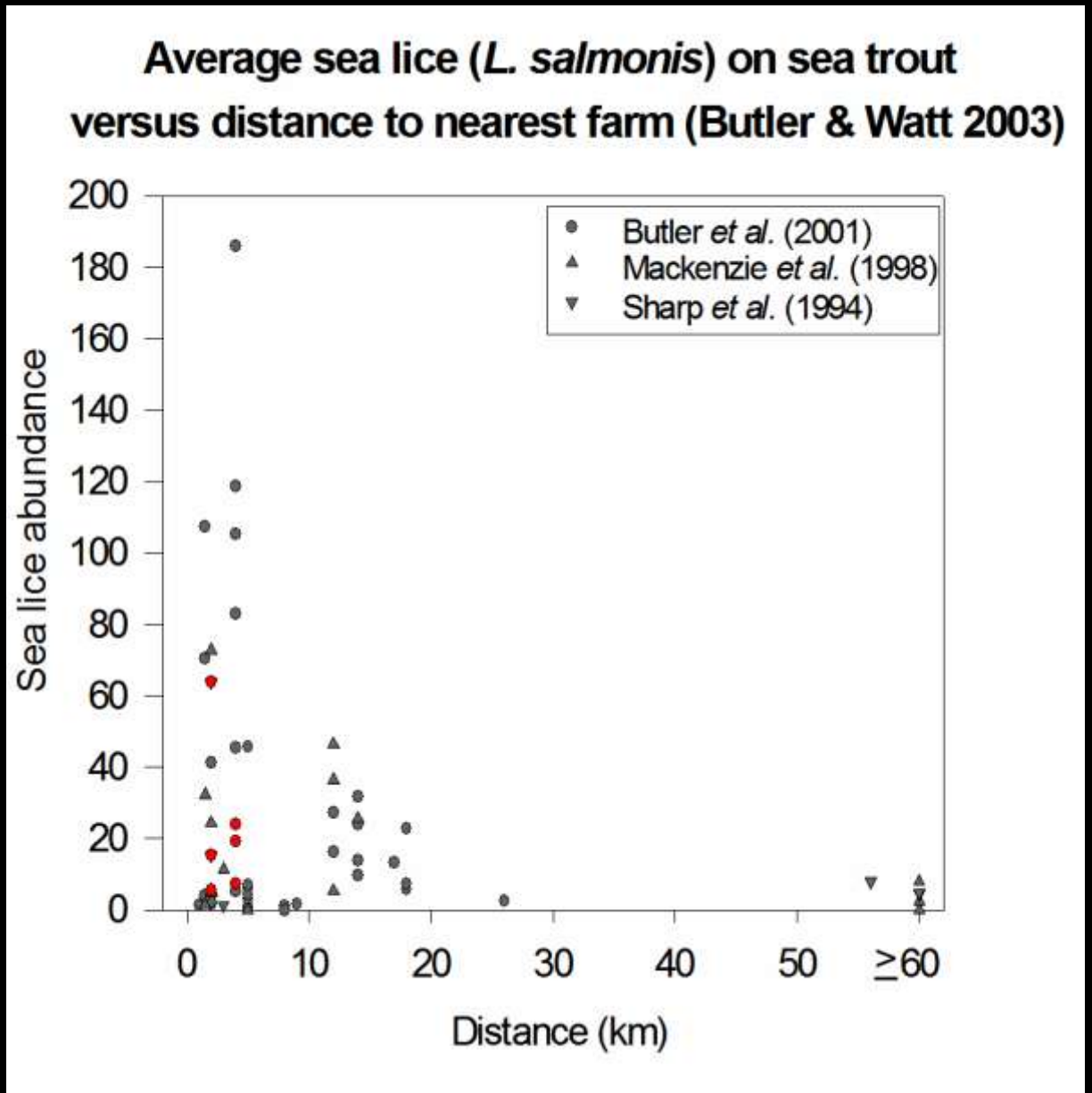
Sweep netting for sea trout, Loch Gairloch

Sea trout with sea lice: note pairs of pre-adults behind dorsal fin, and ovigerous females.

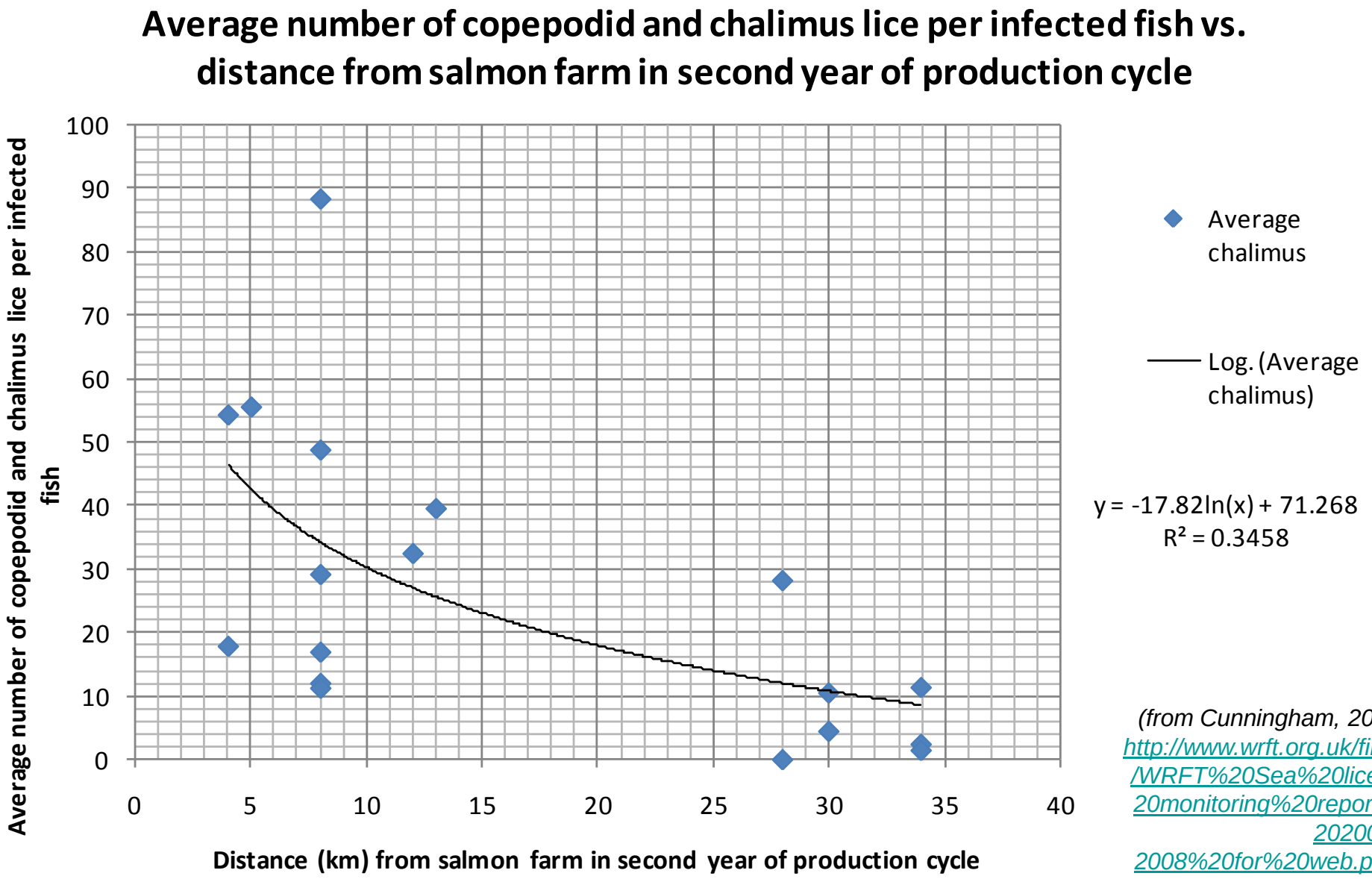

Sea trout from the River Carron (Wester Ross) estuary in May 2012
Over 500 lice on this fish

A louse damaged sea trout from the River Ewe

Several studies have found a relationship between lice levels on sea trout and proximity to salmon farms

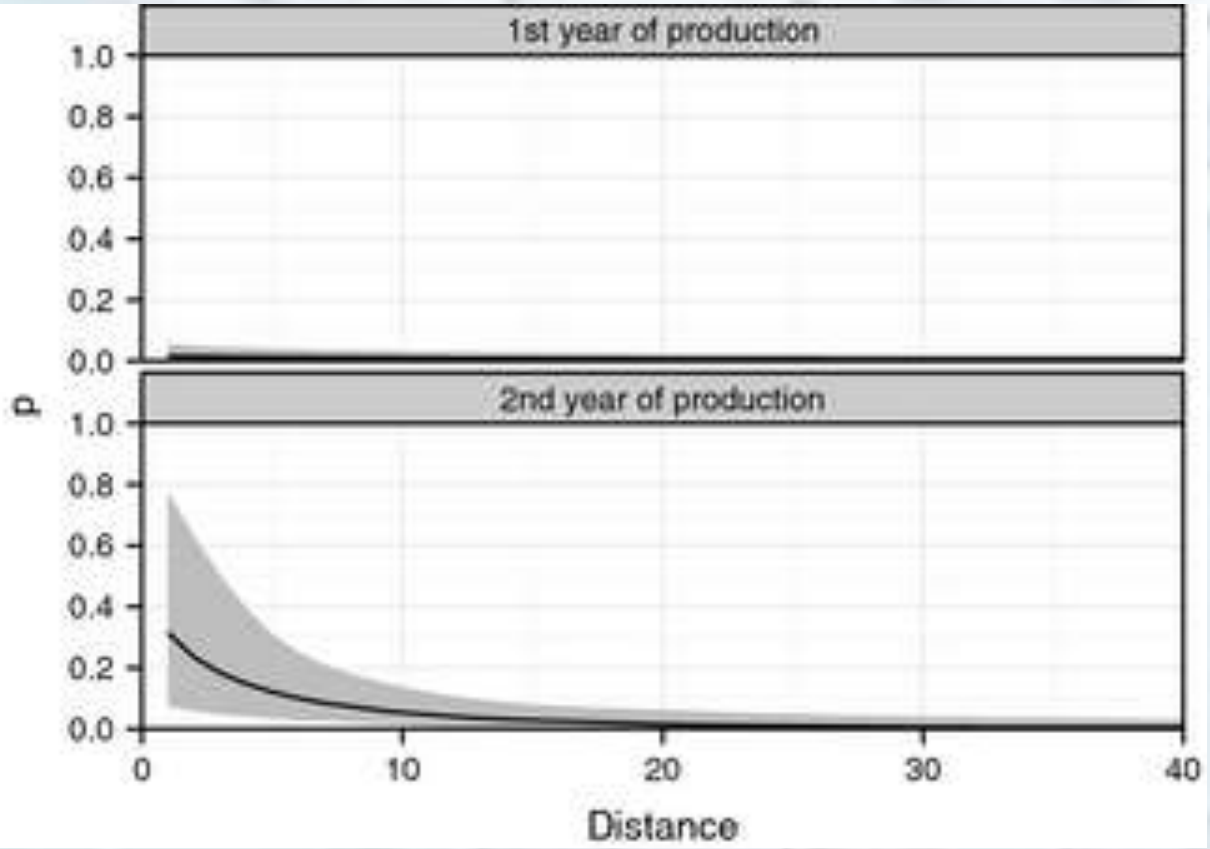


Results from sampling in Wester Ross in 2007 & 2008



(from Cunningham, 2009 http://www.wrft.org.uk/files/WRFT%20Sea%20lice%20monitoring%20report%202007-2008%20for%20web.pdf)

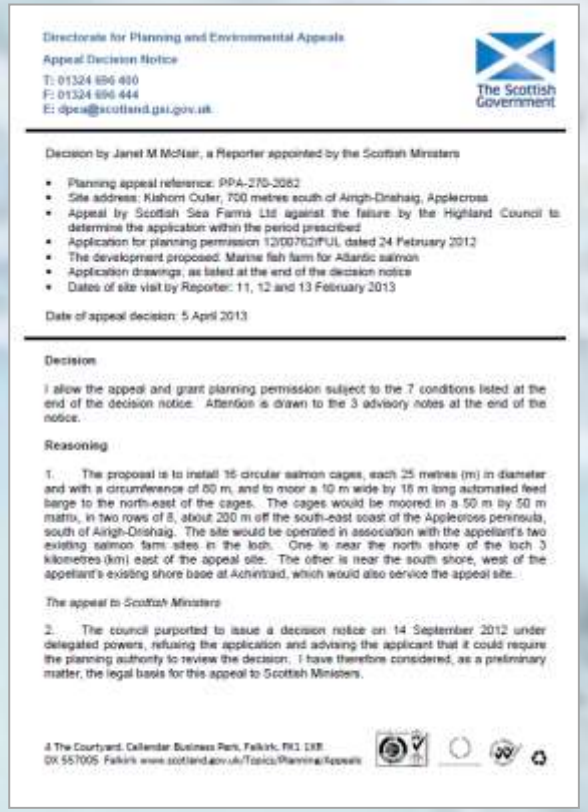
Middlemas *et al* 2012 analysed fishery trust data and showed that there was a **correlation between lice levels on sea trout post-smolts and the proximity of salmon farms in the 2nd year of the farm salmon production cycle.**



Relationship between sea lice levels on sea trout and fish farm activity in western Scotland, Figure 4: Fitted relationships between the probability of sea trout exceeding the critical lice burden (p) and distance to nearest farm (in km) calculated using the median fork length of sea trout (160 mm). Relationships are presented using the typical weight of individual salmon on farms in the first (0.2 kg) and second (3 kg) years of production. The line shows the fitted relationship with the shaded areas representing the 95% pointwise likelihood bands.

Fisheries Management and Ecology
Volume 20, Issue 1, pages 68-74, 5 NOV 2012 DOI: 10.1111/fme.12010
http://onlinelibrary.wiley.com/doi/10.1111/fme.12010/full#fme12010-fig-0004

However, we have not yet been able to quantify the impacts of sea lice epizootics on sea trout populations . . .



Directorate for Planning and Environmental Appeals

Appeal Decision Notice

T: 01324 696 400
F: 01324 696 444
E: dpea@scotland.gsi.gov.uk

The Scottish Government

Decision by Janet M McNair, a Reporter appointed by the Scottish Ministers

- Planning appeal reference: PPA-270-2082
- Site address: Kishorn Outer, 700 metres south of Airigh-Drishaig, Applecross
- Appeal by Scottish Sea Farms Ltd against the failure by the Highland Council to determine the application within the period prescribed
- Application for planning permission 12/00762/FUL dated 24 February 2012
- The development proposed: Marine fish farm for Atlantic salmon
- Application drawings: as listed at the end of the decision notice
- Dates of site visit by Reporter: 11, 12 and 13 February 2013

Date of appeal decision: 5 April 2013

Decision

I allow the appeal and grant planning permission subject to the 7 conditions listed at the end of the decision notice. Attention is drawn to the 3 advisory notes at the end of the notice.

Reasoning

1. The proposal is to install 16 circular salmon cages, each 25 metres (m) in diameter and with a circumference of 80 m, and to moor a 10 m wide by 18 m long automated feed barge to the north-east of the cages. The cages would be moored in a 50 m by 50 m matrix, in two rows of 8, about 200 m off the south-east coast of the Applecross peninsula, south of Airigh-Drishaig. The site would be operated in association with the appellant's two existing salmon farm sites in the loch. One is near the north shore of the loch 3 kilometres (km) east of the appeal site. The other is near the south shore, west of the appellant's existing shore base at Achintraid, which would also service the appeal site.

The appeal to Scottish Ministers

2. The council purported to issue a decision notice on 14 September 2012 under delegated powers, refusing the application and advising the applicant that it could require the planning authority to review the decision. I have therefore considered, as a preliminary matter, the legal basis for this appeal to Scottish Ministers.

4 The Courtyard, Callendar Business Park, Falkirk, FK1 1XR
DX 557005 Falkirk www.scotland.gov.uk/Topics/Planning/Appeals

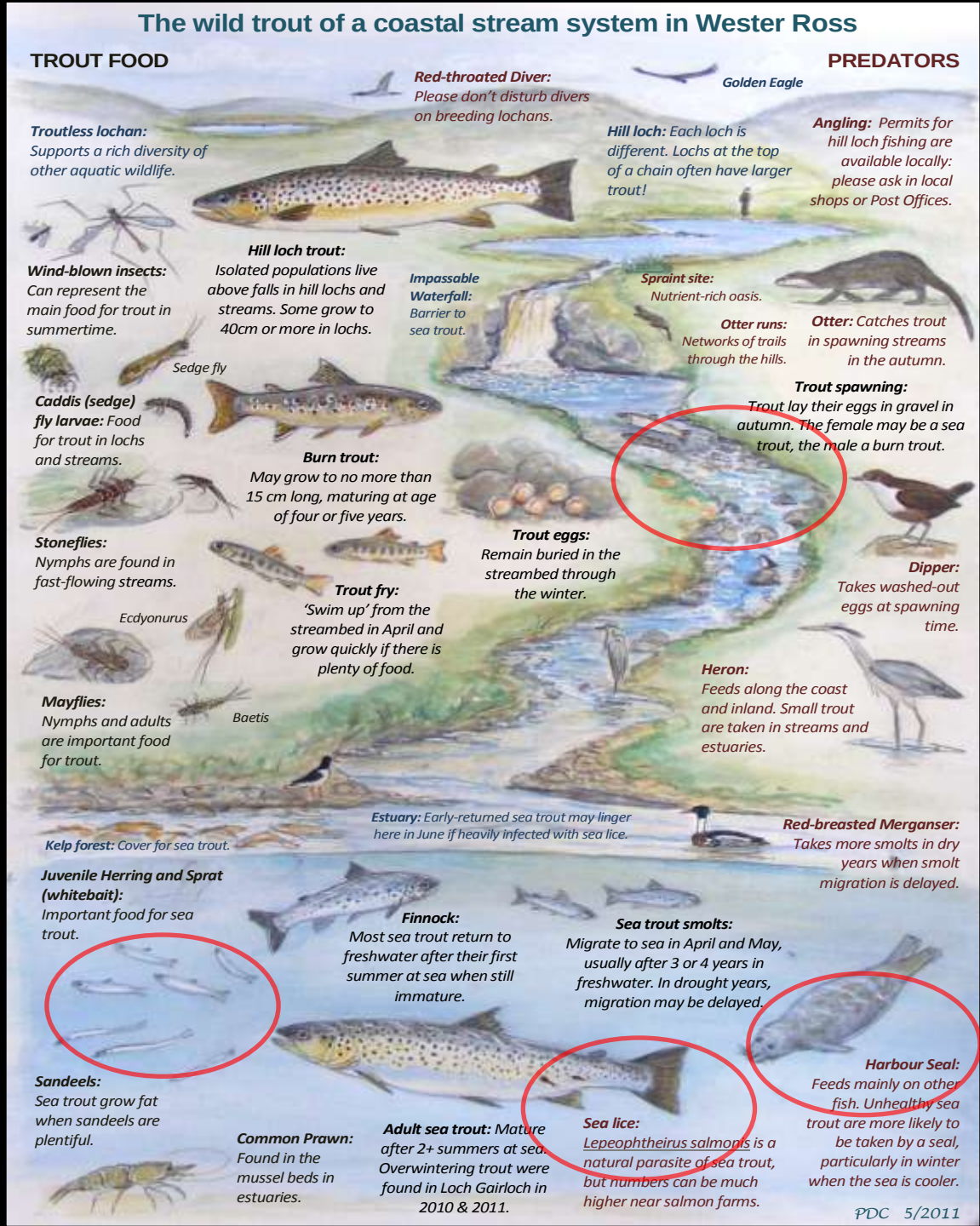
Response to . . . proposed new fish farm planning appeal, 5th April 2013

'. . . As regards sea lice, MSS states that . . . there is evidence of an effect on sea trout and that . . . high levels of lice infestation near fish farms in the second year of the production cycle mean that such an effect is to be expected.

. . . MSS concludes that . . . the current state of knowledge does not allow MSS to quantify the impact [to sea trout populations] . . . if any.'

This is because other pressures have also affected sea trout in Scotland over the past 30 years, for example

Food availability
Predation pressure
Freshwater problems



Status of Scottish sea trout stocks

'Since 2003, rod catches of sea trout in Scotland as a whole have been among the lowest in the time-series.

The catch in 2012 was the fifth lowest in the 61 year time series.'

Sea trout catches in Scotland rod and line fishery to 2012

http://www.scotland.gov.uk/Resource/0043/00434139.pdf

‘There are clear differences among geographic regions in the relative strength of the 2012 rod catch.

All mainland regions in the west of Scotland reported catches which were within the lowest eleven recorded for their region over the period 1952 to 2012.

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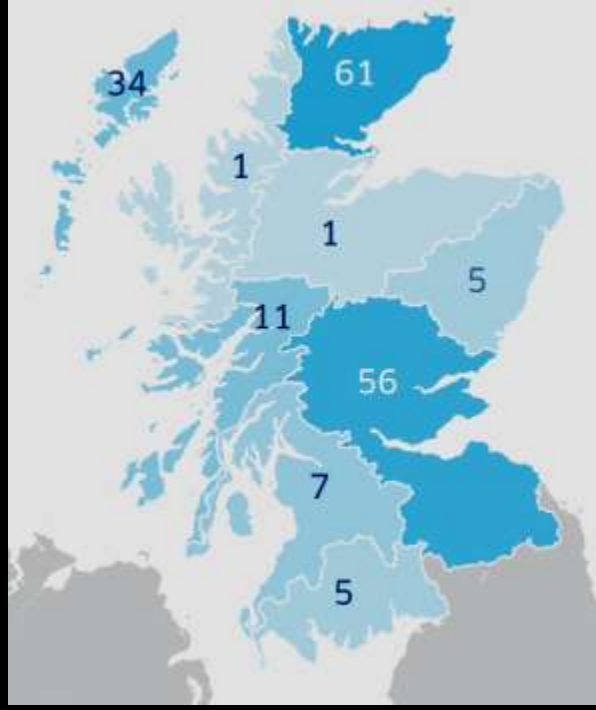

Colours reflect ranking values for the regions (shading from lightest to darkest indicate ranking values from lowest to highest).

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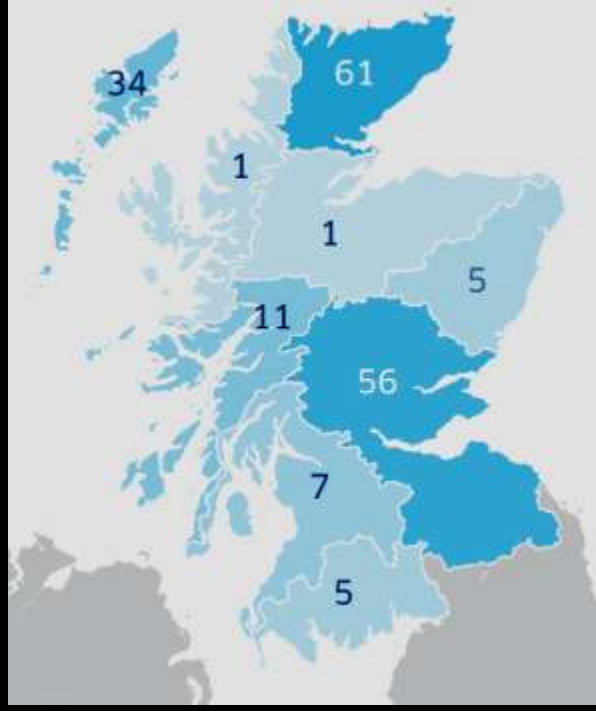

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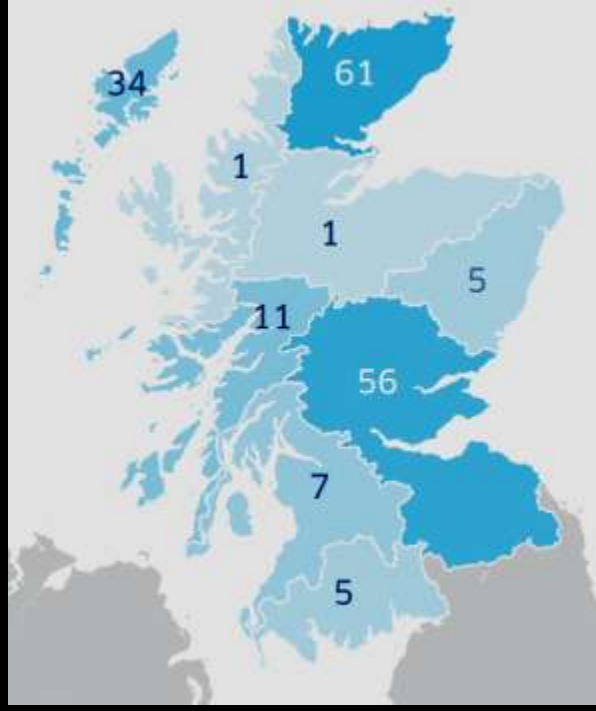
Catches in the East and North regions in 2012 were, on the other hand, both among the top ten catches recorded within their respective regions.



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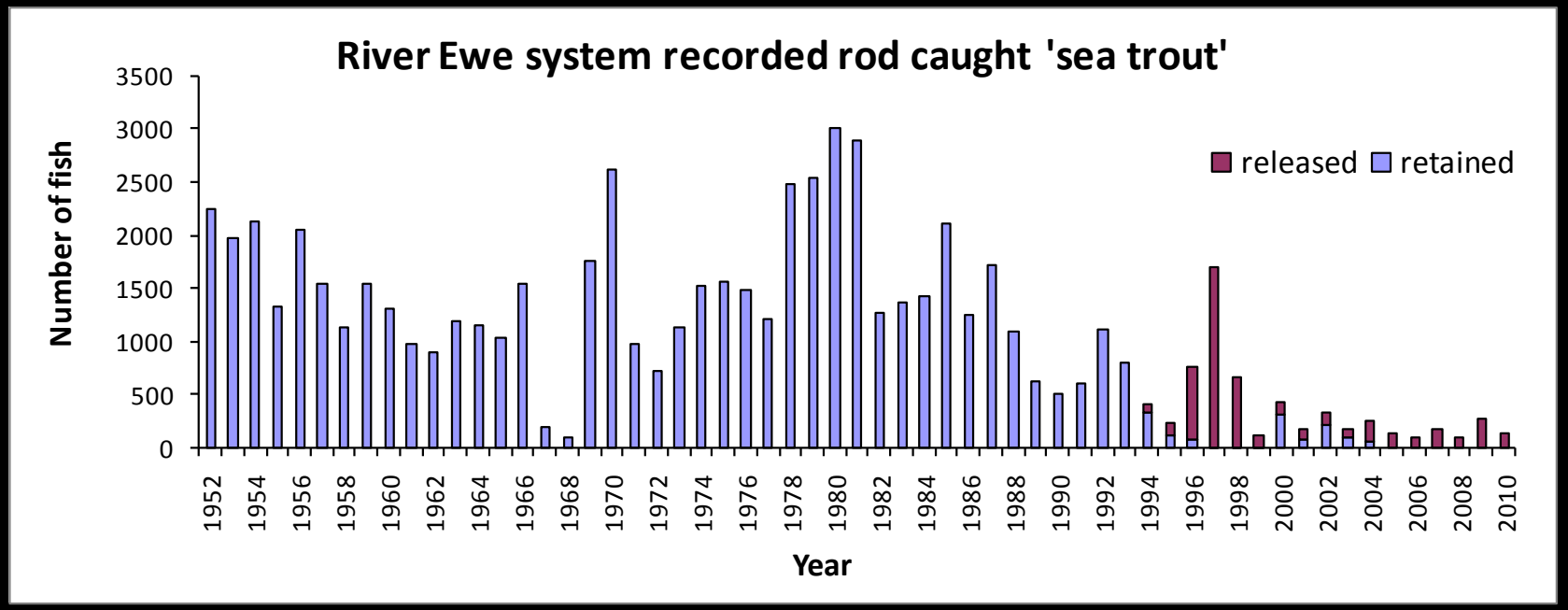
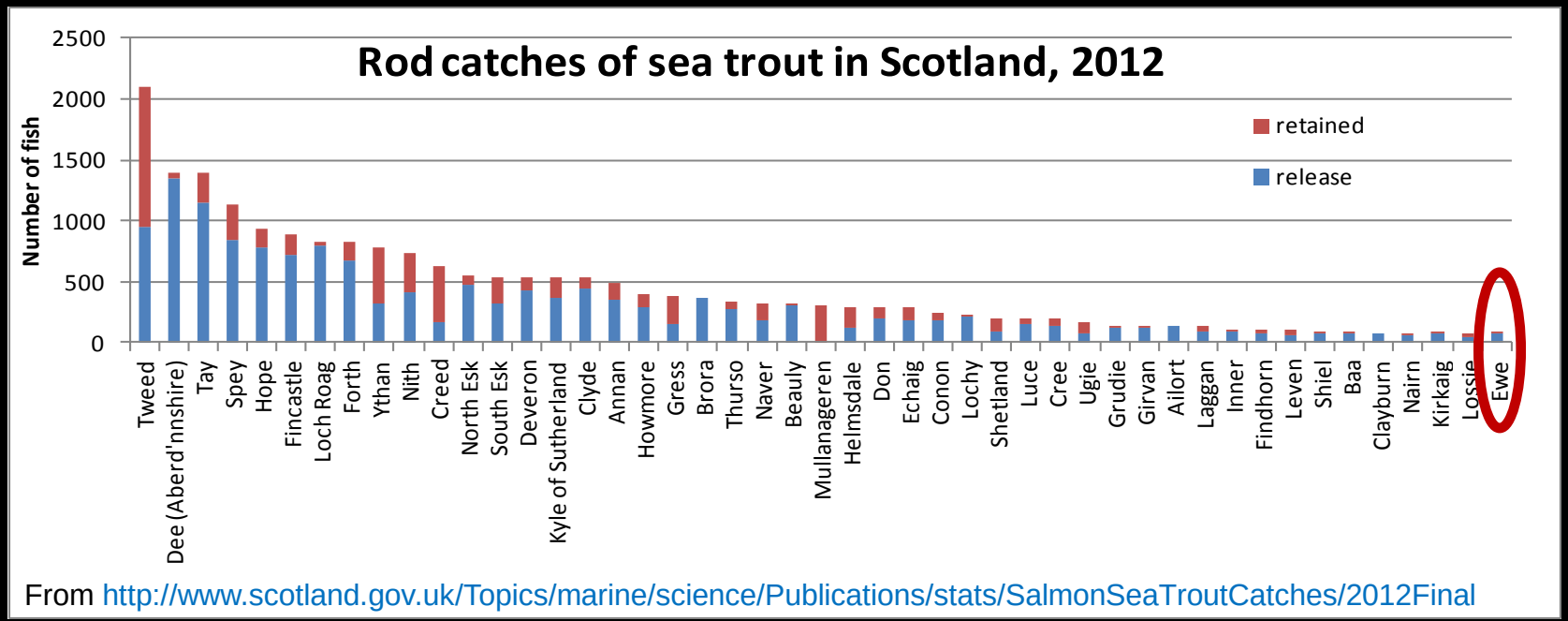
Loch Maree is not currently one of Scotland's premier sea trout fisheries





From http://www.scotland.gov.uk/Topics/marine/science/Publications/stats/SalmonSeaTroutCatches/2012Final

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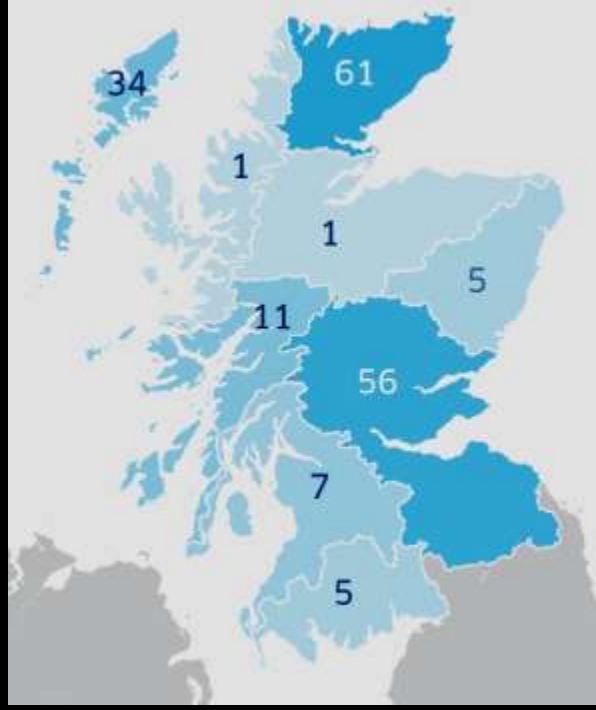


http://www.scotland.gov.uk/Resource/0043/00434139.pdf

Why?

Some questions

- Is there a relationship between the ***survival*** of sea trout and proximity to salmon farms?

- Can the relationship be quantified?

- To what extent is it possible to predict how a sea trout population will respond to nearby open cage salmon farming as recently practiced?

Method

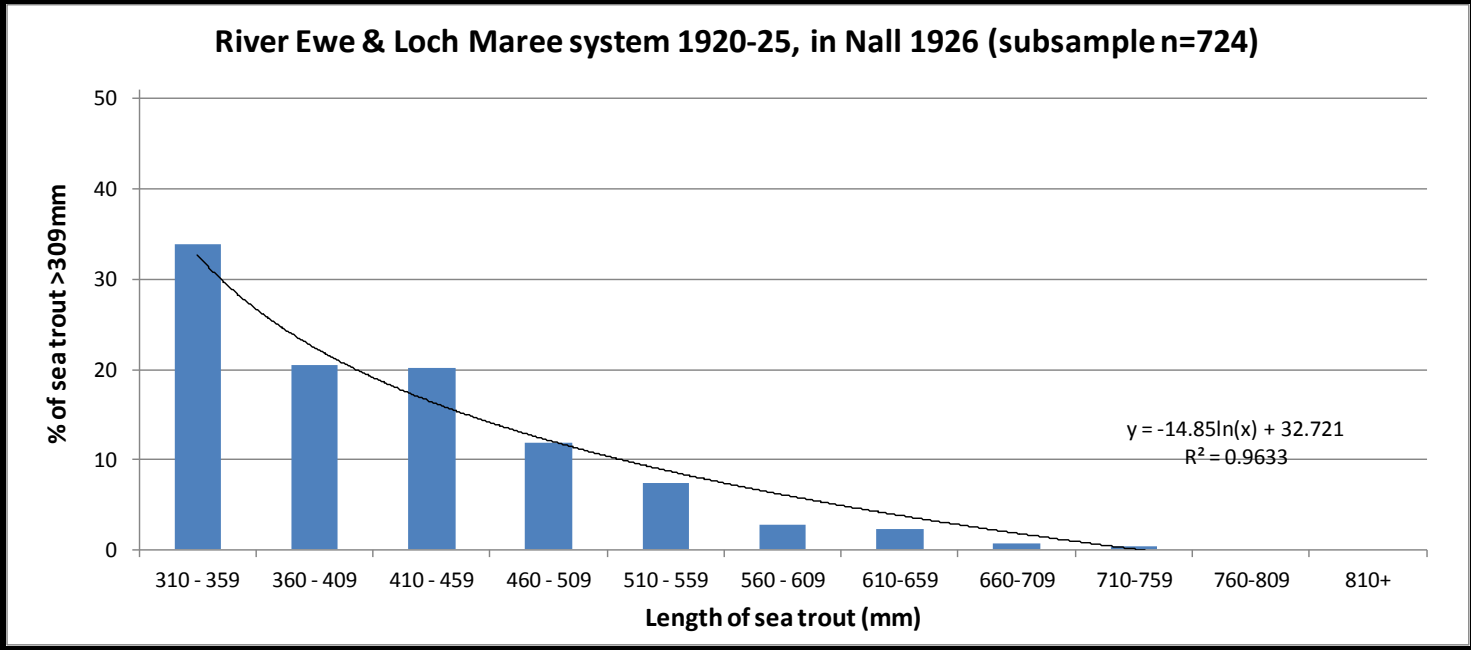
Compare the size-frequency distribution for sea trout in samples taken

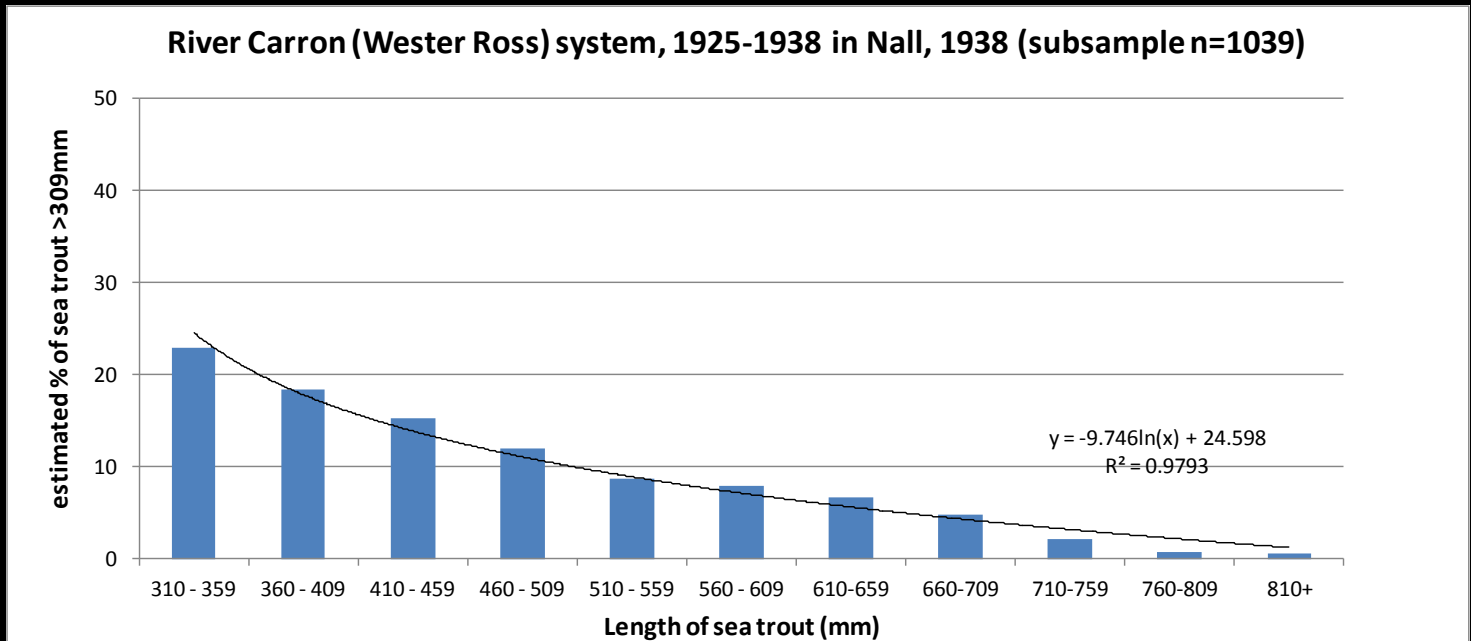
- in salmon farming areas before and after salmon farming
- at different distances away from salmon farms.

•Focus on sub-samples of larger sea trout of over 30cm in length.

Historic records of larger sea trout in Wester Ross . . .

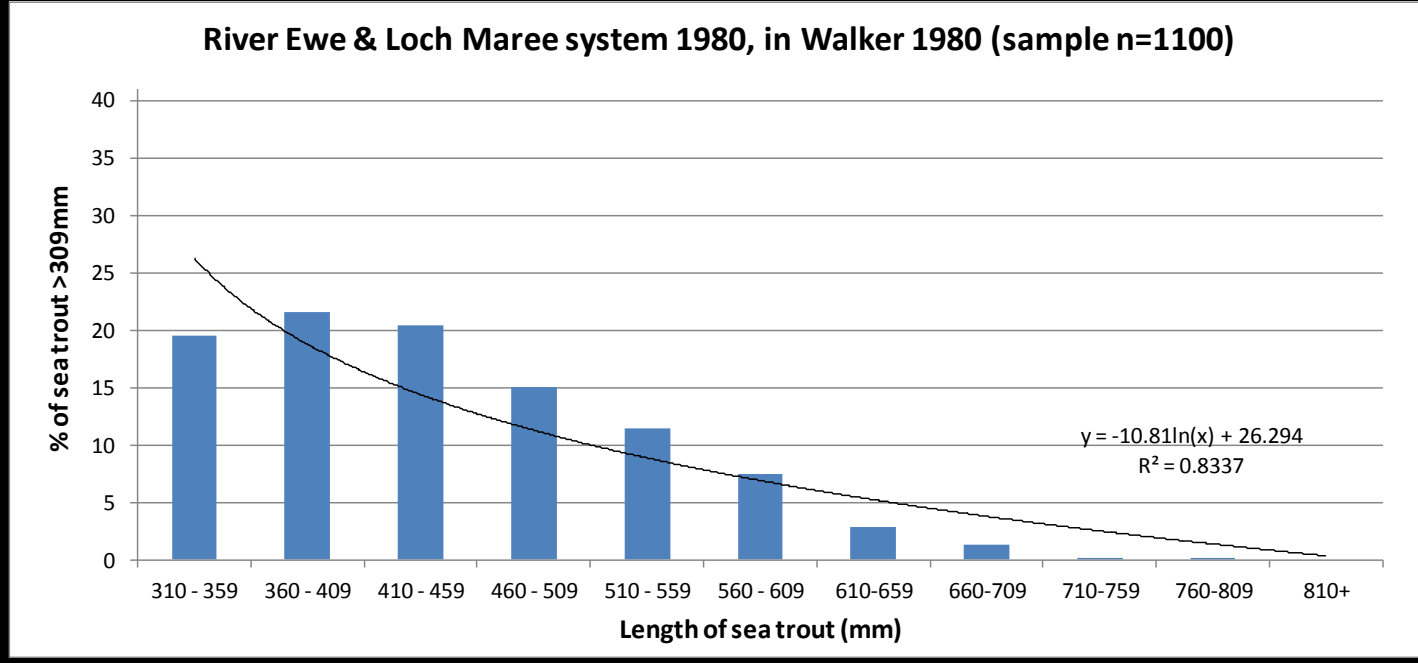
Data from Scottish Fisheries Research Reports by Herbert Nall in 1920s and 1930s.





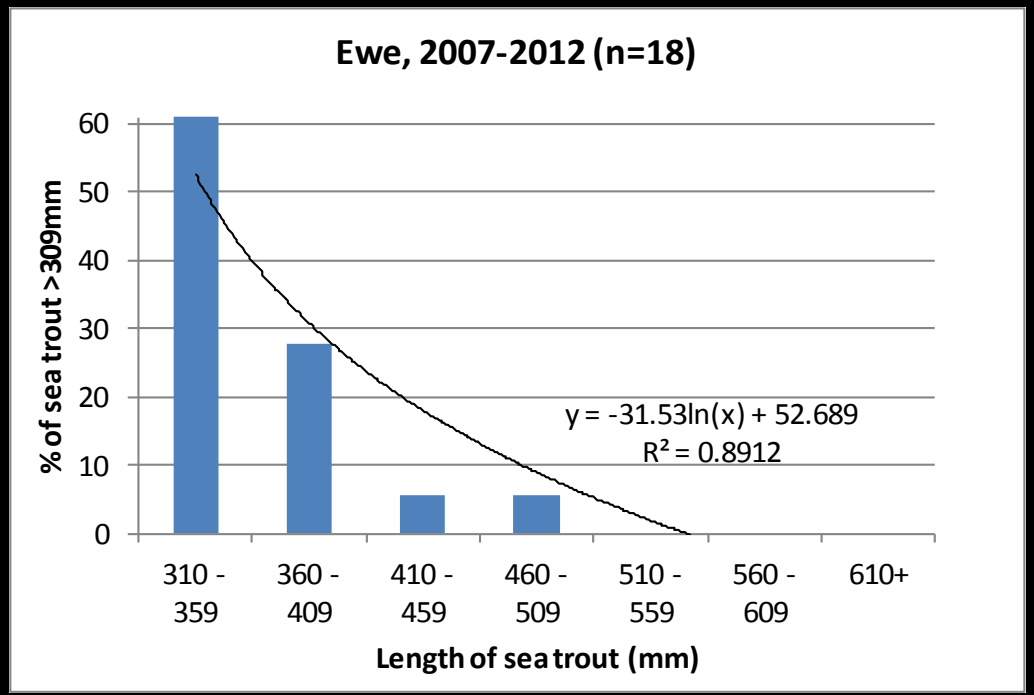
33 years ago . .

Ewe system lochs sea trout rod catch 1980 (Walker, 1980)



More recently:

Loch Ewe sweep netting and River Ewe rod sampling catch, 2007-2012 (WRFT data)

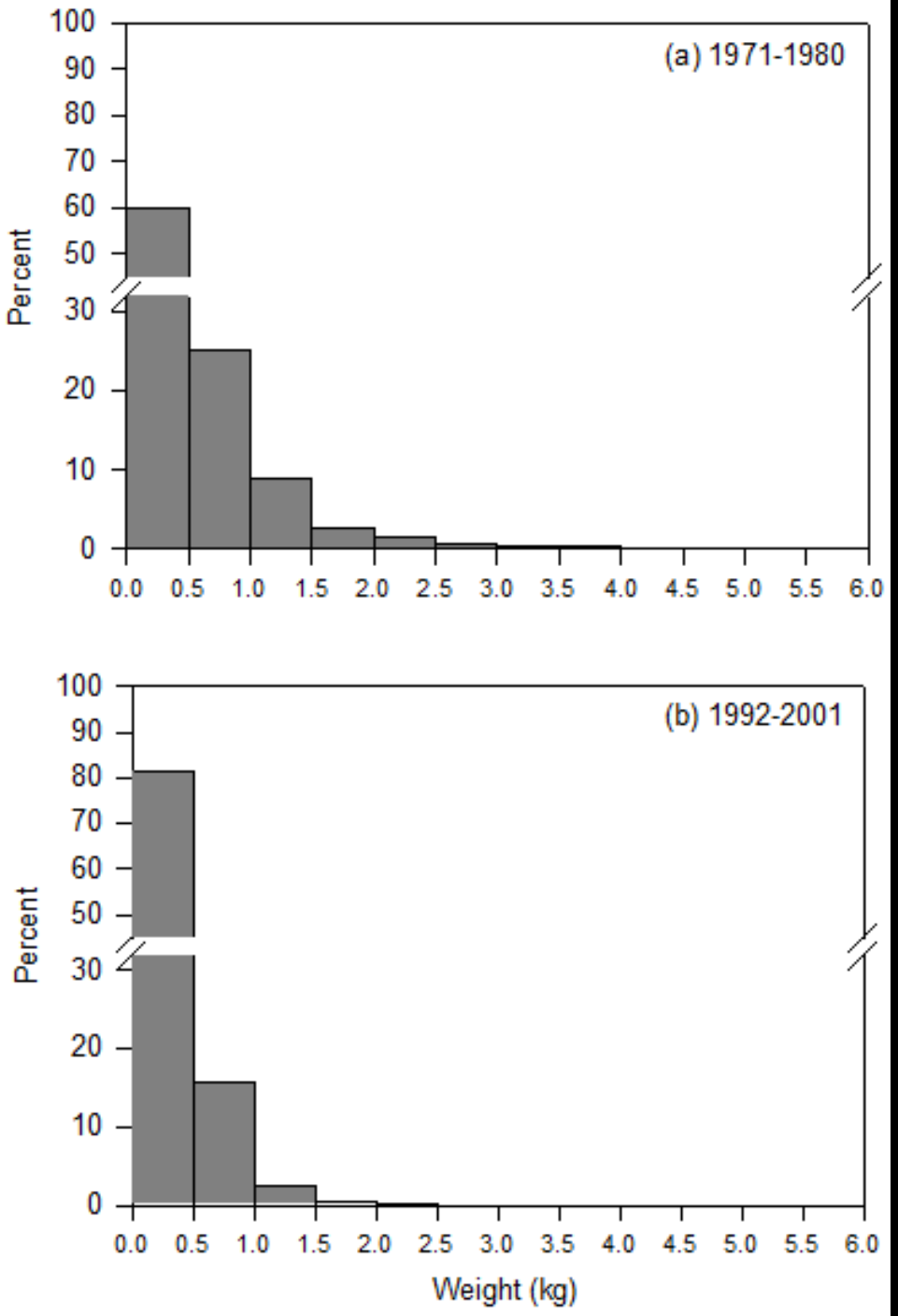


Weight distribution of sea trout caught in the River Ewe rod fishery

(a) Before development of salmon farms in Loch Ewe: 1971-1980

(b) After development of salmon farms in Loch Ewe: 1992-2001

Big fish disappeared. . . .



From: Butler, J.R.A. & Walker, A.F. (2006), **Characteristics of the Sea Trout *Salmo trutta* Stock Collapse in the River Ewe (Wester Ross, Scotland), in 1988-2001**. In Sea Trout: Biology, Conservation and Management. Published Online: 15 Nov 2007, Pages: 45-59

Results 1

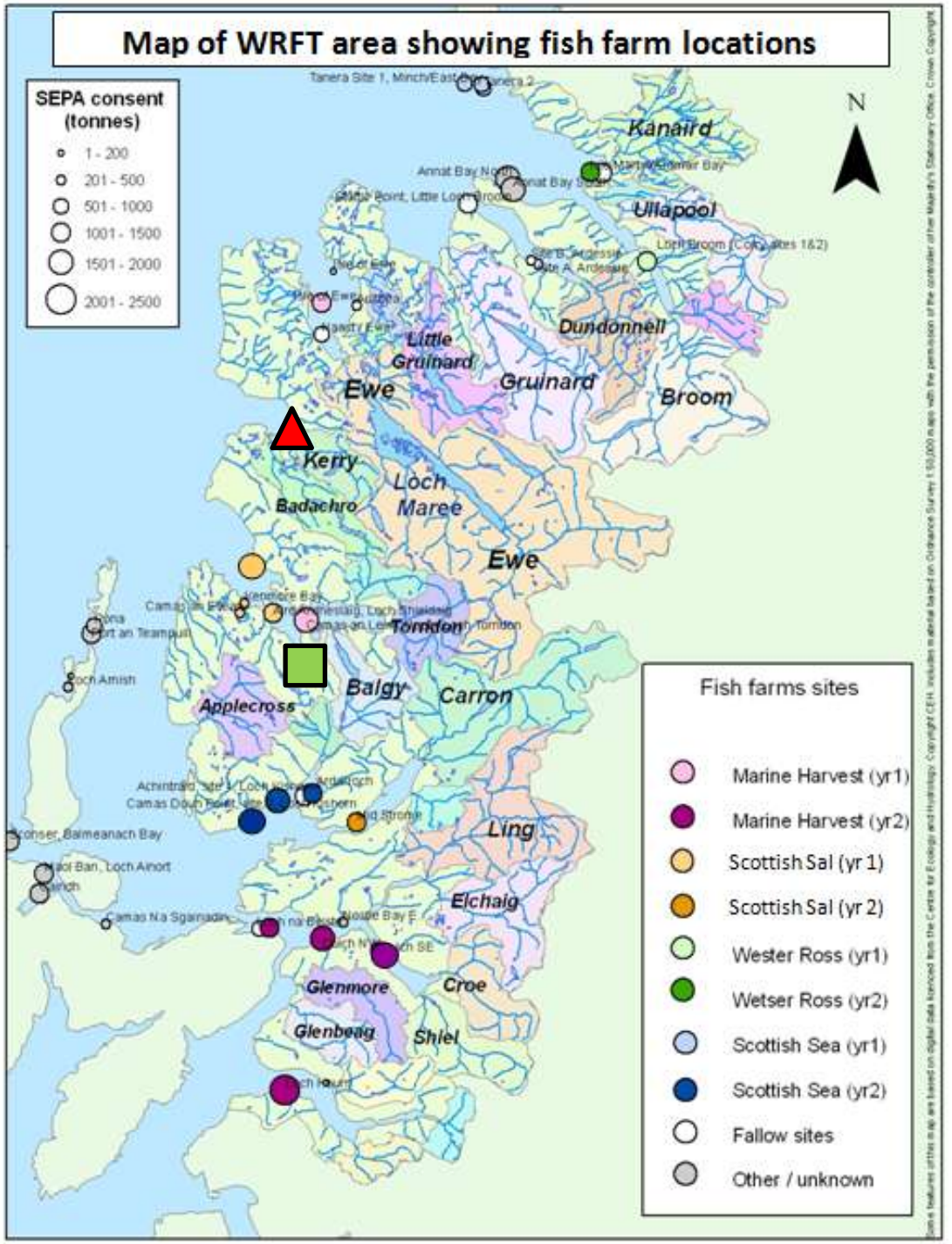
Historically (1920s – 1980) there were many more larger sea trout in areas with fish farms in Wester Ross than in recent years (1992-2013).

'Two good sea trout from Loch Maree, 13.5lb and 6.5lb caught on fly by Major T. W. Baker, July 8th 1927'.

Plate 73 *Lent by Major Baker*

TWO GOOD SEA-TROUT FROM LOCH MAREE

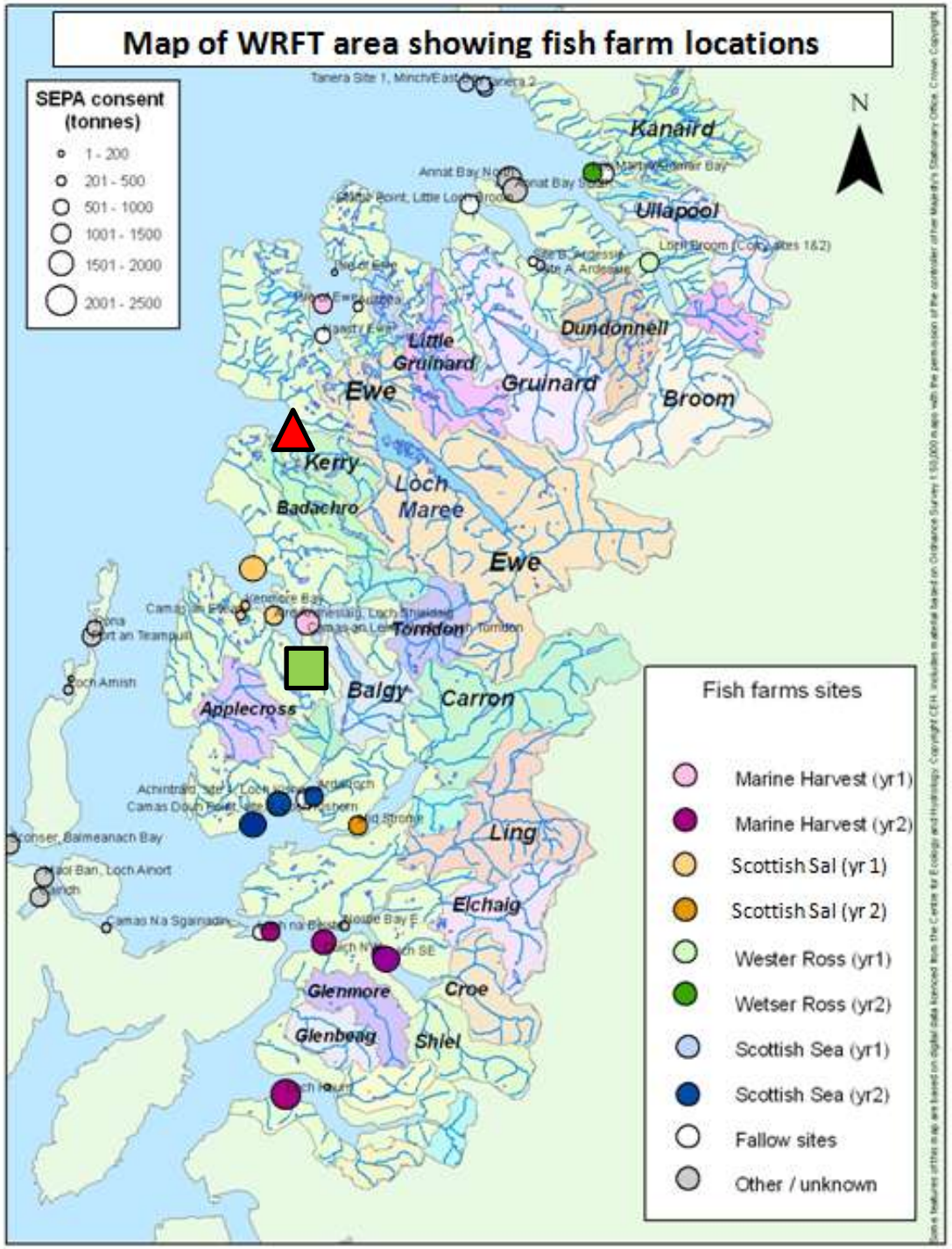
13½ LBS. AND 6½ LBS., CAUGHT ON FLY BY MAJOR T. W. BAKER, JULY 8TH, 1927.



Distance vs. salmon farming

Gairloch sweep netting site

MSS Shieldaig Trap



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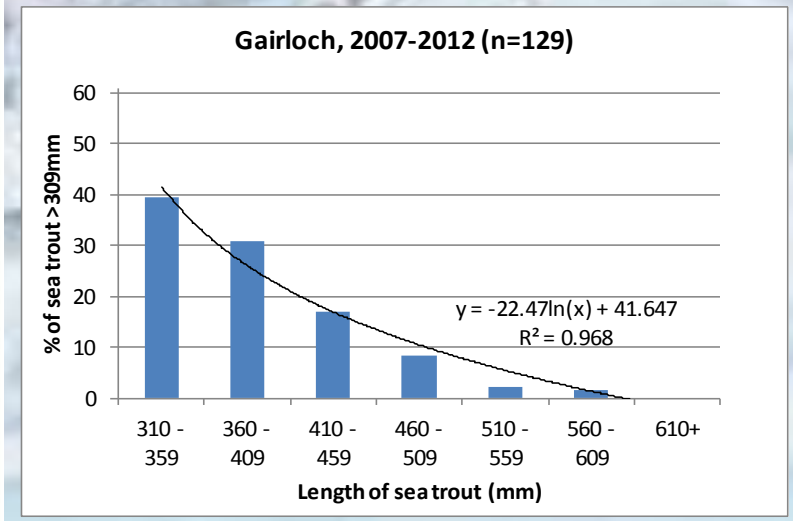


MSS Shieldaig Trap

During the period 2008 – 2013 some of the largest sea trout in the Wester Ross area were taken in Loch Gairloch (in front of the WRFT office!)

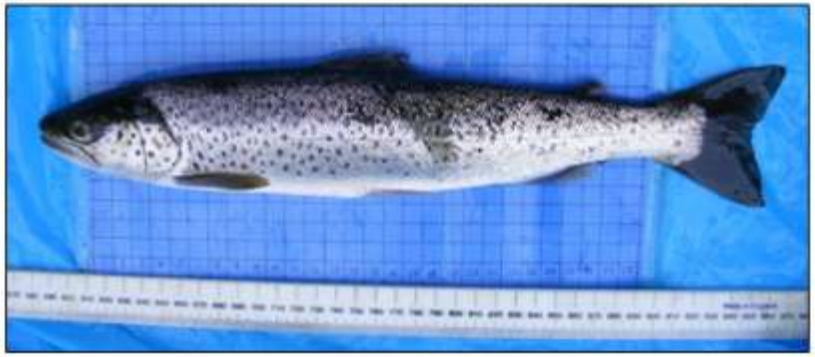
Sea trout, 580mm, taken in WRFT sweep net on 7th June 2010

This trout, recognised by its spot pattern, was taken on 5 separate occasions over a two year period in the same place

Growth of 'Squaretail', a male sea trout caught 5 times by the WRFT sweep netting team in Loch Gairloch, from March 2011 to September 2012

The following pictures are of a wild sea trout that was caught five times with the WRFT sweep net in Loch Gairloch. Each time the fish was caught, it was anaesthetised, a scale sample was taken, a photograph was taken, and the fish was returned to the water following recovery. The fish has been recognised by its spot pattern. When first caught in April 2011, the fish had a damaged pectoral fin and other predator damage ('beak' mark), and dorsal fin damage associated with earlier sea lice infection. The trout survived for at least another 16 months following its initial capture, growing from less than 1lb (455g) in weight to over 3lb (1365g) during this period. The fish suffered further predator damage to its tail between September 2011 and April 2012. Note the changes in colouration from silvery during the spring and early summer to bronze (spawning colouration) by September in both years.

18 Mar 2011: 355mm, 380g; deformed right pectoral fin; note scale loss attributed to beak damage. *Lepeophtheirus salmonis* lice counts: 3 copepodid & chalimus, 5 preadult & adult, 3 ovigerous female; dorsal fin slightly eroded. The scale reading suggests that the trout had already spawned twice (see last page).

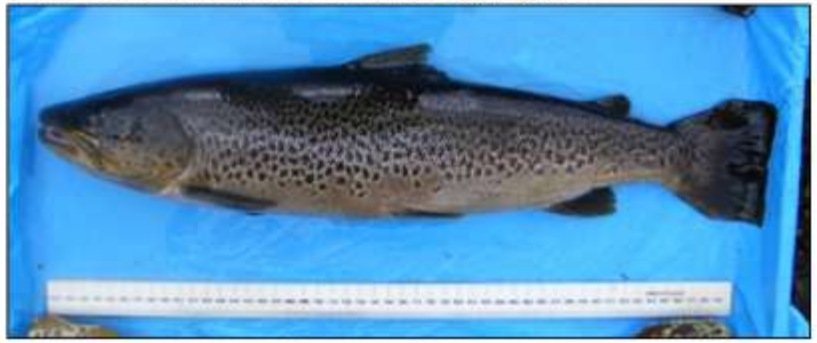


27 Sept 2011: 455mm, 933g; *Lepeophtheirus salmonis* 0 c&c, 2 pa&a, 0 of.

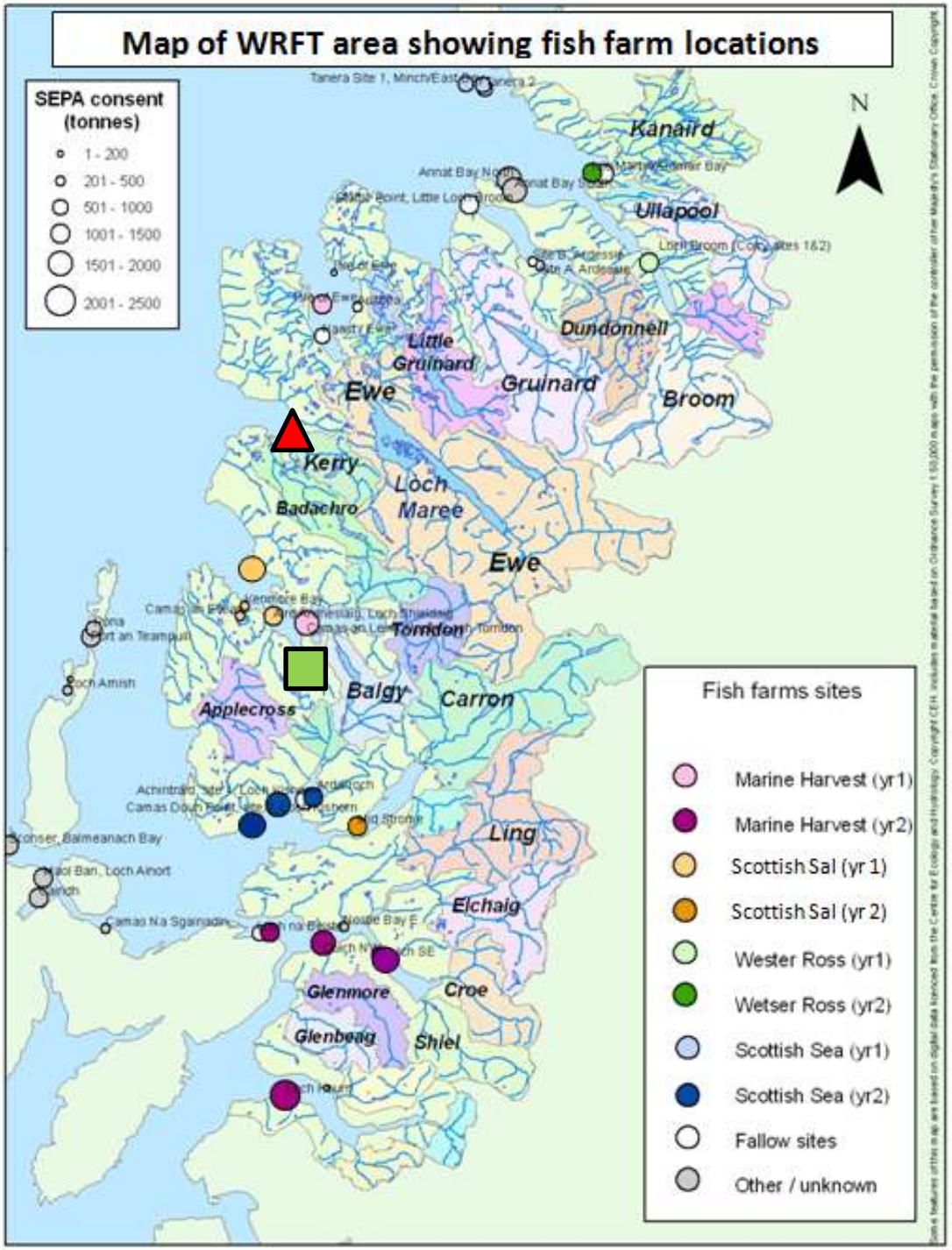
11 Apr 2012: 465mm, 948g; *Lepeophtheirus salmonis* 2 c&c, 0 pa&a, 0 of

22 June 2012: 487mm, 1154g; *Lepeophtheirus salmonis* 10c&c, 3 pa&a, 4 of; 4 *Caligus*

17 Sept 2012: 520mm, 1512g; *Lepeophtheirus salmonis* 0 c&c, 4 pa&a, 6 of.

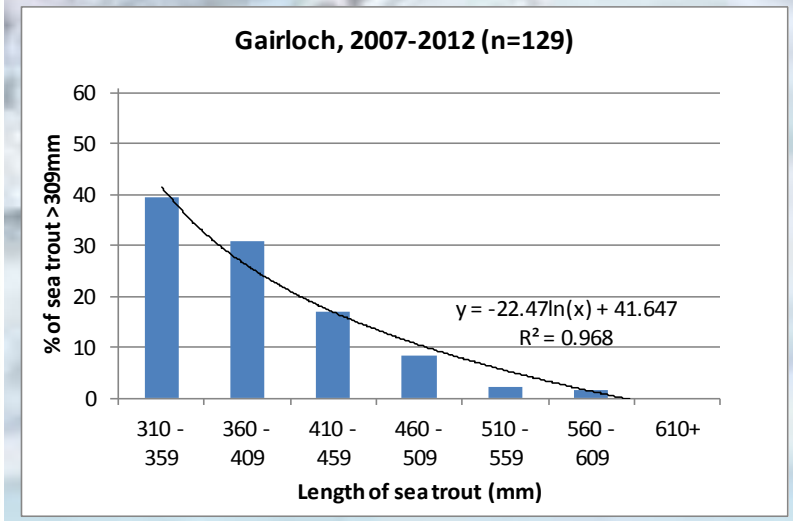


See WRFT sea trout monitoring report for 2012 at http://www.wrft.org.uk/fisheries/seatrout.cfm

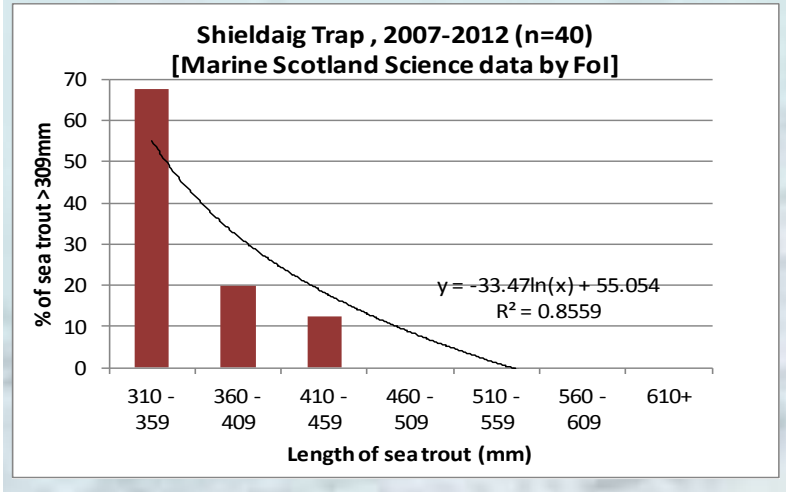


Distance vs. salmon farming

Gairloch sweep netting site



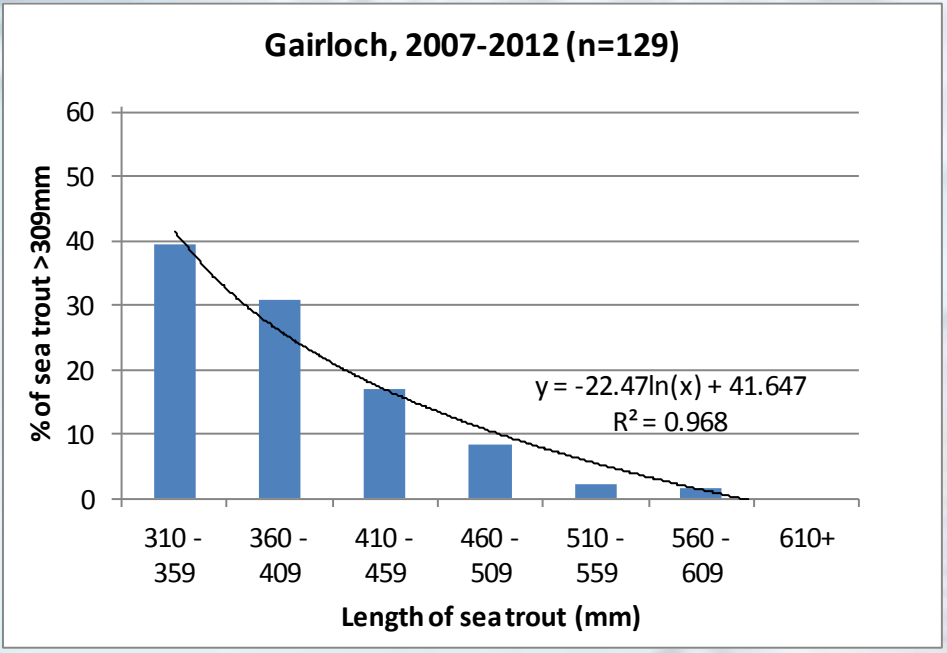
MSS Shieldaig Trap

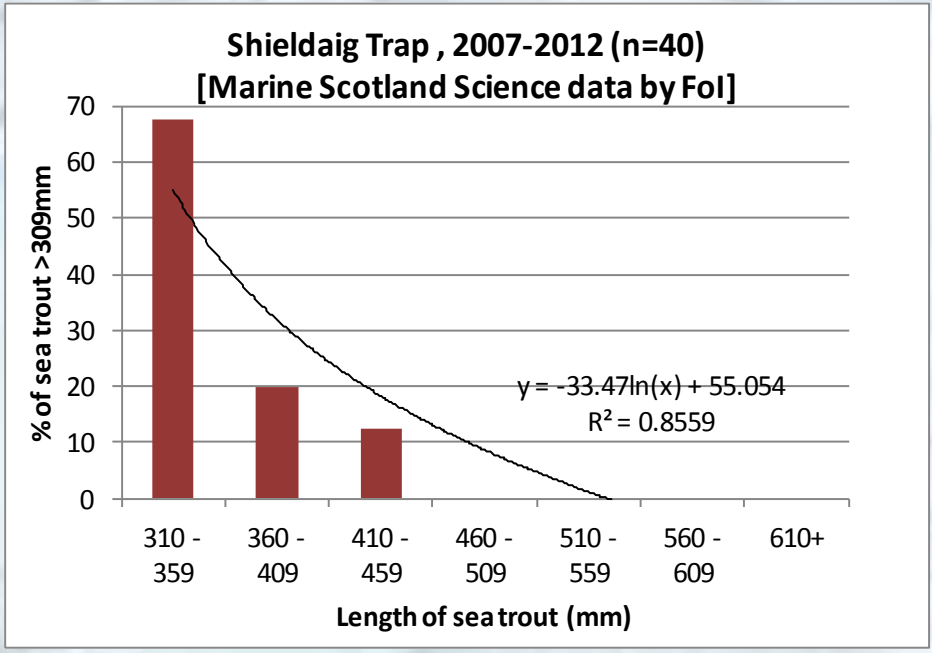


Marine Scotland Science data distributed following FoI request. MSS data is Crown copyright and is covered by the terms of the Open Government Licence.

Results 2

Sea trout caught in the WRFT sweep net in Loch Gairloch (25km away from the nearest salmon farm) were larger than the sea trout taken in the MSS Shieldaig trap, by Loch Torridon (within 5km of a fish farm).

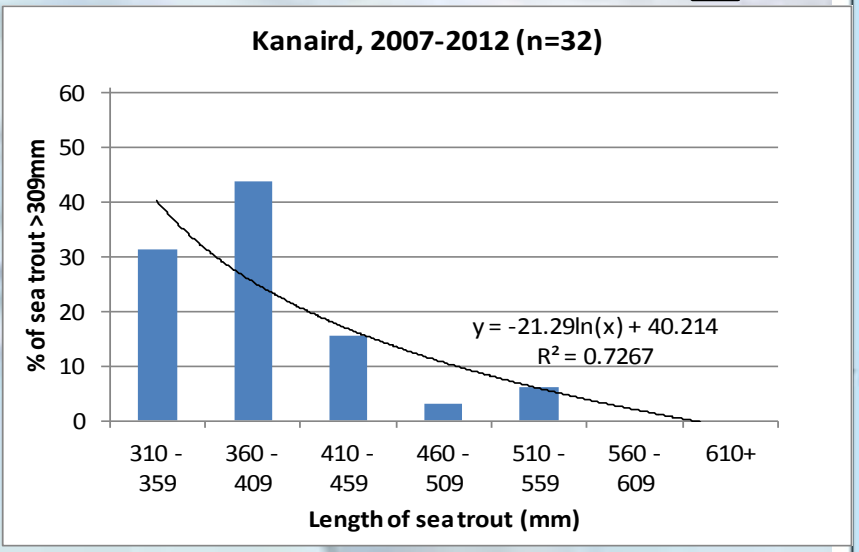




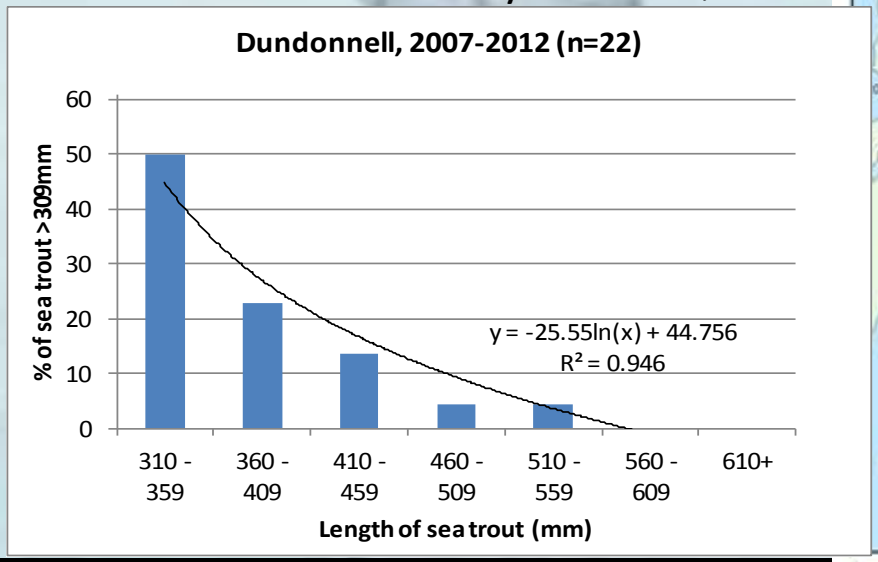
Relative proportions of sea trout in each size class within the subsamples of sea trout of over 309mm in length taken at Gairloch (left) and the MSS Shieldaig trap, Loch Torridon (right) during the period 2007 to 2012. Marine Scotland Science data distributed following FoI request. MSS data is Crown copyright and is covered by the terms of the Open Government Licence.

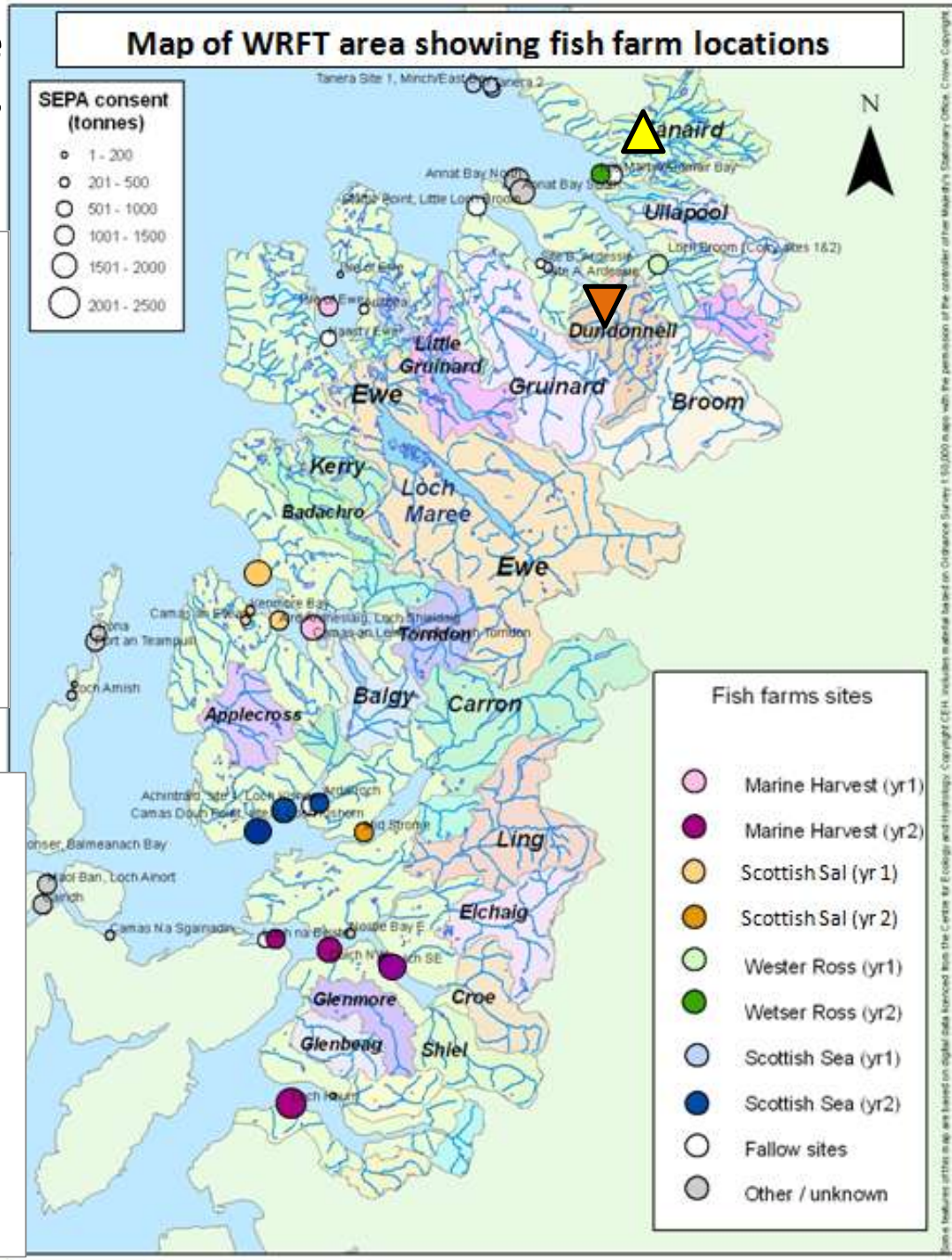
However, some larger sea trout were recorded at some of the lousiest sites

Kanaird sweep netting site



Dundonnell fyke net





Managing Interactions Aquaculture Project
2012/13

Regional Report;
2012 Sea Trout Post
Smolt Monitoring

January 2013

RAFTS
Rivers And Fisheries Trusts Of Scotland

Kanaird estuary 2012

Lice levels were higher than at most other RAFTS post-smolt sea trout monitoring sites.

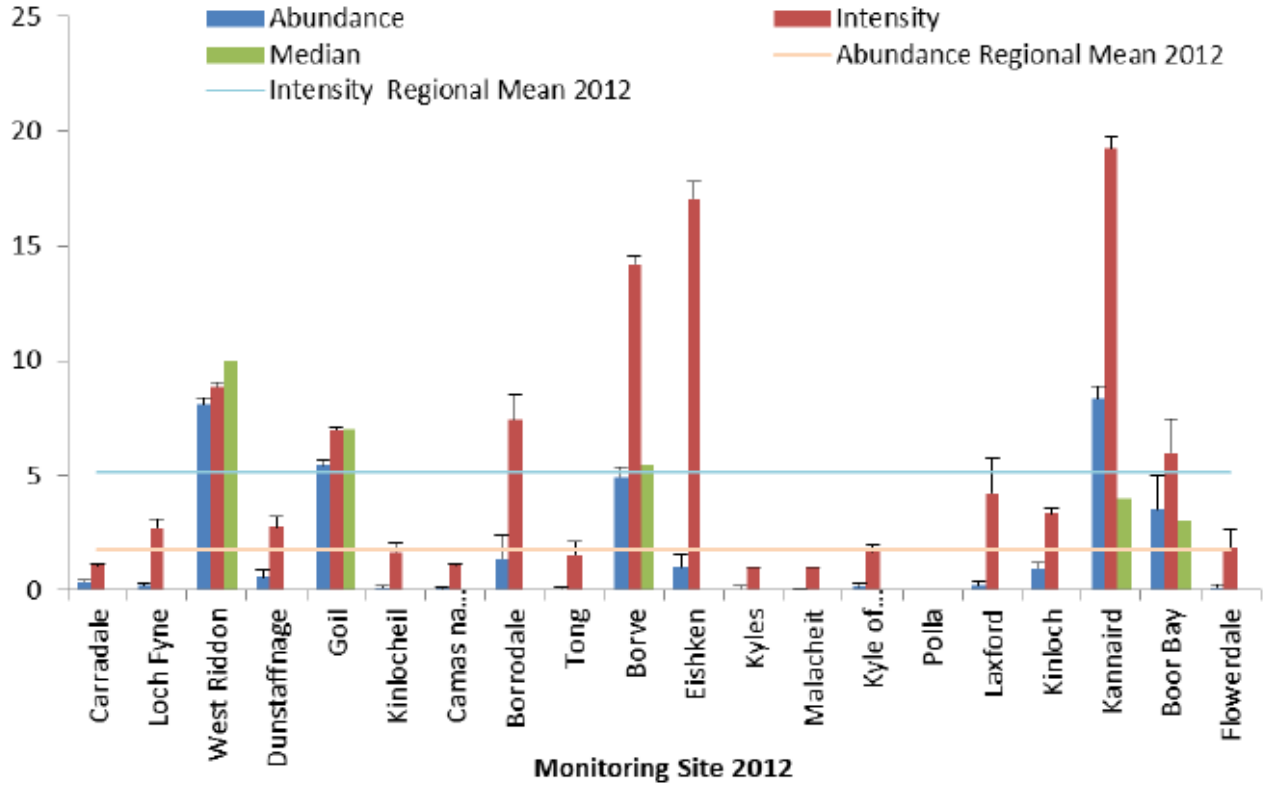


Figure 8: Back Transformed means in 2012 for Abundance, Intensity and Median for Copepodid/ Chalimi at each monitoring site (including 95% confidence intervals).

http://www.rafts.org.uk/wp-content/uploads/2013/01/RAFTS-Regional-Monitoring-Report-2012.pdf

Managing Interactions Aquaculture Project
2012/13

Regional Report;
2012 Sea Trout Post
Smolt Monitoring

January 2013

RAFTS
Rivers And Fisheries Trusts Of Scotland

Kanaird estuary 2012

Lice levels were above epizootic thresholds.

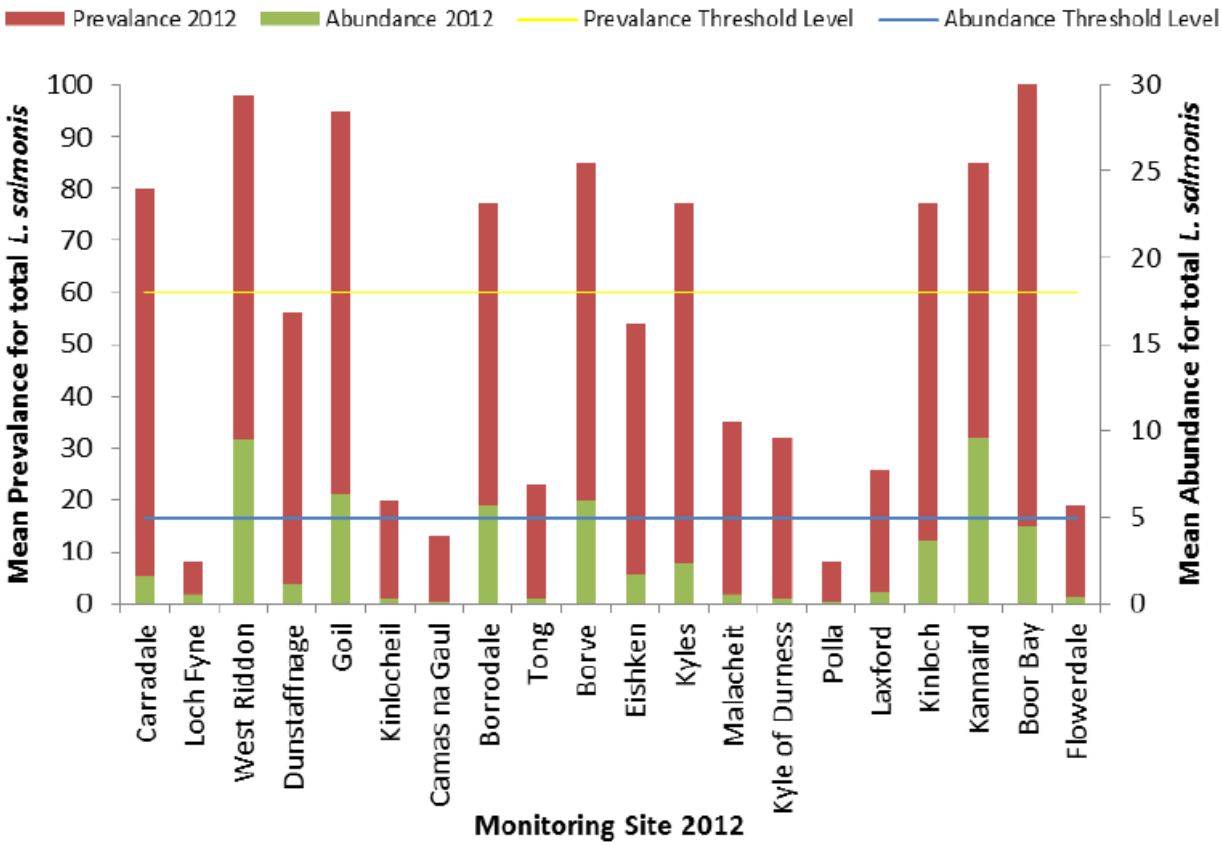


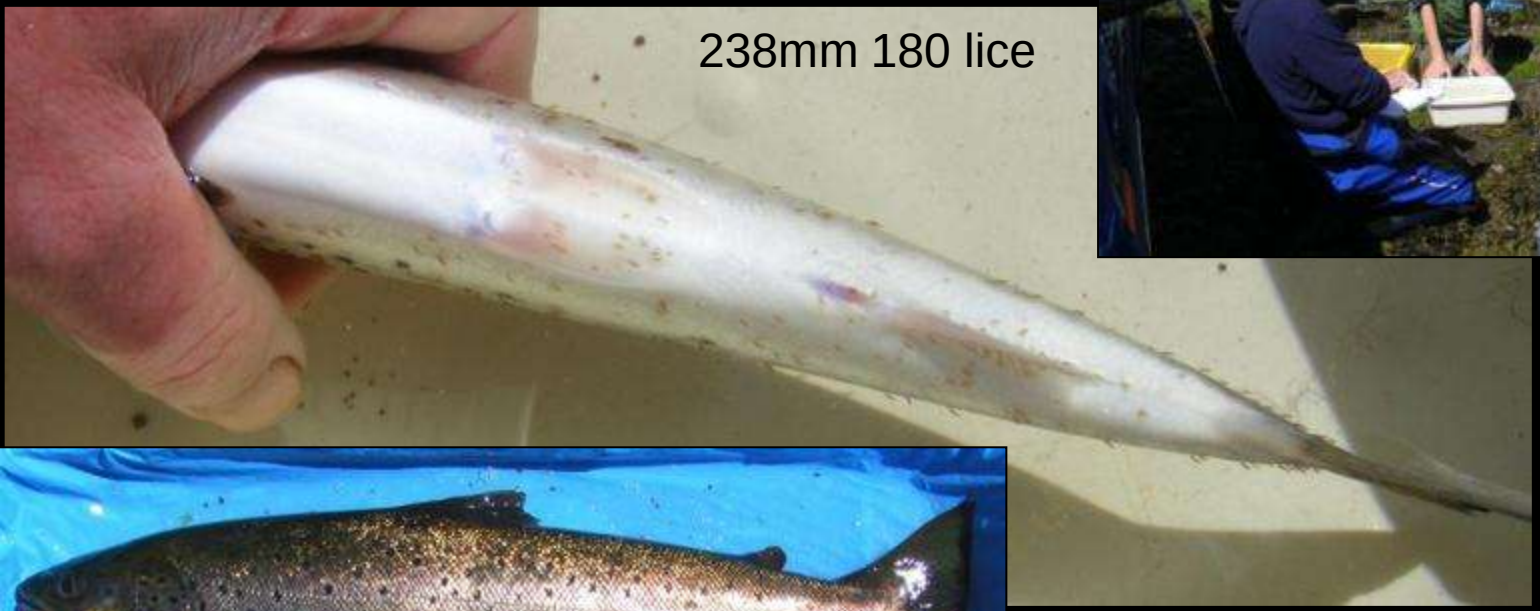
Figure 17: Prevalence and Abundance results for all life stages at each monitoring site in 2012. The Costello 2009 threshold levels for identifying epizootics are highlighted on the graph by a solid yellow line for the prevalence threshold and a solid blue line for the abundance threshold.

http://www.rafts.org.uk/wp-content/uploads/2013/01/RAFTS-Regional-Monitoring-Report-2012.pdf

Kanaird estuary

One of the lousiest sites in the RAFTS post-smolt monitoring project area

5th June 2012



238mm 180 lice

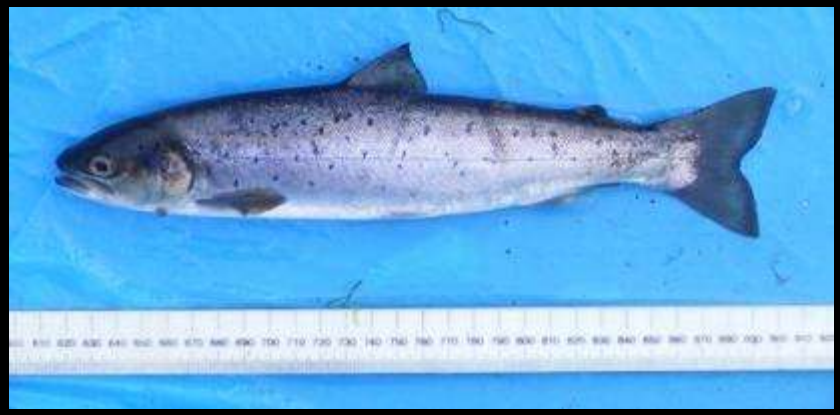
In addition to many heavily louse-infected post-smolts, a few larger trout of over 50cm were also recorded.

Kanaird estuary

17th July 2012 sample

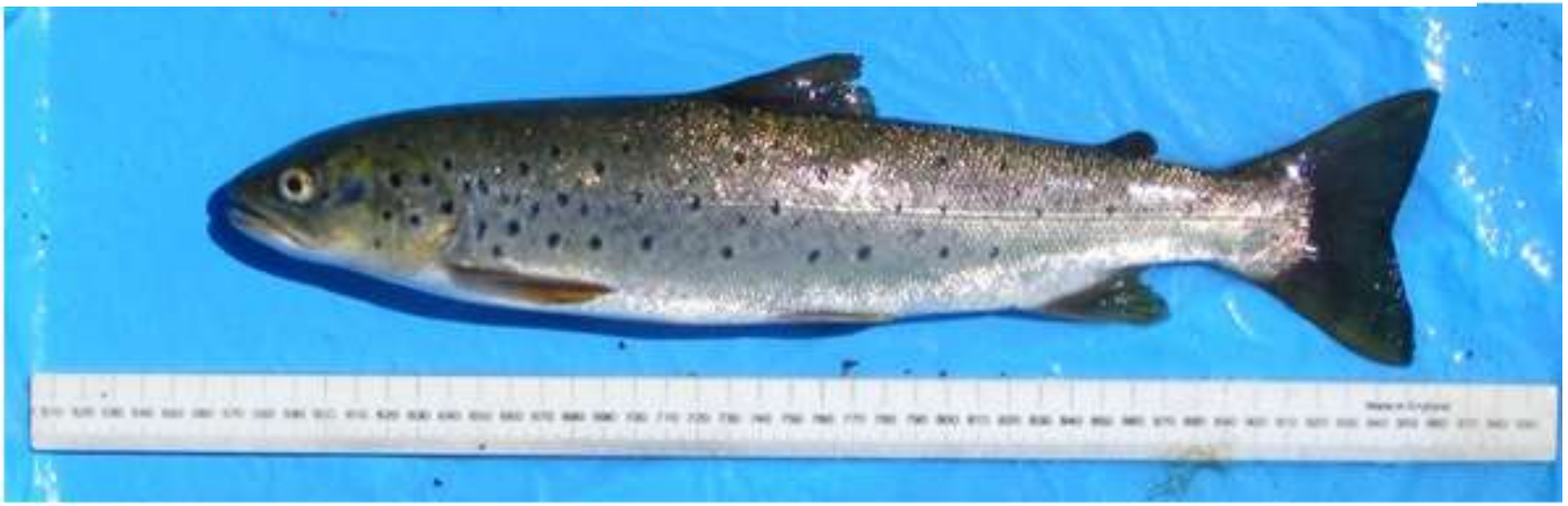
Many of the larger sea trout had lice-damaged dorsal fins.

However lice levels were lower than in June and some of the fish had been feeding.



In 2012, some larger sea trout taken in the Kanaird estuary survived and grew

Sea trout of 375mm, 532g with 120 chalimus lice taken on 5th June 2012



Recaptured sea trout, now 390mm, 640g, with only 10 lice taken on 17th July 2012

In the Dundonnell River estuary, a fyke net has been fished near top of tide in June each year to sample post-smolt sea trout since 1997

Dundonnell – fyke net fished near top of tide

Alastair Macdonald emptying the fyke net, July 2008

Dundonnell finnock, July 2008

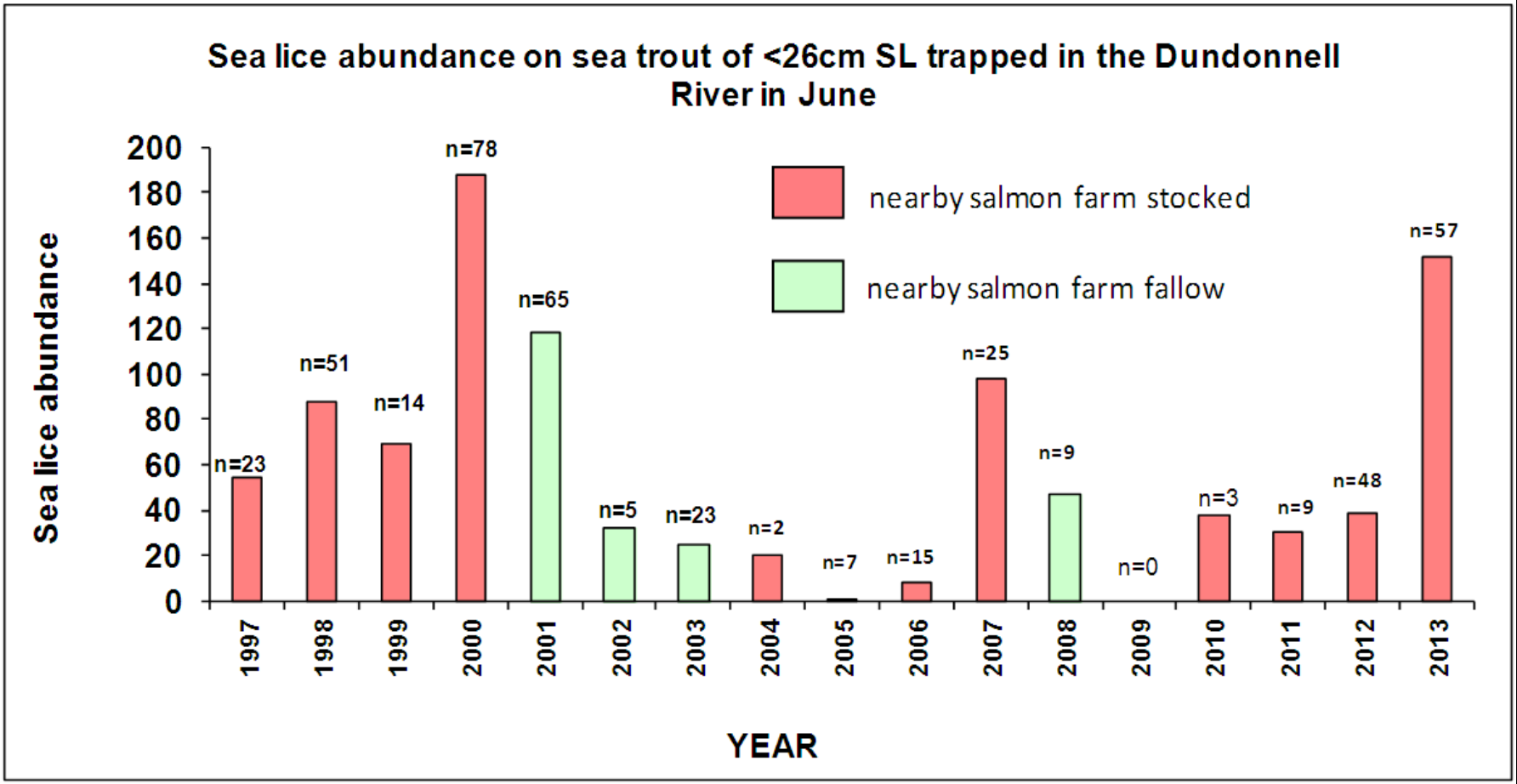
Dundonell fyke net 2013

sea trout, 8th June 400+ lice

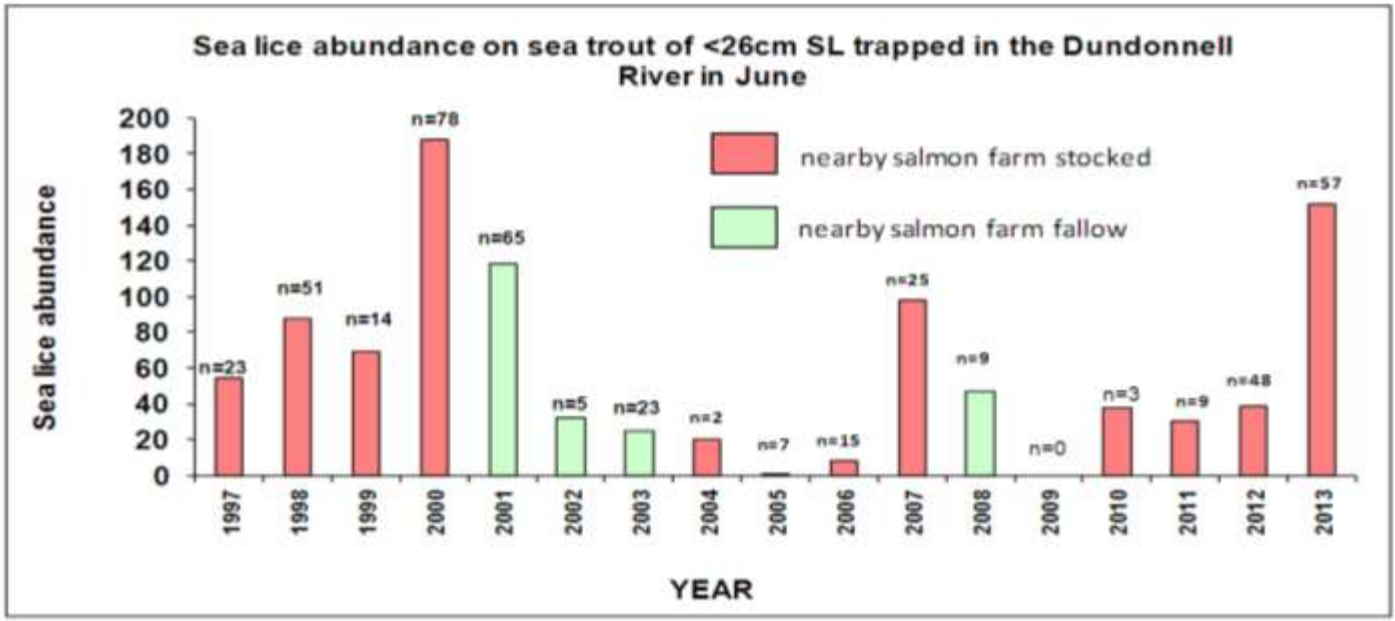
Photos by Alasdair MacDonald

Dundonell fyke net 2013

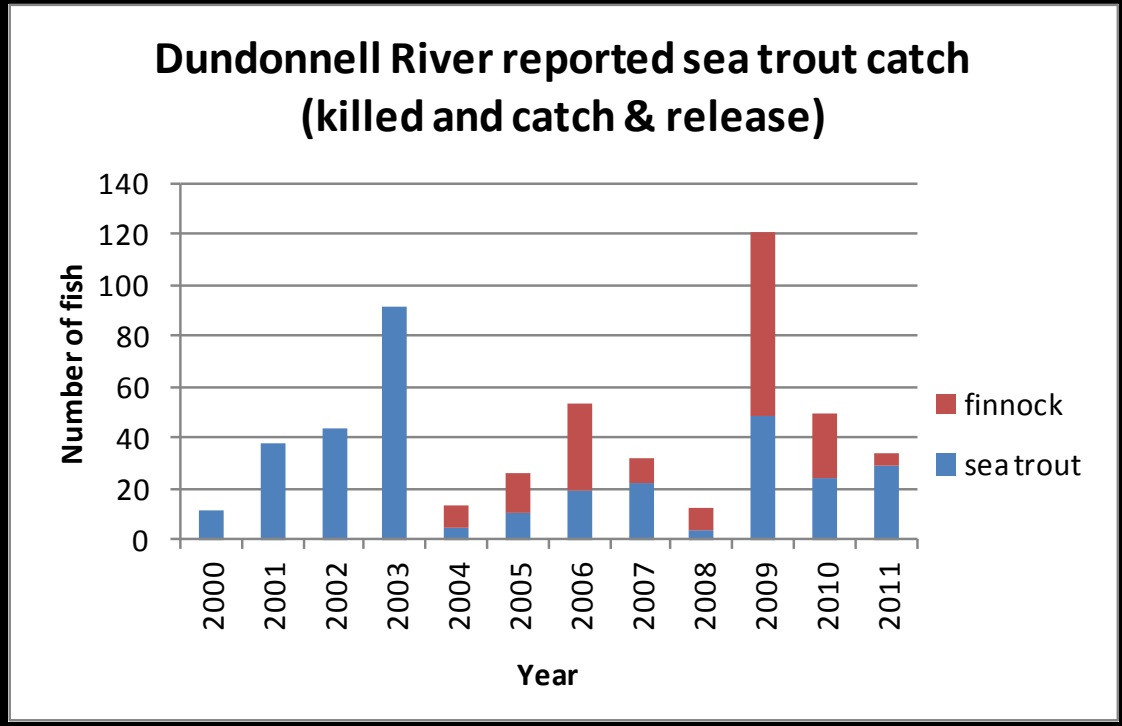
Lice levels recorded on post-smolt sea trout in June were the second highest in the 17 year time series.



Dundonnell fyke net



During periods when the nearby salmon farm was fallow, lice levels on post-smolts were lower and rod catches of sea trout in the Dundonnell River were higher.



'The fish just keep coming . . .'

Posted: Friday 11 September, 2009 @ 08:05:30

The following report was circulated by Eilean Darach ghillie, Brian Fraser on 8 September 2009:

"I just thought you would like to know that we have had another fantastic week's fishing on Gruinard and the River Dundonnell. The fish just keep coming. We have seen fresh fish every day this week bar Saturday as the river was verging on being too big to fish due to the rain on Thursday night. It's the quality of the fish and the numbers that are impressive. Bumble, a good friend of Jonnie Parry, who has been fishing the Dundonnell River for 30 years said she had not seen so many fish in the river for 20 years and more. This lady caught over 40 sea trout on the River Dundonnell in the first week of September, the best being 4 lbs and a 5 lbs respectfully, hen fish, and quite a few between the 2-3lbs range. Bumble also had 3 grilse and a fresh run sea liced salmon of 12 lbs. That is quite a catch of fish for one lady fishing 2-4 hours a day for six days. Jane Wright had 4 sea trout in one hour on Saturday night, the best being 2lbs. Fantastic fishing I am sure you would agree!!

Nick Wright has been fishing the Gruinard for over 60 years and he said that he has not seen so many fish in the river in years, and caught what he describe as a fish of a lifetime in the Bothy Pool on the Gruinard.

It's a pity it rained so hard Thursday night as that seemed to put the fish off the take Friday and Saturday. We ended up with a total catch for the Gruinard of 48 salmon for four days really as Friday and Saturday the river was too high. We had double figure fish being caught clean off the tide carrying small numbers of lice. Bill Whyte reported catching beautiful plump little silver Sea trout on Loch na Sheallach at the head of the River Gruinard on the Saturday, clean off the tide. The sea trout really are in good condition this year with no grazing marks from lice to be seen on their backs and they can only be described as being in perfect condition.

This is a remarkable turn around with Ardessie only being fallow for one and a half years and confirms that all the environmental reports ever done about Ardessie over the years have been right. They all state that Ardessie Fish Farm is badly sited and is having a huge affect on the Rivers Gruinard, Little Gruinard and the Dundonnell sea trout and salmon. There can be no doubt after the results of this year."

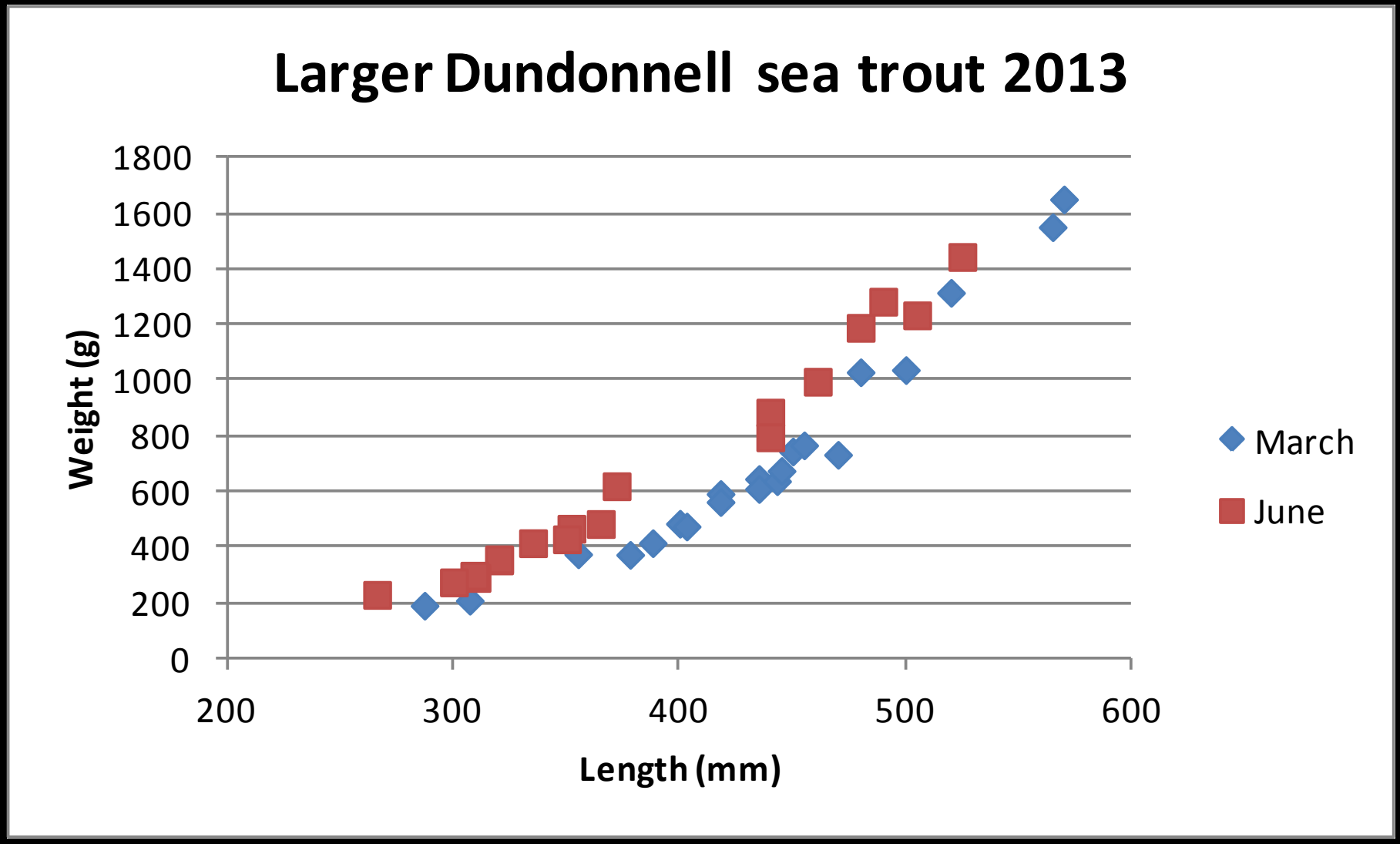
Dundonell fyke net 2012

Dundonell fyke net 2013

13th March 2013: 480mm, 1030g, 29 Chalimus lice, 3 preadult and adult lice, 0 Ovigerous females, Dorsal fin damage 1 'old predator damage'

Caught again . . . . June 2013 . . .

Dundonnell fyke net 2013: larger trout caught



Results 3

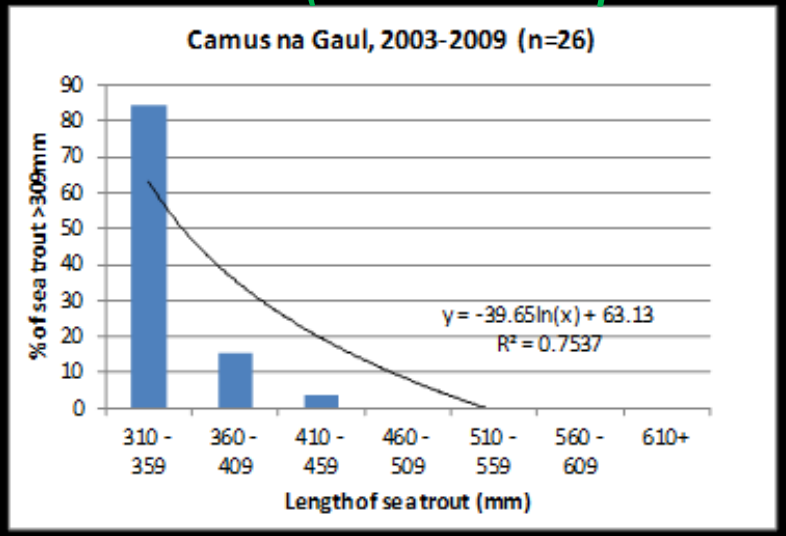
At Kanaird and Dundonnell, despite epizootic sea louse levels on post-smolt sea trout in some years, some of the larger fish were able to survive and grow.

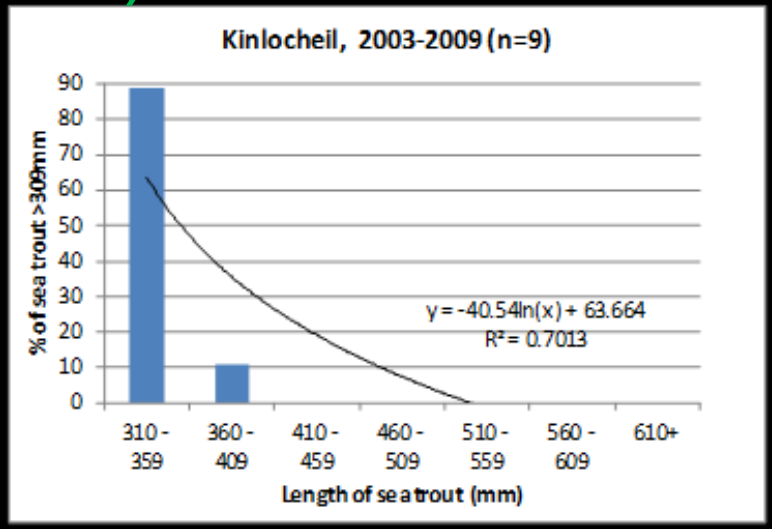
Sea trout 570m, 1652g, Dundonnell 13 March 2013

Are some trout able to learn how to avoid sea lice (e.g. by nipping in and out of freshwater)?

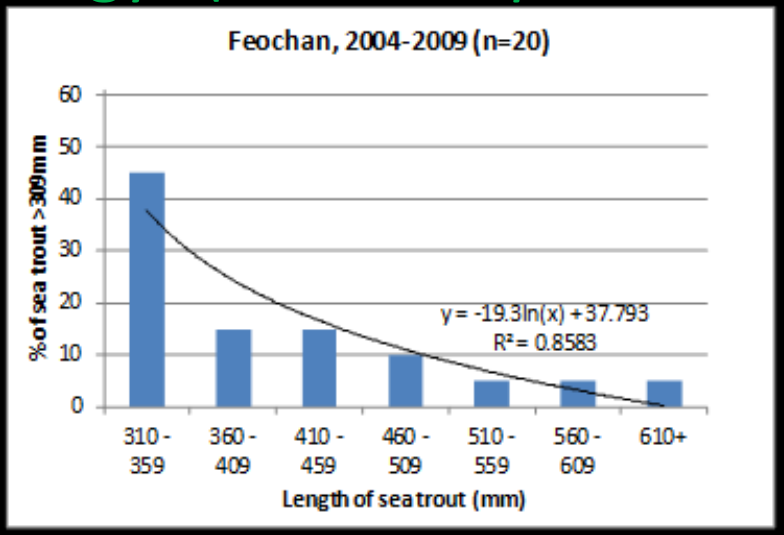
Lochaber *(LFT sweep net data)*

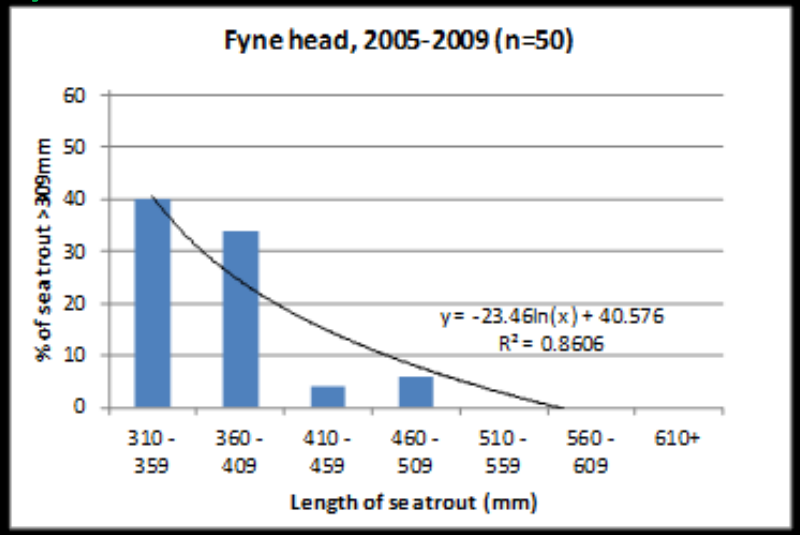
How does the length distribution of larger sea trout vary in other parts of the West of Scotland?





Argyll *(AFT sweep net data)*

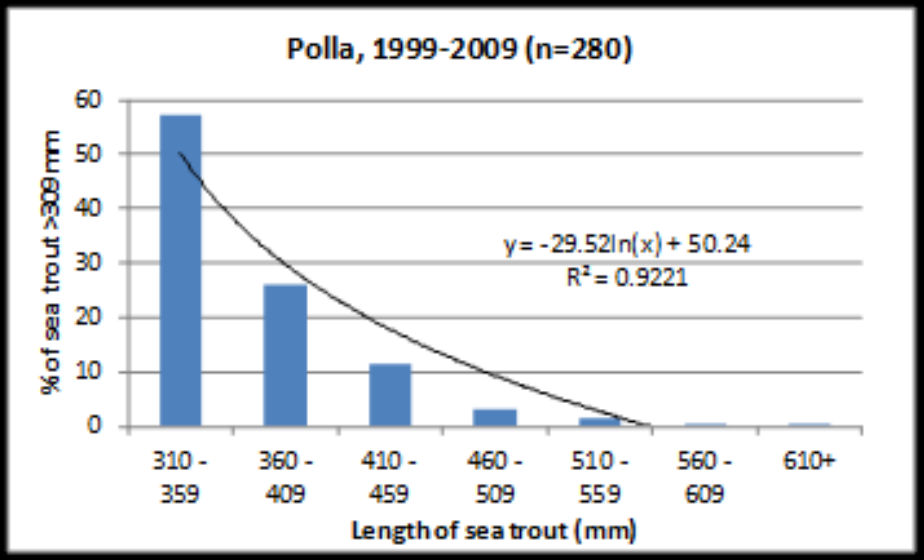


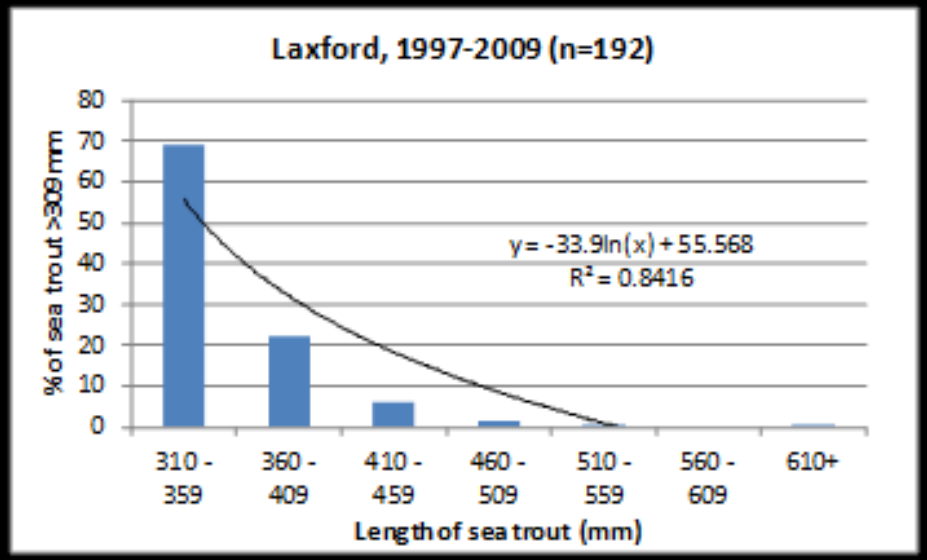


Relative proportions of sea trout in each size class within the subsamples of sea trout of over 309mm in length taken at respective sweep net sampling sites . This data was collected by and is used with the permission of the Lochaber Fisheries Trust and Argyll Fisheries Trust and released by the Scottish Government following a freedom of information request.

West Sutherland

Relative proportions of sea trout in each size class within the subsamples of sea trout of over 309mm in length taken at sweep net sampling sites in the estuaries of the rivers Polla and Laxford in West Sutherland. This data was collected by the West Sutherland Fisheries Trust and released by the Scottish Government following a freedom of information request.



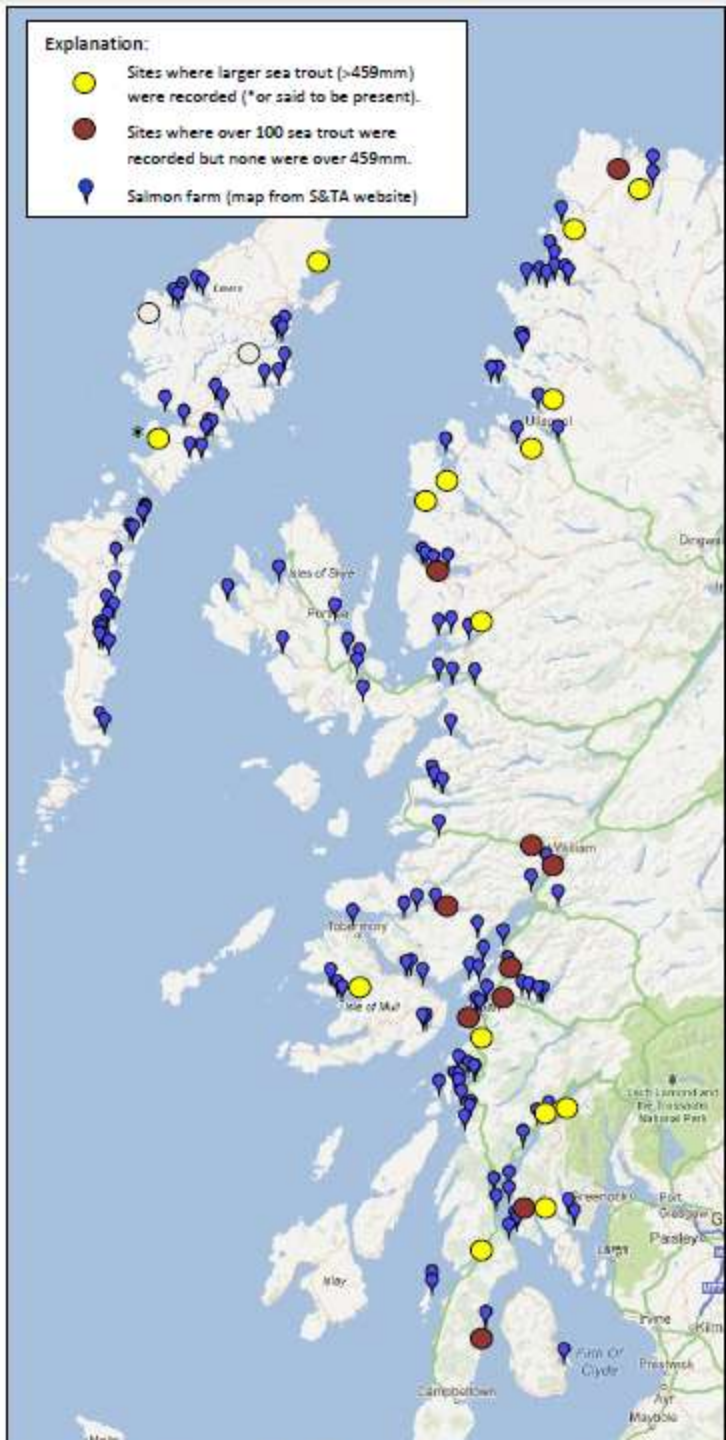


Sea trout of 750mm, estimated weight 9.5lb from the estuary of the River Polla, taken on 13th June 2007. This is thought to be the largest sea trout taken by a fisheries trust in a sweep net sample in the West of Scotland to date. Photo by A. Marsham published in the WSFT Review 2008.

Results 4

In sea trout sampling data sets collected by fisheries trusts in the West of Scotland (2003 – 2009) , there were relatively fewer larger sea trout in samples taken in the Loch Linnhe area (with high concentration of fish farms) than in samples from other areas .

Can we use larger data sets to explore this correlation further?



Some initial conclusions

1. Larger trout were more often absent from samples of sea trout taken in proximity to active salmon farms.
2. In a few situations some larger trout were recorded in areas where post-smolt sea trout carried high levels of lice infection.

What other factors may be affecting sea trout survival?

What has happened to other inshore fish populations since 1980s?

For much of the 20th Century, Gairloch supported a busy herring fishery and a then whitefish fleet . . .

ringnetter “Mhaighdean Mara“ ashore at Badachro, Gairloch around 1950

http://www.trawlerphotos.co.uk/gallery/showfull.php?photo=14481

UK Record Weights, rod/line from boat

Plaice: 10-03-08 Longa Sound, Scotland. H Gardiner 1974
(photo: http://www.uk-fish.info/pages/plaice.html)

Loch Gairloch was well known for sea angling

Dab: 2-12-04 Gairloch, Highlands. R. Islip 1975
(photo: http://chesilbeach.forumotion.net/t7074-smashed-dab-record)

LETTERS TO THE EDITOR

Dear G&DT

January, 2010

I was interested in Derek Roxborough's letter and Dorothy's response à propos the Gairloch cod fishery. As stated, both must be correct. A few years ago I was told by an old local fisherman that he vividly remembered setting out the long lines - or 'great lines' if they were for cod - in his grandfather's boat, across Gruinard Bay. He said, 'I can still feel, one by one, the bangs and knocks of fish hooking themselves all down the line' as I held the end.

In 1972 I was living in Lee-On-Solent when I read in *Angling Times* about a British record plaice that had been rod and line caught from Longa Sound by a young man in a canoe. Being very keen sea anglers, my family and I towed out boat all the way up from south Hampshire. We camped at Big Sand and fished every day for a fortnight and talked with local fishermen about the winter cod netting amongst their other commercial activities.

We caught fifteen species of fish in the Gairloch area during that holiday, many to specimen size. These included codling and hake, haddock, thornback and conger plus a lemon sole within half an ounce of the British record (in ten feet of water of Strath) and a dab from Longa Sound that actually became the British rod caught record. May still be in the Guinness Book of Records - haven't checked recently.

We had fished from shore and boat many coasts around Britain and many since then, but I never encountered anything to compare with this.

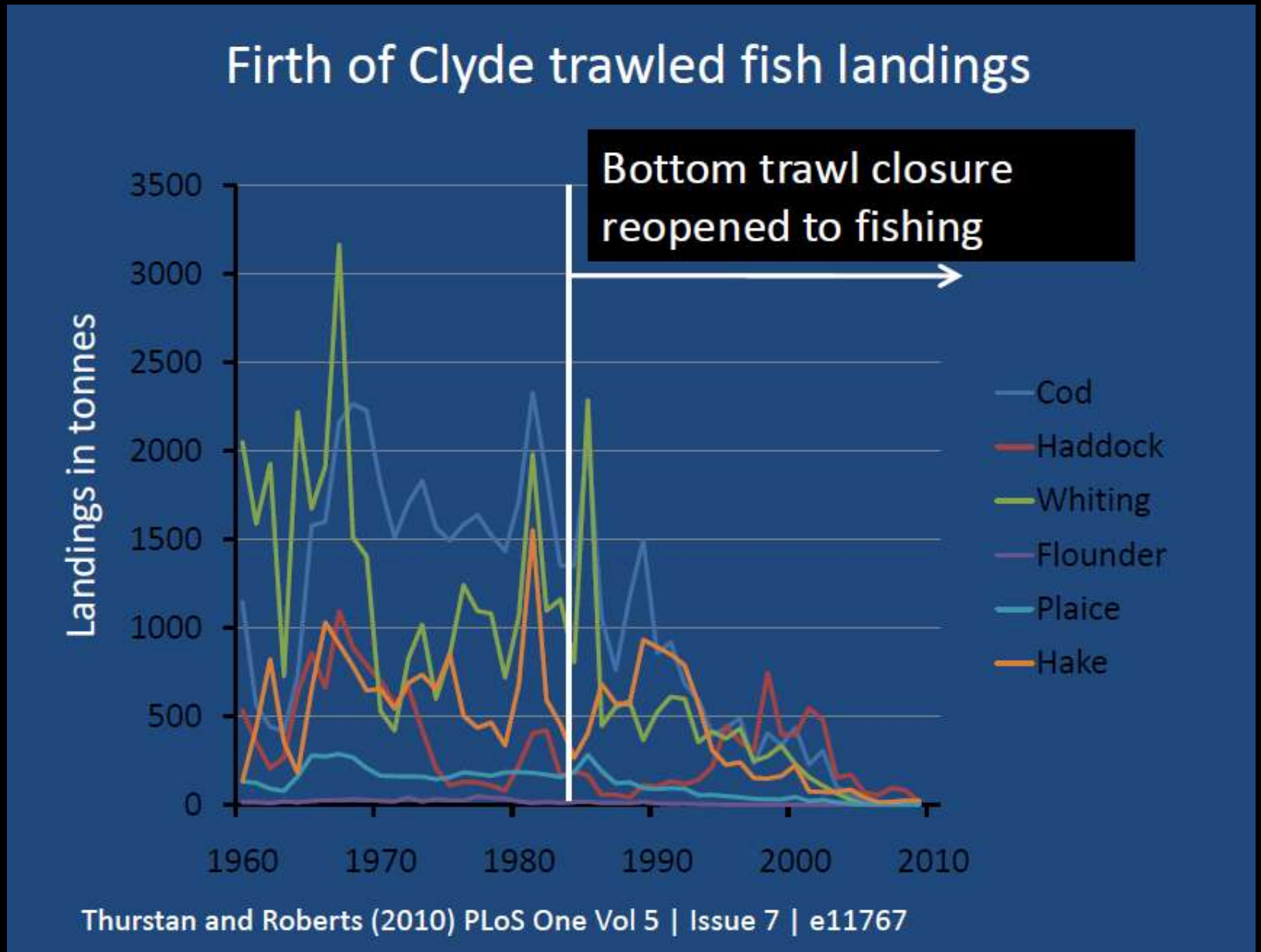
But two years later we returned, this time catching very little. The boys in the big boats had been listening! By 1980 the fishing in Gairloch wasn't worth the candle. We heard stories of suction dredgers and illegal night trawling, 'sea bottom like a ploughed and weed-less field', etc, etc. Why are we so keen, so often, to cut off the branch on which we sit?

I hope that one day Loch Torridon, the Gairloch and Loch Ewe can become a New Zealand style Marine Park, thus allowing these precious breeding grounds to return to their former glory, for the future benefit of all.

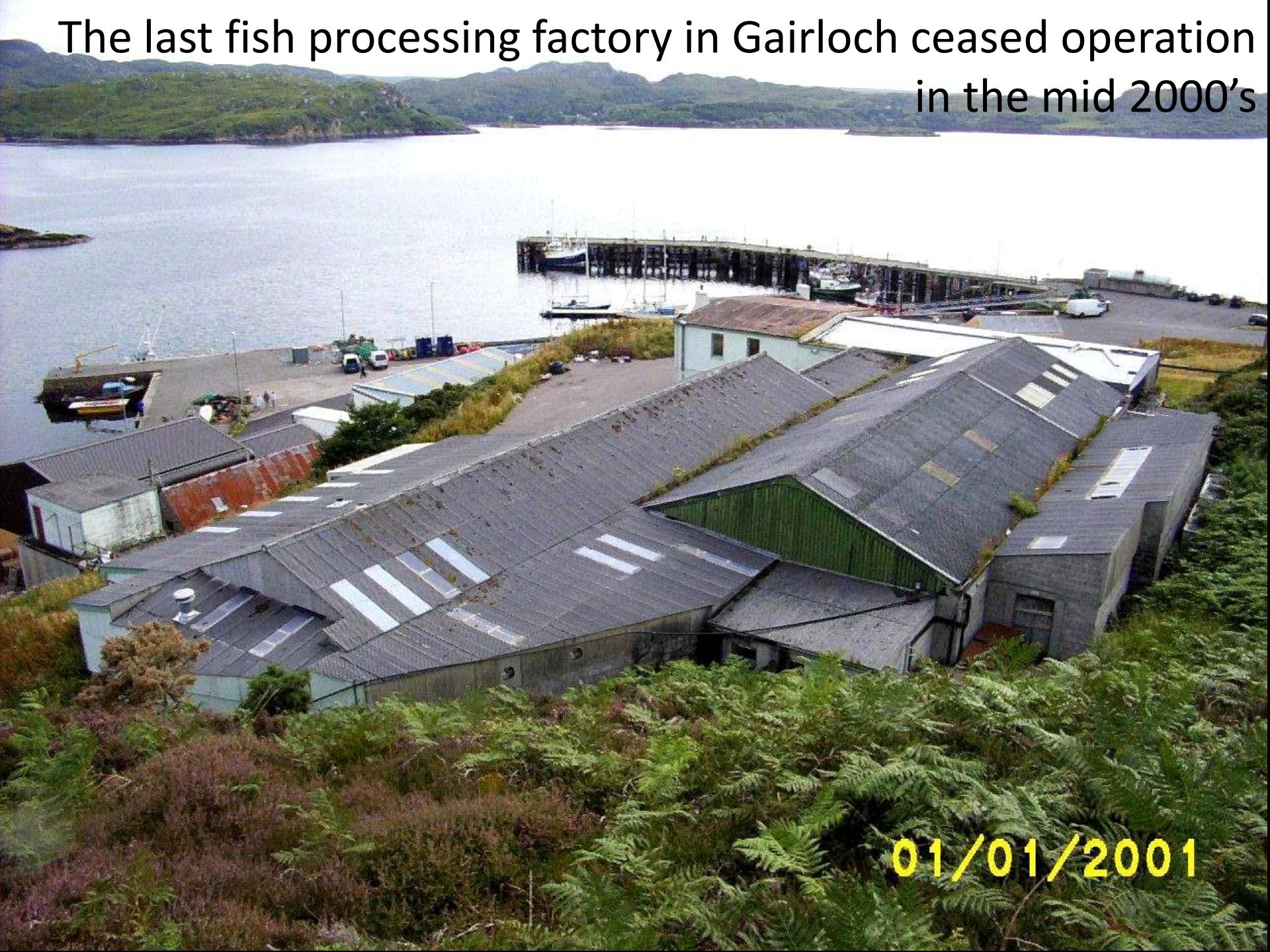
Bryan Islip

‘Seaflower : When I was a child, in the early 70s, we used to go on family holidays to Gairloch in Wester Ross. Every evening, we would go down to the pier to watch the fishing boats unloading. In these days, there were about a dozen or so boats, mostly east coasters I think, which unloaded white fish (i.e. cod, haddock etc. as opposed to herring or prawns) at Gairloch. The pictures were taken in the 80s after the new pier had been built but are similar to the scenes on a summer evening 10-15 years earlier I'm recalling’

Many other fish populations collapsed around the west of Scotland during the past 25 years, c. Firth of Clyde . . .



The last fish processing factory in Gairloch ceased operation in the mid 2000's



Sea trout condition varies according to food availability. . .

Fishing for sandeels, Strath Bay, Gairloch, July 2009

When there are lots of wee fishes in the sea, sea trout condition factor can be high by mid-summer

A remarkably 'fat' sea trout of 380mm, 800g, ***condition factor 1.46,*** *taken in the sweep net at Boor Bay on 15th July 2009.*
(photo Ben Rushbrooke)

We know that sea trout eat sandeels

Sandeels and sprats are often seen when sweep netting, especially by the snorkeler behind the net.

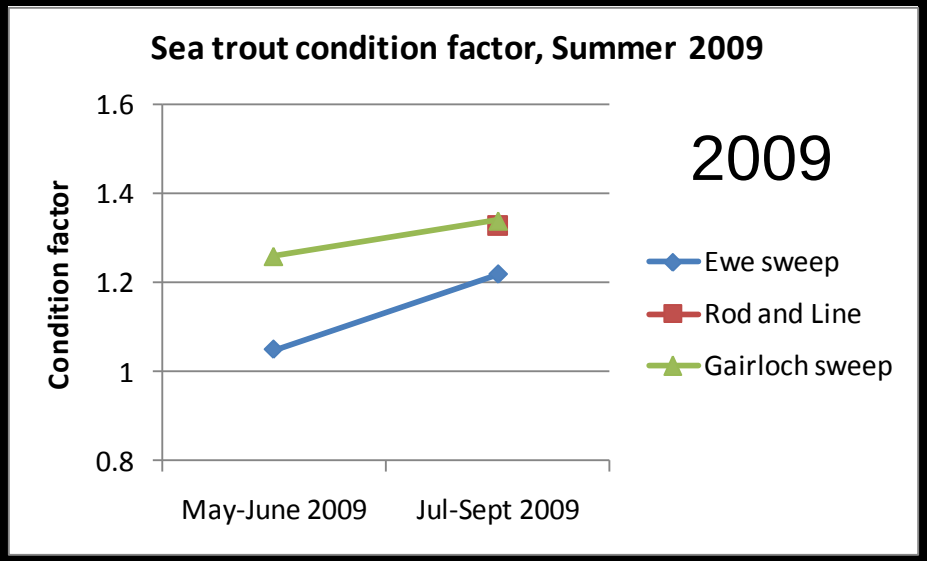
*Post-finnock of 285mm, 240g with 102 L. salmonis lice taken in the sea pool of the R. Ewe on **4th June 2012 using rod and line.***

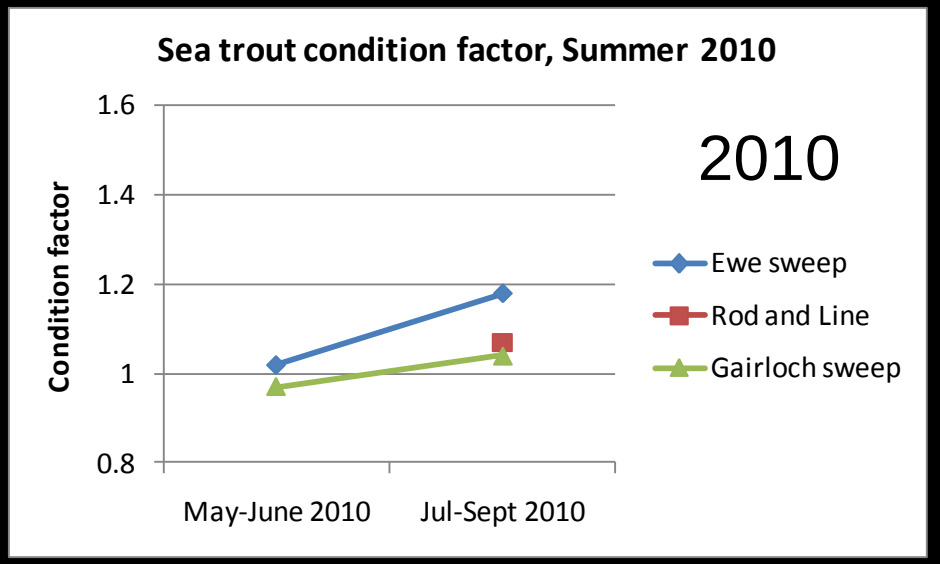
***On 4th July 2012,** 7 sea trout were caught, ranging in length from 181mm to 251mm. There were few lice on these fish, except the fish of 251mm which carried 61 Lepeophtheirus salmonis lice, and 4 Caligus elongatus.*

This fish (left) was killed and dissected: 15 small sandeels were found in its stomach.

The sea trout we caught in 2009 were fatter than in 2010, 2011, 2012 and 2013.

To what extent was this related to sandeel abundance?





Sea trout from Kerry Bay, Loch Gairloch, 29th June 2009.

Sea trout from Flowerdale Bay, Loch Gairloch, 29th June 2010

Sandeel numbers may collapse for reasons relating to climate . . .

Sandeel kill, Gruinard Bay, 14 June 2013 (associated with plankton bloom?)

Photos by Johny Parry

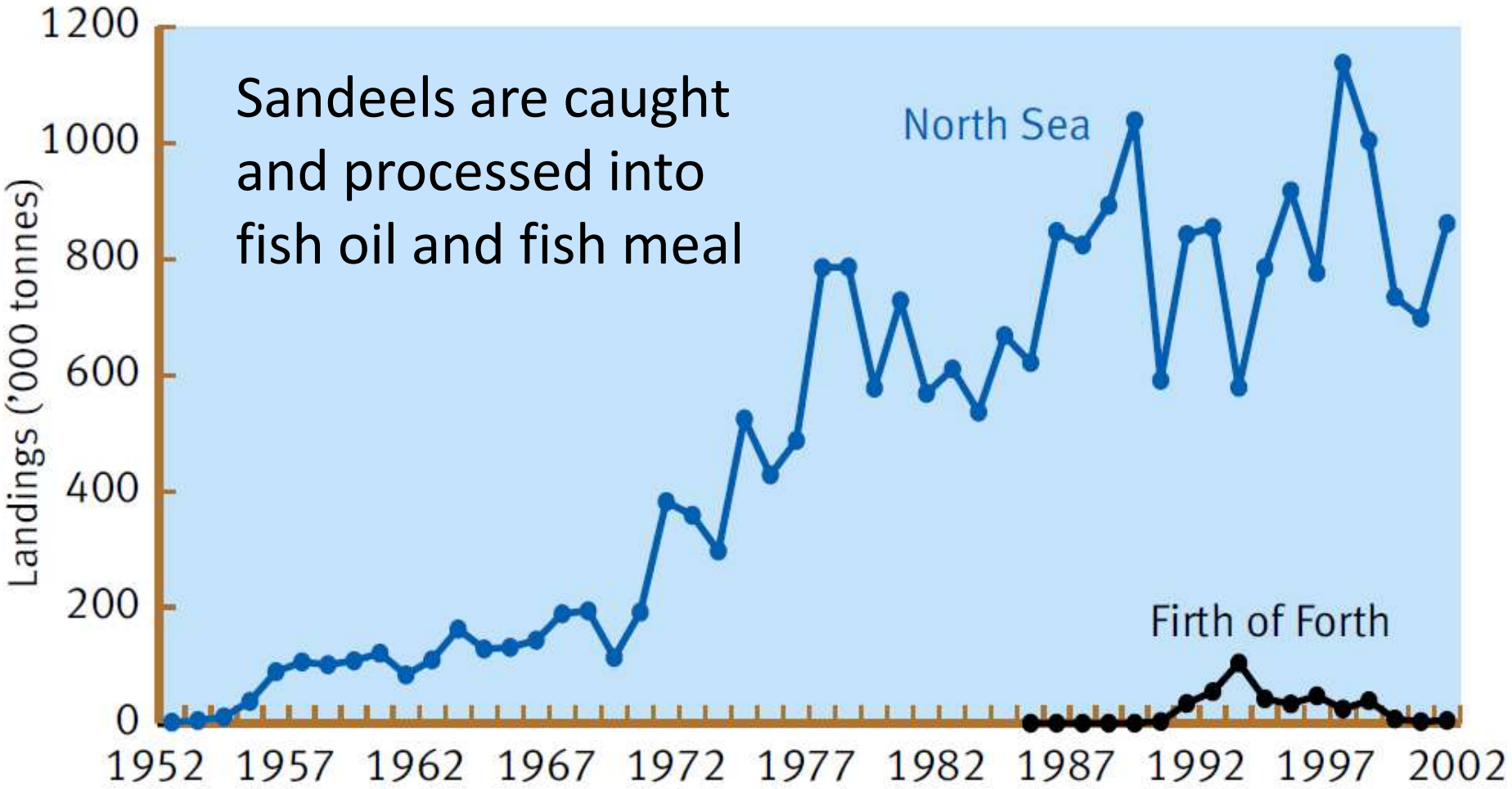


Figure 2. Landings of sandeels from the North Sea and Firth of Forth, 1952 – 2001.

http://www.sciencedirect.com/science/article/pii/S1470160X13003981

THE SCOTSMAN

SCOTLAND on SUNDAY

Sandeel fishing linked to Scottish seabird decline

Thousands of tonnes of sandeels are used for animal feed and fertiliser. Picture: Getty

by FRANK URQUHART

Published on the 01 December 2013 00:28

5 comments

A LINK has been confirmed for the first time between the intensity of industrial sandeel fishing in the North Sea and the failure to breed of internationally important seabirds.

Common Tern *(photo by Barry Blake)*

Aonghais S.C.P. Cook, Daria Dadam, Ian Mitchell, Viola H. Ross-Smith, Robert A. Robinson, (2014) ***Indicators of seabird reproductive performance demonstrate the impact of commercial fisheries on seabird populations in the North Sea.*** Ecological Indicators, Volume 38, March 2014, Pages 1-11, ISSN 1470-160X, http://dx.doi.org/10.1016/j.ecolind.2013.10.027.
http://www.sciencedirect.com/science/article/pii/S1470160X13003981

http://www.scotsman.com/news/environment/sandeel-fishing-linked-to-scottish-seabird-decline-1-3216052

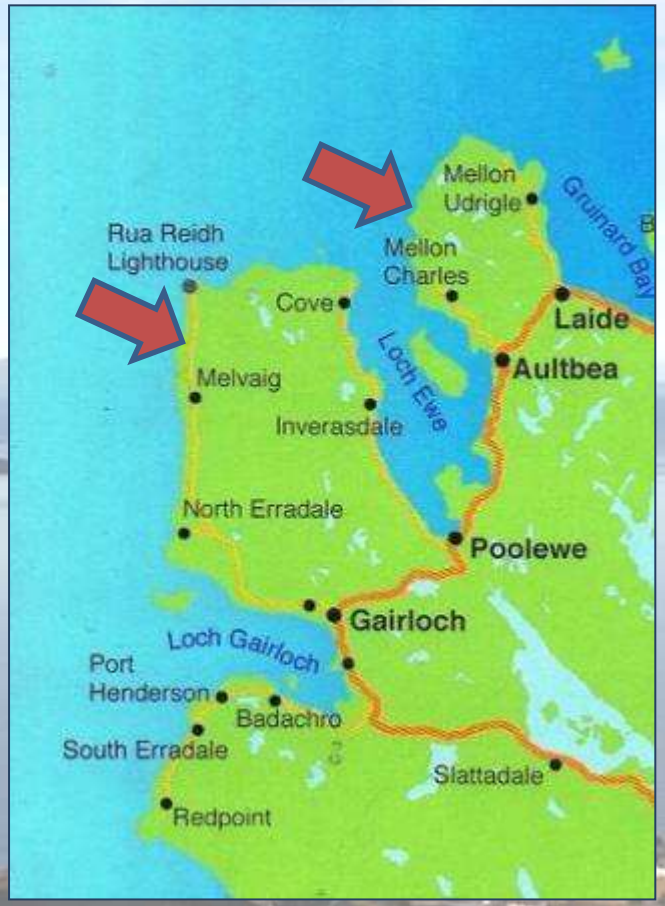
Sea trout also eat juvenile herring

Photo by James Butler

Herring and sandeels need suitable habitats where they can lay their eggs.

Local fishermen say herring spawn on 'coral' (?maerl beds) near Rhu Reidh, Greenstone Point and in Loch Ewe. Herring eggs are sticky and attach to maerl, gravel or other substrates.

Fishermen say that Minch herring spawn(ed) on ‘coral’ [maerl beds] around Wester Ross in March.

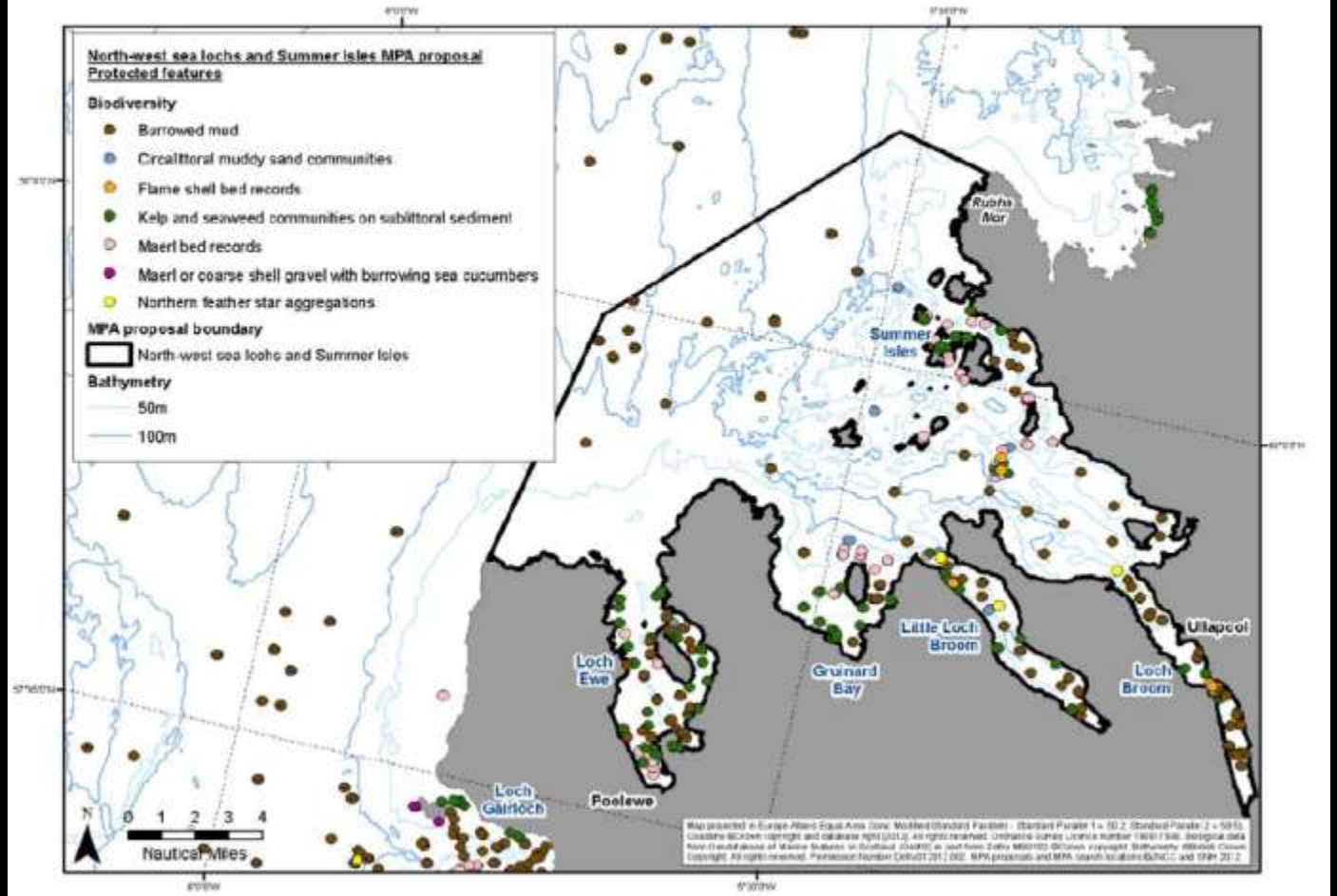


(map from Celtic Fringe magazine.)

Can a marine protected area help protect herring spawning grounds from damage by scallop dredgers?

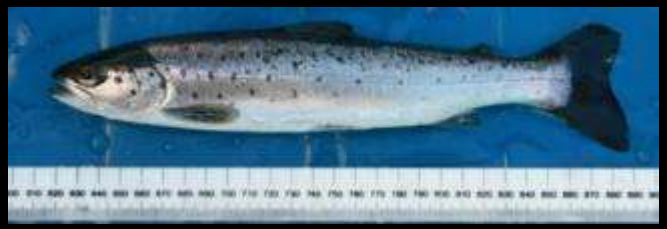
NORTH-WEST SEA LOCHS AND SUMMER ISLES MPA PROPOSAL - DATA CONFIDENCE ASSESSMENT

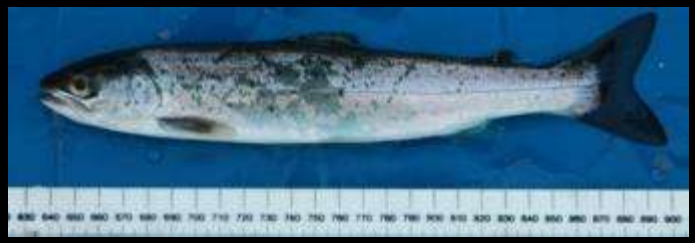
Figures 2i and ii *Records of protected features within the North-west sea lochs and Summer Isles MPA proposal (native oyster records not shown on Figure 2i)*

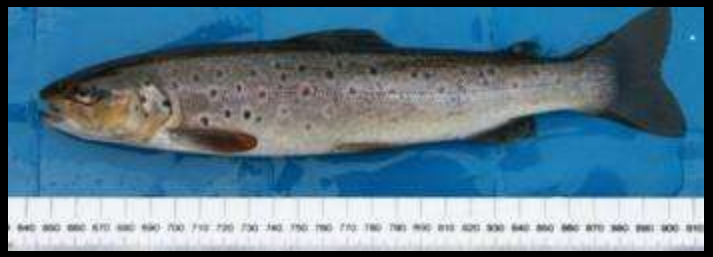


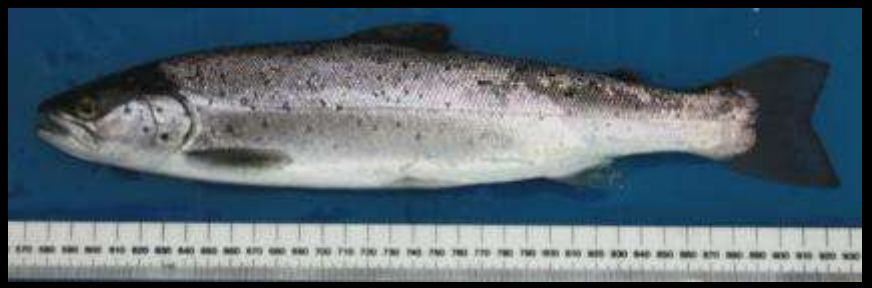
Flowerdale, Loch Gairloch, 19 February 2014. (photo by Ben Rushbrooke)

Thin sea trout with ***average condition factor of 0.84*** from Loch Gairloch, 19 Feb 2014 *(fish shown from sample of 18)*









(photos by Ben Rushbrooke)

Seals

'Both grey and harbour seals are probably more numerous now [2010] than in the historical past, when they were locally hunted and/or harvested.

. . .The Conservation of Seals Act 1970 replaced the 1914 Act (and its 1932 successor) and, for the first time, included protection for harbour seals which had been heavily exploited for their skins . . .

Boat surveys of harbour seals in Scotland in the 1970s showed numbers to be considerably lower than in recent surveys which started in 1988, indicating increases in numbers in all areas. For example, 1800 counted in Shetland in 1971 (Bonner et al., 1973) and 4900 counted in 2001 (Duck et al., 2007).'

From: Duck, C. (2010). Charting Progress 2 Healthy and Biological Diverse Seas Feeder Report: Section 3.5: Seals. Published by Department for Environment Food and Rural Affairs on behalf of UKMMAS. p506-539. In: UKMMAS (2010) Charting Progress 2 Healthy and Biological Diverse Seas Feeder Report (Eds. Frost, M & Hawkridge, J).

Harbour seals in August (2007-2011), compiled by Sea Mammal Research Unit

Scientific Advice on Matters Related to the Management of Seal Populations: 2012

Contents

Tournaig Trap project

Ben Rushbrooke photographing a salmon from the Tournaig trap in 2012

Tournaig trap grilse, 2012. Zoom in to examine individual fish.

The Tournaig Trap Project was supported by Marine Harvest in 2012. All photos Ellen Rushbrooke

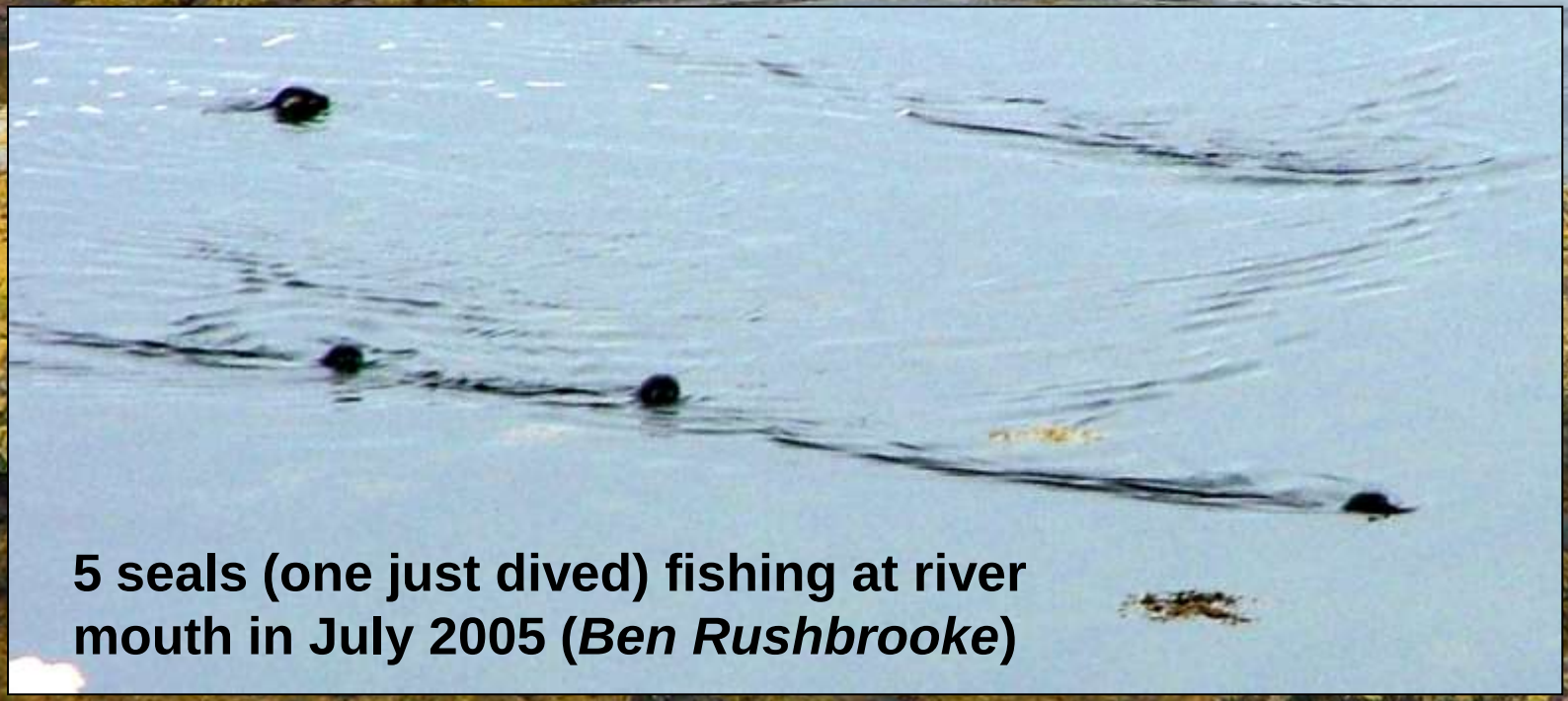
Tournaig predator damaged fish

•of 155 salmon and grilse in upstream trap from 2004 -2011, 16 had scars or bite marks (mainly seals?)

Seal on rocks by Tournaig

(all photos by Ben Rushbrooke)

Seals at Tournaig, by Loch Ewe



5 seals (one just dived) fishing at river mouth in July 2005 (*Ben Rushbrooke*)

However . . .
Harbour seals

Salmon farms . . .

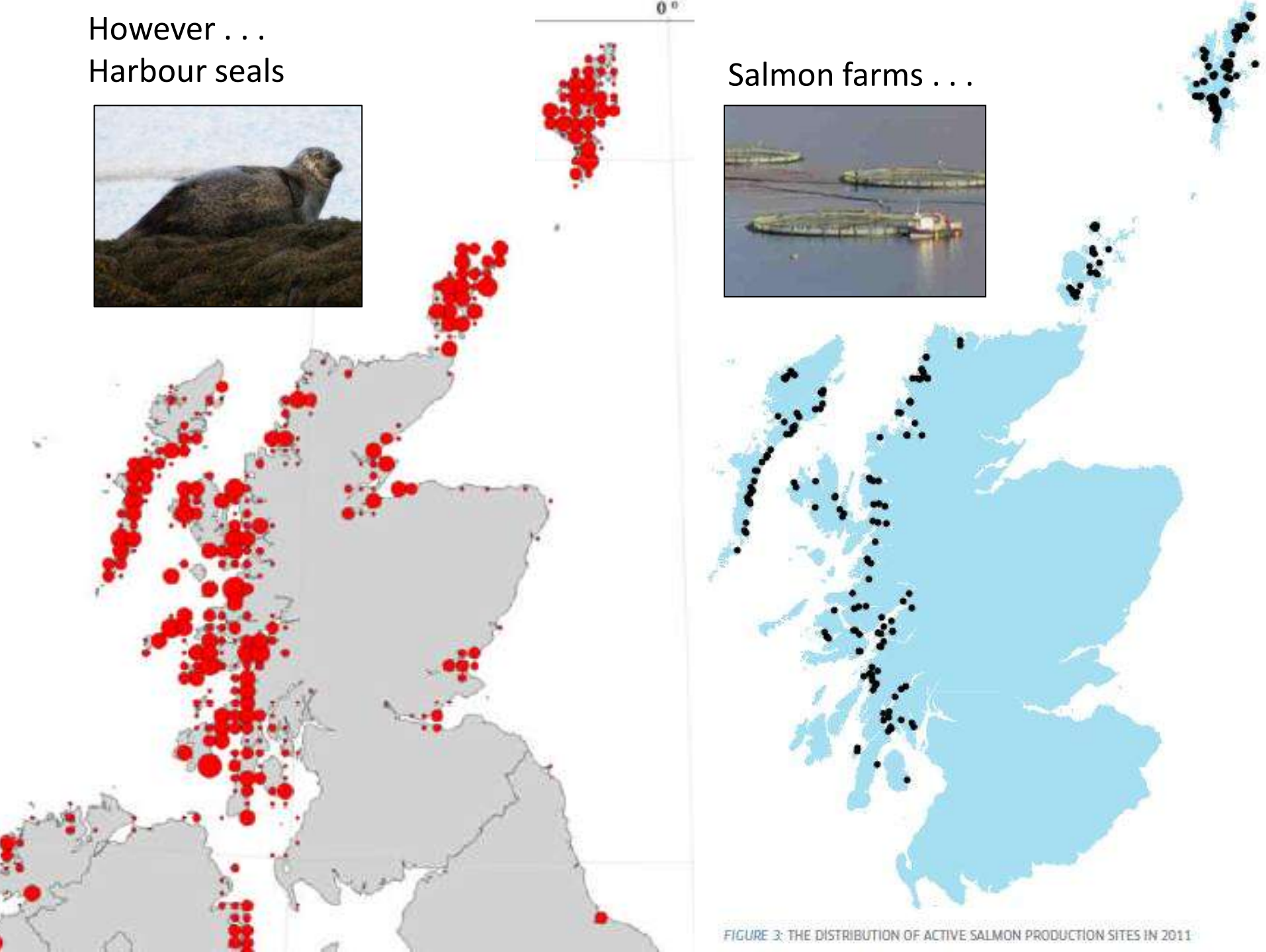
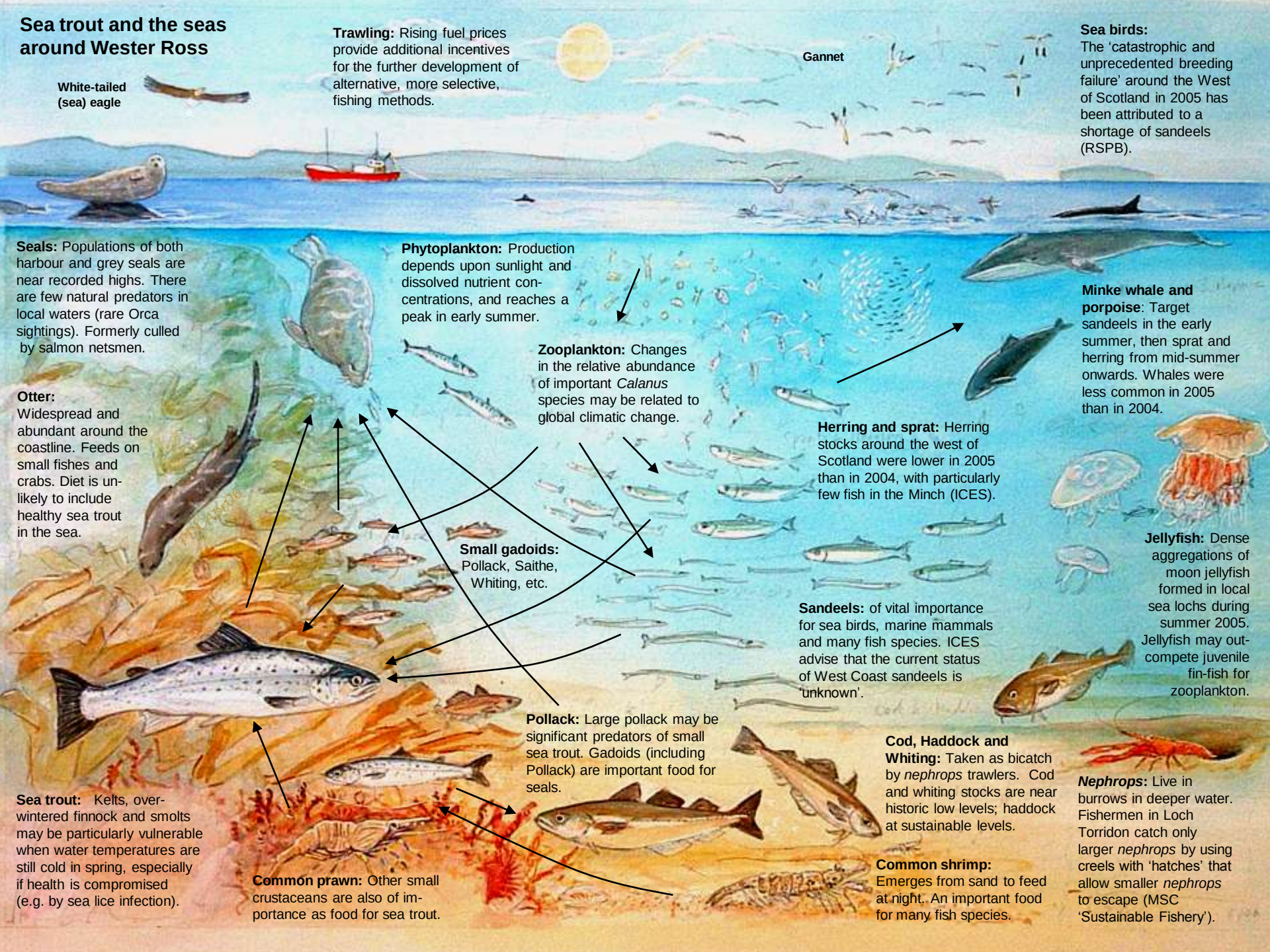


FIGURE 3: THE DISTRIBUTION OF ACTIVE SALMON PRODUCTION SITES IN 2011

Sea trout and the seas around Wester Ross



White-tailed (sea) eagle

Trawling: Rising fuel prices provide additional incentives for the further development of alternative, more selective, fishing methods.

Gannet

Sea birds: The 'catastrophic and unprecedented breeding failure' around the West of Scotland in 2005 has been attributed to a shortage of sandeels (RSPB).

Seals: Populations of both harbour and grey seals are near recorded highs. There are few natural predators in local waters (rare Orca sightings). Formerly culled by salmon netsmen.

Phytoplankton: Production depends upon sunlight and dissolved nutrient concentrations, and reaches a peak in early summer.

Zooplankton: Changes in the relative abundance of important *Calanus* species may be related to global climatic change.

Minke whale and porpoise: Target sandeels in the early summer, then sprat and herring from mid-summer onwards. Whales were less common in 2005 than in 2004.

Otter: Widespread and abundant around the coastline. Feeds on small fishes and crabs. Diet is unlikely to include healthy sea trout in the sea.

Herring and sprat: Herring stocks around the west of Scotland were lower in 2005 than in 2004, with particularly few fish in the Minch (ICES).

Small gadoids: Pollack, Saithe, Whiting, etc.

Jellyfish: Dense aggregations of moon jellyfish formed in local sea lochs during summer 2005. Jellyfish may outcompete juvenile fin-fish for zooplankton.

Sandeels: of vital importance for sea birds, marine mammals and many fish species. ICES advise that the current status of West Coast sandeels is 'unknown'.

Pollack: Large pollack may be significant predators of small sea trout. Gadoids (including Pollack) are important food for seals.

Cod, Haddock and Whiting: Taken as bicatch by *nephrops* trawlers. Cod and whiting stocks are near historic low levels; haddock at sustainable levels.

***Nephrops*:** Live in burrows in deeper water. Fishermen in Loch Torridon catch only larger *nephrops* by using creels with 'hatches' that allow smaller *nephrops* to escape (MSC 'Sustainable Fishery').

Sea trout: Kelts, overwintered finnock and smolts may be particularly vulnerable when water temperatures are still cold in spring, especially if health is compromised (e.g. by sea lice infection).

Common prawn: Other small crustaceans are also of importance as food for sea trout.

Common shrimp: Emerges from sand to feed at night. An important food for many fish species.

Wester Ross sea trout

1. In addition to sea lice epizootics, other interacting factors may have contributed to the current state of depleted fisheries.
2. Stocks of other inshore fish populations collapsed around the west of Scotland after the ban on inshore trawling was lifted in 1985.
3. Seal populations increased (partly due to fewer salmon netsmen shooting them, following decline of net fisheries!).

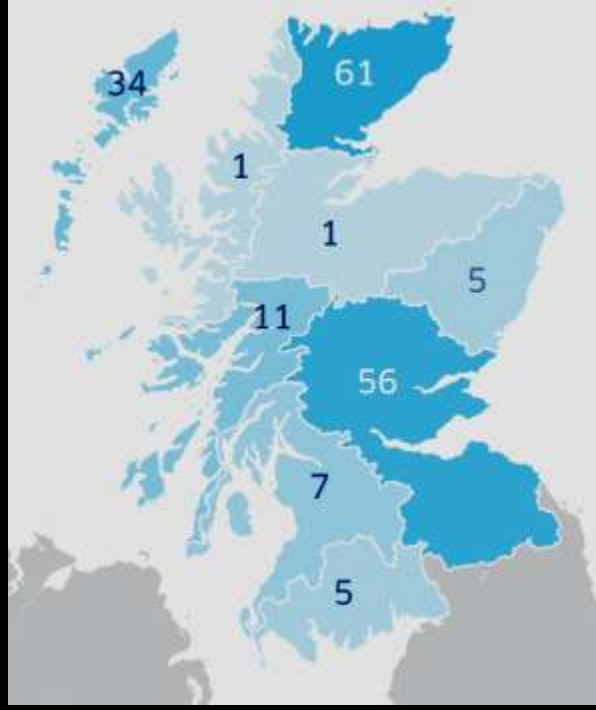
'There are clear differences among geographic regions in the relative strength of the 2012 rod catch.

All mainland regions in the west of Scotland reported catches which were within the lowest eleven recorded for their region over the period 1952 to 2012.

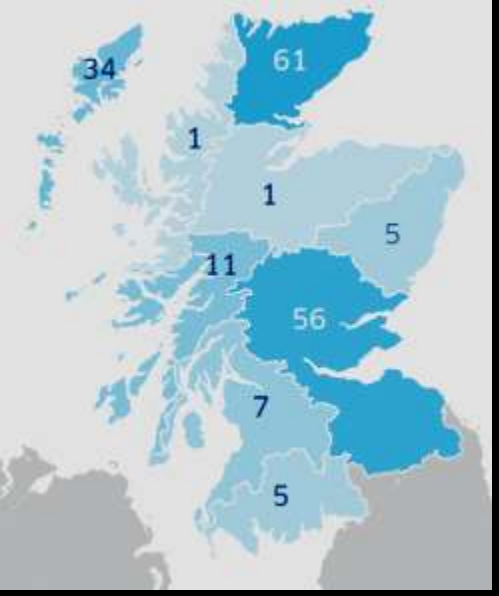
The reported catch in Moray Firth and North East regions were, similarly, the lowest and fifth lowest respectively over the same period.

Catches in the East and North regions in 2012 were, on the other hand, both among the top ten catches recorded within their respective regions,

while the catch recorded in the Outer Hebrides was close to the midpoint in the time series.'



http://www.scotland.gov.uk/Resource/0043/00434139.pdf



Current status of Scottish sea trout stocks

. . . The status of stocks on smaller geographical scales (e.g. among or within catchments) may differ both from each other and also from the overall assessments presented above.'

http://www.scotland.gov.uk/Resource/0043/00434139.pdf

Therefore: to understand why sea trout stocks differ, we need to assess how they differ at smaller geographic scales.

Challenge

Can we predict how a sea trout population will respond to changes in sea louse infection pressure, given that there are other factors that influence growth and survival?

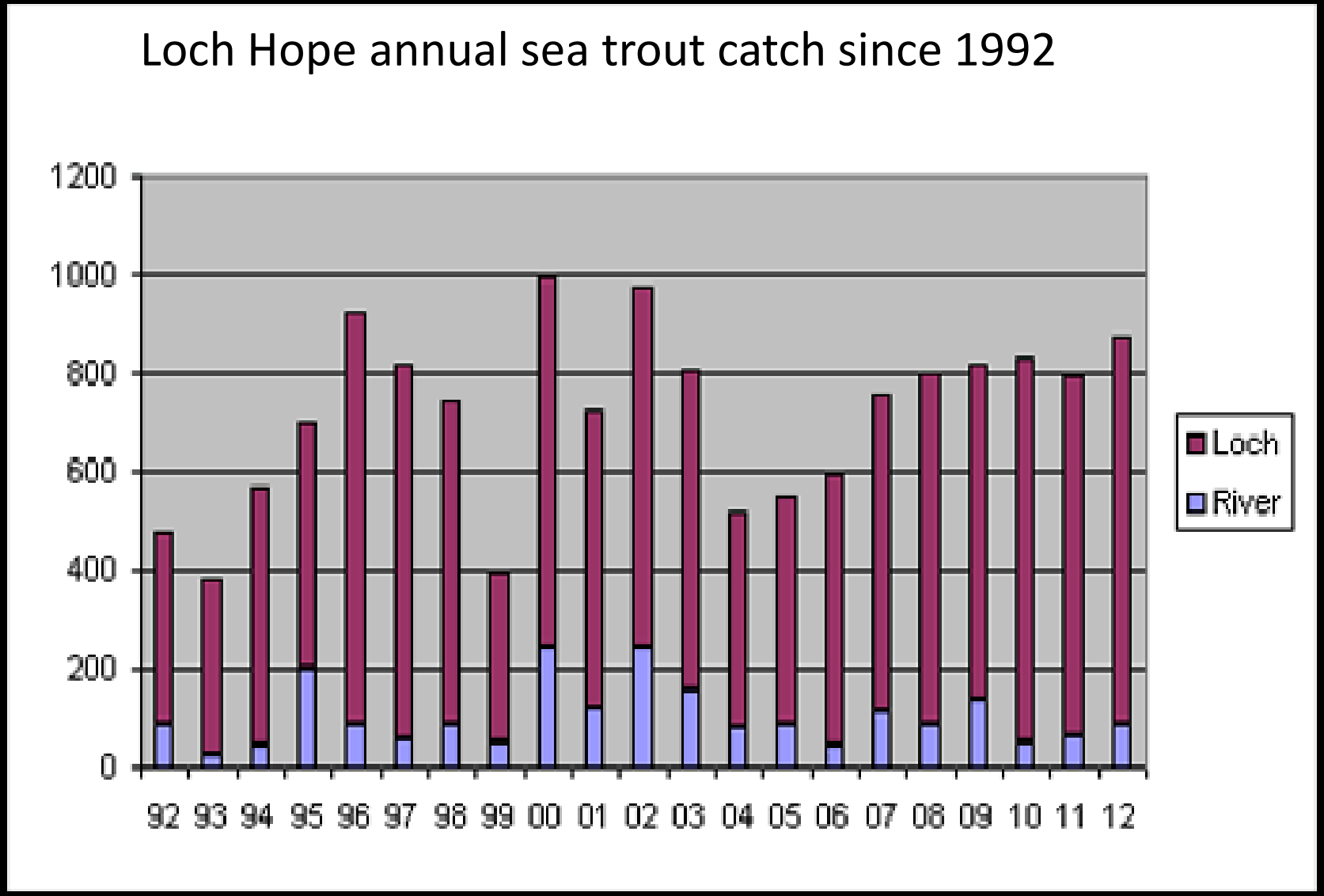
Outer Hebrides: still some big sea trout

N. MacNeil with 8lb sea trout, Loch Roag, S. Uist, Sept 12th 2013

'Having worked on this estate for 22 years I have never seen such a dry Spring, with no substantial rainfall from 17th April – 22nd May, I was slightly concerned for the fishing season. Thankfully the lack of rain didn't affect our season and we ended with a great total: 288 salmon and 700 sea trout, which is above the 5 year averages of 254 salmon and 412 sea trout.'
Amhuinnsidhe, 2012 roundup by Innes Morrison

11lb12oz sea trout from Loch Scourst, Amhuinnsuidhe, Harris
August 2013

North Sutherland: River Hope system



http://www.lochhope.co.uk/catchstats.html

Scottish Sea Trout Project proposal

Aim: to understand how sea lice and other factors affect sea trout populations in Scotland, in order to better inform management.

Objectives:

1. Assess how the size distribution of sea trout varies in time and space around Scotland.
2. Then assess the strength of relationships with salmon farm distribution, seal occurrence, trends in sandeel fisheries and any other factors.

- **The project would be developed as a ‘citizen science’ project with both volunteers and professional scientists taking an active role, with parallels to the current Scottish Mink Initiative.**

Task 1

- **Standardise key data collection protocols for sea trout sampling in the sea around Scotland.**

1. *Record lengths (mm) of all fish (including larger trout in addition to post-smolts) taken in sweep net and other samples.*
2. *Weigh fish (g).*
3. *Photograph live fish.*
4. *Count sea lice on fish caught in or near the sea (SFCC protocol).*
5. *Take scale samples.*

Task 2

- **Collect data from samples of sea trout from rod fisheries around Scotland. Focus on obtaining lengths of all sea trout >30cm in samples.**

Good quality data sets are needed to further assess the relationships between sea trout, salmon farming & other factors (e.g. local geography, predator populations, food availability).

Task 2 (continued)

Role for Scottish Fisheries Coordination Centre

- *Co-ordinate data collection via SFCC members*
- *?Adapt the SFCC Anglers Diary to a 'trout app' to enable anglers with smart phones to record basic information*
- *Develop a paper alternative (set of forms or log book) for catch data collection and distribute to participating anglers.*

Task 2 (continued)

Role for Fisheries Trusts

- *Identify anglers & ghillies able to provide reliable data.*
- *Provide hands-on training for fish processing, data collection and recording.*
- *Supervise collection of data as required to ensure high quality.*
- *Collect and collate data in format for SFCC.*

Task 2 (continued)

Role for Scottish Fisheries Coordination Centre (continued)

- *Collate and analyse data, focusing on relationships and correlations between sea trout size distributions and various possible pressures.*

- *Prepare report with interpretation and recommendations for management.*

Task 3

- **Investigate what happens to sea trout populations when salmon farms are removed from a large coastal area (e.g. south Skye sea lochs) . . .**

To what extent can sea trout populations recover when salmon farms are removed from an area?

Camasunary & Coruisk ‘moonies’ . . .


Bruach na Frithe
Sgurr nan Gillean
Marsco
Glen Brittle For
Bla Bheinn
Sgùrr Dearg
Sgurr Alasdair
Loch Coruisk
Abhainn Camas Fhionnairigh
Loch Brittle
Elgol
Soay
1 mi
2 km
Imagery ©2014 TerraMetrics, Map data ©2014 Google
Edit in Google Map Maker

Properties
Ben Nevis Estate
Li and Coire Dhorrcail Estate
Quinag Estate
Sandwood Estate
East Schiehallion Estate
Skye Estates
Sconser Management Plan
Strathaird and Torrin Mgt Plan
Factsheets
Glenlude (Scottish Borders)
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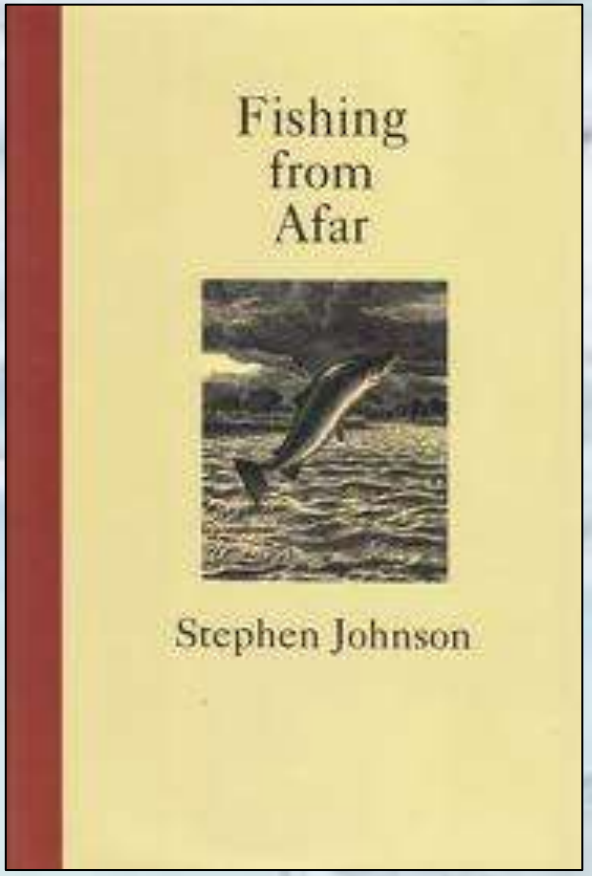
Sconser, Strathaird and Torrin on Skye

A grand landscape boasting acres of regenerating woodland and the spectacular Cuillin Hills

The John Muir Trust looks after three adjoining estates on southern Skye – Sconser, Strathaird and Torrin – comprising dramatic mountains, rugged coastline, woodland, important peatlands and crofting land. The area covers 12,044 hectares (29,761 acres) between the Cuillin Hills and Broadford with more than 80 per cent of Strathaird and Torrin falling within the Cuillin Hills National Scenic Area.

Camasunary & Coruisk ‘moonies’



Loch Coruisk

Photo by Piotr Zycki via www.pbase.com

Is there a need to designate some ‘special’ sea trout systems in Scotland?

For help with sampling sea trout, useful information, comments or other support, thank you to

Alfie Gudgeon, Ruby Neervoort, Ian MacFadyen, Arran Matheson, Ben and Henry Bulmer, Marcus Munro, Angus Davidson, Don Staniford, Hugh Richards, Alan McGillivray, Donald Rice, Alasdair and Sophie Macdonald and friends, Brian Fraser, Stuart Allison, Sue Pomeroy, Bill Whyte, Ben Rushbrooke, Roger McLachlan, Dave Mullaney, John Mackenzie, Duncan MacKenzie, Hugh Whittle and family, Ray Dingwall, Gary Bulmer, Peter Jarosz, Prof Peter Maguire, Dr Donna-Claire Hunter, Andrew Ramsay, Mark Williams and family and friends, Prof Barry Blake, Prof Dave Barclay, Ala MacKenzie, Derek Roxburgh, Norman Thomas, Marcus Simpson, Bill Anderson, Fraser Anderson, Frank Buckley, Callum MacKenzie, Terry Jack, Alasdair Pearson, Dr John Ogle family and friends, Frank Kalinowski, Pat Wilson and family, Philip Smith, Neil Morrison, Simon Stewart, Jim Raffell, Dr Andy Walker, Karen Starr, the Foreman family, Dr Steve Kett, friends and students Vu Dang, and Niru, Jonah Tosney, Alan Johnson and family, Peter Kinloch and family, Gunnar Scholtz, SNH Beinn Eighe NNR volunteers, Ben Collier, Sean Dugan, Ross Gardiner, Malcolm Thomson, Jim Henderson, Marcus Walters, Alan Kettlewhite, Geoffrey Billiet, Tony Andrews, Prof Mark Costello, Prof Ken Whelan, Ivor Llewelyn . . . and everyone else who has helped.

The Scottish Government

marine scotland

RAFTS

Wester Ross Area Salmon Fishery Board

The Highland Council

The Nineveh Charitable Trust

Scottish Natural Heritage

The National Trust for Scotland

SEPA Scottish Environment Protection Agency

Atlantic Salmon Trust

River Carron Restoration

University of the Highlands and Islands Oilthigh na Gàidhealtachd agus nan Eilean

Inverness College

Wester Ross Est 1977

marineharvest

The Crown Estate