

WSFT Ghillies Seminar

26th April 2019, Scourie Village Hall

Shona Marshall welcomed all for attending and explained that the seminar is for everybody present to get as much out of it as they can, and encouraged questions to be asked as and when throughout the presentations.

Shona Marshall: West Sutherland Fisheries Trust

2018 WSFT activities

Overview of MSS National Electro-fishing Plan

- This is a trial in order to incorporate juvenile density data into the models used to calculate national conservation limits.
- Density benchmarks were predicted for each region prior to the surveys, with North West Scotland predicted to have the lowest benchmark.
- Results showed salmon populations were slightly above the predicted benchmark in the North West area.
- The results showed that when incorporating this juvenile data into the models, last year this region would have been category 1.
- The NEP is still within trialling stages at present.
- The SFCC classification scheme for the West Sutherland area showed that juvenile salmon densities were good to excellent within half of the total sites surveyed.
- Juvenile trout densities did not fare so well, however it was noted that whilst the sites were selected at random, there were certain criteria which selected areas more probable to contain salmon, therefore this does not necessarily give a true representation of the current status of juvenile trout populations.

Conservation limits for the 2019 season

- Category 1: Daill River, Grudie River, River Dionard, River Hope, Rhiconich River, River Inver, Kinloch River, River Kirkaig, Gleann Dubh River, River Laxford
- Category 2: River Polly, River Oscaig
- Category 3: River Polla, Oldshoremore, Sandwood, Duartmore Burn + the remainder of the area for which data is not available

Questions and discussions

There was a question asking to clarify the definitions for Categories 1, 2, and 3:

- Category 1: At least 80% probability of meeting conservation limit. Exploitation is sustainable therefore no additional management action is currently required. This recognises the effectiveness of existing non-statutory local management interventions, such as voluntary catch and release.

- Category 2: 60-80% probability of meeting conservation limit. Management action is necessary to reduce exploitation: catch and release should be promoted strongly in the first instance. The need for mandatory catch and release will be reviewed annually.
- Category 3: Less than 60% probability of meeting conservation limit. Exploitation is unsustainable therefore management actions required to reduce exploitation for 1 year i.e. mandatory catch and release (all methods).

There was a discussion about the difficulties of basing conservation limits on factors such as catch returns which do not take into account fishing effort and environmental factors which affect catchability of salmon, as well as the assumption that all wetted areas of rivers should be counted as suitable habitat when this is not always the case.

It was also noted that 2018 was an exceptionally dry summer which inevitably resulted in low salmon catches, and that due to catch statistics being used in calculating conservation limits, dry summers may push the categories back down in coming years.

There was a discussion about fishing effort. Loss of rod hours on category 3 rivers will also lead to lower catch records. Anglers on the Naver club water are now being asked to report catch effort information. It was noted that it would be a good idea for all fishery managers to start recording catch effort data as soon as possible as this will now be being taken into account for calculating the conservation limits.

Sweep Netting Surveys

- This work allows the trust to gather data on the health of local sea trout populations such as growth rates, and fish condition. Visual implant tagging is also carried out, and it was asked if sea trout caught locally could be checked for these tags. If a tag is present we would like to know the tag number and length of the fish.
- Sea lice counts are also carried out which ties in with local area management agreements with coastal salmon farms; part of a larger national program undertaken on the west coast of Scotland.

Mink monitoring in Assynt

This was an experiment to find out if wildlife cameras would detect mink. No mink were recorded, though lots of other wildlife was captured on film.

Assynt loch audit

- 20 lochs are to be surveyed, with 10 completed so far. This will provide information on fish species present, diets, and growth rates.
- Charr were recorded in two lochs, minnows from one, and trout in all.
- Interestingly, from surveys in two separate lochs very close together, fish were found to be feeding on plankton in one and aerial insects in the other.

Armada acoustic tracking study 2017

- MSS project in which 81 salmon were tagged with receivers placed in the lower reaches of rivers around the Scottish coastline.
- In the West Sutherland area, two fish were recorded in the River Hope, and one in the River Polla.
- Most fish from the study were recorded in the River Naver.
- Genetic research showed that one of the fish caught in the River Hope would have been expected to return to the Outer Hebrides. Genetic mapping of salmon populations, while helpful, will not give 100% accuracy.

Request for scale samples

- Lots of information can come from scales.
- They can help identify species, whether sea trout, brown trout, or salmon.
- Whether or not a salmon or sea trout is fresh run, e.g. kelt or springer.
- They can show spawning activity; the scales become eroded and rough, known as spawning marks.
- Even growth banding on scales shows an escaped farmed fish.
- Isotope analysis can be carried out using salmon scales which can show where in the ocean it has been feeding.
- Genetic sampling can be undertaken many years in retrospect, using scales.
- WSFT would like as many scale samples as possible from anglers and estates. We have a large supply of scale packets to hand out; all we need is the scales themselves along with length, date, species, and where the fish was caught.

Shona also asked for reports of any non-native invasive plants, as WSFT is a partner in the Scottish Invasive Species Initiative which enables us to carry out control of many of the non-natives present within the area, and invited the audience to raise any other matters for discussion:

The Naver has had two farmed salmon confirmed this year; this was mentioned as a reminder for all to stay vigilant for escapee farmed salmon.

It was mentioned that we all need to be on the alert for pink salmon this year, as the prevalent “odd year” population (e.g. 2017) would be expected to return this year.

A rare sighting of a black striped dolphin has been reported in Lochinver.

There was a request to report any fish with seal markings to the North West District Salmon Fishery Board, as they need to gather this information. Either contact the board directly, or report to WSFT, and we will pass the information on.

Chris Daphne: Ness and Beaulieu Fisheries Trust

Freshwater Pearl Mussels – Restoration and Protection

Chris has extensive experience as a river watcher officer for freshwater mussels as well as an in-depth knowledge of their biology. Part of Ness and Beaulieu Fisheries Trust's remit is to restore mussel populations in the river Moriston (a hydro river). Poaching problems are thought to be the main cause of their decline. N&BFT became a partner in SNH's Pearls in Peril project, which finished during 2016. The main aims of the project were to:

- Restore: Via habitat improvement (reducing in-river nutrients) and artificially encysting glochidia (mussel larvae) into the gills of salmonids.
- Secure: By safeguarding populations in liaison with wildlife crime officers.
- Communicate: via education sessions with local schools and communities.

Chris went on to explain the lifecycle of the freshwater mussel, a symbiotic relationship with salmonids. During late summer, glochidia (mussel larvae) are released by the females (known as spatting), the glochidia then attach to the gills of trout or salmon where they remain and grow over the winter months, before dropping off during late spring and burying into the fine sandy sediments in the river bed. Only 1% of the mussel larvae released will attach to fish, and in turn, only 1% of these attached larvae will make it into the sand/gravel. It takes 12-20 years before the mussels become mature; they can live for 150 years.

Artificial encystment of glochidia

Initially N&BFT wanted to discover what natural levels of encystment were occurring; electro-fishing surveys were carried out to inspect the gills of juvenile salmonids for presence of glochidia. It was discovered that mostly salmon fry were being encysted in this particular river.

The next stage was to determine when the natural spat occurs; this happens during late summer within a single 24 hour period. The mussels were carefully inspected to observe and determine the developmental stage of the growing glochidia, using small samples viewed under a microscope. At the final stages of development before the glochidia are released, the individual larvae can be observed snapping open and shut. Through this, they managed to calculate to the day when the mussels would spat.

Technique for artificial encysting:

- The mussels were placed in to a bucket of river water which was slightly warmer than the natural temperature, which triggers the mussels to spat, after which they were released back into the river.
- The bucket containing the spat was transported to a site absent of mussels.
- Juvenile salmon were captured via electro-fishing, and placed in the bucket of water to allow the glochidia to encyst on to their gills.
- The fish were then released back into the water.

In order to determine whether or not this method of encystment was effective, the sites had to be electro-fished the following spring in an attempt to find fish with glochidia present on the gills. This was like looking for a needle in a haystack, but specimens were found with glochidia present.

- N&BFT have now encysted 2-3000 juvenile salmon, with recent electro-fishing surveys showing that 30-40% of fish are heavily encysted with glochidia during the spring months.
- It is not yet known if the young mussels are surviving and growing on within the riverbed, as it takes many years for them to get to a visible size for surveying.

Though the Pearls in Peril project funding is no longer available to support this work, further funds are being sought in order to maintain the work that has been carried out so far. As the encystment method has now been fine-tuned, there is now less work required meaning it will be easier for this to continue into the future. Chris then showed an excellent video of mussels spatting in the wild.

Questions and Answers

Q: What was the effect of the warmer water temperatures last summer during the mussel spat?

A: The process was simpler and faster than in previous years, due the increased temperature; even if the bucket of water containing the mussels warms slightly in the sunlight, this helps to get the spat going.

Q: What do the mussels feed on, and of what benefit are they to salmon?

A: Mussels are filter feeders, and have two syphons; an inlet and outlet, with the water filtering through the gills in between. Each mussel can filter 50 litres of water per day, meaning that large populations can have a very positive effect on water quality. This forms the symbiotic relationship between juvenile fish and the mussels. The mussels hitch a ride on the gills of the fish, and help improve the water quality which benefits the fish.

Q: With the habitat improvement work aiming to reduce in-river nutrients, does this have an adverse effect on river invertebrates (e.g. fish prey)?

A: N&BFT were not directly involved with this particular aspect of the Pearls in Peril project, but this work was carried out in areas where eutrophication was more excessive, in order to restore balance. It was also noted that interestingly, while mussels produce calcium within their shells, they don't respond well to high calcium levels within the water.

Keith Dunbar noted that a Russian study had discovered juvenile salmon densities were highest in locations where mussel densities were highest and also that it had been found that higher densities of river invertebrates were present in these areas, possibly due to the pseudo faeces released by the mussels. Chris also noted that large densities of mussels create physical instream cover and habitat for both salmonid fry and invertebrates; a further benefit to instream biodiversity.

Q: How widespread is freshwater mussel crime?

A: Mussel kills have been discovered all over river regions where they are present, including within the WSFT area. A lot goes unnoticed.

Q: If shells are found on the riverbank is it likely to be otters rather than humans?

It is usually clear that a knife has been used. An otter won't do a neat job. The shell is more fragmented or perhaps pierced. If a person has used a knife, it's usually obvious.

General discussion on freshwater pearl mussel wildlife crime

Poachers are adapting, and will now sometimes just cut a small slice in the back of the shell so they still appear live, and then place them back in the river. In some cases, people may simply be taking all the shells home to check, so no signs are left behind. The most vulnerable areas are where roads run alongside rivers with laybys, as it's very easy to park a vehicle and take mussels from the water.

It's possible to tell how long the mussel has been dead; if the frills on the shell edge are present, this shows the incident was very recent. Though when on the river bank, birds and other wildlife will pick at the mussels and distort the appearance of the shells, so it's best to treat any shells found as suspicious.

Chris noted that 1000 shells may have to be opened just to find one pearl, which demonstrates how devastating mussel poaching is. Historically, pearl mussel fishers didn't kill them. They handled the mussels carefully, and if it didn't contain a pearl they would return the mussel alive, and mark it to alert them not to check the same one again in future. If a pearl was found, the mussels could still be returned alive.

Little at all is known about the black market value of the pearls, or where they are being sold. To date, nobody has ever been prosecuted for pearl mussel poaching. Chris advised to report any suspicious activity surrounding the burns and rivers, particularly if anybody is seen with a bucket; report to the police as soon as possible.

Mussels can move about slowly and make their way into deeper water, but can become stranded during extreme prolonged dry conditions when river levels drop very quickly. A licence is needed to handle mussels in the first instance, and the question of whether human manipulation should be carried out was raised, given that these events are natural. The general consensus was that there would be little cause for concern if the mussel populations were at more natural healthy levels, but that given the current situation of such threatened populations there is good reason to relocate stranded mussels. This would be something that SNH could provide further advice on.

Chris Daphne has written guidelines on freshwater mussel surveying and encystment, and also guidance on detecting wildlife crime which have now been adopted by police Scotland. N&BFT are hosting a freshwater pearl mussel survey course during 2019, which will include encystment training.

Isabel Moore: Scottish Centre for Ecology and the Natural Environment (SCENE)

Coastal use by anadromous trout

Adam Beynon-Jones gave a short recap of the 2018 sea trout tracking project in Loch Laxford to introduce Isabel's presentation on coastal use by anadromous trout. The aim of the project from the perspective of WSFT was to build upon the sweep netting surveys in order to answer further questions about local sea trout behaviour in the marine environment in order to inform management practices at local and wider levels. The project was carried out in collaboration between WSFT, SCENE, AST, and MSS, with other funds donated from local stakeholders and crowd funding. Loch Duart Ltd., Loch Laxford Shellfish Ltd., and Shorehouse Seafood Restaurant also provided fully crewed boats for the marine work. Isabel Moore's PhD focuses on various aspects of sea trout conservation and management, part of which involves the tracking of sea trout movements in sea lochs; she was heavily involved with the sea trout tracking work in Loch Laxford.

Isabel gave an overview of the aims of her studies on Scottish anadromous trout. Declining catches of sea trout have led to considering the varying threats in the marine environment, with aquaculture, predation, and exploitation being likely key factors. There is great difficulty in finding out what is happening to sea trout whilst at sea though acoustic tracking helps with this.

As coastal salmon aquaculture is prevalent within the west coast of Scotland, this was a big consideration with regard to her projects. Her initial project was aimed to determine if there was a correlation between proximity of fish farms and abundance of lice on wild sea trout.

- Several sites were sampled around the Isle of Skye using seine nets and fyke nets.
- Over 230 fish were collected.
- Length and weight were recorded, along with sea lice counts.
- Sea lice were categorised as: juvenile, mobile, or gravid females.
- Where lice were present, abundances were higher where fish farms were nearby.
- Abundances decreased as the distance from fish farms increased.
- This demonstrates the same results as similar Scandinavian research.
- There was also a change in the lifecycle stage of lice depending on where the sea trout was caught relative to fish farms; more juvenile lice were found on wild sea trout close to fish farms, with more adult lice found on fish further from the farms. It is suspected that fish farms are the source of these high juvenile densities.

Coastal Habitat Use

Given there are higher levels of lice on wild sea trout close to fish farms, the next step was to find out which areas wild fish are using most frequently, in order to determine how much of the populations were more likely to be exposed to higher densities of juvenile lice.

There are several published Scandinavian studies monitoring sea trout in the marine environment using acoustic tracking, but not many in Scotland. It was of particular interest to find out what is going on at smolt stage, at which time the fish are at their most delicate.

One of the biggest queries was to determine interaction between wild sea trout and salmon aquaculture units in order to discover ways to protect wild fish in intensive aquaculture zones.

Acoustic telemetry (tracking marine animals using acoustic tags and receivers) has been rapidly developing over the years and is becoming more accessible and cheaper; though still a very expensive undertaking.

Isabel explained the basic concept of how acoustic telemetry works:

- Acoustic receivers are placed in strategic locations and remain stationary for the duration of the study.
- Transmitter tags are surgically implanted into the fish. Each tag emits an ID ping.
- When a tagged fish swims within range of a receiver, the ping gets logged and stored within the receiver.

The battery life of the V7 tags, which are of suitable size to be fitted to sea trout smolts, is approximately three months, which limits study lengths.

Skye sea trout tracking project 2017

Isabel was interested to find out if there was any difference in sea trout movements between two adjacent sea lochs, one with, and one without salmon cages; Loch Greshornish and Loch Snizort Beag respectively.

Fyke nets were used to catch 30 sea trout smolts from each of the two rivers feeding the sea lochs. The sea trout were caught at the river mouths so were likely on the verge of entering the marine environment. The fish were tagged during the spring smolt run, and the receivers were recovered at the end of July.

Laxford sea trout tracking project 2018

SCENE were keen to get involved in this work when enquiries were made by WSFT, particularly as the study design was to be very similar to the work on Skye; information from another site may help to solidify theories on coastal sea trout movements and behaviour in the north west of Scotland.

- 38 receivers were distributed across Loch Laxford, covering various habitat types, salmon cages, and shellfish lines, with an outer array to detect fish leaving the sea loch.
- 99 tags were allocated from MSS for the study.
- Fish were tagged in the Laxford estuary sweep netting site, and also the Badnabay smolt trap.
- 60 post-smolts were tagged from the first tagging session at Laxford estuary in May.
- 14 smolts were tagged at the Badnabay smolt trap later that month.
- 25 larger post-smolts and adults were tagged in July; taggings were split in order to gain information over a longer study period as well as to provide some information on behaviour of larger fish.

For both studies, preliminary results are showing that the majority of tagged fish remained in their natal sea loch for the duration of the studies. Few fish were detected near fish farm cages. Tagged individuals demonstrated a gradual increase in territory over time. Some individuals potentially de-smolted and were not picked up on the receiver array. Overall, large variation in the patterns of activity has been shown by tagged individuals.

Isabel showed animations of fish movements from both studies, some fish moved large distances, whilst others stayed closer to the river mouths. Another video showed a fish that stayed in one spot for several weeks then suddenly shot up towards a seal colony, potentially showing predation.

She also noted that they would now be incorporating tides and moon phases into data analysis to look for correlations with fish movements, particularly in intertidal zones.

Questions and discussions

Q: Query regarding sea lice exposure and fish farm production year; the tracking studies don't support that sea trout move close to salmon cages, but shows they largely remain within the sea lochs, so are still exposed, particularly in the 2nd year of production.

A: A build up of lice within the lochs is likely; now we know that most smolts are staying within the sea lochs, they are exposed in these areas. The studies are the first stage of trying to model fish and lice movements to find out how much contact is being had between fish and lice, in the hope of decreasing contact in the future.

Q: With regard to the higher percentage of juvenile lice found on wild fish in close proximity to fish farms; what distances were involved?

A: The sites with more normal levels of lice on wild fish (7-8 lice) were around 50km from the farms.

Q: If the fish in Laxford are largely staying in the estuary area, during the WSFT sweep nettings why are large numbers caught in May, then by July, catches are very low? Is it mortality?

A: The fish do seem to be slowly expanding their territory, so may be moving slightly further away from the estuary netting site, though still in the same relative area.

Q: What impacts do the tags have on fish behaviour?

A: The tag weight in water is only 1-2oz, though to a small fish, this could have an effect on behaviour such as feeding, particularly as the tag is inserted into the stomach cavity. Behaviour is likely to be affected most during the initial time after tagging. There have been 2 recaptures from the Skye tracking project where fish have tripled in size since the transmitter tag was attached; though this is not a large enough sample size to make any definite assumptions, it is a positive finding.

Q: If the wild fish are picking up larger numbers of juvenile lice near the fish farms, are farms reporting both younger and adult lice on their salmon?

A: The farms will have lice at all life stages, but as the adults are releasing cycles of larvae, there is a more constant "supply" of younger lice in close proximity to the farms.

Q: How long do the lice live?

A: 3-4 weeks until they mature. The females can produce hundreds of eggs, and can repeatedly reproduce. Fish farms will use fallow periods to break the life cycle, but if they are not fallowing long enough to let numbers decline to natural levels then background lice numbers will still be unnaturally high. There are patterns; the 2nd year of farming production usually produces much

higher lice levels than the 1st. It was also noted that salmon lice can reside on other species but will not be able to breed.

Q: There is a threshold level of sea lice that is considered acceptable on farmed salmon within cages, but should there not be a threshold level for acceptable lice numbers on wild fish?

A: The code of good practice suggests 0.5 gravid louse per farmed salmon during the wild smolt run and 1 gravid louse per fish the rest of the time. MSS guidelines state 3 gravid lice per fish at any time, with 8 gravid lice per fish being the legal limit to trigger a cull of farmed fish.

It was suggested by Gideon Pringle of Mowi Scotland that if farms can keep down to 0.1 gravid lice per fish, then this will effectively break the reproduction cycle, as there would not be enough lice present to get a population going. With regard to acceptable levels on wild fish, this would be something that would require a lot of collaborative effort to get something fixed in place, though it would be desirable. In the case of WSFT, if there are fish caught during sweep netting surveys that the biologist deems to have unacceptable lice infestations, dialogue is entered into with the local fish farms for consideration. This has worked both ways in the past, as a warning can be made from either party that levels are high on either the wild fish or the farmed fish, meaning that a problem may be imminent.

There was a discussion on potential for the expansion of closed containment salmon farming, which has been shown to successfully produce farmed salmon in some areas abroad.

Q: What proportion of sea trout populations may be de-smolting? It would be useful to understand what has triggered it.

A: Agreed, though it's uncertain at this stage of preliminary analysis, but it will be incorporated into the analysis for the report.

Q: Was only one fish found to be predated on in the Skye study?

A: Unsure as to exactly how many at this stage; this is the sort of information that can be teased out through further analysis; for example, predation may be deduced through different swimming speeds over time.

Shona Marshall: West Sutherland Fisheries Trust

Biosecurity

Shona gave an explanation of INNS (invasive non-native species), and the importance of implementing biosecurity measures in order to stop their spread. INNS include plants, animals, and disease/parasites. There are thousands of non-native species within the UK, where they would not naturally occur, though not all are invasive, e.g. taking over and spreading rapidly.

Examples of invasive non-native plants affecting fisheries are:

- Himalayan Balsam
- Japanese Knotweed
- Giant Hogweed
- Skunk Cabbage

WSFT has all but giant hogweed within the area, as far as we know. On river banksides invasive plants will shade out ground growing vegetation, and die back during the winter months leaving bare soil, which will wash into the water and smother spawning gravels, as well as causing bank destabilisation. Rhododendron is another species present here, and though they do not cause this particular problem they are very toxic to wildlife.

Examples of invasive non-native species within the water:

- American signal crayfish
- Killer shrimp
- Zebra mussels
- *Gyrodactylus salaris*: not yet known to be present in the UK, but a very high risk parasite

Crayfish and killer shrimp are present within the UK and will prey on salmonid eggs and fry. Crayfish will also burrow into riverbanks causing destabilisation. Zebra mussels will fill up in a burn and choke/block flows. *Gyrodactylus salaris* parasitizes salmon fry and has wiped out many salmon populations in Norway where it was accidentally introduced.

WSFT is lucky to have very few invasive species within the area, though there are known populations of Japanese knotweed, Himalayan balsam, skunk cabbage, and gunnera. We have Canadian pondweed in places, though this is not a big issue yet. We also know of one population of monkey flower where it has taken over the river, choking up the banksides – it is not a fishing river, but it could spread.

It is very important we keep clear of invasives, and all of us need to ensure we do what we can to stop them spreading:

- Spread of invasives is usually accidental
- They are mostly transported on waders and fishing gear
- They affect habitats, fish populations, and fishing

We don't know invasives are here until it's too late. If *Gyrodactylus salaris* gets into one of the river catchments the first we would know of it would be that there are no juvenile salmon in the electro-fishing surveys.

Shona showed a series of maps which illustrated the spread patterns of several invasive species within the UK:

- Signal crayfish populations are most concentrated within England, but several populations exist within Scotland, the furthest north are in Nairn: this is not too far away from here.
- Water fern and floating pennywort have spread as far north as Moray.

- Zebra mussel – there are no established populations in Scotland, though they are present in the Tay.

Killer shrimp are among the 6 species that are on the GB non-native species secretariat species alert list. The 3 known UK populations have become well established in only 8 years.

The best way to avoid the spread of non-native species is to stop them before they start. WSFT disinfects all equipment before moving between catchments. All local estates and fisheries should have biosecurity plans in place, and stick to these plans:

- Before fishing, ask guests where they have fished, particularly if they have fished abroad.
- Has their kit been checked before fishing?

Everyone needs to adopt the check/clean/dry process, which is very simple; there are videos on youtube which demonstrate the process, for example:

<http://www.nonnativespecies.org/checkcleandry/ccdVideos.cfm?video=8>

- After fishing, look over your gear and check for mud, plants, and animals.
- Clean it off with hot water.
- Leave to dry; some INNS can survive up to two weeks in damp conditions.

Gyrodactylus salaris decontamination methods:

- Drying at 20°C for 2 days
- Drying at 60°C for 1 hour
- Deep freeze for 1 day
- Immersion in virkon, wescodyne, sodium chloride, or sodium hydroxide

WSFT is carrying out control of non-native invasive plants and mink as a partner of the SISI project, and Shona noted that Reay Forest Estate are doing a great job of eradicating Rhododendron on the estate. But all water users pose a risk of spreading non-native species, e.g. canoeists, kayakers, walkers, and anglers, and we all need to adopt the check/clean/dry process.

Questions and discussions

Q: Is check/clean/dry promoted to other water users as well as anglers?

A: Yes, there are many different promotional campaigns in all areas of outdoor/water related activities which are relaying the same message.

Q: Is ragwort considered to be on the list of invasives?

A: Technically not, as it is a native species. Though understandably undesirable in many places, various INNS related projects would not provide funding for its removal.

There were then various discussions surrounding the topic including mention of populations of monkey flower that WSFT was not previously aware of, which illustrates the fact that many INNS can go easily unnoticed. It was also mentioned that zebra mussels can come out of ballast water from boats, and Chinese mitten crabs got into the Clyde several years ago. Aside from the issues they

cause to local biodiversity there was also mention of the high costs involved in order to control or eradicate various INNS, e.g. it is costing approximately 2-3 million per year for giant hogweed treatment in the Loch Lomond area, and that costs are into the billions per year nationwide. Gunnera is also spreading within the WSFT area, and it was mentioned that Montbretia and lupins could be the next problems on the list. Interestingly, lupins seem to be outcompeting Japanese knotweed within the Beaulieu area.

Q: How many mink have been found in the WSFT area?

A: A carcass was found in Reiff many years back, and another at Loch Eriboll. Last September, a mink was captured and despatched at Inverpolly fish farm, which seemed to be an isolated event as no prints had been discovered in the area for a long while before then. Various suspicious prints have been discovered within the Coigach peninsula area over the past several years, but trapping efforts have not resulted in any captures. It was noted that the same problem occurs on the Ness – trapping efforts are unsuccessful, which all tends to suggest roaming males not remaining in one spot for any length of time. Whilst mink are not a prevalent issue within the WSFT area, it is important that we remain vigilant as we don't want them taking hold here.

Finally, there was a query for some information about the recent FMS conference:

It was split into a mixture of workshops; Shona and Adam attended different workshops.

The aquaculture workshop was interesting:

- Gideon Pringle of Mowi Scotland introduced his theory on lice immunity if numbers could be kept below 0.1 lice per fish. He also thinks lice will develop resistances to the newer non-chemical methods of lice treatment.
- There was mention of the SEPA sector plan and the findings from the REC committee, but this did not form a major part of the workshop.
- The Norwegian aquaculture sector have large legislative plans in place for lice related issues, though this is not perfect as up to 30% mortality is allowed before an issue is noted, and even this is not heavily enforced.

John Gibb, River Lochy gave a talk about his smolt ranching operations, and has now concluded that it is not working well enough to be viable or worthwhile. He is now experimenting with growing on wild smolts to adults, and releasing them into the rivers in order to spawn naturally.

The high seas workshop provided heated discussions, with interesting theories about mackerel stocks; Jens Christian Holst thinks the estimates of mackerel stocks are far too low and that stocks are massively increasing and predating on salmon smolts.

The renewable energy workshop focussed on issues of migration through dams, as well as the Moray Firth offshore wind farm, which is getting underway. It highlighted the need for adaptive management through monitoring efficacy of measures put in place to mitigate negative impacts on all species of migratory fish.

The workshop on predation highlighted measures being taken on the Dee to determine where and when they are losing salmon smolts to predators, as well as non-lethal methods to deter predators

such as seal scaring and lasers to move cormorants off their roosts. Further work has been carried out on the Tweed experimenting with using lasers on cormorant roosts. This is proving to be very effective, but it was highlighted that whilst populations are being moved off, they may be causing problems elsewhere. In Denmark, they have determined that cormorants are taking approximately 45% of the salmon smolt runs. Plans have been put in place through fisheries experts and ornithology experts working together in liaison, resulting in culling of up to 40,000 cormorants per year across key areas. Though this seems like a massive amount of birds to be culling in comparison to UK standards, the numbers of cormorants roosting in Denmark are extremely high in comparison, so the numbers culled here will be only a fraction of the populations present. The differences in what is culturally acceptable were noted between different countries; for example in Norway, seals are shot much more readily than in the UK.

At the beginning of the conference Alan Wells introduced the international year of the salmon. A representative from NASCO highlighted that they had been provided with information regarding the status of salmon stocks from within the UK, which showed a lack of information from the Scottish west coast. Information is held in these areas, so this has highlighted a communicational break down.

Shona wrapped up the seminar by thanking those present for attending.