Agenda item 6.2
For information

Council

CNL(16)51

Progress and challenges in achieving NASCO's international goals

(Tabled by the Faroe Islands)

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Progress and challenges in achieving NASCO's international goals

In spite of being situated at 62° N and 7° W, with major feeding grounds for Atlantic Salmon *Salmo salar* L. to the north, there is no historical record of the rocky archipelago of Faroe Islands hosting any natural wild salmon population, presumably due to the small rivers having modest catchment area, being shallow with unstable water level and having temperature fluctuations often near or above lethal limits to salmon.

From 1947 onwards, Atlantic salmon fry from Icelandic rivers have been released into several Faroese rivers, and since 1950, anglers have been able to catch salmon. In 1963, a hatchery was built, whereafter fertilized salmon roe have been imported, and around 30.000 locally hatched fry have been released into local rivers every or every second year. In the 1980s, salmon roe from Norway was also introduced to the stock in the Faroes, and fish ladders have been built to facilitate the inland migration of salmon.

Commercial fishing for Atlantic salmon in the waters around Faroe Islands started in 1968 and remained at ~ 40 tonnes or less annually until 1978, after which it intensified to ~ 500-600 tonnes up to 1990, peaking at above 1.000 tonnes in 1981. Since the establishment of NASCO in 1984, the fishery for Atlantic salmon in the Faroese Fisheries Zone has been managed in accordance with regulatory measures/decisions agreed within NASCO. Since 1991 - the last year in which commercial fishery took place - the Faroe Islands have refrained from having commercial fishery within its fisheries zone in order to contribute to the conservation and rebuilding of the North Atlantic salmon stocks.

Faroese coastal waters offer excellent conditions for farming of Atlantic salmon with stable temperatures from ~ 5 to 12° C and high currents ensuring good sea water exchange, oxygenation and removal of feces and feed waste. Unsurprisingly, farming of salmon is responsible for up to and some years above 40% of export earnings, the bulk of the remaining export being wild caught fishes.

Overview of the Faroese aquaculture industry

Historical records indicate interest in and possible attempts at introducing aquaculture as early as 1886-87, the possible realization and results of which are today unknown. The first documented tentative, yet later halted, steps at aquaculture were taken in the early 1950s with farming in on-shore ponds of Rainbow trout *Oncorhynchus mykiss* by pioneers Elith Godtfred (1915-58) and Menning Geyti (1912-88).

Reports in the mid and late 1960s by government official at the Fishery Research Institute, Andrias Reinert, spurred new interest and trials with sea cage farming of Rainbow trout by fisher and skipper, Just í Túni (1919-95), who in 1970 co-founded the now purely public Aquaculture Research Station of the Faroes, Fiskaaling.

By 1971, Atlantic salmon had been found by the Norwegians to be more adapt for aquaculture production, and inspired hereby, Just í Túni hatched the first eggs of Atlantic salmon in 1973 and put the first batch of smolts to sea in 1975. At the same time, breeding material of Atlantic salmon was obtained from the upstarting Norwegian breeding programme, which later formed the basis of a

Faroese programme under the Aquaculture Research Station, initially with 120 and later 400 families.

Aquaculture did however not emerge as an industry until 1980, initially with 6 companies, yet after skyrocketing prices in 1983-85, with 50 companies and later more than 70 at sea and some 20 smolt stations on land. By this time, aquaculture was seen as a component to local development, local villagers, fishermen and farmers being considered deserving of leases and goverment funding (Hovgaard 2015), which most were however unable to take proper and lasting advantage of.

During the 1980s and 1990s, rapid expansions were followed by equally rapid collapses in the wake of major outbreaks of pests such as Infectious Pancreas Necrosis (IPN), Hitra Disease, Furunculosis, Costiasis and later Bacterial Kidney Disease (BKD) and simultaneous problems with algae and from around 1984 salmon lice *Lepeophtheirus salmonis* L.. Price fluctuations and a general long term decline in prices also took its toll and gradually reduced the operating companies at sea to ~20.

A ban from 1985 on import of live salmonids and their gametes may to some extent have slowed the introduction of exotic diseases. Since the ban was lifted in the early 2000s, the local market proved too small and unstable to support a Faroese breeding programme, which was hence abandoned in favour of imported fertilized roe from the Icelandic and Norwegian breeding programmes. Today, Fiskaaling keeps a female stock and receives semen from SalmoBreed of Norway, delivering a portion of the roe for the Faroese aquaculture industry. In other respects, Fiskaaling has developed into an almost pure research institute, also offering research-related services to the aquaculture industry, e.g. monitoring of sea lice and establishing profiles of sea current and wave time series to be included in advice on location and dimensioning of fish farms as well as other aspects in required decisions.

After Infectious Salmon Anaemia (ISA) struck in the early 2000s, Faroese aquaculture legislature was tightened to meet international recommendations and standards including mandatory all in – all out production, fallowing, disease preventing management including provisions on maximum biomass/m3. In the wake of a near total collapse of the industry, exacerbated by simultaneous low prices, most remaining companies were put out of business, leaving a mere 4, of which the largest today controls half of the leases and 70-80% of salmon exports.

The below chart shows the weight in tonnes of slaughtered Atlantic and Rainbow Trout for 1997-2015.

Slaughtered weight in tonnes of Atlantic Salmon *Salmo salar* and Rainbow Trout *Oncorhynchus mykiss* from 1997-2015

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total	17947	16858	35149	28660	40545	46896	52269	38191	19593	15662	25173	38272	48622	39012	49588	62783	63338	70893	66090
Salmon	16651	15724	32187	27477	37731	36861	43071	33608	15549	10728	18290	31565	42134	37221	49588	62783	63266	70893	66090
R. Trout	1296	1134	2963	1184	2813	10034	9198	4583	4044	4934	6883	6707	6488	1791	-	-	72	-	-

Source: Hagstova Føroya (Statistical Bureau of Faroe Islands), www.Hagstova.fo

Due to the following reasons, the quantity of slaughtered tonnes does however not correlate well with number of smolts put to sea, with the stocking number of fish at sea or with stocking density.

- The weight of slaughtered Atlantic salmon was ~5 kg live weight in the late 1990-ies and 6.6 kg in 2015

- Annual mortality at sea, including escapees, was 12-28% in the late 1990-ies and 5-12 % in 2007-15
- In 2000-2002 ~20 mill. smolts were put to sea annually, while the number is now ~15 mio. annually
- The average size of smolts put to sea was ~50 grammes in the late 1990-ies and ~170 grammes in 2015
- The average production time at sea until 6 kg was 19 months in 2008 and 16 months in 2015
- The average no. of days with fish at each production site dropped from 714 in 2008 to 612 in 2015.
- Average stocking density was up to and above 25 kg/m3 in late 1990ies and is now ~7-9 kg/m3.

Courteousy of Avrik/Rúni Dam.

It would seem that strict compulsory management regimes, elevated theoretical knowledge and advantages of there being fewer players are likely to have transformed Faroese aquaculture and enabled producers to take true advantage of the otherwise excellent conditions for farming of salmon. In largely all financially significant aspects such as feed conversion ratio, mortality, production cost, quality, price and profitability, the Faroese aquaculture industry now seems to be in the lead, so much that in 2015, Faroese cultured salmon fetched ~1 Euro more pr. kilo than the quantitative world leader of salmon production, Norway (Kontali Analyse 2016).

In spite of all progress, earthly trees are not known to grow into the heavens....

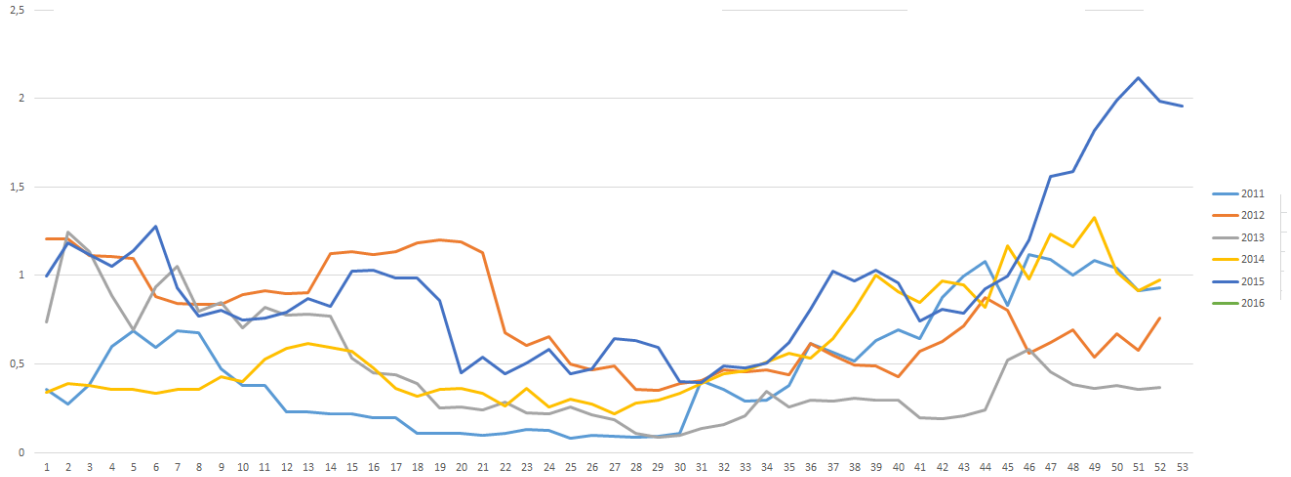
Salmon Lice

As elsewhere, Faroese aquaculture is struggling with infestation of salmon lice *Lepeophtheirus salmonis* L., the cost of which runs at around ½ Euro/kg including prevention, treatment and losses. Sea lice of course threaten both wild and farmed salmon alike by stressing the fish and rendering it susceptible to pathogens. In general, it may be said that lice is the most serous veterinary challenge of Faroese aquaculture with

- Increasing immunity/resistance to treatment
- Relatively few therapeutic options
- Effective doses near toxic/lethal levels to salmon
- Recurrent treatment & treatment at high dose affect welfare and resilience of salmon
- Early life stage of lice spreads throughout islands within a fortnight (the total size of the islands is such as they may comfortably fit within a single fjord system of the neighbouring countries).
- The same specie/strain of lice is throughout the islands leading to lasting immunity

The figure below shows average no. of lice/fish, week by week, in 2011-2015

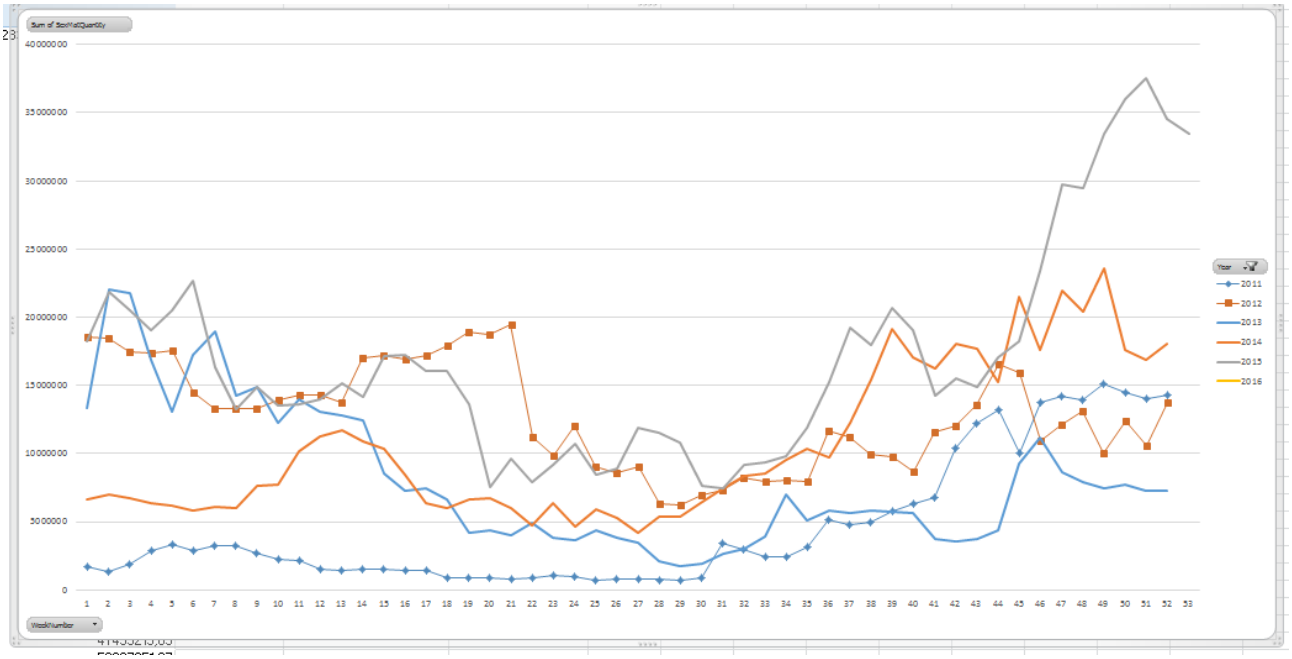
Average no. of lice pr. fish



Week no.

The figure below shows the total calculated no. of lice, week by week, in 2011-2015

Total no. of lice



Week no.

As may be observed, the number of lice/fish tends to decrease in the spring and summer and to increase in the fall. The unusually high increase in late 2015 is mainly due to ineffective louse treatment at a single producer, exacerbated by lacking capacity for immediate slaughter of infested fish. In the spring of 2016, the average no. of lice/fish is within the level found at the same season during 2011-2014.

The below table shows countings of sea lice and number of breaches, year by year, from 2009 to present.

Year	Breaches	Countings
2009	0	2
2010	4	80
2011	16	183
2012	32	357
2013	23*	555
2014	45*	469
2015	63	470
2016	4	15

*In 2013 & 2014, treatments were coordinated, at first appearing to lower infestation, but also to lead to increased immunity/resistance towards therapeutics.

As may be observed, there were 63 instances of farms breaching the threshold in 2015.

The main elements of the already existing provisions relating to sea lice are as follows:

- All farms must have an in- or external veterinary consultant and an effective management plan for the impediment of lice infestation
- On each farm and in each unit, counting of sexually mature females, of moving and of adhering lice of the species *Lepeophtheirus salmonis* and *Caligus elongatus* by an external non-aligned party is mandatory, from 1. May – 31. Dec. fortnightly, and monthly from 1. Jan. – 30. April. The demand on the non-aligned party yields dependable information, which can be used both as basis of veterinary decisionmaking within the companies and by the CVO.
- The data is to be available to the Chief Veterinary Officer (CVO) no later than the following day. In practice it is entered into a database available to/shared by the CVO
- The sea lice threshold applied at Faroese salmon farms triggering action to control sea lice has been and is fortwith 2 adult female lice or 10 developing mobile lice

Reach or breach of threshold triggers/triggered the following actions:

- immediate mandatory notification of the Chief Veterinary Officer (CVO)
- Immediate mandatory treatment in all fish units in the farm to be concluded within a fortnight and, if the CVO so demands, in all farms and units on the same fjord and/or nearby fjords
- Mandatory evaluation and new counting immediately after each treatment
- Mandatory scrutiny of the cause of ineffective treatment (each farm must have an in- or external veterinary consultant)
- Mandatory reporting to the CVO of ineffective treatment, suspicion of immunity/resistance or other inconsistency with expected results

The CVO may demand further/more frequent counting/counting of other species of lice and coordinated fallowing of nearby fjords if found needful to impede lice infestation. Exception or postponement of treatment may be allowed by the CVO:

- if the breach is diminutive and other effective action is likely to lower the infestation,

- if coordinated treatment with other farms is imminent or
- in case of imminent slaughter

In case of ineffective treatment, other agents/treatments are to be used. When such also prove ineffective, the CVO can order other action including imminent slaughter or destruction. In case of elevated infestation, disproportionally frequent or incomplete/defective treatments, the CVO may freeze or decrease the number of smolts put to sea at the following production cycle.

In addition to mandatory requirements, the following actions were taken by the CVO in 2015:

- Demanding imminent slaughter in 5 cases
- Reducing the allowed no of in smolts put to sea by 30 % in one case (comming into force early 2016)
- Reducing the allowed no of smolts put to sea by 10 % in 2 cases (1 put into force in 2015, 1 early 2016)
- Denial of 2 applications to increase stocking/no. of smolts put to sea (1 put in force in 2015, 1 in 2016)
- Excemption from treatment due to slaughter in one case

Due to the increasing number of breaches and taking account of research, former and new treatment regimes, empiric results and regulatory instuments having proven to be beneficial, a new proposal for firmer legislative action has been prepared. With caution of approval, it includes:

- Lowering of the treatment threshold to 1,5 sexually mature female louse pr. salmon
- Allowing treatment of cage by cage at this threshold (or voluntarily at lower thresholds)
- Making the threshold absolute, breaches automatically leading to immediate mandatory slaughter and restrictions in future stocking

It may be said that in addition to owners realizing and following their own best interest, limitations in the number of smolts to be put to sea at the following production cycle may be among the most efficient tools to secure adherence to regulative requirements.

Voluntary coordinated treatments were jointly undertaken by the aquaculture industry in 2013/14 leading to a preliminary decline in the number of sea lice, however also building up immunity/resistance against the used drugs, which have likely contributed to recent increases.
Thus, new approaches are asked for, not only within legislature and treatment.

Along this line, R&D is ongoing – much of it by the Aquaculture Research Station of the Faroes, Fiskaaling, having f.i. developed methods for mapping the spatial distribution of sea lice in its pelactic state (Nauplies and Copoditts), and for in situ estimation of naupli production at farm sites. This field effort is combined with distribution derived by hydrodynamic numerical models.

Aquaculture companies themselves also try to adapt and test new approaches. Over the last couple of years, the use of lumpfish *Cyclopterus lumpus* L. in cages to combat lice has been introduced and has been increasing. Although not 100 % effective, it may in some cases help keep the infestation at bay. Breeding of better adapted *C. lumpus* to aquaculture and with a better appetite for salmon lice is under consideration.

As elsewhere, other approches have also been introduced or are under consideration, including laser canon, counter current sea lice removers, fresh water treatment, post treatment sea lice collectors, increasing size of smolts put to sea and thus shortening the life cycle at sea further etc.

Escapes

Related to NASCOs sphere of concern is also occasional events of escapes of salmon. Given the financial implications of escapes, the prevention of such incidents is undeniably in the best interest of aquaculture farms.

Reporting of escaped aquaculture fish to the Chief Veterinary Officer (CVO) is mandatory, and farmers are obliged to have a contingency plan in case of escape incidents and to attempt to catch escapees. Escape incidents mostly occur as incidents relating to stormy weather or to handling of nets in relation to delousing, transport to slaughter etc. In such cases, prevention of further escapes, mending of nets and alike logically becomes a priority.

Should one be tempted to question whether all incidents are in fact reported, it can be held that in order to obtain insurance for escape incidents, the Food and Veterinary Authority must be notified. Escape incidents are often quantified through lacking feed intake post incidents, and since mortalities are also reported on a daily basis, both to alert the Veterinary Authorities of possible disease problems and for the companies to manage feeding optimally, escapes can also indirectly be verified through lacking fish, when slaughter has taken place. Reliable estimates of escapees are therefore available with some delay. From 2011 to 2014, the following incidents have been reported:

2011: 2 incidents, no information on number/quantity given. Average weight 1,9 kg. The incidents are reported to have occurred as perforation in relation to delousing and in relation to moving fish into a new net pen.

2012: 4 incidents, whereof 2.741 fish escaped in two incidents, while no numbers have been reported in the 2 other incidents. The average weight of escapees was 4,8 kg. The incidents are reported to have occurred in relation to moving fish to slaughter, sorting of fish into two net pens and stormy weather.

2013: 4 incidents, estimated at 25.000 fish averaging 2,8 kg. The incidents are reported to have occurred in relation to stormy weather during winther of 2013 and to moving fish into a new net pen.

2014: 2 incidents estimated at 40.000 fish averaging 4,8 kg. The incidents are reported to have occurred in relation to stormy weather and to moving fish into a net pen in relation to slaughter.
The numbers must be taken with some caution and are in most cases based on decreased fodder intake in net pens. More accurate numbers may be achieved when the net pens are slaughtered.

The Faroes are small, the fjords few and mostly relatively short, hence production units are increasingly placed at exposed sites, necessitating the strengthening and adaptation of the equipment to endure higher currents and waves. Furthermore, harsh weather conditions, also at less exposed sites, lead to fairly frequent renewal of the equipment. Hereby, the latest technological innovations and improvements are implemented, often also with improved protection against events, which may result in escapes.

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