Towards the reformation of wild fisheries management in the northwest of Scotland

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Summary

Has Scotland got what it takes to be a world leader in sustainable marine fisheries management? Are we able to look beyond short-term aspirations? This contribution to the debate about the future of inshore fisheries, drafted initially as an anonymous response to the Scottish Government's 'Future of Fisheries Management in Scotland' [FFMS][2] consultation in spring 2019, focusses on wild fisheries in the coastal waters around the northwest of Scotland.

The FFMS consultation document largely ignored inconvenient but fundamental trans-global issues which all nations must confront. They include the need to recognise in a more responsive way that the fishing industry and other impacts associated with human activities have long since overwhelmed the ability of marine ecosystems to maintain good health and to maximise surplus production of wild fish and shellfish without much greater restraint and more careful regulation than achieved so far.

These issues are reconsidered. In response, radical changes are proposed.

A future fisheries management scenario is presented where all fish and shellfish harvesting rights within a defined area belong to a co-management organisation. The proposed co-management system is based on shared ownership of fish and shellfish fishing rights instead of 'free for all'.

Those who harvest fish and shellfish are employees and shareholders of the co-management organisation. Income from fish and shellfish sales belongs to the co-management organisation. By 'co-management', it is implied that membership of the organisation includes elected government (local, regional, national) representatives as well as those who work or have worked within the fishing industry.

Salaries of all co-management organisation employees are based on the jobs they do rather than from income from sales of fish following each fishing trip. Employees develop knowledge, skills, and experience to enable career progression. Comparisons are made with aquaculture and the management of forests and timber production in Scotland.

A range of fish and shellfish harvesting methods are deployed to harvest different species of fish and shellfish in different parts of the fishing area based on their effectiveness, efficiency and low environmental footprint, thereby ensuring that the habitats and biota of importance to fisheries production, other wildlife and other environmental services are maintained in optimum condition.

Harvesting methods may include mobile gear, static gear and hand picking.

The co-management organisation works with research organisations to introduce new harvesting methods which utilise new technology as it becomes available (e.g. drop-down cameras and remote operating vehicles, 5G mobile phone networks) that makes fishing more efficient, more user-friendly, with less adverse impacts to the environment (e.g. wind, electric &/or hydrogen fuel cell propulsion systems).

The co-management organisation provides a wide range of employment opportunities within coastal communities, thereby helping to support local economies. Young people are able to follow in their father's footsteps within the fishing industry with many opportunities for a rewarding career. The more successful the co-management system is in achieving high value fish and shellfish production without harming the habitats and ecosystems upon which production depends, the more employment opportunities that can be offered.

The emergence of a fisheries management scenario of this sort may take as long as a generation. Or perhaps Scotland can lead the rest of the world by moving a wee bit faster?

One challenge will be to find ways of bringing together stakeholders who have different opinions based on traditions and past experiences, the commercial realities of recent years, on loyalty to the organisations which represent them, or on firmly held convictions about what is needed to protect and restore fragile coastal biogenic habitats of importance to fisheries and wildlife such as maerl, sea grass and others.

An important initial step for those currently active within the fishing industry and management of inshore waters is to be able to contemplate alternative scenarios of how our fisheries might be managed in the future for, and by, those who follow. Every generation is confronted by new challenges. The challenges for today's younger generation are as big as any of the past; so are the opportunities.

In summary, this document offers a different approach to inshore fisheries management in NW Scotland and explains how such an approach may be able to lead to a better future for all who seek to revive and safeguard wild fisheries and the ecosystems that sustain them.

Contents

1. Introduction

1.1 From wild fin-fish and shellfish fisheries to intensive artificially-bred salmon farming

Wild capture fisheries in and around the northwest of Scotland have contributed 10s of millions of pounds per year to the national economy[3] and remain of much importance to local communities.

They currently include fisheries for pelagic fish (mackerel, herring, etc.) carried out by large nomadic mid-water trawlers based elsewhere; demersal fisheries for 'white' fish (cod, haddock, hake, whiting, various flatfish, etc.) and *Nephrops* (otherwise known as Langoustines or Dublin Bay prawns [referred to as 'nephrops' hereafter]) carried out mostly by smaller more locally based trawlers which fish over the seabed; fisheries for scallops carried out using mobile gear through the seabed ['scallop dredgers']; static creel fisheries for nephrops, crabs and lobster carried out by many smaller local boats; and dive fisheries, especially for king scallops. Several other wild seafood products are harvested mostly by hand around the shoreline including winkles, cockles, mussels, razor clams and seaweed.

Over the past 100 years there have been many changes in both the abundance of wild fish and in methods of capture as technology has evolved.

As elsewhere around the world, stocks of some fin-fish were depleted during the latter part of the 20th century[4]. As fishing methods became more effective, it became possible to capture fish more rapidly than could be replaced by natural recruitment. As fishing became more technologically advanced, competing fishermen became the biggest threat to their own long-term prosperity. The need for restraint, in other words for appropriate fisheries management regulations including catch restrictions, became increasingly important. However, fisheries management regulation was unable to keep pace with advances in fish catching power; so one by one most traditional fisheries declined, some collapsed.

The **herring fishery** which played a prominent role in the development of Ullapool in the 18th Century was still going strong in the 1950s and 1960s with annual landings of over 50,000 cwt in some years at Ullapool and also Gairloch (Unsworth, 2013)[5]. In 1977, a ban on herring fishing around Scotland was put in place following a collapse of herring stocks due, primarily, to overfishing. By the time the ban was lifted in 1980, most fishermen in northwest Scotland were fishing for other species. There was some recovery of herring stocks; for example in 1989 a fisherman with a license to catch herring for creel bait made good catches off Melvaig near Gairloch (*pers comm.*). The most recent assessment of herring stocks by ICES for sea area VIa published in June 2020 indicated that the spawning stock biomass of herring was near an all-time low. Observations of herring spawn near Gairloch in March 2018 and 2019 may be indicative of some level of local recovery[6].

The **inshore fishery for whitefish** (cod, haddock, etc.) also experienced a period of boom before bust, this time following the removal of the 'three-mile limit' by the Inshore Fisheries Act (Scotland) 1984[7]. Historically, the Gairloch area was noted for cod; fish were mostly taken using long lines. Many fish were cured at Badachro for export, with 80,000 cod cured in 1884 (Smylie, 2004)[8]. In the 1960s the northwest of Scotland was also noted for sea angling; Ullapool hosted the British skate fishing championships and the European sea fishing championships (Robinson, 1970)[9]. Scottish record rod caught plaice and dab were taken from Loch Gairloch in the 1970s.

Stocks of whitefish collapsed in coastal waters around the northwest of Scotland within a few years of trawlers being able to fish within three miles of the shore (*pers comms.* from retired local fishermen). Many of those who remained in the industry switched from fin-fish fishing to shellfish fishing. At the current time (September 2020), the nephrops fishery (creel and trawler) is the most important within the area. In 2019, the fishery for brown crab was also of growing importance to some local fishermen with high prices paid in east Asia for air-freighted crab; however the price of crab collapsed in 2020 with the covid-19 pandemic and with closure of the Chinese market[10].

Wild salmon were trapped and netted around Wester Ross for many hundreds of years, as well as being caught with rod and line. As the numbers of salmon returning to local rivers declined in the 1980s, coastal netting became less profitable and one by one netting stations ceased to operate. By the end of the 1990s, most netting stations were inactive[11]. The Red Point netting station southwest of Gairloch briefly re-opened 2003, but has not been active since then.

Salmon farming developed rapidly in the northwest of Scotland in the 1980s and 1990s and provided a cheaper source of salmon for consumers, taking some of the pressure off wild stocks of salmon. Salmon farming also provided alternative jobs to those in wild capture fisheries; farmed salmon were the highest value food export for Scotland in 2017[12].

However, salmon farming also led to initially unforeseen adverse consequences for wild fish. During the 1990s escaped farm salmon entered many rivers in northwest Scotland where they interbred with wild fish[13]. In some rivers genetic introgression may have contributed to the decline of wild salmon by reducing the fitness of local salmon populations resulting in fewer adult salmon returning to freshwater from the sea[14]. At the time of writing (August 2020), emissions of larval parasitic salmon lice from an expanding intensive open cage farm salmon production industry remains a principle threat to wild salmon populations and sea trout fisheries within the west of Scotland, as in Norway (NSACAS, 2020[15]).

1.2 Inadequate fisheries management

In recent years Scottish wild capture fisheries have been regulated according to decisions made at EU level (Common Fisheries Policy [CFP]), by the UK Government level, and in the Scottish Parliament (which has control over inshore waters within 12 nautical miles of the coast). The largest and most valuable stocks of fish have been managed according to quota allocations agreed in Europe as part of the CFP. Overall harvest levels have been guided by published scientific advice from, amongst others, the International Council for the Exploration of the Seas [ICES] and from Marine Scotland Science [MSS]. Political considerations, influenced by lobby groups representing both fishermen's interests on one side and conservationists usually on the other side, have also contributed to the outcome of quota allocation negotiations. Marine Scotland is responsible for allocating quota shares to Scottish boats[16].

For the purposes of informing management with clear guidelines, fish stock assessment is not an exact science. It is rarely possible to obtain clear evidence for real-time fisheries management purposes through normal scientific routes, partly because of the time it takes to draft and peer-review academic papers. Furthermore, fisheries data analyses typically provide estimates of fish stock sizes with wide margins of error.

For these and other reasons, the annual negotiations with representatives of other countries at the EU to set quotas for different fish stocks have never been straightforward. There can be disagreement between fishermen's representatives and scientists as to the status of different fish stocks based on different interpretations of data or even conflicting reports from scientists and fishermen. When presenting advice regarding the size of a fish stock, scientists with long-term conservation objectives in mind err on the side of caution. Many fishing businesses, on the other hand, depend upon access to sufficient quota to keep themselves in business in the short-term; so fishing industry reprentatives may lobby to be allowed to catch more fish than recommended by scientists.

So the short-term financial needs and desires of fishermen can be at odds with recommendations from scientists for what is best to recover or maintain healthy fish stocks and sustain near optimum fisheries production. The outcome of negotiations between politicians from different nations also confronted with conflicting and competing agendas may be some form of compromise that is inadequate to enable stocks to recover to maximum productive potential. Hence, a major flaw in the system so far as achieving the best possible long-term outcomes for sustaining fisheries production overall[17].

For some fisheries, Brexit could make negotiations even harder. Fish drift and swim; even the herring which spawn around Cape Wrath (herring eggs are food for haddock . . .) may be dependent upon the productivity of nursery areas in the North Sea in German or Danish waters (c. Farrell, Ed. *pers comm.)* An industrial fishery in nursery areas far away has the potential to do damage to herring stocks in Scottish waters; so it remains as important as ever to maintain good working relationships with EU members.

There have been some partial successes. In the North Sea, some formerly depleted fish stocks recovered following the implementation of management measures, especially those agreed by fishermen working in collaboration with scientists and conservationists. These included the North Sea cod fishery in the early 2000s. However soon after submitting an initial draft of this document in response to the FFMS consultation in July 2019, it was reported that North Sea cod stocks had again been over-fished and reduced quotas would be needed in 2020 to protect stocks[18].

Around the northwest of Scotland there are still many fish species where levels of productivity are much less than they were in the past. Retired herring fishermen, when interviewed as part of a project led by Wester Ross Fisheries Trust, expressed much regret about some of the changes in fishing practices and stocks within their lifetimes[19]. Many had experienced periods of boom (e.g. herring in late 1960s, whitefish in late 1980s) as well as the consequences of stock collapse.

Further background information relating to the demise of wild fin-fish fisheries in the west of Scotland can be found in Roberts (2007)[20], Smylie (2004), Thurston and Roberts (2010)[21], Roberts (2010)[22] and others [citation to up to date review of history of fisheries required].

Section 2 provides a more detailed consideration of current challenges.

1.3 A future scenario of wild fisheries management?

The main purpose of this document is to propose a way in which the fishing industry in northwest Scotland could be transformed to achieve greater overall productivity, profitability and economic stability; to propose a way of developing a sustainable fishery.

I live in a community which faces the sea and where fishing remains a source of employment for many. Some of my friends and neighbours are fishermen; they include creel fishermen, trawlermen and scallop divers. Many fishermen are compelled to work long hours compared to most on-shore waged workers. For local fishermen, the future remains uncertain largely for reasons outwith their control. This is especially so at the current time (December 2020) during the Coronavirus pandemic and as a new post-Brexit framework for fisheries management begins to take effect[23].

The scenario presented here aims to support the FFMS 'vision':

'to sustain exploitation of target species; to minimise capture and damage to non-target species; and to protect important habitats for fish and other marine wildlife.'

The ideas presented here have been expanded from those summarised in a submission to a consultation regarding proposed management measures for then newly designated Wester Ross Marine Protected Area [WR MPA] in 2013[24]. Earlier ideas were presented at a marine symposium organised by the Community of Arran Seabed Trust [COAST] in 2010[25].

Following the FFMS consultation in 2019, there has been some progress. In June 2020, a summary action plan was published by the UK inshore fisheries steering group [IFSG] entitled 'Future of Our Inshore Fisheries: Summary Action Plan'[26]. This plan focusses on five themes: 1. Co-management; 2. Collaborative science; 3. Credible fisheries management; 4. Rights and access; 5. Effective compliance.

The scenario presented here has been developed in parallel with the IFSG plan and addresses several issues that are fundamental to achieving long-term stability for wild-capture fisheries and success in the northwest of Scotland. They include the following:

1. to remove conflict between fishers;
2. to secure regular income for fishers;
3. to reduce fishing effort and carbon footprint per unit of wild fish production;
4. to sustain higher yields of wild fish production and that of other marine produce than achieved in recent decades;
5. to increase the value of wild fisheries production;

6. to maximise the contribution of wild fisheries to the economy of northwest Scotland;

and more broadly:

7. to restore biodiverse and vibrant coastal marine ecosystems which are best able to adapt to climate change;
8. to maximise calcium carbonate production and carbon sequestration by maerl and other carbonate producing biota including molluscs and echinoderms;
9. to maximise the value of our coastal seas in terms of other environmental services;
10. to maximise the overall economic value of natural systems in coastal seas to Scotland and sustain it.

1.4 Personal statement

This document has been produced primarily with local fishermen and other people living in the northwest of Scotland and their families in mind, together with concerns about how to restore the productivity of the marine environment for people and wildlife; the two remain interlinked. The intention is that the main idea can be understood from my description; some additional diagrams may help.

The document may evolve as responses are considered and changes or additions are made. I welcome other ideas and input from academics and anyone with more knowledge of fisheries management systems elsewhere; what has worked in other areas? The intention is not so much to produce an academic paper as to develop an idea that may progress towards something useful for the future management of our coastal seas. The main idea is as much about restoration and conservation of the marine environment as it is about fisheries management.

My background is in aquaculture (Scotland and Thailand), Voluntary Services Overseas [VSO] community fisheries support (Mekong River, Laos PDR), wild salmon and trout (and herring . . .) fisheries ecology and management (Scotland); and as a member of a community in Wester Ross which 'faces the sea' and where most people know and support each other; ideas are based on knowledge gained from all of these experiences.

The central idea of transforming wild capture fisheries from a management system where fishers' income is based on sales from catches, to a management system where all fishers within a defined area are waged employees, is already 10 years old. If someone else has developed or is developing similar ideas, I should like to learn more.

It might be most useful if comments could be organised as follows:

(a) supporting information [especially this draft]: please correct inaccuracies and suggest further references to articles or papers or websites which provide useful data.

(b) analyses: where unclear or flawed, please explain why.

(c) proposals for management: are these reasonable? What changes and alternatives would work as well or better? Are there examples from other parts of the world which could be adapted to work well in NW Scotland?

Discuss with others; encourage anyone else who may be interested to consider. List things where there is agreement and those where there is disagreement.

Since starting to write this draft in 2019, much has been published causing need for some revision and rethinking, including:

- Scottish Government (2020) Consultation on the allocation of Additional Quota for 2021
- Scottish Government (2020) Future Of Our Inshore Fisheries
- Scottish Government (2020) Scotland's Fisheries Management Strategy
- Hart, PJB (2021) Stewards of the Sea. Giving Power to Fishers. This paper overlaps with some of the ideas presented here.

This is not about quick fix; it is about finding a long term solution; towards sustainability.

If subsequent responses are overwhelmingly negative for good reason to the point at which I'll be able to abandon them, phew! I'll be just as content spending more time on other things; there are many wild trout lochs in nearby hills . . .

2. Current challenges: some fundamental problems with the management of fisheries in the northwest of Scotland

2.1 'Freedom to fish': competition and conflict

With regard to the land, a point in time was reached at the beginning of the Neolithic period when people settled down to nurture animals (deer, cattle, boar . . .) and plants (cereals, fruit, trees . . .). By then, some ~4,500 years ago, human ingenuity and stone tools were more than adequate to kill virtually every last edible cloven-footed mammal on Scottish soil and to cut down every last timber-sized tree. Neolithic peoples were able to agree management rules and regulations for sharing and defending resources, for working together, for sustaining production of the things needed to survive. Thereafter, they were generally more successful than those who continued to deplete natural resources and move on rather than adapt to a more settled, sustainable way of living. And so have things been on land in Scotland as elsewhere in the UK more or less ever since.

Fishermen have been described as the last of the hunter-gatherers (Wigan, 1998)[27]. Is the hunter-gatherer system still the one in which our 21st century fishing industry and culture remain subconsciously rooted?

FFMS (p36) referred to the 'principle of free movement of vessels around the coast' implying that 'freedom to fish' remains the most basic right of all, perhaps in the same way that once upon a time there was freedom to hunt wild birds and wild mammals for food and to take wild trees for timber on the land? Are Scotland's seas essentially still a free-for-all with regard to fishing as our forests were to hunters during the Mesolithic?

This conceptual 'freedom' is one of the most fundamental problems of all. Over the past 200 years, wild fish and shellfish have become an increasingly limited resource in much the same way that wild cloven-footed animals and plant products were recognised (one assumes) as a limited resource thousands of years ago. Although no one owns red deer or wild game birds on land; harvesting rights in Scotland have long since progressed beyond 'freedom to hunt'.

Fishermen are free to operate across large areas. Wild fish and shellfish belong to no-one until they are caught. There is competition between fishermen for limited resources. Nomadic fishermen deploy fishing gear and take what they can find from hunting grounds without always knowing what that will be beforehand. For most fishermen, income is still dependent almost entirely upon the amount of wild fish that can be caught and its market value when sold.

The less discriminate fishermen or fishing methods often make more money in the short term than those that are more careful based on concerns about long-term consequences. Impacts from fishing activity on non-target biota and other environmental services are someone else's problem and cost. Do we really want to burden future generations with sorting out these problems and having to pay for them?

Creel fishing vs. trawling

Many fishermen around northwest Scotland are self-employed or work for small often family-based fishing enterprises. The majority are **creel fishermen**, fishing for brown crab, lobster and nephrops prawn using static gear. A typical creel fisherman owns his own boat and creels. Access to fishing grounds may be based on gentlemen's agreements and unwritten rules where each fisherman respects the rights of other fishermen with whom they share the sea area where creels are set.

Creel fishermen ultimately remain in competition with the other creel fishermen with whom they share a fishing area. Conflicts may arise when a new boat moves into an area, or where an existing fisherman increases his number of creels resulting in additional fishing effort within that area. More creels may be set than are perceived by other fishermen to be needed to sustainably harvest the resource. This may lead to disputes. Most likely, the increased fishing effort will result in fewer shellfish captured per creel, so thereafter each fisherman must set more creels to achieve the same catch as before. Without exclusive access to an area of sea, a creel fisherman can do little about such scenarios other than to increase his own fishing effort or to seek alternative fishing grounds.

Most of the other fishermen in the northwest of Scotland are **trawlermen**. Most of the smaller inshore trawlers have also primarily targeted nephrops prawns in recent years. Disputes can arise in much the same way as with creeling; for example if a nomadic trawler based far away starts fishing within an area traditionally used by local boats (e.g. a boat from the east of Scotland starts fishing in the Minch), local fishermen are likely to express concern. The situation further offshore is even more complex where boats from other countries are allowed to take fish from waters perceived by Scottish fishermen to belong to them (. . . hence Scottish offshore trawl fishermen's support for Brexit in the hope that fewer 'foreign' boats will be allowed to fish within the UK EEZ in future years?[28]).

For access to many fishing areas, there is competition and sometimes **conflict between trawl fishermen and creel fishermen**. Some areas are closed-off (out of bounds) to mobile gear, sometimes for fisheries management reasons (e.g. Loch Gairloch and Loch Torridon) or to protect seabed habitats (e.g. parts of Wester Ross Marine Protected Area). This can reduce pressure on fish and shellfish stocks and seabed habitats by design or otherwise. Note that even within these 'closed-off' areas, creel fishermen remain in competition with other creel fishermen as described above. Therefore, even a creel-only fishery tends to be inherently vulnerable to conflict and ultimately overfishing. For example, the formerly Marine Stewardship Council [MSC] accredited Loch Torridon nephrops fishery lost its 'sustainable fishery' accreditation when creel-fishing effort increased beyond levels where stocks of nephrops could be sustained[29].

All fishermen face the same challenges if they are to remain in business: finding somewhere to fish that is not being fished and defended by others; catching enough fish to sell; getting their catch to market; and getting a good price for their catch. A fisherman's income may vary according to all these and many

other factors, including adverse weather and sea conditions and natural variation in the abundance or behaviour of the targeted fish or shellfish species. Most of these factors are beyond their control. There is therefore little possibility of long-term security of income or incentive for working in ways that are in the best long-term interests of coastal fisheries production as a whole. To be successful, most fishermen must work long hours; and for trawlers, making the most of the days at sea in which they are allowed to fish. In Gairloch many trawlers set off from the harbour at around 5am and return after 10am. It's Sunday; the blue scallop dredger referred to earlier in footnotes has been working since at least early this morning.

Fishermen's federations

Many trawlermen and operators of scallop dredgers are members of the Scottish Fishermen's Federation [SFF]. Creel fishermen have been encouraged to form their own associations; many are now affiliated to the Scottish Creel Fishermen's Federation [SCFF]. Scallop divers have also formed their own association which is now a member of the SCFF. Because they represent sectors which in some areas compete with each other, the Scottish Fishermen's Federation and the Scottish Creel Fishermen's Federation do not always agree about what is in the best long-term interests of the fishery as a whole[30].

In summary, a typical full-time 21st century fisherman in northwest Scotland is compelled to work long hours to secure a decent income, not because that is the best way to maximise the productive value of the fish or shellfish stock in question, but because if he doesn't, for example if he chooses to 'rest an area' to allow stocks to rebuild or recover, someone else is likely to take his place and take the shellfish upon which his livelihood depends.

Fisheries management in the northwest of Scotland has not reached the stage where all fishermen are able to work together and with other stakeholders to nurture more productive and healthier marine ecosystems, and to share the long-term benefits. At least in this respect, the transition away from a hunter-gatherer system of exploitation and management still has some way to go.

The same can be said for many fisheries and coastal waters across the rest of the world[31].

2.2 Excessive pressure on fish stocks

Where there is competition between fishermen, fish or shellfish stocks are more likely to be depleted below levels where the fishery can achieve maximum value. Hence the declines in stock abundance referred to in section 1.

For some relatively sessile shellfish such as **nephrops**, excessive fishing effort may simply result in prawns being taken before they are as big and valuable as they could be, or at times of the year when prices are lower than at other times of year. That said, the nephrops fishery in its current form is a relatively sustainable fishery so perhaps not the best candidate for illustrating how the 'tragedy of the commons' (discussed in Roberts, 2007) operates. This is for two reasons. Firstly, nephrops prawns are small animals which usually live in deep water. Much effort and expense are required to catch them in commercial quantities. Fuel and fishing gear are expensive. Each prawn has to be worth a lot of money and many have to be caught per unit fishing effort (whether to creeler or trawler) if prawn fishing is to be profitable. Secondly, nephrops can retreat into burrows where they cannot all be caught. It is therefore very difficult to fish them to the point at which their reproductive potential is greatly reduced. A worthwhile nephrops fishing trip can only be achieved when there are still many prawns and stocks are still in relatively good health.

Furthermore, nephrops may benefit from fish discards and seabed disturbance caused by trawling (Hayward, 2016[32]). Nephrops are opportunistic hunters and scavengers and eat dead finfish and shellfish (including conspecifics), and also jellyfish. Other animals including cod and flatfish which prey upon them that are killed and discarded around nephrops burrows provide supplementary food. Perhaps the nephrops fishery, which developed in the 1960s, should be regarded as a form of extensive aquaculture because the seabed habitat and ecosystem is modified by demersal trawling in ways which increase production of nephrops prawns? More about that in Section 3.

Figure 2.x Nephrops fisheries ecology [to do].

A better example of a species vulnerable to overexploitation is the **herring**. Herrings [I use the plural as different populations of herring in the northwest of Scotland including spring and autumn spawners can be distinguished using latest genetic techniques[33]] were the most important fish species in the northwest of Scotland for most of the 19th and 20th century until stocks collapsed in the 1970s. Unlike nephrops, herrings are schooling fish and cannot hide from modern fish-finders and fishing gear. As stocks become depleted, those that remain may shoal together and remain vulnerable to capture, for example, by a single mid-water trawl net. So it can still pay to go fishing for herring even when stocks are at only a very small fraction of former levels of abundance.

With fish as with tigers and rhino', the rarer they become, the more valuable they become. For some species, the last ones are the most valuable of all (c. Bluefin Tuna; Giant Salmon Carp (*Aaptosyax grypus* [my photograph of a female *A. grypus* in spawning condition taken in Pakxe market in February 1997 may be one of the last of this possibly now extinct salmon-sized predatory Mekong cyprinid; it was the most expensive fish in the market that day.[34]]).

2.3 Few places left to hide

Much has been written about the advantages of designating extensive areas as off-limits to fisheries for the overall benefit of those fisheries (e.g. Roberts, 2004 & 2007; Sala and Giakumi, 2018[35]). Conservation areas can provide refuges to safeguard some of the adult fish from which offspring become available to the fisheries in surrounding waters. There are many examples from around the world. Related issues include protection of seabed habitats for fish or shellfish populations or other wildlife; for maintain ecosystem health and resilience (e.g. to climate change).

Marine Protected Areas [MPAs] can be part of the answer to sustaining fisheries around Scotland if protection measures can be enforced. Note that the MPAs in the northwest of Scotland including the Wester Ross MPA were not designated with fisheries management in mind. The FFMS consultation document proposed designation of 'buffer-zones' around MPAs into which only fishing boats with on-board tracking systems are allowed. That might help in the short term.

But why do some fishermen disregard MPA limits or other rules to protect seabed habitats and fisheries?

A fundamental problem is that there is still financial incentive for some fishermen to 'go under the radar'[36]. If the fishing industry was where it could and should be, the fishermen themselves would be the principle proponents and guardians of MPAs, rather than sometimes turning a blind eye to illegal encroachment[37].

MPA designation is a threat to some fishermen who lose access to the places where they have fished in the past. If they fish elsewhere then other fishermen are also likely to be adversely impacted. Designation of marine protected areas can therefore only be part of a long-term solution and not the principle management measure for regenerating and sustaining fisheries.

'The limit'[38]

During preparation of this document, organisations concerned about protecting marine ecosystems and inshore habitats launched a campaign calling upon the Scottish Government to reinstate an inshore limit to mobile fishing under the 'Our Seas' coalition.

For almost 100 years until 1984, the seabed within three miles of the shore around Scotland was protected from damage by mobile fishing gear (bottom trawlers and dredgers). Prior to removal of the three mile limit by the Inshore Fisheries Act (Scotland) 1984, levels of fisheries production particularly of white fish (cod, haddock, whiting, plaice, turbot, halibut. . .) were higher than now. Much of the seabed had not been surveyed prior to the removal of the three mile limit so there was poor understanding of the consequences of removing the limit on sensitive and important biogenic habitats such as maerl beds.

Given what happened with other fisheries in 1960s and 1970s and how fishermen behave, it was entirely predictable what the long term consequences would be to fisheries following removal: boom and bust. For a few years some local fishermen prospered from catching and selling previously unexploited shoals[39]. And then, one by one, the stocks of fish declined and the big fish (capable of producing many young ones) were gone.

I have not signed the petition calling for reinstatement of a limit. This is not because a new limit with adequate compensation for all the affected fishing businesses and fishermen would not be beneficial in many ways; it is because the campaign does not address fundamental problems of competition and conflict between fishermen, between fishermen and conservationists; of a lack of trust[40]. Because of the investment and jobs within the mobile sector, there would be much unhappiness, ill feeling and hostility unless representative organisations such as SFF were able to agree a way forward and persuade their members to support it[41].

There may be another way forward . . .

2.4 No time to stop and think

Most working lives are busy, distracting, tiring and rarely provide opportunities for impartial review and reconsideration. Opportunities to think 'outside the box', to consider alternative scenarios and ways to progress do not come along every day (I'm trying to make the most of this one . . .).

This reassessment of fisheries management in the northwest of Scotland is not a criticism of any of those who work as fishermen; they include some of Scotland's hardest working people; many things are stacked against them. If there is fault, perhaps it is because of a lack resolve and imagination within government? Or because of the partiality and intransigence of the federations which represent different competing sectors which lobby government?

But even that is not a helpful approach to take. The situation that the fishing industry finds itself in has been brought about primarily because the evolution of fishing technology and catching power (especially after hydrocarbons became widely available as fuel and raw material) has progressed faster than it has been possible to effectively restrain and regulate fishing activity, for complex reasons.

Ultimately no one is to blame; the evolution of fish catching technology has followed its own path; enterprising businessmen have always responded to the opportunities for making money that came their way[42].

We all share the responsibility for finding a better way forward and will all benefit (especially future generations of fishers) if one can be found. A similar scenario is at the core of many other man-made environmental problems, for example degradation of agricultural land, loss of biodiversity, plastic pollution, and climate change. There are many similar challenges. By consuming wild fish and other food and using other products, we are all a part of each problem; so we share the responsibilities of finding solutions.

2.5 Excessive carbon footprint per unit fish catch

Most governments, including the UK and Scottish Government have recognised the threat from man-made global warming to our shared future. With future survival and national well-being in mind, most have pledged to do what they can to reduce the amount of CO_2 that they produce. Since I started writing this, the First Minister in the Scottish Government has declared a 'Climate Emergency'.

However, I didn't find any assessment of the carbon footprint of fishing in Scotland within FFMS nor targets for reducing this. Did I miss something? Or is global warming still regarded by the fishing industry as a problem for others to solve?

More energy and effort goes into harvesting seafood than is necessary. This applies to both creel fisheries and trawl fisheries; both forms of fishing remain largely 'hit and miss'. There is rarely clear knowledge of what will be caught prior to setting the net or creel, and whether or not it is indeed the best time to harvest. Because fishermen are in competition with each other (as discussed above) and need to make the most of days at sea allocation of periods of good weather, the industry is inherently inefficient.

Many fishing businesses have been sustained by untaxed red diesel. The relatively low cost of fuel enables fishermen to make money even when the catch of fish or shellfish per unit fuel combusted (and CO_2 produced) is relatively low. Damage to the environment associated with inefficient fishing practices remains a problem for others, especially future generations, to pay for and clear up.

Fishing boats in NW Scotland may soon have options of reliable zero-emissions propulsion systems[43]. These should be promoted instead of red diesel. Electric battery and hydrogen fuel-cell technologies are rapidly advancing; these are things that enterprising young people can be excited about. The first trawlers were sail powered. A combination of electricity, hydrogen fuel-cell and perhaps wind will be used to power the fishing boats of the future. The government should provide financial incentives.

FFMS Chapter 9 implied a lack of ambition to even address the carbon footprint of the Scottish inshore fishing industry.

2.6 Resistance to change

This maybe the biggest challenge: how can change for the long-term benefit of coastal fisheries be brought about without causing unwelcome short-term difficulties for individual fisherman and influential fishing businesses? Overworked, weary fishermen can be grumpy during the best of times. Those who profit from the way things are are unlikely to vote for change. Do things have to get so bad that even the businesses that have prospered in recent years must face financial hardship before change can be brought about?

It is not an easy thing to do to present ideas that may challenge the way things have been for many years without being seen by those who may be affected as a threat. Nor is it easy to see how change can be easily brought about without being seen to provide some with an unfair advantage or disadvantage.

The world is a rapidly changing place. Environmental degradation will eventually affect us all. Even some of the most sceptical free-market capitalists are beginning to respond to problems associated with climate change; who would have thought ten years ago that a Conservative Party led UK Government would have introduced targets to ban the sale of new petrol and diesel powered cars by 2030 (. . . and fishing boats?)? Are they really serious?

Fishermen are an enterprising lot; they have to be. There has been plenty of innovation and investment around Wester Ross in recent years. Most is by individual fishermen seeking ways to catch more fish for themselves rather than collaborative actions to benefit the overall fishery. That's not because it is not in the nature of fishermen to be altruistic towards each other; it is because of the harsh economic and fisheries management realities that they experience.

For change to occur, fishermen and fishing communities need to face up to fundamental problems and seek solutions.

A positive outcome for everyone is needed. Is this possible? The FFMS consultation document does not even address some of the problems and challenges discussed above; perhaps because the authors (and politicians) were wary of provoking vociferous objections from some key stakeholders? PS. Or perhaps because of vested interests within some of the institutions for example Marine Scotland who prefer the status quo?[44]

2.7 Summary

This section has described some of the challenges that are faced by the inshore fishing industry, namely:

- the need to reduce competition and conflict between fishermen;
- the need to reduce fishing pressure on stocks and seabed habitats;
- the need to provide more places where fish and shellfish are protected from fishing activity;
- the need to respond to the development of new fish catching technology without increasing pressure on stocks;
- the need to reduce the carbon footprint of inshore fishing;
- the need to provide incentives and opportunities for all involved with the inshore fishing industry to think ahead and make changes.

The next section considers whether aquaculture offers a way forward?

3. A future for finfish and shellfish production in coastal waters: to catch or culture?

Technologies for the capture of finfish and shellfish have evolved rapidly over the past 100 years. Marine ecosystems have been altered by activities powered by combustion engines, plastic nets, and by increasing concentrations of carbon dioxide and other by-products from an expanding human world.

In response to greater demand for fish and shellfish products, to a decline in or a limit to yields from many wild fisheries and to the corresponding increase in the value of some species, there has been rapid expansion of fish and shellfish farming in many parts of the world.

Is aquaculture the only way forward?

3.1 A wild - cultured continuum for seafood production

The distinction between wild fisheries and aquaculture is not clear cut; there is a continuum. In terms of wildness[45], the species that are harvested from the waters around the northwest of Scotland vary.

Amongst the wildest are mackerel and herring which spawn in the wild, feed on natural food throughout their lives, and are free to swim large distances prior to capture, and where 'natural' selection is still a dominant force shaping their evolution.

At the other end of the spectrum are farmed salmon, produced from carefully selected breeding stock, where fish are cultured in semi-controlled environments, and where fish are fed diets formulated from a mix of ingredients of both wild origin (fish meal and fish oil) and cultured origin (vegetable protein, mineral supplements, bioproducts from agriculture . . .).

Between these extremes are many other seafood species which have attributes of being both wild and cultured.

For example, mussels (*Mytilus edulis*) are grown on long-lines around the northwest of Scotland; however the spat from which they are grown comes from natural sources, and mussels feed on a natural diet of plankton. *Nephrops* prawns (Languostine) are managed as a wild fishery; however as described above (see section 2.2), their muddy seabed habitat, associated predator populations, and the amounts of food available to them are all subject to alteration by human activities especially in areas which are regularly trawled.

Analogies with the wild - cultured continuum for seafood production can be found with regard to production of animals and plants on the land. For example, in the northwest of Scotland, 'wild' red deer are fed by some estates during the winter. Some 'domestic' sheep are hefted onto hill ground where they live a near wild existence and rarely encounter people. And somewhere along this wild - cultured continuum are the 'feral' goats which graze roadsides by Little Loch Broom during winter months and migrate onto craggy mountain slopes during the summer[46].

With regard to trees, there are ancient self-seeded woodlands of birch, alder, oak and Scot pine; other native woodlands of nursery grown trees planted by foresters; and at the other end of the continuum, commercial woodlands where stocked non-native conifers (e.g. Sitka spruce) are grown for timber production.

Figure (to insert): wild-cultured; natural-unnatural

As demand for seafood and other produce from the sea has increased and wild sources of finfish and shellfish have dwindled, there has been a trend in many parts of the world towards more intensive forms of aquaculture; perhaps in some ways reminiscent of the Mesolithic – Neolithic transition[47]?

3.2 Future finfish production in the northwest of Scotland: intensive salmon farming?

The Scottish and UK governments have focussed much investment on supporting the expansion of open cage salmon farming in recognition of the economic benefits that the industry has brought to Scotland and especially to rural coastal communities.

In 2019, 203,881 tonnes of farmed salmon were produced in Scotland, an increase in 30.79% from previous year; and 1,651 people were employed in marine, an increase of 185 people (11.2%) from the previous year. Those who work in farm salmon production have relatively secure jobs and earn more than most fishermen (Scottish Government stats, Oct 2020).

Is further expansion of intensive open cage salmon farming the best or only way for coastal communities to be able to prosper in future years? Or are there opportunities for generating more income from the revival of wild fisheries in our coastal seas?[48]

Open cage salmon farming developed in the 1980s partly as a consequence of the decline in wild salmon fisheries. Wild Atlantic salmon are particularly difficult to manage because they travel so far. Wild salmon from rivers in the northwest of Scotland migrate through the territorial waters of the Faroes, Iceland, Norway, and Greenland where local fishermen may catch them. The survival of wild salmon therefore depends upon cooperation between all these nations to agree and implement catch quotas and other fisheries management regulations. Several international organisations including the North Atlantic Salmon Conservation Organisation [NASCO] continue to work hard to safeguard wild salmon; however many wild salmon populations remain fragile. The commercial netting of wild salmon around NW Scotland ceased in the early 2000s.

The Scottish salmon farming industry has attracted international investment not so much because of altruistic desires to ‘feed the world’ or to reduce the carbon footprint of edible protein as some multinational companies may claim, but because much money can be made for shareholders. The business model, environmental footprint, and contribution to alleviating global protein shortages of intensive salmon farming has more in common with multinational burger chains than with increasing the global supply of food through ecologically sustainable means.

Market pressures and technological development have led to increasing efficiencies in salmon farming. Larger cages and greater mechanisation has reduced production costs and increased profitability. A risk of failure due for example to elevated mortality associated with sea lice epizootic or loss of stock can be accepted where profits from success are high and the penalties for failure are small in comparison.

Ambitions currently include increasing production of Scottish farmed salmon to be airfreighted to North America and East Asia. Guided by an increasingly influential industry lobby, the salmon farming industry in Scotland remains subject to relatively weak regulation compared to Norway. Constituencies where

the salmon farming industry is a major employer include that of the Scottish Government's former Cabinet Secretary for Rural Affairs, Fergus Ewing (MSP for Inverness East)[49].

The Scottish Government still shows no signs of bringing in regulations for salmon farming that can safeguard fragile wild salmon populations and sea trout fisheries in salmon farming areas.

For all its merits, producing a crop of farmed salmon still requires more input of energy and other resources and has a bigger detrimental impact on the environment than harvesting a crop of wild fish. Much edible wild fish is rendered down to fishmeal and fish oil to the detriment of marine ecosystems and threatened species in other parts of the world which depend on small fish for food (including some endangered penguins)[50].

Some companies promote the concept that farm salmon protein has the lowest carbon footprint of all forms of cultured animal protein[51]. Compared to intensively produced 'feed lot' pork, beef and chicken, this may be so. Ruminant animals including cattle and sheep produce methane, an even more potent 'greenhouse warming' gas than carbon dioxide.

However once packaging and transportation by air to far away markets have also been included in calculations, the carbon footprint of salmon farming remains far from neutral. Further expansion of salmon farming will contribute to further increases in CO_2 emissions rather than to a reduction unless there is a corresponding reduction in production of animal products with an even higher carbon footprint (e.g. feedlot beef).

Compared to traditional wild fisheries in the northwest of Scotland, intensive aquaculture of salmon has many disadvantages including the following:

1. farmed fish need to be nurtured and artificially fed.
2. protein inputs can be greater than protein outputs. For example, production of 1 kg of farmed salmon protein still takes more than 1 kg of protein from other sources.
3. grown under intensive conditions, many aquaculture species experience costly health challenges (e.g. sea lice epizootics and gill disease).
4. emissions of waste products, including suspended solids, dissolved nitrates, and parasites from open cage salmon farms can damage ecosystems in surrounding waters which the industry does not pay to clean up.
5. harvesting 1000 tonnes of wild pelagic fish (e.g. herring or mackerel) requires much lower energy inputs and carbon dioxide outputs than production of 1000 tonnes of intensively farmed salmon.

Salmon farming should therefore not be regarded as a more sustainable alternative or a solution to the mismanagement of wild fisheries and marine ecosystem collapse.

As levels of farm salmon production have increased, pressure on remaining wild stocks of salmon and sea trout and other wild fish have also increased. For the purposes of providing affordable protein, humanity would be better served with the revival of wild fisheries production and the development of aquaculture systems for fish species which feed nearer the base of the food chain, for example barramundi (Asian sea bass)[52] or tilapia which can be grown to harvest size on a diet of plankton[53].

The non-government organisations that have chosen to work with the salmon farming industry to improve standards (for example WWF, Soil Association, RSPCA) risk appearing foolish by providing a green smokescreen for an industry that when considered in the whole remains detrimental to prospects of achieving sustainable seafood production based on the revival of healthy marine ecosystems[54]. Ask the penguins!

However in terms of overall impact to the environment, some of the remaining wild fisheries in the northwest of Scotland are not so different from intensive aquaculture. Impacts to valuable seabed habitats such as maerl beds associated with scallop dredging have been widely documented, hence designation and management policy for the Wester Ross MPA. The nephrops trawl fishery remains viable because high prices are paid by consumers elsewhere in Europe; nephrops (langoustines) are intriguing things to eat and taste good; food for special occasions. But much energy is required to harvest and transport what is ultimately a relatively small quantity of edible protein. Nephrops are unlikely to ever become regular protein for people in the northwest of Scotland in the same way that the haddock, cod and herring caught by previous generations of local fishermen once were.

One of the frustrations which provoked this response is that in Gairloch, with a once thriving herring and whitefish fishery, it has not been possible to buy affordable locally-sourced finfish for many years.

As a Gairloch resident, I live off fish fingers, tins of sardines, tuna and mackerel, and fish carried across Scotland from east coast ports.

So for the future, which is better: aquaculture or wild fisheries?

Both intensive salmon farming on a large scale and indiscriminate fishing practices can have a detrimental impact on stocks of wild fish and upon the environment. Perhaps the way forward is somewhere else on the continuum between ‘catch’ and ‘culture’? Could our coastal seas be more productive and make a bigger contribution to supporting local communities and the economy if some of the management practices associated with aquaculture were extended to ‘wild’ fisheries production?

3.3 Extending aquaculture management systems to wild capture fisheries

The economic success of salmon farming demonstrates that aquaculture production has many advantages over wild capture fisheries, in much the same way that agricultural production of cloven-footed animals (sheep and cattle) has many advantages over the nomadic hunting of deer.

These include the following:

1. a seabed lease and a licence give the operator exclusive access to a defined area for the production of fish or shellfish;
2. production can be controlled (pending challenges from weather, pests and diseases);
3. the crop can be harvested in a planned way to maximise its value;
4. employees are paid a regular wage so have security of income;
5. employees work together within a large company for the benefit of all;
6. employees can follow a career path and progress to positions of greater responsibility according to their ability and experience.

So what can we learn from aquaculture than can help plan for more sustainable wild fisheries management? Here are some things:

1. **Know and nurture your crops**.
2. **Manage harvests**. Wait until the price is highest and harvest in an efficient way which does not damage other crops.
3. **Work as a team**. Provide incentives for everyone to support each other instead of competing with each other. Provide a career path for employees and appropriate rewards.
4. **Look after the environment upon which your crops depend**. For open cage marine salmon farming (and shrimp farming in ponds Thailand), that is primarily about ensuring adequate flow through of clean, oxygenated water (the major flaw with intensive aquaculture is that damage to other aspects of the environment is for others to pay . . .)
5. **Protect your crop from predators and pests**. This can be sensitive; few people object to the removal of starfish and crabs from oyster farms of scallop ranches. However lethal control of seals is deeply unpopular and unlikely to be acceptable to consumers any time soon. To those who grumble at high seal numbers: remember that wild fish evolved alongside predators and were hugely abundant at times when there were many more large fish predators (seals, sharks and other large fish, [e.g. tuna]) than currently found in coastal waters. To those who grumble at the killing of seals: remember that once there were many more orca . . ..

The next generation is challenged with rebuilding more productive fisheries where people act with greater knowledge, sensitivity and responsibility as part of Earth's biosphere; where people have better understanding and nurture ecosystems through management rather than causing damage as a result of ignorance or inadequate knowledge and the unforeseen or inadequately regulated consequences of fish-catching technology combined with free-market forces.

That requires change.

Section 4 offers a framework for how this could be achieved.

4. A framework for the future: towards reformation of inshore fisheries management

4.1 A fisheries co-management organisation(s) for the northwest of Scotland?

In summary, the scenario presented here is for a co-management organisation [CO] which employs all the fishers working within a defined area. Fishers' income is no longer determined simply by how much fish (or shellfish) they can catch and what they can sell it for; their main income is from a regular wage paid by the CO.

Different forms of fishing gear are used by the CO according to what is best to achieve defined objectives; employees using static gear and mobile gear are all part of the same organisation and on the same side.

Because the co-management organisation has exclusive harvesting rights for all species (or very many of them) in the area in which fishing takes place, and fishers' incomes are directly linked to the overall long-term success of the organisation in terms of fish sales (and other income from e.g. monitoring contracts on behalf of government), there is no incentive to overfish or to circumnavigate management regulations.

All fishermen contribute to the information base from which management decisions are based as part of their normal work. It is in everyone's short-term as well as long-term interests that management decisions are based on all available correct information.

Aims and objectives

This proposed co-management organisation led scenario aims to achieve the following:

1. to maximise the value of coastal seas to people especially those living nearby;
2. to maximise the value of wild fish production together with income from other marine assets including harvesting of other species, aquaculture, wildlife tourism and recreation;
3. to provide secure employment for as many people as possible, thereby reviving and supporting nearby communities
4. to regenerate and sustain healthy, biodiverse and productive marine ecosystems.

Objectives include the following:

1. A multi-species ecosystem-based approach is taken to the management of coastal waters which maximises the value of the area for fisheries production, wildlife conservation and local economies.

2. A fisheries co-management organisation [CO] is developed where all employees work in collaboration with each other as part of the business management team.
3. All income from sales of fish and shellfish belongs to the co-management organisation.
4. Employees are paid a regular wage based upon a contract of employment.
5. Fish harvesting is just one activity which employees undertake as part of their normal duties. Other duties may include monitoring and assessment of fish and shellfish stocks; monitoring of other wildlife; the development and maintenance of fishing boats and other equipment; and other activities including contribution to fisheries management decisions.
6. The co-management organisation is managed by a team of directors with hands-on experience within the fishing industry and other coastal industries (e.g. aquaculture; wildlife tourism; . . .) and by representatives of local and national government to ensure that the concerns of other sea users and the wider public are accommodated.

The current system of fisheries management is compared to the proposed scenario in Figure 4.1. [I'm assuming that in the future women will participate fully, hence use of 'fishers' rather than 'fishermen' in proposed scenario column].

Figure 4.2 compares some of the features of the proposed scenario with a reinstated three-mile limit scenario[55].

Figure 4.1 Comparisons between existing and proposed fisheries management scenarios.

Existing scenario	Proposed scenario
= Fishermen work independently or as part of a small producers organisation.	= A co-management organisation with exclusive fishing rights to a defined sea area employs all.
× Fishermen share access to fishing grounds so are in competition with each other.	✓ Fishers work together with other employees as part of a co-management organisation.
× Creel fishermen, mobile gear fishermen, clam divers work independently and sometimes in competition with each other causing conflict.	✓ All sectors are employed by the co-management organisation removing conflict. It is recognised that different fishing methods are appropriate for different scenarios.
× A fishermen's income is uncertain and varies seasonally according to catches and sales.	✓ All employees including fishers receive an employment contract, weekly wage and sometimes share of profits as a bonus.
× Fishermen may feel compelled to work long unpaid hours to survive in business, and may suffer ill health as a result.	✓ All employees including fishers are paid for agreed working hours including time-off for rest and recovery.
× Fishermen own or lease their boat and fishing gear.	✓ Boats and equipment belong to the management organisation.
✓ Fishermen work long unpaid hours to maintain their boats and equipment in good condition and take pride in owning their own boat.	× Fishers may take less pride in their boats and equipment and may rely more on others to keep them in good order? (c. salmon farming).
✓ Fishermen are free to fish where and when they choose. There is personal satisfaction and personal reward for choosing where and when to fish successfully.	× Fishers are expected to work according to arrangements agreed with others (hours and places). However these can be flexible. There is less incentive to 'go the extra mile' to maximise the value of time at sea.
× Fishermen are largely excluded from monitoring and management activities because they are either too busy, cannot afford to, or do not have opportunity.	✓ Fishers are crucial to successful management and are paid for monitoring and management activities including decision making as part of their employment.
× Fishermen don't always trust other fishermen and fisheries managers so are not always inclined to share information about fish stocks.	✓ Fishers contribute fully to knowledge base by providing information about fish stocks and management ideas in a more transparent way.
× Some fishermen are tempted to circumnavigate regulations as they'll make more money that way.	✓ As all income from fish sales goes to the management organisation from which employees are paid, there is therefore little incentive to cheat.
× Fishers turn a blind eye to others who circumnavigate management regulations especially if they don't agree with the regulations.	✓ Fishers report rare infringements by those who are not part of the co-management organisation as if they don't they'll also lose out.
× Fishery protection and compliance are expensive as there are big financial incentives for cheating.	✓ The fishery is largely self-policing because there are virtually no incentives for cheating, so money can be spent elsewhere.
× Most people in coastal communities disregard activities which damage fisheries and associated biota because they have little incentive to care for them.	✓ People living in coastal communities are actively encouraged to participate in monitoring and management activities and share the benefits of healthy and productive fisheries. Coastal communities develop greater sense of ownership of coastal waters.

Figure 4.2 Some features of the existing scenario, a reinstated three-mile limit scenario, and the proposed co-management organisation scenario

A. Existing scenario	B. Three-mile limit reinstated	C. Co-management where all income is shared
Some areas are closed to trawling and dredging (e.g. Loch Gairloch, Loch Torridon, parts of Wester Ross MPA).	Much larger areas are closed to trawling and dredging than at present.	Areas are closed for specific purposes: to allow sensitive habitats to recover, to protect breeding stocks of fish or shellfish, etc.. Many closed areas are within 3-miles of the shore; others may be further out.
Creelers and hand divers operate throughout these 'closed' areas as well as areas where mobile gear operates.	Creelers and hand divers operate within the 3-mile limit.	Throughout the area different fishing gears may be used at different times according to assessment of impacts, costs and benefits. Members of the co-management organisation share knowledge and work together to agree best options, regulations and develop new methods of fishing with minimal adverse impacts.
Within closed areas there is still competition between creelers and potential for overfishing of shellfish.	Within the three-mile limit there is still competition between creelers so still potential for overfishing of crab, lobster and prawn.	Seabed habitats and stocks are managed throughout the area to enable full recovery.
Outwith closed areas there is competition between and within sectors so fishermen are unable to rest areas to allow stocks to fully recover.	Outwith the 3-mile limit, trawlers and dredgers operate as before; important habitats for biodiversity or fisheries away from land are still subject to excessive pressure limiting the overall productivity of fishery.	All income from sales of fish and shellfish belongs to the co-management organisation. Employees including fishers receive a regular wage and sometimes bonuses.
Seabed habitats and stocks of finfish are unable to recover because of excessive fishing pressure.	Seabed habitats and stocks of many finfish recover within 3 mile limit and spill out into other areas.	There is little temptation to operate outwith agreed regulations, and the fishery is largely self-policing.
Most fishermen have to work long hours to survive, and there is much frustration and insecurity in all sectors.	However, fishing incomes remain insecure because of competition within sectors. Mobile fishermen resent reinstatement of the 3-mile limit and are tempted to operate outwith regulations so compliance costs are high.	

4.2 Providing opportunities for the next generation

Many of the fishermen currently operating around the northwest of Scotland have parents, grandparents or uncles who were also fishermen. Each generation has faced challenges, good times and bad times. Successful fishermen developed detailed knowledge and the skills to enable success often largely through practical experience on the job rather than through formal training.

Being a fisherman has changed greatly from the days of drifting in an open-deck boat all night before manually pulling in the sodden cotton net and shaking out the herring. Traditional ecological knowledge handed down from generation to generation remains important. In addition, especially in recent years, training courses have been offered to young people to enable them to be able to operate and ultimately to take charge of increasingly complex and powerful technology and expensive equipment. The young people who enter the industry nowadays have complex knowledge and many skills to enable them to safely and efficiently operate 21st century boats.

However because of the problems described in section 2, prospects of a secure long-term job in the fishing industry remain scarce. Some skippers continue to employ people from overseas countries to work on their boats because most local young people who have the ability, ambition and training to secure a steady income find better opportunities elsewhere. As described above, embarking on a career in salmon farming provides better prospects of a secure well-paid job than a career in wild capture fisheries.

If a co-management scenario similar to the one proposed here could be developed and implemented in the northwest of Scotland, there is no reason why wild capture fisheries could not provide young entrants with career opportunities similar to those offered by the salmon farming industry.

The next challenge is to consider some options for introducing new ways of doing things.

4.3 A progression?

This is the most difficult bit to foresee and why it may take many years to make the changes from the existing hunter-gatherer based system of fisheries management to one with attributes more in line with that of aquaculture management.

Even if the need for the radical changes proposed were to be accepted by many fishers, progress will only be possible if short-term concerns and immediate threats to fishermen's income can be adequately addressed. The rate at which progress could be achieved will depend upon acceptance by the fishing communities that may be affected, and by the investment of time, energy and money by fishers and other stakeholders in local communities and especially by government at all levels in discussions and planning for change. All of this will take much time.

Gradual transformation from current to future scenario

One way forward could be for existing fishermen to continue to work their usual areas much as before, but get some guaranteed income for carrying out certain management tasks and over time receiving a greater proportion of their income from an emerging co-management company.

A new system of co-management could emerge for just a small sea area and for just a few fish or shellfish species (perhaps a bit like a Several Order or Regulation Order)[56]. For example, within the context of the northwest of Scotland, the proposed 'co-management organisation' scenario could initially be trialled for a relatively small sea area (e.g. enclosed sea loch: Loch Torridon[57], Loch Gairloch or Little Loch Broom) or for a medium-sized area (e.g. Wester Ross Marine Protected Area) before, pending satisfactory outcome, and agreement by all stakeholders, extending the co-management system area to a much larger area (e.g. North Minch).

What I think is not in the best interests of local communities nor for the nation as a whole is for private businesses to be able to divide up the seas and effectively 'own' and manage them for their own financial benefit (e.g. a small number of absentee shareholders in faraway places) rather than for the benefit of more caring local people and the wider public through democracy.

BBC Cornwall: the Fishing Life (2021) reported that just 5 families own 25% of the total quota allowance for UK fish stocks. Under a similar scenario, it is conceivable that just a few businesses could purchase exclusive fishing rights for extensive areas of coastal water to the detriment of the local people who have traditionally made their living from them.

Ultimately a political decision is needed: should coastal waters and the fisheries resources therein be managed as a national asset or should they be tradable and therefore subject to private ownership? Multi-national salmon farming companies have already effectively taken ownership of 10s of km^2 of coastal waters; however their long-term commitment to the health of the environment in which they operate remains questionable.

Some of this may depend on the desire and ability of local communities to take on management responsibilities and the extent to which the government is able and willing to provide the investment and support required to achieve the desired objectives.

Many of these things are more about politics than fisheries management so largely beyond the intended scope of this document.

The need for government £ support for restructuring

If people in Scotland want more productive and valuable fisheries, they will need to accept that much investment will be required in addition to changes in policy. Fishermen who choose to opt into a new system will need to be paid a wage. A new CO will need funds to purchase fishing equipment including boats.

Opting in could mean that an active fishermen becomes an employee of the new management organisation; and sells or leases his boat and equipment to the new management organisation.

Thereafter options (not mutually exclusive) may include continuing to use an existing boat in the same local area within which the fisherman is familiar; and / or training to use a new boat and new technology. He may continue to fish much as before, but income from sales of what he catches goes to the co-management organisation of which he is a shareholder as well as an employee.

Thereafter, if the proposed scenario works as envisaged, he'll earn more money for fewer hours of work than he would otherwise earn as an independent fisherman in competition with other fishermen. If already a part-time fisherman with other work (e.g. running a holiday business) then the management organisation could ensure flexibility of working hours to accommodate that.

A scheme could be set up where future entrants are offered employment with opportunities for continuous professional development. Note that the new organisation includes both wild fisheries and other wildlife monitoring activities, so younger entrants could be given a broader range of work and associated training to build up a knowledge base.

One objective is to improve the overall efficiency of fish catching and to reduce the carbon footprint. A voluntary decommissioning or buy-out scheme would be needed especially for older fishing boats[58]. But not all at once; some existing boats could be upgraded as new technology for e.g. hydrogen powered engines becomes available.

Figure 4.3 compares and contrasts the existing scenario with a possible future scenario with regard to CO_2 emissions.

Figure 4.3 Comparison of carbon footprints of existing and proposed fisheries management scenarios. The proposed 'management organisation' could be for a relatively small sea area (e.g. Loch Torridon or Loch Gairloch), for a medium sized area (e.g. Wester Ross Marine Protected Area) or for a much larger area (e.g. North Minch).

Existing	Proposed
× Fishermen may travel 10s of km to fishing grounds and back each day according to weather, burning much fuel.	✓ Within the management organisation's area, locally based fishing boats have priority access to nearby fishing grounds.
× Fishermen feel compelled to go to sea on days when sea conditions make fishing local waters unsuitable.	✓ Fishers get paid for days on shore doing other activities in support of the fishery.
× Because income is entirely based upon fish sales, when conditions or fish quality is suboptimal, fishermen continue to go fishing even on 'bad' days, burning much fuel for a small or low value catch.	✓ Fish and shellfish are harvested in an energy efficient manner which maximises the value of the catch relative to the costs of obtaining it.
× Most boats are fuelled by relatively low cost (tax reduced) red diesel so there is less incentive for introducing low carbon alternative means of propulsion.	✓ New or refitted boats utilise locally generated renewable energy via latest battery or fuel cell technology. Sails are also used on some boats.
× Profitability depends on access to inexpensive fuel (red diesel).	✓ Customers pay a premium for fish and shellfish produced from a low carbon fishery.
× Fishermen use methods they have invested in and are familiar with and lobby representatives to defend the existing set up rather than to introduce changes which may threaten their own operations.	✓ There is investment by Government in the development and introduction of new fish and shellfish capture technologies which have reduced environmental impact, for example using ROVs.
× Fishermen must take unpaid time away from fishing if they are to retrain.	✓ All employees, including fishers are paid to attend training courses and receive continuous professional development.

5. Next steps

Prompted by the FFMS consultation in 2019, this document was initially drafted in response to the request by the Scottish Government for comments. It is still evolving in response to other ideas and information though has reached the stage where peer review is required, perhaps especially by fishermen and other who seek to improve the management of coastal seas. This document is far from 'job done', many issues require much more thought following responses from those who are involved directly or indirectly with inshore fisheries.

Since starting, there has been time to learn more and to consider further. Some things have moved on. A new fisheries management strategy for Scotland[59] and a '*future of our inshore fisheries summary action plan*'[60] have been published; a consultation regarding allocation of post-Brexit fish quota in Scotland is on-going. More people are talking about 'co-management' than in 2019.

However some things have not changed. Many of the Brexit hopes of fishermen affiliated to the Scottish Fishermen's Federation for a much larger share of access to UK waters have yet to be realised[61].

The main purpose of this document is to focus not so much upon short-term difficulties associated with the coronavirus pandemic and post-Brexit international trading arrangements; but to outline an alternative fisheries management scenario which in the long term can benefit everyone involved with inshore fisheries in the northwest of Scotland; and to encourage others to think about the sort of fishery they would like for the next generation.

What do you think?

If this document helps in some way to promote further conversation and consideration of options and opportunities for reducing conflict and instability within the inshore fisheries in northwest Scotland and for reviving and sustaining productive fisheries, it will have served some useful purpose. There are many things still to work out; and it would not be right for one person to attempt to resolve them all.

Thank you for your consideration.

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Notes

[1] The author has lived in Wester Ross for almost 20 years where he has worked as a 'fisheries biologist' for Wester Ross Fisheries Trust and learned much from friends and neighbours some who are still active commercial fishermen.

[2] SG Future of Fisheries Management in Scotland https://www.gov.scot/publications/national-discussion-paper-future-fisheries-management-scotland/

[3] NW Scotland Inshore Fisheries Management plan https://www2.gov.scot/Topics/marine/Sea-Fisheries/InshoreFisheries/IFGsMap/northwest/NWIFGMP)

[4] FAO State of Fisheries and Aquaculture 2021 www.fao.org

[5] Christopher Unsworth (2013) The British Herring Industry The Steam Drifter Years 1900-1960

[6] Peter Cunningham (2019) Wester Ross spring spawning herring recorded on video to the west of Red Point, near Gairloch

[7] John McIntyre (2018) http://seachangewesterross.co.uk/three-mile-limit/

[8] Mike Smylie (2004) Herring a History of the Silver Darlings

[9] Laurie Robinson (1970) 'Sea Fishing in Scotland'.

[10] BBC 'Cornwall: This Fishing Life' Series 2 Episode 3. With a big increase in crab price associated with new Chinese market, there was much investment by fishermen in new crab boats and fishing gear. The programme highlighted many issues, optimism associated with a new fishery; a 'gold rush' as fishermen set about exploiting new opportunity, the emerging reality of limited stocks, a lack of catch quotas and inadequate response of governing authorities; and the collapse in crab price associated with closure of Chinese market in 2020, with many fishermen facing hardship.

[11] Legally netted salmon were taken until around 2010 around Skye. Legal netting rights remain, closure has been at request of fisheries boards and through voluntary agreement (check).

[12] Source https://foodanddrink.scot/

[13] Webb, JH, AF Youngson, CE Thomson, DW Hay, MJ Donaghy and IS Mclaren (1993) Spawning of escaped farmed Atlantic Salmon (Salmo salar) in western and north Scottish rivers: egg deposition by females. Aquaculture research 24, Issue 5

[14] Marine Scotland Science were continuing investigations of genetic introgression of wild salmon by escaped farm salmon in 2020. Results are awaited . . . .

[15] Norwegian Scientific Advisory Committee for Atlantic Salmon (2020) Status of wild Atlantic salmon in Norway 2020 https://www.vitenskapsradet.no/Portals/vitenskapsradet/Pdf/Status%20of%20wild%20Atlantic%20salmon%20in%20Norway%202020T.pdf .

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[17] Marchal, P. et al (2016) A comparative review of fisheries management experiences in the European Union and in other countries worldwide, Iceland, Australia and New Zealand (available on-line) for related discussion.

[18] ICES, June 2019 & June 2020. Advice for North Sea Cod. Fishing pressure remained 'too high'.

[19] Pomeroy, Sue (from 2012) Recorded conversations with former herring fishermen in Wester Ross area; subsequently edited for broadcast on Two Loch Radio by Ann Gray and transcribed by Ruby Neervoort for her MSc thesis 'The one that didn't get away'.

[20] Roberts, Callum (2007) 'The Unnatural History of the Sea'

[21] Ruth Thurston and Callum Roberts (2010) Ecological Meltdown in the Firth of Clyde, Scotland: Two Centuries of Change in a Coastal Marine Ecosystem. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0011767

[22] Roberts, Callum (2010) 'Ocean of Life'

[23] As I redrafted this paragraph (Sunday 30/8/20, 7:30am; and again Thursday 29/10/20, 6am), a scallop dredger was operating only 3km away over the shallow (<30m deep) shelf where there is (was) some live maerl. 'So what?' you may ask. My concern is based on estimates for the overall value of a seabed where the maerl is alive and where the habitat also supports much secondary productivity, in comparison to those for a seabed where the maerl is dead, and there is therefore reduced calcium carbonate production associated with maerl and associated biota (e.g. bivalves) living within the habitat [ref. required]. With some help from Jason Hall-Spencer, I have started drafting a maerl bed poster . . .

[24] https://www.wrft.org.uk/news/newsitem.cfm?id=181

[25] The COAST marine symposium was attended by coastal community group representatives, fishermen and conservationists and academics including Prof Callum Roberts of University of York (author of 'The Unnatural History of the Sea' and 'Ocean of Life').

[26] Future of Our Inshore Fisheries www.seafish.org This group was established in January 2019 and brings together active fishermen and industry leader together with policy makers, regulators and academics from across the UK.

[27] Michael Wigan, 1998 'The Last of the Hunter Gatherers'

[28] PS. The new UK Fisheries Bill which sets out measures to manage fisheries in UK waters post Brexit, was debated in the House of Commons on 1st September 2020. The Bill sets out proposals for the United Kingdom to gain greater control of waters within its exclusive economic zone (extending to 200 miles from the shore). The Bill proposes a co-management approach where fishermen have greater influence in fisheries management. The Bill proposes measures to exclude vessels from other countries fishing in UK waters without a license. Boats from different parts of the UK will still be able to fish anywhere they chose within UK waters. Some politicians talked up 'new opportunities' for boat builders and other fisheries related businesses. There was little discussion of issues relating to straddling stocks; that there would still be a need to agree quotas for stocks which move between EU and UK waters. Following the debate, the EU fisheries spokesmen expressed much concern (3rd September). Up to a third of fishermen in other EU countries which currently have access to UK waters through the Common Fishery Policy [CFP] may face redundancy.

PPS. On 24th December 2020, a Brexit trade deal was agreed between the UK Government and the EU. For marine fisheries (the last issue to be agreed), a 5-year transition period from pre-Brexit CFP access and quota arrangements for fishing boats from mainland Europe countries to UK waters has been agreed. Some representatives of the UK fishing industry have not responded favourably to the deal (BBC Radio 4 News, 27th December 2020). The whole agreement will be reviewed after 4 years.

[29] Torridon nephrops fishery petition http://www.parliament.scot/gettinginvolved/petitions/PE01300-PE01399/PE01386_BackgroundInfo.aspx

[30] SFCC supported by Fish Legal took the Scottish Government to court in December 2021 over the right to trawl in the 'Inshore Fisheries Report: Inner Sound of Skye Consultation Outcome Report'. In January 2021, Marine Scotland was found to have acted irrationally by reopening the area to trawlers following the consultation against best public interest.

[31] A BBC documentary broadcast on 3rd January 2021 about Cornish fishing industry described similar experiences; see www.bbc.co.uk/fishinglife . PS [10/1/21]subsequent episodes of this excellent series explored issues relating to Cornish sardine (pilchard) fishery; trawling; creeling for lobsters; small boat fishing for mackerel; and gill netting for mix species including spider crabs. Many of the issues are very similar to those which affect fishermen in NW Scotland.

[32] Peter J Hayward (2016) The Shallow Seas of Northwest Europe

[33] Farrell, Ed (in prep., 2020) a review of the history of herring fisheries research around Ireland and the west of Scotland

[34] Cunningham (2010) *'Mekong fishes and mainstream dams'* Jul 2010 compressed; see also Wikipedia entry for 'Giant salmon carp' where the photo I took in 1997 is also used. The Giant Mekong salmon carp (*Aaptosyax grypus*) appears to have become extinct as a consequence of overfishing associated with modern technology (cheap nylon gill nets), opening up of faraway markets (e.g. in Thailand) and environmental degradation including muddying of waters associated with deforestation. Several other spectacular large Mekong carp species are also threatened (e.g. *Labiobarbus* spp.).

[35] Sala and Giakumi (2018) https://academic.oup.com/icesjms/article/75/3/1166/4098821

[36] 29/10/20: The scallop dredger currently working just offshore (outside a MPA) has its AIS tracking device turned off. Find out why VHF kept on but not AIS; how precise is it in locating a fishing boat? .

[37] In *Stewards of the Sea. Giving Power to the Fishers*. Marine Policy 126 (2021) Paul BJ Hart argues that a major problem is that in recent decades, active fishermen have become increasingly less powerful in decision making as more and more external institutions have emerged with a remit to sustain fisheries and the marine environment with vested self-preservation interests. Much of this analysis chimes with my own experiences; sometimes it is not clear who is supporting who. The radical solutions that Hart proposes are not so different from those that are outlined below. We have subsequently corresponded . . .

[38] For information about the campaign to reinstate the three mile limit follow links at www.openseas.scot and also www.fishingnews to get both sides of the debate.

[39] One fisherman spoke of the discovery of overwintering whiting shoals near the Crowlin Islands by locally based boats in late 1980s or early 90s (to confirm). For a short period of time, large catches were made; then they were gone. Post-Brexit (11/1/21) there are still proponents who would have you believe that you can 'have your cake and eat it'.

[40] I may reconsider; pending outcome of this initiative.

[41] Since drafting this paragraph, Hart (2021) has argued that fishermen would have more respect for fisheries management regulations is they had more decision making power. I agree up to a point: the Loch Torridon MSC Nephrops fishery demonstrates that where there remains competition and potential for agreement breakers to benefit regardless of peer pressure, prospects of achieving sustainability remain vulnerable.

[42] The BBC series 'Cornwall: the Fishing Life' (2020 – 2021) is an outstanding documentary series presenting many issues of relevance to inshore fisheries in the northwest of Scotland.

[43] The 'Karoline', a Norwegian boat, claims to be the first fully electric-powered commercial fishing boat.

[44] Hart (2021) *ibid*

[45] 'wildness' here refers to the extent to which a species completes its life-cycle within the natural environment (i.e. unaffected by man).The wildest species are those which live in natural environments from birth to death; the least wild are those where lives and ecosystems (habitats, food and feeding, predation, breeding . . .) are determined by human influence.

[46] The large 'natural' predators of deer, sheep or goats in Scotland were brown bear, wolf and lynx. People have been the major predator since the wolf became extinct. Eagles and foxes take young sheep, deer and goats.

[47] Mesolithic and Neolithic refer to subdivisions of the Stone-age . . .

[48] At the time of writing (January 2021), there is much political talk at UK government level of post-Brexit opportunities for marine fisheries with increased access to UK waters for UK registered boats; for investment in construction of new boats and new co-management groups.

[49] For example, a £457,000 HIE grant to Gael Force marine was announced in December 2018 for development of 160m – 200m plastic cages (www.fishfarmingexpert.com). This was justified as a demonstration of the Scottish Government's support for 'sustainable' expansion of aquaculture to new offshore sites. How can even larger intensive open cage salmon farms, in more-exposed higher risk locations, with greater nutrient discharges and emission of sea lice larvae, and greater demand for fishmeal and fish oil be seen as part of a progression towards greater sustainability? Is this level of support for multinational corporations and their wealthy shareholders the best use of taxpayer's money? Multi-national MOWI has been first to deploy the new cages; why was MOWI not able to finance development of the new cages without government support? Gael Force is a major employer in Fergus Ewing's constituency, Inverness East; it might at least have looked a wee bit better if some other MSP had made the announcement? Why does the Scottish Government not invest in the development of semi-enclosed waste recapture systems as recommended by its own agency, SEPA, instead?

[50] See 'Feedback: Fishy Business' and 'Feedback: On the hook' via links at http://feedbackglobal.org

[51] Statement by Scottish Government Cabinet Secretary Fergus Ewing to the Rural Economy and Climate Change Committee, 2nd December 2020.

[52] Greenberg, 2010 'Four Fishes'.

[53] I helped colleagues and students grow tilapia in Thailand where the only inputs to their green water culture ponds were slurries from chicken, pig and cattle units and septic tanks from toilets. BBQed, they were delicious. However more recent intensive production systems have been based on compound feeds, not so different from those used by fish species with more carnivorous natural diet (ref). Furthermore, there is some concern that escaped non-native Tilapia in SE Asia are now a threat to some native fish species (WWF 2021).

[54] For Christmas 2020 we ordered TESCO Finest Smoked Scottish Salmon. The package we received has *'farmed in Snizort East Hebrides'* stamped on it. The back of the pack states that *'our TESCO Finest Scottish salmon is RSPCA assured so we know the fish are farmed responsibly'.* Salmon farms in the east of Loch Snizort, Isle of Skye were operated by Grieg Seafood in 2020; reported on-farm sea lice levels were much higher farms than even SSPO Code of Good Practice levels; for November 2020, the Snizort East salmon farm reported the highest lice figure for any farm in Scotland (see SSPO Sealice Report). Wild salmon populations in rivers on the Isle of Skye have fallen to critically low levels, some wild salmon populations may already have been lost. The largest and most important river for wild salmon on the Isle of Skye is the River Snizort; wild juvenile salmon would have had to migrate past the RSPCA assured, lice-infested Snizort East salmon farm.

[55] The 'Our Seas coalition' is calling for: The return of a modern seaward limit on bottom-towed fishing, via a just transition; Effective vessel tracking systems for all boats; Preferential allocation of fishing opportunity to vessels with low environmental impact, bringing increased sustainable economic value and employment to communities. See https://www.ourseas.scot/ .

[56] PS. I'm encouraged to find that Hart PJB (2021) Stewards of the Sea: Giving Power to the Fishers. Marine Policy 126 (2021) 104421 has proposed similar 'led by fishermen' fisheries management scenarios; one for a small defined inshore area; another for an industrial pelagic fishery such as that managed by the Scottish Pelagic Fisheries Association which employs a dedicated scientist to assess stocks. One difference to what is proposed here is that the SPFA is an association of private owners rather than a business based on management of pelagic fisheries for wider public benefit?

[57] Has anyone ever carried out an assessment of why the Loch Torridon nephrops fishery lost its MSC certification?

[58] Government sometimes acts with large amounts of money when it sees the need. As I rewrite this section (6th November 2020), the UK Government has just announced an extended furlough period extending until the end of March for those who are unable to work due to the Covid-19 pandemic.

[59] Scottish Government (2020) Scotland's Fisheries Management Strategy 2020 - 2030

[60] Seafish (2020) Future of our Inshore Fisheries: Summary Action Plan

[61] Scottish Fisheries Federation (2021) Letter to Prime Minister from SFF Chief Executive, January 2021.