

THE FUTURE OF SCOTTISH FISHERIES IN A CHANGING WORLD

The annual science meeting of the Marine Alliance for Science and Technology for Scotland attracts the cream of Scottish researchers, including many whose topic of interest is fisheries. **Kelvin Boot** reports

The Marine Alliance for Science and Technology for Scotland (MASTS) annual science meeting (ASM), the largest of its kind in the UK, has a well-earned reputation for the quality and quantity of its presentations. This year, the ASM was again held at the University of Strathclyde's Technology and Innovation Centre in Glasgow, where more than 400 delegates were treated to almost 140 presentations and e-posters presented over two days, which included plenary sessions and 10 specialist workshops that allowed for more detailed discussions. One specialist session brought together research aimed at understanding 'The Future of Scottish Fisheries in a Changing World'.

An uncertain future

As long as uncertainty remains over exactly how Brexit will pan out, the impacts on Scottish fisheries, and the industry and communities they support, is also not clear. But we should not forget that Brexit sits within a context of other changes taking place in our waters; climate change and ocean acidification hover ominously in the background, while pollution in the form of microplastics has been rocketed into the public consciousness in recent months. Then there is competition for space, as more demands are made on coastal waters from marine renewable installations, aquaculture facilities, and even competing sectors of the fishing industry.

We may not know what the future holds, but as far as fishing is concerned, 'we can be certain that it is going to be very different from what we are experiencing today', according to Dr Tara Marshall of the University of Aberdeen, who chaired the session. Therefore, more than ever before, good-quality marine science research has an important part to play in the future of Scottish fisheries, as the world changes.

Getting territorial

Professor Michel Kaiser of Heriot-Watt University, who is almost a household name in fisheries, got the session off to a topical start by discussing the greater use of territorial fisheries in management in the UK, specifically for sedentary species like *Nephrops* or scallops.

Professor Kaiser illustrated the principle with a case study of the scallop dredged fishery in the Isle of Man – an area he has been involved with for many years. As he reminded delegates, scallops are the third-largest fishery in the UK, worth about £60m *per annum*, but to date, the fishery has been subject to little management, not much science, and patchy stock assessment, so overexploitation remains a possibility. Scallop dredging is also known to have the most impact of all towed-gear fishing, and this is a sustainability concern, both for the scallops and for other seabed life.

The Isle of Man makes an interesting case study because as an independent territory, it has exclusive rights to manage its fishery within three nautical miles. About 10 years ago, a fisheries and conservation zone was implemented in Ramsey Bay; some areas are set aside for seagrass beds, maerl beds or horse mussel reefs, but there is a designated fishery management zone. The Manx Fish Producers' Association was given the lease to fish the area for scallops, but with conditions that the fishermen had to participate in scientific survey and quota setting, effectively taking responsibility for how they would fish the zone.

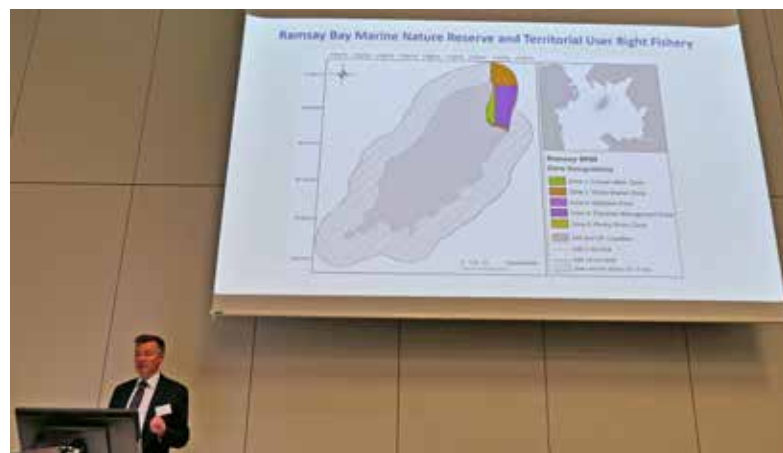
Because of the quota that limits how much can be fished, the fishermen were encouraged to fish the high-density scallop areas, resulting in less time fishing, not only reducing fuel costs but also the environmental footprint – fishing became more efficient, and less damaging. In fact, thanks to high-frequency



▲ Around 400 delegates attended the MASTS ASM 2019.

GPS recorders, it was shown that the actual area that was fished was minute, with 96% of the potential fishing area not being fished at all. Compared to the rest of the Isle of Man scallop fishery that is not managed as part of this regime, the carbon footprint is less, catch relative to effort is better, and in the wider context of food production, it outperforms pig, cow and egg production for energy return on investment.

This work demonstrates that in the real world, if you get the management right to create suitable conditions, wild-capture fisheries, even using environmentally disturbing fishing gears like scallop dredges, can be managed effectively to improve profitability, reduce time at sea and lessen the environmental footprint on the seabed.



▲ Professor Michel Kaiser presented a case study of the Ramsey Bay scallop dredged fishery.

Ecosystems and fisheries working together

Scallop fisheries have gained notoriety for the damage they might cause to the seabed, but all demersal towed gears

can have benthic impacts, potentially compromising factors including nutrient recycling, biodiversity maintenance (including commercial species), climate regulation and carbon



▲ Dr Tara Marshall, who chaired the fisheries session, with Janneke Ransijn.

By-catch, chokes and selective gear

In Scottish waters, the *Nephrops* and mixed whitefish trawled fisheries can have a very diverse by-catch, including juveniles of target species. Quota regulations and the landing obligation have increased economic risk to Scottish vessels through 'choke' species, which if rapidly captured above quota, even if not targeted, can close down fishing.

There is therefore a strong financial incentive to modify fishing gears to avoid unwanted catches, but the uptake in Scotland has been slow. Shaun Fraser of the University of the Highlands and Islands presented some of the work being done

with colleagues at the Gear Innovation and Technology Advisory Group (GITAG), set up by the Scottish Fishermen's Federation (SFF) and Seafish.

The collaborative approach of GITAG has encouraged flexible partnerships between fishing vessels, industry, public bodies, gear technologists and scientists, and has led to recent innovations in gear selectivity which take existing innovations, such as mesh size and escape windows, to the next level.

Shaun Fraser reviewed some of these innovations, including escape panels to reduce cod by-catch, as trialled on the Atlanta II, and separators in the *Nephrops*

fishery, trialled by the Amity II; both of these modified gears take advantage of the swimming behaviour of the species in question. A double-codended net allowed the natural upward swim of by-catch species, while *Nephrops* moved down to be retained in a lower codend. In the initial Atlanta II trial, which allowed cod to follow their natural instinct and swim downward where there was an escape window, results showed a reduction of around 80% in the cod by-catch rate. This approach would appear to go some way to solving at least part of the by-catch challenge. The published paper can be read at: bit.ly/2CFrkxf

Participation in MPA management

We know that fisheries provide an essential source of food and employment in coastal communities, and we know that most target species live on and over sedimentary habitats, but we don't know much about the ecological condition of these habitats and how sensitive they are to fishing. This lack of information makes it difficult to manage effectively for an ecologically sensitive and commercially sustainable approach to fishing.

A two-year project, involving the JNCC, the MMO, Natural England, the NFFO and Bangor University, is setting

out to explore processes for establishing, evaluating and adapting fisheries management measures in marine protected areas (MPAs) that contain sedimentary habitats. Key aims are to engage with the fishing sector and add their knowledge and experience to the mix, encourage compliance within MPAs, and raise stakeholder awareness of the impacts of fishing activities.

The outcome is intended to provide an adaptive management approach which can remain flexible as new information comes to light. It is highly dependent upon

stakeholder participation, and workshops have enabled the development of participatory processes and governance frameworks, with an ecological model predicting the outcomes of different management scenarios using real-life examples.

Outputs from the project include an MPA management toolkit, a fully tested governance and participatory process, educational materials aimed at stakeholders, and a stakeholder engagement manual to help regulators and other stakeholders encourage participation. More details can be found at: bit.ly/208xDik

sequestration. The North Sea and western Scottish waters accounted for about two-thirds of all UK landings of demersal species, with a value of £183m, in 2016. Such fishing operations therefore have great potential for disturbing seabed habitats and the goods and services they provide.

In her presentation, Yolanda Arjona of the Joint Nature Conservation Committee called for a move away from single commercially valuable species management toward a more holistic 'ecosystem approach'. The idea is to have better management without increasing impact on fishing opportunity.

The conventional approach to fisheries management, as well as only looking at single species, is also fishery-focused, is solely concerned with fish catches and stocks, only listens to scientific knowledge, and is top-down from government to fisheries authority. The ecosystem approach differs by considering the ecosystem and its biodiversity; it includes how the fishery interacts with other sectors and how it relates to all marine ecosystem goods and services, and it encourages more participative co-management, and listens to fishermen as well.

Yolanda Arjona described how the Mitigation Impact (MIMPACT) project had collated examples from around the world of best practice to minimise the benthic impact of towed gears, using Scottish seas as a study area. Selected commercial species

were mapped, together with habitat types and their sensitivities to towed gears, in order to produce outline recommendations for reducing bottom contact, and thus minimising impacts.

From this scoping study, various conclusions were reached, including the need for habitat maps and sensitivity scores, and an accurate idea of the pressures put on the habitats, in order to inform management measures. These might include incentivising fishermen to fish in certain areas and avoid others, and to use specific gears in specific areas.

The research continues to gather more data over longer periods to gain a better idea of how damage can be minimised, while still supporting fisheries.

Are there enough fish?

Fish have long been recognised as playing a vital role in global food security, not only as an important source of protein but also for their health benefits, through omega-3 and other fatty acids, amino acids, vitamins and trace elements. This has led to fish being incorporated into many national dietary recommendations, but this awareness of nutritional benefits has led to an increase in consumption.

So, with populations rising, demand increasing and environmental changes beginning to bite, against a background of political uncertainty, are there

enough fish in the sea? The basic calculation is easy: simply compare the currently available fish supply, including domestic production and imports, with the national nutrition guidelines per person (two portions a week in the UK) multiplied by the population.

Some European countries do not access enough fish to meet the dietary requirements, but on average, there does appear to be enough to go around,

We should not forget that Brexit sits within a context of other changes taking place in our waters

although imports play a large part in the supply. The UK is one of the countries where fish supply does match national dietary recommendation, but if UK fish imports decrease, the requirement will not be met, even if the UK ceases to export fish and retains them for domestic consumption – another Brexit balancing act!

Two points come from this research, being carried out by Anneli Lofstedt and colleagues at the University of Aberdeen: sustainable fish production is likely to be even more important in future, and there is a need for changes in cultural consumption trends. We should be encouraging a broader species range, as well as a greater awareness of how much fish we should be eating, all tempered by how much fish is available.

What stops fishing?

Small-scale fishing can be a precarious occupation, and many factors influence whether a fisherman goes to sea, or stays ashore and misses opportunities to earn income. Janneke Ransijn of the University of St Andrews and her colleagues interviewed 105 lobster and crab fishers from 42 ports around Scotland, to better understand their fishing behaviour, as part of the Scottish Inshore Fisheries Integrated Data System (SIFIDS) project.

One thousand five hundred vessels in the Scottish fleet are



▲ Janneke Ransijn and colleagues have been digging into the factors that stop fishermen from fishing.

12m and under, and these are almost entirely owner-operated, working largely in unregulated space. This project wanted to learn more about where and when fisheries activity was taking place, and what the drivers were that determined that activity.

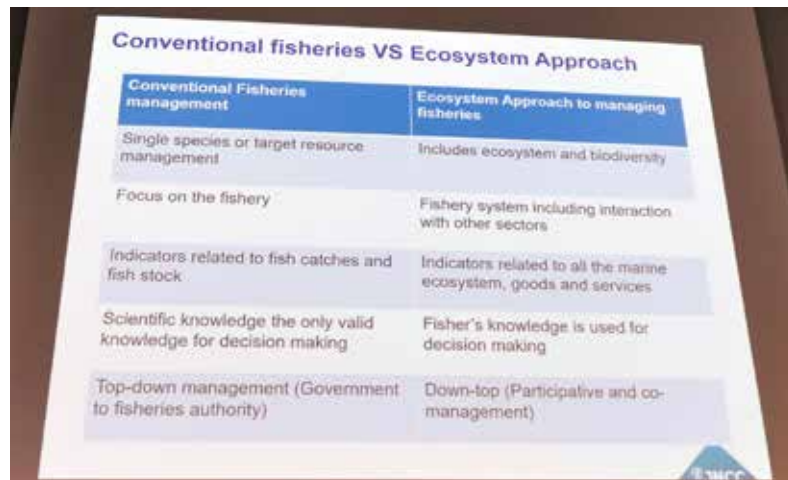
Vessel size and fuel price have already been recognised as important, with larger vessels more resilient to adverse weather conditions; 95.2% of respondents cited bad weather as the most important driver for stopping fishing, but there are other factors that dictate the probability of going fishing on any given day. Low catch rate was the second most important reason for not venturing out to fish, according to more than a third of those interviewed; around a third also gave vessel problems and personal problems as reasons for staying ashore. Seasonality and sale price of catch were also deemed important, while only 1% reported ground closures as a reason for not fishing.

Still in its early stages, the project is using the data it has

collected to populate computer models that should help to predict the likely behaviour of the fisheries as a whole, as well as that of individuals, under different future economic, environmental and ecosystem scenarios. An increase in stormy weather due to climate change, for example, will clearly impact the number of fishing days. Importantly, the effect of multiple factors working together will be made clearer, so enabling forward planning and management for maximum reward.

SIFIDS summary

In the final presentation, Mark James drew together the nine work packages that came out of the Scottish Inshore Fisheries Integrated Data System (SIFIDS), which set out to develop a series of prototype processes and systems designed to improve data collection in inshore fisheries. SIFIDS was mostly concerned with static-gear fisheries for crab, lobster and langoustine, but also included some other sectors such as scallop diving, dredging and fixed-net fisheries. The results from SIFIDS are impressive, and will be the subject of a later article in *Fishing News*. ■



▲ Yolanda Arjona compared conventional and ecosystems approaches to fisheries management.

A test for self-sampling

The importance of working together to break down stakeholder boundaries is well-recognised among key players in Scotland's fishing industry. Kate Bridgen described a project between academics from the University of the Highlands and Islands, the pelagic sector, represented by the Scottish Pelagic Fishermen's Association (SPFA), and policy advisors in the shape of Marine Scotland Science (MSS).

The Scottish pelagic industry is very enthusiastic about supporting science and collecting data to underpin it, while academia recognises that the SPFA is well-placed to collect good-quality data to bolster that obtained by MSS to inform management initiatives. As part of the Paradigm for New Dynamic Oceanic Resource Management (PANDORA)

project, seven pelagic vessels have volunteered to test self-collected data, with a view to designing and testing the feasibility of self-sampling methods for use in the future.

This pilot study has been looking at three species initially: herring, mackerel and blue whiting, and includes length and weight data, date, time and location, as well as some environmental information. The self-sampled data is ground-truthed against traditionally collected MSS data, and so far appears to be providing additional useful information. The project also supports the need for good communication and feedback, and has established routes to achieve this, including end-of-season reports for each vessel, email, and a WhatsApp group, which are proving to bolster engagement.