Rural Affairs and Islands Committee

Science and data in inshore fisheries management

The purpose of this paper is to provide background information to support the Committee's consideration of inshore fisheries issues.

The paper sets out information on the role of science and data in inshore fisheries management in Scotland.

Introduction

A key focus of the Scottish Government's 2015 Inshore Fisheries Strategy was "improving the evidence base on which fisheries management decisions are made".

The Scottish Government's Future Fisheries Management Plan 2020-2030 also commits to *"champion science-based approaches that are tailored to the needs of specific regions and ecosystems, are supported by robust yet proportionate management measures, and which take account of the shared challenges we face, such as climate change".*

Respondents to the consultation on this strategy raised the following points regarding science:

- The importance of strong science was seen as vital by respondents from the inshore sector for providing data regarding stocks and locations.
- There was strong support for direct industry involvement in the gathering of scientific data as well as support for the idea of an industry-science levy.
- Industry would like a role in relation to working with Marine Scotland scientists to identify priority priorities for data collection.

A lack of robust scientific evidence, data collection and monitoring in inshore fisheries has been a recurring theme in the Committee's scrutiny of recent policy developments such as the Joint Fisheries Statement and the seasonal cod closures in the Clyde.

In written and verbal evidence related to the Committee's consideration of seasonal cod closures in the Clyde, stakeholders expressed concerns over the absence of any data collection and monitoring programmes to support inshore fisheries management measures.

Read the published submissions received on the call for views

Official Report for meeting on 2 March 2022

For example, in written evidence, the **Orkney Fisheries Association** said

> "Strong, robust, and transparent science underpins effective fisheries management. Data on inshore fisheries is patchy […] Failure to share the science behind the decision to close the Clyde Cod Box undermines fisher faith in the decision-making process and prevents the industry and Marine Scotland exploring alternative scenarios and management options. This has long-term consequences for how fishers view management and conservation and may undermine future attempts at co-management."

Marine Directorate Science

Scottish Government funded marine science is primarily delivered through the Marine Directorate's 'Science, Data, Evidence and Digital' (SEDD) portfolio (formerly 'Marine Scotland Science'). It is responsible for monitoring and research and provides advice for the management of activities in Scotland's aquatic ecosystems.

The Scottish Government sets out the purpose of science within the Marine Directorate is to:

- provide expert scientific, economic and technical advice and services on issues relating to marine and freshwater fisheries, aquaculture, marine renewable energy, and the aquatic environment and its flora and fauna,
- provide the evidence to support the policies and regulatory activities of the Scottish Government through a programme of monitoring and research,
- perform regulatory and enforcement activities,
- represent the Scottish Government at national and international meetings.

The Scottish Government published its Marine Science and Innovation Strategy in January 2024. The strategy established the Scottish Government's 'vision for marine science and innovation' which is:

> "We will be innovative in using science, evidence and data to develop, strengthen and evaluate our policies and promote opportunity in delivering the Blue Economy vision."

The Scottish Government's 'Blue Economy Vision' is set out in a separate document which is:

> "By 2045 Scotland's shared stewardship of our marine environment supports ecosystem health, improved livelihoods, economic prosperity, social inclusion and wellbeing."

The Marine Science and Innovation Strategy also sets out six outcomes to *"strengthen the impact of marine science, evidence and data"* which are:

1. The Marine Directorate, with the rest of Scottish Government, delivers our Blue Economy vision. Our long-term ambition demonstrates the value we place on our marine environment and natural capital and its significance to the health of our planet. Scotland's shared stewardship of our marine environment supports ecosystem health, improved livelihoods, economic prosperity, social inclusion and wellbeing.

2. Scottish Government's marine and freshwater management, policies and plans are informed by science, evidence and advice that's continuously improving and innovating and based on quality data and analysis and supported by strong collaboration across the science (natural and social) community.

3. With our partners we aspire to co-create a Scotland-wide delivery approach to marine research that develop communities of practice, which harness our collective expertise in marine research across Scotland. These communities of practice would work together to deliver the scale of our collective aspirations as an Island Nation and attract world class talent to deliver the science, technology and innovation Scotland needs in the marine and freshwater environments to deliver the Blue Economy. Thereby ensuring we are returning the best value for Scotland and cementing the Nation as one of the centres for marine research globally.

4. The Marine Directorate will complement its existing work through collaboration nationally and internationally in a manner that fosters bold, innovative solutions, and technologies to deliver the scientific solutions – such as Scotland's existing work on Blue Carbon - to the challenges we face as a nation, and as a planet.

5. The Marine Directorate will develop its ability to anticipate, respond innovatively and adapt efficiently to opportunities and emerging challenges, such as the twin threats of climate change and biodiversity loss.

6. Our assets, in particular our aquarium and national reference laboratory, provide national value to Scotland across industry, the scientific community and in delivering a public service; informing contingency planning for disease outbreaks, collecting valuable data and enabling innovation, research and development.

Laboratories and facilities

The main laboratory relevant to inshore fisheries is the marine laboratory in Aberdeen. The Marine Directorate also has a freshwater fisheries laboratory in Pitlochry and field stations in Montrose and Shieldaig, which are supported by the freshwater fisheries laboratory.

The Marine Directorate has two research vessels, the MRV Scotia and MRV Alba na Mara. The larger of these vessels, the MRV Scotia, was commissioned in 1998,

replacing the ship of the same name which had been in service for 26 years. As such, Scotia is now approaching the years of service of its predecessor.

An information request under the Environmental Information (Scotland) Regulations 2004 published by the Scottish Government in June 2022 shows that, within the calendar year 2021 and up to the end of May 2022, **a total of 89 days at sea were lost due to breakdowns or technical faults with the MRV Scotia**. One of MSS's key performance indicators is to *"plan and conduct an annual programme to achieve most efficient use of available days on research vessels".* See more on this below and in **Annex A**.

Total running costs (staffing, repairs and maintenance) of this vessel over the same period (January 2021 to May 2022) was £3,441,491. of which, £38,277 was spent on engineering repairs and £174,193 on vessel repairs.

Key performance indicators

The Marine Directorate SEDD portfolio (formerly Marine Scotland Science) has in the past reviewed its key performance indicators in annual review reports from the Head of Science to the Marine Scotland Board. The most recent annual report available on the Scottish Government website is from 2017/18. A table setting out KPIs and the outcome of the 2017/18 review is provided in Annex A.

These annual reviews have not been conducted since 2017/18. As such, there is no information on how the work of Marine Directorate's scientific research has been impacted by additional work related to the post-EU exit transfer of regulatory functions to the Marine Directorate that were previously undertaken by the European Commission.

It is also worth noting that in the 2017/18 review, KPI C.2 on *'value of externally funded work in total and for strategic research projects'* states that *"In recent years, there has been a concerted effort for MSS to be involved in EU funded projects."* Without subsequent reviews it is not possible to assess the impact of the loss of EU funding sources on MSS's ability to undertake strategic research projects.

Other issues such as the COVID-19 pandemic and the current cost crisis may also have impacted the ability of the Marine Directorate to carry out research and survey work.

For comparison, the Centre for Environment, Fisheries and Aquaculture Science (CEFAS), the equivalent scientific advisory body for England, produces annual reports and accounts which includes performance reviews against KPIs. It also has a Science Advisory Board that meets every five years.

Inshore stock assessments

Stakeholders have criticised a lack of data and scientific evidence to support regular stock assessments for inshore shellfish species. For example, in written evidence to the Committee, a joint submission from the Shetland Fishermen's Association, Orkney Fishermen's Association and Community Inshore Fisheries Alliance said:

> "[…] ultimately inshore fisheries science requires government commitment to ensure the creation of independent, long-term data sets. The current system of inshore fisheries science relies heavily industry bids for short-term projects, which is not suitable for the creation of long-term data sets which fisheries management requires. […] The paucity of data for the inshore not only has the potential to undermine fisheries management, but also impacts the international reputation of Scottish seafood around the world. One example of this is the Marine Conservation's Society unjustified 'Avoid' rating for West of Scotland Brown Crab due to a lack of data on the stock."

Assessments of the state of the stock typically consist of estimating fishing pressure and stock size, and judging whether the fishery is sustainable and the stock healthy by comparing these indicators to pre-defined reference points.

The Marine Directorate carries out assessments for the main shellfish targeted in Scotland's waters. These are:

- *Nephrops norvegicus* (often referred to as *Nephrops*, Norway lobster, langoustine, scampi or prawns),
- king scallops,
- brown and velvet crabs,
- lobsters.

Of these stocks, Nephrops are the only species that are subject to a Total Allowable Catch.

Assessments for shellfish stocks broadly have less available data and are less regular when compared to commercial fish stocks of greatest commercial value to Scotland.

For example, information on the Marine Directorate website states that, for scallops, there are currently no agreed biomass or fishing mortality reference points and are based on historical values and perceptions of how the stock might develop. The latest assessment for this stock was in 2016 using landings data up to and including 2015 and survey data to 2016.

For crab and lobster, the Marine Directorate states that the population structure of crab and lobster stocks around Scotland, and the rest of the UK, is not well understood, with insufficient data to provide stock assessments in some areas. The

Marine Directorate conducts and publishes assessments on a triennial basis with the latest assessments making use of data from 2016-2019.

How does this compare to offshore stocks?

For comparison, fish stocks that tend to be targeted by larger vessels further offshore are assessed annually by the International Council for the Exploration of the Sea (ICES). These are pelagic, mackerel and herring being the two most valuable species, and demersal (in descending order of economic value) being haddock, monkfish, cod, hake, whiting and saithe. These assessments combine commercial (catch) and research survey data from several countries.

Marine Directorate states that data collection schemes for these stocks are long standing and follow standard protocols which have been developed over a number of years either at ICES or in-house by the Marine Directorate and there is relatively high confidence in the assessments.

The Scottish Marine Assessment 2020 (SMA2020) states the assessments for these stocks are *"some of the most data-rich in the world, and are extensively analysed by internationally-renowned groups."*

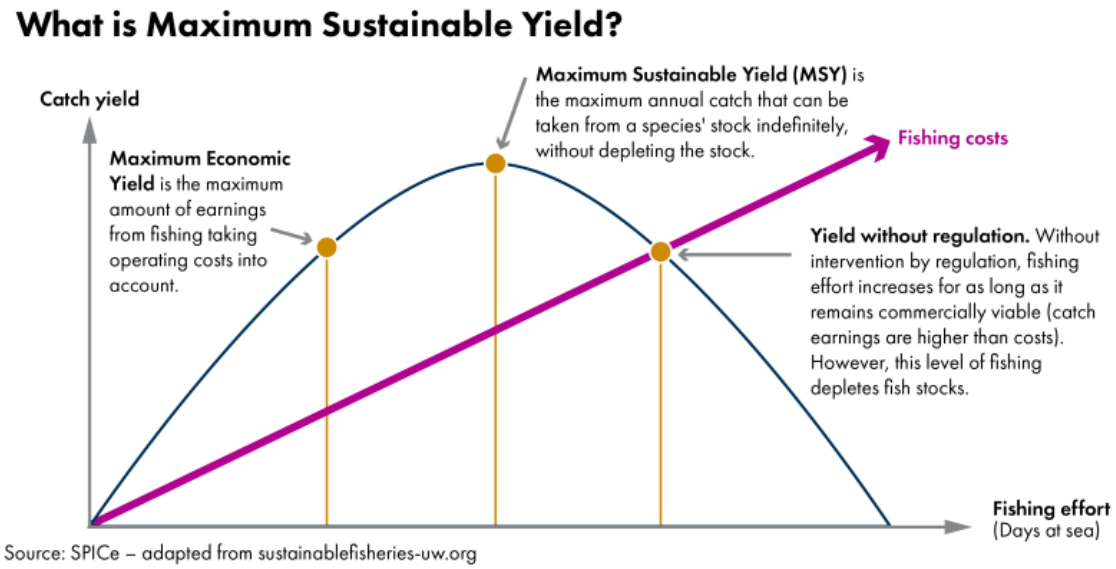
Some of these stocks are 'straddling stocks' and 'highly migratory fish stocks' that travel across international sea borders and are, therefore, required to be jointly managed under international law with quota shares and catch limits decided in annual international fisheries negotiations. As such, there is more impetus on collecting scientific data for stock assessments.

State of inshore stocks

Stocks are assessed against predefined reference points, the key reference point being the fishing mortality reference point (F_{MSY}) which is the fishing mortality consistent with achieving Maximum Sustainable Yield.

Maximum Sustainable Yield (MSY) is the maximum catch that can theoretically be harvested sustainably as determined by scientific assessment. The theory is that if fishing does not exceed a rate consistent with MSY, fish mortality from catches is replenished at the same rate, so the stock can be fished indefinitely without depleting the stock (see chart 1 below).

Chart 1: Conceptual diagram of Maximum Sustainable Yield



Apart from prawns, Scotland's shellfish resources are assessed as being overexploited. All prawn stocks are above the stock size required to produce maximum sustainable yield (MSY).

The latest assessments from the Marine Directorate of scallop relate to the period 2013-2015. Scallops were declining in eastern areas due to higher exploitation but were stable to the west of Scotland.

The latest assessments for crab and lobster relate to the period 2016-2019. The latest assessment for these stocks concluded:

> "The results of assessments for the period 2016-19 indicated that in the majority of the assessment areas, brown crab, velvet crab and lobster were fished close to or above F_{MSY}. It is recommended that effort/fishing mortality should be reduced in those crab and lobster stocks where fishing mortality is estimated to be above F_{MSY}."

Further details on stock assessment methodology and assessment results are set out in the Scottish Government's 'Crab and lobster fisheries - stock assessments: results 2016 to 2019'.

How does this compare to offshore stocks?

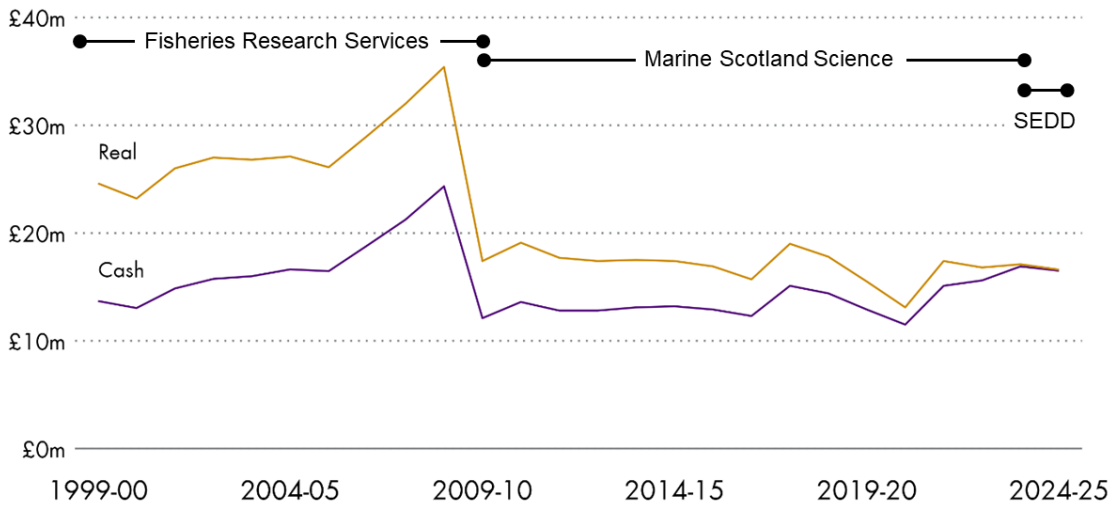
The SMA2020 states the latest broad trends in fishing mortality across these key stocks shows "*regular improvement over the period 2016 to 2018, the percentage of stocks being fished at or below F(msy) has increased from 46% (2016), to 50% (2017) and to 54% (2018). This suggests either effective management action overall, or broadly beneficial environmental conditions, or a combination of both.*"

Funding and resources

Chart 2 below shows how the marine science budget allocation has changed over time from 1999/2000 to present. Funding levels were notably higher when marine science was undertaken by Fisheries Research Services which was an Executive Agency of the Scottish Government between 1999 to 2009.

Funding levels decreased significantly following the 2008 financial crisis and may also reflect changes in funding associated with the amalgamation of Fisheries Research Services, the Scottish Fisheries Protection Agency into the Scottish Government to form the Marine Scotland in 2009.

Chart 2: Annual marine science budget allocation 1999/00-2024/25



Source: Scottish Government, Fisheries Research Services annual reports and accounts.

Chart 3 below shows the distribution of marine science budget allocations for key science programmes from 2009/10-2022-23 in real terms.

Funding for some programmes have either remained relatively stable or have experienced declines over time. For example:

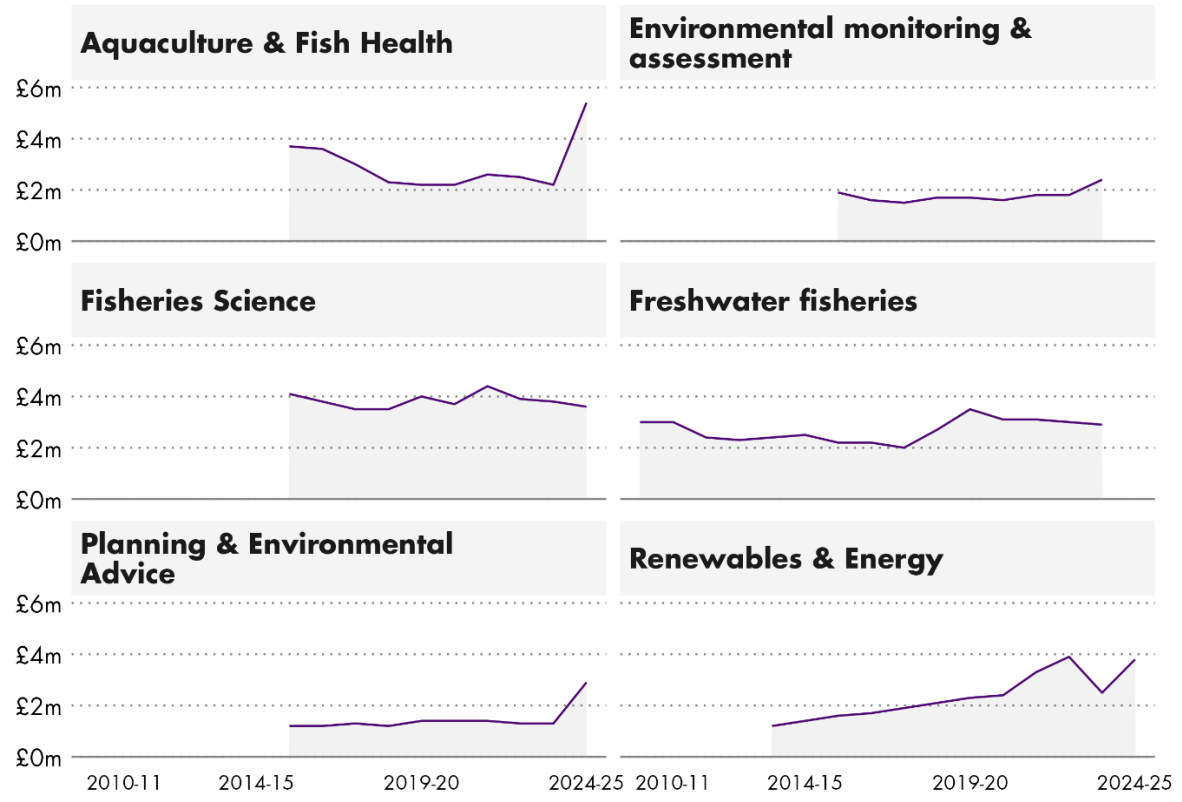
- **Environmental monitoring and assessment: £0.6m increase (£0.5m in real terms)** in funding for between 2022-23 and 2023/24. Overall funding for this programme increased by £0.5m but decreased by £0.1m between 2015/16 and 2023/24.
- **Fisheries science:** £0.2m decrease (both cash and real terms) between 2023/24 to 2024/25. Over the longer-term funding has **increased by £0.5m (£0.5m decrease in real terms)** between 2015/16 and 2024/25

- **Freshwater fisheries:** funding has been variable, declining from £2.1m (£3m real) in 2009/10 to £1.6m (£2m real) in 2017/18. Funding then increased by £1.3m (£1.5 real) in 2019/20 and has since declined in real terms by £0.6m (unchanged in cash terms) in 2023/24.

Other science programmes have been allocated more significant increases such as:

- **Aquaculture and Fish Health: £3.2m increase** (both cash and real terms) from 2023-24 to 2024/25. **This followed a longer period of overall decline in funding** from £2.8m (£3.7 real terms) in 2015/16 to £2.2m (cash and real) in 2023/24.
- **Planning and Environmental Advice: £1.6m increase** (both cash and real terms) from 2023-24 to 2024/25.
- **Renewables and Energy: £1.3m increase** (both cash and real terms) between 2023/24 to 2024/25. Overall this programme has increased by **£2.9m (£2.6m in real terms)** between 2013/14 and 2024/25

Chart 3: Distribution of marine science budget allocations for key science programmes (real terms) 2009/10-2022-23



Source: Scottish Government

Partnerships with academic research institutes and international

The Marine Directorate webpage explains that the Directorate is a partner in the Marine Alliance for Science and Technology for Scotland (MASTS). MASTS is a consortium of 17 research organisations (mostly universities) engaged in marine science, and represents the majority of Scotland's marine research capacity.

The MASTS Fisheries Science Forum represents the organisation's fisheries interests and is chaired by Prof. Paul Fernandes at Heriot-Watt University. In February 2023, the Fisheries Science Forum held an event with Marine Directorate policy to showcase the range of relevant fisheries work being undertaken: one of the outcomes of this event was the nomination of MASTS members to the Fisheries Management and Conservation group (FMAC); another was that Marine Directorate policy would like to have more frequent focussed events in future. The Marine Directorate also works with other national and international scientific institutions through a range of collaborative research projects and studentships.

International links include partnership working with the International Council for the Exploration of the Sea (ICES), the OSPAR Commission, International Maritime Organisation (IMO), the European Marine Biological Resource Centre (EMBRC), and the North Atlantic Salmon Conservation Organisation (NASCO).

Damon Davies, Senior Researcher, SPICe Research
Professor Paul Fernandes, Committee Advisor
Date 27/02/2023

Annex A: Marine Scotland Science Key Performance Indicators 2017/18

KPI		2017/18 Review
A: Delivery of Service	1. Plan, execute and report a programme of science to meet the needs of Scottish Government.	In 2017-18, Marine Scotland Science achieved 90.2% of its services targets and 64.8% of research project milestones (see plot below [p.23]). The achievement rate for scientific services such as monitoring and advice has remained stable but research achievements are more variable and the number of research projects has decreased in total.
	2. Plan and conduct an annual programme to achieve most efficient use of available days on research vessels	Marine Scotland research vessels served an impressive 259 and 275 days at sea for MRV Scotia and MRV Alba na Mara, respectively. These remain the most active research vessels in both Scotland and the wider UK.
B. Quality of science output	1. Number of peer-reviewed publications and book chapters.	In 2017/18, MSS produced 106 peer reviewed papers and book chapters. This is a very slight decrease from 108 in 2016/17 but is well above the 10 year rolling average of 90 such publications per year. Publication output, particularly peer-reviewed papers, is an important route for maintaining scientific reputation and credibility for Marine Scotland.

	2. Number of non-peer-reviewed publications produced,	The number of non-peer-reviewed publications and conference presentations and proceedings was 170. This represents a highly significant output from Marine Scotland Science and is well above the 10 year rolling average of 123 non-peer-reviewed publications
	3. Commissioned reports.	Since 2013/14 MSS has published commissioned reports which often relate to work funded by the SG's Contract Research Fund. Nine were published in 2017/18, which is equal to the 5-year rolling average.
	4. Results of external and internal audits.	The United Kingdom Accreditation Service (UKAS) conducts an annual visit to assess a range of accredited methods against the ISO 17025 Testing and 17020 Inspection standards. Following the visit, MSS staff were complimented on their excellent technical competence and quality system knowledge. The internal audit programme to support the accreditation system was up to date at the end of the calendar year.

C.Collaboration	2. Value of externally funded work in total and for strategic research projects.	In recent years, there has been a concerted effort for MSS to be involved in EU funded projects. This requires a period of time to build up as there needs to be collaborations formed, projects formulated and bids assessed. MSS has experienced some significant success in recent times as illustrated in the Table below [p.24].
	3. Communications with stakeholders.	MSS works with a very wide range of stakeholders. These include other government departments, other devolved administrations, those directly involved in many maritime industries or activities, and students who might one day become staff or collaborators of MS. Staff from MSS also collaborated on many projects with academic and other research colleagues in Scotland and worldwide. Individual examples of this work can be found in the highlights from each Programme.
	4. Integration of natural and socioeconomic sciences with policy.	MSS gives due consideration to the socioeconomic evidence and works collaboratively with the Marine Analytical Unit to provide integrated evidence and advice to policy.

D. Balance between strategic science and routine activities	1. Proportions of science programme budget allocated to strategic science and to scheduled activities.	At the beginning of the year, 18.1% of the direct science project budget was allocated to strategic science projects and 81.9% allocated to advice, monitoring and regulatory services. Although the strategic science budget increased from 2016/17, it should be noted that 2016/17 represented a particularly low budget allocation. Overall there continues to be a very strong focus on advice and regulatory activities. There tend to be fewer R&D projects conducted. However MSS continues to directly fund a number of PhD studentships.
	2. Proportion of in-year resource, reallocation between strategic science and ongoing activities.	At the end of the year, out-turn figures show that 16.9% of the budget was spent on strategic science and the remaining 83.1% on advice, monitoring, regulatory and surveillance work. This balance reflected an in-year decrease in strategic science and represents the second lowest spend on strategic science (see plot below [p.25])