

marinescotland
science

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Marine Scotland Communications

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[CLICK TO LINK TO ABSTRACT BOOKLET](#)

VISION

To provide robust research and advice underpinning the management of Scotland's marine and freshwater resources.

KEY MESSAGE

Marine Scotland Science will enhance its reputation by providing reliable advice and high quality science, ensuring that all staff are valued and that they contribute fully to Scotland's future.



When I look at what all those contributing to the outputs from Marine Scotland Science (MSS) during 2016/17 actually delivered, I am struck by the variety, quantity and quality. We have delivered so much that it makes it difficult to capture everything in this short review, but please be assured that everyone's effort and hard work is much appreciated. I encourage you to delve in and explore the achievements, impact and delivery of Marine Scotland Science. Find out what each Programme has focussed on during 2016/17 and enjoy the supporting images and the richness of what has been achieved.

During 2016/17 there have been a number of significant challenges relating to our infrastructure. However, staff have responded to these challenges, made some modifications to their programmes and continued to deliver. I acknowledge we are not where we want to be yet, but I am encouraged by everyone's commitment to improving things. It is that team spirit that is fundamental to making and embedding the changes we all

want to see. Your views indicated some of our working practices need to change and myself and the senior leadership team are committed to taking these forward. However, reflecting on what we have delivered, it is important not to lose sight of the fact there is much for us to celebrate and be positive about.

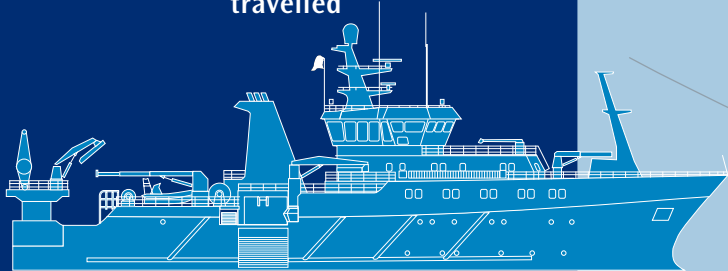
I am genuinely proud of staff, students and wider contributors who are Marine Scotland Science; without the dedication, knowledge, experience and willingness of the MSS Team, the advice provided would be of a lesser quality and our impact would fall well short of what is reasonably expected of us.

Can I thank each and every one of you for your unique contribution that has ensured strong delivery of high quality science and advice.

Colin Moffat
Head of Science

HEADLINE STORY : RESEARCH SEA TIME

Our two research ships, MRV *Scotia* and MRV *Alba na Mara*, are fundamental to the delivery of research, monitoring and advice. Both vessels delivered a very full programme during 2016/17 with over 280 days at sea and a total of 88,902 km travelled



MRV SCOTIA

283

DAYS AT SEA

66,975

KILOMETERS TRAVELLED



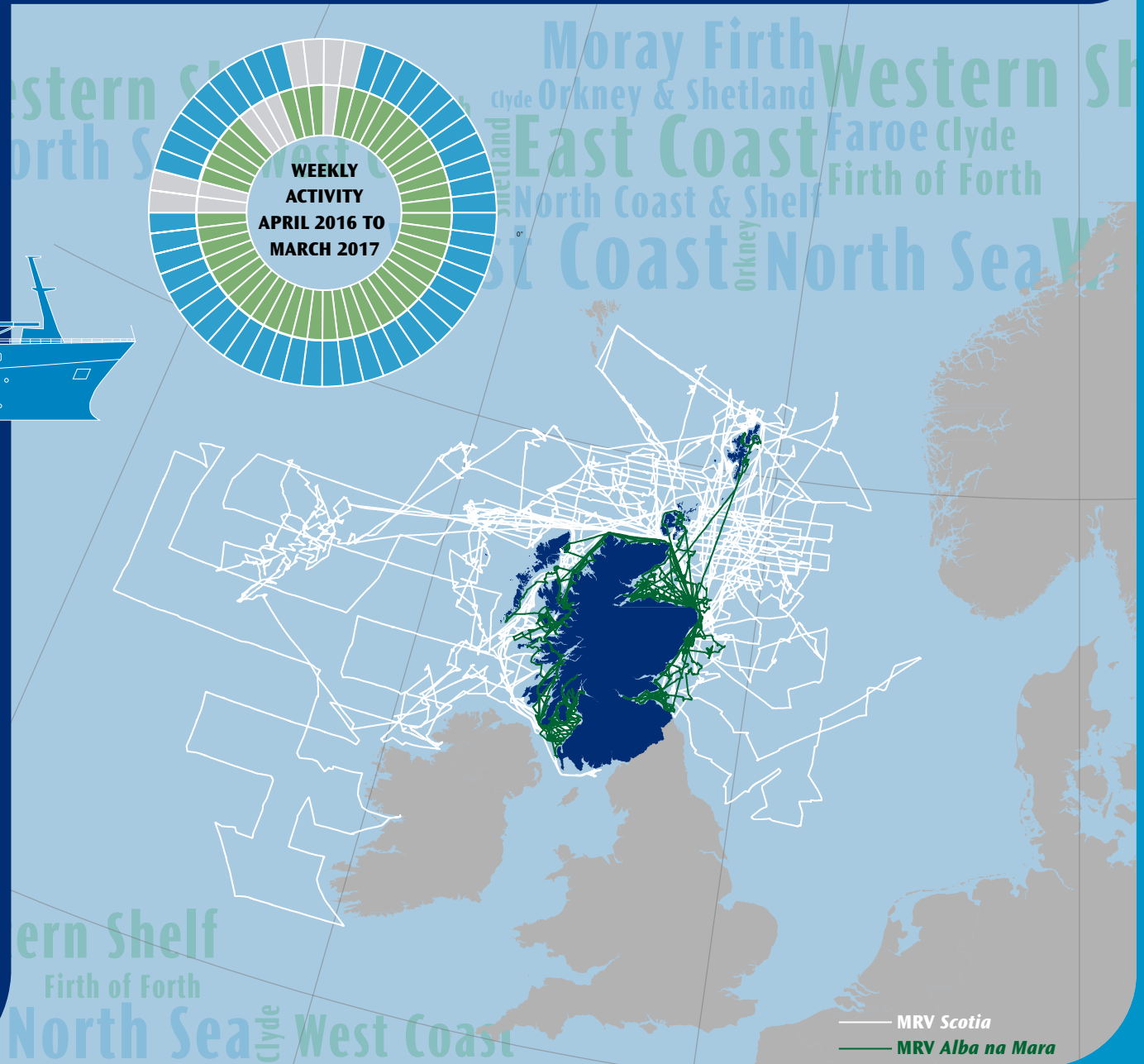
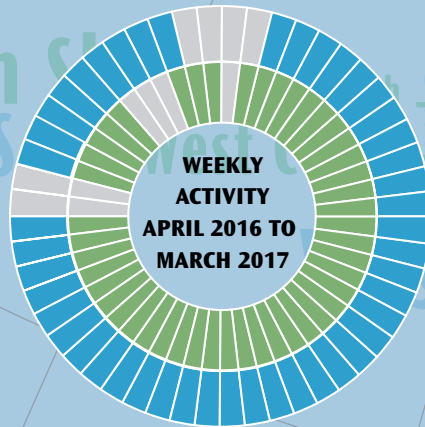
MRV ALBA NA MARA

288

DAYS AT SEA

21,927

KILOMETERS TRAVELLED



HEADLINE STORY : DAMAGE TO A FLAME SHELL BED IN LOCH CARRON

DAMAGE REPORTED 23 April



Reports emerged of potential scallop dredge damage on flame shell beds in Loch Carron, outside the Marine Protected Area (MPA).

Local inshore fishermen, recreational divers and ENGOs protested, and it was picked up by media.

BACKGROUND

Flame shells (*Limaria hians*) create 'beds' – a seabed habitat supporting high biodiversity which acts as a nursery for commercial species.

Very few beds are known in Scottish waters and because of limited movement, they are very slow to recover from damage (over 100 years).

Flame shells are a Priority Marine Feature (PMF) and are part of five MPAs. A few beds occur outside the MPA network.

National Marine Plan Policy requires 'no significant impact on the national status of PMF'.



RESPONSE 3-4 May

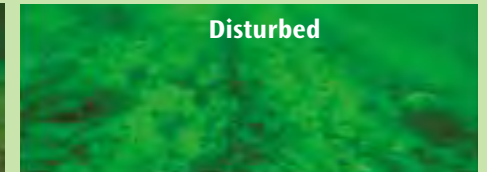


Marine Scotland Science (MSS) mobilised MRV *Alba na Mara* for seabed survey work and Scottish Natural Heritage (SNH) mobilised their dive team to confirm impact.

MSS surveyed the extent of the flame shell bed from MRV *Alba na Mara* while the SNH dive team confirmed the nature of the damage to the bed.

FINDINGS

Survey work confirmed that the damage was typical of that caused by a scallop dredge and there was still substantial habitat remaining which may be vulnerable to future damage.



ACTION

8 May

Options for handling put to the Cabinet Secretary

19 May

Area designated as an MPA and protected by a Marine Conservation Order

From report of damage to measures in place in 4 weeks

PROGRAMME MANAGER:
Dr. Rob Raynard

AQUACULTURE AND FISH HEALTH (AFH)

PROGRAMME OBJECTIVE:

The Aquaculture and Fish Health programme provides regulation and scientific advice, underpinned by research, to support the Scottish Government's vision of a sustainable and growing aquaculture industry while safeguarding the high health status of farmed and wild fish and shellfish stocks in Scotland.

SCIENCE DELIVERY:

Projects /Milestones Completed	
Monitoring and Advice (58):	50
Research Projects (11):	6
External Contracts (12):	12
Publications	
Peer-reviewed papers:	22
Book chapter:	1
Government Reports, Conference Proceedings etc:	23
Commissioned Reports:	0

« 288 site inspections conducted »»

AQUACULTURE AND FISH HEALTH



Key Highlights and Impact from 2016/17

Implemented a new access programme to enable *trans*-national use of our high bio-containment experimental facilities.

Delivered industry testing for a potential sea lice treatment.

Participated in and presented to the European Aquaculture Society's conference.

Delivered collaborative research through Horizon 2020 funding.

Provided recommendations to the European Commission on cleaner fish.

Worked with Norwegian and Irish scientists to develop a European standardised approach to sea lice dispersal modelling.

Represented Scotland on a working group to review progress of prevention, control and, where required, eradication of the *Gyrodactylus salaris* parasite.

Organised and hosted the annual international meeting on Salmon Pancreas Disease at the Marine Laboratory.

Provided disease testing and mussel species identification to businesses to assist in their management.

Delivery Against Key Programme Objectives

Contributed to the Multi-Annual National Control Plan (MANCP) for the UK. www.food.gov.uk/enforcement/regulation/europeleg/feedandfood/ncpuk

Completed a programme of surveillance, inspection, testing and regulation relating to aquatic animals.

Conducted 288 risk-based inspections of fish and shellfish farms and responded to reports of mortality and other issues.

Placed two marine salmon farms and three freshwater rainbow trout farms under restrictions to prevent the transmission of Bacterial Kidney Disease.

Maintained independent accreditation by VETQAS and UKAS for inspections and disease testing respectively.

Assisted in the aquaculture planning process as a statutory consultee, supporting sustainable development.

Protected safe trade in aquatic animals and markets for aquaculture products to support the import and export of live animals for the industry.

Collaborated with Policy, Science, industry colleagues and stakeholders to revise the sea lice control policy.

Published annual aquaculture production surveys for the shellfish and finfish industries.

PROGRAMME MANAGER:
Stuart MacDonald

BUSINESS OPERATIONS (BO)

PROGRAMME OBJECTIVE:

The Business Operations Programme supports science delivery through direct participation in research and monitoring projects, and indirectly in supporting Information Technology (IT), Health and Safety, Finance and Contracts. In addition, the Programme offers operational support for Freshwater Fisheries Science, Learning and Development and Business Support for the Head of Science and Programme Managers.

FINANCE AND CONTRACTS

LEARNING AND DEVELOPMENT

INFORMATION TECHNOLOGY

BUSINESS SUPPORT

« 250 days of Health & Safety training provided for Science staff »»

BUSINESS OPERATIONS



Key Highlights and Impact from 2016/17

Undertook a Health and Safety campaign which included targeted training opportunities, the creation of a Marine Scotland Science-specific induction video and an array of specific posters to raise staff awareness of everyone's responsibilities in and out of the work place. This will continually be developed to include further opportunities for all staff.

Worked in partnership with Scottish Government Facilities Services colleagues to deliver large scale projects, such as the refurbishment of the Fish Cultivation Building (FCB) and a number of general improvements at the Faskally site in Pitlochry.

Acted on outcomes from previous business planning sessions and processes from last year to make corporate reporting easier, enabling staff to move more freely within their programme.

Provided critical GIS (Geographic Information Systems) input across all Marine Scotland and ensured legacy IT and software applications were maintained and updated, where necessary, to maintain functionality.

Successfully created a dual environment laptop which enables Marine Scotland Science staff to utilise different networks depending on their specific business and scientific requirements.

Successfully delivered an extensive training programme to Marine Scotland colleagues in close partnership with key areas of the public sector.

Delivery Against Key Programme Objectives

Worked with staff to move towards a more positive Health and Safety culture through better staff engagement, in-house training and raising awareness of everyone's role in maintaining a healthy and safe work environment.

Facilitated collaborative working to deliver maximum value for money in areas such as Learning and Development, Information Technology and Health and Safety.

Delivered carefully planned and scheduled improvements to processes across the support functions including streamlined financial planning and enhanced infrastructure.

Consolidated and simplified Marine Scotland Science management information, implementing greater transparency to enable effective decision making from senior management.

Invested at least 500 days in staff development.

Spent 250 days training our staff in Health and Safety.

PROGRAMME MANAGER:
Dr. Bill Turrell

ENVIRONMENT MONITORING AND ASSESSMENT (EMA)

PROGRAMME OBJECTIVE:

The Environment Monitoring and Assessment Programme delivers a coherent programme of environmental monitoring, assessment, research and advice in order to help Scotland achieve Clean, Healthy, Safe, Productive and Biologically Diverse marine and coastal environments demonstrated by Good Environmental Status (GES).

SCIENCE DELIVERY:

PROJECTS/MILESTONES COMPLETED

Monitoring and Advice (56):	52
Research Projects (16):	14
External Contracts (9):	9

PUBLICATIONS

Peer-reviewed papers:	28
Book chapter:	0
Government Reports, Conference Proceedings etc:	51
Commissioned Reports:	0

“ More than 29,000 environmental samples taken from 6 sites around Scotland’s coasts since 1997 ”



ENVIRONMENT MONITORING AND ASSESSMENT



D. vexillum growing on oyster trestles

Key Highlights and Impact from 2016/17

Concluded the scientific response to the outbreak of an invasive non-native species on a shellfish farm in Loch Creran, including the provision of advice needed to allow the movement of live shellfish. Trials were held to identify a bath treatment for live shellfish possibly harbouring *Didemnum vexillum* on their shells, and these were successfully concluded in time for the fulfilment of business commitments by the farm. Scientific publications describing the work will follow in 2017/18.

Provided a considerable scientific response to the grounding of the oil rig Transocean Winner on Harris, including modelling of the trajectory and fate of the spilled diesel fuel, along with the chemical analysis of samples assessing the introduced hydrocarbons. Our sensory panel was also involved in order to provide rapid screening of samples.

Delivered the Marine Strategy Framework Directive (MSFD) fish community data product. This involved a great deal of quality assurance of complex international fish survey data. New checking procedures were devised, and effort put in to correcting a multitude of issues with the original data. The new product formed the basis of high quality assessments of the health and status of our demersal fish communities, including non-commercial species.

Successfully published a series of three reports, and an accompanying data set, which described the important coastal data series which Marine Scotland maintains. The network of coastal stations providing the data has now been rebadged as the Scottish Coastal Observatory. A summary data set has been published under the doi 10.7489/1761-1, and is already being used for a multitude of scientific and policy-related studies.

Delivery Against Key Programme Objectives

Performed all inshore and offshore environmental monitoring as planned - data was quality checked, archived and submitted to national and international data centres.

Provided scientific representation and input on behalf of Scotland or the UK on a diverse range of environmental issues, including ecosystem health assessment, climate change impact and assessment, and invasive non-native species.

Provided scientific monitoring and advice in support of the response to the Transocean Winner grounding, a hydrocarbon leak at the Clair field, the occurrence of an invasive non-native species in Loch Creran as well as a range of minor incidents.

Delivered a quality controlled European fish survey database to the OSPAR Fish Community Assessment Group in order to assess the health of the fish community for the Marine Strategy Framework Directive (MSFD) assessment.

Input in to a range of indicators for the OSPAR Intermediate Assessment 2017, with particular emphasis on D1 (biodiversity) and D4 (fish community health assessments), D8 (hazardous substances in sediment and biota), and D4 (pelagic habitat – plankton community health assessments).

PROGRAMME MANAGER:
Dr John Armstrong

FRESHWATER FISHERIES (FF)

PROGRAMME OBJECTIVE:

The Freshwater Fisheries Programme delivers regulation and scientific advice, underpinned by research, to support the Scottish Government's vision of productive freshwater fisheries.

SCIENCE DELIVERY:

Projects/Milestones Completed	
Monitoring and Advice (50):	50
Research Projects (13):	11
External Contracts (3):	3
Publications	
Peer-reviewed papers:	12
Book chapter:	0
Government Reports, Conference Proceedings etc:	13
Commissioned Reports:	0

Deploying a temperature logger on the River Brora as part of the Scotland River Temperature Monitoring Network.
Picture by Iain Malcolm

“ 1,857 salmon and sea trout catch returns processed ”

FRESHWATER FISHERIES



Key Highlights and Impact from 2016/17

Provided evidence and assessment in relation to the Atlantic salmon conservation regulations to moderate harvesting.

Worked in collaboration, through the Salmon Liaison Group, with members of the Scottish freshwater fisheries sector to assist in the regulations using principles agreed by the International Council for the Exploration of the Sea (ICES) and North Atlantic Salmon Conservation Organisation (NASCO).

Made substantial advances in the development of models to compare estimated numbers of spawning salmon and fry with target levels.

Delivery Against Key Programme Objectives

Facilitated the effective monitoring of salmon stock status using spatial mapping, salmon and sea trout catches, and data from trap and counters sites.

Supported the sustainable exploitation of salmon through the Conservation Regulations, which were developed through:

- river level modelling;
- updating the national distribution map of juveniles;
- using monthly estimates of size, sex ratio, fecundity, and catch/count ratio;
- adding river flow variation as a co-variable; and
- deriving sex ratio estimates using genetics.

Assisted sustainable salmon aquaculture development using models to predict distribution routes of salmon smolts then comparing the actual swimming trajectories of smolts from the River Applecross.

Monitored movement patterns of acoustically tagged salmon smolts from the Rivers Awe and Lochy, around the Isle of Mull, using an array of receivers.

Developed plans to monitor behaviour of smolts leaving the River Dee at Aberdeen.

Obtained first results from two sites used to assess survival of salmon treated with an anti-sea lice chemical.

Facilitated responsive management to temperature change through completion of PhD projects and a network of local biologists.

Maintained a network of temperature loggers and monitored data accrual.

Developed spatially referenced models for guidance of management in response to climate change.

Continued the analysis of the Girnock Burn salmon population, as a PhD project, in relation to temperature and water discharge.

Licensed fisheries activities in fresh water. In total, 630 applications to stock fish and use otherwise illegal methods were processed.

Provided advice on the potential to ranch salmon on the West Coast of Scotland with associated research requirements.

Provided a wide range of advice and ad hoc scientific activity in support of policy development.

Initiated a study of salmon fecundity and outlined plans for tagging salmon from coastal nets.

Contributed a substantial effort to the preparation and delivery of a Freshwater Fisheries Laboratory Open Day.

PROGRAMME MANAGER:
Dr Cornilius Chikwama

MARINE ANALYTICAL UNIT (MAU)

PROGRAMME OBJECTIVE:

The Marine Analytical Unit provides socio-economic and statistical advice and analysis to support effective policy development and operational delivery. It provides evidence that is used to develop policies to encourage sustainable economic growth and future development of existing and new marine sectors such as aquaculture, fisheries, and renewable energy.

SCIENCE DELIVERY:

PROJECTS/MILESTONES COMPLETED

Monitoring and Advice (50):	37
Research Projects (0):	0
External Contracts (0):	0

PUBLICATIONS

Peer-reviewed papers:	0
Book chapter:	0
Government Reports, Conference Proceedings etc:	5
Commissioned Reports:	1

“ Advised on awarding £34 million in support for the fishing industry ”

MARINE ANALYTICAL UNIT



Key Highlights and Impact from 2016/17

Worked with marine sector representatives to gather and present evidence on the socioeconomic impacts of Marine Protected Areas (MPA) fisheries management measures introduced in 2016.

Continued to provide key management information to Marine Scotland's Policy and Compliance Divisions, and to industry, to support sea fisheries management.

Provided economic analysis and advice on options for interim and long term arrangements for devolving the Crown Estate to Scotland.

Provided economic advice to the Scotland's European Maritime and Fisheries Fund (EMFF) Project Assessment Committee to guide

funding awards worth £34 million to support sustainable economic growth of Scotland's fishing industry.

Provided socioeconomic evidence and analysis to inform measures for improving pay and working conditions for those working in Scotland's sea fisheries.

Delivery Against Key Programme Objectives

Coordinated Marine Scotland's contributions to the European Commission Data Collection Framework including the Aquaculture Economic Survey, Sea Angling Survey and Fleet Economic Survey.

Published the 2015 Provisional and Final Scottish Sea Fisheries Statistics on time and in line with the code of practice for national statistics.

Provided timely updates to the Scotland National Performance Framework marine indicator, and is leading work to develop a new set of indicators that have a broader representation of Marine Scotland's priorities.

Developed and launched a data visualisation tool for interrogating Scotland's sea fisheries data.

Provided our Policy Divisions with analysis, evidence and advice to support development and delivery of policies covering a range of areas including:

- pay and conditions for those working in Scotland's sea fisheries;
- strengthening the economic link condition in the sea fisheries licence;
- inshore fisheries management and data systems;
- socioeconomic assessments for marine Special Protection Areas (SPAs);
- marine renewable energy and marine licencing;
- sustainable growth of Scotland's aquaculture industry; and
- supporting Marine Scotland's licencing operations.

PROGRAMME MANAGER:
Dr Matt Gubbins

PLANNING AND ENVIRONMENTAL ADVICE (PEA)

PROGRAMME OBJECTIVE:

The Planning and Environmental Advice Programme provides the evidence base to support the development of national and regional planning and the development of a network of Marine Protected Areas in Scottish waters. It also provides advice to Scottish Government on monitoring, environmental assessments and management measures to achieve Good Environmental Status for the Marine Strategy Framework Directive (MSFD).

SCIENCE DELIVERY:

PROJECTS/MILESTONES COMPLETED

Monitoring and Advice (14):	13
Research Projects (5):	4
External Contracts (4):	4

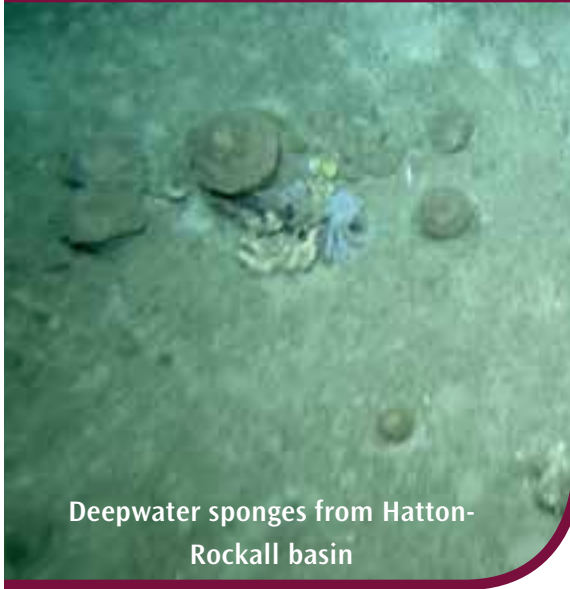
PUBLICATIONS

Peer-reviewed papers:	19
Book chapter:	1
Government Reports, Conference Proceedings etc:	11
Commissioned Reports:	0

« 8 Marine Protected Areas surveyed »

Tagging Skate : Francis Neat, © Crown copyright

PLANNING AND ENVIRONMENTAL ADVICE



Deepwater sponges from Hatton-Rockall basin

Key Highlights and Impact from 2016/17

Performed key roles at a number of international events including “Marine Spatial Planning Worldwide”, the EU’s Marine Spatial Planning Expert Group, the International Council for the Exploration of the Sea (ICES) Working Group on Marine Planning and Coastal Zone Management, and the United Nations workshop on bottom fishing.

Completed a multi-year research project entitled “MOREDEEP” to survey Scottish deepwater environments.

Reported on unique ecosystems found in the Hatton-Rockall basin and discovery of the largest deepwater sponge grounds in the

UK. Papers describing the findings will be produced this year.

Developed a Scottish Marine Protected Area (MPA) monitoring strategy, with Scottish National Heritage (SNH), the Joint Nature Conservation Committee (JNCC) and stakeholders. Findings will be reported to the Scottish Parliament in 2018.

Established a European Maritime and Fisheries Fund (EMFF) project monitoring key inshore Marine Protected Areas (MPAs) and Special Areas of Conservation (SACs).

Completed a specific programme of monitoring inshore and offshore MPAs with SNH and JNCC.

Assisted with management measures for The Small Isles MPA and completed surveys to inform future monitoring and management.

Delivery Against Key Programme Objectives

Maintained a high profile at international marine planning events throughout the year, including work with ICES and Marine Alliance for Science and Technology for Scotland (MASTS) on marine spatial planning gaps .

Produced a Scottish MPA monitoring strategy, with SNH and JNCC, for implementation later this year.

Undertook an offshore survey, in partnership with JNCC, of the Geikie Slide and Hebridean Slope MPA. Underwater imagery and benthic samples were collected to allow a measurable assessment of future changes in fishing pressure on habitats and species within this site.

Completed surveys of inshore MPAs, in partnership with SNH, as well as testing the viability of using fish traps to measure the potential benefits of the MPA on local commercial fish species.

Successfully completed skate tagging work with sea anglers and SNH in the Loch Sunart to the Sound of Jura MPA. We monitored the movements of a large number of acoustic tagged fish, which provided data on movements and residency. A method of monitoring mortality rate was established to estimate the effectiveness of management measures.

Completed surveys of deepwater protected sites including the Faroe Shetland Channel, Rosemary Bank and the Hatton-Rockall basin. Produced reports on the deepwater fish communities, contaminant levels in deepwater fauna, and benthic habitats.

Drafted maps for aquaculture locational guidance based on sensitivity to wild salmon and sea trout.

PROGRAMME MANAGER:
Dr Ian Davies

RENEWABLES AND ENERGY (RE)

PROGRAMME OBJECTIVE:

The Renewables and Energy Programme applies best regulatory practice, supported by high quality science, to ensure that renewable energy on land and at sea develop in a planned and sustainable manner, and that supports the regulation of the oil and gas industries. The sustainable management of Scotland's marine and freshwater resources requires us to provide robust science and reliable advice in these areas that are central to Scotland's economic plans.

SCIENCE DELIVERY:

Projects /Milestones Completed

Monitoring and Advice (16):	16
Research Projects (2):	2
External Contracts (10):	10
Peer-reviewed papers:	15
Book chapter:	0
Government Reports, Conference Proceedings etc:	14
Commissioned Reports:	8

« **Provided environmental advice on 1,630 oil and gas industry applications in 2016/17** »»



Photo by Mhairi Sinclair, © Crown copyright

RENEWABLES AND ENERGY



Key Highlights and Impact from 2016/17

Worked with Scottish Natural Heritage (SNH) and the Joint Nature Conservation Committee (JNCC) to review and revise proposals for Special Areas of Conservation (SACs) for harbour porpoise in Scottish waters. Chaired a Scottish Working Group to draft and obtain Ministerial approval for a SAC for harbour porpoise in inshore waters to the west of Scotland.

Provided detailed support for policy and legal colleagues in preparing for an appeal against an earlier judgement of Ministers' decisions to license/consent the construction of offshore wind farms in the Forth/Tay area.

Undertook a project to monitor the movements of emigrating salmon smolts in

the river Conon/Cromarty Firth/Moray Firth system in collaboration with Beatrice Offshore Wind Ltd, the University of Glasgow and others. This resulted in unique insight into the behaviour of smolts at sea and informing risk assessments of the possible interactions between offshore wind farms and salmon smolts.

Continued a long term programme of observations of small cetaceans (and ambient noise levels) in coastal waters to the east of Scotland, in support of improving risk assessments to these species from projects including offshore wind farms and harbour improvements.

Delivery Against Key Programme Objectives

Maintained international profile through participating in relevant ICES Expert Groups related to marine renewables (WGMRE), being an active member of US WREN expert group on environmental impacts of wind farms, and delivering seminars and talks to international groups through conferences, webinars, etc.

Maintained a strong profile in UK science and regulation sector by participating in relevant conferences and workshops, supporting the development of the ORJIP joint industry programmes on wind energy and wave/tidal energy, continued membership of steering

groups for UK scientific meetings, encouraging links with UKRC, and increasing our publication rate.

Met all requests for advice on renewable energy development at sea and on land, and on offshore oil and gas development, and gave particular emphasis to support to legal proceedings.

Designed, commissioned and managed science projects funded by the Scottish Government and external science delivery partners to address key areas of uncertainty in assessment of the environmental consequences of renewable energy development.

Significantly increased external income through participation in EU-funded projects on marine planning (e.g. MAPMEP, RiCORE). Actively participated in new collaborations to exploit funding opportunities through EU H2020 (e.g. MUSES), INTERREG (e.g. NorthSEE, COMPASS).

Strengthened links with UK funding bodies, primarily NERC, and increased the dedicated resource for Marine Scotland priority areas including the decommissioning of offshore oil and gas infrastructure.

Successfully executed field research programmes on marine mammals, salmon at sea, and the behaviour of seabirds in strong tidal streams.

PROGRAMME MANAGER:
Dr Carey Fraser

SCIENCE OPERATIONS (SO)

PROGRAMME OBJECTIVE:

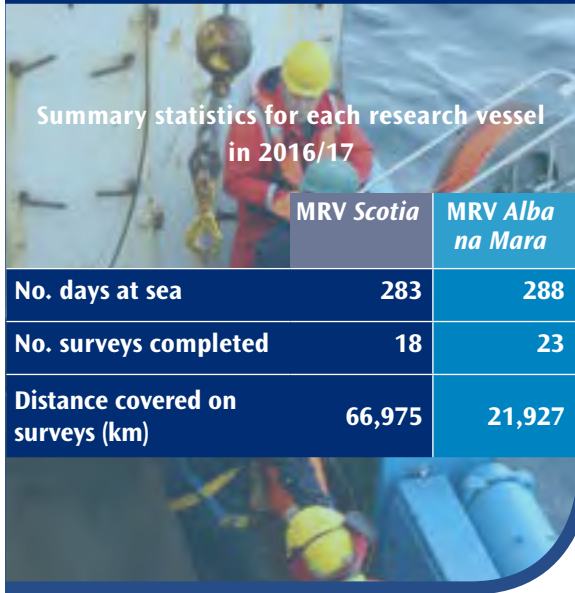
The Science Operations Programme provides scientific, engineering and logistics support services to all the science programmes in Marine Scotland Science (MSS). Science Operations contains professional statisticians, scientists, and quality, data and information managers with knowledge and experience to contribute to the planning, construction and operation of various science programmes and projects.

SCIENCE DELIVERY:

Service Level Agreements (SLAs):	29
41 research surveys conducted	
571 days at sea	

« 88,902 km travelled by our research vessels »»

SCIENCE OPERATIONS



Summary statistics for each research vessel in 2016/17

	MRV <i>Scotia</i>	MRV <i>Alba na Mara</i>
No. days at sea	283	288
No. surveys completed	18	23
Distance covered on surveys (km)	66,975	21,927

Sampled 400,000 fish of at least 245 different species.

Conducted 41 research surveys.

Hosted over 230 individual scientific staff, engineers, stakeholders, students and visiting colleagues, aboard the research vessels.

Led the submission of the 2017 annual workplans for fisheries data collection under the revised Data Collection Framework.

Initiated work towards Athena SWAN gender equality charter status for Marine Scotland Science.

Provided expert advice on handling Freedom of Information (FoI) requests.

Maintained statistical consultancy capacity.

Facilitated the coordination of large research vessels across the UK.

Promoted work to improve gender balance within Science and Engineering Divisions of Scottish Government.

SHIPS

Marine Scotland Science (MSS) operates two offshore research vessels, MRV *Scotia* and MRV *Alba na Mara*, and three inshore workboats, including the MRV *Temora*, based in Stonehaven. Survey vessel data is of critical importance to the provision of high quality scientific evidence and advice for the key policy areas of sea fisheries management, aquaculture and fish health and marine planning and policy.

Each vessel has fully equipped laboratories onboard, that allow our scientists a unique platform to conduct their research in real time.

MSS is a member of MASTS (Marine Alliance for Science and Technology for Scotland) and continues to collaborate with other MASTS members and organisations such as the Joint Nature Conservation Committee, Scottish Environment Protection Agency and Scottish Natural Heritage through provision of vessel time.

Key Highlights and Impact from 2016/17

Designed, constructed and deployed underwater equipment including a new drop frame and stereo image system used to meet objectives relating to the monitoring of Scotland's MPA network. Over 2,500 still images and many video files were produced.

Provided the highest number of active science days at sea of any Scottish or UK public research vessel – 571 days between the MRV *Scotia* and MRV *Alba na Mara*.

Delivered improved Quality, Data and Information management, including publication of 126 datasets with 421 individual resources available for download on the Marine Scotland Data portal.

Delivery Against Key Programme Objectives

Maintained engineering skills and capability whilst ensuring services and expertise were fully available to all science programmes, including recruitment of a new group leader.

Submitted the annual technical and financial reports of fisheries data collection activities - on time - to the European Commission, to high praise.

Developed the management and publication of Marine Scotland Science data to make it more widely available.

Supported, assisted and advised areas of Marine Scotland in relation to information, data and records management.

PROGRAMME MANAGER:
Dr Coby Needle

SEA FISHERIES (SF)

PROGRAMME OBJECTIVE:

The Sea Fisheries Programme provides advice on fish stocks to ensure the best possible sustainable catching opportunities, and provides timely support on all implications of relevant ongoing and forthcoming political and regulatory changes.

SCIENCE DELIVERY:

Projects /Milestones Completed

Monitoring and Advice (27)	27
15 Research vessel cruises:	
Research Projects (4) :	4
External Contracts (5) :	5
Publications	
Peer-reviewed papers:	14
Book chapter:	2
Government Reports, Conference Proceedings etc:	16
Commissioned Reports:	0



« Biological data obtained for 250 fish and shellfish species »»

SEA FISHERIES



Mackerel spawned in 2016

Key Highlights and Impact from 2016/17

Recruited successfully for the Stock and Fishery Science Group Leader, Fishery Analysis and Assessment Group Leader, Electronic Engineer and Otolith Training Manager.

Co-chaired the ICES Working Group on the Celtic Seas Ecoregion.

Co-chaired the ICES Herring Assessment Working Group.

Successfully conducted the triennial mackerel egg survey consisting of three linked trips to estimate the density of mackerel eggs to the west and north of Scotland. This is a major international collaborative endeavour that forms a key part of the ICES mackerel stock assessment.

Conducted the annual *Nephrops* underwater TV survey, during which (for the first time, and despite some difficult weather) all footage was reviewed, assessed and reviewed again while at sea.

Collaborated with the pelagic fishing industry in a new acoustic survey of herring on the west coast; an innovative and very successful venture, along with collaborative work on herring morphometric analysis.

Successfully completed an important research project on status indicators for data-poor stocks which has led directly to key developments in methods used by ICES to analyse and provide advice on these stocks. Parallel work on multispecies management strategies is progressing well.

Provided the keynote speaker for the ICES-Food and Agriculture Organisation (FAO) Symposium on “Technology Development and Sustainable Fisheries”, held in Merida, Mexico.

Led on the development of factsheets on gear selectivity trials, as part of the EU Horizon 2020 DiscardLess project. These were presented to scientists and stakeholders at the project conference and were extremely well received.

Collaborated on a Contract Research Fund project with the University of East Anglia on automated image analysis. Excellent progress

has been made towards species identification and fish measuring using CCTV footage of discards from trawlers.

Mentored a Buckland-Smith student and two Careerwise internships while they assisted the Programme in relation to species identification.

Co-sponsored an event at the United Nations Oceans Conference in New York.

Delivery Against Key Programme Objectives

Participated in all the relevant ICES fishery Expert Group meetings including assessment working groups, advice drafting groups, data collation meetings, and an array of relevant study groups and workshops.

Hosted the ICES Scallop Assessment Working Groups.

Hosted the Biology and Life History of Crabs Seminar.

Assisted with a significant number of advisory consultations, briefings and meetings by providing essential advice, and recommendations, to policy colleagues in Edinburgh, London, Brussels, Bergen, and elsewhere.

Contributed specifically to policy requests for potential implications of Brexit for

SEA FISHERIES



Scallop sampling on MRV *Alba na Mara*

fisheries and fisheries science, the EU Landing Obligation, Marine Protected Area (MPA) implementation and evaluation, inshore fisheries monitoring and management, and gear development through the Gear Innovation and Technology Advisory Group (GITAG) and others.

Conducted sampling and monitoring programmes using at-sea observers, market sampling and research-vessel cruises, then subsequent data collation to provide substantial contributions to a number of data provision mechanisms including Data Collection Framework (DCF) data calls.

Contributed to the development and ongoing success of the Scottish Inshore Fisheries Integrated Data System (SIFIDS) project aimed at improving monitoring and analysis processes for Scottish inshore fisheries (within 12 nautical miles of the coast).

Continued to make key contributions to courses and student supervision for universities in Scotland.

Maintained the research profile of Marine Scotland Science with outreach activities such as the Aberdeen Exploration, whilst also supporting STEM ambassadors.

Instigated and developed the Marine Scotland Science Staff Engagement Group (SEG), intended to improve communication and interaction with staff of all levels.



KEY PERFORMANCE INDICATORS (KPIs)

Marine Scotland Science has undertaken an annual review of performance against a set of Key Performance Indicators (KPIs) for many years. The process was initiated when MSS was an Agency and there was a requirement to report to the Scottish Parliament. However, continuation of the use of KPIs permits a longer-term assessment to be made of any changes in performance.

Over time, there has been a change in emphasis such that assessing 'impact' is more critical today than even three or four years ago, hence the specific reference to 'impact' within each Programme summary.

Individual Programme publications are also presented in the Programme summaries, however, for consistency, publications are summarised in this section. The KPIs are presented, in full, to the Marine Scotland Science Advisory Board and the relevant paper can be accessed. A summary is presented in this Annual Review highlighting key aspects of:

- A. Delivery of service
- B. Quality of science output
- C. Collaboration
- D. Balance between Strategic Science and routine activities.

« 104 Peer reviewed publications »

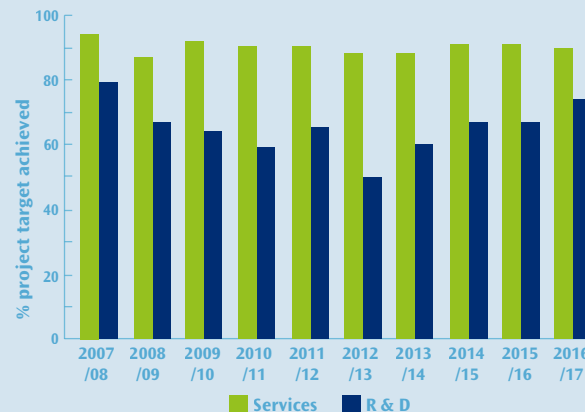
A. Delivery of service

1. Plan, execute and report a programme of science to meet the needs of Scottish Government.

In 2016/17, Marine Scotland Science achieved 90.6% of its services targets and 74.4% of research project milestones. The achievement rate for research projects increased from the previous year, however, the number of projects decreased from 28 to 11 in 2016/17.

2. Plan and conduct an annual programme to achieve most efficient use of available days on research vessels.

Our research vessels served an impressive 283 and 288 days at sea for MRV *Scotia* and MRV *Alba na Mara*, respectively. These remain the most active research vessels in Scotland and the UK.



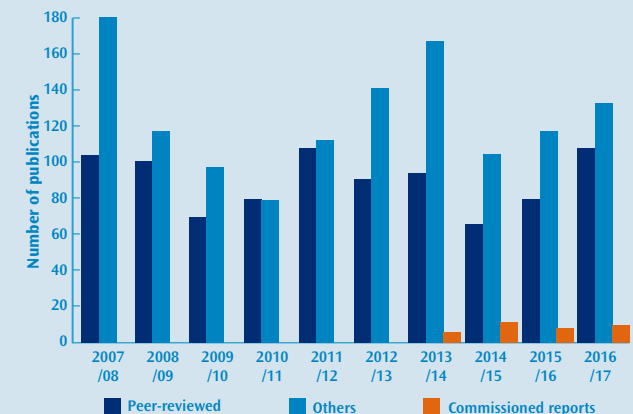
B. Quality of science output

1. Number of peer-reviewed publications.

In 2016/17, MSS produced 108 peer-reviewed papers and book chapters. This is an increase from 80 in 2015/16 and is well above the 10 yr rolling average of 90 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, e.g. Scottish Marine and Freshwater Science Series, Marine Scotland Science Reports, Fish and Shellfish Stocks booklet, Conference proceedings.

The number of non-peer-reviewed publications and conference presentations and proceedings was 133, slightly higher than the number produced in the previous year above below the 10 year rolling average of 125.



KEY PERFORMANCE INDICATORS (KPIs)

CLICK TO LINK TO ASSOCIATED DOCUMENTS

ABSTRACT BOOKLET

MARINE SCOTLAND SCIENCE STAFF PUBLICATIONS 2016/17

- 3. Commissioned Reports.**
 Since 2013/14 MSS has published commissioned reports which often relate to work funded by the Contract Research Fund. Ten were published in 2016/17, which is one above the 4-year rolling average.
- 4. Results of external and internal audits.**
 The annual United Kingdom Accreditation Service (UKAS) visit assessed a range of accredited methods against the ISO 17025 Testing and 17020 Inspection standards. UKAS again praised staff working in MSS on their excellent technical competence and quality system knowledge.

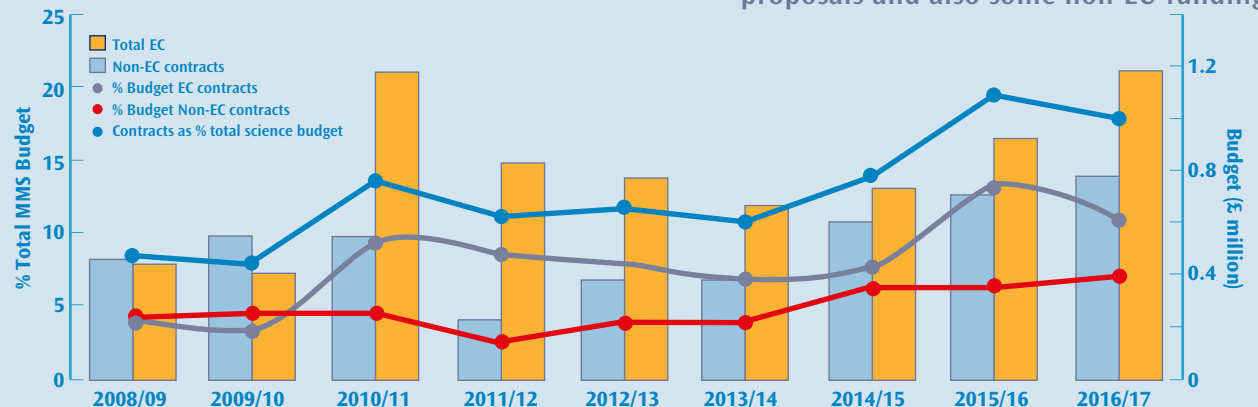
The internal audit programme to support the accreditation system was up to date at the end of the calendar year. More information is provided in the section on Quality Assessment.

Impact of MSS

Individual examples of the impact of MSS are presented in the Programme summaries in this report. The work of MSS has wide and significant impact. As well as providing direct advice to SG policy Divisions and other national stakeholders, MSS expertise influences the development and implementation of international policy and regulations through participation in ICES, OSPAR and other international organisations. This work often draws on long data series and knowledge and expertise built up over many years.

C. Collaboration

- 1. Value of externally funded work in total and for strategic science projects.**
 MSS contract income was £1.5M (excluding reimbursement of funding under the Data Collection Framework). This illustrates success in a number of Horizon 2020 proposals and also some non-EU funding.



KEY PERFORMANCE INDICATORS (KPIs)

[CLICK TO LINK TO ASSOCIATED DOCUMENTS](#)

[ABSTRACT BOOKLET](#)

[MARINE SCOTLAND SCIENCE STAFF PUBLICATIONS 2016/17](#)

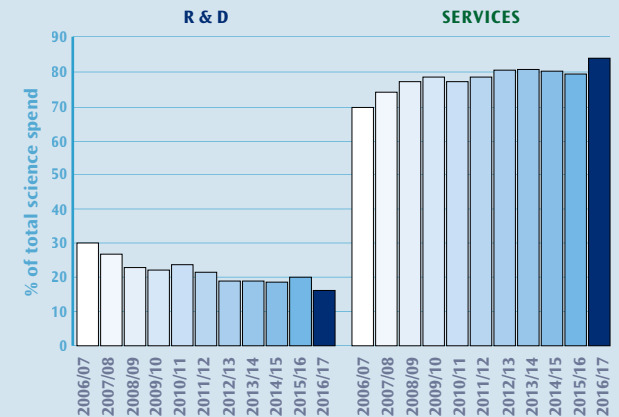
2. **Communications with stakeholders.**
MSS communicates and collaborates with a very wide range of stakeholders, including other government departments, those directly involved in many maritime industries, and schoolchildren or students who might one day become staff or collaborators. Staff from MSS also collaborated on many projects, often including work with academic colleagues in Scotland and worldwide. Individual examples of such work can be found in the highlights from each Programme.
3. **Integration of natural and socioeconomic sciences with policy.**
The Marine Analytical Unit now delivers socioeconomic advice and services through a series of services, in the same manner as the other programmes. In 2016/17, the Unit budget was 7.6% of the total direct science project budget, slightly higher than 2015/16 reflecting the importance of this work.

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, 12.2% of the direct science project budget was allocated to strategic science projects and 87.8% allocated to advice, monitoring and regulatory services. The strategic science

budget was lower in previous years, reflecting a reprioritisation towards ongoing advice and regulatory activities, and resulted in a decrease in the number of projects carried out.

2. **Proportion of in-year resource, reallocation between strategic science and ongoing activities.**
At the end of the year, out-turn figures show the actual spend was in line with budgeted amounts, with 11.4% of the budget spent on strategic science and the remaining 88.6% on advice, monitoring, regulatory and surveillance work. This balance reflected the decrease in strategic science.



« 100% of audits completed within this accreditation cycle »

« 120 open data sets »

« 4,000 internal quality control tests, 640 external quality control samples analysed »

Key Highlights and Impact from 2016/17

Positive feedback was received from the United Kingdom Accreditation Service (UKAS) annual surveillance visit. UKAS consider that the quality system is robust and that staff have extensive knowledge and a high level of technical competence.

The internal audit process continues to identify improvements across the quality system, with eighteen internal quality audits and six Inspector competency audits completed.

Ten validation plans for improving currently accredited or introducing new methods were agreed, and a validation process for the Aquaculture Diagnostics laboratory move was developed to ensure that method performance is maintained following the move.

Four new Molecular Genetics methods were successfully validated through the flexible scope process and are now accredited – piscine myocarditis virus (PMCV), infectious haematopoietic necrosis (IHN), *Marteilia refringens* and piscine reovirus (PRV).

Internal quality control samples (IQC) are run with each batch of analytical samples

to provide assurance on a daily basis that method performance is satisfactory. Over 4,000 internal quality control tests were run across all accredited methods, with an average success rate > 96%.

External quality assurance (EQA) schemes such as those maintained by Quasimeme, Bequalm, Aquacheck and Community Reference Laboratories (CRLs) provide an independent check on the performance of accredited methods. Over 640 external quality control samples were analysed, with an average success rate >86%.

The Information Management metrics assessment approach has been further developed, with seven assessments in progress or completed and an additional two staff in training to conduct the reviews. A further seven assessments are planned for 2017.

The Marine Scotland Data portal now has over 120 open data sets available, with over 400 individual resources available for download. These range from Scottish Marine and Freshwater Science reports with associated data to a climatology data set with over 130,000 records.

MARINE SCOTLAND SCIENCE REPRESENTATION 2016/17

	Fisheries	Environment	Energy	Aquaculture	Freshwater Fisheries	General Science
International	EU-Norway & CS NEAFC ICES EGs	OSPAR ICES EGs	WREN ICES EGs	SAV Tri-nation WG ICES EGs Gill Health Initiative WG ScoFaNo Collaboration	NASCO ICES EGs IASRB	ICES Council & ACOM
Europe	Advisory Councils STECF	JRC MSFD review groups		EURLs COFASP DG SANCO FVO UK Mission EAS organising committee	Click columns for explanation of acronyms and their relevant links	EFARO EMBR European projects
UK		UKMMAS MCCIP – SG & MG UKIMON Exec Com UKMBMPB WFD UKTAG TTs NERC SGs OGUK OSRF / MTIG	SCOS MREOG ORELG EOSCA Chemical WG OGUK Environment Advisory Group	Animal By-product Waste Disposal Group BBSRC/NERC SG Defra CVO		MSCC Vessel coordination Group
Scotland	FMAC / IFMAC FIS-SG FISA selection panel Fishermen's Associations	MPA SG SSDAG SMIG Biodiversity CG SMMCG SCSEMP SEWeb MINNSWG	SPORRAN FLOWW	Ministerial WGS (MGSA) SARF board CoGP MG ISLM Grp PO liaison Scottish-NRL	MS/SNH/SEPA IF FFAG Wild Fisheries SRG SFCC	MASTS CAMERAS MSF
Local	IFGs Clyde 2020	Clyde 2020 SG and RAG SOTEAG & Mon Com	Developers Groups & RAGs	Salmon Fishery Boards	MS / Local FB liaison Grp Scotland's Salmon Festival Steering Group	MarCRF

MARINE SCOTLAND SCIENCE STAFF PUBLICATIONS 2016/17 (251)*

Peer-reviewed Publications (104)

Adams, S., D. Hoole, J. McArdle, M. Metselaer, E. Munro, P. Smith, K. Thompson, and D. Verner-Jeffreys. 2016. EAFP UK and Ireland Branches Second Meeting: "Aquatic animal health in a changing world". *Bulletin Of The European Association Of Fish Pathologists* 36 (5):183-185.

Amorim, A. L., P. Leon, J. M. Mercado, D. Cortes, F. Gomez, S. Putzeys, S. Salles, and L. Yebra. 2016. Controls of picophytoplankton abundance and composition in a highly dynamic marine system, the Northern Alboran Sea (Western Mediterranean). *Journal Of Sea Research* 112:13-22.

Asjes, A., J.M. González-Irusta, and P.J. Wright. 2016. Age-related and seasonal changes in haddock (*Melanogrammus aeglefinus*) distribution: implications for spatial management. *Marine Ecology Progress Series* 553:203-217.

Ball, R. E., B. Serra-Pereira, J. Ellis, M. J. Genner, S. Iglesias, A. F. Johnson, C. S. Jones, R. Leslie, J. Lewis, S. Mariani, G. Menezes, F. Neat, L. R. Noble, D. W. Sims, and A. M. Griffiths. 2016. Resolving taxonomic uncertainty in vulnerable elasmobranchs: are the Madeira skate (*Raja maderensis*) and the thornback ray (*Raja clavata*) distinct species? *Conservation Genetics* 17 (3):565-576.

Beaulieu, C., H. Cole, S. Henson, A. Yool, T. Anderson, L. de Mora, E. T. Buitenhuis, M. Butenschon, I. J. Totterdell, and J. I. Allen. 2016. Marine regime shifts in ocean biogeochemical models: a case study in the Gulf of Alaska. *Biogeosciences* 13 (15):4533-4553.

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Borja, A., M. Elliott, P.V.R. Snelgrove, M.C. Austen, T. Berg, S. Cochrane, J. Carstensen, R. Danovaro, S. P. R. Greenstreet, A-S. Heikänen, C.P. Lynam, M. Mea, A. Newton, J. Patricio, L. Uusitalo, M.C. Uyarra, and C. Wilson. 2016. Bridging the gap between policy and science in assessing the health status of marine ecosystems. *Frontiers in Marine Science* 3 (Article 175).

Boyle, K., M. J. Kaiser, S. Thompson, L. G. Murray, and P. F. Duncan. 2016. Spatial variation in fish and invertebrate bycatches in a scallop trawl fishery. *Journal Of Shellfish Research* 35 (1):7-15.

Bresnan, E., R.J. Fryer, S. Fraser, N. Smith, L. Stobo, N. Brown, and E. Turrell. 2017. The relationship between Pseudo-nitzschia (Peragallo) and domoic acid in Scottish shellfish. *Harmful Algae* 63 (193-202).

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Burgeot, T., F. Akcha, D. Menard, C.D. Robinson, V. Loizeau, C. Brach-Papa, C. Martínez-Gómez, J. Le Goff, H. Budzinski,

K. Le Menach, J. Cachot, C. Minier, K. Breog, and K. Hylland. 2017. Integrated monitoring of chemicals and their effects on four sentinel species, *Limanda limanda*, *Platichthys flesus*, *Nucella lapillus* and *Mytilus* sp, in Seine Bay: a key step towards applying biological effects to monitoring. *Marine Environmental Research* 124:90-105.

Burton, T., G. Robertsen, D. C. Stewart, S. McKelvey, J. D. Armstrong, and N. B. Metcalfe. 2016. Maternal age at maturation underpins contrasting behaviour in offspring. *Behavioral Ecology* 27 (5):1280-1287.

Cano, I., B. Collet, C. Pereira, R. Paley, R. van Aerle, D. Stone, and N. G. H. Taylor. 2016. In vivo virulence of viral haemorrhagic septicaemia virus (VHSV) in rainbow trout *Oncorhynchus mykiss* correlates inversely with in vitro Mx gene expression. *Veterinary Microbiology* 187:31-40.

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Eckford-Soper, L.K., E. Bresnan, J-P Lacaze, and D.H. Green. 2016. The competitive dynamics of toxic *Alexandrium fundyense* and non-toxic *Alexandrium tamarense*: the role of temperature. *Harmful Algae* 53:135-144.

Edwards, E.W.J., L.R. Quinn, and P.M. Thompson. 2016. State-space modelling of geolocation data reveals sex differences in the use of management areas by breeding northern fulmars. *Journal of Applied Ecology* 53 (6):1880-1889.

*INCLUDES 10 COMMISSIONED RESEARCH REPORTS

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- Elliott, S. A. M., P. A. Ahti, M. R. Heath, W. R. Turrell, and D. M. Bailey. 2016. An assessment of juvenile Atlantic cod *Gadus morhua* distribution and growth using diver operated stereo-video surveys. *Journal Of Fish Biology* 89 (2):1190-1207.
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Bresnan, E., K. Davidson, A. McKinney, S. Milligan, C. Belin, and H. Enevoldsen. 2016. The use of the IOC-ICES-PICES Harmful Algal Event Database (HAE-DAT) to detect spatial and temporal trends in harmful algal bloom events in UK waters. *ICES CM* N: 382.

Bresnan, E., S. Fraser, L. Brown, P. Leon Diaz, K. Cook, S. Hughes, P. Walsham, and L. Webster. 2016. The spring diatom bloom in Scottish waters; regional differences and interannual variation. *ICES CM* N: 381.

Clarke, L., A. Pout, S. Sweeting, F. Zeng, L. Ritchie, P. Clark, M. Gault, and H. Cole. 2016. Which species to sample? An objective method for the selection of species when sampling fish on a market. *ICES CM* O: 589.

Eerkes-Medrano, D., K.B. Cook, and P.J. Wright. 2016. The role of temperature as a proxy for prey availability. *ICES CM* M: 364.

Kafas, A., J.B. Illian, I. Davies, and B.E. Scott. 2016. Spatio-temporal modelling of fishing effort pattern after displacement due to offshore wind developments using INLA. *ICES CM* L: 575.

Mastrantonis, S., A. Kafas, L. Blackadder, L. Williamson, H.A. McLay, and B. E. Scott. 2016. Using Species Distribution Models to predict king scallop (*Pecten maximus*) distribution along the East coast of Scotland. *ICES CM* L: 360.

Miethe, T., and H. Dobby. 2016. Testing length-based indicators in harvest control rules (HCR) for shellfish stocks and fisheries. Working Document in Report of the ICES workshop on the development of quantitative assessment methodologies based on life-history traits, exploitation characteristics and other relevant parameters for data-limited stocks category 3-6 (WKLIFE VI), 3-7 October 2016 Lisbon, Portugal. *ICES CM* 2016/ACOM:59: 58-76.

Moriarty, M., A.F. Sell, V.M. Trenkel, Y. Vérin, and S.P.R. Greenstreet. 2016. Effect of shortening haul durations on a survey's species richness estimates. *ICES CM* O: 166.

Pout, A., L. Clarke, A. Ribeiro-Santos, J. Elson, P. Börjesson, M. Christman, K. Birch Håkansson, and M. Storr-Paulson. 2016. Evaluating regional designs for the on-shore sampling of North Sea demersal fisheries. *ICES CM* O: 263.

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Tweddle, J.F., M. Gubbins, and B. E. Scott. 2016. Phytoplankton: supporting a good pelagic habitat. *ICES CM J*: 386.

Walmsley, S.F., R. Blyth-Skyrme, D. Rodmell, W. Lart, P.S. Weller, N.K. Dewey, D.O. Lambkin, and F.G. O'Neill. 2016. Assessing the significance of fishing and natural disturbance at local scales. *ICES CM L*: 437.

Contributions to Meetings and Other Publications (99)

Aamelfot, M., D.H. Christiansen, O. Bendik Dale, A. McBeath, I. Matejusova, S.L. Benestad, and K. Falk. 2017. HPR0 ILA virus infiserer epitel hos Atlantisk laks (HPR0 ISA Virus Infects Epithelial Atlantic Salmon Cells). *Frisk Fisk (Healthy Fish) Conference, Bergen, Norway, 1-2 February 2017*.

Armstrong, J.D. (2017). Conservation regulations-developments during 2016 and future refinements. *Fisheries Management Scotland Annual Conference, Battleby, UK, 29 March 2017*.

Armstrong, J.D. (2017). Marine Scotland Science freshwater fisheries programme. *Scottish Fisheries Coordination Centre Annual Biologists' Meeting, Faskally, UK, 28-29 February 2017*.

Barreto, E., and N. Bailey. 2016. *Fish and shellfish stocks 2016*. Aberdeen: Scottish Government. 54pp.

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Berdalet, E., N. Banas, E. Bresnan, M. Burford, K. Davidson, H. Enevoldsen, C. Gobler, B. Karlson, R. Kudela, P.T. Lim, L. Mackenzie, M. Montresor, V. Trainer, E. Urban, G. Usup, and K. Yin. 2016. GlobalHAB: the international SCOR-IOC program for the study of Harmful Algal Blooms. *International Conference on Harmful Algae, Florianopolis, Brazil, 9-14 October 2016*.

Berx, B., J. Hopkins, S. Jones, J. Huthnance, and M. Inall. 2016. Long-term variability of exchange between the Slope Current and the West Shetland Shelf. Paper read at Challenger Society Conference, 5-9 September 2016, at Liverpool.

Berx, B., D. Lee, and M. Geldart. 2016. Impact of Plastic Insert Type on Stability of Stored Salinity Samples. *MASTS Annual Science Meeting 2016, 19-21 October*.

Bresnan, E. 2016. Harmful algal blooms and policy. Invited lecture, *Oceans and Climate course, University of St Andrews, 10 October 2016*.

Bresnan, E. 2017. Plankton and policy: protecting human health and assessment of state. Invited talk - Nippon Foundation - *POGO Centre of Excellence in Observational Oceanography Programme 2017, Alfred Wegner Institute, Helogland, Germany, 21 March 2017*.

Bresnan, E. 2017. The Scottish Coastal Observatory Stonehaven time-series: lessons working at the science/policy interface. Invited lecture, Nippon Foundation - *POGO Centre of Excellence in Observational Oceanography Programme 2017, Alfred Wegner Institute, Helgoland, Germany, 22 March 2017*.

Bresnan, E., C. Baker Austin, C. Campus, K. Davidson, M. Edwards, A. Hall, D. Lees, A. McKinney, S. Milligan, and J. Silke. In press. Human health. *Marine Climate Change Impacts Report Card*.

Bresnan, E., and W.R. Turrell. 2017. The Scottish Coastal Observatory. *Harmful Algae News (A newsletter of the IOC) 56:15*.

Campbell, L., A. Gallego, and R. O'Hara Murray. 2016. The Scottish Shelf Model - future developments and directions. *MASTS Annual Science Meeting, Glasgow, UK, 19-21 October 2016*.

Collins, C., K. Lester, J. Del Pozo, and B. Collet. 2016. DNA Vaccination Against SPDV: Suppression of Viraemia, Protection, and Individual Monitoring. PD TriNation Meeting, Aberdeen, UK, 12-13 October 2016.

Cook, K., E. Bresnan, J. Fraser, S. Fraser, S. Robinson, L. Brown, and P. Diaz. 2016. Status of pelagic habitats in Scottish coastal waters: an application of the UK plankton index. *ICES/PICES 6th Zooplankton Production Symposium, Bergen, Norway, 9-13 May 2016*.

Crawford, C.B., M. Russell, C. Ewins, and B. Quinn. 2016. Chemical adsorption of hydrophobic polycyclic aromatic hydrocarbons in the marine environment onto microplastic polymers and subsequent desorption in a simulated gut. *SETAC Europe 26th Annual Meeting, Nantes, France, 22-26 May 2016*.

Crawford, C.B., M. Russell, C. Ewins, and B. Quinn. 2016. Microplastics as vectors of Polycyclic Aromatic Hydrocarbons (PAHs) via chemical adsorption and desorption. *MICRO 2016, Lanzarote, Spain, 25-27 May 2016*.

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Commissioned research (10)

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Fisheries

EU Norway & CS	Bilateral fisheries agreement between EU, Norway and coastal states. See http://ec.europa.eu/fisheries/cfp/international/agreements/index_en.htm
NEAFC	North East Atlantic Fisheries Commission http://www.neafc.org/
ICES EGs	International Council for the Exploration of the Sea (ICES) Expert Groups http://www.ices.dk/community/groups/Pages/default.aspx
Advisory Councils	http://ec.europa.eu/fisheries/partners/advisory-councils/index_en.htm
STECF	European Commission Science, Technical and Economic Committee for Fisheries https://stecf.jrc.ec.europa.eu/
COFASP	Cooperation in Fisheries, Aquaculture and Seafood Processing http://www.cofasp.eu/
FMAC	Fisheries Management & Conservation Group http://www.gov.scot/Topics/marine/Sea-Fisheries/engagement/FMAC
IFMAC	Inshore Fisheries Management and Conservation Group http://www.gov.scot/Topics/marine/Sea-Fisheries/InshoreFisheries/ifmac
FIS - SG	Fisheries Innovation Scotland Steering Group http://www.fiscot.org/
FISA	Fishing Industry Science Alliance http://www.gov.scot/Topics/marine/science/FISA
Fishermen's Associations	Numerous: http://www.swfpa.com/ http://www.scottishpelagic.co.uk/http://www.scottishfishermen.co.uk/ http://www.scottishcreelfishermensfederation.co.uk/http://www.sff.co.uk/
IFGs	Inshore Fisheries Groups http://ifgs.org.uk/
Clyde 2020	http://www.gov.scot/Topics/marine/marine-environment/Clyde2020

Environment

OSPAR	OSPAR Commission http://www.ospar.org/ MSS staff are members of and contributed to a number of committees, working groups and intersessional correspondence groups (ICGs) including: Coordination Group Committee on Environmental Impacts of Human Activity (EIHA) (by correspondence) Working Groups on Monitoring and on Trends and Effects of Substances in the Marine Environment (MIME). ICG to manage preparation and publication of IA 2017 and QSR 2021 (MAQ) (Chair) ICG on the protection of species and habitats (POSH) ICG on Marine Protected Areas (MPA) ICG on underwater noise (NOISE) ICG on coordinated biodiversity assessment and monitoring (ICG-COBAM) (by correspondence)
ICES EGs	International Council for the Exploration of the Sea (ICES) Expert Groups http://www.ices.dk/community/groups/Pages/default.aspx
JRC MSFD Review Groups	European Commission Joint Research Centre https://ec.europa.eu/jrc/ This organisation held a number of expert review groups to consider changes to the 2012 Commission Decision on targets and indicators for some of the Descriptors of Good Environmental Status for the Marine Strategy Framework Directive
UKMMAS	UK Marine Monitoring and Assessment Strategy http://webarchive.nationalarchives.gov.uk/20130123162956/http://www.defra.gov.uk/environment/marine/science/ukmmas/
MCCIP	Marine Climate Change Impact Partnership http://www.mccip.org.uk/ Co-funded by Marine Scotland and MSS are represented on the overarching Management Group and Steering Group.
UK-IMON	UK Integrated Marine Observing Network initiative http://www.uk-imon.info/ MSS contributes the Scottish Coastal Observatory (ScObs) monitoring (long term monitoring sites) to UKIMON and is represented on the Executive Committee.
UKMBMPB	UK Marine Biodiversity Monitoring Programme Board. Oversees UK biodiversity monitoring conducted by JNCC for Natura 2000, MSFD and MPA purposes. MS represented by Michael McLeod. http://jncc.defra.gov.uk/page-3356

WFD UKTAG TTs	MSS is represented on a number of Task Teams reporting to the UK Water Framework Directive Technical Advisory Group http://www.wfduk.org/ including: Alien Species Group Chemistry Task Team Marine Task Team
NERC SGs	Natural Environment Research Council http://www.nerc.ac.uk/ MSS staff are represented on project steering groups.
OGUK OSRF / MTIG	Oil and Gas UK Oil Spill Response Forum Modelling Technical Interest Group.
SSDAG	Scotland's Seas Data and Assessment Group. Chaired by MS Marine Planning and Policy Division, this group oversees the revision of Scotland's marine Atlas and the continuing development of National Marine Plan interactive.
SMIG	Strategic Marine Issues Group http://www.biodiversityscotland.gov.uk/doing/scottish-biodiversity-governance/strategic-marine-issues-group/
Biodiversity CG	New structures in place (2016) to oversee what were Scottish Biodiversity Strategy Governance structures http://www.biodiversityscotland.gov.uk/doing/scottish-biodiversity-governance/ . The new structures are yet to be formalised, but can be seen here. MSS is represented on the Invasive Non-Native Species Group (Lyndsay Brown), Science Support Group (Matt Gubbins) and Ecosystem Health Indicators Sub-group.
SMMCG	New group chaired by MSS dealing with Scottish Marine Monitoring Coordination. Terms of Reference in preparation. This group will report to SMIG and brings together all the managers of marine monitoring across Scottish public sector together with the resource and vessel managers to seek efficiencies and improved coordination.
SCSEMP	Scottish Clean Seas Environmental Monitoring Programme. Coordinates contaminant and nutrient monitoring in Scottish waters between MSS and SEPA.
SEWeb	Scotland's Environment Web http://www.environment.scotland.gov.uk/ Editorial Group. Ensures consistency of message between NMPi and Marine Atlas and SEWeb. Produced a marine newsletter with large readership in 2016.
MINNSWG	Marine Invasive Non Native Species Working Group. The only marine focussed group dealing with non-native species at a Scottish level.

Clyde 2020 SG and RAG	http://www.gov.scot/Topics/marine/marine-environment/Clyde2020 MSS is represented on both the Steering Group and Research Advisory Group.
SOTEAG and MON COM	Shetland oil Terminal Environmental Advisory Group http://www.soteag.org.uk/ MSS is represented on the committee and the Monitoring Committee.

Energy

WREN	World Renewable Energy Network http://www.wrenuk.co.uk/index.html
ICES EGs	International Council for the Exploration of the Sea (ICES) Expert Groups http://www.ices.dk/community/groups/Pages/default.aspx
SCOS	Special Committee on Seals http://www.smru.st-andrews.ac.uk/pageset.aspx?psr=411
MREOG	Marine Renewable Energy Ornithology Group.
ORELG	Offshore Renewables Energy Licensing Group http://www.gov.scot/Topics/marine/Licensing/marine/scoping/orelg
EOSCA Chemical WG	European Oilfield Speciality Chemicals Association MSS represented on the UK Chemical Working Group
OGUK EAG	Oil and Gas UK Environment Advisory Group
SPORRAN	Scottish Offshore Renewables Research Framework. Multiple representation from MSS chairing various research and monitoring coordination groups http://www.gov.scot/Topics/marine/Licensing/marine/scoping/orelg/SpORRAN
FLOWW	Fishing Liaison with Offshore Wind and Wet Renewables Group (FLOWW) http://www.thecrownstate.co.uk/energy-minerals-and-infrastructure/offshore-wind-energy/working-with-us/floww/
Developers Groups and RAGS	MSS staff regularly attend through membership of site specific developers groups and associated research advisory groups eg The Forth and Tay Offshore Wind Developers Group (FTOWDG).

Aquaculture

SAV tri-nation WG	Salmonid Alphavirus Trination Working Group http://trination.org/about/ A collaboration between Scotland Norway and Ireland to progress management of pancreas disease in salmon.
ICES EGs	International Council for the Exploration of the Sea (ICES) Expert Groups http://www.ices.dk/community/groups/Pages/default.aspx
Gill Health Initiative WG	http://scottishaquaculture.com/events/gill-health-initiative-meeting/
ScoFaNo	Scotland, Faroe and Norway collaboration on fish health research
EURLs	EU Reference Laboratory for Crustacean, Fish and Mollusc Diseases http://www.eurl-fish.eu/Activities http://www.eurl-mollusc.eu/Main-activities/NRLs-network http://www.crustaceanr1.eu/
COFASP	Cooperation in Fisheries, Aquaculture and Seafood Processing http://www.cofasp.eu/
DG SANCO FVO	European Commission Directorate General for Health and Food Safety, Food and Veterinary Office http://ec.europa.eu/dgs/health_food-safety/index_en.htm MSS staff had input to this Departments UK Mission in 2015/6
Animal By-product Waste Disposal Group	http://www.gov.scot/Topics/farmingrural/Agriculture/animal-welfare/ABPs/aquacultureABP MSS staff contributed to this group producing recommendations on disposal and contributing to Zero Waste Scotland targets.
BBSRC/NERC SG	Biotechnology and Biological Sciences Research Council http://www.bbsrc.ac.uk/ and Natural Environment Research Council http://www.nerc.ac.uk/Steering Group (to co-fund aquaculture research)
Defra CVO	Department for Environment, Food and Rural Affairs Chief Veterinary Officer
MGSA	Ministerial Group for Sustainable Aquaculture http://www.gov.scot/Topics/marine/Fish-Shellfish/MGSA MSS scientists contribute to the Ministerial Group and most of the associated Working Groups
SARF board	Scottish Aquaculture Research Forum. http://www.sarf.org.uk/ MSS is represented on the board and many MSS scientists are represented on project steering groups.

CoGP MG	Code of Good Practice Management Group http://thecodeofgoodpractice.co.uk/
ISLM Grp	Integrated Sea Lice Management Strategy Group
PO Liaison	Regular quarterly liaison meetings with the Producer Organisations eg http://scottishsalmon.co.uk/
Scottish-NRL	MSS acts as the Scottish National Reference Laboratory for fish, mollusc and crustacean diseases http://www.gov.scot/Topics/marine/Fish-Shellfish/aquaculture/NRL
Salmon Fishery Boards	Fish Health Inspectorate Staff regularly attend meetings of Fishery Boards to participate in issues related to aquaculture and biosecurity.

Freshwater

NASCO	North Atlantic Salmon Conservation Organization http://www.nasco.int/
ICES EGs	International Council for the Exploration of the Sea (ICES) Expert Groups http://www.ices.dk/community/groups/Pages/default.aspx
IARSB	International Atlantic Salmon Research Board http://www.nasco.int/sas/
MS/SNH/SEPA IF	Marine Scotland / Scottish Natural Heritage / Scottish Environment Protection Agency Information Forum
FFAG	Fish and Fisheries Advisory Group http://www.sepa.org.uk/environment/water/river-basin-management-planning/who-is-involved-with-rbmp/ffag/
Wild Fisheries SRG	Wild Fisheries Stakeholder Reference Group http://www.gov.scot/Topics/marine/Salmon-Trout-Coarse/fishreform/refgroup
SFCC	Scottish Fisheries Coordination Centre http://www.sfcc.co.uk/
MS / Local FB liaison Grp	Marine Scotland / Local Fishery Board Liaison Group
Scotland's Salmon Festival SG	Scotland's Salmon Festival Steering Group http://scotlandsalmonfestival.org/

General Science

ICES Council and ACOM	International Council for the Exploration of the Sea http://www.ices.dk/Pages/default.aspx Council and Advisory Committee. MSS is represented on Council by Matt Gubbins (one of two UK delegates to ICES) and on the Advisory Committee by Nick Bailey. http://ices.dk/community/groups/Pages/ACOM.aspx
EFARO	European Fisheries and Aquaculture Research Organisation http://www.efaro.eu/ Marine Scotland is a member of EFARO
EMBRC	European Marine Biological Resource Centre http://www.embrc.eu/ A new resource pooling initiative and an ERIC (European Research Infrastructure Consortium) across marine research institutes in Europe. MSS is a signatory.
European Projects	Many MSS scientists are partners in European projects (Horizon 2020, INTERREG, Parliament funds etc). This is a key mechanism by which MSS scientists collaborate with European partners.
MSCC	Marine Science Coordination Committee https://www.gov.uk/government/groups/marine-science-co-ordination-committee Oversees the coordination of Marine Science in the UK.
MASTS	Marine Alliance for Science and Technology Scotland http://www.masts.ac.uk/ Many MSS scientists participate in MASTS Fora and Themes. MSS has representatives on the Executive Committee and Governing Council.
CAMERAS	Coordinated Agenda for Marine, Environment and Rural Affairs Science http://www.gov.scot/Topics/Research/About/EBAR/CAMERASsite The Scottish Marine Science Strategy was developed through CAMERAS and a number of MSS scientists are represented on various CAMERAS working groups.
MSF	Marine Strategy Forum http://www.gov.scot/Topics/marine/seamanagement/forum The key forum for routine dialogue between Marine Scotland and its stakeholder organisations. MSS is represented and various scientists attend as required to update on progress with specific work areas.
MarCRF	Marine Collaboration Research Forum https://www.abdn.ac.uk/environment-food-security/marcrf This forum was set up to enhance local collaboration with Aberdeen University. It funds a number of PhD studentships, small grants and a post doctoral research fellow in Marine Spatial Planning.