

A COORDINATED AGENDA FOR MARINE, ENVIRONMENT AND RURAL  
AFFAIRS SCIENCE (CAMERAS) (2011-2016)

SAMS

Scottish Association for Marine Science

Dunstaffnage Marine Laboratory

Oban

Argyll

PA37 1QA

**The following comments are offered for the CAMERAS consultation by the Scottish Association of Marine Science. They refer to the marine and coastal environment, which are our key areas of competency. SAMS is a learned society with some 500 members and is one of the longest established marine research institutions in Europe.**

### **Headline Themes**

*1. Do you agree that the two broad categories of “Local Responses to Global Change” and “Optimising the Potential of Scotland’s Natural Assets” are helpful in providing an overlying structure to the Co-ordinated Agenda?*

We consider these two categories as convenient starting points for defining a co-ordinated agenda, noting that there is scope for overlap. Adaptation to global change, for example, may contribute to economic regeneration by realising the potential for new fisheries, eco-tourism, renewable energy and port infrastructure – for Scotland, global change may be measured in benefits as well as costs. The transition to a green, low carbon economy, driven by climate change and influenced by factors such as the recent credit crisis, can provide real and tangible benefits to the Scottish economy by simultaneously addressing employment opportunities, innovation and sustainability. We believe that an early engagement in both categories can generate knowledge and skills that can also be exported to less prepared places and can contribute to Scotland’s “knowledge economy”.

*2. Are the descriptions of these set out in Section 3 (and Annex 3) comprehensive?*

The notion that there is a need to respond to changes and impacts “that are largely beyond our control” is pragmatic but should not be a reason for shying away from National responsibility for preventative action, even though this may prove to be expensive. Fortunately, there may be synergies: developing renewable energy and reducing our carbon footprint come hand in hand; the initial cost of technological development should pay considerable dividends in the longer run through innovation and skills, employment, export potential and addressing energy security. We believe that it is important to understand global economic and social drivers and to undertake careful “horizon scanning” before making short-term policy decisions. A case in question is the

global fluctuation in fishmeal prices that have a huge consequence for the strategic development of fin fish aquaculture. These prices depend upon a combination of market forces and the productivity of remote marine upwelling systems (such as the Humboldt Current off Peru and the Benguela system off southern Africa). Another would be to monitor the spread of opportunistic species carried in ballast waters, introduced accidentally from aquaculture or extending their range as a result of climate change. Not all of these vectors are inevitable and Scotland must develop its own early warning mechanisms and work with its neighbours on preventative strategies where possible. We believe that horizon scanning is inadequate throughout the UK and that Scotland needs to have its own capacity for such “socio-ecological intelligence” in order to protect its economic interests. We agree that there is a need to develop an evidence base and to apply it, through systems thinking, and strategic case analysis scenario modelling, to provide systematic advice for policy development and implementation.

As regards the second category, this has to develop within two constraints: (1) the sustainable productive capacity of the ecosystem, and (2) the global change issues described in category 1. Thus, the two categories are intertwined and we feel that this should be made clearer in the descriptors. We are concerned with the popular myth that marine systems have vast untapped potential. This is certainly not the case for food production where many fish stocks are being exploited well above their maximum economic yield (a point that is generally reached well before the maximum sustainable yield required by the current Common Fisheries Policy). Furthermore, even marine renewable energy – which does have a huge potential for expansion – often comes at a cost to other uses of the sea. We believe that sound science can support better articulated development options for consideration by policymakers and avoid expensive planning errors or unsustainable practices. It can also lead to new technologies that enable development with a decreased environmental and social impact. This technological aspect is understated in the current descriptors and the potential for its development in Scotland is considerable.

*3. Do these cover the major policy challenges where science can contribute as you see them?*

They are so broad that they can accommodate most of the challenges. This broad brush approach also risks misinterpretation and the descriptors should be clearer. For some stakeholders “optimising the potential of Scotland’s Natural Assets” might be interpreted as throwing caution to the wind and using current science and technology to convert natural assets to tangible assets in a way that seems sustainable. But science is imperfect and marine systems that appear resilient can suddenly collapse when human pressure exceeds thresholds that are poorly understood. The balance between conservation and exploitation must be explored carefully, noting that conservation is also an activity with short and long term economic benefits (generating jobs for tourism, providing a host of ecosystem benefits and services and potentially valuable opportunities for future generations).

Furthermore, in some cases, actions may be taken to help degraded habitats recover and therefore enhancing the potential of natural assets.

*4. Are they likely to remain broadly relevant over the longer time horizon (well beyond the 2016 focus of this Coordinated Agenda)?*

The issues will undoubtedly change in the longer term but these broad challenges should be valid for decadal periods. Importantly though, in the marine environment, we will have to set tighter objectives as a result of our commitments to the EU Water Framework Directive and the EU Marine Strategy Framework Directive (MSFD). The MSFD requires countries to agree upon a definition of “Good Environmental Status” for their waters by 2012 and to achieve this objective by 2020. These very specific targets will force a policy agenda for Scotland’s marine environment well beyond 2016 and are pre-existing commitments. They also require interdisciplinary science of the kind presented in the CAMERAS consultation document.

EU, UK and Scottish legislation are not the only agenda-setting drivers. There are practical drivers related to strategic decisions on use of the sea bed that are already happening. Thus, the recent announcement of new offshore wind farm concessions by the Crown Estates will shape the use of Scotland’s marine space for some decades. Any large infrastructure decision will have decadal consequences and there is no time to lose to get appropriate science in place to help decision makers to understand the available options. The 2016 date must be put into this context; actions taken in this period are likely to have consequences outside it. In our view, this should be reflected in the document.

*5. Do you agree with the description of support for the National Capability Theme set out in Section 3 (and Annex 3)?*

Scotland (particularly under the new devolution settlement) will have custody over a very large sea area, proportionally one of the largest in Europe. This is a huge asset but also an onerous responsibility. We do not believe that the current marine science capabilities (including social science) are sufficient to meet this challenge. Furthermore, it is entirely unclear to us how the Fisheries Research Services will operate in the context of Marine Scotland, in which it will be a constituent part from 1 April 2009 (it will no longer be an NDPB). The consultation document only refers to the ‘national capability resources’ of the MRPs and FRS. There is a clear asymmetry of provision between the land and the sea in this respect and we consider that this should be urgently addressed.

We will discuss these needs in more depth in Q 23. As Scotland’s leading independent interdisciplinary marine research institution and learned society, SAMS has much natural and social science expertise to offer for policy development in Scotland and would welcome an expanded role in this arena.

*6. What facilities, resources and data do you think are important for Scotland to maintain?*

For the marine environment, the emphasis should not be on maintaining capacity but building it. Apart from regulatory and compliance functions (that will be appropriately focussed on Marine Scotland), there will be a need to detect long-term trends and to provide early warnings of climate change and its consequences. It will also be necessary to conduct research into other large-scale changes such as shifts in species distribution, the occurrence of alien species (these can cause havoc to fisheries and aquaculture), habitat loss, and algal blooms. In addition, planning decisions and risk assessments should be informed by studies of ecological status, species specific effects (including 'charismatic species' such as seals, cetaceans, sea birds, etc), water and sediment dynamics and socio-ecological modelling. Scotland is short of data on societal and economic aspects of the marine environment. Social science research can underpin and support innovations to governance, lead to long term assessments on values, attitudes, behaviour and action, explore the development and use of new environmental policy instruments such as market based instruments, and inform economic and social development.

This seems a long list but is the minimum necessary to inform decisions of the kind contemplated in current and proposed policies. These necessary studies require sufficient infrastructure including properly equipped research vessels. Some of this infrastructure exists today but has not been used in this context and there will be difficulties to face the increased demands. Long-term data sets are currently woefully inadequate, often because of discontinuities in funding as the priorities of successive governments change.

*7. Are there other resources that Scotland needs to acquire to support future policy development?*

Scotland needs to develop and service long term programmes of observation that are not currently in place. This will place increased demands on the limited infrastructure. Currently, for example, only one research vessel is available for this work (the Scotia from FRS, an excellent but heavily used ship) and it may be necessary to provide an additional vessel in the future.

In addition to this, there is a need to strengthen information gathering for social and economic studies of the relationship between human development and the sea. The limited and dispersed current data is making it hard to develop a rational base for decisions that fully embrace social and economic factors. This is not an issue of book-keeping; it requires primary data gathering and the human and logistical resources needed to support it. Scotland is very weak in this area.

## **Policy Issues**

*8. Have we correctly identified the key policy issues and the associated scientific opportunities in Section 3?*

We have partly answered this question in section 2. The policy issues are presented in a rather confusing manner in the consultation document; statements in one case, questions in another.

For the local responses to global change, climate change is likely to be the major long-term issue but it is certainly not the only one of great importance. Acidification is an emergent issue associated with climate change and with potentially grave implications. The global-scale redistribution of species is another issue that can have devastating economic impacts (e.g. the sudden jellyfish invasion on an aquaculture unit in N. Ireland only 2 years ago). Existing levels of escapes of farmed fish – including salmon - have the potential to devastate wild stocks - indeed may be doing so already. Additionally, genetic modification of fish for aquaculture (prohibited in Scotland but may be developed elsewhere) would have the potential to deplete wild stocks following accidental release. We agree that the indirect consequences of globalisation need to be considered as a major driver, especially for horizon scanning exercises. Peak oil, sooner or later, will be a very significant driver and it will be wise to plan for it.

In the case of optimising the potential of Scotland's natural assets, we are uncomfortable with the definition of some policy issues and they are not stated clearly. A primary concern for Scotland - but certainly not a unique one as suggested – is the need to ensure **energy supplies** in the future. This will weigh heavily on the political agenda in the coming decades and marine renewables will figure heavily in the debate. We agree that food production, conservation and social equity issues are highly important issues in the marine context too. We would wish to place more emphasis on regeneration of damaged ecosystems with a purpose to bring them back to optimal use. We need an explicit recognition that some fish stocks have been overexploited and that science will continue to play a key role in their recovery. Dealing with the legacy of the past also extends to policy regarding the increasing number of redundant structures in our coastal waters from the oil and gas industry that will require decommissioning.

In our view, a key issue in the marine environment is the need to assign **user rights** through marine spatial planning (MSP). The development of an offshore windfarm for example has major implications for the fishing industry as it usually excludes mobile fishing gear. By concentrating fishing effort elsewhere, it may have unexpected knock-on effects. Systems thinking would examine the trade off between the need to reduce fishing effort, the opportunities for employment in the wind farm sector and the implications for conservation and food supply. In addition, we view it as critical to publicly articulate the process of MSP and the governance arrangements behind any MSP designation and generation of user rights.

In line with systems thinking, we need to move from managing for optimal, economically efficient outcomes towards a resilience-based framework in terms of increasing the adaptive capacity and resilience of both natural and anthropogenic (infrastructural-social-economic) systems in an effort to mitigate effects of climate change and other strong exogenous factors such as

increasing oil prices and invasive species as mentioned above. Increasing the resilience and adaptive capacity of coastal communities will place them in a better position to help themselves rather than solely relying on government rescue packages. It is currently difficult to determine how much resilience has been lost from coastal communities as a result of economic development policies that have allowed cumulative environmental effects to propagate over the last century and this knowledge gap needs to be urgently addressed.

Returning to the first question, the assignation of economic and societal value, as stated, is an important methodological issue rather than a primary one. Environmental economists try to assign monetary values to natural assets to help with planning. But societal values are not assigned; they are part of the cultural fabric of the human population, can be assessed and change with time and circumstances and are important drivers for policy. It is important not to confuse the two. Changing current attitudes to the marine environment is indeed a major issue in Scotland and linked to this is the attitude-behaviour gap revealed by recent research. Societal values are key to bridging this gap, yet we have a very poor understanding of such values and how they drive human behaviour.

*9. Are there additional issues that should be included?*

We believe that special consideration should be given to the unique circumstances of the West coast of Scotland and the Islands where the dispersed population and limited infrastructure provide huge challenges for sustainable development. In this context, there is a major role for interdisciplinary science, carefully analysing the potential of alternative options for development, examining resilience of natural and social systems, developing accessible and appropriate technologies.

*10. What do you think will be the most important influences on Scotland's future in the Marine, Environment, Rural Affairs and related areas?*

From the marine and coastal perspective, there are two types of influence:

- (1) Local scale: demand for food, energy, transport, employment, landscape and recreation; willingness and ability to invest in new development projects; and
- (2) National scale (also driven by external commitments): policies and regulations to promote economic growth, protect natural assets or to ensure their rational exploitation.

Scotland's seas and coasts will be expected to provide all of the services listed in (1) and some in increasing quantities to satisfy the demand for growth. Of these, the provision of renewable energy and food (aquaculture and well as wild fisheries) are likely to dominate in the short/medium term. In some places, recreation and tourism will surpass fishing as an economic activity and generator of employment. A current top priority for investors is renewable energy and in the current market circumstances, this is likely to be the biggest development driver. The biggest policy and regulatory drivers will be the Scottish Marine Bill (inshore waters), the UK Marine Bill (empowering

Scotland for its offshore waters), the European Marine Strategy Framework Directive and the reform of the Common Fisheries Policy.

*11. Why do you think these are important?*

They reflect current trends and realities. Energy security is crucial for Scotland and renewables offer considerable scope for development. The main point is that many of the societal uses listed in (10) depend on maintaining a resilient natural and anthropogenic system. A greater scientific understanding is needed of the limits of the system to provide goods and services and maintain resilience. The resilience of both social-economic and biophysical ecosystems is inherently a social issue given the dominating role that humans have on ecosystem goods and services.

*12. Are there other scientific opportunities which should be highlighted?*

These policy challenges are not entirely unique to Scotland. Solving them will put Scottish expertise ahead of many other countries. This can be the basis of a knowledge economy on the international stage, particularly if it is also accompanied by innovative technology.

## **The Science**

*13. What existing areas of Scottish based scientific expertise should be maintained to contribute evidence to key policy issues?*

This has been addressed in Q 6-7. Scotland's capacity in marine science is barely adequate to cope with the demands of the new "discovery" of the potential of its marine environment, the challenges of managing a huge marine area and the uncertainties of global change.

*14. How clear is the relationship between the scientific areas and the key policy issues?*

Science has developed historically in silos and the relationship between science and policy is an uncomfortable one. The reason for this is complex but includes the way in which science is rewarded. Performance measures such as the RAE and funding calls do not reward policy relevant science work adequately. Furthermore, it is only relatively recently that some science for policy has been deemed as excellent and published in top journals. Systems science (interdisciplinary science looking at coupled social and ecological systems) is particularly poorly developed in the UK and is again partly the result of a tradition of forcing scientists to work in silos. There is a real opportunity in Scotland to foster a new pathway towards rewarding and encouraging policy relevant science. In addition, we are acutely aware of the special role that social science can play in supporting, assessing and contributing to policy development and analysis of science and policy linkages. There is a rich tradition of social science research that has not yet been applied to decision making or science and policy integration in Scotland. The current consultation document is very general in scope and lacks clarity

on the science required for specific issues. Nevertheless it is encouraging because it opens the door for engagement and innovation.

*15. In which areas of science can we continue to make use of expertise supported elsewhere e.g. at the UK, EU and international levels?*

Science does not operate within strict geographical boundaries. We benefit from collaboration and shared experiences at all levels and could not operate in isolation. In SAMS, for example, we offer services across the UK thanks to our status as a NERC Collaborating Centre. This represents a relatively small part of our funding but gives us access to a wealth of expertise that we do not have in Scotland. Similarly we work across Europe, leading or contributing to policy-related work with partners from at least 15 countries. This wide base for cooperation generates huge added value in the context of our primary role as a Scottish institution. In the case of SAMS, it also gives us access to a critical mass of social scientists tackling a diverse range of issues of direct relevance to Scotland.

*16. In the time frame for CAMERAS (2011-2016) what new emerging areas of science are likely to mature and become available for more general use or application?*

CAMERAS is a relatively short time frame. We would expect:

- (a) Improved automated data gathering equipment and sensors that greatly enhance our capacity to study the sea;
- (b) Major developments in molecular biology that unlock the potential for biotechnology related to natural products;
- (c) Improved technology for marine renewable energy and their interactions with the marine environment (Scotland is currently leading the academic race in marine renewables environmental impact science);
- (d) Major innovation in modelling and data presentation (e.g. serious use of Google Earth and Google Ocean and similar data visualisation mechanisms);
- (e) Accelerated development of systems science applied to coupled social and ecological systems (applicable to programmes such as LWEC) including the development of design principles for resilient social-ecological systems;
- (f) Stronger evidence base for global change and models to support policy decisions.

*17. Do we have the expertise available to be able to use these new opportunities?*

Not in all cases. We need support to build capacity and recruit new people when necessary. Modern competitive science relies heavily on mobility.

*18. In which areas does Scotland need to be self reliant?*

It is unreasonable to expect Scotland to be completely self-reliant in any area of science; science works best through cooperation and it would not be cost-effective to work in isolation. However, Scotland should have sufficient capacity to support its own sustainable development agenda. This implies that

most of the science needed for CAMERAS should be based in Scottish institutions. In the case of the marine environment, this implies an increase in existing capacity; some of the expertise used for supporting current policymaking is contracted to English institutions for example. It is entirely possible that the reverse is also true.

## **Delivery**

*19. Knowledge Exchange is essential for scientific activity to achieve impact. Do you agree that KE should be an explicit and integral aspect of the delivery of this Coordinated Agenda?*

KE is a term that has many different interpretations. Ideally, policy-related science, particularly social science, can develop through a process of collaborative enquiry; involving stakeholders from the outset. By involving stakeholders at an early stage, there is a greater likelihood of 'buy in' to the outcomes of the research. We strongly believe in this kind of KE and of spending time and effort in the diffusion of our science.

In addition to this though, there is a strong need for Continuous Professional Development, particularly in building the capacity of local authorities and small businesses to engage meaningfully in marine spatial planning. This is an important opportunity for policy-oriented scientists to engage directly with those who will be implementing new policies arising from Scotland's Marine Bill.

*20. How can we continue to improve the integration of evidence from a diverse range of sources into forms that are accessible to end users?*

Currently there is insufficient independent science representation on committees dealing with key marine policy issues and this is becoming a bottleneck to effective involvement in policy development. Translation of **existing science** into policy-relevant information is not something that happens by chance or should be expected of all scientists; it is an activity that requires particular skills for synthesis and communication. The Government has two basic choices in the matter: (1) centralising the work in a Government body, or (2) outsourcing it to another (or other) institution(s). The second option has some advantages worth considering because it places the science communicators near the scientists. **New policy-relevant science** developed using the paradigm of 'joint fact-finding' involves some of the key stakeholders with the scientists from the outset and ensures better buy-in of science into effective policy. We strongly recommend this process and would be happy to provide further information on its implementation.

*21. How can we reconcile the requirement for science to be responsive and flexible to short term demands while at the same time ensuring that longer term strategic research continues to progress our knowledge and understanding?*

By being explicit about this from the outset. In some cases it is possible to use the principle of 'gather once and use many times' for scientific data but this is not always the case. The question posed here is somewhat rhetorical; it is the funding councils and government agencies that need to reconcile this problem. Short-term needs can often be met by (or charged to) the beneficiaries of the information but this is almost impossible with long term needs. For longer-term strategic research, the Government has a duty of care for future generations and their environment. This is enshrined in the principles of sustainable development that all governments have signed up to in 1992 at UNCED and reaffirmed ten years later in Johannesburg.

*22. How can we ensure that the 2 way flow of knowledge from science to policy and from policy to the academic community is optimised?*

This relates directly to our answer to Q 20. More attention should be paid to science forums in new policy rather than the traditional approach of discussions behind closed doors with a selected few individuals (often no longer active scientists). We need to recognise and reward the role of professional communicators. Furthermore, all Government-funded environmental research projects should include a responsibility for communicating the results; in the case of social science involving interviews with local people and industry, there should be a duty to provide information to these people on the results of the research and their implications. In addition, we would support the investment in social science research that directly explores the dynamics and problems inherent within science and policy integration, and do not see the role of social science as a 'bolt on' that legitimises existing processes. This will benefit a transition to innovative systems of governance that deliver the integration of scientific and policy thinking.

*23. Are there alternative structures/systems or new approaches/organisations that could enhance these flows?*

Scotland needs to increase its human and physical resources in order to cope with the complexities of sustainable use of its marine environment. This is the emphasis of new pooling initiatives such as SAGES and MASTS; genuine efforts to build a critical mass of expertise through pump-priming groups of universities with the additional support they need to build coherent programmes. These programmes (that we participate in and support) are time-limited and not explicitly designed to provide long-term support to policy though they should lead to lasting alliances, primarily between university institutions.

In the marine environment, adaptive management requires systematic investigations of the relationship between human development and the sea and simulations of the environmental implications of future development patterns. In our view, some of this capacity should be in independent institutions such as our own (SAMS), a situation that would help to achieve the checks and balances that maintain public confidence and efficient policy development.

We note that land and sea systems are closely coupled and we must also be careful to ensure a close dialogue between policy issues in the sea and on the land and encourage programmes that promote an active dialogue between researchers in these two environments.

Government should seriously consider one or more MRPs in the marine area.

*24. Are there science delivery models which could provide examples of good practice for Scotland to follow?*

We have had recent experience of science delivery in Canada, Australia and the USA. Each of these offers elements of good practice involving a high level of government and stakeholder support and involvement. We would not recommend following any of these models directly though because the circumstances and culture of Scotland are unique. But it is worth understanding the elements of good practice and learning from them and also from the difficult experiences that have not yet been overcome in some cases.