Appendix C – Full script of answers for each interviewee

11.1. Participants were initially contacted by email in order to introduce the project and arrange a convenient date for the interview to be conducted. Interviews were recorded with prior consent from each participant and subsequently transcribed. Interview transcripts were shared with interviewees in order for them to review the information collated and agree on its veracity for inclusion in the final report (see Appendix C).

Interview 1 details (7/12/2014)

Organisation: Regulator

Position: Case Manager

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

Prompt: EIA, SEA, Environmental monitoring, Marine spatial planning, Statutory monitoring, academic research

Regulator – involved in a large range of processes. Mainly involved in EIA and HRA.

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

Overall, we have a good comprehensive process. There are the occasions where we have to go back for more information, or something is missed during scoping that has to be reconsidered. With screening and scoping it is up to the applicant, once they have the information from the regulator, to go away and form the assessments. Sometimes things are performed to different standards.

In regards to cables were don't really have an issue with the quality. Sometimes there is an assumption made by the developer on what the appropriate solution is, and we would want more information on other mitigation or installation techniques – this follows into post-consent, with assumptions made into what is technically feasible e.g. long horizontal HDD was planned, it failed to work and everything went back into assessment. I think mostly the standard is quite high.

Q3 **Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

Q3 (A) **What are your experiences / your reasons for highlighting these environmental effects?**

I think overall knowledge is quite high, marine cables are not a new thing, have been installed for over 100 years. Specific features may not be as well researched – recovery of salt marsh, there is very little data on. There are some projects coming through which will help to provide knowledge.

EMF is often questioned but tends to be followed up with a statement that EMF is not much of an issue. Some research under COWRIE suggests Elasmobranchs can detect EMF fields but no evidence of an impact. It is a slightly grey area, as we do have the marine policy statement. Burbo bank offshore wind farm showed that elasmobranchs were still feeding within the cable area.

Most of the installation techniques have been around for a while. The impact from a dredge head plough technique seems to be a bit more extensive, and I would want more information on this technique. It is useful to have more information on new installation technology.

Interaction with fisheries we look at heavily – making people aware, ensuring discussions are going on. This is usually up to a high standard. Co-existence plans are in place, sometimes requirement to ensure no snagging on the cabling. More knowledge on the impacts upon the fishing industry would be nice.

Salt marshes - one of the major are highly protected and information on how they recover is limited and what factors that affect recovery.

Q4 **What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?**

See above

Q 4 (B): **What knowledge gaps do you think should be prioritised for future research?**

Q5 **In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?**

Bio-genic reefs are of concern, however we have always dealt with this with appropriate mitigation such as preconstruction surveys and micro-siting around reefs. You have to look at reef just before construction and plot your way around it, this is an effective mitigation

Geo-genic reefs, salt marshes, eel grass – any assessment that is looking at designated sites and what the cable is actually going through and mapping your way around features like this make consenting easier. EIA is based on weight of evidence, while HRA is based on the precautionary principle so a more precautionary approach has to be taken, assuming the worst case scenario.

Q6 **Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?**

Same as above. It's all about the physical disturbance. Geo-genic bio-genic, salt marshes, intertidal habitats, cockle beds, mussel beds – areas that are going to be physically disturbed and looking at how they recover. Any installation would have the same effect.

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

Almost every offshore wind farm will have had monitoring – covering the array and sometimes the export cable. Most will have some sort of monitoring. Links OWF had monitoring of the salt marsh post consent, Nemo cable also had monitoring. Most OWF has monitoring around benthic, ornithology, fish and marine mammals – only benthic is normally relevant to cables.

Some fisheries monitoring may also be relevant to cables – Burbo bank elasmobranchs survey (2012). Cable burial depth is something that is also required to be monitored, looking at that the cable is buried to a sufficient depth potentially over the life time of the project but if it is a stable environment and a number of surveys say it isn't moving this may be acceptable.

Aware that there is some sensor information regarding temperature but I don't know of anywhere where is has been used or presented. I think Navitus (OWF), the cable may have had sensors to measure the burial depth. This could be an opportunity if there is the potential to gather data that way.

Q8 What tools could help to reduce environmental and permitting difficulties?

It would be useful if everything was submitted in the same format, following the same approach. A standard approach to environmental surveying and assessment. If there is an HRA providing an appropriate screening document, that would be useful. A standard template for assessing is needed. The round 3 OWF in the UK, have an evidence plan process in the pre-application phase, there is an agreement upfront of what evidence is needed, what evidence is required ,this is agreed with stakeholders and discussed with relevant SNCBs. The final document, you might not agree with the conclusions, but you know the evidence has been agreed in the right way. In many ways scoping is supposed to do, and therefore more work may need to be done to ensure we are getting the most out of this process.

Q9 Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?

Annex 1 reef habitats – Sabellaria always seems to need consideration. Impacts on the fishing industry. Impacts to navigation are the key issue. These are all well researched but there is always more work to be done, especially with the fishing industry.

Gaps around salt marshes. A few concerns around EMF, it hasn't hindered a project, but it may be worth looking further.

There is a group called FLOW for the offshore renewable industry which is basically a fisheries liaison group, there are some good outcomes from this – this could be useful for the cable industry, although as it exists for renewables not sure how much help it would be, potential for more inclusion of cable industries within this. Might help ensure an appropriate and consistent approach.

Q10 What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?

Expansion of the grid is good, inter connectivity gives stability to the UK and to our energy and across Europe. Definitely something that is worthwhile.

The impacts of cable are minor and spread out over a large area, unless you are going through specific features the impacts are usually acceptable. Usually in regards to cumulative impacts, if there are specific impacts you can work your way around them. It's a case of routing the cable if you have done the consultation in the pre-application phase. Maybe if you're crossing a pipeline there may be concern.

Interview 2 details (14/12/2015)

Organisation: Statutory advisor (x2)

Position: Project level expert

Q1 What environmental assessment processes have you utilised, been engaged with or are aware of recently?

We are involved with providing advice to the regulator (MMO), we would be asked by the MMO or developer directly review the environmental assessment or any associated assessments (e.g. MCZ assessment).

Q2 How effective were the environmental assessments described in Q1?

And how could they have been improved?

I think the main improvement would be better evidence, the more evidence we have the better advice we can give and the regulator can make a more informed judgement. Having good seabed data enabling good cable burial assessments and use of correct tools to ensure that cables are sufficiently buried.

The more realistic the scenarios are the better our advice can be. One of the issues is that we have experienced different things from reviewing multiple assessment, and industry doesn't necessarily learn from each other. Greater sharing of information across industry and learning.

The aim for everyone is to bury the cables sufficiently once without the need for reburial and cable protection.

Q3 Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables

I think we have reasonable knowledge of installation of cables in soft sediment environments and the kind of impacts and recovery. We struggle with the significance of this within marine protected areas and the use of cable protection. There is reasonable evidence but there are still some gaps.

Q3 (A) What are your experiences / your reasons for highlighting these environmental effects?

Q4 What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?

Marine protect areas as above.

Greater understanding of cable burial and whether the cables will remain buried. Our experience is that cables become exposed and require remedial works such as protection which has greater impacts. The other area is that there is a lack of evidence surrounding the installation techniques on harder sediments, such as chalk or rock, how well the tools will work and what the impacts are.

Large interconnectors – EMF is an issue and vibration in relation to cable laying. It depends on what the cable is going through.

Sand wave clearance, developers believe that if they clear the sand waves out of an area the cable is more likely to remain buried. But because this hasn't been done yet we don't have the evidence to confirm this will work. IF it doesn't work then you will have increase impacts due to the clearance of the sand waves as well as cable reburial or protection.

Q 4 (B): What knowledge gaps do you think should be prioritised for future research?

Depends on the cable, project specific. They are all equally important depending on the project.

Q5 In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?

It is more in relation to certain habitats. Biogenic reefs would have to be focused on e.g. Sabellaria reefs and mussel reefs. In an ideal circumstance we would micro site cables around particularly sensitive habitats.

Impacts on intertidal habitats have also presented issue – salt marsh.

Q6 **Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?**

See above

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

Not aware of any. If there would be any opportunities to collect more marine data it should be investigated. You should look at the available data first in order to avoid the replication of data.

Q8 **What tools could help to reduce environmental and permitting difficulties?**

Presenting the best available evidence, the most realistic scenarios using all the knowledge that is out there. Testing of installation tools so we know what the impacts are, sometimes we have had cases where a new tool being used and assumptions are being made in the assessment so it is difficult to provide good advice.

Difficulties come from uncertainties, so the more that can be done to reduce these uncertainties in terms of monitoring data or letting us know exactly how the machinery works, letting us know the range of impacts that can be produced.

Where you have the freedom is choosing the route carefully and choosing the landfall site carefully. Often a lot of issues where the cables come onshore and in the intertidal.

Industry workshops would be the best way to share experience to break down the barriers around commercial sensitivity. Not being afraid to share experience that have gone wrong or been difficult. It's about getting people together to discuss the issues.

Q9 **Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?**

I think good and sensible route choice.

Evidence of the impacts. Looking for monitoring data, to show how the seabed recovers, showing temporary impacts. Focusing on ensuring the correct burial depth so you only have to impact the seabed once, avoiding reburial because there wasn't enough information on the seabed. If sand wave clearance works that is great, if it doesn't maybe we should try to avoid areas with high sediment movement.

Use of installation techniques that have the least impacts or the development of new installation techniques.

Q10 **What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?**

It depends on where the cables will go and a thorough understanding of what the impacts are. The last one I looked at used electrodes and when they were working everything was good but when they failed levels of EMF rose. Can't really say it would be great to have all these cables, a lot depends on careful route planning and understanding the knowledge gaps.

There is potential for cumulative effects if the right routing isn't used and if cable burial is correctly conducted or cable protection is required. If the cables are well buried, sensitively with minimal impacts on sensitive habitats there will be less potential for cumulative impacts.

Interview 3 details (17/12/2015)

Name: Andrew Gill

Position: Senior expert

Organisation name: Cranfield University – Centre for Offshore Renewable Energy and Engineering

Organisation category: Academic

Email: a.b.gill@cranfield.ac.uk

Q1 What environmental assessment processes have you utilised, been engaged with or are aware of recently?

Engaged with the whole EIA process, particularly relating to offshore renewable energy, mainly wind farms. I have a module at Cranfield for post-graduate students and professional development on introduction to EIA.

Where I have been involved on actual projects has been as an expert advisor in regards to the cable installation and the cable emissions during operation of mainly inter array cables and export cables. This is across the UK, wider Europe and North America.

Q2 How effective were the environmental assessments described in Q1?

And how could they have been improved?

They have been slightly cursory and quite general. I don't think this is an issue with the process but more the knowledge base. You can only do so much when you are trying to assess the environmental impact based on the current knowledge. My biggest query is that because of lack of knowledge, the outcome tends to be dismissal of any predicted impacts. The EIA by its nature only considers negative consequences, and the information that is used to predict impacts is often actually only relevant to effects and responses to perceived stressors, often we don't actually have the knowledge on the impacts.

Q3 Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables

Q3 (A) What are your experiences / your reasons for highlighting these environmental effects?

Best understanding is in relation to cable burial, and how sedimentary habitats are disturbed during the burial process and recover afterwards. This is more due to the physical nature of what is going on rather than a link to the ecosystems. I think this is reasonably covered. Other environmental effects are not in my opinion covered appropriately (links to lack of knowledge).

I have reviewed parts of EIAs as an expert advisor and I have seen that information been put forward.

Q4 What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?

Influenced by my research into operational EMF, but this is an area where we know very little about. It is dealt with at a cursory level as it is a difficult topic to understand. We rely on models and not actually the data that is required to support these models. We know little on the longevity of any impacts in relation to the consequences of the installation and operation, also for combined effects we don't have any detail. Particularly when we are talking about multiple cables, it comes down to the often referred question of cumulative aspects.

There is a lot of modelling done on the emissions, but little on measuring actual EMF. We have just finished a project for the EU looking at quantifying the emissions coming out (MaRVEN). The data that were collected

doesn't fully match up with the modelling of the cable itself, this was probably because the models are run in an ideal environment and we don't think about the movement of seawater. This project didn't look at any organisms. We would be more capable of doing predictions if we can provide these data for the models, they would improve. In terms of interactions with organisms there is evidence of a response but at this stage we can't do any impact predictions.

The longer term potential change to the habitat that the cables are laid on is another thing. These could be deemed positive or negative, we know that organisms will colonise structures on the seabed, also there is evidence that if they are buried there is association of fish along the trench. The longer term understanding of how it might change the local system is not understood.

Thermal radiation is raised occasionally, I think we need to understand it more, I think everyone assumes the extent would be minimal but this would change with the size of the cable and type of cable.

Q 4 (B): What knowledge gaps do you think should be prioritised for future research?

EMF from my point of view. First asked about it in 2001 and we still aren't much further forward. Also the changes associated with the habitat around the cable, (aka artificial reefs) need to be understood but it is a longer term process. From an EIA perspective we probably aren't looking for major negative issues because this is the way the process pushes us. EMF keeps getting raised because of whether it is creating a blockage or diversion for migratory species. This is raised as of particular interest because of fisheries important species and conservation species.

Q5 In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?

Sabellaria reefs because of their protection and physical nature. Migratory species, (e.g. fish, eels, migratory lobsters in N. America). Tends to be species sensitive to EMF or where the physical nature of the cable might damage the environment the species are in. They all seem to have some sort of commercial and conservation importance, other ecologically important species (such as elasmobranchs) tend to be less considered.

This experience is from offshore renewable energy projects and interconnectors.

Q6 Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?

EMF sensitive species – Elasmobranchs. Sturgeon and relatives, migratory species such as eels and salmonids. Those that use the Earths EMF for long migrations and Elasmobranchs which is more to do with daily activity and feeding. Two different modes of detection and scales. The likelihood of encounter is likely to play a part in the scale of response.

Q7 Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?

There is a requirement for some projects to collect data in relation to the construction phase, such as data on sedimentation, i.e. the disturbance. In terms of things like EMF, there have been a few companies that have been asked to collect data that might link to it, based on numbers of potential species (abundance) caught doing fisheries surveys looking for sensitive species. Or they have been required to model the emissions and judge that there's no impact. But these are coarse level and at best correlative studies and are not collecting data that can be used to directly address the question of evident impact (or not).

Other studies relating to cables are specific research projects as an assistance for the EIA process.

Q8 What tools could help to reduce environmental and permitting difficulties?

We are never going to get everyone to collect the same data from all the sites –this is just too much. Thinking about EMF, as long as you understand the basic attributes of the cable you can make predictions so you don't have to monitor every single cable. If there was more of a coordinated approach by the authorities, for example we are going to consent these 10 projects and 2-3 are going to collect data which will be used as a reference. Collecting emission data based on what is going through the cables, type of cables, how are they being used in terms of the power going through them. This is what we don't understand, how it fluctuates because the models only tell us the answer at one time (i.e. a snapshot). We wouldn't need to collect data forever but it would be extremely useful to feed it into models to make them reflect reality.

Because we don't know enough, forcing the developer to collect lots of information on the distribution of fish and crustaceans is probably too much at the moment. We need to try to work with these people and be more positive, saying we need to understand this for true environment sustainability. So collecting information at particular sites, such as tracking animals linked in with fisheries catch data to help understand spatial use around the sites. There is an opportunity to get people to work together to reduce the onus being on one particular part of the sector, but to work together to try to answer these questions that keep coming up. The potential at the moment is for regulation to say we need to take the precautionary principle because of lack of knowledge and hence high uncertainty; this isn't going to help renewable energy or smart grids.

Q9 **Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?**

See above.

At the end of the MaRVEN project there was a request to put forward integrated research, trying to assist in reducing barriers around things. This can only be done with the right kind of data but we have to ask the right questions and collect the right data. A coordinated approach to answering the common questions across different countries particularly when we are talking about smart grids and connecting countries. There is a benefit to work together on different elements of this, with an overriding strategy to say we are addressing these questions that everyone wants answered. There is a wider international perspective as N. America is asking the same questions. RGI sounds like it could be a vehicle to try to promote this sort of thing. There isn't one particular priority. It needs a coordinated oversight.

Q10 **What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?**

It is inevitable. We have to approach it with an open mind. We are interacting with an environment that is already severely perturbed and we need to demonstrate that we are not perturbing it or if we are this is how we are mitigating it. I don't think we can do either. We can't say it is definitely not going to be perturbed and we can't say it not going to be perturbed much compared to fishing or climate change etc. I think it is inevitable, this whole movement for energy sharing and export there are a lot of positives from it but we have to go at it from a view point of working together.

Interview 4 details (10/12/2015)

Anonymous

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

Part of the maritime and spatial planning unit, working on the, spatial plan for the grid connection for interconnectors and for offshore wind farms. Only responsible with the EEZ. In touch will the SEA for the

offshore grid plan and for the EIA for the permitting procedures for the grid connection. Involved with several projects within the North Sea and Baltic Sea.

Q2 How effective were the environmental assessments described in Q1?

And how could they have been improved?

The applicant has to complete surveys or start with a desktop study, and collect the data and report this to the agency. We would them approve the data and the report and consult the other agencies (natural conservation agency).

Benthic data is often missing or hasn't been assessed as thoroughly.

Q3 Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables

Q3 (A) What are your experiences / your reasons for highlighting these environmental effects?

I think distinguishing between the North Sea and Baltic Sea. Tennet in the North sea has quite a few projects so the knowledge base is quite good, as they have experience with operating projects and projects being constructed. In the Baltic sea there is less experience, some data for nature conservation areas and the existence of biotopes is missing.

It is a regulated system, there are a number of plans covering certain questions. There is the offshore grid plan which covers the spatial planning and the network development grid plan is established by the TSO and approved by the federal network agency and this covers the prioritisation of the projects.

Q4 What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?

Some with have discussed during consultation is the effect on benthic species, and biotopes. Both the effect and the habitats recoverability. Some data is limited locally and then the definition of what a biotope is, is under discussion.

Several projects in the North Sea in relation to the grid connection of offshore wind farms and also the procedures for a number of Interconnectors, NordLink and Cobra cable.

Q 4 (B): What knowledge gaps do you think should be prioritised for future research?

It is not the EMF but the warmth of the cables that needs investigating.

Q5 In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?

With the standards we have, usually not but it depends where the cable is routed. If it is through protected areas there will be more discussions. If maritime spatial plan and offshore plan provide the route there is usually less discussion.

Q6 Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?

Nature conservation stakeholders, shipping authorities and aggregates stakeholders. In the North Sea we usually have discussions with wind farm developers about distances from the cable to the wind farm.

Usually we discuss the effects on biotopes and Natura 2000 sites.

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

Usually when cables are in operation the applicant has to monitor the cable through surveys to assess whether burial depths are met and what the environmental effects are. It is usually the applicants that collects data.

Not sure of any cases where the cable has been used.

Q8 **What tools could help to reduce environmental and permitting difficulties?**

Sharing of data would help, but the applicants own the data so there is no obligation to share the data. Early stakeholder consultation, using previous experience. Within the EEZ the permitting procedures are smoother. An international or national platform allowing the sharing of experience something like the North Sea Grid Initiative, RGI I think is a great project for sharing experience.

Q9 **Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?**

The requirements for environmental assessment are different in each country. Some standardisation could help, having similar requirements. The impacts and assessments on protected areas should be carried out in a similar manner.

Q10 **What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?**

In general, the expansion is definitely needed in terms of integrating renewable energy and energy security.

The impacts and cumulative impacts needs to be assess more. Each country has their own method and requirements, it would be helpful to have one common method. This relates to cumulative effects as well. I think cumulative impacts need to be assessed in more detail.

Interview 5 details (26/11/2015)

Organisation: TSO

Position: Senior expert

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

Responsible for the preparation of environmental impact assessments such as electrical interconnection Majorca-Ibiza, Peninsula-Balearic islands and Ibiza-Formentera (present).

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

Everything that was studied in the EIA was useful.

I think that the assessment was needed. I don't know if everything was included and I don't think the social impacts were included enough. The problem is more with the social impacts rather than the biological ones.

Q3 **Please can you give your opinion on the current level of knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

Q3 (A) What are your experiences / your reasons for highlighting these environmental effects?

Route planning on land is much easier, with access to google maps. Available knowledge is not the same as on land – this is a major knowledge gap. Marine surveys are therefore necessary over the entire area, then you can plan where the cable can fall. The marine environment is not studied as well when compare to on land. There is a lack of morphologic, biological, or detailed cartography maps, therefore the starting point is worse than when compared to on land.

Social impacts - commercial fishing is an issue. Fishermen say that cables are a major impact, but there is no information to argue against this or to confirm the fishermen's point of view. If there is a problem with fishermen or tourism there is no information. There is information on seagrass, mammals etc and there are laws about these topics. However relating to social there is no basis or laws to work from.

Environmental impacts are translated from the impacts on land, and they are not the same.

- Noise – noise is an issue for electric lines on land however in the sea this is not an issue as there is no noise, yet the administration insists that I must know the noise emitted by the subsea cable.
- Electric fields – on land there are electromagnetic fields but in sea cable there are only electric fields and they ask for electromagnetic fields, this is different. The cables are buried down to 1 m, so electric fields aren't a problem.

These impacts are translated from land based assessments, and you have to spend money and time researching them when they are not relevant. On the other hand, e.g. sea grass is a priority habitat, and is therefore avoided. Or mammals, discussion with administration over the installation of the cables, administration say the cable may affect the mammals, while the boat is going very slow and mammals are just curious.

NGOs think there is a big impact will marine mammals but there is nothing in the construction or the maintenance of cables. There is no noise or electromagnetic field, therefore marine mammals are not affected.

We can draw conclusions on the impacts of electromagnetic fields and noise. We don't have the studies in the marine environment on the electric fields or noise from subsea cables, but we can draw some conclusions from on land studies as the emissions are the same. We don't have enough studies in sea cables but there are studies on land.

Q4 **What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?**

See above

Q 4 (A): **Have you experienced these gaps on projects you have been involved in? (which) ?**

Studies are carried out with the knowledge gaps, nobody has this knowledge which is an issue when you are trying to explain the impact. E.g. we are affecting sea grass fields, and I propose a corrective measures but there is nothing appropriate available to suggest, so we are starting a project in the company to recuperate the sea grass fields. When I present the EIA to the administration, I don't suggest a specific corrective measure, I say that we are doing research and if the results are positive we will do this corrective measure. On land there

are studies that support the corrective measures. In the marine environment there are no such studies. The administration want to know whether the measures will work or not.

Q 4 (B): What knowledge gaps do you think should be prioritised for future research?

Electromagnetic fields and noise – have to study to determine whether it's actually important.

Social impacts, tourism – in Majorca construction doesn't stop for animals but it does for summer time. Fishing is another important gap as well as marine species, although these are studies better.

Q5 In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?

Benthic species are most important. Followed by any priority habitats. Marine mammals are not so important. Pelagic animals are not particularly impacted.

Q5 (A): Why do you think this (in response to Q5)? What experiences have brought you to this conclusion?

Q6 Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?

Commercial fishing – you make a reserve where they can fish. They cannot demersal fish, fishermen demand compensation for the loss of fishing grounds. So you have to study which fish are present in the area and at what time. If the fish are present all year round or just one month. These things are all site specific as well.

Q6 (A): Do you have experiences with this from specific projects?

Q7 Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?

Not really – when the EIA is complete the results are used to monitor the marine environment and to check the impacts.

Peninsula-Balearic islands , the cable is 15 yrs old. Now the area is better than before. So we monitor the area and improve it because it is now protected. They cannot fish, benthic species aren't disturbed by fishing.

Not aware of any case where the subsea cables themselves have been used to monitor the marine environment. I think this is an opportunity by I don't know how it would happen.

Q8 What tools could help to reduce environmental and permitting difficulties?

Improving the construction technology – two or three companies who create the equipment. To reduce the width of the trench is important, really research the marine environment. Communication and experience exchange between different projects.

Q9 Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?

First steps is this project. Reach a consensus on what are the important environmental impacts. E.g. Noise how do you measure it, what are the corrective measures. List this environmental impacts that are associated with sea cables. Differentiate between land cables and subsea cables. Specific guidelines for sea cables.

Second aspect is the technology of the trench cable, two constructions using different technologies, one is supposed to be better because it is improving but in the end it effected more. The technologies are too varied.

Q10 What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?

The north sea is quite shallow, and it has a history of oil platforms and now there is wind power. I don't think sea cables will be a significant change , as the north sea is quite busy. More difficult to protect the cables, to have a place to move boats. An issue is going to be the coordination between countries, to allocate areas to certain activities. At the moment certain industries may clash.

Interview 6 details (11/12/2015)

Anonymous

Q1 What environmental assessment processes have you utilised, been engaged with or are aware of recently?

Historically involved in consenting, environmental studies and assessments for the last 15-20 years. Originally telecoms cables and then from the early days of round 1 (OWF) to round 2 (OWF) projects, in terms of cables.

Q2 How effective were the environmental assessments described in Q1?

And how could they have been improved?

In the last 5-10 years we have seen the scale of environmental assessments increase in size, scale and content, and this is mainly driven by the increase in regulations. Nothing has changed in terms of those cables being installed in the sea bed, what has changed is the appetite and the need for involving everyone possible. We have as an industry have generated excessive amounts of information and what may or may not happen when you place a cable on the seabed, we still lack post-construction monitoring which seems to get less attention. It is very clear that in the majority of cases cables on their own do not require EIAs. When they are linked to generation assets, then they get included in that EIA process. I quote from DECC (2014) that electricity submarine cables do no fall within annex 1 or annex 2 of the EIA directive and do not normally require EIA. We need to take a pragmatic look at why are we writing reports such as air quality and health and waste management for submarine cables. It just seems excessive and unnecessary, we live in this fear of screening out impacts at various stages of the project.

On a planning inspectorate project, we were unable to screen out transboundary waste impacts from a project, and this doesn't seem proportionate. I feel strongly that the precautionary principle is misunderstood in terms of application to real world projects.

The more research projects go on the more there is the perception that there is a large impact from submarine cables. If cables are put in the right place there should be no significant environmental impacts.

Q3 Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables

I think we have a very good understanding of the short term, temporary and near effects of installing cables. These effects are extremely short-term in nature. The operational long-term impacts in the vast majority of cases are negligible in the context of the wider environment and other infrastructure. I am not saying there are no impacts, just that the impacts that can be measured are negligible and simple mitigation can be put in place.

Q3 (A) What are your experiences / your reasons for highlighting these environmental effects?

Q4 What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?

I don't think there are any major gaps. There is an appetite driven by the research and consultancy industries, there is an endless list of reports on the potential impacts of EMF from cables on marine receptors and you can carry on doing research on it and there is always an issue as you are dealing with mobile species, different cables specification and cables impacts are very difficult to measure under a controlled environment, so there will always be an appetite to do further work on this. At what point is the regulatory authority going to be satisfied. Fundamentally we do have a good understanding of the marine environment and the potential impacts, whether it be sediment plumes from jetting tools or EMF effects on elasmobranchs, or commercial fisheries impacts – we do have a good understanding but I think there is a reluctance to draw conclusions.

No one wants to issue a licence that contravenes a European Directive, so conditions are placed upon the licences which usually involve a monitoring exercise with non-conclusive findings. The licence condition reports never really see the light of day and these are the most important in terms of feeding back to environmental reports supporting applications..

Q 4 (B): What knowledge gaps do you think should be prioritised for future research?

See above

Q5 In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?

Elasmobranchs species, Sabellaria being another favourite of certain regulatory authorities, salt marshes, eel grass beds, mussel beds – precautionary principle says we aren't quite sure how long they will take to recover. Commercial fishing always comes up, trawling gear might snag.

Q6 Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?

No. The regulators are sensitive to certain species and habitats but I don't think cables provide any particular problem.

Q7 Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?

I'm not familiar with such systems, but have heard of systems in cables that are used to monitor vessel AIS tracking with associated trigger alarms.

Q8 What tools could help to reduce environmental and permitting difficulties?

Something that avoids reinventing the wheel every time an application comes in. A library of standardised information available to everyone that can be referenced within an application. So when it comes to e.g. shipping impacts during installation, here is the standard management procedure when going about their interface with the authorities. Rather than trying to reinvent something.

I would like to see standardisation and acceptance of the environmental impacts that have been monitored or are understood by the projects, to avoid this high volume and unnecessary amount of information that goes into applications. When in UK waters cables should not subject to a full EIA.

Q9 **Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?**

Going to back to standardisation of management plans or mitigation procedures, rather than going out and finding a benthic organism which may or not be impacted by submarine cables. I think some clear guidance from the UK authorities on environmental impacts but notably an acceptance that some things can be screened out. Stronger screening processes, a bolder approach from the operators in regards to the environmental impacts to spend more energy on managing the installation process correctly.

Q10 **What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?**

Fully supportive of the expansion. When it comes to interconnection alone, it has its own target of 10% by 2020. When it comes to interconnection of OWF projects the difficulties will be that the projects have to have certainty on their grid connection, it's going to be difficult to change that mind set and the interconnection of projects completed on different timelines will be difficult. You are going to need a separate organisation to take on this risk. You will never get investment on interconnection between two projects that haven't been built yet, it is the timing of building this grid between projects which will be fundamental. A project isn't going to reach a financial decision if they are reliant on third parties to provide connections on a different timescales.

Interview 7 details (9/12/2015)

Name:	Clive Fox
Position:	Senior expert
Organisation name:	Scottish Association for Marine Science Scottish Marine Institute
Organisation category:	Academic
Email:	Clive.Fox@sams.ac.uk

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

Baseline assessments on fisheries for offshore renewable projects, all wind, wave and tidal developments.

Involved in the collection of primary data along the cable route, fisheries survey using beam trawling.

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

In relation to cabling, the assessments are generally adequate. Most of the impacts are not from the cabling aspect of developments (referring to offshore energy infrastructure).

Q3 **Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

There are some gaps in understanding. One of the things that seems to be happening in Scotland is that some of the companies are being request to go for burial by the regulator and is mainly driven by fishermen who want to be able to tow over cable routes. The push for burial of cables doesn't have an environmental benefit. In those cases where cables cannot be buried protective measures need to be implemented, and the impacts associated with the introduction of such structures are not well understood.

Q3 (A) What are your experiences / your reasons for highlighting these environmental effects?

Impacts on fish are not particularly well understood, but for most cables is hard to say that the impacts are going to be substantial. They are relative impacts in comparison to other underwater infrastructure, for example underwater turbines will have a more significant impacts than cables. When looking at EIAs of offshore energy infrastructure you tend to look at relative impacts of the whole system and tend to focus on major ones, of which cables are not normally included.

The installation of cables is also quite disturbing but is temporary (7-10 days) and the likelihood of recovering is quite high (some weeks) and then the cable operates for 15 years. So it is important to take into account these temporal scales in the assessment.

Q4 What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?

EMFs generation. Potentially this could have impacts if cables run through migratory routes of elasmobranchs, which can be sensitive to this. We don't know much about how common and flapper skate behave in response to the presence of subsea cables and EMFs generation, whether they act as a barrier or not, and future research should focus on this.

Q 4 (A): Have you experienced these gaps on projects you have been involved in? (which) ?

It has come up as an issue in cable projects crossing the Sound of Jura, which is designated as a MPA for common skate. Migratory routs are also not particularly well understood, which would include salmonids, eels, common skate. There has been a bit of tagging work done and there is some idea on how common skate moves but it is not comprehensive.

Q 4 (B): What knowledge gaps do you think should be prioritised for future research?

See above.

Q5 In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?

I am not aware of any of these issues causing the rejection of consent, but it is something that tends to come up in the scoring matrix of the projects, particularly in areas in the West of Scotland.

Q5 (A): Why do you think this (in response to Q5)? What experiences have brought you to this conclusion?

n/a

Q6 Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?

Most of my experience is with the Southern west of Scotland where the habitat is rocky, often in quite high energy areas so the amount of organisms is somewhat limited. In softer sediment areas this may be different, but I don't have much experience on those.

Q6 (A): Do you have experiences with this from specific projects?

Q7 Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?

I am not aware of any science where that has been done, although it has been suggested that it would be a useful thing to do, particularly given that most of the infrastructure used is quite expensive so it could be used to gather environmental/biological data for monitoring within the site or wider ecosystem base. Careful consideration should be given to the type of data to be targeted by these instruments. There are UK subsea committees that could be used to consider this. The data to be compiled would also have to be coordinated.

Q8 What tools could help to reduce environmental and permitting difficulties?

The area where people struggle a lot is in the assessment of cumulative impacts. We don't really have particularly good tools or approaches for assessing cumulative impacts. Guidance only states that you consider them but doesn't really specify how to do it. Approaches tend to be developed on a project-by-project basis and potential cumulative impacts are not really taken accounted for.

It is an area which is difficult to get a handle on because there is not an accepted methodology for approaching it. People are on a project-by-project basis saying, oh well, we are aware of these X projects in the pipeline and there may be an extra impact. So the tools are not really there to assess what the impacts of all these projects working together. A collaborative approach should be taken to develop these tools, and perhaps also consider how other industries have addressed this issue, such as oil and gas industries.

Q9 Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?

From the cost point of view, the cost of burying cables in the future is going to be quite high. Some look into whether there is an actual harm into leaving cables on the surface. If regulators insist of them being buried, it should be clear that is chosen form a safety perspective and driven by the fishing industry, who are not actually going to bear the cost of these burials. Trade off analysis would be useful.

Disposal of cabling is also an issue. Traditionally when they had to replace a cable they would leave the old cable in situ, however, there is increasing pressure on removing old cabling, which has high associated costs. Some work may be needed to check whether this is a sensible thing to be doing or whether leaving the old cables where they are as any actual impacts. Sometimes there is no justification for some actions to be requested by regulators, particularly from an environmental perspective.

Q10 What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?

See above.

Interview 8 details (1/12/2015)

Organisation: TSO

Position: Senior expert

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

Provision of technical environmental advice to subsea cable industry for the las 15 years. High Power lines.

Involved in Peninsula and Balearic Island DC link, currently in service.

Links in Balearic Islands: Majorca-Ibiza AC link project started in 2011 and is currently under constructions. Ibiza-Formentera AC link actually in study stage. Majorca – Menorca AC link project, for which an EIA was submitted, has been consented by the Ministry of Environment.

Links in Canary Islands: Lanzarote - Fuerteventura and Tenerife – La Gomera AC links, are both in planning stage.

Ceuta – Cadiz interconnection crossing the Gibraltar strait for the second time (1st time between Morocco and the Peninsula).

REE are currently looking at the connection between Spain-France crossing Bay of Biscay.

Some of these AC and others DC depending on the length or the power capacity.

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

EIAs completed have been very interesting and useful for the construction and monitoring phase.

Q3 **Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

The submarine environment is far more unknown than the terrestrial, requiring extensive marine campaigns. Coastal areas are better characterised.

The impacts of fishing on subsea cables and the impacts of subsea cables on seagrass beds, as well as impacts caused by EMF are often targeted by these EIAs, although not necessarily well understood. Beneficial impacts of the infrastructure on fish populations and protected areas are not well understood.

The fishing sector has been found to be a constraint during data gathering exercises. Fishing areas with interests in species that live at the seabed have been a specific problem, although this is less of a problem when cables are proposed to be buried. Although in the Mediterranean bottom trawling has proved to be a challenge, in the Bay of Biscay we are working closely with fisheries interest groups to find solutions.

Q3 (A) **What are your experiences / your reasons for highlighting these environmental effects?**

The impact of the cable to seagrass meadows in the Mediterranean Sea very important to keep in mind. It is necessary in the event of an impact study effective measures of compensation and / or restoration of these priority habitats. We are making significant efforts in this area

We had to carry out specific studies with target fishing species such as the case of Blackspot seabream (Pagellus bogaraveo) in the Strait of Gibraltar. It has also been necessary to argue when we went through some fisheries in the Mediterranean if they are trawling

Q4 **What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?**

Positive effects from the servitude of the cables on the conservation of habitats and species. Effect of ecological connectivity between natural areas and green corridors. Type studies to shed light on EMF of subsea cables emissions.

Q 4 (A): Have you experienced these gaps on projects you have been involved in? (which) ?

Thinking about how to put them up

Q 4 (B): What knowledge gaps do you think should be prioritised for future research?

To identify types of impacts of subsea cables with the goal of build a reference paper at European level

Q5 In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?

Critical issue we currently face is the justification of impacts on seagrass bed (Posidonia oceanica), a protected species in the Mediterranean. We have spent a lot of money to find a solution to cross the seagrass beds without impacting on them. We collaborate with Universities to find technical solutions, including the growing of this species in vitro in the lab with the aim to be planted

Cymodosea nodosa (called localy “sebadales”) in the Canary Islands is also a critical issue.

Monitoring is also focused on fauna species including: Pinna nobilis (noble pen), which are sometimes translocated and monitored showing really good results

Other species in the terrestrial domain that are in threat or endangered must be considered, as the case of the Mora Turtle in Baleares (Testudo graeca) For example easy measures in this case to minimize the impact

Q5 (A): Why do you think this (in response to Q5)? What experiences have brought you to this conclusion?

Q6 Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?

Same as above

Q6 (A): Do you have experiences with this from specific projects?

Balearic- Peninsula DC interconnection, Mallorca-Ibiza AC interconnection

Q7 Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?

We use an extensive study area for detailed surveying in order to inform the EIA

Q8 What tools could help to reduce environmental and permitting difficulties?

-EIS very well done

-Negotiation with fisheries

-Work schedule to consider tourism peak times

-Cultural heritage sites need to be identified and assessed as soon as possible as these require specific consents for their research. Cultural heritage studies have been very useful to agree on method and alternatives to lay subsea cables on archaeological important sites, and compensation measures.

Q9 **Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?**

Setting up an international group of environmental experts to help on issues that the subsea cable industry faces would be helpful.

Priorities on issues related to habitats, species, natural spaces, fisheries, archaeology and tourism are key issues.

Q10 **What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?**

Important to look at the sea characteristics

Not in a position to give an opinion, limited knowledge of the North Sea

Interviewee 9 details (3/12/2015)

Name:	Fokko van der Goot
Position:	Senior expert
Organisation name:	VBMS (VolkerWessels Boskalis Marine S)
Organisation category:	Marine Contractor subsea cable installation
Email:	f.vd.goot@vbms.com

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

Work as an environmental engineer for a cable laying contractor and a dredging company, of which VBMS is part of. We are involved in assessing environmental requirements for our cable laying projects - reviewing EIAs is part of that, how the outcomes affect our work and how we can involve environmental requirements in design and installation method.

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

For my point of view, most EIAs are related to wind farms, and cable laying as part of the wind farm is considered a minor part and has minor impacts. The EIAs for this purpose are effective, and the cable is only a minor consideration.

Q3 **Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

Q3 (A) **What are your experiences / your reasons for highlighting these environmental effects?**

The work methods that are proposed in the EIA for cable laying are in some cases based on the environmental impacts. However, these proposed methods are not always the most environmentally friendly. There is a knowledge gap in what is the most suitable installation method. Both the impacts of each burial tool and which tool is used for different environments.

Most EIA present model assessments of sediment dispersion related to burial techniques. There is a lack of field data, for example for turbidity measurements around burial methods, the actual footprint of the installation tools, not only during the construction but also the effects on the longer term.

Q4 **What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?**

See above

Q 4 (A): **Have you experienced these gaps on projects you have been involved in? (which) ?**

From wind farm EIAs

Q 4 (B): **What knowledge gaps do you think should be prioritised for future research?**

They are equal in priority.

Q5 **In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?**

The landfall tends to be the areas of main concern. Therefore species associated with the coastal area are of most important. Land fall is the most important because people (general public) can see it and therefore put the most resistance to that stage. Different land owners also are a problem along the nearshore. These areas are often part of protected sites/conservation areas. It would be useful to know how landfalls have been developed / revitalised after the construction has finished.

Q5 (A): **Why do you think this (in response to Q5)? What experiences have brought you to this conclusion?**

Q6 **Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?**

There is a data gap on what species are sensitive to the impacts. During operation there is a lack of information on the species which may be impacted.

Not aware of any. There could also be opportunities. E.g. during the construction period localised impact may occur. However, in the long run habitats could improve due to the changes., From dredging and marine infrastructure projects, we have seen for example that rock protection can be used as a habitat restoration tool.

Q6 (A): **Do you have experiences with this from specific projects?**

Not in relation to cable installation projects. Only in relation to dredging projects related to the offshore oil and gas industry.

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

Cable protected could be used as habitat restoration and this is could be monitored.

Not aware of the cable being used directly, although it would be useful. Difficult as the cable is either buried or protected with rock, I am not sure whether there is an opportunity to collect data. Depends on the purpose of the data.

Q8 **What tools could help to reduce environmental and permitting difficulties?**

Involvement of relevant stakeholders from the start. With offshore wind farms and interconnectors the contractors are only involved at the end of the process, where the processes and methods are already fixed. By involving contractors and other stakeholders you could improve opportunities in the development. The issue is not so much the actual impact because this can be mitigated and managed. The issue is that we need to explain in a very early stage of the project development what is going to happen. I believe that contactors also have a responsibility in this and can definitely contribute to the discussion.

Q9 **Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?**

Lessons learnt from previous projects could be useful for future developments – through open access of data, institutes like RGI.

Involvement of contractors at an earlier stage in the process.

Publish monitoring data from previous projects.

Appropriate best practice documents would be useful.

Q10 **What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?**

It is inevitable that it has to happen. The cumulative impacts have to be assessment, taking all projects into account, instead of having to assess each of them individually and permit them individually.

Interview 10 details (8/12/2015)

Organisation: Regulator

Position: Senior expert

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

Working within the standard framework that each directive provides. Within the Habitats Directive, Birds Directive, WFD, MSFD, within those constraints in relation to planning. When we are making plans, we point developers towards the main considerations of the directives.

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

Challenging at the moment within the current economic climate there is a certain drive for economic development this can appear to come at an environmental cost. However a lot of projects are being compensated for if there is a loss to a habitat (e.g. salt marshes restored elsewhere if a port development removes some of the habitat). So habitat isn't always lost it is just moved, but this takes time.

The structure is good but it could stronger. It is trying to work with it rather than against it, a lot of developers think what is the minimum I can get away with, rather than how can I use this to my advantage.

For example; a marina wants to expand further, but this comes with a cost and habitat is lost. They need to understand that the protection is there for a reason and there is a wider benefit. Looking for alternatives should be considered more, instead of just doing what is convenient or cheapest. And there should be encouragement of positive applications that try to do this – which is what we're trying to do with plan policies.

Q3 **Please can you give your opinion on the current level of knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

Q3 (A) **What are your experiences / your reasons for highlighting these environmental effects?**

There is a real lack of knowledge. When the MCZ process was put in place JNCCs advice said that the impact was negligible, it is a very small area where a cable is installed. There are effects of whatever installation method, but if they are monitored and installed properly then there can be real benefits from cables (artificial reefs) and minimal impact.

The industry is a champion of research into the thermal effects, burial depths to mitigate those effects, also research into reducing EMF and the effect on Elasmobranchs (is it an effect, can we prove it, can we mitigate it). There is a real lack of awareness on the actual effects of cables.

I think there are some misconceptions of the impacts that already exist, I feel the JNCC guidance is quite supportive.

Q4 **What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?**

See above

Q 4 (A): **Have you experienced these gaps on projects you have been involved in? (which) ?**

Q 4 (B): **What knowledge gaps do you think should be prioritised for future research?**

In stakeholder engagement, EMF always stands out and it would be useful to have some clarifying study which says yes there is an effect and potentially kill off the myth, one way or another. You could define a burial depth quite easily and it would help industry as they would know what the costs are. I think there is a general lack of awareness that 90% of data comes through cables, so understanding the benefits of cables would be helpful.

Q5 **In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?**

There are points around EMF and elasmobranchs, but I can't comment further as I don't deal with consenting.

Q5 (A): **Why do you think this (in response to Q5)? What experiences have brought you to this conclusion?**

Q6 **Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?**

Same as above.

Q6 (A): **Do you have experiences with this from specific projects?**

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

I have heard of ferries being used for monitoring, attached with equipment taking water samples looking at water quality etc. There are other types of monitoring equipment put on as well.

It would be interesting to see how it would work for cables and what you would expect them to monitor, I think they could, if you have repeater stations you might be able to place equipment on top of them. If you are burying them it may be more difficult. I think it is a conversation to have with industry are they open to, it will it help them in the long-term, however the benefits would need to be sold to them.

Q8 What tools could help to reduce environmental and permitting difficulties?

Better understanding of what cables do and what there impacts actually are.

If we can maximise the amount of data coming in that would be helpful. We know so little about the marine environment. If industry would be happy to attached a black box to their repeater stations and make this data publically available that would be great.

I could see hydrophones on top of repeater stations – just an idea. Would obviously have to consider back ground effects etc.

Q9 Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?

EMF and temperature – German government are very clear about temperature change, some consistency across this is an issue. Is EMF actually having an effect. Then those standardised studies can be used more widely in policy and development.

Q10 What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?

If you can manage to get all North Sea countries to sign up to it, it will be hugely beneficial in the long-term for renewables and reducing climate change. Getting them to sign up is the issue, who is going to pay for it. Maybe a premium could be placed on everyone who uses the cables to pay into the development of a grid.

If NSCOGI could actually do a bit more it would be helpful. There are several connectors going across the North Sea we should be joining up and trying to save money. It is a sensible thing to do, just have to get the buy in. Need to understand what people get out of investing in it. If we continue to lay cables as we are we will end up with a ridiculous amount of cable. We could reduce this and the onshore infrastructure as well.

The development of a grid would help the cumulative effects with better management of landfall sites.

Interview 11 details (8/12/2015)

Anonymous

Q1 What environmental assessment processes have you utilised, been engaged with or are aware of recently?

Involved in licensing process. Assessment of EIAs for offshore renewables, provide advice to regulators based on available evidence.

Q2 How effective were the environmental assessments described in Q1?

And how could they have been improved?

They generally suffer from being too long. Project developers consider that they should have a broad the scope to avoid missing anything out. They should, however, be more focused.

The scoping process should therefore be improved, and stakeholders involved in the scoping process should be more flexible and willing to consider that some of the issues don't necessarily need to be assessed at a great level of detail and be treated briefly. At the moment it feels that everything is scoped in.

Q3 Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables

If you consider other infrastructures at the sea (e.g. pipelines, of which there are many thousands of km), the impacts of subsea cables compared to those of pipelines are very limited. The unique pathway associated with cables are to do with EMFs but there is little evidence that EMFs actually matter in the field. Published experimental work with salmon and eels in tanks, indicates very little response to AC EMFs.

In addition, having a cable buried, EMF impacts should be very limited.

Main receptor group on which research has focused so far has been salmon, an important species in Scotland, particularly in migratory routes.

Q3 (A) What are your experiences / your reasons for highlighting these environmental effects?

Elasmobranchs have specific receptors that are sensitive to EMFs, there is need for research on whether interactions with cables results in actual effects on behaviour. Experimental work has been carried out at the Ardtoe laboratory around 6 years ago under Crown Estate funding (COWRIE programme). They kept skate and dogfish in tanks with and without electric cables and EMFs and there was no strong evidence that these were affected.

Q4 What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?

Difficulty with potential interactions with commercial fishing activity. It is very clear with oil and gas pipelines, laying on the surface, and therefore subsea cables laying on the surface can also become a key issue with fishermen. If cables are buried that should reduce the potential but if you bury the cable in places where the sediment is mobile, it can become a major issue.

Q 4 (A): Have you experienced these gaps on projects you have been involved in? (which) ?

n/a

Q 4 (B): What knowledge gaps do you think should be prioritised for future research?

Cable laying and fishing. A number of telecom cables to offshore islands has caused quite a lot of exchanges between the installing company and local fishermen.

Q5 In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?

Elasmobranchs

Q5 (A): Why do you think this (in response to Q5)? What experiences have brought you to this conclusion?

See above

Q6 **Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?**

Same as above

Q6 (A): **Do you have experiences with this from specific projects?**

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

This has been discussed. Installation of meteorological masts are a precedent, sensors underwater can also be used. It has been done to a limited extend underwater. Also radars and cameras have been used on marine infrastructure to monitor bird behaviour. Temperature sensors could be used. Sensors for EMF do also exist.

Q8 **What tools could help to reduce environmental and permitting difficulties?**

Effective stakeholder engagement, especially with fishermen. It has been done between developers and specific single interest groups, but simultaneous engagement with different interest groups has been shown to be very effective. It allows different groups to understand the perspectives of other stakeholders and their interests. This also brings additional opportunities for negotiation and trade-offs.

Q9 **Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?**

Look at all user groups, cables crossing cables, cables crossing pipelines. Greatest pressure is in the intertidal area and immediate area onshore. Be careful on cable installation in sensitive zones. The use of directional drilling for deep burying and avoidance of certain sensitive onshore habitats like sand dunes. In some areas, it can be difficult to find suitable locations to bring cables ashore that are not designated or protected in some way (e.g. SAC, SSSI, etc). A lot of issues around how you cross the intertidal zone, important for specific habitats and human use.

Q10 **What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?**

The economic and climate change mitigation case for doing it outweighs any environmental implications. Cumulative impacts are manageable. Unsure whether there are any actual cumulative impacts, even with elasmobranchs.

PCI (EU Projects of Community Interest) system – major infrastructure projects, system to facilitate the creation of international grids, they should encouraged. Strategic planning is a national authority responsibility, as would be undertaken before the project would be considered as PCI. There has to be a decision made on whether we want to reduce our carbon emissions or not. Wonder what is the least bad and what is the biggest advantage

Interview 12 details (3/12/2015)

Name: Ivan Scrase

Position: Senior expert

Organisation name: RSPB

Organisation category: NGO

Email: Ivan.scrase@rspb.org.uk

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

I have not used environmental assessment processes, but I know a lot about them as I completed a PhD on them. I know a lot about SEA, EIA, appropriate assessments (Habitats Directive, HRA), cost benefit analysis, lifecycle analysis.

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

Each one of the tools has different objectives.

I feel the appropriate assessments (AA) are very strong, they are based on a rigorous scientific approach and have a strong legal mechanisms attached. They are precautionary in nature, the authority has to demonstrate that the development will not have an adverse effect on the protected sites concerned within the Natura 2000 network. If they can't establish that, the project either can't go ahead or there are various hoops that have to been gone through, which can be quite difficult. There is a mechanism to only allow sustainable development. Their effectiveness is undermined where protected sites have not been fully designated, which is the case in the offshore environment and where there is a lack of data or adequate modelling. For example, in the offshore wind industry it is not known where the birds are or where they are going or what height they fly at, so the modelling is fairly crude.

EIA – that is effective in it is used with the right intentions to identify the method of least environmental effects and good mitigation measures., If it is used as a 'tick box' exercise then it is ineffective. Its ineffective in its findings are ignore. It, doesn't have the strong legal mechanisms attachments to it to prevent the most damaging developments like AA. It has the advantage over things like cost-benefit analysis that it is based on real information and looks at the environment in natural science terms. Cost-benefit analysis is based on economic preferences. Life-cycle assessment and cost benefit analysis tend not to have the legal framework around them. CBA is used a lot in grid planning but the consideration of the environment is negligible. It is very hard to put a money value on biodiversity. In my experience, with life cycle analysis the methodology can be altered to produce whatever result you want.

SEA is often not so effective, but has the potential to be and occasionally is. The main problem is that there are a lots of exceptions that allow plans and programs not to complete an SEA. In the UK we don't have legally binding grid development plan. We have the Ten Year Statement, which is just a look at the future with no legal requirements for SEA therefore one isn't done. Most other EU states they do SEA or national grid plans but I am pretty sure in most of those there aren't any major consideration given to nature conservation. The reason for this is that they feel until you have decided you are going to connect points A and B, it is too early to think about what is in between points A and B. That is the thinking within the UK, you could do proper SEA or proper strategic AA and use this to identify where the consenting risks are greatest, but DECC and the industry say we have to do it when we propose a project so why do it twice, which I think is crazy because you then go in blind. OWF in the UK have been altered or changed because they have found out there are huge aggregations of seabirds that no one knew were there.

Q3 **Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

Q3 (A) **What are your experiences / your reasons for highlighting these environmental effects?**

Knowledge is reasonably good. Cabling has been going on for a long time. OSPAR have reviewed the impacts. Subsea cabling has been going on for a long time, quite a lot is known about the sediment movements and how to carry out subsea surveys, how to avoid coral. Things like EMF effects on fish seem slightly speculative. There seems to be some debate around EMF.

Impact on intertidal birds is small if a good location is chosen and the correct time of year, when the birds aren't using it. It is a good idea to involve local ornithologists – instead of just an EIA consultant. If you go through soft sediment it will heal very quickly. But I understand there are a shortage of sites where it is that easy – end up using HDD, don't know the impacts of this. There may be an issue when we come to the limit of areas where we can install cables, and a limit to the development of onshore infrastructure.

The exclusion of other activities may be a good thing. Dredging is a disaster for nature.

Q4 **What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?**

See above

Q 4 (A): **Have you experienced these gaps on projects you have been involved in? (which) ?**

Q 4 (B): **What knowledge gaps do you think should be prioritised for future research?**

Surveying of the seabed, so habitats can be taken into account in the first place. Although cost will be a factor here.

How to reduce the number of landing points – an integrated offshore grid would bring together the cables offshore. Certain cables can only carry so much power, research could focus on how to improve this.

More research into coordinating seabird surveys to find out where they go during the non-breeding season. The data currently used is quite crude, with large gaps. This would help identifying the correct timings for work.

Q5 **In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?**

Q5 (A): **Why do you think this (in response to Q5)? What experiences have brought you to this conclusion?**

Q6 **Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?**

Offshore reefs, are always advised to be avoided. Not sure about the effects on fish, but I imagine there isn't much impact. There may be an impact on cetaceans from noise.

Q6 (A): **Do you have experiences with this from specific projects?**

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

Not aware – great opportunity. We have very little knowledge about what is out there. You have this linear transect, which could be an amazing opportunity to look at temperature, salinity gradients, cetaceans passing over the different connectors.

Q8 **What tools could help to reduce environmental and permitting difficulties?**

Not sure how much permitting difficulty there is. Cables are in Annex 2 of the EIA Directive so in some MS there is no requirement for EIA, although developers do something equivalent. Maybe it would help if it was listed in Annex 1 because the level of consistency would be increased in how data is collected or across borders, coordination among the authorities. It would help to improve coordination between the authorities and bring some common methodologies into what is being done.

EIAs tend to be forgotten once consent is given. This is a pity as large amounts of valuable data are never shared, and there is a lot of reinventing the wheel.

Q9 **Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?**

Subsea cables are a benefit in assisting the development of renewables and tackling climate change, and limiting dredging. I think there is a priority for developers to work with the shipping industry and fishing industry to try to overcome cable objections. I think environmental NGOs aren't the issue for cabling, its more shipping and fishing industries. It's the impact on peoples livelihoods that may be the bigger issue.

Q10 **What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?**

Cumulative effects is about how many landing points, the integrated grid is important due to the effect it would have onshore and in the intertidal areas. My greatest of concern is climate change and therefore subsea cabling is good, the important thing is to plan it well and ensure it part of a move towards a European renewable energy system. Minimising impacts is important to protect nature and to help with public acceptability.

Interview 13 details (10/12/2015)

Organisation: Consultancy

Position: Senior expert

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

EIA for interconnectors (Western Link and Moyle) and export cables associated with offshore energy developments. Focusing on EMF effects.

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

Specifically in EMF the knowledge base is poor and there are a lot of knowledge gaps, making difficult to make any final decisions. We know that a number of organisms are sensitive to electric and electromagnetic fields but there hasn't been enough research to understand the actual impacts.

Q3 **Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

There was a vast amount of research on EMF through the COWRIE work but this didn't lead to major conclusions on EMF. It is known that EMF affect elasmobranchs, sharks, rays, skates, which are considered the

most sensitive receptors to EMFs. EMFs may also affect migratory fish, and potentially marine mammals, but further research should be undertaken to clarify this.

Heating effects are currently being debated, there is uncertainty of the effects of heating by subsea cables.

Q3 (A) What are your experiences / your reasons for highlighting these environmental effects?

When working in ES, it is difficult to argue the potential for effects caused by EMFs given the limited availability of evidence available, however, ES try to focus in mitigation measures, taking a precautionary approach and proposing means to reduce any potential effect. Examples include:

-Interconnectors usually use a bipole design, the closer you can put those two cables together the less EMF would be emitted, if they can be bundled in the same trench, EMF can be reduced significantly. Trade-off between whether it is feasible from the engineering perspective and the environmental / navigation perspective.

-Burial doesn't stop magnetic fields reaching the sea, and you also get electric fields induced by the magnetic field. However, it will prevent some organisms to interact with the strongest fields.

Q4 What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?

See above

Q 4 (A): Have you experienced these gaps on projects you have been involved in? (which) ?

See above

Q 4 (B): What knowledge gaps do you think should be prioritised for future research?

Within EMF, there hasn't been enough field research. EMF effects known are based on theory and we don't actually know how EMF can affect the behaviour of different species.

For example, elasmobranchs may be attracted to small electric fields, they may confuse the electric sources for food, and equally for stronger fields they may be repelled. Field behavioural studies would definitely be beneficial.

Q5 In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?

Opinions on this issues have changed overtime. Significant concern on elasmobranchs could be seen a few years ago but it has shifted to marine mammals, fish and noise, etc. Migratory species are also considered of great concern.

Q5 (A): Why do you think this (in response to Q5)? What experiences have brought you to this conclusion?

N/A

Q6 Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?

Installation of cables is the activity to be considered most disturbing to habitats, causing habitat removal, and increasing in the amount of suspended solids. However, these effects are considered to be localised and temporary depending on type of sediment. Coral reefs, for example, find it difficult to recover.

Q6 (A): **Do you have experiences with this from specific projects?** N/A

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

I haven't heard of this. I have always wanted to use camera traps to record the behaviour of electro sensor species. Difficult to find funding or find the developer willing to do this. The government national policy statement (EN-3 doc) advises that EMFs shouldn't be an issue as long as the cables are buried but it only references a project that used a 3kV cable, whereas subsea cables now use 130-500 kV cables with potential to increase capacities in the future with new technologies.

Q8 **What tools could help to reduce environmental and permitting difficulties?**

Better data, better government guidance. Better communication between different sectors: consultants, the industry, the government to disseminate the better data more broadly.

Issues with local fishermen, cables and wind farms affecting their fishing areas. Fair amount of mistrust.

I haven't heard fishermen are concern about the physiological effects of subsea cables, they are more concern about the exclusion of their activities by subsea cables and associated infrastructure, and the effect of the cables on the presence of fish, which may be repelled, or acting as a barrier.

Q9 **Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?**

Increasing research, getting more data. From the EMF point of view, case of more research and better data, increase understanding.

Q10 **What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?**

Expanding rapidly, becoming a complex pattern. We need to get on top of these uncertainties. Subsea cable crossings, and cumulative effects may become important.

CIA less easy to address but from the point of view of EMFs you need to make sure that cables cross each other perpendicularly so you don't get interaction between the different cables EMF. The distances aren't great, hundreds of meters rather than kilometres.

Interview 14 details (30/11/2015)

Organisation: Other – European convention organisation

Position: Senior expert

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

Not involved in individual EIAs, involved in best practice guidelines, all the countries in the North Sea and north east Atlantic. We agree a common position which is brought through into the national legislation. 2014 guidelines – which help to sculpt national EIAs and SEAs within their own waters.

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

Not in the best position to answer this question. The focus is at the regional scale, and cumulative impacts, rather than individual parts or EIAs for projects.

Q3 **Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

The OSPAR guidelines are a good start in outlining what the impacts are.

Q3 (A) What are your experiences / your reasons for highlighting these environmental effects?

Q4 **What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?**

The OSPAR guidelines outline knowledge gaps e.g. the impact upon benthic species and communities from sediment temperature increase, electromagnetic fields on fish and mammals – studies are rare and contradictory, regeneration period and capacity of particular habitats (mudflats, reefs), noise levels produced during cable burying proceeding and how they affect the area.

Q 4 (A): **Have you experienced these gaps on projects you have been involved in? (which) ?**

N/A

Q 4 (B): **What knowledge gaps do you think should be prioritised for future research?**

Not sure I can really say. Some are being more actively worked upon – underwater noise because of its inclusion in the MSFD, maybe not so much on the cable development side, in terms of wind farm pile driving. We will be looking at monitoring impulsive and ambient noise. Noise will get the most focus.

Q5 **In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?**

Specific species highlighted in the guidance that should be taken into consideration, sharks and rays particularly can be effected by EMF.

Q5 (A): **Why do you think this (in response to Q5)? What experiences have brought you to this conclusion?**

Q6 **Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?**

The most affected are benthic species through the actual disturbance of cable laying. But still knowledge gaps on EMF on fish and mammals.

Q6 (A): **Do you have experiences with this from specific projects?**

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

No not currently, perhaps within the Oil industry where they have used surveys of pipelines to gather biological information, but I am not sure of any kind of on-going monitoring.

Not aware of any case where the infrastructure directly has been used to collect environmental data. It would depend on what type of information you are trying to gather, general environment data or data on the impacts of the cables. Many factors involved to develop a program, location. Most monitoring data we look at involves samples e.g. contaminants sampling is done within the sediment or biota, noise you wouldn't want to put the equipment next to the cables in case it effected the recording. Perhaps fixed stations for water temperature. Not sure how that would work.

Q8 **What tools could help to reduce environmental and permitting difficulties?**

More detailed sharing of cable routes or planned routes and the information collected during the EIA process – I know it's difficult because not all companies what to share the details. But I am not directly involved with the EIA process.

Marine mammals could be a key issue for cumulative effects in regards to impulsive noise and construction. If you hugely increase the amount of cabling there can be an effect on fish species, sharks and rays. There will be a lot of cabling going in on at a different scale as before.

For cumulative effects – we don't have specific data on wind farm turbine locations or the exact cable locations. We don't have an accurate map of all the new and planned cabling that is going in, making it difficult to look into the cumulative effects. Companies don't want to share the exact position of cables because of worries the cables will be damaged or deliberately cut, commercial confidentially. Some are released, some are just in schematic form. Communications is one they don't want to give out, I think it will become more regular that they just provide the GIS data.

Q9 **Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?**

As long as everyone follows best practice in terms of laying the cables. Getting a clear overview of where the cables are going, that would help .

Q10 **What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?**

No opinion at the moment. Need to look at the cabling against the impact of renewable energy generation. I think as long you can minimise the impacts as much as possible, it is something that is very necessary.

I think when we look at renewable development the impacts of the wind farms and the construction are the main factors we are looking at rather than the cabling impact.

Interview 15 details (3/12/2015)

Organisation: TSO

Position: Senior expert

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

Involved in subsea cable planning, environmental assessment procedures for the licencing.

Involved with the Cobra Cable between the Netherlands' and Denmark (Dutch, German and Danish waters) and the NordLink Norway to Germany (German, Danish and Norwegian waters).

Q2 How effective were the environmental assessments described in Q1?

And how could they have been improved?

They have been effective, they are obliged for the permit procedures. In every jurisdiction, there is a permit process and they all require an environmental assessment.

The aim is to obtain a permit, so in relation to data collection, if the assessment is enough to meet the condition and requirement for each authority then the assessment is effective. The requirements differ between countries and authorities, so all comparable parameters, scope and details are also different between procedures.

Q3 Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables

Q3 (A) What are your experiences / your reasons for highlighting these environmental effects?

Limited still, especially when it comes to the real impact parameters – it is based now on expert judgement.

Q4 What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?

When talking about impacts on mammals due to subsea noise, there are many ideas on it, but I don't think there is a real scientific based for a clear effect or for an environmental impact assessment.

The impact assessment on the seabed, the square meters of the footprint of the installation tool is multiplied by the length of the route to measure the impact – is this a scientific basis for quantifying the environmental impact?

The trencher itself has gliders or track which can be positioned outside of the trench, a total of 15 m wide (7 m each side). It can be argued that it is only the impact of the track and the trench not the full 15 m. Lack of clarification on the extent of the footprint. No standard on how this is to be calculated. The footprint is then calculated as a negative impact along with a high compensation fee, millions of euros more than compared to a smaller tool, when it results in the same impact extent.

Recovery of the seabed, we compensate for nature. Assuming the environment is destroyed, the environment may be able to recover quickly – in 1 year the environment may have completely recovered.

Q 4 (A): Have you experienced these gaps on projects you have been involved in? (which) ?

As a basic rule we calculate the square meters and pay for it, but the mind-set of the public is that we are going with a machine to destroy the seabed. Compare to demersal trawling fisheries, one trawling run will have a higher impact than the installation of a subsea cable.

Q 4 (B): What knowledge gaps do you think should be prioritised for future research?

The priority is the impact parameters of the installation tools – that is the basis that need to be investigated.

Secondly, the heating of sediment. In Germany the 2 K criteria, the 20-30cm of seabed from the surface is not allowed to increase in temperature by 2 K because of environmental protection. In my view there is no scientific evidence to support this. We need to measure this temperature afterwards to ensure the 2 K is complied with. This is also influencing cable design and burial depth, as a result it may be installed deeper which raises questions over whether it is needed, whether there is more environmental impacts with this.

Q5 **In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?**

Seals in the Wadden sea – they are critical as they have a large amount of public attention. Particularly during breeding season.

Other mammals common in the north sea but also sensitive to noise.

Q5 (A): **Why do you think this (in response to Q5)? What experiences have brought you to this conclusion?**

Q6 **Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?**

Reef area in the North Sea, which have a higher protection level for cable installation. It's a matter of definition where the boundaries of the reefs are. Once defined then you need to minimise the impacts even more in the reef areas. You are only allowed to impact less than 1% of the reef area.

Q6 (A): **Do you have experiences with this from specific projects?**

Definitely because of reefs we need to avoid reef areas. If this isn't possible we have to find technical solutions, with other installation tools to minimise installation impacts.

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

No. This is an opportunity, this would be very good. It's a matter of setting up an environmental monitoring programme by the authorities and NGOs, together with TSOs, to define the scope. Then I could imagine the frequent surveys of cables during the operational phase, to monitor the cables burial depth etc. This could be combined with ecological monitoring.

Q8 **What tools could help to reduce environmental and permitting difficulties?**

Public acceptance is needed. The focus is always on hotspots of cable installation, but what is missing is the benefits of cabling. Wind connection to the grid, I see a lot of benefits. The balancing of the development impacts together with the more general benefits is missing within the discussion.

The balancing the interest of interconnectors versus nature interests and shipping interests. Now, shipping interest are seen to prevail in planning priorities and one could look into more detail the shipping safety risk posed by subsea cables, which is exaggerated.

Q9 **Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?**

Priority number 1: The scientific standards of the environmental impact of installation tools.

We need a program to develop these standards.

Q10 **What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?**

I think the benefits of a North Sea cable network is outweighing the environmental impacts. There is economic and environmental benefits to the development of a North Sea cable network – removing coal power plants [through the development of renewable energy].

Interview 16 details (3/12/2015)

Organisation category: Consultancy

Position: Director

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

With regards to cables and pipelines, EIA and post consent environmental monitoring – Project Nemo, delivering consent and leading negotiations with stakeholders and consultees on behalf of National Grid. Otherwise, involved in offshore renewables for approximately 10 years, including site selection, prospecting, EIA, development and construction.

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

Pretty effective – the potential environmental effects are generally less (spatially and in terms of level of impact) than those for e.g. an offshore wind farm – so the environmental statements should be shorter and more targeted. Very important that the stakeholders are aware that it is just a cable, not a wind farm, no piling.

The environmental assessment is needed as it is essential that any project has its environmental effects properly considered. Key to highlight it is just a cable, there aren't large scale effects (such as avian collision or marine mammal displacement) like there are with offshore wind farms. Only short term impacts during installation. Once operational the only potential effects are associated with obstruction, such as for dragging anchors – and there a number cables on the seabed anyway, a number of obstructions that have the same impact.

Q3 **Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

Generally pretty good.

Certain areas we need to stop focusing on. Key things I have discussed with CEFAS is EMF. When I worked on Thanet [offshore wind farm] 2008, we had to produce a post-consent document on how EMF is potentially going to affect elasmobranchs and other sensitive species. It concluded there is a very small scale and localised effect. We had to do a very similar assessment on Lincs [offshore wind farm] and Race Bank [offshore wind farm], and on Nemo [interconnector] there was a very similar exercise. It says the same thing. We could do with not looking at this anymore. We need guidance saying these things aren't a consideration anymore, there is no point spending hundreds of thousands of pounds on benthic assessments when we know there is going to be no long-term impacts.

Incorrect significance placed on the impacts, which is common across a range of industries. We need to focus on what are the key issues, rather than what are all the issues.

Q3 (A) **What are your experiences / your reasons for highlighting these environmental effects?**

Q4 **What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?**

I think we probably know the effects of the cables. There aren't a number of long-term significant effects. If you are installing it through a beach or a mudflat, there will be a short term adverse effects on the communities, but after 5 years this isn't noticeable. In the offshore environment there is only a small impact, no significant effects on birds or marine mammals. I think we have a good handle on the effects

Q 4 (A): **Have you experienced these gaps on projects you have been involved in? (which) ?**

Q 4 (B): **What knowledge gaps do you think should be prioritised for future research?**

We have reasonable understanding. The effects of cables buried over a long period of time needs to be looked at, we aren't in the position where cables have been buried for more than 100 years, but that is something that can only happen over time. Concerns have been raised in Germany surrounding leaching, but this is thought unlikely with the majority of subsea cables installed now, as the shrouding is particularly robust and therefore relatively inert.

Q5 **In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?**

Not really – there are is with habitats like Sabellaria (species), undue importance placed on things like Sabellaria reef, even though it is endemic across the North Sea. There is too much emphasis on avoiding the impacts on Sabellaria, when impacts such as storms are much larger.

Q5 (A): **Why do you think this (in response to Q5)? What experiences have brought you to this conclusion?**

Q6 **Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?**

Sabellaria is probably one of the most sensitive species but the overall impact is almost negligible long-term given the fluctuations in the marine environment. Eel grass beds, maerl habitat etc but short term impacts.

Q6 (A): **Do you have experiences with this from specific projects?**

Thanet we had Sabellaria within the array and micro-sited around it. We also had to maintain a set distance from aggregation. Race Bank planned to bring the cable through The Wash, which also had Sabellaria aggregations. In addition to the known areas of reef, 'Sabellaria boxes' which were identified by Natural England as areas with high Sabellaria potential (noting potential, not recorded occurrences), which we had to avoid – which seems particularly unscientific.

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

Not really.

Anything that puts undue cost on the development ultimately affects the consumer so you have to be very careful with collecting data for data sake. Anything that is done has to be done properly with a cost consideration.

Either you put the cost up at one end or you cut down on what is being spent.

Q8 **What tools could help to reduce environmental and permitting difficulties?**

EIA – needs to be focused on the key issues. More effective scoping, the offshore industry in general isn't 'bullish' enough with scoping. We need to say there is no effect and that we are not looking at it, and get regulators and advisors to buy into that approach.

People are scared over the acceptance of nationally significant infrastructure EIAs (i.e. those being submitted to PINS) and therefore go over the top to ensure acceptance.

Q9 **Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?**

A review of EIS for subsea cables, look at issues that can be scoped out, look at issues that can be focused upon, agree this with regulators and advisors. Comments from JNCC and Natural England, on Project Nemo, asked us to put marine mammals observers in place around the cable installation vessel because it is good practice when installing offshore wind farms. There is no piling with cable installation, therefore it is completely disproportionate – yes its good practice for monopoles but not for cables and so there needs to be a 'guide' for inexperienced regulators.

This should happen pan-European. What tends to happen is that e.g. the Germans are dealing with noise through bubble curtains, UK SNCBs try to implement a similar approach to mirror best practice. A common approach would make things easier.

With Nemo the requirements that need to be met across UK, France and Belgium were very different. UK required a marine licence and an environmental assessment, in France it was a letter – but we are in theory subject to the same directives. The consenting processes were remarkably different in the three countries.

Q10 **What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?**

The footprint of a subsea cable is tiny, 10-20 m impact, which on the scale of the North Sea is nothing. If you are going to use a network for plug in points for offshore wind that will be incredibly useful.

Interview 17 details (1/12/2015)

Name: Kurt Jensen

Organisation Consultant

Position: Senior expert

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

EIA and Environmental monitoring of Westermost Rough offshore wind farm (at the Yorkshire coast). EIA of Burbo Offshore Wind Farm extension, EIA of Walney Offshore Wind Farm extension.

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

The two most recent EIAs reflected the general trend in EIA development that "no item is too small or unimportant to call for a detailed investigation". The scoping procedure has been meaningless as neither recent experience nor general common sense are being used to focus upon the important matters and scope

out the unimportant ones. The result is EIAs of the size that actually is a hindrance to involvement of the public in accordance with the Aarhus Convention.

It would be an important improvement to reintroduce an intelligent scoping process.

Q3 **Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

Q3 (A) **What are your experiences / your reasons for highlighting these environmental effects?**

Most of the topics are well elucidated both due to research and to experience.

Q4 **What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?**

Publications of shoreline disturbance over a longer period seem to be missing. 2. Further, although I consider impact of thermal radiation unlikely to have but a very limited, local effect, research of the impacts would be welcomed to support or reject this viewpoint.

Q 4 (A): **Have you experienced these gaps on projects you have been involved in? (which) ?**

In particular with the Race Bank Offshore Wind Farm that I was involved in in a short period.

Not personally, but from my colleagues that are working with German wind farms.

Q 4 (B): **What knowledge gaps do you think should be prioritised for future research?**

Same two.

Q5 **In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?**

Many speculations are always related to the impact of EMF on Elasmobranchs, although several research programmes have failed to demonstrate any significant problem. It would of course be nice to have this topic closed once and for all.

Q5 (A): **Why do you think this (in response to Q5)? What experiences have brought you to this conclusion?**

Comments from research institutes and public to EIAs in the hearing phase.

Q6 **Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?**

Migrating fish species and elasmobranchs seem to be able to sense the EMF from the subsea cables, but the impact appears insignificant.

Q6 (A): **Do you have experiences with this from specific projects?**

Only in the EIA, not in monitoring results.

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

I do not understand the question. If you mean cases where the monitoring in connection with infrastructure and cable projects are used to improve ordinary environmental state monitoring, which should actually be done by the authorities, the answer is yes. I suspect the monitoring requests are often to driven by a wish for more general environmental state information. However, it is my experience that the outcome is poor and hardly ever used.

Q8 What tools could help to reduce environmental and permitting difficulties?

A detailed analysis of the results of all the monitoring programmes that are hidden in the files of the consenting authorities would enable us to focus on significant impacts that have been demonstrated instead of speculative impacts.

Q9 Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?

As stated in Q8.

Q10 What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?

I think that the utilization of gained experience should be expanded beyond the North Sea. There is good experience from the Irish Sea, The Channel etc. and I find it hard to imagine cumulative impacts in the North Sea with the foreseeable density of cables.

Interviewee 18 details (11/12/2015)

Organisation: Stakeholder group

Position: Fisheries Policy Officer

Q1 What environmental assessment processes have you utilised, been engaged with or are aware of recently?

Wind farm EIAs. Cable projects around Scotland.

Q2 How effective were the environmental assessments described in Q1?

And how could they have been improved?

They may well have achieved their objective but to my mind they are too restricted, they stick to a certain formula and have no ability to reference reality. Our industry (fishing) is dynamic and ever changing so there is a definite gap in understanding that an EIA can give you.

Some sectors are in motion, with different working patterns, different coordinates. Certain operational coordinates get discounted if they aren't there time after time.

Q3 Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables

We are lacking in knowledge of certain areas of ground but I think it is a case of making clear to stakeholders what the inputs are. Rather than having stakeholders having to investigate for themselves.

Perception that heat and EMF coming off cables could be detrimental – information on this needs to be communicated properly so this concern is taken off the table at an early stage. I think the knowledge is there it just isn't being communicated in the right way.

Q3 (A) What are your experiences / your reasons for highlighting these environmental effects?

Q4 What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?

See above

Q 4 (B): What knowledge gaps do you think should be prioritised for future research?

See above

Q5 In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?

Scallops, shellfish in general.

Q6 Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?

It's hard to say there is evidence both ways, it needs to be presented in a way that is peer-reviewed and accessible to stakeholders.

Q7 Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?

Not aware. I think post-construction monitoring should be part of the licence conditions.

Not aware of the cables being used to collect marine data, but this could be an opportunity.

Q8 What tools could help to reduce environmental and permitting difficulties?

I would like to see the complete burial of cables so reduce the difficulties with the fishing industry.

Q9 Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?

Burial negates most of the impacts so this should be encouraged.

Q10 What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?

It should only be expanded if they can guarantee co-existence, and they aren't removing other industries.

Interview 19 details (4/12/2015)

Organisation: Consultancy

Position: Director

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

Generally provide input to environmental assessments, don't tend to deliver the assessments entirely ourselves. Our expertise is in coastal and offshore hydrodynamics and transport. The involvement has been providing input surrounding the landfall, which is one of the keys areas and that is interesting because of the transition between the two planning systems. Two different areas of work, different aims and different expectations. Coastal areas seem to be the biggest issue.

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

Probably depends who you are working with, experience is key. The experience allows people to understand what the critical issues are, it is easy to become waylaid be minor issues within the process. There are one or two large issues not many.

Q3 **Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

Q3 (A) **What are your experiences / your reasons for highlighting these environmental effects?**

Relatively good knowledge surrounding the installation. Very little is done in terms of monitoring. WE have a history of monitoring behind dredging, and even there the knowledge is very low – note the impacts are around two orders of magnitude bigger impact than subsea cables.

There is a level of knowledge, cables itself maybe the knowledge isn't that great but there are other areas we can use as proxies.

In terms of operation there is almost no impact. There are benefits of having structures on the sea bed.

Difficult to say comprehensive overall. Biggest issue is that there is too little amount of data. With sediment transport the uncertainty is exceptionally high, the models need validation from the real world. The nature of sediment transport is so uncertain, we know the basis, we know the physics but how it plays out the site is the issue.

Q4 **What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?**

Yes any project with sediment transport involved, we say this is an estimate and there are a number of outcomes. This level of uncertainty can be damaging. In sediment transport terms this is everything from erosion, to moving cables or the movement of cables to another location

Q 4 (A): **Have you experienced these gaps on projects you have been involved in? (which) ?**

Q 4 (B): **What knowledge gaps do you think should be prioritised for future research?**

We have a lot of knowledge around sediment plumes from dredging, I think there is less knowledge on the specifics of cables in terms of how much sediment moves. This is more a measurement research area. The key thing is site specific data, and picking up proxies from other locations can be very difficult.

The level of disturbance is only relative to existing environment of an area. Without having site specific data it is hard to actually frame how bad a problem it is.

Q5 **In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?**

Not well placed to deal with species, apart from experiences seen around Sabellaria reefs some of the high value benthic communities. What you often find is that you will have high resolution multi-beam bathymetry, maybe with some information on the ground classification, but habitat mapping can be quite poor. You can't habitat map the whole of everywhere – the only thing you can do is try to pick up more data where you can.

Q5 (A): **Why do you think this (in response to Q5)? What experiences have brought you to this conclusion?**

Q6 **Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?**

Struggle to confirm, see above.

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

I know in the Mediterranean, voltage shifts in transmission were used to measure current speeds. People have used cables for a sideways use. They were seeing a tidal signal in what was going on, they could then understand what is going on and how the currents were changing – it was a by-product not something they went looking to do.

Q8 **What tools could help to reduce environmental and permitting difficulties?**

It comes down to lack of knowledge in the consenting bodies. So anything that put in place agreed protocols that they would be expecting to see, is a good start to ensure people are saying and doing the same things makes things a lot similar.

Reducing the consenting body's ability to change things too much, ensuring that they remain focused on the key issues. Trying to provide a way of funnelling their methodology approach to make sure they stay on board with you – generic EIA aspect.

Q9 **Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?**

Regional strategic risk assessments – we generally know the areas where we put cables, so having the first stages done (collation of regional data sets, identifying data sets that could be collected in advance of anything else). Often end up with one data point, but with no other data and when trying to look at impacts looking at the future and the past one data point isn't enough.

Q10 **What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?**

I think it is vital to an electricity system that isn't dominate by a central source of electricity, which is not a good idea from a security point of view. I think a distributed grid is much better.

When installing new power cables why not put in more communication cables as well in the same bundle – same as on land.

I think the environmental impacts aren't a big issue, where the land fall is the most contentious, sensible choosing of locations ties in with a strategic approach the identification of corridors where you could pre-consent for cables

Interview 20 details (15/12/2015)

Organisation: Statutory consultee

Position: Senior expert

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

Previously used to work in our offshore industry advice team and was involved with providing advice on EIAs, Habitats Assessment appraisals, the full range of assessments, licence applications.

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

I think broadly most consultants are good and have a good view on where things should go, in terms of assessing the impacts. There tends to not tackle the issues in enough detail or depth and show that there is no impact based on very little evidence, no all environmental assessments. This doesn't mean there is an impact but just that it hasn't been investigated in enough detail.

The best ones are when they come directly to speak to us in advance of preparing any assessment, where we can provide them with the latest information or direct them in the correct way. When we get blindsided by applications or assessments, that haven't thought through the information appropriately is when there is a problem.

Recently there was an application for an oil pipeline within an MCZ currently being considered for priority designation. Information on the site is available, DEFRA made announcements and we (JNCC) had provided information. But the developer had only looked at 2012 information, and hadn't considered anything new and they suggested there was no impact. We find these problems quite often. I don't know why this is, either as a shortcut, to try to get things through but it does happen on at least 70% of situations.

Q3 **Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

Q3 (A) **What are your experiences / your reasons for highlighting these environmental effects?**

We know a lot about local effect, but would struggle to say anything beyond that at this point in time. WE know what the pressures resulting from the cabling are, depending on what type of cable etc. There is generally medium to high knowledge on what that pressure will be and what effect it will have. Anything beyond a local knowledge is limited.

At a local scale, we would know that if a cable is being laid on the surface and cable protection is used then there is a change in the substrata. We know that locally there would be a change in EMF of that area, which may have a local impact but we don't know want effect it would have more widely.

Q4 **What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?**

Scale issue as mentioned above.

We are usually taken down a path by the developer, in which they want to use a specific type of installation technique which I guess would be laying it on the surface and armouring it. There isn't enough evidence to stake a preference for a particular habitat type and what would be useful would be to advance the work carried out by the statutory nature conservation bodies looking at the individual impacts of different installation methods. How much seabed disturbance is there, how much noise, what are the changes in suspended solids due to the different methods. How much hard substrate is produced, are there differences in EMF between buried and surface laid. The detail isn't there, the emphasis is on what is the cheapest method for the developer and there is very little we can say as the scale is so small.

Q 4 (A): Have you experienced these gaps on projects you have been involved in? (which) ?

Q 4 (B): What knowledge gaps do you think should be prioritised for future research?

I think some we know reasonably well. EMF and seabed disturbance and sediment removal I think would be of most interest. Although there may be interest in considering the physical change in substrate. Can say there would be a particular area that would be best to focus on, but some study should be done to examine the different installation methods and armouring methods that would allow us to have a fuller understanding of the environmental impact of cabling.

Q5 In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?

Sabellaria reef is a major one.

Q5 (A): Why do you think this (in response to Q5)? What experiences have brought you to this conclusion?

Q6 Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?

It depends on the scale and location. If it is within a MPA or a sandbank and you are introducing a hard substrate the site may be more sensitive to the impacts. It depends on the interaction between habitat type and type of activity that is going on. All habitats may be sensitive it depends on the type of installation techniques.

Q6 (A): Do you have experiences with this from specific projects?

Q7 Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?

I am aware that data is gathered along the pipeline, I don't know how much it is shared. In an ideal world data would be gathered beforehand and after and provide this to ourselves and others so we can use this to better our understanding. Most things we have to judge on at the moment consider local effects and cumulative effects or applying a precautionary approach increasing the risk of licences not being awarded.

We get some pre and post construction surveys but not them all, because of commercial confidence issues. There are issues where data licence agreements have to be signed. In one case at the moment, the developer is happy to provide the data they have collected but the legal issues are complicated.

There has been monitoring on oil rigs and those data sets were collated into various things. There is an opportunity for cables, particularly if cables are being monitored or if something needs to be installed on the cable this is an opportunity. It would be great if we are all working together to assess the impacts, the issue tends to be around us needing to make all the data available and developers not wanting to add the potential risk of the data being use to impact them. In principle yes providing we can resolve those issues.

Q8 **What tools could help to reduce environmental and permitting difficulties?**

The piece of work on developing an understanding the potential impacts of each installation tool, relating to different habitats as well. This would be a useful matrix that ideally would be publically available so everyone is on the same page. We would want to do this but don't have the finance for this.

I don't think it would have to be updated on a very regularly basis. We have a database on activities-pressure matrix, Natural England have their own features- activities-pressures matrix which is available online. So these tools are available so any studies that could be done would feed into these tools as the information became available.

Some agreement that data would be collected and shared for any cabling installation method. Don't know how realistic this is, there are legal issues, RGI could play a role in supporting the sign up to this.

Q9 **Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?**

Tool developments and agreements as mentioned.

Encourage developers to engage with ourselves prior to application. There are complicated regulations surrounding cables. I would like to see common process or agreeing to engage with ourselves before making any decisions.

Q10 **What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?**

Generally supportive of it, I can see the benefits socially and economically. Environmental issues are the increase of manmade structures and the physical change to the seabed type. We have wind farms, oil and gas, aggregates and the cumulative impacts are beginning to develop, are focused around the same particular sites. There is a risk to our offshore SACs at the moment, the best thing would be for the cabling industry to work closely with other industries so there is a proper considerations of the potential impacts. There is always a consideration of a developers own project and not of the bigger picture, so this is our worry. As long as those issues can be addressed there are no real problems.

Interview 21 details (7/12/2015)

Name: Peter Jamieson

Position: Other (Chairman)

Organisation name: Subsea Cables UK / Virgin Media

Organisation category: Other (Trade Association)

Email: Peter.jamieson@virginmedia.co.uk

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

We are engaged with the MMO involved with the development of planning policies. We look at all kinds of environmental reports. For example the OSPAR best practice documents which we are trying to get revised. I take a more holistic view of the industry as a whole.

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

I think as they are, they are quite good. We have been putting cables in for a long time, we know what the issues are, we know where we should and shouldn't put cables. I feel the EIA that are done are quite adequate for the purpose.

Q3 **Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

Q3 (A) **What are your experiences / your reasons for highlighting these environmental effects?**

I feel the impacts are well known, we have been putting cables in since the 1800s so as far as we are concerned the main impacts are during the installation. Seabed disturbance is unavoidable, but in many cases it is better than having them surface laid. The seabed disturbance is only over a small area, and for a short period of time and there is evidence which shows the seabed recovers reasonably quickly. The cables when in the seabed are benign, which have very little or no impact.

Q4 **What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?**

Not that I can think of. Nothing that requires a large project. Nothing that hasn't already been done. With the influx of offshore wind, there have been lots of studies on the installation of cables and associated impacts such as sediment plumes from the installation. I don't think anything new is required

Q 4 (B): **What knowledge gaps do you think should be prioritised for future research?**

n/a

Q5 **In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?**

Not that I am aware of. It all depends on good route planning to route around highly sensitive or protected areas if necessary to ensure no impact.

Q5 (A): **Why do you think this (in response to Q5)? What experiences have brought you to this conclusion?**

Q6 **Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?**

There may be. Anything in the path of the plough is going to be affected, but this is very localised we are talking about a 2 m stretch. If there are any places that are highly sensitive and highly protected we have the ability usually to route around them. Installation has been identified as a low impact activity. JNCC and Natural England have advised that installation and maintenance of cables is an accepted activity within MCZ.

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

Some fibre optic cables are used to measure seismic activity underwater and temperature. Whenever a fibre optic is disturbed you can see this, it affects the light within the fibre optic and this can be picked up by a sensor.

Not aware of any cases with power cables. It could be an opportunity, I would have to know the science behind it.

Q8 What tools could help to reduce environmental and permitting difficulties?

A general acceptance of how benign the impact of cables are. We know about the slight impact when the cables are installation, but after that there is no impact. Even for EMF fields there have been numerous studies that show they don't effect ships compasses, fish or other species and they don't heat up the seabed. These myths continue to be brought up. Documents such as the OSPAR best environmental practice are guilty of supporting these issues and Subsea Cables UK and the ICPC are in the process of hopefully getting this changed. Having one over-riding accepted document that is factually correct, that the OSPAR BEP should be, that all European countries should be able to use as a baseline.

Q9 Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?

Get the message out there that cables are not a major environmental issue. We can then stop environmental groups worrying about cables and stop industry having to jump through the permitting hoops.

Q10 What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?

If The offshore grid is economically and engineering viable it would be a good thing. From a cable side of things there is no environmental difficulty.

Interview 22 details (3/12/2015)

Name:	Phil smith
Position:	Director
Organisation name:	Aquatonics Ltd
Organisation category:	Consultancy
Email:	phil@aquatonics.com

Q1 What environmental assessment processes have you utilised, been engaged with or are aware of recently?

Background in benthic ecology. Involved in high level assessments. We examine the sensitivity of habitats, that may be affected by cables or other infrastructure. In some cases we have done this through terrestrial habitats in addition to aquatic habitats, providing advice on cable landing sites as well. We follow the EIA processes, along with liaising with stakeholders with what is of concern.

Q2 How effective were the environmental assessments described in Q1?

And how could they have been improved?

The assessments are effective, in that they identify the best routes. Although there is an issue when linking land based planning with marine planning. It is a shame that there isn't a single body taking care of these

important structures. It is a strange idea that a local planning authority may say no when everything else points to that location being best.

Q3 **Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

Q3 (A) **What are your experiences / your reasons for highlighting these environmental effects?**

I think we have a good knowledge around which benthic habitats recover quickly. Mobile sand communities recover quickly, but in rocky habitats or where sea fans and other long lived species the recovery time can be over a decade or more. Dredging impacts can last 15-20 years from gravel extraction, so it isn't just the hard substrates.

Q4 **What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?**

Knowledge may be out of date. But the concerns were surrounding EMF fields on elasmobranchs (skates and rays etc). These gaps may have been filled, although it is a difficult area to study as field research would be required which is not a cheap task.

Q 4 (A): **Have you experienced these gaps on projects you have been involved in? (which) ?**

Yes, I got the impression people were concerned about it but weren't able to quantify the impact. In my opinion, is that probably the elasmobranchs would sense this EMF in a different way to how they would detect prey – the concern was that will skates and rays waste their time thinking there is a food source, it is my opinion that the EMF is so different in scale and size and linearity that they would learn to avoid it.

Q 4 (B): **What knowledge gaps do you think should be prioritised for future research?**

Q5 **In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?**

I think that biotopes or habitats are the main concern, where the recovery time may be longer. In terms of species I think maybe species like Sabellaria or ross worm. They are species that are relatively common and there has been discussion around Sabellaria reefs and how you have to define whether they are a reef or not. There numbers can change year to year making it difficult to work out the natural changes, what is the baseline and whether there is going to be an impact or not. My opinion is that you obviously don't want to destroy a well-established bed, but if it is just patchy areas then I think they will recover reasonably quickly.

Q5 (A): **Why do you think this (in response to Q5)? What experiences have brought you to this conclusion?**

Q6 **Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?**

Sabellaria, muddy gravels, certainly in the southwest there are large sea grass beds in which the impact can be greater than just the trench itself. Pink sea fans as well as other long-lived species. It is about scale of impacts and whether you can work out a route that would only affect the least sensitive species.

Q6 (A): **Do you have experiences with this from specific projects?**

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

People do look at biofouling on oil and gas platforms, not always with a view to monitoring but with a view to assess the build of biofouling organisms. People have used, as part of the monitoring programme, fish aggregations around subsea structures, whether they are more prevalent around subsea structures.

I am aware that people are collecting met-ocean data from structures. Haven't thought about this opportunity with subsea cables, it may be an opportunity. Not a technical person more of a biological person. On other structures, oil and gas platforms, the biofouling and fish aggregations people take underwater footage. I can't think of a way of collecting data from cables. What you don't want is something sticking above the seabed that could get dragged by fishing gear. If it completely buried, I am not sure what you would get. If it was used as a tether to something that collected data from the surface, that was marked and avoidable that could be done.

Q8 What tools could help to reduce environmental and permitting difficulties?

I feel that everybody has potential access to the relevant information. There are some areas where people may be relying on old data; most of the sediment maps produced by BGS are only crude approximations. So people might think if they can add these layers to GIS this is an accurate representation of what it out there. These gaps are usually filled in by specific monitoring. Not worked on any cross jurisdiction projects, although general feeling is that Germany, Britain, Northern France and Netherlands have similar attention to detail. It might be done differently in Mediterranean countries.

Q9 Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?

Tying up the terrestrial planning and marine planning, with someone taking overall responsibility saying this is a relatively minor impact and the marine side should lead the terrestrial side, ensuring that these projects do go ahead and aren't subject to undue delay caused by people whose concerns are overstated. Generally I have specific concerns to certain species being over protected. The tentacled lagoon worm which occurs regularly but is still protected, people thought it had restricted distribution but it actually occurs very broadly and there is no sensible mitigation for it. There seems to be a feeling that once animals are protected, removing them from the Wildlife and Countryside Act is very difficult even with improved information on that species which shows that it is over protected.

Q10 What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?

I think an expansion of the network is excellent. Only recently Britain was struggling to produce enough energy on a mild day with little wind and no sun. If it was connected to other areas of the north sea, other areas could kick in to transfer electricity.

I feel the marine environment is relatively robust if routes for sub-sea cables are planned carefully. Overall I would judge impacts from sub-sea cables to be relatively minor and in the lower 10% of the impacts from marine developments.

Interview 23 details (8/12/2015)

Position: Senior expert (x2)

Organisation name: Joint Nature Conservation Committee (JNCC)

Organisation category: Statutory advisor to the UK Government

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

Statutory consultee for HRA and EIA in renewables, oil and gas and aggregates. Involved at looking at the permitting and consenting conditions for those areas. For cables we have been involved with commenting informally, as it is not so much of a licenced industry.

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

Cables – dealt with one project that certainly wasn't extensive in terms of HRA. The cables process is difficult for us as there is no legislation to support the types of conversations that we have with other industries.

There can be little difference between pipelines and cables in terms of their seabed impacts, and so some best practice guidance for environmental impact on the subsea cable process would be a good thing.

Q3 **Please can you give your opinion on the current level of knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

Q3 (A) **What are your experiences / your reasons for highlighting these environmental effects?**

The effects that are the same as for other industries for which we have better knowledge. But there are some cable specific issues that we don't see so much of. There is a gap around understanding impact of EMF. We have a good idea about benthic disturbance but could always do with more information. In terms of EMF, the investigations have been too short term and more long-term monitoring is required. We know that even developing embryos respond to EMF, but we don't understand the implications of these responses. Long-term data is needed for all life history stages of electro-sensitive organisms.

Long-term data is lacking across most areas. There are very few long-term monitoring efforts, because most industry hasn't been operating for long enough to produce long-term timescales. It does make it difficult to understand the long-term implications.

Q4 **What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?**

See above

Q 4 (A): **Have you experienced these gaps on projects you have been involved in? (which) ?**

Q 4 (B): **What knowledge gaps do you think should be prioritised for future research?**

EMF is a big one. There have been studies showing that organisms respond to EMF but what this actually means for the long-term is where the gap is. Within the wind farm ESs EMF stands out as the impact which we don't know the impact of. It may have no impact but we don't understand it.

Q5 **In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?**

We tend to deal with specific sites. Even though cables are a less licenced activity they are still subject to the habitats directive so if they affect a protected feature that would be an issue. Quahog can be an issue offshore. We can recommend what we think should happen from an EIA / HRA perspective, but this is not what has to happen legally.

Q5 (A): **Why do you think this (in response to Q5)? What experiences have brought you to this conclusion?**

Q6 **Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?**

Species that are EMF sensitive, or species that are subject to benthic disturbance and/or spawning fish. The cables emitting an EMF is one of their characteristics. The more you bury a cable the more you shield the EMF, but this needs to be balanced against the benthic disturbance that would result, which would likely be site-specific.

Q6 (A): **Do you have experiences with this from specific projects?**

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

A lot of the wind farms have a lot of consent conditions for post consent monitoring, it does tend to be birds and mammals. Moray Firth and Beatrice are both going through their consent conditions and they will include benthic monitoring. Some oil and gas installations consent conditions will also include benthic consent conditions.

I am aware that sometimes on the wind farms, they have put marine mammal observers on the wind turbine infrastructure / shipping. Some oil platforms have marine mammal observers as well.

There are opportunities for everything. For cables - there is survey work prior to laying and there is monitoring post construction for cables, which could be very useful.

Q8 **What tools could help to reduce environmental and permitting difficulties?**

There aren't really many permitting difficulties as the cable projects aren't permitted. We would want to have a sensible discussion over impact and mitigation of impact with a cable company.

Q9 **Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?**

Cumulative impacts – large cable sets ups, the consideration of other industry and other cables.

We don't fully understand the extent of magnetic fields and electromagnetic field resulting from cable installations, particularly how they may interact in larger arrays. So more research around this area would be helpful.

Having some formal set up agreed by the cable industry to assess impacts.

Q10 **What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?**

In general, I can see the benefits for society of improving renewable energy, but the appropriate assessment need to be correct.

It is difficult for us if an unlicensed industry goes through a protected site. The data that could be gathered, we could mutually benefit from.

Interview 24 details (4/12/2015)

Organisation: Cable installation company

Position: Director

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

We tend not to be involved with the assessments themselves, they are completed before our involvement. We work the results of the investigations and the requirements coming out of them. If there are particular species of concern it is listed within the material we receive, it is seldom that we are involved in the investigations themselves. The typical issues that we deal with surround the effects on marine life and bird life, if we are working in an area that is particularly protected (e.g. Wadden Sea) there is special protection and there may be requirements to not disturb their breeding periods. Other common environmental areas of concern surround polluted sea bed or water clouding.

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

Depends on what you want to get out of the assessments. Many of the assessment say there is little to no effect on the marine life or bird life, so in that way it seems a bit of a waste. There is a tendency to be worried about the impacts when in reality nothing is happening. Bird monitoring has occurred during installation and they were not impacted at all, they actually used the disturbance in the sediment to feed. We have never had any assessment showing an issue. We have work in polluted mud, and this was cut off using silt curtains, samples were taken showing polluted material in the water column but this was expected. You can contain this using the right precautions.

Q3 **Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

Q3 (A) **What are your experiences / your reasons for highlighting these environmental effects?**

Transmission project within Denmark, between three small islands within Natura 2000 sites.

There may be people lacking the knowledge. There have been surveys and assessments within most areas. If there is new technology, there can be a need for the further assessment of the tools impact. But generally the longer term impact of subsea cables being buried at sea we have reasonably good data for. There seem to be very few impacts.

Q4 **What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?**

See above

Q 4 (B): **What knowledge gaps do you think should be prioritised for future research?**

We don't need to increase our knowledge, but gather the knowledge that we have from the different areas, owners and operators to produce a white book, saying in this scenario these are the right precautions to have, in this scenario these are the right precautions.

For example magnetic impacts – it is well known that with HVDC cables can impact upon vessels compass but this is only an issue relating to HVDC cables. If you have a white book listing the issues can check see what

issues are relevant to your project. There should be recommendations which you can evaluate against your site to see if there will be an impact. Instead of listing the concerns every time.

Q5 **In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?**

No not aware of any species that are sensitive to the cable itself. It is the construction work itself which proves the issue and this is the same as with any other works.

If there is a bird feeding ground then you are restricted from working during certain periods. This is the same for marine mammals, with marine mammal observers sometimes being required for certain projects. But we don't see any legitimate reasons for an impact from subsea cables

Q6 **Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?**

See above

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

No – I am aware there have been projects that monitor the seabed afterwards to see if there is any scouring, but not using the cable itself. It might be a possibility – not something a have given a lot of thought to. There is research into monitoring cables to prevent unintended damage – putting noise monitoring devices on the cables to detect ship traffic, fishing gear and you could use this understand what kind of disturbances there are in these areas.

Q8 **What tools could help to reduce environmental and permitting difficulties?**

If there was a white book you could refer to when discussing with the authorities. You could say this has been investigated, the normal precaution is to do the following. I think this would be helpful for both developers and contractors.

Further investigation into the various tools and there different impacts and which tools should be used for different habitats. A plough may have a greater effect on the marine ecology but it may be better than a jetting tool which can cause water clouding.

Q9 **Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?**

Shortlist of areas of concern that should be investigated. Is there any toxic sediments, sensitive ecology; so you can have the same evaluation no matter the country. Things seem to be very different between countries.

Q10 **What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?**

There are limited impacts from subsea cables.

From a renewable point of view it is very positive. Bring offshore wind to shore and utilising renewable energy is areas that it isn't produced. Connecting the countries makes it easier to use wind energy. Marine archaeology needs to be considered to ensure anything with historical value is not damaged and special care needs to be given to any environment that is specially protected or sensitive. The risk of damage is from the installation phase, there is no operational impact.

Interview 25 details (7/12/2015)

Organisation: Consultancy

Position: Senior expert

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

Involved with EIA assessment for offshore renewable energy projects. Currently managing floating offshore wind farm EIA consent process. I have a slightly Scottish process viewpoint.

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

Depends on which elements have been reviewed and which stakeholders have been involved in the process. Also whether the stakeholders have practical experience of working in the commercial world, some stakeholder are very good scientifically don't have a commercial mind set.

The cabling side – a key area is EMF effect on fish species. Lots of studies have been undertake and say they can't define anything but most studies go towards there being no impact. It's often pushed back saying we want more information which is difficult to achieve when there isn't more information. Other side of the equation is the fishing industry where there is the potential for over trawling and those interactions are managed through a stakeholder process. Pure science to pure commercial.

Q3 **Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

Q3 (A) **What are your experiences / your reasons for highlighting these environmental effects?**

One of the big things is the scale of cables. There is a lot of inter array cables on the seabed already the knowledge and the practical application is there, as we get towards larger wind farms, further offshore what is the impact of those. The understanding rom an environmental point of view is less well understood, you can't really demonstrate something at the moment. The export cable is the target in regards to the largest unknown.

The north sea oil and gas activity has been in the sea for years and they fully understand how the marine pipelines operate in these environments.

Q4 **What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?**

The offshore wind industry is constantly evolving and adapting, things tend to be getting larger. Therefore when a question comes back from the consenting organisations, you can't demonstrate the knowledge because is currently doesn't exist, there are always additional consenting questions and challenges that need addressing. If you bury a 60kV cable at 2m, if you bury a half giga watt cable at a similar depth, the impact to the sea bed is the same but the electromagnet current will be different and how can you demonstrate knowledge on this. There should be knowledge on this from connectors between the UK and France but has this been studies in enough detail to be transferred across.

Scour around structures and the issue that scour has around inter array cables and export cables. Scour hasn't been included in the assessments, the focus has been around the foundations (of turbines). We are seeing a lot more failures in inter array cables due to the exposure of cables, causing fatigue and ware.

Q 4 (B): What knowledge gaps do you think should be prioritised for future research?

They all target different areas. The large export cables – ensuring the scientific research on how they work and operate. There are things we could do to push this forward – in the UK Robin Rig offshore wind farm as been the focus of a lot of research a lot EMF work but a small wind farm and a small export cable. There is a lot of scour work going on.

Q5 In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?

Not aware of any. Haven't had a lot of salmonid species or eels that are more sensitive to EMF. The projects I have worked haven't had these issues. I imagine this would present challenges, and it would also depend on how aware the stakeholders are.

Q6 Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?

Not especially. There are certain species where you can't define that there isn't a significant impact (salmon). Fixed corals would be sensitive but it's often the case that offshore wind farms and therefore there cables are built in shallow waters that are trawled so there would be a limited chance of effecting corals.

Q7 Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?

Oil and gas sector use ROV surveys so there is a clear way of going about these activities.DNVRPJ301 (report) there is guidance within the oil and gas industry.

Robin Rigg is a designated test site within the UK, there are various papers around this output.

Q8 What tools could help to reduce environmental and permitting difficulties?

Stakeholder agreement on the actual impacts of cables. If you dredge a cable there is a local impact but in the long-term scheme of a 25 yr project that is nothing compared to trawling. There a lot of areas I have been working in which are heavily impacted and the trenching activity is very short lived that have no future impact until decommission – having a clear stakeholder view would be very useful – this is how we approach it end of story, instead of having more debates more science there is a body of evidence that says there is no clear impact.

Q9 Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?

Clear by in from stakeholders for various activities. Clearly defined guidance on how you go about certain activities e.g. rock dumping. Clear statements saying this activity has this impact, it would make things a lot easy with a table saying what you have to do.

Q10 What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?

It would give a pan-European power grid network that would allow the over selling and underselling of offshore renewable energy. If there is wind in the UK may not be in Germany and vice versa, we have limited storage capacity so if you have a network that allows the quick and efficient transfer of power around the European grid, this has the potential to lower our CO2 outputs.

There will be site specific marine conservation zones which will have to be addressed but in general most will be quite general and broad, the consenting challenges should be reduced.

Interview 26 details (10/12/2015)

Organisation: Academic

Position: Senior expert

Q1 **What environmental assessment processes have you utilised, been engaged with or are aware of recently?**

Involved in a couple of areas that are relevant to environmental impacts. The theoretical modelling of temperature fields of cables once they are buried in the marine environment, particularly how this can vary quite significantly depending on the substrate properties. Experience with high resolution marine geophysical data, that you might use in trying to understand the surrounding environment.

Q2 **How effective were the environmental assessments described in Q1?**

And how could they have been improved?

From the reactions we get from cable operators, most of them are not that aware of how the cables may interact with the sediment substrate. From their view point the primary concern is how easy it will be to bury the cable rather than what is the effect of the substrate on cable operation or environmental feedbacks when the heat is transferred away from the cable.

Our research has shown that the sediment type determines whether heat will be conducted through conduction or convection. How the environment and how the cable reacts to these different substrate is totally different. This is primarily based on the permeability of the sediment, high permeable sediments allow convection to take place. Very fine sands will be mostly conductive and coarse sands will be mostly convective – transition takes place within the range of sands.

Haven't been able to measure temperature in the field. Some operators have given us there internal cable temperatures sensing, I can't see the chance of ever being able to place temperature probes into the sediment near cables. Measuring in situ temperatures isn't really an option. We are hoping to make links between the modelling we have done, pre-installation surveys and the online temperature information – to show it all links together and to validate the modelling.

Q3 **Please can you give your opinion on the current knowledge of the marine environmental effects of subsea cables in relation to subsea power cables**

Q3 (A) **What are your experiences / your reasons for highlighting these environmental effects?**

We are able to do with model geo-physics gives you a good ability to evaluate the environment before you start doing anything, to identify substrates and habitats within those substrates – SWAF techniques, side scan sonar and some element of ground trothing, so baseline environment is pretty well understood.

It is more complicated on things like temperature, where the only statement is in German regulation (20-30cm, 2K). This is the only statement about thermal impacts and this is pretty crude and only targets a single parameter. We know that in a lot of substrates seabed depth is not a sensible concept, as most sediment is mobile so referencing everything to seabed depth doesn't make sense, when the cable depth is going to be changing.

The biological impact is one thing. What we have to bear in mind is that cables are operating at high temperatures, skin temp of 50-70 degrees this is a temp that would normally be reached at a distance of between 1-2 km under the Earth's surface, not in the top meter of sediment. There is the potential for geochemical changes, some clays at high temperature will have a very different stability. If you have vigorous convection there are a number of things that could happen, and the German 2 K rise will almost definitely be broken as you will have warm fluid coming to the seabed. If you use the IEC standards you assume there is no convection taking place and that is it all by conduction, so if you follow those standards but bury your cable in sand you will breach the guidelines even though the system will run much cooler and may have less overall environmental impact. There isn't a holistic approach that is being applied to the question of thermal impact.

Q4 **What do you think the major knowledge gaps on the marine environmental effects of subsea cables are?**

See above.

Q 4 (B): **What knowledge gaps do you think should be prioritised for future research?**

The first priority would be to establish whether the modelling we have done is right when being applied to cables in the real world. Demonstrating that there is a change in the way heat is transported in reality. If the change doesn't take place, you don't need to worry about the associated knowledge gaps.

If we do have warm water coming out of the sea bed, what is the effect on biology, is it neutral, negative, does it allow the migration of species.

Q5 **In your opinion are certain species or species groups a critical issue during the consenting of subsea cables?**

N/A

Q6 **Are there specific species, species groups or habitats that are particularly sensitive to the environmental impacts of subsea cables?**

N/A

Q7 **Are you aware of cases where subsea cables/marine infrastructure are used to monitor the marine environment? Do you think this is an opportunity? How could this function?**

Group in the National Oceanography Centre that has been doing this with the oil industry (project SERPENT). They have had wide scale access to ROV video that are used to do basic monitoring and maintenance. They have used this to do biological monitoring. So it is certainly possible, what seems to cause complications with cables is that the complexity of the industry, there are a lot of different companies involved at different stages or for different aspects of a project. So who's property would the monitoring data belong to. We have been able to get access to cable temperature data, companies can get sensitive to the cables inputs as in how much

power is going through the cable at different times, effectively telling you how efficient the wind farm – which is commercially sensitive.

Collecting information from the infrastructure, the biggest problem is likely to be the cable construction – everything about the construction is to do with keeping the outside and inside separate. Sensors on the outside would be very vulnerable to damage during installation. People may argue it might compromise the cable. Not sure if it is possible from an engineering point of view.

Q8 What tools could help to reduce environmental and permitting difficulties?

In order to test the impacts it would be easier to get good impacts to cables in the field where they are operating or some kind of large scale test facility. You could construct this type of facility.

I would be surprised if the German standard can be monitored. Unless you were really confident of where your cable was, I can't imagine an operator allowing temperature rods to be inserted or figuring out how you're going to do it safely from a vessel. I think this is used as a design guideline.

Q9 Reflecting on our discussion so far in your opinion what should be the future priorities surrounding the environmental impacts of the subsea cable industry? What steps should be taken next?

Getting a handle on the thermal impact around an operating cable, this might mean setting up a test facility, instrumenting a region before a cable is installed. I am not convinced you could instrument a cable on the outside in a way that would actually work.

Q10 What is your opinion on the expansion of a subsea cable network across the North Sea, in relation to the environmental impacts and cumulative effects?

In general it is essential, if we are going to be generating renewable energy, our best assets are offshore and if we start to rely on renewable energy you need regional networks to balance wind power across different regions. The consideration of impacts at the moment is mainly on the effects during installation not during operation.