The Potential for a Northern Ireland Marine Hub – A Scoping Project

Photo credit

Prepared by MarFishEco Fisheries Consultants Ltd for

Ulster Wildlife Trust and the Northern Ireland Fishermen's Federation.

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Introduction

Northern Ireland's coastline is one of the most geophysically diverse globally, creating a range of landforms and natural environments that has led to roughly 70% being designated an Area of Outstanding Natural Beauty[1]. The scenic landscape underpins the country's tourism industry and creates a wide range of recreational activities for NI's population, with most living within an hour's drive of the coast[2].

NI's coastline supports a variety of marine wildlife and habitats, including bottlenose dolphins and basking sharks, worm reefs, sea cliffs and craggy coastal shores[3]. Many of the species and habitats found in the waters and on the coast surrounding NI are recognised as internationally important, and most of the NI coastline is protected as a result. Such diverse marine waters provide multiple and varied services and benefits to marine life and people. These services include providing food for human and livestock consumption, regulating coastal waters through filter-feeding species, supporting services such as habitat formation, and important cultural heritage. For example, the service of carbon sequestration, provided by rich blue carbon habitats (covering approximately 658 km^2) within NI's inshore area, provides climate change buffering services that are important for the country's climate change mitigation and adaption strategies[4].

The richness of the NI coast has long provided livelihoods for generations of coastal communities, from fishermen to ship builders[2]. Today, maritime activities remain essential to the NI economy and society, with high expectations for future growth alongside the expansion of developing marine industries such as renewable offshore energy and transportation. Competing use of NI's coastal waters is therefore increasing and achieving the sustainable use of the marine environment whilst preventing and potentially reversing environmental damage remains a challenge. Given the services and benefits NI's healthy seas deliver, addressing this challenge is fundamental for NI's sustainable development.

Ulster Wildlife (UW) and the Northern Ireland Fishermen's Federation (NIFF) have formed a partnership in response to the sustainability challenges faced by NI's marine environment. The partnership aims to identify emerging issues and strategic research agendas to address areas of common interest in the marine environment between the eNGO and commercial fisheries sector in NI.

Siloed communication within and between stakeholders in the NI marine environment has been identified through the partnership as hindering attempts to strengthen NI's coastal waters and the sustainability of marine industries. Currently, most NI marine sectors work in silos - with only a few formal channels that allow for communication or collaboration. Often research is conducted without input from the industry, and policy is sometimes developed without substantial evidence, which can stall or even weaken long-term policy aims and objectives. This lack of communication and collaboration can also result in the duplication of efforts (and therefore wasted resources), misunderstandings and polarisation between stakeholder groups. Furthermore, it has been highlighted that more locally relevant research and data is needed to inform the swathe of current and incoming legislation and policy that will impact how the marine environment is used today and in the future. Examples of this legislation include the Joint Fisheries Statement (JFS), the Marine Strategy UK, the Environment Strategy (NI) and the Climate Change Bill (NI), to name a few.

To address the challenges associated with achieving the sustainable use of the NI marine environment in the face of competition from multiple marine users, UW and NIFF are scoping

the potential for a Marine Hub in NI. A NI Marine Hub will be a connecting and sharing platform, creating a network of representatives from across relevant NI marine industries. Connecting relevant stakeholders will enable those involved in the Hub to identify evidence and knowledge gaps and promote marine research in NI. Over the long-term this improved communication and synergistic research and collaboration will help drive a sustainable future for NI accounting for the diverse differences in stakeholder interests and political agendas.

This report outlines the main steps that were taken to scope the potential for a NI Marine Hub, identifying:

- Relevant stakeholders in the fishing and aquaculture Industry, Academia, Government, NGO and other marine sectors such as offshore renewables, harbours and ports etc.

- Research and projects underway in NI, applicable to the NI marine environment and relevant marine industries.

- Current and incoming marine, fisheries, and environmental legislation relevant to the Marine Hub research focus, prioritised by relevant stakeholders.

- Existing research infrastructure and facilities in NI that could be utilised or developed further in a NI Marine Hub.

- Similar 'Hubs' worldwide to inform best practises, including funding, business models, management, and collaboration techniques.

To conclude, the report provides recommendations for the development of a potential NI Marine Hub, including its style (physical/ virtual hub options), appropriate funding sources, management priorities and collaboration techniques. Hypothetical scenario examples of the most appropriate style Hub are also given, based on the information gathered.

Methods

Landscape review

Client conversations were initially carried out with Ulster Wildlife and NIFF to establish baseline information that could be built upon during the scoping work. A landscape review consisting of a literature review alongside internet searches was then used to provide baseline knowledge on;

- Marine research and projects currently underway in NI, including research relating to marine industries e.g., fisheries, aquaculture, offshore energy, tourism etc. (including past projects).
- Current and incoming marine, fisheries, and environmental legislation (NI and broader UK legislation, policy, and strategies) relevant to the design of a NI Marine Hub.
- Existing research infrastructure and facilities in NI (academic, NGO, governmental, private) that could be utilised/incorporated into a Marine Hub.
- Similar style global 'hubs' (not only marine focused) to inform best practice of a NI Hub. Searches for global Hubs also involved research related to the governance structures, funding models and collaboration/communication methods used.

Snowball sampling was used for the literature reviews and internet searches covered peer-review, government, industry and general public media literature and outputs.

Stakeholder Engagement Interviews

Informal, virtual stakeholder interviews followed the landscape review to supplement information gained through the literature review and internet searches. Interview questions were developed that would allow stakeholders to share their thoughts and knowledge relating to a potential NI Marine Hub (Appendix 1.).

In total, 35 interview questions were developed that were split into three sections focusing on; (1) the state of communication between stakeholders in the NI marine environment, (2) legislation and research relevant to the NI marine environment and (3) stakeholder opinions on the design of a potential Marine Hub.

Once the interview questions had been designed, relevant stakeholders from across the NI marine sector were identified (by UW's and NIFF's professional networks, and by internet searches run by MarFishEco) and contacted via email to inform them of the project and invite them to provide their input on the potential development of a Hub. Candidate stakeholders were defined as any individual specifically working in sectors relevant to the NI marine environment, and included academia, the fishing and aquaculture sectors (including algae farming), government, NGOs, offshore energy and renewables, harbours, and ports.

A smaller number of individuals working in similar 'Hubs' outside of NI were also contacted (Appendix 3.). However, interview questions for these 'global' stakeholders were focused on: start-up and sustained funding models; governance, management, and staffing needs; collaboration techniques and frameworks; and business model and partnerships.

Results

Key Informant Stakeholder Interviews Reponses

In total, 47 individuals working in sectors relevant to the NI marine environment (known as the stakeholders herein) were invited to take part in online interviews. Overall, 30 stakeholders from 23 organisations (

Figure 1) and five separate stakeholder groups agreed to be interviewed, including Academia (n=3), the Fishing and Aquaculture Industry (n=8), Government (n=8), NGOs (n=7) and 'Other Industries' (n=4) (relating to all other marine industries that do not fit into the other groups e.g. renewable energy, marine development, harbours and ports etc.) (Figure 2) (see Appendix 2. for a full list of names and organisations of those interviewed). The remaining 17 stakeholders did not respond to the interview invitation (n=2 from Academia, n=5 from the Fishing and Aquaculture Industry, n=2 from Government, n=6 from NGOs and n=2 from Other Industries), resulting in an overall successful response / interview rate of 64%.

Figure 1. Logos of the 23 organisations that make up the stakeholder audience that took part in the stakeholder engagement interviews.
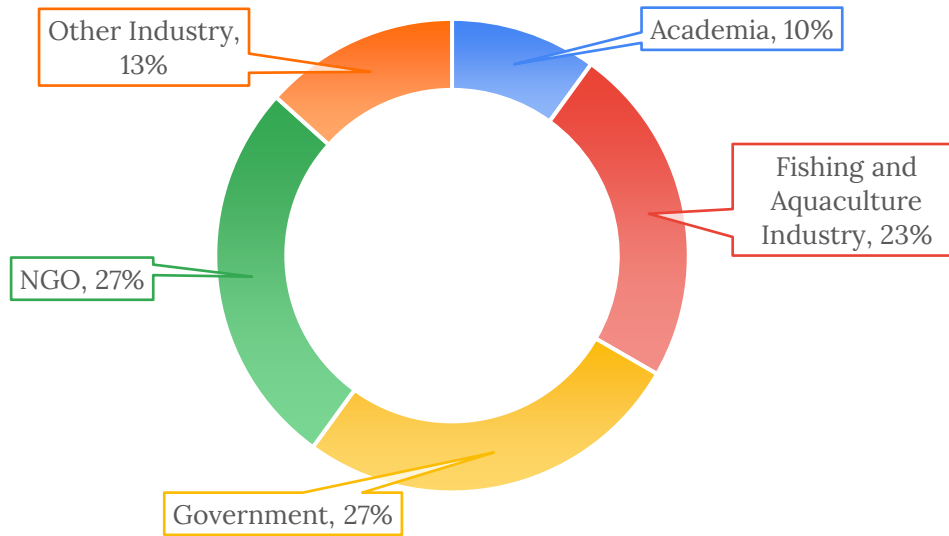
Figure 2. Division of stakeholders that took part in the key informant interviews. In total, 30 Stakeholders took part in the inteviews, from across 5 main stakeholder groups.

Government and NGOs made up the largest sectors of individual stakeholders spoken to, with both sectors accounting for 27% of the total. Stakeholders from the Fishing and Aquaculture Industry accounted for the third largest at 23%, whilst stakeholders from 'Other Industry' and Academia made up the smallest proportion of the total stakeholder audience, at 13% and 10% respectively.

Communication

Is communication between stakeholders in the Northern Ireland Marine environment open, efficient and facilitating collaboration?

Overall, answers to this question were very mixed (Figure 3). When looking at the responses by industry, the data shows that a greater percentage of stakeholders from Academia (100%), NGOs (87.5%), the Fishing and Aquaculture Industry (71.5%) and 'Other Industries' (77%) felt that communication between stakeholders is not open, efficient, or facilitating collaboration either entirely or to some extent.
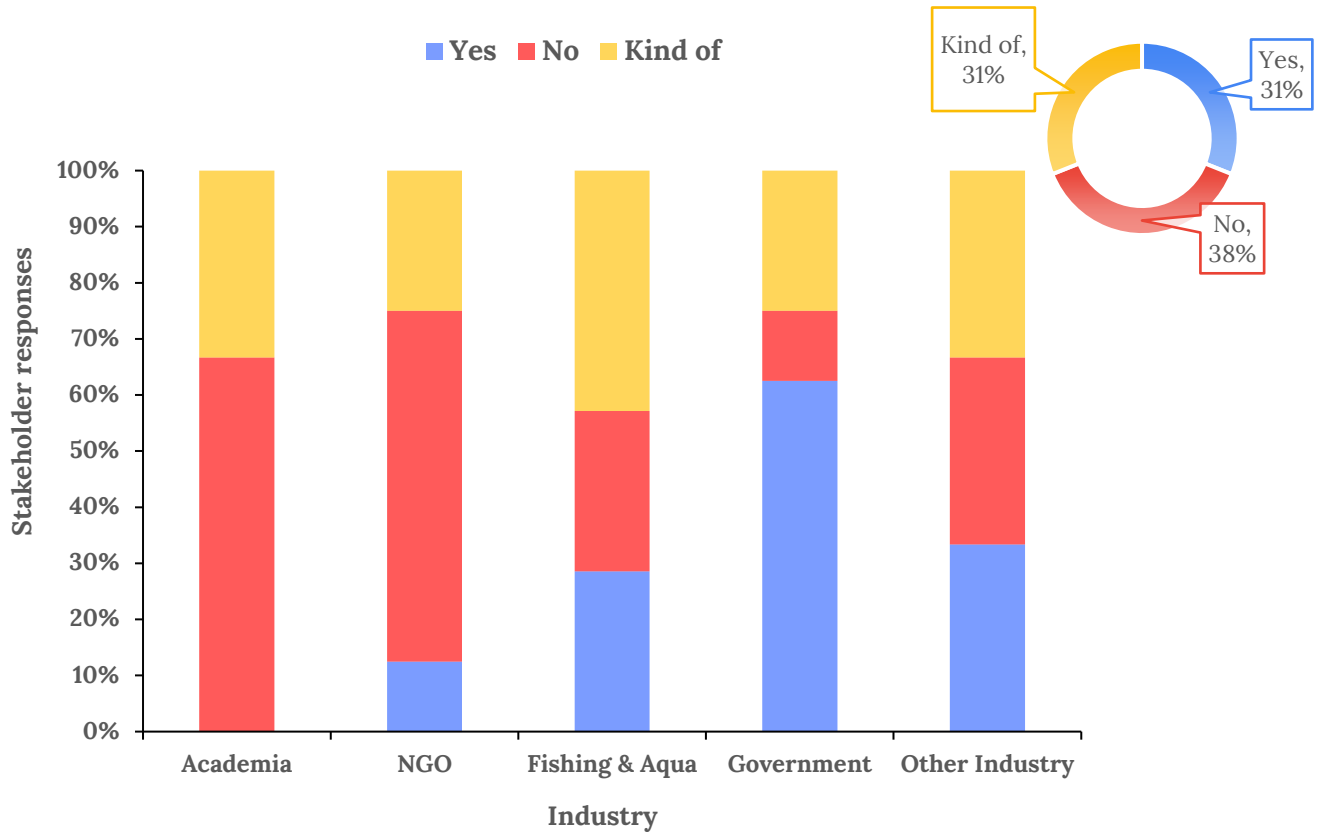
Figure 3. The bar chart shows the percentage of responses to the question "'Do you feel that communication between stakeholders in the Northern Ireland marine environment is open, efficient and facilitates collaboration?" by stakeholder group. The doughnut chart shows the percentage of stakeholders that answered Yes, No and Kind of to the question

In comparison, a greater percentage of stakeholders from Government felt that communication is open, efficient, and facilitating collaboration between stakeholders (62.5%). Only 37.5% of those spoken to from the Government stakeholder group agree with the other stakeholder groups, that communication is not fully open, efficient, nor facilitates collaboration.

Why do some stakeholders feel that communication is not open, efficient, and facilitating collaboration?

The reasons some stakeholders feel communication regarding the NI marine environment is not open, efficient, and facilitating collaboration (those that answered 'No' or 'Kind of') can be categorised as follows(Figure 4);

1. Current communication between stakeholders exists only through personal contacts. This makes it hard to communicate with people outside of already formed personal relationships and difficult for those stakeholders with few personal contacts across sectors.

2. There is no formal communication platform to assist communication between stakeholders (causing people to rely on connections through personal contacts).

3. There are strong communication links between certain stakeholder groups (that have formal working partnerships), yet poor communication channels between all stakeholder groups overall.

4. There are too many stakeholders and disjointed communication channels such as "forums" that make understanding how to communicate (and with who) confusing.

5. Communication between stakeholders is poor in general.
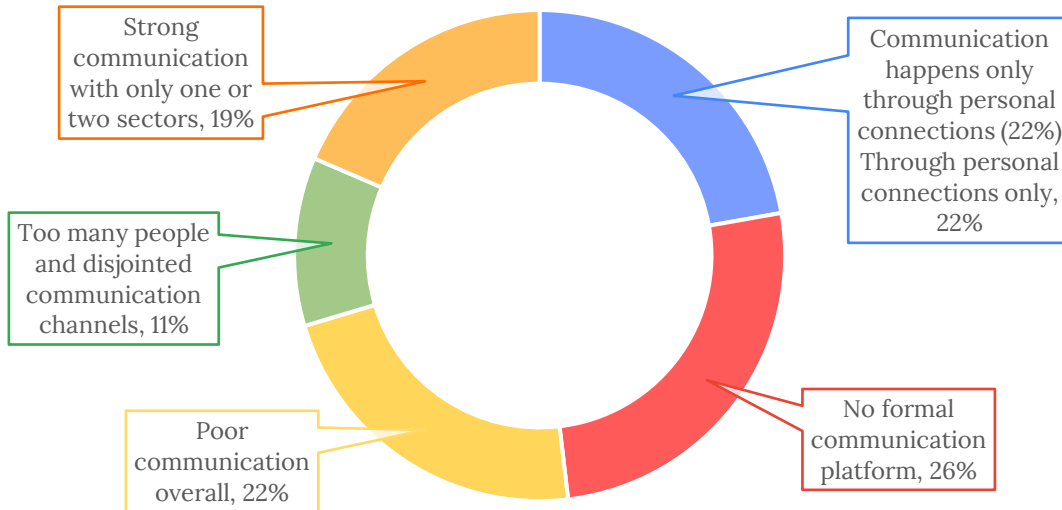
Figure 4. The chart shows the main reasons why some stakeholders (those who answered 'No' or 'Kind of') feel that communication between stakeholders in the Northern Ireland marine environment is not entirely open, efficient, and facilitating collaboration.

The division of reasons why communication was not felt to be open, efficient, and facilitating collaboration was equal amongst the stakeholders. This indicates that there is no one, clear reason why 63% of stakeholders felt communication is not as open and efficient as it could be. Instead, it appears there are a diverse array of reasons why stakeholders felt this way. Furthermore, stakeholders from each industry mentioned a combination of the five main reasons emphasising that the issues surrounding communication in the NI marine setting are more challenging than expected, with differing opinions also within stakeholder groups. Therefore, coming up with a solution that works for all relevant industries may be difficult.
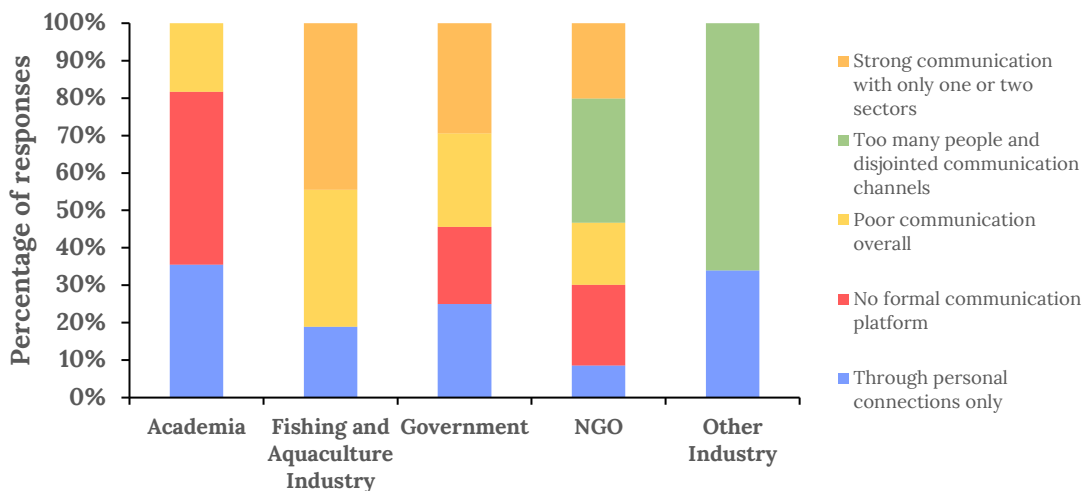

Figure 5. The chart shows the main reasons given by stakeholders (those who answered 'No' or 'Kind of') when asked 'why do you feel that communication between stakeholders in the Northern Ireland marine environment is not entirely open, efficient, and facilitating collaboration?" Results are presented by stakeholder group.

A lack of a formal communication platform by which to share information, news and updates was given as the main reason (26% of responses) for poor communications. However, the issue of communication occurring 'through personal connections only' was the only reason mentioned across all stakeholder groups (22% of responses).

"Communication tends to be one to one."
- **Government stakeholder**

"Communication currently only occurs through personal contacts."
- **Academia stakeholder**

"Communication is based on personal relationships, meaning new stakeholders or those with small networks are left out."
-**Fishing & Aquaculture industry stakeholder**

In addition to concerns around communication occurring 'through personal connections only', a large percentage of stakeholders from the 'Other Industry' group felt that there are 'too many people and disjointed communications channels', which causes confusion. This confusion revolves around how to collaborate and understand who best to collaborate with in the face of multiple forums. Younger industries such as offshore energy may find it difficult to communicate and form networks via the current 'personal connection only' system as these relationships may not be as well established, compared to other industries that have been operating in for decades.

Finally, stakeholders from the Government and NGO groups were the only ones to mention all five reasons given for communication issues between stakeholders. This may reflect the broader scope and focus of these groups compared to the other groups that are more specialised on one particular service provided by the marine environment. As a result, Government and NGO stakeholders may be more likely to come up against different communication challenges as projects, objectives, and stakeholder collaborations change.

"So many disjointed communication channels, it's hard to keep up!"
- **NGO stakeholder**

Legislation and Research

What legislation do stakeholders see as important for Northern Ireland in the coming years?

Legislation type

Fisheries and marine environment-related legislation are viewed as the most important legislation for the NI in the coming years (each making up 30% of all legislation mentioned) (Figure 6). Legislation relating to climate change is viewed as the second most important overall (21%), whilst fewer stakeholders mentioned general environmental (14%) and trade legislation (i.e., the NI Protocol) (5%).
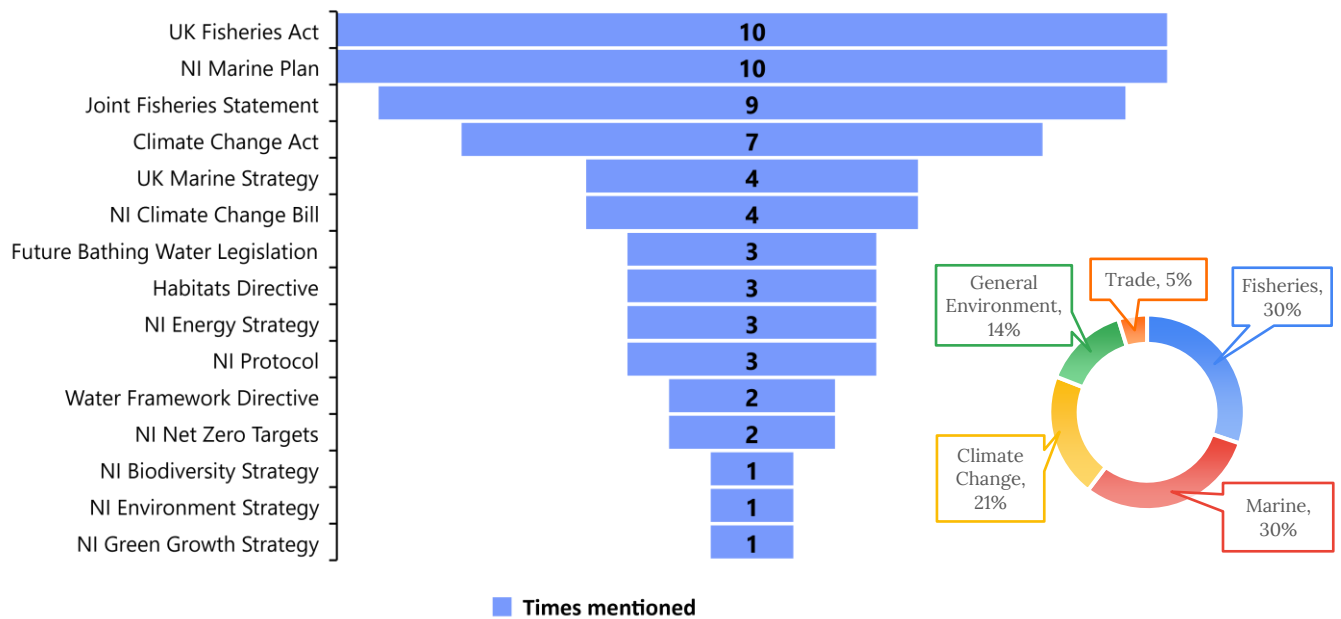
Figure 6. The pyramid shows the legislation mentioned by stakeholders as important for Northern Ireland in the coming years, along with the number of times each was mentioned. The doughnut shows the percentage of legislation mentioned by the stakeholders, categorised by legislation type.

Stakeholder groups appear to be focusing their attention on different types of legislation (Figure 7).

- Academia and the Fishing and Aquaculture Industry mention more fisheries legislation overall (blue circle).
- Government and NGO stakeholders mentioned more marine specific legislation overall than other legislations (red circle).
- Other Industry stakeholders mentioned more climate change and general environment legislation overall (pink circle).

		Fisheries		Marine general				Climate change			Environment general					Trade
		UK Fisheries Act 2020	Joint Fisheries Statement	NI Marine Plan	UK Marine strategy	WFD	Future bathing water legislation	Climate Change Act	NI Climate Change Bill	NI Net Zero targets	NI Biodiversity Strategy	Habitats Directive	NI Energy Strategy	NI Environment Strategy	NI Green Growth Strategy	NI protocol
Industry	Academia	100	67	0	33	0	0	33	0	0	0	0	0	0	0	33
	Fishing & Aquaculture	57	57	43	14	0	14	14	14	14	0	14	0	0	14	0
	Government	25	13	13	25	25	25	0	0	0	0	25	0	13	0	13
	NGO	25	25	63	0	0	0	38	38	0	13	0	13	0	0	13
	Other Industry	25	0	25	0	0	0	50	0	25	0	0	50	0	0	0
Total mentions		10	9	10	4	2	3	7	4	2	1	3	3	1	1	3
Total per group		19		19				13			9					3

Figure 7. Matrix showing the proportion of each stakeholder group that mentioned each legislation. Note that most stakeholders identified multiple legislations. (WFD relates to The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017 and The Climate Change Act refers to Climate Change Act 2008 (2050 Target Amendment) Order 2019. The UK marine strategy refers to the most recent review in 2021 and The Habitat Directive relates to the 2019 regulations which amended the Habitats Regulations 2017.

Specific legislation

Overall, NI's stakeholder audience appears to focus more on the UK Fisheries Act 2020 and the NI Marine Plan (in development), highlighting both as, in the stakeholder's opinion, the most important NI legislation for the marine environment in the coming years. The UK Fisheries Act 2020 specifically, was the only legislation mentioned by all stakeholder groups (

Industry		Fisheries		Marine general				Climate change			Environment general					Trade
		UK Fisheries Act 2020	Joint Fisheries Statement	NI Marine Plan	UK Marine strategy	WFD	Future bathing water legislation	Climate Change Act	NI Climate Change Bill	NI Net Zero targets	NI Biodiversity Strategy	Habitats Directive	NI Energy Strategy	NI Environment Strategy	NI Green Growth Strategy	NI protocol
	Academia	100	67	0	33	0	0	33	0	0	0	0	0	0	0	33
	Fishing & Aquaculture	57	57	43	14	0	14	14	14	14	0	14	0	0	14	0
	Government	25	13	13	25	25	25	0	0	0	0	25	0	13	0	13
	NGO	25	25	63	0	0	0	38	38	0	13	0	13	0	0	13
	Other Industry	25	0	25	0	0	0	50	0	25	0	0	50	0	0	0
Total mentions		10	9	10	4	2	3	7	4	2	1	3	3	1	1	3
Total per group		19		19				13			9					3

Figure 7). The Joint Fisheries Statement (JFS) is also viewed as important (making up 14% of total mentions), along with the UK Climate Change Act (11%).

Academia and the Fishing and Aquaculture Industry are aligned in their focus on the UK Fisheries Act 2020 and the JFS. One hundred percent of Academia stakeholders mentioned the UK Fisheries Act as the most important legislation, along with the JFS (67%). The Fishing and Aquaculture stakeholders agree, with 57% of stakeholders mentioning both (

		Fisheries		Marine general				Climate change			Environment general					Trade
		UK Fisheries Act 2020	Joint Fisheries Statement	NI Marine Plan	UK Marine strategy	WFD	Future bathing water legislation	Climate Change Act	NI Climate Change Bill	NI Net Zero targets	NI Biodiversity Strategy	Habitats Directive	NI Energy Strategy	NI Environment Strategy	NI Green Growth Strategy	NI protocol
Industry	Academia	100	67	0	33	0	0	33	0	0	0	0	0	0	0	33
	Fishing & Aquaculture	57	57	43	14	0	14	14	14	14	0	14	0	0	14	0
	Government	25	13	13	25	25	25	0	0	0	0	25	0	13	0	13
	NGO	25	25	63	0	0	0	38	38	0	13	0	13	0	0	13
	Other Industry	25	0	25	0	0	0	50	0	25	0	0	50	0	0	0
Total mentions		10	9	10	4	2	3	7	4	2	1	3	3	1	1	3
Total per group		19		19				13			9					3

Figure 7).

NGO stakeholders were more focused on the NI Marine Plan, with 63% identifying its development as the most important legislation for NI in the coming years (

		Fisheries		Marine general				Climate change			Environment general					Trade
		UK Fisheries Act 2020	Joint Fisheries Statement	NI Marine Plan	UK Marine strategy	WFD	Future bathing water legislation	Climate Change Act	NI Climate Change Bill	NI Net Zero targets	NI Biodiversity Strategy	Habitats Directive	NI Energy Strategy	NI Environment Strategy	NI Green Growth Strategy	NI protocol
Industry	Academia	100	67	0	33	0	0	33	0	0	0	0	0	0	0	33
	Fishing & Aquaculture	57	57	43	14	0	14	14	14	14	0	14	0	0	14	0
	Government	25	13	13	25	25	25	0	0	0	0	25	0	13	0	13
	NGO	25	25	63	0	0	0	38	38	0	13	0	13	0	0	13
	Other Industry	25	0	25	0	0	0	50	0	25	0	0	50	0	0	0
Total mentions		10	9	10	4	2	3	7	4	2	1	3	3	1	1	3
Total per group		19		19				13			9					3

Figure 7).

'Other Industry' stakeholders were focused on the Climate Change Act and the development of the NI Energy Strategy, with 50% of stakeholders identifying both as equally important.

Government stakeholders saw several different legislations as equally as important, potentially highlighting that they feel a wider policy picture is important for the future of the NI marine environment. This may, however, be a result of the fact the government by default has to be aware of all legislation types.

To understand whether the year a legislation came into force had any impact on it being considered important by stakeholders, the legislation enactment date was considered alongside the number of times it was mentioned by stakeholders. No stakeholders referred to legislation enacted prior to 2017 (

Figure 8), indicating that stakeholders are focusing more on recent legislation. This is particularly true for incoming legislation, with stakeholders mentioning legislation currently in development 30 times compared to current legislation from 2017 to today 33 times (

Figure 9). This potentially highlights that the stakeholders expect future legislation to be of more importance to the health of the NI marine environment than legislation already in place. One reason to potentially explain this is that NI is behind other UK Administrations in delivering on key environmental legislation and strategies (e.g., a NI Marine Plan has been in draft format for several years vs established marine plans for Scotland, England and Wales). Nevertheless, the key legislation needed to address gaps in NI legislation are in progress and expected to come into force over the next few years (e.g., NI Marine Plan, NI Climate Change Bill, NI Net Zero targets).

> *"Northern Ireland is behind on environmental legislation compared to the rest of the UK. There are a number of bills and strategies yet to be delivered".*
>
> **- NGO stakeholder**

> *"The NI Climate Change Act is still not fully developed. Also, the NI Marine Act has been in the draft stage since 2018."*
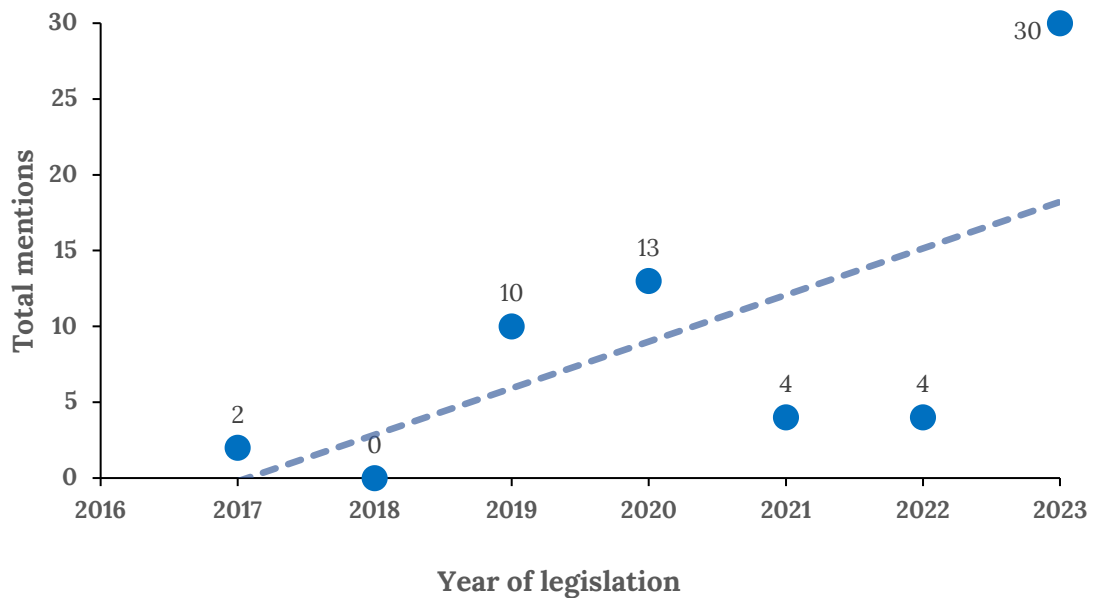>
> **-NGO stakeholder**

> *"The NI 1966 Fisheries Act is currently not compatible with the JFS. It needs to be updated to bring NI in line with the rest of the UK".*
>
> **- NGO stakeholder**

	Legislation														
	Water Framework Directive	Climate Change Act	Habitats Directive	UK Fisheries Act 2020	NI protocol	UK Marine strategy	NI Energy Strategy	NI Green Growth Strategy	NI Environment Strategy	NI Biodiversity Strategy	Future bathing water legislation	NI Net Zero targets	NI Marine Plan	NI Climate Change Bill	Joint Fisheries Statement
Legislation date	2017	2019	2019	2020	2020	2021	2022	2022	2023	2023	2023	2023	2023	2023	2023
Academia	0	33	0	100	33	33	0	0	0	0	0	0	0	0	67
Fishing and Aquaculture Industry	0	14	14	57	0	14	0	14	0	0	14	14	43	14	57
Government	25	0	25	25	13	25	0	0	13	0	25	0	13	0	13
NGO	0	38	0	25	13	0	13	0	0	13	0	0	63	38	25
Other Industry	0	50	0	25	0	0	50	0	0	0	0	25	25	0	0
Total mentions	2	7	3	10	3	4	3	1	1	1	3	2	10	4	9

(Industry is the row grouping label on the left spanning Academia through Other Industry.)

Figure 8. The same matrix as in

| Fisheries | Marine general | Climate change | Environment general | Trade |

Industry		UK Fisheries Act 2020	Joint Fisheries Statement	NI Marine Plan	UK Marine strategy	WFD	Future bathing water legislation	Climate Change Act	NI Climate Change Bill	NI Net Zero targets	NI Biodiversity Strategy	Habitats Directive	NI Energy Strategy	NI Environment Strategy	NI Green Growth Strategy	NI protocol
	Academia	100	67	0	33	0	0	33	0	0	0	0	0	0	0	33
	Fishing & Aquaculture	57	57	43	14	0	14	14	14	14	0	14	0	0	14	0
	Government	25	13	13	25	25	25	0	0	0	0	25	0	13	0	13
	NGO	25	25	63	0	0	0	38	38	0	13	0	13	0	0	13
	Other Industry	25	0	25	0	0	0	50	0	25	0	0	50	0	0	0
Total mentions		10	9	10	4	2	3	7	4	2	1	3	3	1	1	3
Total per group		19			19			13			9					3

Figure 7 orders the legislation mentioned by stakeholders as important by enactment date. The proportion of stakeholders from each industry that mentioned each legislation is also shown. Note that '2023' refers to incoming legation (with unknown future enactment dates).

Figure 9. Scatter graph shows the number of times legislation from a given year was identified by stakeholders as important for Northern Ireland's marine environment in the coming years. The X axis plots the year the legislation came into force whilst the Y axis shows the number of times legislation enacted in each year was mentioned.

Do stakeholders feel there is enough research being done to support legislation in Northern Ireland?

Of the stakeholders interviewed, 65% felt that insufficient research is being undertaken to support NI legislation that relates to fisheries and marine legislation (Figure 10). Twenty-two percent of stakeholders were undecided as to whether adequate research currently supports legislation (Figure 10), and just 13% felt that it is.
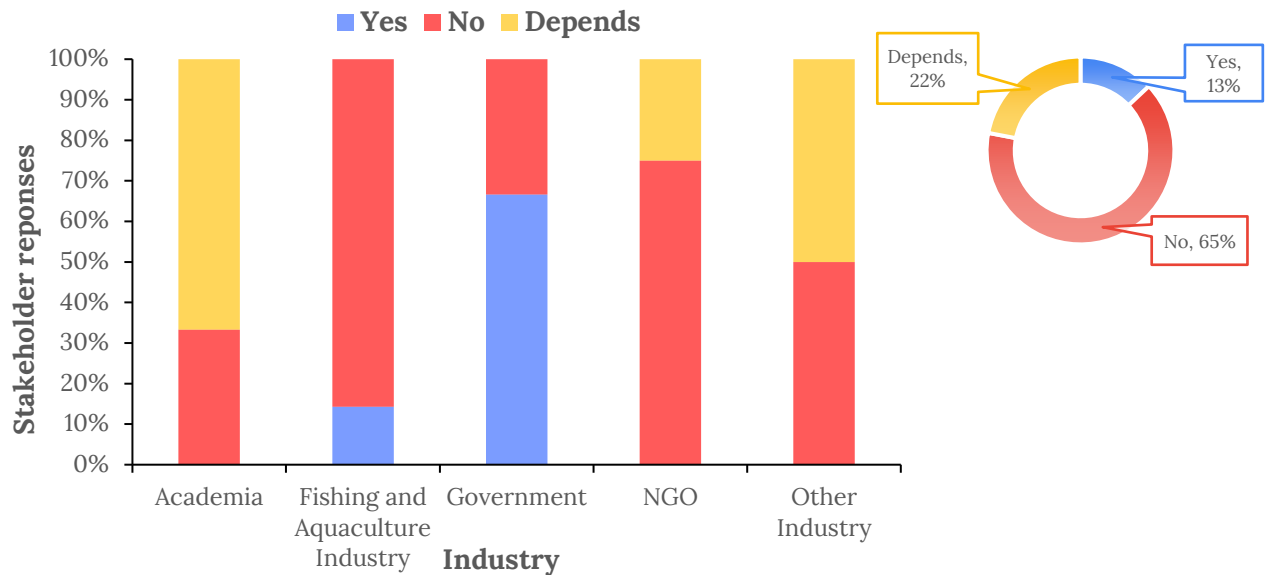

Figure 10. The bar chart shows the percentage of stakeholders from each stakeholder group that answered 'Yes', 'No' or 'Depends' to the question "do you feel there is enough research being done in Northern Ireland to address current and incoming legislation?" The doughnut shows how the stakeholder audience responded to the question. Note that 23% (n=7) of the total stakeholder audience (n=30) did not answer this question as they felt they didn't have enough knowledge on NI legislation in general. The percentages in this graph are therefore calculated using a total stakeholder audience of 23.

When looking at the responses by industry, 'No', was the only response given by all stakeholder groups overall, highlighting that all stakeholder groups agree to some extent that there is not enough research being undertaken to support legislation (Figure 10). This response was dominated by the Fishing and Aquaculture Industry and NGO groups with 86% and 75% answering 'No' (respectively).

Evaluating Government stakeholder responses to this question (do you feel there is enough research being done in NI to address current and incoming legislation?) was difficult, based on the fact that only 2 out of the 8 interviews gave definitive answers. For the two that did response, the answer was 'Yes' (67%) which contrasts to the other stakeholder groups. It should, however, be noted that although there was no definitive response from the other 6 Government stakeholders, the attitude of the stakeholders seemed to imply that answer would be 'Yes'. The contrasting response from Government compared to other stakeholder groups could indicate that government feel positive about the research they are currently undertaking, yet it is perhaps not well communicated with other stakeholder groups.

"There is a lot of work being done by AFBI to feed into legislation".

-Government stakeholder

Research gaps and research threads

When asked 'what research is needed to support legislation?', the stakeholder audience mentioned 61 areas of research that they felt require more focused research. Those areas of research mentioned more than once (by different stakeholders) have been classed as key research gaps according to the stakeholder audience (Table 1).

Table 1. Table shows the key research gaps relating to the Northern Ireland marine environment, according to the stakeholder audience. The right column shows the number of times each research gaps was identified by multiple stakeholders.

Key research gaps	Times mentioned
Fishing Impacts on marine environment – gear impact, discards, overfishing, catch selectivity gear innovation.	9
Fuel consumption - decarbonisation of marine industries, particularly fishing fleet	7
Blue carbon – habitats, stock, processes, contribution/ potential, and restoration	6
Socioeconomic studies- fisheries displacement, fleet demographics, MPA costs and impact on marine industries, marine cultural heritage	6
Marine spatial planning –spatial distribution of the multiple and conflicting marine users	5
Offshore renewables – impacts on commercial species, potential benefits provided	5
Habitat/ species monitoring – biodiversity decline, movements, distribution, populations	4
Decision-making tools – support and develop interaction between users of the sea	3
MPAs – effectiveness, redesign for blue carbon network	3
Sustainable development of commercial seafood –sustainable aquaculture potential/development	3
Climate change - impacts, mitigation, and adaptation	2
Water quality/ pollution – agricultural runoff, pharmaceuticals, plastic etc.	2

To develop a more complete picture of the state of research on the NI marine environment, the research gaps identified by the stakeholders were compared to live (or recently completed) research projects underway in the NI marine environment (identified through the landscape review and stakeholder interviews) (Figure 11) (see Appendix 4. for a list of current and past projects).
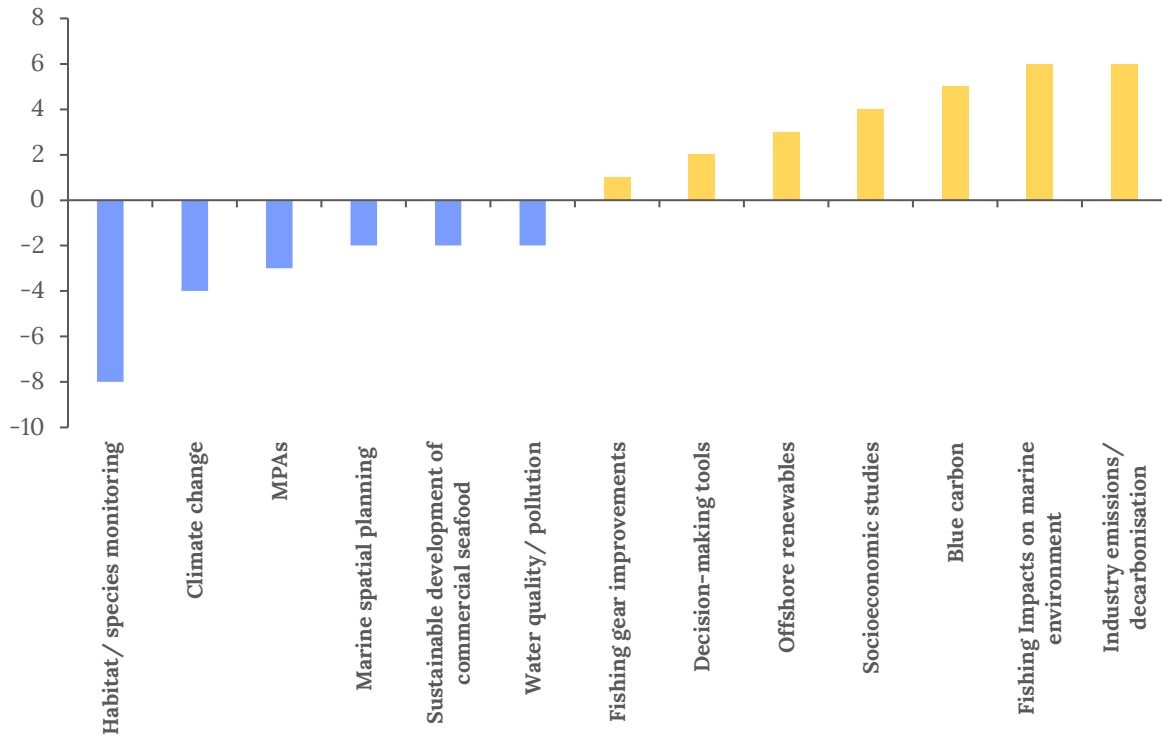
Figure 11. Bar chart shows the difference between the number of times a research gap (x axis categories identified by the stakeholder audience) was mentioned, and the number of live (or recently completed) research projects underway in Northern Ireland. Negative numbers (blue bars) show research gaps that are the focus of multiple research projects (where there is good research effort but poor communication to stakeholders), whilst positive numbers (yellow bars) show research gaps that are the focus of a much smaller number of projects (where research effort is lacking). Note: the y-axis numbers do not denote the number of projects, they denote the difference between the knowledge lacks and the number of projects that cover that identified research area.

Through this comparison, two scenarios became evident (note that both scenarios assume that the opinion of the stakeholder audience reflects the true picture of NI's marine research needs);

1. Roughly half of the research gaps identified by stakeholders are in fact the focus of multiple research projects underway in NI (blue bars), including habitats/ species monitoring, MPAs, marine spatial planning, sustainable development of commercial seafood and water quality/pollution. This therefore highlights that some stakeholders are unaware of the research taking place and that better, clearer communication on current research is need.

2. Roughly half of the research gaps identified are the focus of fewer research projects underway (yellow bars), including fishing gear improvements, decision making tools, offshore renewables, socioeconomic studies, fishing impacts on the marine environment, blue carbon, and industry emissions/ decarbonisation (note that at least one research project was identified for each of the research gaps mentioned). This highlights that there is a lack of focused research on these research areas. Therefore, more effort should be placed on these areas to fill any assumed research / knowledge gaps.

In summary, it appears that the research projects occurring in NI cover a wide range of different marine-related research areas. However, there does not appear to be equal effort in terms of the number of projects across all areas of the different research. For example, certain research areas are the focus of multiple projects, compared to other research areas that are the focus of very few. Consequently, around half of the research gaps identified by stakeholders require an injection of research effort to ensure there is an equal knowledge base across all the research

areas identified – assuming this would be a worthwhile objective. In addition, some stakeholders appear to be unaware of projects currently underway in NI, resulting in misidentifying research gaps that are the focus of multiple studies. Consequently, more effort should also be focused on the communication and awareness of research projects going on in NI.

Marine Hub

Is there need for a Northern Ireland Marine Hub?

Of the stakeholders interviewed, 70% said 'Yes', a NI Marine Hub is necessary, compared to 30% that answered it 'Depends' (

Figure 12). None of the stakeholders answered 'No', highlighting a majority consensus that a NI Marine Hub would be a beneficial development.

Three out of the five stakeholder groups were in favour of a NI Marine Hub (Figure 12), including Academia (100%), NGOs (88%) and the Fishing and Aquaculture Industry (86%).

Stakeholders from the 'Other Industry' stakeholder group had an equal split in their response to the question with 50% answering 'Yes' and 50% answering that it 'Depends'.

Government stakeholders on the other hand, appeared more cautious regarding the idea of a NI Marine Hub, with only 38% answering 'Yes', compared to 63% that answered 'it depends'.
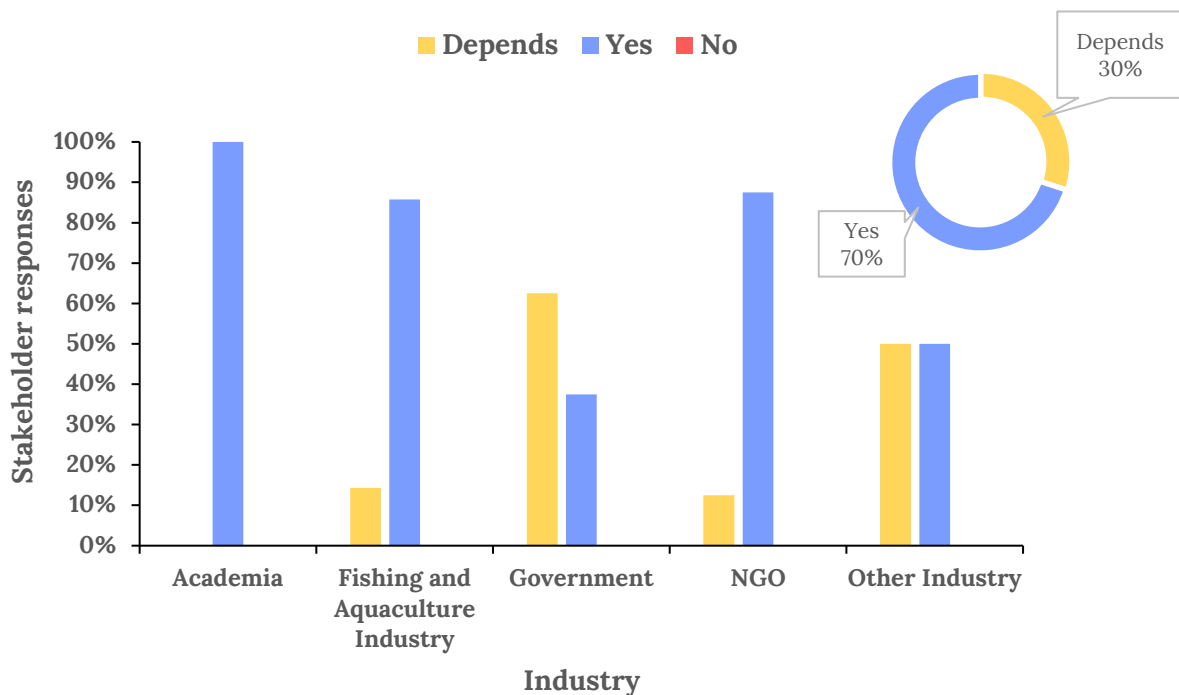

Figure 12. The bar chart shows the percentage of stakeholders from each stakeholder group that answered 'Yes', 'No' or 'Depends' to the question, "do you feel there is a need for a Northern Ireland Marine Hub?". The doughnut shows how the stakeholder audience responded to the question.

Those stakeholders that thought a NI Marine Hub is necessary, felt this for several reasons (Figure 13).
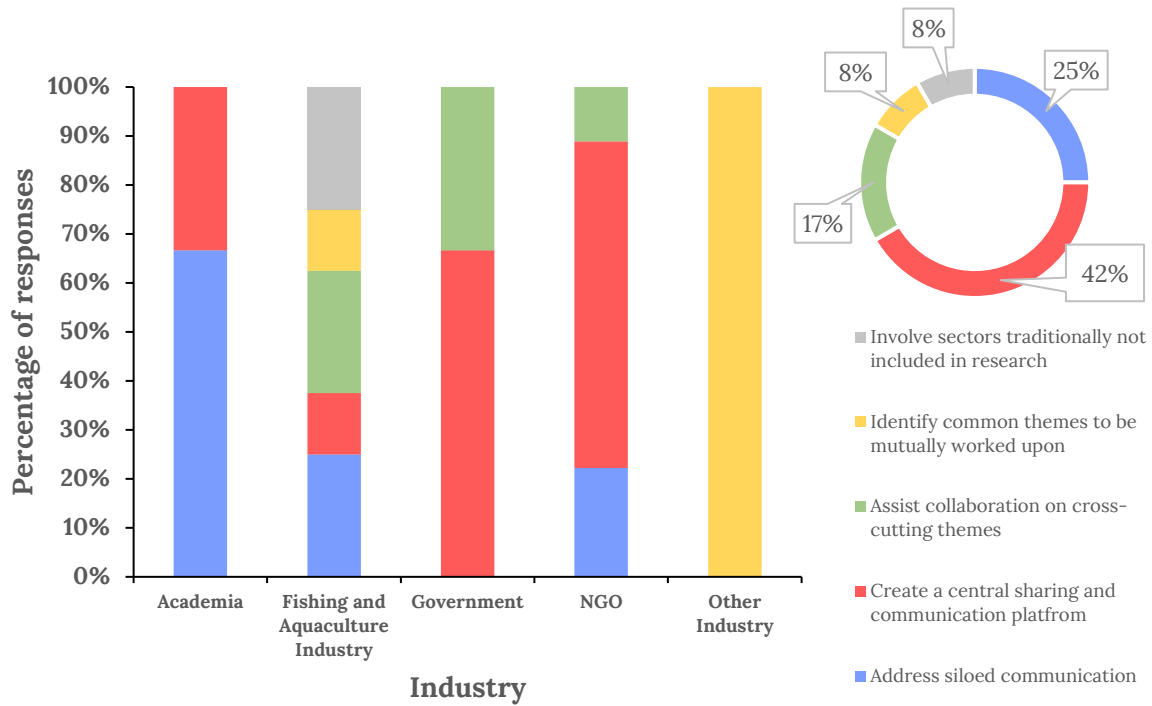
Figure 13. The bar chart shows the main reasons given by stakeholders from each stakeholder group for the need for a Northern Ireland Marine Hub. The stakeholders that answered this question are those that answered, 'Yes' to the question "Do you feel there is a need for a Northern Ireland Marine Hub?" The doughnut shows how the stakeholder audience responded.

Needing to create a central and unbiased sharing and communication platform to facilitate collaboration and marine research was given as the main reason (42% of responses) to develop a NI Marine Hub. A significant proportion of the stakeholder audience (25% of responses), however, also noted that a Marine Hub is needed to address siloed communication within and between marine sectors.

"Northern Ireland needs one central place to find out information that isn't biased towards one industry."

– Fishing and Aquaculture Stakeholder

"A shared platform could benefit the drive for marine research in the future."

– Government stakeholder

"Research is siloed and scattered. It would be better funnelled through one shared space."

- NGO stakeholder

Individual stakeholders that were more uncertain about the need for a NI Marine Hub (those that answered it 'Depends', 30%), felt this way for several reasons:

> "Having too many people involved may make it unstable, as it tries to please too many different agendas. May become a talking shop."
>
> **-Other Industry Stakeholder**

> "There are already a lot of forums for similar goals."
>
> - **Government stakeholder**

> "Unsure if there needs to be a central place for communication."
>
> - **Government stakeholder**

> Not convinced a Marine Hub is needed. We just need to build on the communication that already exists.
>
> **-NGO stakeholder**

> "There is a need for improved communication but I'm not sure what this would look like, or where funding should come from."
>
> - **Fishing & Aquaculture stakeholder**

> "Unsure there is a need for one and how it would work."
>
> - **Government stakeholder**

Some stakeholders noted concerns about a Marine Hub becoming a potential 'talking shop' that may become another disjointed communication channel that adds further confusion. Other stakeholders supported this view, highlighting that it may be better to work on the communication already established through similar projects.

Some Government stakeholders questioned the need for a Marine Hub, querying whether a central place for communication between stakeholders is needed. This concern by government, however, does not reflect the overall stakeholder audience opinion. Nor does it align with one of the main opinions why communication between stakeholders is lacking in openness and efficiency ('there is no formal communication platform to assist communication between stakeholders'). Government stakeholder group were also the only group that largely felt communication between stakeholders is working efficiently. This highlights Government stakeholders are not well aligned with the other stakeholder groups when it comes to wider communication and collaboration issues surrounding the NI marine environment. This may also indicate that communication and feedback to Government on such issues from other stakeholder groups is lacking.

Should a Marine Hub be a Physical or Virtual Space?

Of the stakeholders interviewed, 70% said a NI Marine Hub should be designed as a mixture of both a physcial and a virtual space. Of the remaining 30% of stakeholders, 17% said that a NI Marine Hub should be a virtual space, existing only online, compared to 13% that said it should be a physcial space, consisting of a brick-and-mortar Hub (Figure 14).
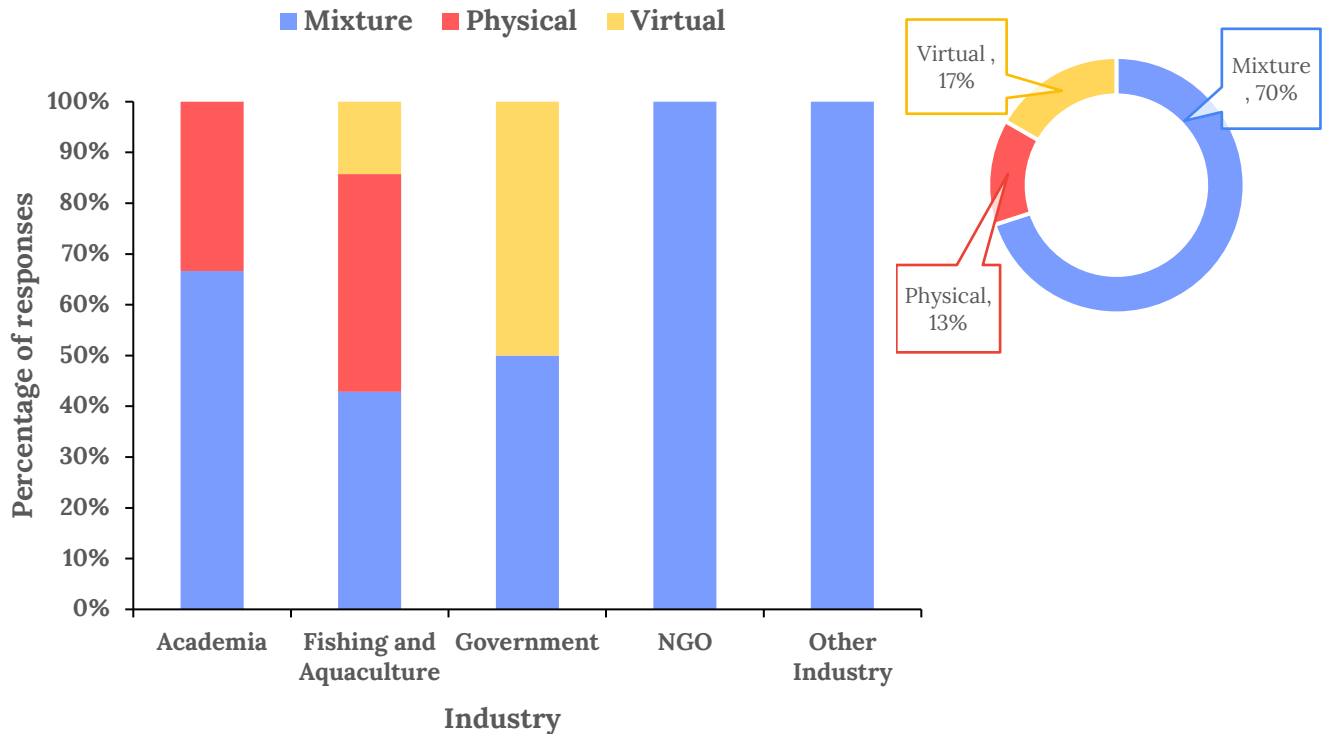

Figure 14. The bar chart shows the percentage of stakeholders from each stakeholder group that answered 'Physical', 'Virtual' or 'Mixture' to the question "What style of 'hub' do you think would work best, a physical hub, virtual hub, or a mixture of the two?" The doughnut shows how the stakeholder audience responded to the question.

All stakeholders spoken to from the Other Industry and NGO groups felt strongly that a NI Marine Hub should consist of mixture of both a physcial and a virtual space. Both stakeholder groups felt that a physical presence in addition to an online presence is needed to stop a Marine Hub from becoming another forum that does not engage. Most of these stakeholders also argued that a purely physcial location would be biased towards those that live locally and that other are unlikely to take time out of work to travel. Nevertheless, they felt that human contact is needed to have the biggest impact and therefore a physcial space is as important as an online space.

The majority of stakeholders from the Academia stakeholder group were also in favour of a Mixture style Marine Hub (67%), stating that an online presence is needed in the modern world of online meetings and connecting with people in remote places. However, certain stakeholder groups will likely interact better with a physical Hub (such as the Fishing and Aquaculture Industry), and therefore a mixture of the two styles would be needed. In comparison, 33% of Academia stakeholders felt that a purley physical space is more appropriate as they felt a brick-and-mortar style Hub would better "bring synergy of people and ideas", compared to a virtual setting.

The remaining two stakeholder groups were more mixed in their feelings around the infrastructure of a NI Marine Hub. Stakeholders from the Fishing and Aquaculture Industry predominately said that a Mixture style, or a Physical style would work best, with an equal 43%

split in response between the two. Many argued that a virtual space is the first priority, however, fishermen would likely benefit from having a physical site also where they could go and physically speak to someone, find out about research, and offer their ideas in person. Other argued that a Marine Hub needs a purely physical space to give it the necessary presence needed to be successful.

Stakeholders from the Government stakeholder group felt that a mixture style Hub and a purely virtual Hub are both equally viable options, with an equal 50% split of stakeholder responses for the two. Those in favour of a mixed style Hub largely felt that a virtual space could potentially be 'lost' to the internet and not used if it were not regularly maintained. Therefore, they felt a physical Marine Hub is needed alongside a good online presence to be effective. In contrast, those who were in favour of a purely virtual space argued that people are unlikely to travel outside of their area to a Marine Hub. Therefore, a virtual Hub would better guarantee more widespread engagement across the stakeholder groups. Others also mentioned that fishermen have been more willing in the past to join online groups over in person meetings, as they reduce the need to take time away from being at sea. Therefore, they see a virtual Hub being more inclusive to the Fishing and Aquaculture Industry.

Where Should a Physical Marine Hub Be Located?

Geographic location

Five geographic locations were identified by the stakeholder audience as preferred locations for a physical Marine Hub (Figure 15);
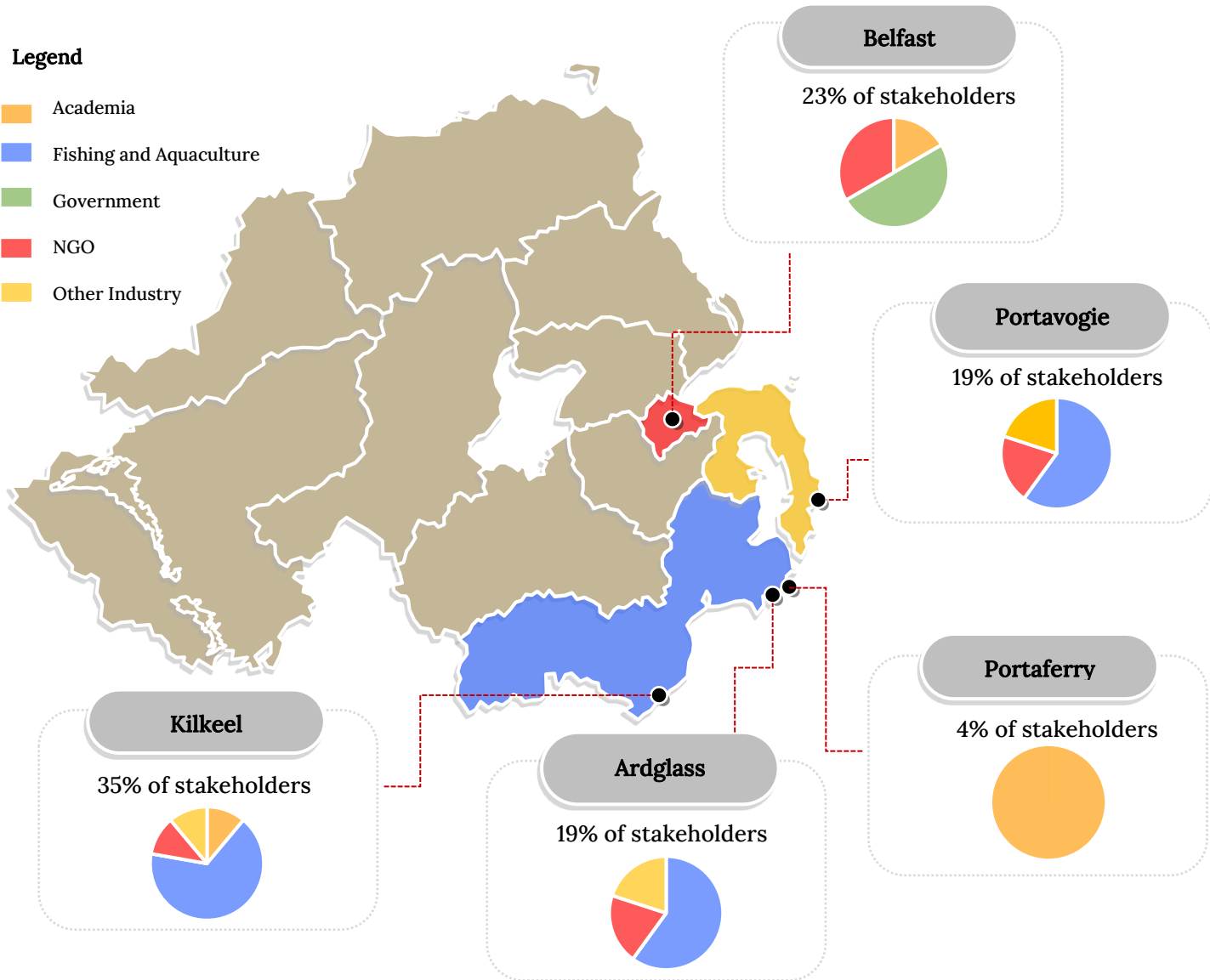

Figure 15. Map shows the specific locations stakeholders identified for a physical Northern Ireland Marine Hub, including Belfast, Portavogie, Portaferry, Ardglass and Kilkeel. The percentages given show the percentage of the stakeholder audience that mentioned each location. The doughnuts show the stakeholder groups that mentioned each location. Note the white, unhighlighted section within the map represents Loch Naegh (Base map image is taken from yourfreetemplates.com).

Kilkeel was the most popular location mentioned by the stakeholder audience (35%) and the majority of stakeholder groups. Four out of the five stakeholder groups felt that it would be the best location for a physical Marine Hub (all except Government). The Fishing and Aquaculture Industry particularly felt that a fishing harbour location would be the most appropriate, with a significant amount mentioning Kilkeel.

Belfast was the second most popular choice (23%) and was mentioned by a mixture of Government, NGO, and Academia stakeholders. It was also the only location mentioned by Government. Furthermore, 17% of those stakeholders that felt Belfast would be the best location felt that it should be housed within Queens University, Belfast.

Other stakeholders felt that a Marine Hub should be spread across the three main fishing harbours (Kilkeel, Portavogie and Ardglass) (13%). This would consist of either a main Hub at one of the harbours and two smaller hubs at the other harbours, or three small satellite hubs at each harbour. Other stakeholders (3%) felt that a Marine Hub should be located purely at either Portavogie or Ardglass, as a way to support the fishing communities there that receive less investment compared to Kilkeel.

More generic locations were given by some stakeholders, referring to the environment a Marine Hub should be located in, such as in a coastal location (13%) or in an area impacted by marine development as a way to bring money and opportunities to the community (3%). Locating a Marine Hub in an area of low job prospects was also mentioned as a way to increase employment and offer an alternate career path for those choosing vocational work over university (this comment was made in reference to a Marine Hub providing the training needed to work in various marine industries).

Existing infrastructure

Some stakeholders (17% of the stakeholder audience) felt that incorporating a Marine Hub into existing research infrastructure and facilities would be the best choice, as these sites are already established and would reduce costs required to build new Marine Hub infrastructure. Existing infrastructure identified (through the stakeholder engagement interviews and landscape review) include university and government laboratory facilities, communities buildings and visitor centres, harbour buildings belonging to the Fishing and Aquaculture Industry, enterprise centres and more (Table 2).

Table 2. A list of existing research infrastructure and facilities in Northern Ireland that could be incorporated into a Northern Ireland Marine Hub. The facilities were identified through both the landscape review and stakeholder engagement interviews.

Existing Facility	Location
Queen's University Marine Laboratory (QML)	Portaferry, Country Down
Portrush Coastal Zone	Portrush, County Antrim
The Nautilus Centre	Kilkeel, Country Down
AFBI Research Vessel Corystes	Belfast
RSPB Belfast WOW Centre (Window OF Wildlife)	Belfast
ReefLIVE Aquarium (in development)	Belfast
River Bush Salmon Station/ AFBI Bushmills	County Antrim
Binnian Enterprise Park	Kilkeel, Country Down
AFBI Fish disease unit	Belfast
Seascope NI Lobster Hatchery & Marine Research Centre	Kilkeel, Country Down
East Lighthouse	Rathlin Island

Are there any concerns around the location of a physical Marine Hub?

Many stakeholders highlighted potential challenges that may occur as a result of the location of a Marine Hub. Most concerns related to the chosen location being biased towards those stakeholders who live locally, with many expressing concerns that geographically closer industries would dominate the hub and sway its interests. Others felt that those stakeholder groups more geographically spread out or based further away would not feel included or that they have ownership of the space.

Unwillingness to travel to a Marine Hub as a result of rural accessibility or inconvenience was identified as potentially causing issues of reduced stakeholder engagement. This is particularly true for the Fishing and Aquaculture Industry, as time spent travelling to a Marine Hub would mean less time at sea for fishermen and therefore a reduced catch. The Fishing and Aquaculture Industry may therefore be less likely to engage with a physical Marine Hub compared to other stakeholder groups if it were located some distance from the harbours. The same may also be said for geographically isolated stakeholders who identified poor road conditions and long commuting times as an issue with a physical Marine Hub in general.

"A physical hub could become dominated by local industries, whilst those further away feel like they aren't included."

-NGO Stakeholder

"The isolation of the country poses problems with where it is located."

-Government stakeholder

"It is unlikely that fishermen will give up time at sea to travel far for meetings."

-NGO Stakeholder

"Location may be biased towards those that live near."

-Other Industry stakeholder

How Should a Marine Hub be Funded?

Of the stakeholders that answered the question 'How should a NI Marine Hub be funded?', 63% felt that funding should come from a mixture of government and private funds. In comparison, 26% of stakeholders felt that a Hub should be entirely privately funded, whilst 11% felt it should be entirely government funded (Figure 16).
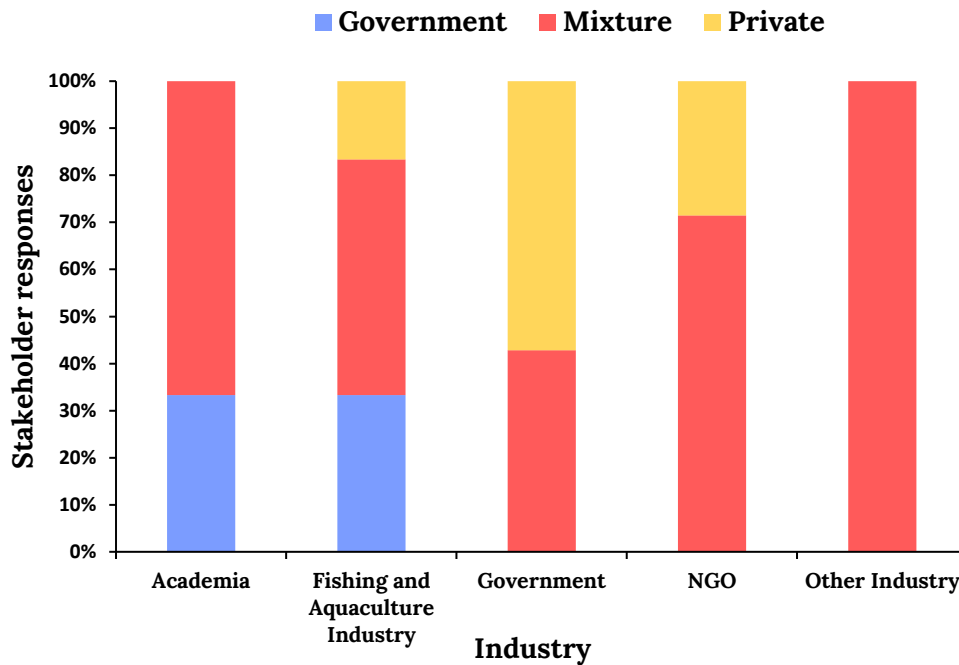

Figure 16. The bar chart shows the percentage of stakeholders from each stakeholder group that answered 'Private', 'Government' and 'Mixture' to the question "how do you think a Northern Ireland Marine Hub should be funded?" The doughnut shows how the stakeholder audience responded to the question.

Mixed funding (private and government) was the most popular response across the stakeholder groups (see Appendix 5. For a list of all available funding options). The main reason for this response were concerns over the level of influence government could have on the Hub if the majority of funding was government provided. A related concern was that government agendas could dominate a hub solely funded by the government. Similar reasons were also given by those stakeholders (except government) that felt private funding is more appropriate (17% of the Fishing and Aquaculture Industry and 29% of NGOs). In contrast, those stakeholders that felt 100% of funding should come from government (33% of Government and 33% of Academia) argued that a Hub would benefit society; therefore, it should be funded by national government.

Of the stakeholders in favour of a mixed funding model, many felt that the main funding should come from independent, private sources, whilst Government provides seed funding.

"Funding should be separate from government, otherwise the interests of the Marine Hub could become too political"

- **NGO stakeholder**

"A Marine Hub would be an integral part of society, so Government should fund it."

- **Academia stakeholder**

When asked where private funding should come from, the stakeholders (those stakeholders who answered 'Mixed' or 'Private' funding), identified four primary sources, including:

- Sponsorship of the Marine Hub
- Private investor funding
- Independent grant funding
- Financial contributions from participating industries

Financial contributions from participating industries were the most commonly mentioned idea surrounding the source of private, independent funding. Many felt that those industries that would benefit from the Hub should contribute financially to its development and upkeep, whilst smaller Government funds could be used for seed funding or ongoing maintenance support. However, many stakeholders highlighted that industry funding contributions must be equal to stop the interest and activities of the Hub being swayed in favour of those that contribute more financially.

To ensure that ownership of the Hub is equally inclusive to all sectors involved, alternative contributions to financial funding were suggested. The Fishing and Aquaculture Industry, for example, suggested that those industries that cannot financially contribute could contribute in other ways, such as providing staff and time in kind to help manage the Hub.

Government stakeholders, however, were more resistant to a mixed funding model, with 57% identifying entirely private funding as a better option, all citing lack of government funding as the reason. Government stakeholders also highlighted that 100% government funding may not be the best idea, as an element of historical distrust towards the government is present across the industries when it comes to collaborative projects.

"Funding should be a mixture of government funding and contributions from benefitting industries."

-Other Industry Stakeholder

"Industries should contribute to give them a financial stake. Those that are not financially able could offer alternate contributions."

-Fishing and Aquaculture stakeholder

"Government don't have the money to support a Marine Hub. It would need to be externally government funded."

- **Government stakeholders**

How should funding be sustained?

The most common idea (mentioned by all stakeholder groups independently) regarding how to best sustain funding for the hub, was the development of a commercial aspect / branch / leg of the Hub that would generate profit. These ideas all relate to a physical Hub taking the form of a Research and Innovation Development Centre to include; housing companies, providing training opportunities and offering Hub facilities to test and develop new innovations.

One government stakeholder highlighted that training opportunities could be of interest to higher education institutes / vocational colleges, and industry sponsorship as a way to fund such a training element of the Hub. Stakeholders from the 'Other Industry' group emphasised the possibilities of offering training to fishermen keen to move into the offshore energy sector. These suggestions were followed by comments that such schemes could work to reduce any negative socio-economic impacts resulting from marine research associated with the Hub.

Other commercial ideas included providing advisory services, offering the Hubs space for events, and selling any innovation developed by the industries involved, such as new fishing gear

technologies. It was also suggested that the Hub could generate funds by charging companies to advertise their technology/ services to members through the Hub

A membership style subscription to the Hub was highlighted by Government stakeholders as a possible way to sustain funding. This could involve a tiered level subscription (such as bronze, silver and gold tiers) with increasing access to the Hub depending on the membership level. Some stakeholders, however, raised concerns around this idea, stating that free access to information is needed to ensure that the Hub stays true to its objective of strengthening collaboration and information sharing across the marine sector.

Stakeholders from NGOs and the Fishing and Aquaculture Industry also emphasised sustained funding opportunities via grants, hosting post-graduate training studentships, and apprenticeship sponsorship. Some stakeholders, however, were concerned that the current longevity of such grant schemes is relatively short and would therefore not provide secure, long-term funding for the Hub.

Finally, some stakeholders identified opportunities to reduce the cost of a physical Hub, by utilising existing research infrastructure and facilities. In addition, some stakeholders suggested sharing staff time between the different stakeholder groups to run some processes within the Hub.

How should a Marine Hub be Managed?

Who do stakeholders feel should direct / manage the Marine Hub?

Of the stakeholders interviewed, 93% felt that a Hub should be directed by either an independent organisation or a steering group of equal representatives from across the range of stakeholder groups involved in the Hub (Figure 17).
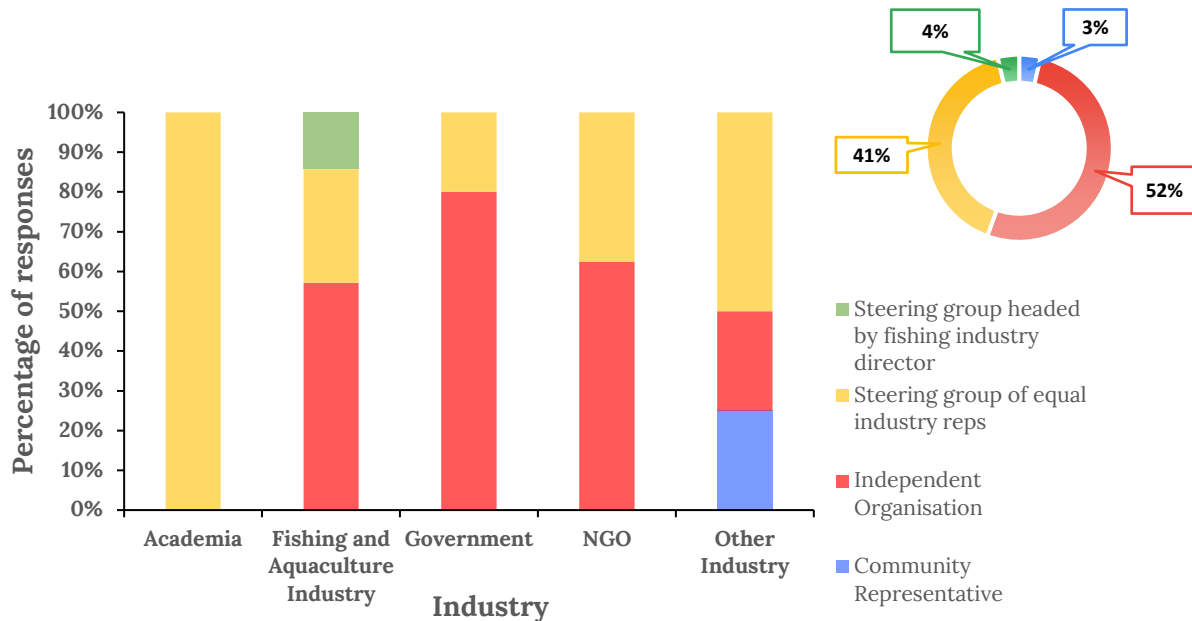

Figure 17. The bar chart shows the responses given by stakeholders from each stakeholder group to the question "who do see directing/ managing a Marine Hub?". The doughnut shows how the stakeholder audience responded.

The most popular responses from stakeholders were that a Hub should be directed by an independent organisation (52%), followed by a steering group made up of industries representatives (41%). No stakeholders (including Government stakeholders themselves) felt that a government representative or agency should direct the Hub. Non-government stakeholders felt that a Hub could become too restrictive in its agenda if it were managed by government, and that its activities may be swayed to fulfil government objectives. Government stakeholders largely agreed with this but noted "a Hub is not something government has the time to run".

A steering group of industry representatives was the only response mentioned across all stakeholder groups. All stakeholders from Academia and half from 'Other Industry' felt that an industry led steering group was the best management option. Stakeholders from the Fishing and Aquaculture Industry highlighted that for an industry led steering group to be successful at directing the Hub, appropriate proportional representation across all involved industries will be important. Equal representation would ensure that management of the Hub is inclusive and remains unbiased. NGO stakeholders further highlighted that a set of criteria would need to be developed to establish strict Terms of References on the length of time industry representatives can serve on the steering board. This would help keep Hub ideas fresh and reduce the possibility of certain stakeholders dominating the direction that the Hub takes.

Some stakeholders from Government and Academia went further and suggested the need for an independent oversight community to direct the steering board of industry representatives. These stakeholders referenced past collaborative projects that have been successful with the use of external advisors tasked with objectively overseeing meetings and projects to keep collaboration on track such as the Sustainable Mariculture (SMILE) project which ran from 2004 to 2006.

Contrary to this idea of self-regulation / -direction, four of the five stakeholder groups felt it would be better that an independent third-party organisation direct the Hub (50% of stakeholders from the Fishing and Aquaculture Industry (57%), Government (80%) and NGOs (63%)). These stakeholders felt that a third-party agency with no industry links should be appointed Director to ensure the management of the Hub remains impartial. In addition, some stakeholders commented that government should be involved in the management of the Hub to some extent, including providing the Hub with necessary data. However, their involvement should be kept separate from Hub decision making.

What staff roles are needed?

Stakeholders suggested several different job roles that should be included in the Hub (Table 3).

Table 3. Staff roles identified by the stakeholder audience when asked 'what sort of staff roles would you expect within the Marine Hub? The table gives staff role title, a brief description of their duties and the number of stakeholders that mentioned it in response to the question.

Staff Role	Brief description of duties	Number of stakeholders that mentioned it
Administrator	Responsible for carrying out the clerical duties of the Marine Hub to ensure its smooth running.	10
Hub Manager	Oversees the general management and running of the Marine Hub.	7
Overseeing Director	Independently oversees the performance and operations of the Marine Hub and reports back to the Hub Manager and steering group.	5
Digital Support Technician	Responsible for the smooth running of the Marine Hubs digital channels and to coach and support staff and clients in the use of the Hubs digital system.	4
Steering group of industry representatives	A group of appointed industry representatives that serve a term making the strategic decisions for the Marine Hub.	3
Communications Facilitator	Responsible for all internal and external communications of the Marine Hub. Primarily focused on advancing the collaborative dialogue between Hub members, such as keeping stakeholders up to date with Marine Hub news, outputs, and opportunities.	3
Grants and Funding Specialist	Responsibilities include managing the Hubs expenses, seeking funding support for projects, providing funding information to members, and assisting in funding applications	3
Social Media Specialist	Tasked with running the social media channels of the Marine Hub, increasing engagement, and sharing news.	1
Policy Specialist	Responsible for providing the Hub and its members with advice on regulatory and policy issues.	1

An Administrator was the only staff role mentioned by some stakeholders from across all stakeholder groups, followed by a Hub Manager (mentioned by four of the five stakeholder groups). Other popular staff roles included a Communications Facilitator, a Grants and Funding Specialist, and a steering group of industry representatives.

By combining stakeholder opinions on the staff roles expected, a (comprehensive) Hub staff hierarchy would look something like the following (Figure 18):
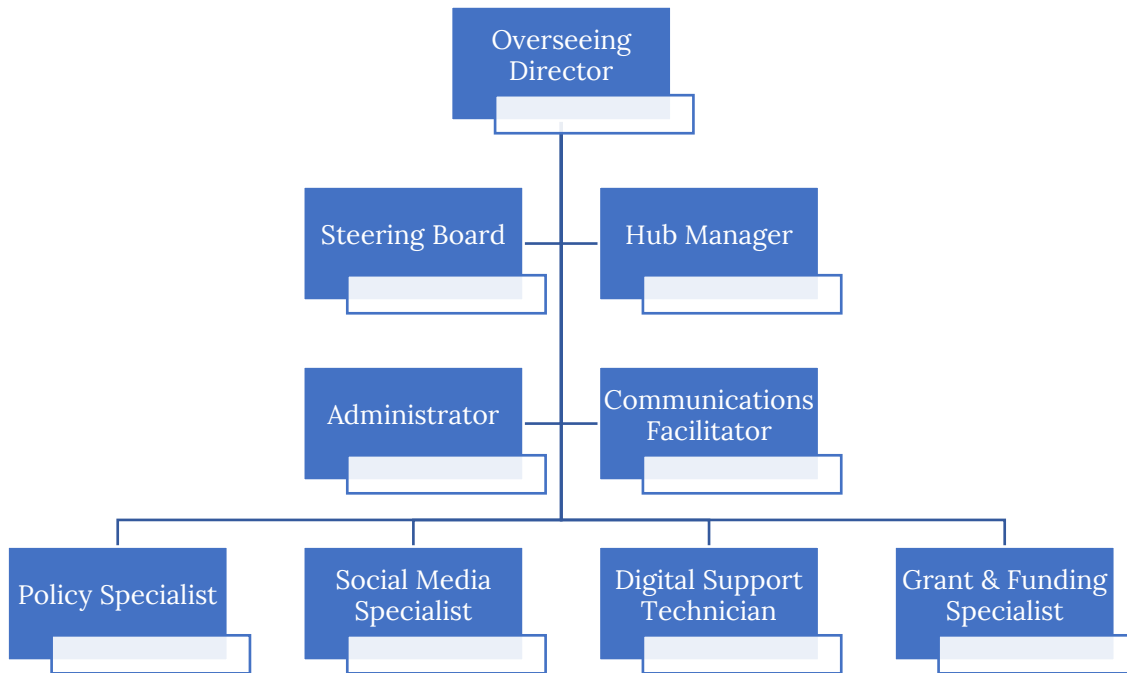

Figure 18. Hierarchy summary of staff roles identified by the stakeholder audience as expected for a Northern Ireland Marine Hub.

At the top of the staff structure hierarchy, stakeholders from Academia and Government felt that there should be some sort of external oversight Director tasked with providing objective supervision on projects and meetings sitting above a steering board of representatives from across the industries involved.

Stakeholders from across all stakeholder groups except Academia felt that a Hub Manager role should sit alongside a steering board with similar levels of managerial authority. Stakeholders from the Fishing and Aquaculture Industry highlighted that a Hub Manager would be an essential role, stressing that the appointed candidate should be highly skilled in networking and visualising opportunities and horizon scanning for the hub.

Below the steering group and Hub Manager, all stakeholder groups highlighted the need for an Administrator that would work to support the general management of the Hub, whilst stimulating and coordinating dialogue between Hub members. Stakeholders from Academia, NGOs and 'Other Industry' also felt that a Communications Facilitator would be needed alongside an Administrator, working to enable open and inclusive communication and research collaboration between stakeholders. Stakeholders from the Fishing and Aquaculture Industry, 'Other Industry', Government and NGOs felt that these key staff roles would be sufficient initially, with the team potentially growing over time in relation to the success of the Hub. Some stakeholders also highlighted the potential to utilise existing marine industry staff to fill these key positions initially. For instance, some NGO stakeholders suggested that the Hub should utilise the expertise and communication channels already established in NI by pulling staff from the eNGO sector to fill key coordinator roles. Similarly, some Academic stakeholders suggested that staff from Queens University Belfast and AFBI should make up the core staff of the Hub.

All stakeholder groups felt that over time the Hub staff structure could evolve to include a range of different staff roles including: a Project Manager, Grant and Funding Specialist, Social Media Specialist, Policy Specialist and Digital Support Technicians to deliver any virtual Hub aspects. Some Fishing and Aquaculture stakeholders also suggested that external contractors could be periodically brought in to cover any specific Hub services such as training schemes and innovation workshops. Whilst some Academic stakeholders felt it would be worthwhile bringing in experts from outside NI to inject ideas into the Hub and keep it in line with similar projects around the world. Some NGO stakeholders felt that it would also be beneficial for the Hub to collaborate with public bodies already working to support certain marine industries (such as Seafish) rather than duplicate services that are offered.

Global Findings

To understand how best to facilitate multi-stakeholder collaboration/communication, secure and maintain funding and manage a Hub, we looked to similar organisations as examples by conducting a global landscape review and KI interviews. Although it is not possible at this stage to define exactly which external organisation match a potential NI Marine Hub, we gained many valuable insights that could be applied to a future NI Marine Hub, form / shape that may take. Below, we summarise our key findings from our global KI interviews (Figure 19, Appendix 6.), and a landscape review (Appendix 6.)

Collaboration & Communication

Collaboration between stakeholders from across the marine sector is crucial to ensure sustainable and efficient marine planning and management in NI. We found that successful multi-stakeholder collaboration primarily relies on the creation of a neutral space that allows for nuanced discussion. Creating an informal setting to facilitate open communication, co-design, and collaboration between stakeholders with different agendas, perspectives, expertise, and understandings will be key to the success of a NI Hub.

Figure 19. Organisations that we interviewed.

In general, organisations that have shown success in bringing stakeholders together:

- Provide useful resources such as funding opportunities, a network of experts, access to research, forums, and advice
- Produce balanced, evidence-based initiatives that are results focused
- Help stakeholders identify knowledge gaps and research needs
- Deliver independent, neutral, and objective information and mediation
- Facilitate knowledge exchange

Successful collaboration and relationship building

Creating a space in which stakeholders with different perspectives come together to work towards a common goal is one of the biggest challenges for multi-disciplinary and multi-agenda organisations / hubs / centres, but also the key to achieving real world, lasting change.

Productive dialogue from all relevant stakeholders will be key to ensure inclusive and integrated solutions to overcoming marine-related challenges in NI. Each stakeholder / stakeholder group has their own expertise and interests resulting in different opinions on needs and how to deliver on these needs. Finding common ground amongst stakeholders is the first step to forming partnerships and effective collaboration. The Dutch Diamond model (Figure 20), where government, civil society organisations, knowledge institutions and the private sector work together, has been used around the world to form successful partnerships and project outcomes, leveraging hybrid finance models. This model acknowledges everyone's interests as well as focusing on balanced, objective solutions. It is noteworthy that users of the Dutch Diamond model highlight the importance NGOs play in building bridges between technology and local context, igniting capacity building and cooperation and spurring innovation and scaling large projects.

Figure 20. The Dutch Diamond Model / Approach showing the 4 'sectors' key to multi-disciplinary and institutional success.

Organisations that are successful in bringing diverse stakeholder groups together generally have: a strong focus on relationship building; finding common ground amongst stakeholders; developing initiatives, research and projects around end-user needs. This is often undertaken through creative, in-person workshops that provide a neutral, informal environment in which stakeholders work together to define common goals and create strategies to achieve these goals.

Such workshops are usually highly interactive and immersive and can typically run for 2-3 days. During these workshops, all ideas, concerns, goals, and needs are presented with the aim of inspiring empathy, gaining a holistic understanding of issues at hand, and understand how issues are and can be connected. Creative activities such as using physical materials to test ideas or acting out scenarios creates a relaxed, non-threatening environment and helps people to think in different ways to their usual thought processes. This often results in a greater level of empathy and understanding between stakeholders, spurring the formation of deep bonds between them. This in turn results in partnerships and cooperation that otherwise (oftentimes) would not have existed.

Having a diverse set of background and "thinking models" in the room for such interactive workshops is important as it stimulates thinking outside the box and in some cases helps maintain neutrality when new stakeholders are "injected" into old conversations. Different thinking types / stakeholders that can specifically benefit such workshop settings include:

- Creative agitators - People who are not in the same sector (in the case of the NI Hub this would likely be individuals with no marine and / or no environmental background) but can offer valuable perspectives and question the status quo of systems and processes. Examples of such participants in the case of the NI Hub could be designers, architects, city planners etc.
- Decision makers – It is important that the major decision makers are in the room from the outset to ensure outcomes can move forward and gain momentum in the real world. Having the decision-makers present also helps build trust between stakeholder groups and often helps non-decision makers understand more about the (often) bureaucratic decision-making processes.
- Investors - Including investors early in stakeholder / collaborator workshops (and the innovation or product cycle) can be very beneficial. Having them in the room as ideas are taking shape can spark interest and help gauge viable products/solutions.
- End-Users - Having end-users in the room enables the group to test the viability and feasibility of implementation. Their presence also ensures needs are being correctly addressed and solutions are suitable tailored to end-user needs. End-users can often also offer valuable insights into problem solving exercises and the design of solutions considerations.

Organisations that take a less interactive, more formal / top-down approach to collaboration generally do not produce the same strong community that is highly collaborative and able to implement solutions that have lasting positive impacts for all. A focus on co-creation, co-design, and co-delivery ensures success and a community/ecosystem that works together rather than at odds with one another.

Future of Fish, USA - Case Study

A discussion with Momo Kochen

Future of Fish (FoF) brings stakeholders together to co-design fisheries solutions. They run multi-day (2-3 days) workshops in which stakeholders are asked to work together and set priorities. Co-design methods include acting, sketching, and working with physical materials are used to help visualize systems, processes, and potential solutions to identified problems. FoF suggest including investors and funders in focus workshops early on to help facilitate funding later down the road. They also stress the importance of bringing interdisciplinary skills / people together during the co-design process to promote fresh perspectives and ideas - creative "agitators" that work outside the normal stakeholder setting should be considered key contributors. FoF workshops generally start with a common definition of problem(s) and opportunity areas. The aim is to get people that are optimistic, open to new ideas, and think differently from one-another in the same room. During the workshop there is the opportunity to surface everyone's perspectives which brings out new ideas and enables stakeholders to see things from all perspectives.

- *"It is important to prevent people from solving problems the way they are used to solving them."*
- *"People tend to form unexpected bonds and common ground when they have to ask the person across the table to pass the macaroni and glitter."*
- *"More important than the products that are produced are the relationships that are forged."*

Communication Channels / Methods

The building of a collaborative community requires a well-executed communication strategy that is effectively delivered, keeping stakeholders engaged, informed, and active within the community. Providing a centralized platform that enables 2-way communication through which stakeholders can stay up to date on events, news, research, projects, connect with others, give feedback, and exchange information is essential in facilitating this effective communication.

A mix of virtual and in-person communication has been found to be most effective in the case of collaborative "hubs". While collaboration can be facilitated virtually, the importance of occasional in-person meetings has been emphasized throughout our discussions with the global KIs – some noting it as "essential to success".

Activities to keep stakeholders informed, engaged, and supported can include the following:

- Initiation workshop to begin co-design of hub
- Weekly newsletters that are tailored for different stakeholders (and general news)
- Free monthly virtual events with Q&A and opportunities to showcase work
- Weekly podcasts
- Annual and/or quarterly meeting to discuss priorities
- Social media updates
- Interactive workshops
- Representation at large industry events
- Leading of community outreach initiatives
- Participation in interdisciplinary collaboration
- Hosting of forums that facilitate networking and information exchange

- Soliciting feedback from stakeholders
- Knowledge brokering (connecting stakeholders to relevant experts, conversations, and resources)

Content that stakeholders may be interested in includes:

- Promotion of events (internal and external)
- Career, funding, and training opportunities
- Ongoing and new projects
- Current research & new findings
- Open-source tools
- Publicly available data sources
- Policy updates or deadlines
- Strategic management plan(s)
- Case studies

Communication & Collaboration Challenges

All the global stakeholders interviewed noted (without prompting) that the most challenging stakeholder groups to bring together (in collaborative settings) are government and industry.

"It was very challenging and took a long time to bring industry and government together"

- Mark James, Operations Director, MASTS

Facilitating quality dialogue between stakeholders to work together towards a common goal requires transparency, neutrality, and objectivity. These are essential to maintain the trust within and between stakeholder groups and individuals. To facilitate inclusive and productive collaborations it is useful to understand the key characteristics that have been identified to ensure success.

1. Power that is spread evenly across stakeholders

2. Stakeholders that are willing to learn from others and offer unique insights

3. A common purpose /goal

4. Prototyping and testing of multiple ideas

5. Shared responsibility of ensuring success and implementation of solutions

6. Regular check-ins to keep all collaborators informed about progress

Research & Project Facilitation

The ability to set research priorities and facilitate projects that create real world impact and change goes hand in hand with the creation of an inclusive, open platform where stakeholders can exchange knowledge and forge partnerships.

Knowledge brokering can facilitate information exchange amongst stakeholders to generate shared understandings and to capture and transfer knowledge (Figure 21). It can help eliminate

the duplication of efforts, establish effective connections and partnerships, and facilitate the adoption of insights.

By implementing a knowledge brokering strategy, the NI Hub can create a strong knowledge infrastructure and build bridges between otherwise isolated initiatives and research producers and users within the marine sector (and potentially beyond, into other sectors).

Figure 21. Diagram illustrating the key components of the knowledge brokering cycle.

Research Threads

Our discussions with global stakeholders all highlighted the importance of projects and research being solutions focused with the end user in mind from the start of the project planning process. Not only does this help ensure results are practicable / 'real-world' but this also helps build trust between stakeholders. When stakeholders see practical solutions evolving from collaborative projects, it builds trust in the process and helps those involved feel their investments were worthwhile.

The importance of practical outcomes also emerged in our discussions when discussion quality versus quantity. Several of the global stakeholders noted that collaboration becomes increasingly difficult when there is a growing history of unsuccessful projects. A few high quality, real gains-focused projects are worth far more than many more projects that produce results that are not practicable in real-world settings. Again, this relates back to the idea of stakeholder trust in a process – in this case, the process being multi-disciplinary collaboration.

To ensure a NI Hub can focus on quality over quantity and build trust between stakeholders it will be very important that all relevant stakeholder groups (and funders – see below) are involved from the start of projects (in the design phase). This will help ensure projects have a real-world end goal in site and that the steps taken to reach that goal are agreed upon by all those involved. To keep co-design "active", regular check-ins involving all participating stakeholders are needed. It is noteworthy that one stakeholder was adamant that regularity is more important than length regarding these check-ins – i.e., a quick 15 minute catch up once a week is more valuable than a 3-hr meeting every 2-3 weeks. This same stakeholder also noted that small, regular check-ins help build other parts of the collaboration model, keeping in touch, promoting ideation and intellectual support between stakeholders, and enhancing the cross fertilisation of ideas.

Case Study – Forums & Themes

The Marine Alliance of Science and Technology for Scotland (MASTS) uses Research Themes and Forums to delineate efforts within the organisation.
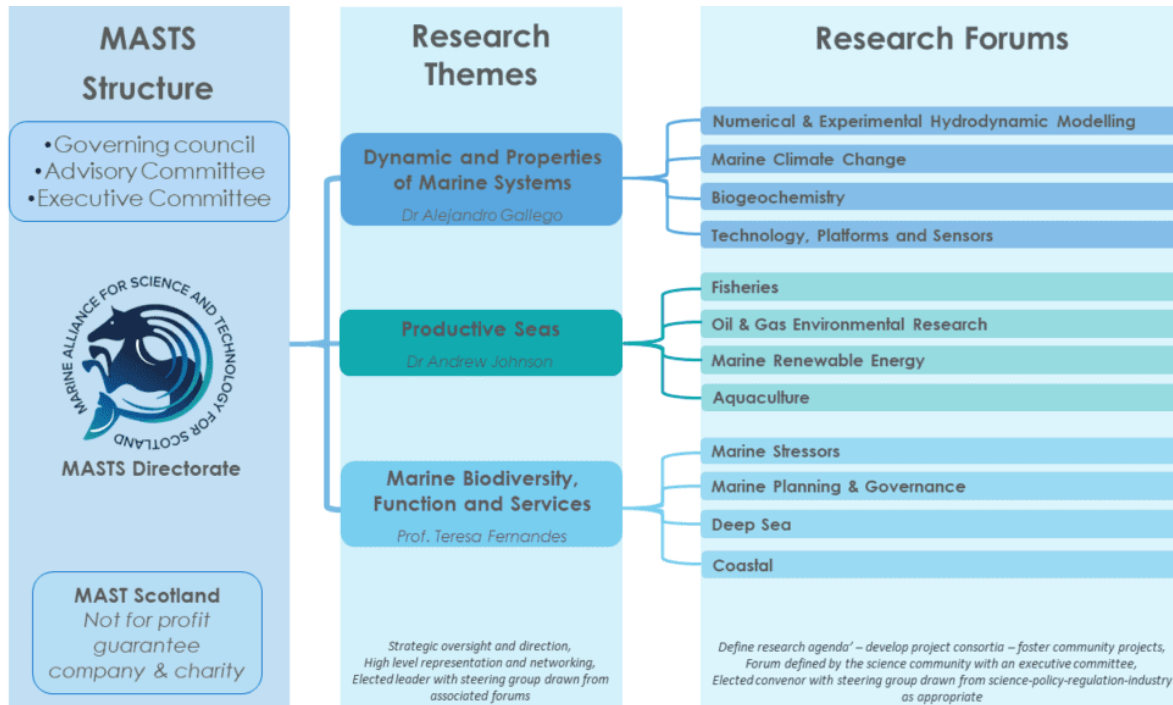
Research Themes describe three broad areas of research. These Research Themes are further divided into Research Forums that are more specific and responsible for developing their own distinct research agendas, project consortia and undertaking targeted knowledge exchange activities.

The main objective of the Forums is to:

- Facilitate networking and information exchange within the Forum by convening meetings and workshops.
- Develop national, regional and sector relevant strategic research agendas to provide direction and a measure of priority to research in particular areas.
- Secure appropriate scientific representation on strategically important bodies to ensure feedback to the MASTS community.
- Develop a coordinated approach to interactions with funding bodies, Government, and other stakeholders.
- Develop a structured, coordinated, and timely approach to the provision of impartial advice to key stakeholders.

The Forums report back to the MASTS Executive Committee at least once each year to provide a brief account of progress against each of the agreed objectives of the Forum.

Funding Models

Without a sustainable funding model, even the best hub will fail. When discussing funding options and models (Table 4) with different stakeholders it was clear that there are many different approaches that can be taken to sustain the life of a Hub. Rather than dive into the specifics of a certain model, below we lay out some key comments that we believe are important irrespective of the exact funding model that will be used.

- Investors should be brought in early in the planning stages to help stimulate funding options and interest. Especially if innovation and product development will be a part of the Hub structure.
- Relying on a single funding source should be avoided both during start-up phases and once a Hub is established. Hybrid finance models are preferable as they spread risk and by default bring multiple players and interests around the same table.
- "Self-generating" revenue is advantageous if possible as it provides a source of unassigned funding which can be used dynamically within the Hub – it also provides some level of self-sufficiency.
- The distribution of unassigned funds needs careful consideration so as not to upset relationships within Hubs. An equal distribution model can help prevent biases (e.g., equal division between themes / clusters / businesses etc.).
- It is useful to try and model / visualise the returns on how funds will be spent – is there a £ for £ value back on contributions made – if so – how is this value realised (profits versus in-kind contribution). This may be difficult for pure research projects, but it helps ensure real world applicability and outputs to and projects.
- One stakeholder noted that when starting a Hub there can be a temptation to try and work on a budget but investments in high calibre individuals, particularly for grant / funding capture and networking is essential.

Recommendations referencing specific to certain types of funding include:

- Membership fees should not be burdensome. If they are too high they will likely exclude certain stakeholder groups / organisation. For example, MASTS is funded in part by each member paying an annual fee of £13,000 which is comfortable for most members and is used to cover 60% of MASTS operational costs. If a membership model is employed, high value "services"* should be offered to attract and maintain membership.
- Time in kind from partner organisations can help reduce operational costs and provided necessary expertise and connections.
- Foundation / philanthropic funding appears to be a promising model in the USA but appears to be far less common in the UK. This, however, should not close the door to such opportunities for the NI Hub.
- Partnerships with universities can unlock diverse funding streams that would otherwise remain restricted. Grants from Research Councils can unlock considerable size funding pots but may be argued to be too research oriented for industrial partners (but this is very context dependent).
- Most funding models that we explored had some component of government funding whilst many were also supported by industry funds and/or membership fees.

*High value services may include:

- Access to experts and professional facilities
- Facilitating co-design and delivery of research and projects
- Knowledge brokering / information exchange

- Helping stakeholders access funding opportunities (i.e., professional animateur support) and/or providing funding
- Representation of stakeholders needs, perspectives and expertise
- Make data fully accessible (and easy to find)

High value services specific to the NI Hub context also include:

- Knowledge brokering within and between sectors (especially at the start to help all stakeholders understand the current landscape of available research/information and establish stakeholder connections)
- Providing support and resources for sectors to engage with issues on a UK level and bring voices together to amplify representation
- Connecting industry to research, innovators, and investors
- Helping stakeholders find facilities & equipment (through improved understanding of collaboration opportunities and inter-stakeholder links)

Table 4. Examples of principle funding structures used in the global hubs that were reviewed.

Hub / organisation	Primary funding source(s)	Notes
Fisheries Leadership and Sustainability Forum	Stanford University, Duke University and EDF	Pooled funding to start the project which ran for 5 years. It was not renewed as funders felt the project had met its target of improving West Coast fisheries networks.
European Ocean Observing System	European Union's Horizon 2020 Research and Innovation Programme and time in kind from partners	One participating organization received funding from European Union's Horizon 2020 Research and Innovation Programme. The programme runs on time in kind from each partner organization (about 30 working days combined throughout the year).
Fisheries Research and Development Corporation (FRDC)	Levy funding (1%) from Seafood industry	Levy is voluntary but most jurisdictions do contribute to FRCD based on the value they get back from contributions. The FDRC is responsible for distributing funds equitably across jurisdictions and must provide a dollar-for-dollar value back on contributions (this can be monetary or time in kind). Have a $32 million annual budget (administrative fees account for 10-12% of budget).
Seafish	Levy funding from Seafood industry	Levy is on the first sale of seafood products in UK (including imported seafood). Fishermen/boat owners, foreign suppliers and fish and shellfish farmers pay the levy.
Too Big To Ignore (TBTI)	Canadian Government, Private Foundations and Institutions, Universities	Largely supported by the Canadian Government, with a 5-year start-up grant which was just renewed for another 5 years.
Cambridge Conservation Initiative	Private Foundations and European Commission, Universities	Largely based on philanthropy and university funding. Also sponsored by David Attenborough.
MASTS	The Scottish Funding Council (SFC) and membership fees	The SFC and original MASTS member institutions invested £75 million for start-up (between 2009 and 2016). Currently, membership fees cover 60% of operational costs and SFC contributes about £112K annually. Membership is £13.5K per year. They will switch to a fully membership-based model within 4 years.
European Marine Board	Membership fees & Flemish Government	Membership fees are sliding scale (based on GDP). Received €300K start-up funds from European Science Foundation. Receive €450K annually from
Cove	Canadian Government, Ocean Tech Companies, Public and Private investment, Universities	Innovation and business accelerator model. Leasing of facilities generates revenue

JPI Oceans	Membership Fees	20 EU (and associated) member countries and a total of 42 organisations
Marine Biodiversity Hub	Australian Government match funding	Funded as part of a Commonwealth science program. Government funding is matched by industry (monetary or time in kind).
Scottish Association for Marine Science	UK and EU Research Grants, Higher Education, Commercial Contracts	Annual budget c £10-11M. 60% of income comes from UK and EU research grants, 20% from higher education, and 20% from commercial contracts.

Governance, Management, and Staff

Discussing the governance structures with global stakeholders often lead into conversations around management and staffing. From these conversations, governance structures should: ensure the efficient delivery of projects and meeting of organisational objectives; include appropriate reporting and feedback loops (ensuring goals are being met); ensure transparency regarding finance use, accountability, and agendas. Some stakeholders also noted the importance of ensuring the governance structure allows a forum for all voices within the Hub to be heard – again echoing back to ideas around open dialogue and neutral spaces.

Of all the different staffing positions discussed, the following were the most mentioned and generally considered the "essentials" even for a small pilot Hub:

- Directorship
- Communication facilitator
- Knowledge Brokering
- Finance / grant and funding facilitation
- ICT / computing / digital development

By analysing the different global hubs and their respective governance structures, we believe successful governance can be achieved by:

- Having a diverse steering committee to approve strategic goals, research programs, and review progress
- Ensuring equal representation from all sectors and stakeholders
- Inviting multi-disciplinary and transparent review processes (including outside of the 'direct' marine themes of the hub.

Recommendations for a Northern Ireland Marine Hub

Hypothetical Hub Scenarios

Based on the information obtained through the stakeholder engagement interviews, the wider landscape review and similar global 'hub' case studies, we believe there are three broad (potential) scenarios that could be used in the development of a Northern Ireland Marine Hub. Note: the following scenarios are presented in no particular order.

Scenario 1. A NI Marine Hub could exist as a central physical space and an online platform.

- A physical Hub space would be used to house relevant staff, provide hot desking opportunities and meeting/collaboration rooms.
- Innovation aspects should be developed to take the Hub a step further than just a collaboration space - the hub should preferably facilitate new research agendas to co-design, prototype and launch new ideas.
- Training facilities would be developed along with 'testing and enterprise zones' where newly developed technologies and equipment can be housed and tested (research-wise and by potential clients).
- A business 'cluster zone' like the space provided at Páirc na Mara in the Republic of Ireland could be developed. This 'cluster zone' would bring together and co-locate similar businesses or industries to drive competition and innovation amongst marine enterprises. The objective of the cluster is to encourage socio-economic growth in the area as businesses develop and evolve over time. NI businesses would be invited to join this cluster, with dedicated Hub staff tasked with identifying potential enterprises.
- The NIRIC would partner with NI universities such as QUB and Ulster University to provide Hub members/ clients with research and development capacity and facilities. University partners could also provide accredited technical training, opportunities to support spinout staff and student companies could also be provided through the cluster space.
- The NIRIC would develop partnerships with cross-boundary marine alliance/ research centres that share resources/ seas with NI e.g. Páirc na Mara in the Republic of Ireland, MASTS, MarRI-UK, the National Oceanography Centre etc.

Scenario 2. A NI Marine Hub could exist as an entirely virtual space

- A virtual Hub would consist of an open-access website and an extensive member-only Portal that would form the basis of the Hub.
- The virtual Hub would partner with universities, industry, and publicly funded research centres/organizations
- Dedicated communications staff would help steer people to the right conversations, people, provide information on funding, connect stakeholders with experts and/or complementary projects and information.
- A members-only Portal would include a 'Networking Zone' where all stakeholder contacts are open and searchable to all members, thus providing a convenient way to build networks outside of personal contacts. A 'Project Zone' would showcase all past, present, and planned projects underway in the NI marine space.

- Research 'themes' and priorities would be determined by a steering committee with representatives from each marine sector and the university partners.
- Dynamic research forums aligned with the overall research priorities would provide a place where stakeholders could develop research agendas, projects, and exchange knowledge. Each Forum would have a moderator responsible for organizing meetings, stimulating conversation, and facilitating knowledge exchange within and between Forums.
- There would be weekly virtual events and meetings, newsletters, articles, regular project updates, career, and funding opportunities to keep the members informed and engaged
- Members would have access to research, data, experts, facilities, and equipment
- The Hub would allow members to apply for funding opportunities through the Hub, applying for funds they would otherwise not be eligible for.
- A virtual Hub would have no need for a physical space or extensive management team. Therefore, considerably less funding would be needed than scenarios 1 and 3.

Scenario 3. A NI Marine Hub could take the form of a 'Hybrid-Hub' that consists of a virtual space and the utilisation of existing facilities.

- A 'Hybrid-Hub' would require no fixed physical space. Instead, the Hub would operate largely via the virtual space that mirrors scenario 2.
- Regular meetings, however, would take place both virtually and in person, in existing facilities either through collaboration agreements or by renting space.
- In person meetings would be held in existing facilities associated with/ owned by Hub partners and would change location based on a needs basis. This attempts to remove some of the challenges associated with the bias of having a fixed physical Hub location and the added expense of fixed / new infrastructure.
- Stakeholder groups should take turns hosting any joint meetings and leading agendas, to help mediate any dominating voices/industries in Hub decision making processes.

The following recommendations build on these three scenarios. However, square bracketed notations (e.g. [scenario 1]) are used to indicate which recommendations (minimum) are directly applicable to a specific Hub scenario.

Marine Hub Management and Staff Structure Recommendations

The initial core management/ staff structure recommended to establish a NI Marine Hub, regardless of Hub 'style' includes:

1. **Appoint an external oversight Director**

   [*scenario 1*]
   - We recommended that an independent oversight director be appointed to provide objective supervision of the performance and operations of the Hub.
   - The director should oversee all projects and meetings (etc.) to ensure the Hub remains in line with its objectives and unbiased towards a particular industry.
   - The director should report back to a steering group and Hub manager (see below).

2. **Establish an Executive committee/ steering group**

   [*scenario 1, 2 & 3*]
   - An executive committee/ steering group should be established to make strategic decisions for the Marine Hub.
   - The executive committee/ steering group should be made up of industry representatives, with appropriate proportional representation across all involved industries. This would aim to ensure that management of the Hub is inclusive and remains unbiased.
   - Committee/ group members should be appointed to represent their industry in the management of the Hub by their industry stakeholders. A set length of time industry representatives can serve should also be established to keep Hub ideas fresh and reduce the possibility of certain stakeholders dominating the direction that the Hub takes.
   - Strict Terms of References should be developed around the committee/group members appointment, including the maximum term they can serve and their responsibility.

3. **Appoint a Hub Manager alongside the Executive committee**

   [*scenario 1, 2 & 3*]
   - An independent Hub Manager is recommended to sit alongside the Executive committee/ steering group, with similar levels of managerial authority as the committee.
   - This position would oversee the general management and running of the Marine Hub, including establishing networking opportunities for the Hub and drawing in new opportunities.

4. **Appoint an Administrator and Communications facilitator to assist the Hub Manager in the running of the Hub**

   [*scenario 1, 2 & 3*]
   - A skilled administrator is recommended to support the general management of the Hub, including clerical tasks that keep Hub activities running smoothly. The appointment of an administrator would also be key to stimulating and coordinating dialogue between Hub members.
   - A Communications facilitator is recommended to work alongside the Administrator.

This position would be responsible for all internal and external communications of the Marine Hub, including enabling open communication and research collaboration between stakeholders (including knowledge brokering).
- We recommended (where possible) to utilise the expertise and communication channels already established in NI to fill these roles. This would include incorporating staff members from other sectors to fill the positions and/or collaborating with public bodies already working to support certain marine industries (such as Seafish).

5. **Appoint a Digital support technician to run and maintain the virtual aspects of the Hub**
[scenario 1, 2 & 3]
- A digital support technician should be appointed to ensure that the digital Hub channels (virtual space) runs smoothly.
- It is recommended that this position also provide coaching and support to other staff members and clients on the use of the Hubs digital interface to ensure maximum engagement.

6. **Appoint a Grants and funding specialist to sustain the Hubs finances**
[scenario 1, 2 & 3]
- A grants and finance specialist are highly recommended to manage the Hubs expenses and seek funding for its sustained operation.
- This position is expected to play a vital role in the establishment of Hub research projects by providing members with information on available funding and assisting with funding applications.

7. **Bring in external contractors for specialist Hub services**
[scenario 1, 2 & 3]
- We recommend, where the budget allows, to hire in external contractors for specialist Hub services (e.g., training schemes and innovation workshops).
-This would ensure that (1) Hub staff are not stretched into filling roles that are not within their skillsets (2) the Hub does not miss out on innovation opportunities because of a small core staff and (3) the Hub becomes a place of innovation and offers external employment.

8. **Additional staff roles should be established as the Hub develops**
[scenario 1, 2 & 3]
- As the success of the Hub grows over time, we recommend that the staff structure of the Hub evolves with this growth. This could include establishing additional positions such as Project Managers, a Social Media Specialist, and a Policy Specialist.

(Note that the estimated annual salaries for these positions can be found in Appendix 7.)

Funding Recommendations

Estimates (low and high) of the funding required for each Hub scenario are approximately:

Scenario 1 (Physical)	Scenario 2 (Virtual)	Scenario 3 (Hybrid)
£1.8M - £5.5M	£200K- £300K	£200K-£400K

(A full table of estimated funding can be found in Appendix 7.)

We recommend that funding for a NI Marine Hub follows similar paths to other UK and Ireland marine research coalitions (including SAMS, MASTS and Páirc na Mara). Therefore, we recommend that funding should come from a mixture of sources, including:

1. UK and EU research grants (including UK and NI government funding)
[Scenario 1, 2, 3]

- We recommend that at least 60% of annual funding comes from UK and EU (if possible following Brexit) research grants that invest in science and research in the UK.
  -A list of potential grant funding examples that could support a NI Hub can be found in Appendix 5.
- Unlike other parts of the UK (see the Scottish Funding Council, the Higher Education Funding Council Wales and the previous Higher Education Funding Council for England (HEFCE)), Northern Ireland has no higher education funding council tasked with distributing public money for teaching and research. Instead public funding for the development of the Hub should look at The Department for Economy's Higher Education Division (which administers funding to support education, research and related activities in the NI higher education sector).
- Funding applications could also be made through the national UK funding agency, the UK Research and Innovation (UKRI) (which replaced The Higher Education Funding Council for England (HEFCE) in 2018). The UKRI operates across the whole of the UK with a combined budget of more than £6 billion to invest in science and research.
- To ensure the Hub is eligible for such grants, Hub partnership with *UK research* organisations/ universities is highly recommended. We recommend the Hub partner with one or more of the two NI universities (Queen's University Belfast, Ulster University) and/or three university colleges (the Open University in NI, St Mary's University College Belfast, Stanmillis University College).

2. Independent funding
[Scenario 1, 2, 3]

- We recommend that different types of independent funding should be used to supplement national and/or UK / EU grant funding. Independent non-public funding should make up a small percentage of the total Hub funds and could come from a mixture of:
- Charitable grant-making foundations (see Appendix 4.).
- Business loans
- Crowdfunding
- Private investment

Other independent/non-public funding that should be considered for larger funding contributions include;

2a. Industry financial investment to support the Hubs development
[*Scenario 1, 2, 3*]

- We recommend that those industries that would benefit from the Hub should contribute financially to its development and upkeep (as an example, £75 million was raised by original MASTS member institutions (match funded by government) to get MASTS off the ground between 2009-2016).
- It is crucial that industry investment into the Hub be equal (per industry), to stop the interest and activities of the Hub being swayed in favour of those that contribute more financially – particularly in the case of unassigned funds. Note: Industry contributions would likely make up a smaller percentage of Hub funding initially, compared to UK and EU research grant funding.
- We recommend that a financial feasibility assessment be undertaken to assess whether Hub industries would be willing / able to invest in the development of the Hub. The feasibility assessment would also help highlight alternate contributions to financial funding that should also be considered so as not to exclude those industries that cannot financially invest – e.g., staff and time in kind contributions. This would help ensure that developing industries have equal ownership of the Hub alongside industries/sectors that have been established longer in NI (assuming developing industries have less available funds to invest compared to longer established industries).

2b. Hub membership contributions
[*Scenario 1, 2, 3*]

- In the long term (by year 5-10) we recommend that the NI Hub should work to become self-sufficient beyond the initial funding period (likely 0-5 years) that would likely rely heavily on grant funding.
- To sustain funding and work towards self-sufficiency, a membership style subscription is recommended.
- For the sake of fair inclusion, membership subscription fees are recommended to be sliding scale, in that the cost is based on the industries/stakeholder's ability to pay/financial situation.
- The development of strong Terms of References is recommended also, to ensure that equal control over the Hubs interests and activities remains across all members, regardless of the price they pay for membership.

2c. Corporate sponsorship
[*Scenario 1, 2, 3*]

- We recommend that a small percentage of annual Hub funding should come from corporate sponsorship of the Hub. This is beneficial because often such funds are unassigned, and they come with useful publicity.
- Corporate sponsorship would ultimately act as a form of marketing in which companies/organisations are associated with the Hub or specific programs/projects within the Hub.

3. Higher Education funding
[Scenario 1, 2, 3]

- We recommend that at least 20% of annual Hub funding come from higher education funding to help access research funding grants and drive research through the hub.
- Higher education funding would be in the form of UK research and innovation grants (previously discussed) and hosting/ participating in post-graduate training studentships (student overhead costs) and apprenticeship sponsorship.
- To ensure the Hub is eligible for such higher education funding, Hub partnership with UK research organisations/ universities is highly recommended.

4. Commercial Hub revenue
[Scenario 1]

- In the case of a physical Hub, the development of a commercial branch is highly recommended to generate self-sustaining revenue. This would help the Hub becoming a self-supporting independent entity that does not need to rely heavily on grant funds which can have highly variable success rates.
- In the case of a physical meeting space, we recommend that the Hub charge for the use of its space for events such as corporate meetings and external training etc. In the case of a physical Hub *[scenario 1] the* Hub would generate more substantial and regular funding by housing companies on site in the 'Cluster' business incubator. Furthermore, it is advised that the Hub should claim a small percentage (at least 1%) of the intellectual property rights associated with Hub start-up businesses (within the 'Cluster). This is recommended to form part of the contract agreement and would ensure the Hub continues to benefit financially from the enterprises it has supported long after they have moved on from the incubator.
- We recommend that where space allows a 'testing zone' should be developed into the plan of a Hub once a 'core' Hub is established (years 5-10 onwards). Test site facilities would allow (paying) members to freely test and develop new technology that could eventually financially benefit the Hub (through the property rights claim mentioned) and the wider NI marine economy. It is advised that non-Hub members/ external companies pay to access the testing zone facilities. Currently there are very few official marine testing facilities in NI (Minesto's test site located at Stangford Lough was the only site uncovered through internet searches) (the nearest facilities include Lir National Ocean Test Facility in Co. Cork, The Galway Bay Marine and Renewable Energy Test Site in Co. Galway and in The Atlantic Marine Energy Test Site (AMETS) in Co. Mayo). Therefore, we feel that the development of a Hub Test Zone would be a worthwhile endeavour and could result in a substantial revenue for the Hub.
- If the development of a Hub Testing Zone is restricted due to required space and/or funding, we recommend that the Hub partner with facilities at Strangford Lough- which is currently utilised as a tidal test site by Queen's University Belfast.
- Where appropriate, we recommend that the Hub take advantage of companies that want to use the Hub as an advertising platform. This would include charging companies to promote their technology/services to Hub members, likely

through a virtual Hub space such as a members-only Portal (discussed through Hub Communication Recommendations) *[Scenario 1, 2, 3]*.
- Other recommended Hub services that could generate funding include providing advisory services and selling any innovation developed by the industries involved, such as new fishing gear technologies.

5. Utilise existing research facilities/infrastructure to reduce Hub costs
[scenario 1, 3]

- To reduce funding, we recommend utilising existing facilities and infrastructures. This could include physically housing the entire Hub within existing Marine facility infrastructure or developing an unused existing building into a Hub.
- If this option was taken, we estimate the cost saving (compared to building an entirely new infrastructure) to be approximately £4,00,000 (based on the estimated cost of developing an existing building compared to simple rental of existing facilities.

Research Recommendations

1. University partnerships should provide research expertise for the Hub
[scenario 1, 2 & 3]

- We recommend that the research expertise of the Hub should come through university partnerships.
- Those universities/ university colleges connected to the Hub should provide streamlined access to research and development capacity, facilities and networks that drive the Hubs innovation and Research Themes.
- Universities could also provide accredited technical training.
- The Hub could also provide support for university spin-offs, including obtaining funding, providing physical space and access to Hub networks.

2. **The Executive Committee should establish the major Research Themes for the Marine Hub**
   [scenario 1, 2 & 3]

   - The research of the Marine Hub community should largely be organised under these major Research Themes. This will help give the research from the Hub structure and provide clear direction within each Theme.

Recommended Hub Research Themes based on the stakeholder interviews and landscape review include:

(1) **Sustainable and productive seas –** with focus on the impact and potential of marine industries, including decarbonisation.
(2) **Resilient seas –** blue carbon, climate change and the drive to Net-Zero.

(3) **Socio-economic research –** with focus on displacement, industry demographics, socioeconomic effects/ tradeoffs of MPAs (and alternative management decisions), value of marine sector, marine cultural heritage, and public perceptions of management.

(4) **Decision making tools –** promoting effective governance of NI waters, support interaction between users of the sea and decision-makers, develop action-orientated research and policy, develop principles and improvements of knowledge exchange (particularly at the interface of science and policy) and co-production in marine research for evidence-based decision-making.

These themes reflect the <u>High Level Marine Objectives</u> agreed upon by UK Government and the Devolved Administrations, and the <u>NI Marine Plan</u> Objectives (according to the 2018 draft).

3. **Research Forums should be set up to be the main delivery mechanism for Marine Hub science**
   - Under each research theme, Research Forums should be set up, consisting of Hub members that have an interest in those areas.
   - Each forum should have an elected Convenor/or multiple Co-convenors and an appointed steering group.
   - Research Forums should be able to apply for funding through the Marine Hub and receive Hub support whilst doing so and following successful research bids

4. **Connect with relevant Centres of Expertise**
   [scenario 1, 2 & 3]

   - The Marine Hub should be linked to the relevant Centres of Expertise (virtual centres that draw expertise together from across the publicly funded research sector) to contribute to scientific advice that informs Government policy.
   - Knowledge brokering should be fostered to help drive relevant connects between centres and within the hub.

Hub Communication Recommendations
The following recommendations are made with the aim to achieve open and efficient communication that facilitates collaboration between stakeholders in the NI marine setting.

1. **Create a regular communication space for cross-disciplinary meetings**
   [Scenario 1,2,3]

   - A regular communication space is essential to facilitate communication between stakeholders. This could be a physical conference space where regular in-person meetings are held or an online meeting space *[Scenario 1,2,3]*.
   - Regular virtual meetings are necessary for both a physical and virtual style Hub to maximise engagement and remove issues around rural accessibility for some stakeholders *[Scenario 1,2,3]*.
   - In an ideal situation, in-person meetings should be prioritised to strengthen networks and enhance communication. We recommend in person meetings taking place at least quarterly *[Scenario 1,3]*.

- Moving meeting locations is highly recommended throughout the year to attempt to remove some challenges associated with the bias of the location of a physical Hub. It is advised that meetings be held in existing facilities associated with/ owned by Hub partners and would change location based on a needs basis [*Scenario 1,3*].
- Rather than the cost and organisation aspects of having to rent spaces, Stakeholder groups should take turns hosting any joint meetings and leading agendas, to help mediate any dominating voices/industries in Hub decision making processes [*Scenario 1,3*].
- Regular drop-in sessions should be offered, either in person or virtually (e.g. via Zoom) [*Scenario 1,2,3*].

2. **Host an annual expo to share projects and provide networking opportunities**
   [*scenario 1, 3*]

   - It is recommended that an annual expo style event should be held by the Hub, to communicate current projects and allow members the opportunity to network.
   - An expo style event would see Hub members host stalls/ booths showcasing the research/projects that they are focusing on that year. This would be a far more interactive event, in comparison to regular Hub meetings with members able to network freely with others undertaking similar research projects.
   - We advise that the event should not be tied to a strict schedule and instead allow people the freedom to dip in and out of their interests.
   - We recommend that the expo be open to all who wish to attend (ticketed) – which could expand the Hubs reach and networking opportunities. It could also see 'on the ground' stakeholders e.g., commercial fishermen, marine energy workers, interacting with Hub staff and other stakeholders in an informal setting.

3. **Develop and regularly maintain an open-access Marine Hub website**
   [*Scenario 1,2,3*]

   - The development of an open access website for the Marine Hub is highly recommended regardless of the style of Hub chosen.
   - This website would provide the face of the Hub, informing the public on the Hubs objectives, activities, and the larger scientific picture underway in NI.

4. **Create an online Intranet Portal for Marine Hub members only**
   [*Scenario 1,2,3*]

   - The development of a virtual Intranet/ Portal is highly recommended to address the issue of stakeholder communication relying largely on personal contacts (which has resulted from a lack of formal communication platform).
   - We advise a key element of the Portal should be a 'Networking Zone', where stakeholder contact information is made open, visible, and available to all Hub members. This would work to widen communication channels and facilitate an open and inclusive networking system. Stakeholder contact information/ stakeholder bios would be easily searchable by name, organisation, research

topic or interests, making it a straightforward, accessible, and convenient way to form connections and develop work relationships outside of established personal contacts. A networking tool such as this would put all stakeholder groups on an equal footing in terms of access to networking, communication opportunities and research collaboration. It would also help reduce confusion associated with currently disjointed communication channels. Thus, strengthening communication within and between those stakeholder groups outside of formal working partnerships.

- The same principle should be followed for a 'Research Recap' space on the Portal, where all past, present, and planned projects being undertaken by Hub members are displayed. We advise that project contact information is made available, and any outputs (reports and data) be uploaded (note the [CEDaR] project could act as a starting block to build upon). This would provide a central place outside of individual projects where Hub members can learn and get unbiased information about the research going on in the NI marine space.
- Research Forum space is also advised on the Portal, to showcase the forums set up under each Research Theme. All forum members should be visible along with contact info to give Hub members the opportunity to contact experts with certain expertise.
- It is recommended that the Portal also be used to provide Hub members with funding information relevant to their industry. For example, members should receive alerts when new funding becomes available and which funding is available to each industry/sector. A grants and funding staff member should also provide drop-in sessions/ appointments to discuss funding and help with funding applications etc (this could be via a 'live chat' section or drop-in session within the Portal or in person).
- Finally, the Portal should house a live news feed (linked to social media) of Hub updates to replace traditional emails that many stakeholders said they often ignore.

5. Establish and regularly maintain Marine Hub social media pages
[Scenario 1,2,3]

- We recommend that Hub social media pages be developed and regularly maintained to keep members and followers up to date with Hub activities.
- Visual social media content is advised over largely text-focused posts. Short bursts of information via 30-second video clips are the most effective at sustaining engagement and delivering information.

References

1. Cooper, A. & Jackson, D. *Northern Ireland Coastal Data: Current Status and Future Options.* (2018).

2. Coastal regions of Northern Ireland | Department of Agriculture, Environment and Rural Affairs. DAERA https://www.daera-ni.gov.uk/articles/coastal-regions-northern-ireland (2015).

3. Coasts and beaches | nidirect. https://www.nidirect.gov.uk/articles/coasts-and-beaches (2015).

4. Strong, J. A. *et al.* Blue Carbon Restoration in Northern Ireland – Feasibility Study. 184.

Survey questions

Table 5. Table shows the interview questions asked to the stakeholders relevant to the Northern Ireland marine environment as part of the formal stakeholder interviews used to scope the potential for a Northern Ireland marine hub. The table shows the question numbers, specific questions listed and the way the answer was recorded.

Question Number	Question	How the answer was recorded.
1	Name	Text
2	Email Address	Email
3	Industry	Industry Name
4a.	Do you feel communication between stakeholders is open, efficient and facilitates collaboration?	Yes, No, Kind of
4b.	Why?	Text
5	How do you currently communicate with stakeholders from other industries	Text
5b.	Does this form of communication usually work in terms of being efficient and productive or does it need change?	Y-Works, N-Needs change, Kind of
6.	How do you think other industries could improve its communication with/between other industries?	Text
7.	Which industry/ies are you most interesting in collaborating with?	Text- Industry
8.	What do other industries need to do to communicate better with you/your industry?	Text
9.	What legislation do you think is going to be the most important for NI in the coming years?	Text- Legislation name
10a	Do you feel that there is enough research being done in NI to address current and incoming legislation?	Yes, No, Depends
10b.	If no (or depends), what specific research (research area) do you think is needed to help aid legislation?	Text – research area
11	Do you have any ideas about what this research would look like? who should be involved, where it should be focused, what approaches should be taken etc?	Text-notes
12a.	Do you feel that your needs in the industry are being met through current legislation?	Yes, No, Maybe
12b.	Why?	Text- notes
13a.	Do you feel that your voice is heard in the development of (policy/management) / legislation that impacts your industry?	Yes, No, Depends
13b.	If no, why?	Text- notes
14.	How do you feel management, policy and legislation could be improved to ensure your industry is fully represented and supported through policy/management?	Text-notes
15a.	Are you currently involved in any on-going research relevant to the NI marine environment?	Y/N
15b.	Name and brief description of research	Text-name
15c.	Who is leading this research?	Text- Institution/ organisation
15d.	If you are a collaborator, who invited you?	Text-name
15e.	How is this research funded?	Text- funding name, type and amount
16.	What research topics are currently popular/ in focus in NI?	Text-research topic
17.	In your eyes, what are the most important research projects currently underway in the NI marine environment?	Text- research
18.	Do you know of any projects outside of NI that you think should be replicated in NI?	Text-notes
19.	Do you think research on the NI marine environment is hindered in any way?	Yes, No, Not sure
20a.	Do you feel there is even a need for a NI marine Hub?	Yes, No, Depends
20b.	what are your reasons?	Text- notes
21a.	If a NI marine hub was developed - what style of 'hub' do you think would work best, a physical hub, virtual hub, or a mixture of the two	Physical, virtual or mixture

21b.	Why is this?	Text-notes
22.	If there was a physical marine hub, how do you think/ see the hub should be funded? Should it be government-funded, privately funded/owned etc?	Government, private or mixture
23.	How do you think funding would be sustained, e.g., where should funding come from five years down the line?	Text-notes
24.	Where do you think a potential physical Hub should be best located?	Text- location
25.	Do you foresee any problems/potential conflicts (potential duplication) with the funding of the hub?	Text- notes
26a.	If the Hub where to help with research funding applications etc, what funds would you be interested in applying for?	Text- notes
26b.	What would this money be for?	Text- notes
27.	Are you aware of any funding revenues/ programs/ schemes that may help serve a marine hub?	Text- scheme name
28.	Do you know of any existing physical research facilities in NI that could be incorporated into a NI marine hub?	Text- facility name/location
29.	If there were to be a physical hub- who do you see directing/managing it?	Text- notes
30.	What sort of staff roles would you expect within the hub?	Text- notes
31.	How do you think the hub should communicate news/ideas between stakeholders?	Text- simple ideas
32.	If the marine hub were a physical building, what problems or issues do you foresee occurring?	Text- notes
33.	If the marine hub were a non-physical (virtual) hub, how do you see it working and what problems or issues you foresee happening?	Text- notes
34.	How do you foresee resolving conflicts between stakeholders holding opposing views?	Text- notes
35.	Are there any ways that the design of a Marine hub could address these possible problems?	Text- notes

Appendix 3.

List of interviewed global stakeholders

Table 7. Table gives the names of all global stakeholders that undertook stakeholder interviews, along with the organisation they work for and contact.

Stakeholder Name	Organisation	Contact
Mark James, Operations Director	Marine Alliance for Science and Technology for Scotland	maj8@st-andrews.ac.uk
Hannah Ladd-Jones, Engagement Coordinator	Marine Alliance for Science and Technology for Scotland	helj2@st-andrews.ac.uk
Crisipan Ashby, Research & Development Investment	Fisheries Research and Development Corporation	crispian.ashby@frdc.com.au
Paul Hedge, Deputy Director	Marine Biodiversity Hub	paul.hedge@utas.edu.au
Kara Brydson, Executive Director	Fisheries Innovation Scotland	execdir@fiscot.org
Momo Kochen, Director of Global Programs (former)	Future of Fish	momo.kochen@sfact.org
Emma Plotnek, Executive Director	Fishing into the Future	emma@fitf.co.uk
Sheila Heymans, Executive Director	European Marine Board	sheymans@marineboard.eu
Pamela Ruiter, Senior Manager of SSF Initiatives	Environmental Defence Fund	pruiter@edf.org
Lynn Gilmore, Director of Communications and Engagement	Seafish	lynn.gilmore@seafish.co.uk
Trish Banks, Operations Director	Global Underwater Hub	
Janson Wong, Senior Manager, Policy and Fish Management	First Nations Fisheries Council	janson@fnfisheriescouncil.ca

Research Projects

Table 8. Research and projects currently underway in NI. (Note that the projects in this list were uncovered through the landscape review and stakeholder interviews, therefore the list is not exhaustive. If there are other projects, it does not mean they should not be included).

Project name	Research topic	Brief description	Relevant KI	Organization	Research stage	Project length	URL
Seagas	Seaweed biofuel potential	Developed a process which uses seaweed for the generation of sustainable energy by anaerobic digestion - potential alternative to land biomass in the production of bioenergy and a digestate suitable for use as fertiliser.	Queens University Belfast	Queens University, The Centre for Process Innovation, The Crown Estate, Newcastle University, Cefas and SAMS	Completed	3 years	Link
EnAlgae	Seaweed biofuel potential	Project aimed to develop sustainable technologies for algal biomass production. Queen's University's was a pilot site for the production of macroalgae (set up custom designed hatchery facility for macroalgae, which were then transferred to longlines in Strangford Lough for onward growth). The research was to see if it is possible to grow sufficient biomass of good enough quality to be used for the production of biofuels.	Queens University Belfast	Queens University Belfast	Completed	March 2011 to June 2015.	Link

Age Determination in Crustaceans	crustaceans market sustainability	Enhancing the sustainability and market share of crustacean fisheries through advances in determination of age/size relationships. Project investigated the age determination of commercially exploited crustaceans in UK waters. - Goal was to establish better-informed relationships between age, size and reproductive stages of specimens from different geographic regions to increase the sustainability and market share of crustacean fisheries in the UK.	Seafish & Kilkeel Seafoods (Whitby Seafoods) & Queens University Belfast	Queens University	Completed	26 months	Link
Utilisation of waste and prawn processing by-product	Shellfish waste & by-products optimisation	Project will develop added value products for market using carapace waste and by-product from prawn processing. It aims to develop practical and profitable production processes for innovative products which will be consumer tested and then launched to market.	Kilkeel Seafoods	Kilkeel Seafoods	Early stages	Over the next two years	Link

SeaMonitor	Marine monitoring	Studying the seas around Ireland, Western Scotland, and Northern Ireland, using innovative marine species tracking technology to better understand and protect vulnerable marine life in our oceans.	Lough's Agency	Lough's Agency, Marine Institute, QUB, AFBI, Uni of Glasgow, Uni College Cork, Galway-Mayo Institute of Technology, Ocean Tracking Network – Dalhousie University, University of California Davis.	Completed	April 2019-December 2022	Link
SWELL Project	Water pollution	Involves the construction of new wastewater treatment works as well as upgrades to sewerage networks on both sides of the border to address wastewater pollution in Carlingford Lough and Lough Foyle.	Lough's Agency	Cross-border partnership comprising NI Water, Irish Water, Agri-Food & Biosciences Institute (AFBI), Loughs Agency and East Border Region.	In progress	2019-late 2022	Link

Marine Protected Areas Management and Monitoring (MarPAMM)	enhanced MPA management	An environment project to develop tools for monitoring and managing a number of protected coastal marine environments in Ireland, Northern Ireland, and Western Scotland. Data collected on the abundance, distribution and movement of marine protected species and habitats - help produce new habitat maps and develop models for a range of species. The project will culminate in the development of six comprehensive MPA management plans.	AFBI, Ulster University	Coordinated by AFBI - partners include consists of statutory organisations (Agri-Food and Biosciences Institute, Marine Scotland and Scottish Natural Heritage), academic institutions (University College Cork; Ulster University; Scottish Association for Marine Science) and a NGO with expertise in a relevant field (BirdWatch Ireland).	In progress	-31st March 2022	[Link](#)
Sea Habitat Mapping and Modelling research– Under MarPAMM project	Habitat distribution mapping	Makes up the largest package of the MarPAMM Project- development of a seabed species and habitats distribution model to fill in the gaps in marine habitat maps/data. Best practice guidelines for species distribution modelling are also under development and novel MPA management technology trials.	AFBI, Ulster University	Led by AFBI with contributions from Marine Scotland Science, Scottish Natural Heritage, the Scottish Association for Marine Science, Ulster University and University College Cork.	In progress	ND	[Link](#)

Seabird Monitoring research – Under MarPAMM project	Sea bird distribution	The project monitors the population sizes and distribution of key seabird species on the west coast of Scotland, around NI and the east coast of Ireland. New data will be combined with existing data to develop a seabird model that explores how populations would be impacted by changes in different pressures e.g. different fisheries management scenarios. This information will enable regulators to make appropriate decisions regarding how to conserve important seabird populations.	ND	Work package led by led by Marine Scotland Science with contributions from BirdWatch Ireland, University College Cork and Scottish Natural Heritage.	In progress	ND	Link
Marine Mammals research – under MarPAMM project	Seal distribution	Project focuses on the impact of industrial and shipping noise on seal distribution. Data is combined on the distribution of seals at sea and shipping activity to pinpoint areas of potential conflict.	AFBI	The work package is led by Marine Scotland Science with contributions from the AFBI and University College Cork.	In progress	ND	Link
Coastal Processes research – Under MarPamm project	Changes to coastal processes	Project explores the coastal processes that operate within the wider Murlough Special Area of Conservation (SAC) in NI to understand of the longer-term changes in the area. This understanding will info a computer model of the areas bathymetry and hydrodynamics to explore how Murlough SAC is likely to respond to a range of predicted climate and sea level changes.	Ulster University, AFBI	Work package is led by Ulster University with contribution from AFBI.	In progress	ND	Link

COMPASS	MPA monitoring	The project will deliver a network of monitoring buoys across the regional seas of the Rep of Ireland, NI and W. Scotland. It aims to develop marine observational and data management capacity across the region.	AFBI	AFBI, Marine Institute, Scottish Association for Marine Science and Marine Science Scotland.	In progress	ND	Link
MaRINET, the Marine Renewables Infrastructure Network	Marine renewable tech development	A network of research centres and organisations that are working together to accelerate the development of marine renewable energy technologies - wave, tidal and offshore-wind. The initiative aims to streamline and facilitate testing by offering periods of free-of-charge access to world-class test facilities and by developing joint approaches to testing standards, research and industry networking & training.	ND	29 partners with 45 specialist marine research facilities spread across 11 EU countries and 1 partner-country, Brazil.	Completed	Ran from 2011-2015	Link

MaRINET2, the Marine Renewables Infrastructure Network	Geothermal energy development	Project aims to harness the geothermal potential in NI to help generate and deliver electricity from renewable sources- specifically across industrial application.	Ulster University	Led by Ulster University and supported by industry partners Causeway GT, Atlantic Hub and Enisca.	Early stages	ND	[Link](#)
Sustainable Mariculture in northern Irish Sea Lough Ecosystems (SMILE) project.	Sustainable aquaculture management	The project addresses the shellfish carrying capacity of five NI sea lough systems; Belfast Lough, Carlingford Lough, Lough Foyle, Larne Lough and Strangford Lough.	AFBI	AFBI	Completed	2 Years. 2004-2006	[Link](#)

Aquaspace - Ecosystem Approach to making Space for Aquaculture	Aquaculture challenges	Research project aiming to understand spatial and socio-economic constraints on the expansion of aquaculture, and to test tools to help overcome these constraints.	ND	Scottish Association for Marine Science, New University of Lisbon Portugal, University College Cork, Thünen Institute Germany, Institution of Marine Research Norway, Dalhousie University Nova Scotia, AZTI-Tecnalia Spain, NARIC HAKI Hungary, Ifremer National Institute for Ocean Science France,	Completed	2015-2018	Link
Fish stock surveys	Fish stock surveys	Fish stock surveys - independent of fishing industry are undertaken using the AFBI research vessel Corystes.	DAERA & AFBI	DAERA & AFBI	Annual	NA	Link
Brown Crab tagging study	Spatial distribution and movement of brown crabs	Tagging brown crabs to address data gaps in the movement of individuals between the Northern Irish and adjoining waters - which may have different management measures.	AFBI, NIFF	AFBI, The Northern Ireland Fishermen's Federation. The fishing industry is also needed to report caught tagged crabs (incentivised by being entered into a prize draw– £1000 provided by NIFF).	In progress	Nov 2021– present?	Link

Blue Carbon Habitat Restoration in Northern Ireland Feasibility Study	NI Blue Carbon potential and restoration	The report/work identifies what, where, and how much local coastal marine habitats, such as kelp forests, saltmarsh, seagrass meadows and shellfish, can remove and store carbon dioxide from the atmosphere.	Ulster Wildlife Trust	Ulster Wildlife Trust, National Oceanography Centre and the University of Hull.	Completed	Final report released 18th May 2021	Link
Cod tagging project in the Irish Sea	Cod stock assessment	Cod tagging project in the Irish Sea to better understand cod mortality, abundance, distribution and movement patterns within the Irish Sea and neighbouring areas. Info hopes to realign differences of opinion between the industry's perception of cod abundance and the scientific assessment of the stock - to provide a consensus opinion.	AFBI	AFBI, Cefas in the England and Wales, and the Marine Institute, in the Republic of Ireland. The fishing industry is also needed to report caught tagged cod (incentivised by rewards of €25 for a red tag, €75 for a pink/blue/yellow tag, plus an additional €1000 for every 20th tagged cod returned).	ND	ND	Link
The Northern Ireland Gear Trials project	Fishing gear improvement	Protect aims to provide the fishing industry with the support to develop more selective fishing gears and to help reduce and eliminate the capture of juvenile fish and non-quota species.	DAERA, AFBI, NIFF	ANIFPO, NIFPO, DAERA, AFBI, Seasource	In progress	2017-2022	Link
CatchmentCARE	Water quality	An EU-funded project aimed at improving freshwater quality in three cross-border river basins by 2023; he Finn, Blackwater and Arney cross-border catchments. The work done will contribute to improving water quality, physical infrastructure and aquatic habitats.	Loch Agency	Local authorities, Donegal County Council (Lead Partner), Armagh City, Banbridge & Craigavon Borough Council, Ulster University, AFBI, British	In progress	2017-2022	Link

				Geological Survey, Loughs Agency, Geological Survey Ireland and Inland Fisheries Ireland.			
Rising from the Depths	Marine cultural heritage	Protect aims to identify ways in which marine cultural heritage can directly benefit coastal communities in Kenya, Tanzania, Mozambique and Madagascar. The project aims to identify new opportunities and methodologies for protecting and utilising the marine cultural heritage of East Africa to stimulate alternative sources of income, foster local identities, and enhance the value and impact of overseas aid in the marine sector.	Ulster University	Includes an academic team, partners, post-Doctoral research team and PhD studentships. Link to full team	In progress?	2017-2021	Link
Scallop Enhancement Project	Sustainable aquaculture	A desktop study looking at potential methods of enhancing scallop stocks within the NI inshore region.	AFBI, Seafish, DAERA	DAERA, AFBI, Seafish (funders)	Completed	March 2020	Link
Review of Water Catchment Modelling for Northern Ireland (NI)	Catchment modelling	To identify a toolbox of catchment models that are applicable in NI to a range of different objectives related to the management of freshwater and Marine waterbodies.	DAERA & AFBI	DAERA & AFBI	In progress	2019-07/2022	Link
Impact of future climate change scenarios on the Irish sea ecosystem	Impacts of climate change on marine environment	This project will examine the ecological and economic impacts of climate warming on the Irish Sea ecosystem and the wild fishery and aquaculture industries dependent on it.	DAERA & AFBI	DAERA & AFBI	In progress	2019-12/2023	Link

The ecological effects of discarding on key commercial marine species in the Irish Sea	Fisheries discards	The project is using modelling and fieldwork studies, to examine the role of discards in the Irish Sea ecosystem, exploring the consumers of discards and calculating the benefit to the food chain that discards currently provide.	DAERA & AFBI	DAERA & AFBI	In progress	2019-11/2023	Link
Impact of emerging contaminants on the Northern Irish water environment	Water pollution	Project aims to assess the impact of contaminated by temporarily expanding monitoring sites, assist the NI antimicrobial resistance (AMR) programme, investigate and estimate the levels of microplastics and investigate if r zebra mussel can filter microplastics from waters.	DAERA & AFBI	DAERA & AFBI	In progress	2019-03/2022	Link
Identifying the impacts of future climate change scenarios on the coastal habitats of Northern Ireland	Impacts of climate change on marine environment	Project aims to identify drivers of climate change in NI waters, their effects, and coastal assets at risk. Develop an onshore-offshore monitoring strategy that will facilitate understand of these changes and allow for responses.	DAERA & AFBI	DAERA & AFBI	In progress	2019-12/2022	Link
Scoping study for research on effects of climate change on fish and fisheries of Lough Neagh	Impacts of climate change on freshwater environment	The primary objective of this scoping study is to determine the key research required to characterise the impacts of climate change on the fish ecology of Lough Neagh.	DAERA & AFBI	DAERA & AFBI	In progress	2019-07/2022	Link
Greenhouse gas emissions assessment for the Northern Ireland Fishing Fleet	Fuel consumption	Project aims to calculate the total greenhouse gas emissions associated with the Northern Ireland fishing fleet.	Poseidon, NIFF	Poseidon, NIFF	In progress	ND	ND

Appendix 5.

Funding schemes

Table 9. Table gives examples of the available funding that could be used to development and maintain a NI Marine Hub.

Type of funding	Examples
UK National Grant funding	UKRI, NERC, EPSRC etc
Direct funding	Government & industry funding
Charitable funding	Esmée Fairbairn Foundation, Oak Foundation, The Nature Conservancy etc.
Levy Funding	Seafish/ FRDC
Sponsorship	Industry/ corporate
Crowd funding	Kick-starter, Crowdfunder, GoFundMe, Patreon
Match funding	-
Membership subscription	Hub members pay an annual subscription to assess the Hub
Loan	Bank loan
Private investment	Venture capital, angel investment
Commercial Hub aspects	Training facilities, business enterprise incubator, rental space, marketing platform
Intellectual property rights	Claim small percentage of property rights for any innovated developed/supported through the Hub
Interest from Hub investments	Own investments

Appendix 6.

Global organisations reviewed

Table 10. Table shows all global organisations reviewed as part of the global 'hub' case study exercise.

Organization	Location(s)	URL	Sectors
Data Lab	Scotland	https://thedatalab.com/	Data & Innovation
IBIOIC	Scotland	https://www.ibioic.com/	Biotech
Marine Scotland	Scotland	https://marine.gov.scot/	Marine
Fisheries Innovation Scotland	Scotland	https://fiscot.org/	Marine
Dutch Diamond Approach	Global	N/A	All
Global Underwater Hub	UK	https://www.globalunderwaterhub.com/	Marine
Roundtable for Sustainable Palm Oil (RSPO)	Global	https://rspo.org/about#:~:text=We%20are%20a%20not%2Dfor,implement%20global%20standards%20for%20sustainable	Palm Oil
Seafish	UK	https://www.seafish.org/	Fisheries
Lloyd's Register Maritime Decarbonization Hub	Global	https://www.lr.org/en/marine-shipping/maritime-decarbonisation-hub/about/	Shipping
MAVA Foundation	Switzerland	https://mava-foundation.org/blog-what-conditions-for-a-multi-stakeholder-partnership-romain-schumm/	Oil & Gas
Foundations of Success	USA, Latin America, Caribbean, Europe	https://fosonline.org/about-us/#our-mission	Conservation & Communication
Partnership for Regional Ocean Governance - Marine Regions Forum	Global	https://www.prog-ocean.org/marine-regions-forum/	Marine
Mnazi Bay-Ruvuma Estuary Marine Park	Tanzania	https://www.sciencedirect.com/science/article/abs/pii/S0964569120304099	Marine
tDAcademy	Global	https://www.td-academy.org/en/home/	Research
Global Partnership on Marine Litter	Global	https://www.unep.org/explore-topics/oceans-seas/what-we-do/addressing-land-based-pollution/global-partnership-marine	Marine

One Ocean Hub	Africa, Pacfic Islands	https://oneoceanhub.org/where-we-work/	Marine
Collaborative Centre for Sustainable Use of the Seas	UK	https://www.uea.ac.uk/groups-and-centres/ccsus#:~:text=The%20CCSUS%20vision%20is%20to,for%20marine%20systems%20and%20society	Marine
Wolfson College Interdisciplinary Research Hub on Sustainability & Conservation	UK	https://www.wolfson.cam.ac.uk/interdisciplinary-research-hubs/sustainability-conservation	Sustainability
Marine Alliance for Science and Technology for Scotland	Scotland	https://masts.ac.uk/	Marine
Prince Edward Island Fishermen's Association	Canada	https://peifa.org/members/	Fishing
MaRs	Canada	https://www.marsdd.com/partner-with-us/	Climate Change
Sri Lanka Maritime Hub	Sri Lanka	https://www.ukessays.com/essays/economics/development-sri-lanka-maritime-hub-9870.php	Maritime
Hong Kong Maritime Hub	Hong Kong	https://www.hongkongmaritimehub.com/category/marine-services-supplies/	Shipping
Wirral Waters	England	https://www.wirralwaters.co.uk/projects/maritime-knowledge-hub/	Shipping
Port of Tyne 2050 Innovation Hub	England	https://www.portoftyne.co.uk/about-us/2050-innovation-hub	Shipping
International Maritime Organization	UK	https://www.imo.org/en/MediaCentre/SecretaryGeneral/Pages/International-Maritime-Hub---Glasgow.aspx	Maritime
Cape Cod Fishermen	USA	https://capecodfishermen.org/the-fish-hub	Fishing
Pacific CFE Hub	Canada	https://cfehub.com/	Fisheries
Monterey Bay Fisheries Trust	USA	https://montereybayfisheriestrust.org/stories/2018/4/15/what-is-the-monterey-bay-fish-hub	Fisheries
Marine Hub Cornwall	England	https://www.marinelink.com/news/innovation-starts-marine-hub-cornwall-439132	Marine
Marine Biodiversity Hub	Australia	https://www.nespmarine.edu.au/	Marine

Forestry Hub	Wales	http://www.forestryhub.co.uk/	Forest
Nexus - Urban Forests Research	Canada	https://urbanforestryhub.com/nexus	Forest
Maine Aquaculture Hub	USA	https://seagrant.umaine.edu/maine-aquaculture-hub/	Aquaculture
SSF Hub	Global	https://ssfhub.org/	Fisheries
The Innovation Hub	UK	https://www.innovationhubuk.co.uk/	Agriculture
Agriepicentre	UK	https://agri-epicentre.com/	Agriculture
BIS Innovation Hub	Hong Kong SAR, Singapore, Switzerland, London, Stockholm	https://www.bis.org/about/bisih/about.htm	Finance
EIT Climate-KIC	Germany, Austria, Switzerland	https://dach.climate-kic.org/en/	Climate
Food and Land Use Coalition	Global	https://www.foodandlandusecoalition.org/about/	Agriculture
Agri-Teche	UK	https://www.agri-tech-e.co.uk/	Agriculture
Scottish Aquaculture Research Forum (SARF)	Scotland		Aquaculture
Marine Science Co-ordination Committee (MSCC)	UK	https://www.gov.uk/government/groups/marine-science-co-ordination-committee	Marine
Sustainable Aquaculture Innovation Center	UK	https://www.sustainableaquaculture.com/	Aquaculture
European Marine Biological Resource Centre	UK	https://www.embrc.eu/	Marine
European Marine Board	Europe	https://www.marineboard.eu/about-european-marine-board	Marine
One Ocean Hub	South Africa, Namibia, Ghana, Fiji and Solomon Islands	https://oneoceanhub.org/	Marine
MEOPAR Canada	Canada	https://meopar.ca/	Research
NERC	UK	https://nerc.ukri.org/about/whatwedo/vision/	Research & Innovation

UK Research and Innovation	UK	https://www.ukri.org/	Research & Innovation
Research Innovation Scotland	Scotland	https://www.research-innovation-scotland.co.uk/our-mission/	Research & Innovation
Sea Scotland	Scotland	http://www.seascotland.scot/	Marine
Fish Mongers	UK	https://fishmongers.org.uk/governance-and-the-executive/	Fisheries
Future of Fish	UK	https://www.futureoffish.org/about-us/	Fisheries
Second Muse	Global	https://www.secondmuse.com/building-community-to-solve-a-sustainable-seafood-challenge/	Innovation & Social Good
The Partnering Imitative	UK	https://thepartneringinitiative.org/about-us/	Communications
Collective Leadership Institute	USA, South Africa, Germany	https://www.collectiveleadership.de/blog/article/feasibility-studies/	Leadership
Aliarse	Costa Rica	http://www.aliarse.org/quienessomos_en/	Partnership facilitations
Partnership Brokers	England	https://www.partnershipbrokers.org/	Communication
Climate and Development Knowledge Network	Global	https://cdkn.org/	Climate
Tropical Water Quality Hub	Australia	https://nesptropical.edu.au/	Water
Reef and Rainforest Research Center	Australia	https://www.rrrc.org.au/governing-board/	Reef and Rainforest
Cove Ocean	Canada	https://coveocean.com/	Marine
Cambridge Conservation Initiative	UK	https://www.cambridgeconservation.org/	Conservation
Too Big to Ignore	Canada	http://toobigtoignore.net/	Fisheries
Fisheries Leadership and Sustainability Forum	USA - West Coast	https://www.cambridgeconservation.org/	Fisheries
First Nations Fisheries Council	Canada	https://www.fnfisheriescouncil.ca/	Fisheries
European Ocean Observing Systems	Europe	https://www.eoos-ocean.eu/	Marine

JPI Oceans	Belgium / Europe	https://www.jpi-oceans.eu/en/about	Marine
European Marine Observation and Data Network (EMODnet)	Europe	https://emodnet.ec.europa.eu/en	Marine
European Science Foundation	Europe	https://www.esf.org/	Science
Scottish Association for Marine Science	Scotland	https://www.sams.ac.uk/	Marine
European Marine Science Park	Scotland	https://europeanmarinesciencepark.co.uk/	Marine
EFARO	Europe	www.efaro.eu	Fisheries & Aquaculture
Pacific Fishery Management Council	USA	https://www.pcouncil.org/	Fisheries
CEDar	Ireland	https://www.nmni.com/CEDaR/CEDaR-Centre-for-Environmental-Data-and-Recording.aspx	Data
WKIrish	Ireland	https://www.ices.dk/sites/pub/publication%20reports/forms/marine.aspx?rootfolder=/sites/pub/publication+reports/expert+group+report/acom/2018/wkirish&folderctid=0x0120005daf18eb10daa049bbb066544d790785&view=%7B5c7a53f9-446e-486e-93af-841fc20c1773%7D	Fisheries

Appendix 7.

Marine Hub costs

Table 11. Table shows the estimated (low and high) cost breakdown of each recommended Marine Hub scenario. The notes column provides context to the cost estimates e.g., 'figures relate to an annual staff salary'.

Cost Points	Marine Hub Scenarios						Notes
	S1-Low	S1-High	S2-Low	S2-High	S3-Low	S3-High	
Physical building	1,500,000	5,000,000	0	0	0	0	Based on initial costs, not including maintenance. Lower S1 figure refers to utilising existing building, whilst higher figure refers to the cost of a new building
Building rental	0	0	0	0	10,000	20,000	Related to the annual costs of the occasional need to hire out a venue
Website	30,000	40,000	30,000	40,000	30,000	40,000	Cost would stay the same regardless of scenario
Portal	50,000	100,000	50,000	100,000	50,000	100,000	Cost would stay the same regardless of scenario
Director	60,000	80,000	0	0	0	0	Based on annual salaries
Hub Manager	30,000	40,000	30,000	40,000	30,000	40,000	Based on annual salaries
Steering board	0	0	0	0	0	0	Initially free, later paid attendance/ stipend
Administrator	17,000	22,000	17,000	22,000	17,000	22,000	Based on annual salaries
Communications facilitator	17,000	22,000	17,000	22,000	17,000	22,000	Based on annual salaries
Digital support technician	22,000	28,000	22,000	28,000	22,000	28,000	Based on annual salaries
Grant & Funding specialist	27,000	37,000	27,000	37,000	27,000	37,000	Based on annual salaries
Annual Expo/ conference	25,000	50,000	0	0	25,000	50,000	Includes a reduction from expo ticket revenue
Inception design workshop	5000	10,000	0	0	5000	10,000	Relates to a workshop on the design consultation of a Marine Hub
Total cost	**£1,783,000**	**£5,429,000**	**£193,000**	**£289,000**	**£233,000**	**£369,000**	Gives low and high estimated costs of each recommended Marine Hub scenario