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# What does integrated ecosystem assessment mean to policy-makers and scientists working in the Atlantic? Implications for ocean science diplomacy

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An important goal of Integrated Ecosystem Assessment (IEA) is to be an inclusive, evidence-based process to engage stakeholders, in support of ecosystem-based management. IEA is resource intensive, requiring the engagement of personnel, experts from many disciplines, public and private institutions, and including issues of technology, infrastructure, capacity building, etc. Stakeholders such as policy-makers and scientists in influential decision-making roles often determine the level of investment when committing to an IEA. It is thus critical to understand how these specific stakeholders understand and perceive IEA, as well as their motivations for engagement. We interviewed government officials, science managers and scientists whose decisions are critical for mobilizing resources (time, expertise and funding) in support of ecosystem based management (and potentially IEA) in the Atlantic Ocean. The interviews aimed at documenting their perceptions of IEA, and their motivations to engage in the process. Our results show that most of these research and policy stakeholders are generally unaware of, or have misconceptions about IEA concepts. Those who expressed awareness of IEA considered IEA as unfit to address most policy and managerial goals. We propose that the IEA process could be improved by promoting inclusivity and applying ocean science diplomacy. We see that these two aspects (inclusivity and science diplomacy) can help research and policy stakeholders understand the true meaning of IEA through negotiating, and by strengthening and diversifying the involvement of international stakeholders. We advocate that the scoping phase of an IEA is of critical importance and should be core to the whole process. It is during the scoping phase that stakeholders are identified and engaged. With their involvement, there is a need to make their interests visible and respected. During the scoping phase, a safe and open space needs to be secured, so these interests can be negotiated and mutual understanding on concepts, roles in the process and the possible outcomes are achieved. This article is part of the Mission Atlantic Project (Horizon 2020) which is designed to conduct IEAs in the Atlantic Ocean.

## KEYWORDS

IEA, ecosystem-based management, All-Atlantic Ocean Research Alliance, science-policy interface, ocean science diplomacy

# 1 Introduction

Ecosystem based management and the governance of human activities require inclusive approaches that engage stakeholders from across disciplines, geographies, sectors, cultures, genders, and generations (Wisiz et al., 2020). Integrated Ecosystem Assessment (hereafter IEA) is an area-based environmental managerial tool, delivered through a multistakeholder platform. It identifies a given management problem, and the necessary evidence to inform decisions on how to balance environmental protection with human activities. IEA has been adopted by the UN Environment Program (UNEP, 2022), the International Council for the Exploration of the Seas (ICES) (Walther and Möllmann, 2014) and the US National Oceanic and Atmospheric Administration (NOAA) (Harvey et al., 2017). IEA has been promoted as an effective evidence and ecosystem-based approach to develop policy-relevant recommendations about the state of the environment and its interaction with human activities (Walther and Möllmann, 2014; Harvey et al., 2017). Participants of an IEA process seeks to combine, interpret, and communicate knowledge in order to define courses of action in a given environmental management challenge (Levin et al., 2009; Dickey-Collas, 2014; Levin et al., 2014; Samhouri et al., 2014; Harvey et al., 2017; ICES, 2019). Moreover, those engaged in an IEA process seek to evaluate management strategies together with the possible outcomes (via trade-offs) derived from the agreed managerial measures (Levin et al., 2009; Dickey-Collas, 2014; Levin et al., 2014; Samhouri et al., 2014; Harvey et al., 2017; ICES, 2019).

## 1.1 The IEA process

IEA is a stepwise process that includes: 1. a scoping phase to identify the goals of ecosystem-based management and threats to achieving these goals, 2. the development of ecosystem indicators and targets, 3. a risk analysis, 4. an assessment of scenarios relative to ecosystem-based management goals, and 5. the monitoring of indicators (Figure 1).

The first phase of the IEA process is the scoping phase, and is the part of the IEA process where relevant stakeholders are identified and engaged to negotiate and formulate the IEA objectives, along with the necessary knowledge to be provided (Levin et al., 2014). During the IEA process, stakeholders are requested to identify the appropriate scale, to define management objectives (Samhouri et al., 2014), and the strategies to exchange the IEA information with decision-making processes (Harvey et al., 2017).

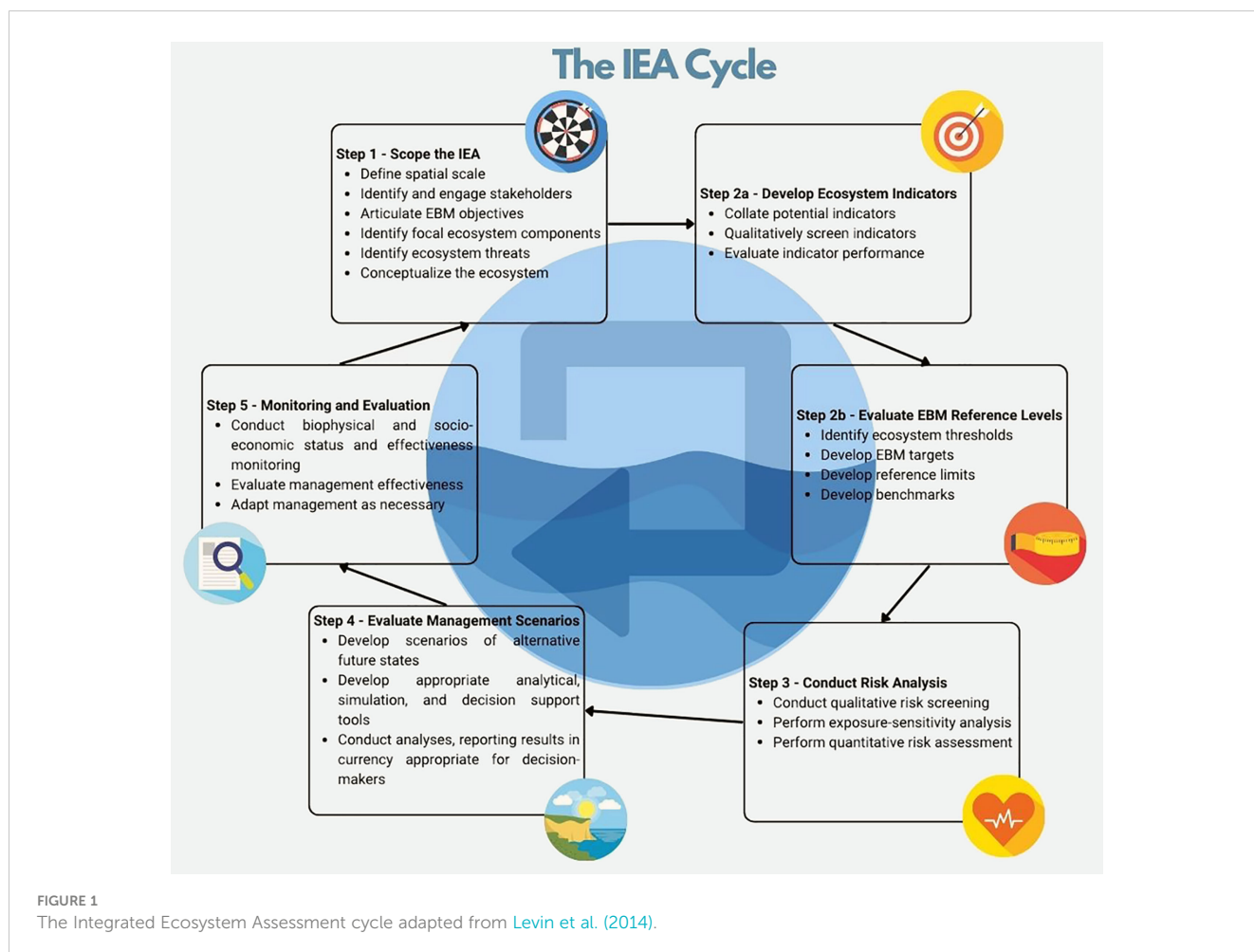
Failure to engage in the IEA process potentially weakens the inclusivity and the effectiveness of the scoping phase, which is the foundation of the entire IEA process (Levin et al., 2014). Stakeholders in an IEA include academics, community representatives, industry, policy-makers, civil society organizations or any interested party in a given geography. The absence of relevant stakeholders in IEA could undermine the potential for IEA to help achieve shared ecosystem based management objectives in a region (and beyond) (deReynier et al., 2010). A lack of clarity on the purpose and need of IEA can be detrimental to the process (Harvey et al., 2017), in particular, due to

its relevance for operationalizing ecosystem-based management principles (Levin et al., 2009; Dickey-Collas, 2014). In this context, it is imperative to understand how individuals perceive the IEA, what are the values they place in engaging with the process and what factors motivate them to commit resources to IEA activities. As critical elements of the IEA, we chose to assess policy-makers and scientists who are influential in the Atlantic Ocean community. Because of the trans-boundary nature of Atlantic marine ecosystems (and the challenges thereof), this paper applies the lenses of science diplomacy, a process by which research and international decision-making interact in actions such as evidence-based decision-making, international support for scientific cooperation, *inter alia*.

## 1.2 IEA and science diplomacy

Ocean natural processes do not adhere to national jurisdictions (Ranganathan, 2020), and for this reason, international science is needed to support the objectives of many marine IEA initiatives. IEA objectives are rooted in societal challenges that require an ecosystem-based management solution, advised by scientific evidence and other forms of knowledge (Rudd et al., 2018). In the cases where the boundaries of an IEA cross jurisdictions or include international spaces, such objectives require international engagement and action, particularly between science and international relations.

Because of the transboundary and international nature of many marine IEAs, ocean science diplomacy can potentially play an important role in facilitating such initiatives. Ocean science diplomacy refers to the interaction between marine research and international relations. Ocean science diplomacy can involve issues of evidence provision, the balance of national versus international interests, and/or power dynamics involving scientific matters between countries (Polejack, 2021). First, evidence provision to international decision-making is perhaps the most commonly known feature of ocean science diplomacy, e.g. data on fish populations to determine fishing quotas. Second (and less visible), is the balancing of national interests (e.g. exploitation of marine resources for economic profit), with more global interests (e.g. ocean conservation). In cases where these interests clash, power conflicts may emerge. For example, the fishing industry of a given country will most probably show interest to engage in the diplomatic negotiation concerning the establishment of no-take zones or marine protected areas, seeking to avoid an overlap with lucrative fishing sites. This specific industry's interest may then become a national interest to be supported and defended by diplomacy. Alternatively, that specific ocean site may become the subject of global interest due to its strategic provision of other ecosystem services, such as biodiversity conservation or climate change mitigation. Finally, power dynamics involving scientific matters between countries can come into play whereby ocean science diplomacy can become a soft form of power (Nye, 2017). For example, better scientifically equipped countries can use their national science assets to seduce other countries and attract investment and talents to empower domestic science systems and



raise competitiveness (Fedoroff, 2009; Nye and Welch, 2017). IEA is a relatively new concept, and there are so far no clear examples where political tensions have hampered specific IEA efforts. However, power disputes can critically influence area-based management exercises, such as Marine Spatial Planning (Ramírez-Monsalve and van Tatenhove, 2020).

The Atlantic Ocean presents a useful opportunity to examine how research and policy stakeholders perceive international IEAs. The Atlantic is the second largest ocean basin and has the world's longest running history of international IEA, mostly done in the North (Levin et al., 2014). For example, NOAA has been a strong advocate for applying IEAs to fisheries management (Harvey et al., 2017; Muffley et al., 2021; NOAA, 2022), while ICES is seeking to expand IEAs to sectors beyond fisheries (Dickey-Collas, 2014; Walther and Möllmann, 2014; ICES, 2019). The alignment of Canada, the European Union, and the United States of America through the Galway Statement has reinforced the importance of IEAs in support of better ocean management and cross-disciplinary research (Rudd et al., 2018; Link et al., 2019; Wisz et al., 2020). In the South, the work jointly done by Angola, Namibia and South Africa in managing marine resources through the Benguela Current Convention has shown how delicate an ecosystem assessment can become when dealing with economical assets in face of the consequences of climate change (de Barros Neto et al., 2016).

The Belem statement is an agreement that aims to support scientific collaboration in the South and North Atlantic by establishing the All-Atlantic Ocean Research Alliance, a cooperative international arrangement with the aim of enhancing citizens' wellbeing, grounded in joint marine research efforts (Polejack et al., 2021). The European Commission, in support of the Alliance, has also contributed major funding to support the development of Atlantic-scale IEA, as by the Mission Atlantic project<sup>1</sup>. It is however poorly understood how policy-makers and leading scientists in the Atlantic understand and prioritize the IEA process.

This paper investigates the diversity of perceptions of IEA among a sample of research and policy stakeholders across the Atlantic, and the inherent implications that these perceptions might pose to the development of IEAs. The investigated perceptions are those of research leaders and high-level policy-makers. These stakeholders' values can potentially influence the level of commitment directed toward the IEA process, and its success. This study is part of the Mission Atlantic project, which aims to operationalize IEAs through case studies from the North and South

<sup>1</sup> <https://missionatlantic.eu/> accessed on June 15, 2022.

Atlantic, in support of ecosystem-based management in the Atlantic and the All-Atlantic Ocean Research Alliance.

## 2 Methods

Our goal was to understand how individuals with positions of power and influence in the Atlantic Ocean perceive IEAs. We selected individuals engaged in negotiating and implementing the All-Atlantic Ocean Research Alliance among government officials and scientists. We conducted twenty semi-structured interviews with government officials (13 interviewees) and scientists (07 interviewees) from Argentina, Brazil, Canada, Germany, Portugal, Spain, South Africa, the United States of America, and the European Commission. These specific countries were selected due to their engagement in negotiating the All-Atlantic Alliance. We focused on government officials who hold decision-making roles important to the allocation of resources for IEAs (human and financial). We also focused on research leaders, as those leading research projects, groups or institutions working on the science-policy interface in the Atlantic Ocean.

The general profile of the interviewed government officials were decision makers who occupy high-level positions in national ocean-related science systems, including Science and Technology State Secretaries and Minister, directors, science managers and diplomats. These government officials are budget owners, agenda setters, and report to the high levels of governments (e.g., Head of State or Ministers). Unlike “mid-level technocrats” (Jasanoff, 1998) who would be personally participating in an IEA process, our interviewees are not expected to take a seat at the IEA table, but rather be fed by the results of IEAs and capable of determining further engagement. The general profile of the interviewed scientist is that of a person who has gained extensive, and high-profile experience in international scientific cooperation by coordinating cross-boundary research projects and scientific programs, and engages across large international marine research institutes in the Atlantic.

The first author of this publication was personally involved in negotiating the All-Atlantic Ocean Research Alliance. His positionality has facilitated the identification and engagement with interviewees. The first author also conducted the interviews, and it is believed that this pre-existing level of trust and acquaintance facilitated access to the interviewees, and their openness and sincerity when answering the interview questions. The first author also analyzed the results. The first author positionality can thus place him as an insider scientist (as per Merriam et al., 2001).

The first author carried out twelve face-to-face interviews during the All-Atlantic Forum<sup>2</sup> (Brussels, February 2020), before COVID-19 travel restrictions were in force. After that, from April to October 2020, the remaining eight interviews could only be carried

out online (via the Zoom platform). Interviews consisted of two questions: 1) In your opinion, what is an international IEA? and 2) how should the success of IEA be measured? The interviews were conducted both in English and in Portuguese and were fully transcribed in their original language. Translation from Portuguese to English was only done to present extracts in this paper. To preserve the anonymity of the interviewees, the names of the interviewees were replaced with numbers, shown in brackets after each quote, along with their professional role (scientist or government official).

The data were approached by grounded theory (Bryman, 2012, pp. 567–570) and MAXQDA Plus 2020 (Release 20.4.1) software was used to support our analysis. Grounded theory predicts that no previous theories will be applied to the data. Instead, the data should guide the analysis and theories used to explain the results are to be grounded in the data acquired. Thus, interviews were coded in accordance to the main idea expressed throughout the conversation. Codes identified in the data were revised multiple times and clustered in themes, which were again revised and used to guide our analysis, as per a thematic analysis (Braun and Clarke, 2006). Thematic analysis was chosen because it allows the identification and organization of patterns of meaning, suitable to identify these individual’s perceptions and values about the IEA, irrespective of the sample size (Braun and Clarke, 2006). Thematic analysis, however, is limited to collect *what* was said, rather than *how* interviewees say it, which also limits the scope of the discussed results. Moreover, positionality is very influential in thematic analysis for it is the researcher who assigns codes and organize themes, which naturally denote the standpoint of the interviewees (Braun and Clarke 2013 pp. 174–83). In spite of such limitations, this method was suited to collect the necessary understanding of what agents in the Atlantic context mean by engaging in IEA. We present the resulting themes as subsections of the Results section below and in Table 1.

## 3 Results

The codes derived from the interviews were clustered around seven themes, summarized and presented in Table 1.

### 3.1 Uncertainty about the IEA concept

Most interviewees premised their answers to IEA questions with the caveat that they lacked a clear understanding of IEA concepts and methods. This was the case for both government officials and scientists we interviewed. Often, interviewees explained that IEA was not their expertise, nor part of their routine work. For example:

*“I’m certain there’s a good definition of it and a good description, but I suppose that’s about as far as my conceptualization of it goes.”* (Respondent 18, government official)

*“It’s a term that often confuses me when people use it. And there’s a whole lot of other information in that, that is not*

<sup>2</sup> <https://allatlanticocean.org/view/atlanticforums/2020-brussels>, accessed in Nov.18, 2021.



TABLE 1 Summarized results showing the main themes identified, key results emerging from those themes, an exemplary quote and whether the result was more frequent amongst government officials, scientists or both.

Theme	Key result	Exemplary quote
Uncertainty about the IEA concept	The lack of clear understanding of the IEA process, its limitations, and benefits	<i>"I'm certain there's a good definition of it and a good description, but I suppose that's about as far as my conceptualization of it goes"</i>
IEA as a resource management tool	IEA seen more as a tool to manage marine resources rather than unveiling ecosystems' complexities	<i>"So for me, it's looking at this resource multi-dimensionally, not just looking at it through one lens"</i>
IEA as a way to understand and manage nature's complexity	Recognition of the human limitations to assess the complexity of ecosystems	<i>"Ecosystems don't know no boundaries. The boundaries are put up in there by our knowledge paradigms. (...) the world itself in the nature in which it's working, it's already integrated. So we need to find a rubric, a methodology that helps us to understand this holistic part of it"</i>
Managing human as part of the ecosystem	IEA is about managing human activities rather than managing nature	<i>"Fisheries management is mostly about managing fishermen, harvesters, not about managing the fish at all. Fish are just the kind of the outcome. They're part of the story"</i>
Managing resources that have economic value	Results arising from IEAs should be tailored to address resource management and governance decisions	<i>"Eventually, there will be a value placed on (...) looking at the economic and monetary aspects of systemic views of ecological ecosystem"</i>
Integrating knowledge	A call for breaking boundaries and working across disciplines and sectors while assessing marine ecosystems	<i>"It requires really different sectors, different disciplines to work together, which then translates as well into ... when you operationalize it, that you need different policymakers, you need different funding agencies"</i>
The challenges of an ecosystem-based approach	IEA does not offer a one-size-fits-all solution	<i>"there's sometimes too much enthusiasm for the idea that there's an optimal solution to what is ultimately not a tractable problem that can go back to having the solution. That there isn't an activity that you could set a target level that will guarantee some particular outcome"</i>

*my expertise. And I can't even begin to comprehend what you would need to actually measure the success of something like that."* (Respondent 19, scientist)

area-based management processes, such as Marine Spatial Planning and coastal zoning.

### 3.2 IEA as a resource management tool

In spite of a lack of clarity on the IEA concepts and process, interviewees showed preconceived beliefs on what IEA would entail and what it was meant to achieve. To these individuals, IEA is mainly perceived as a marine resource management tool. For example:

*"So for me, it's looking at this resource multi-dimensionally, not just looking at it through one lens."* (Respondent 12, government official)

*"It's fundamentally just about recognizing the complexity of the environment that we are managing. Fisheries management is more than just about managing fish. But our point would be that fisheries management is mostly about managing fishermen, harvesters, not about managing the fish at all. Fish are just the kind of the outcome. They're part of the story."* (Respondent 9, scientist)

Another perception brought by interviewees was about IEA being an area-based managerial tool. In this sense, one of the roles of the IEA is to assess specific geographical areas to be applied in

*"So we have to be more flexible on what we call this animal but I think, at the end of the day, it is about zoning, thinking about the entrusted real estate that you have in the ocean and how you really want to manage or interact with it in a sustainable way."* (Respondent 10, scientist)

*"You sit down and look at an area, see what the activities are, and you try to decide for that country, for that community, without purely lobbying and economic influences, which makes sense, right? So, where is each area, what each area is going to be intended for. What is best to do, what is best not to do, right, so that the fauna and flora can recover, and everything else."* (Respondent 13, government official)

### 3.3 IEA as a way to understand and manage nature's complexity

Interviewees communicated a belief that IEAs are designed to assess and report on the complex connectivity found in nature. Scientists were more inclined to express the complex linkages between ecosystem components, and the role that IEA can play in understanding and managing these complexities. For example, a scientist stated:

*"IEA is complex because it tries to see all the possible impacts of an action, not just one or two aspects, but really all the*

*aspects that can affect an ecosystem, a landscape, etc.”*  
(Respondent 7, scientist)

Government officials expressed a certain degree of confusion and skepticism when addressing the complexity of nature. For example:

*“Ecosystems are integrated anyway, so I’m not sure that makes immediate sense to me.”* (Respondent 18, government official)

*“I’ve never heard or read about integrated ecosystem, but all ecosystems need to be integrated”* (Respondent 15, government official)

According to one government official, IEA is...

*“...a flexible way of beginning to vision (sic) how the wild itself operates. Ecosystems don’t know no (sic) boundaries. The boundaries are put up in there by our knowledge paradigms. We like classifying these kinds of things and so to that extent we create the need for an integrated but the world itself in the nature in which it’s working, it’s already integrated”* (Respondent 16, government official)

The belief that IEAs are designed to assess and report on the natural interconnectedness of nature seems to be related to the adoption of concepts that are artificially created by humans. As suggested by respondent 16 above, this can be a paradigm created by humans in an attempt to frame the complexity of nature so we are capable of understanding it. Another official challenged the dominant conceptualization of ecosystem:

*“[ecosystem] is one dimension of a much bigger set of integrated systems where what we understand an ecosystem to mean is going to change as having a value in itself or having a function on production supplies in terms of the basic processing that ecosystems achieve as part of the services that it provides to us.”* (Respondent 4, government official)

### 3.4 Managing humans as part of the ecosystem

While the interviewed government officials tended to understand the IEA as a tool to report on the state of the marine environment, in particular from the perspective of providing services to humans, scientists brought forward the notion that humans are an intrinsic part of those ecosystems. Therefore, assessing ecosystems would necessarily mean assessing the human dimensions within them. Consequently, to the interviewed

scientists, IEA would be a tool to understand the impacts of human activities on the environment, and to manage them. For example:

*“It’s a struggle because the word ‘ecosystem’ means a lot of different things to people and what was most useful in what we brought to the Minister, was to recognize that humans are included in the ecosystem and that most environmental management is about managing human behavior.”*  
(Respondent 9, scientist)

### 3.5 Managing resources that have economic value

Interviewed government officials seemed more likely than scientists to attach the goals of an IEA to the economic value of marine resources. This concern was also translated when linking IEAs to political objectives. To those officials, results arising from IEAs should be fit-for-purpose in aiding decision making mainly about resource management for economic gain.

*“Eventually, there will be a value placed on that [ecosystem] and [we] need to be looking at the economic and monetary aspects of systemic views of ecological ecosystem.”*  
(Respondent 4, government official)

*“We have to understand the value of what the condition at that ecosystem is.”* (Respondent 6, government official)

Scientists rarely brought political and economic issues upfront when explaining their views of IEAs, but one in particular stressed the need for governments to take more responsibility in managing marine resources, stating:

*“The government has to establish some kind of rules. And of course, the government has to control what is happening there. So you have to have a complete monitoring of the area in order to control what is happening there. They have to have much more responsibility.”* (Respondent 11, scientist)

### 3.6 Integrating knowledge

Both Government officials and scientists have expressed the need to break boundaries and work across different disciplines and sectors when assessing marine ecosystems:

*“It requires really different sectors, different disciplines to work together. When you operationalize it, you need different policy-makers, you need different funding agencies, and that is the complexity.”* (Respondent 2, government official)

*“I come in from the physics. I think it’s really important to start connecting. So we are doing a lot of that, like, doing more multidisciplinary analysis. The variability that the physical components are providing for the environment, for the ecosystems.”* (Respondent 20, scientist)

According to some government officials, other multidisciplinary frameworks should be integrated to IEA, among which the United Nations (UN) 2030 Agenda (Sustainable Development Goals (SDGs)), the World Ocean Assessment (United Nations, 2021), and the IPCC reports (e.g., IPCC, 2019):

*“I think the national level is quite important, but in the international level you would also have maybe the use of the sustainable development goals and reports to the UN that possibly could be used with the various indicators. Each of the goals would have a set of indicators and reporting against those indicators could provide some sense of how that integrated ecosystem approach implementation is going on, whether it’s been achieved or not.”* (Respondent 12, government official)

*“First of all, if you take the general assessment, the UN assessment of the ocean status, you have an established methodology. The other one is the IPCC. You take the SDGs and the different indicators. Then, you might have different key performance indicators related to performance required at national level, so you have again a whole series of descriptors there. So, we have enough, we have all these existing frameworks. What is always missing is: how is this actually implemented?”* (Respondent 2, government official)

### 3.7 The challenges of an ecosystem-based approach

To most interviewees, there are challenges posed to IEA, particularly to find managerial solutions. For example, a government official stated:

*“When I see in my own country our fisheries folks who are leading integrated ecosystem assessments and I see how slow it is to get people to migrate from a fisheries-based ecosystem to a totality of the ecosystem, it’s frustrating. It takes a long time for that level of focus to change its direction.”* (Respondent 3, government official)

Another official illustrated the inefficiencies of the current management system:

*“As an RFMO (Regional Fisheries Management Organization) manager said: we closed the fisheries for this*

*species, it’s been 10 years. And the species doesn’t recover. Why doesn’t it recover? Because it’s not fishing, it’s climate change, it’s oil, it’s shipping ... so this stock will never recover, because it’s not impacted by how much we’re fishing.”* (Respondent 13, government official)

One scientist shares this frustration:

*“I think there’s sometimes too much enthusiasm for the idea that there’s an optimal solution to what is ultimately not a tractable problem. That there isn’t an activity that you could set a target level that will guarantee some particular outcome. That’s just not possible because there are too many movable pieces in the system, but I think it’s much better to talk about ecosystems approaches than it is to talk about single species or even multi-species approaches.”* (Respondent 9, scientist)

## 4 Discussion

These interviews reflect the individual perceptions of Integrated Ecosystem Assessments collected from government officials and scientists who are influential in the Atlantic Ocean science community. These individuals are agenda-setters, budget holders, science managers and influential scientists with the capacity to either provide knowledge to an IEA or influence the commitment of resources. Therefore, our results do not represent a generalization of any population, but rather individual insights that compose their truths and understandings of IEAs. This is the framework by which we discuss the results.

### 4.1 The importance of understanding the IEA

Although IEA is considered among the scientific community as a well understood concept, and features prominently in the discourse of organizations such as ICES, UN Environment, and NOAA (Levin et al., 2014), interviewees declared being unfamiliar with the IEA concept. This finding highlights the need to discuss and harmonize all participants of the IEA in defining central concepts and ambitions at early stages of the process.

Although these individuals state being unfamiliar with IEA, their perception aligns with current descriptions of a participatory process by which fit-for-purpose research is delivered to decision making, mainly regarding marine resource management (Long et al., 2015). This view produces an expectation that science will deliver the necessary answers to a more sustainable ocean management in the Atlantic. The scientists we interviewed expressed concern over the inherent complexity of nature, which challenges science when presenting possible managerial paths. Government officials

who we assessed seek solutions from science to enhance sustainable economic development, despite the uncertainties that compose the scientific endeavor. Our results provide evidence of this clash in the expectations that these government officials and scientists have of the outcomes of IEAs.

## 4.2 Expectations of the IEA

In general, interviewees were skeptical about the capacity of IEA to deliver a silver bullet solution to design relevant actions towards marine sustainability. Government officials expressed concerns over IEAs being isolated from political ends, including economic development. Scientists seemed to be concerned about possible misinterpretations on the limits of IEAs by decision makers and wider society.

Although both government officials and scientists advocated for the adherence of IEA to broader societal benefit, they seem to conceptualize this societal benefit differently. To the scientists we interviewed, this benefit would be a better protected marine environment. To officials, social benefit would come from the economic, yet sustainable, exploitation of marine resources. Both perceptions are complementary in an IEA process, but our results reinforce the importance of harmonizing concepts, goals and expectations from all actors involved.

## 4.3 The meaning given to IEA

To our interviewees, IEAs tend to be seen more as Integrated Assessments of Human Threats. Consequently, interviewees reflected a utilitarian view of the ocean, whereby humans act as engineers of nature, with the power to both disturb and manage it. This finding aligns with the ideas of human dominance and ownership over nature, with a resulting responsibility over our actions (Ludwig et al., 2021). The improved understanding of the natural events of the marine environment, events which are independent of humans, come as a second goal, as a means to identify a feasible level of human exploitation of the marine environment. According to this perspective, the IEA process would prioritize the assessment of ecosystem components linked to the provision of services to humans.

Throughout the interviews, these individuals have challenged presupposed concepts, such as “ecosystem”, claiming these to bear distinct meanings to different stakeholders. To the interviewed government officials, IEA seeks to find sustainable, but also profitable ways of leveraging ecosystem services for societal benefit. In this case, ecosystems are manageable. To scientists, what is manageable is human activity, not ecosystems and their services. Thus, these conflicting perceptions will probably impact communication throughout the IEA process when bridging communities that have different understandings of ecosystems and IEA. There is a need to make sure that all participants engaged in an IEA have a common understanding of the adopted IEA concepts and what is reasonable to achieve from the process.

## 4.4 The importance of the scoping phase

As our interviews have indicated, combining government officials and scientists is not a usual, easy task. Both communities value IEAs differently and communication needs to be secured in order to properly address each groups’ concerns. For this dialogue to occur, all relevant stakeholders need to be engaged and participating in the IEA process, otherwise the whole IEA process runs the risk of resulting in an exclusively academic activity. In the IEA process (Figure 1), the scoping phase is a determinant step to properly identify and engage the most relevant actors. In this phase, participants engage in negotiations about the scope, the target, the scale and all necessary steps to be done in an IEA. Similar to most negotiations, stakeholders’ interests and expectations can clash and create conflicts that can put in risk the whole IEA process (Furnham and Boo, 2011). It is therefore essential to identify these conflicts and make sure that relevant evidence is generated by the IEA and expectations are equally shared amongst those involved.

Best practices for cross disciplinary stakeholder inclusion (e.g., Ostrom, 2014; Land et al., 2017; Oates and Dodds, 2017) should be applied during the scoping phase of the IEA process. Although these best practices for stakeholder inclusion are well established (e.g. Ostrom, 2014) there is always the risk of lacking inclusivity in the scoping phase of IEA. Thus, extensive surveys in search for the relevant stakeholders should be common practice in all IEA.

The scoping phase of the IEA needs thus to be a safe, open and committed space by which the inherent limits of the proposed assessment are disclaimed and dealt with, transparently. We advocate that neutral, professional mediators should be involved in the scoping phase of any IEA, using exercises for enhanced trust-building and dialogue, so participants would feel safe in sharing perspectives.

## 4.5 Transdisciplinarity as a basic principle for IEA

Many interviewees highlighted the importance of transdisciplinary science (as described in Jahn et al., 2012) to the success of IEAs. Many transdisciplinary research efforts fail to secure the sufficiently balanced participation from the various disciplines and stakeholders (Kelly et al., 2019). This weakens the potential for research to address the social, environmental and economic aspects of sustainability challenges that must be dealt with by IEAs. In addition, navigating transdisciplinarity across scientific disciplines is not enough, as stated by some interviewees. In their view, integration in IEA should embed all available knowledge sources, including the outcomes of international reports such as the Sustainable Development Goals and the World Ocean Assessment (United Nations, 2021). Transdisciplinarity in IEA should not be constructed as an exclusive endeavor of scientists and government officials, but rather welcome other ways of knowing. Such inclusivity is supported by scholarship (e.g., Wisz et al., 2020; Fischer et al., 2022).



## 4.6 What “Integrated” means in the IEA

This feature was highlighted several times, in particular among the interviewed government officials. In these official’s perspectives, IEA should go beyond integrating knowledge of the marine environment. To them, IEAs would be one component of a much broader system that includes production, distribution and other economic value chains of marine resources. Such a “system of systems” would enhance economic profit at the lowest environmental cost. According to this perspective, IEAs should provide sufficient information about the environmental components affecting resource exploitation, so this information could be integrated to other assessments, such as those more economically-oriented. Following this line of reason, IEAs would serve the market, that is, contradictory to the view that IEA findings are intended to lead the market to adapt to ocean thresholds (Rockström et al., 2009). Therefore, among the Atlantic stakeholders we interviewed, IEA may be perceived as tool for finding solutions that maximize economic profit, while minimizing loss to environmental health. The question remains on how to define which level of environmental loss would be acceptable, or how to refrain economic activities to allow ecosystem recovery in the IEA process (Martin et al., 2016; UNEP, 2021).

## 4.7 International IEAs and ocean science diplomacy

Marine ecosystems often transcend legal jurisdictions. Countries that share these ecosystems often have distinct regulatory and social-cultural systems, which can possibly result in conflicting interest when negotiating transboundary marine IEAs. This international complexity involves integrating the interests of the private sector, of social actors and other stakeholders that can trigger conflicts with impacts to the IEA process.

We find the framework provided by science diplomacy to be relevant to discuss international and transboundary IEAs. Transboundary marine IEAs, such as those conducted under the Mission Atlantic project, are complex due to the potential for conflict between different national interests at play, generally dealt with by diplomacy. Diplomatic environmental negotiations are highly supported by scientific findings as science provides information on the state of the marine environment, on the human threats and on options to manage such threats (Holford and Nichols, 2017).

As suggested by interviewees, IEAs should be integrated with other marine management frameworks, such as area-based management initiatives like Marine Spatial Planning and coastal zoning. The IEA process holds similarities with these area-based management tools, particularly regarding participation and collective decision-making. Power struggles have been reported to be critical to marine spatial planning (Ramírez-Monsalve and van Tatenhove, 2020). Therefore, one could expect a similar context in an IEA where acknowledging and managing power conflicts

become paramount, particularly in transboundary IEAs, where science diplomacy is in action.

Ocean science diplomacy (Polejack, 2021) can provide a framework to study the multi-actor dynamics of those engaged in international IEAs. It provides a new perspective on studying the power play underlying the negotiations of international IEAs. Through ocean science diplomacy, regulatory frameworks, such as international legal regimes or States’ practices, can be better addressed in an IEA. Apart from producing the relevant scientific evidence in an IEA, there is also the issue of communicating this evidence so it impacts the policy formulation. Once again, ocean science diplomacy adheres to the objectives of transboundary IEAs by combining elements of international relations scholarship with political sciences and science and technology studies. Lastly, international IEAs could be enhanced by including the training and expertise of diplomats, in particular negotiation and mediation techniques, which also falls into the scope of ocean science diplomacy.

## 5 Conclusions

This paper analyzes the perceptions of government officials and scientists on the meaning of Integrated Ecosystem Assessments (IEA) in the context of the All-Atlantic Ocean Research Alliance. Most of the interviewees stated not having had previous experience with IEAs, and being generally unaware of IEAs concepts and process. However, this lack of understanding of IEA was no obstacle for them to elaborate on what IEA is and how it should proceed. According to their perceptions, the main goal of IEA is to co-produce knowledge about the management of human threats to the marine environment. In such a case, humans are perceived as separate from the marine environment, with the power to both disturb and manage it. The scientists and government officials we interviewed had distinct views of IEAs. Scientists reflected on the complexities of assessing integrated ecosystems and rarely placed economic benefit as a priority. Officials perceived IEA as the environmental component of a broader system that aimed to maximize economic profit while minimizing environmental risk. We question who can determine what an acceptable level of environmental risk would be in the Atlantic context. From our research, we can make the following recommendations, in particular for transboundary marine IEAs. We advocate that the scoping phase of an IEA is of critical importance. It is during the scoping phase that stakeholders are identified and engaged. With their involvement, there is a need to make their interests visible and respected. During the scoping phase, a safe and open space needs to be secured, so these interests can be negotiated and mutual understanding on concepts, roles in the process and the possible outcomes are achieved. We acknowledge the limitations of this study, particularly regarding the profile of our interviewees. Nonetheless, the government officials and scientists we interviewed showed preconceived assumptions of the IEA process that highlight the importance of communicating and agreeing upon IEA concepts between all participants as a top priority.

## Data availability statement

The datasets presented in this article are not readily available because of the necessary protection of participants' anonymity. Requests to access the datasets should be directed to AP, [andrei.polejack@gmail.com](mailto:andrei.polejack@gmail.com), to be assessed and evaluated.

## Ethics statement

The studies involving human participants were reviewed and approved by WMU Research Ethics Committee World Maritime University. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

Conception: AP. Design: all authors. Data collection, analysis, and first draft: AP. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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