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The human-ocean-relationship and responsible ocean literacy

Final WP3 report on the interdependencies between marine communication and information channels, ocean narratives, and knowledge reception of relevant societal stakeholders.

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The human-ocean-relationship and responsible ocean literacy

WP3 Deliverable 3.5

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Introduction

In this report, we present the summarized approach, results and conclusions of work package 3 of H2020 ResponSEAble.

On one hand, the work package plays a substantial part in the analytical concept of the project by examining the existing channels for ocean literacy, the sender and receiver of communications, their main messages, as well as their perception. It is thus closely linked to work package 1 and 2. WP 1 carries the task of gathering existing knowledge into 6 selected key stories on the human-ocean relationship and arranging them according to the requirements of the project, that is to increase ocean literacy in Europe and to support a behavior change of societal actors. WP 2 examines the societal and economic shares of the human-ocean relationship and identifies efficient approaches within the social and economic system, that can be utilized for a positive change.

On the other hand, WP3 is an essential bridge between the analytical part of the project and the development of innovative and cost-effective ocean tools, which are aiming at a substantial contribution to the increase of ocean literacy in Europe and thus a change in behavior. The work package fulfills this task by recording the current situation, developing an analytical framework for the assessment of narratives and messages, as well as describing conceptual and content gaps in the current knowledge system on the human ocean relationship.

This report includes a general description of the human-ocean relationship that seems necessary to clarify which knowledge components should ultimately fall into the conceptual framework of ocean literacy. In this chapter, also the question of the relationship between knowledge and emotional qualities is addressed.

From here, the report moves on to the description of so-called ocean narratives or narrative figures, which include the essential messages on the human-ocean relationship. Ocean narratives are an original concept of the work package that results from the overlap of the DAPSI(W)R framework of WP1 and the study of narrative marine-related communication and ocean literacy resources in WP3. They are an innovative instrument to assess the modes of communication between different societal actor groups.

This communication is addressed with the concept of information flow between senders and receivers of information, that support the identification of the overall discourse between a broad variety of groups of actors.

Conclusions of the analytical work are presented as an intersection of content of communication in the form of narrative figures, information flows and communicative functions between different

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groups. These conclusions are then applied to the six key stories of the project, so that the discussion can be taken further in the following work package 5.

This report also serves as a contribution to the development of a European translation of ocean literacy, that must be targeted to current societal challenges and support a societal change of behavior rather than just increase an understanding of scientific approaches to the ocean. Therefore, the report ends with a proposal for the development of an extended concept of **responsible ocean literacy.**

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What is the human-ocean relationship?

With its efforts to increase ocean literacy, ResponSEAble aims at an extension of the concept towards a literacy on the whole human-ocean relationship, instead of a scientific literacy on marine environmental conditions.

The human-ocean relationship in the sense of ResponSEAble is defined by a common framework, that describes it as the causality of human needs and activities, the marine environment in itself, the marine environment as a resource for human activities, and reflections on as well as transformations of these activities.

Human activities aim at the production of goods or services for the human society. In many cases, they rely on natural resources, i.e. resources that are not themselves products of human activities but rather natural processes or their products. These activities are driven by forces ranging from human needs to economic and technical developments.

The marine environment in itself can be described as the state of interrelated chemical, physical and biological components. These components are constantly changing in number, composition and distribution. Regarding their ecological function, they are in a dynamic equilibrium, if the change in the single components of the state does not exceed a certain threshold.

If the components of the environmental state cannot compensate for the pressure applied, the overall state changes. The change takes place either in the component of the environmental state to which the pressure is applied, or it transfers it to another component. By transferring these changes throughout the ecological nexus, the overall ecological state can be **impacted**.

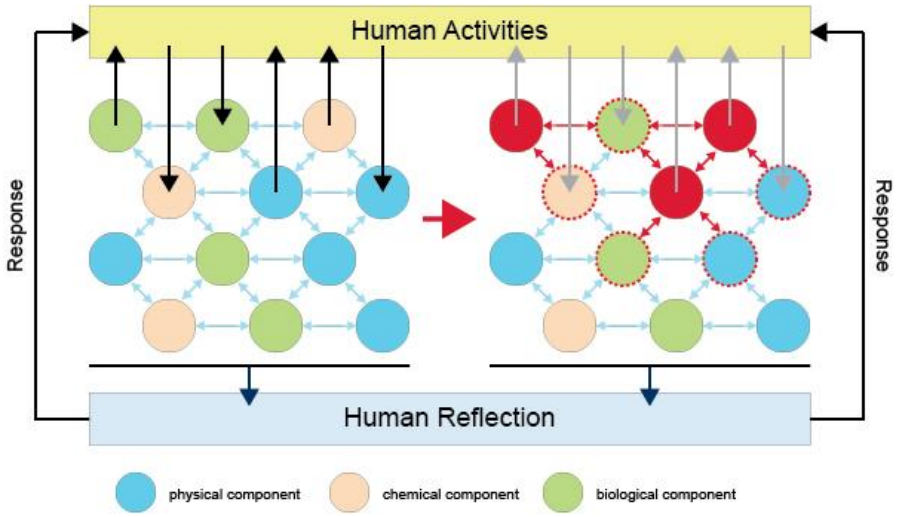

Figure 1: The simplified relationship between human activities, the marine ecosystem, and human reflections. Human activities exert pressure on components of the ecosystem. If the ecosystem cannot compensate changes in some of the components, the overall state changes. Human reflection focuses on the unaffected ecosystem as well as the affected. Responses are based on reflection.

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In addition to the description of the self-sustaining qualities of the ecosystem components, the marine environment and its processes can also be described as a **(re-)source for human welfare.** It is a source for nutrition, wealth, and cultural values.

Any reflection of the causality between **driving forces**, **activities**, exerted **pressures**, **impacts** and **welfare** aspects is also a part of the human-ocean relationship described above. This is true for any kind of **responses** to ecological problems that arise from human activities, solution-oriented and fundamental research, as well as reflections of the ocean or human-ocean related challenges in arts.

The human-ocean relationship is not a one-sided relationship that only harms the ocean and benefits people. It is a movement between complex human needs and a complex environment, which ultimately affects both. From a human perspective, it has a material as well as immaterial aspect, both in its use and in its reflection.

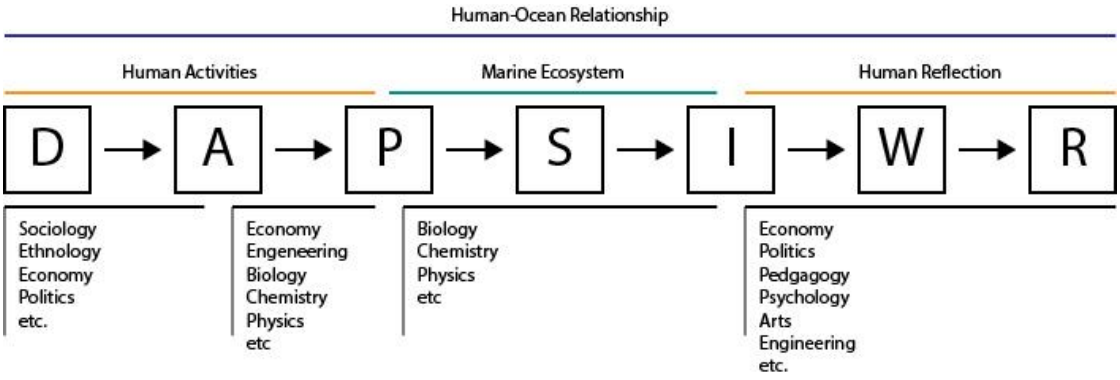

Figure 2: The simplified human-ocean relationship described as the DAPSI(W)R causality and examples of related disciplines. (For a detailed explanation of the DAPSI(W)R-framework see deliverable D3.1)

What kind of knowledge is available on the human-ocean-relationship?

As we have shown above, the human-ocean relationship expands the focus of ocean literacy from ecological connections within the sea and to other environmental areas towards the areas of human activity and economy as well as the reflection of human influences. Therefore, also the understanding of knowledge on the human-ocean relationship must be expanded from ecological knowledge. It includes knowledge from a broad variety of disciplines.

It is obvious, that **environmental knowledge** is needed to understand the inherent dynamics of the marine environment. As per the descriptions above, this includes knowledge on biological, chemical and physical components of the marine ecosystem. Environmental Knowledge is one of

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the bases of the whole ocean literacy approach, as it increases the understanding of the marine environment as something that is distinct from the human society and thereby potentially in itself valuable.

The second basis of the human-ocean relationship lies with **economic knowledge**. Knowledge on the relevant parts and processes of the economy play a major role in this aspect. In the same area of the human-ocean relationship, technical knowledge is a major component for a comprehensive ocean literacy. With our common understanding of the importance of sustainability also environmental knowledge has its part in this place. Often, traditional knowledge is mentioned as a source of inspiration for more sustainable techniques for the use of natural resources. Since we describe activities as being driven social, political, economic, and technical forces, also the respective disciplines take a role in the understanding of the human-ocean relationship.

On the other hand, the relationship between people and the ocean is characterized by reflection. This includes both the reflection of one's own influence and the reflection of nature itself in the form of different cultural manifestations. The one is mainly characterized by environmental knowledge that has already been included in this list above. The other is characterized by **arts**, even if they are usually not understood as a form of knowledge. They are however a fundamental form of reflection in the human society that should not be missed.

Finally, the circle of the relationship between people and the ocean closes on the various forms of concrete responses to threatened ecological components and welfare aspects. Knowledge in the realm of responses included **political** and **regulative knowledge** as well as some forms of knowledge mentioned already above, including environmental, technical and economic knowledge.

On the interdependencies of knowledge and emotion

In numerous project meetings and seminars, it was emphasized that beyond knowledge, also a feeling for the ocean and the marine environment is of great importance to create a change in behavior. For the sake of the argument we want to add that emotional qualities serve as a motor for a shift in behavior, not as clear guidelines for the new behavior. Behavior itself should always be guided by some sort of understanding, although the substance and complexity of that understanding can still be the object of debate.

The notion that emotional qualities, play a vital role in the shift in behavior, points to the fact that nature itself or aspects of the human condition (including health aspects, technology, etc.) must be part of the content of the information. In the terms of the framework used to capture the knowledge components and the content of corresponding knowledge resources, this means that the inclusion of either the **ecological state, activity, or welfare** is of importance to resonate with the feelings of people.

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Knowledge of the complexity of the ecological interrelations, or knowledge of one's own ignorance of the complex interconnections, perhaps also the desire for an understanding, can lead to a feeling of a sublime nature beyond one's own existence as a human. In contrast to this, feelings of shame and anger are created through the recognition of the inadequacy of many human activities in nature, their long-term **impacts**, and ultimately also the potential unconscious self-destruction in terms of the human dependence on natural resources. In both cases, an awareness of the complexity of the natural system is the base on which these feelings are built on.

Without describing the interrelationships of ecological components to each other, e.g. the ecosystem in itself, ecological components can only be described as natural resources for the human society. This ultimately refers to the legitimate description of human **welfare** based on ecosystem services. The mere reference to health aspects for example shortens the relation described above by deleting forms of "something else", something non-human, from the equation. Emotionally, the resulting equation generates confidence, distrust, or fear, from the consequences of one's own behavior for oneself without directly addressing consequences for nature. Still, these emotional qualities can also serve as a motor for a change in behavior.

Addressing human **pressure** exerting **activities** and the underlying **driving forces** also belongs to this area. Confidence in one's own actions in nature is based on the continuous verification of the appropriateness of this action and the reflection of underlying driving forces. Confidence is therefore a feeling that is very much based on knowledge if it is not supposed to be imagined.

Image 1: The Little Mermaid by Jeff Hong[1]. The New York-based animation artist Jeff Hong has warped Walt Disney's motto "where dreams come true." The illustrator has imagined some of the Disney's most popular characters battling the currently grim conditions we are all facing of climate change and pollution. Thus, we see mermaid Ariel emerge from a filthy sea.

[1] http://eluxemagazine.com/magazine/eco-friendly-artists/

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In contrast, it is evident that narratives that completely leave out aspects of both the ecological state and aspects of human benefit, can only built a behavior change on the individual will to comply with social requirements. If this will is not present, these narratives can only cause rejection.

As mentioned above, emotional qualities are often used as a motor for behavioral change. On the basis of emotions, it can happen that a person is trying to abandon their old behavior in favor of a new one. But to establish a new behavior, reflection on the negative aspects of the old is unavoidable. In addition, there is a need for concrete possibilities on which a new behavior can be built. If these **responses** are available, they must be communicated and understood. Any change in behavior is thus not only dependent on the will, which may be supported by emotions. A concrete change in behavior is even more dependent on the knowledge about alternative possibilities.

All of the above is not meant to say that feelings cannot be generated or supported without relevant knowledge and facts. Many examples of populist approaches to pressing societal challenges oppose this notion. All of the above is instead meant to emphasize that knowledge and emotional qualities are not necessarily distinct. As a European ocean literacy project, ResponSEAble should serve as an example to support this notion.

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Image 2: The Fisherman and his wife, An Interdisciplinary interpretation of the Baltic sea[2]. The play describes the struggle to maintain a livelihood as a fisherman in the Baltic Sea. Stockholm Resilience Centre provided scientific background material for it.

The knowledge system: How is knowledge communicated?

Narrative figures

As explained, ResponSEAble uses a common framework (DAPSI(W)R) to classify existing and communicated knowledge. In terms of the classification of knowledge the application of the framework helps to structure existing knowledge and helps to identify knowledge gaps. In terms of analyzing ocean literacy resources and communications the framework is useful in translating communicated knowledge into **key messages**.

Depending on how the components of this framework can be recognized in communicated knowledge of ocean literacy resources, different configurations of these components, or **narrative figures** are identified. Different narrative figures potentially lead to different effects in the mind of the receiver of information. To explain this thought, a short revision of the knowledge components of the DAPSI(W)R framework and their possible combinations is helpful.

If formulated as a message, the overall rationale of the DAPSI(W)R framework would read like this: *"Specific forces drive our activities, which in turn exert known pressures that target specific components of the ecosystem and change its overall state. By this, also the source of our welfare is affected. After reflection, we respond accordingly."*

The following picture assigns this message to the individual components:

[2] https://thegreenartsnetwork.wordpress.com/2016/04/07/an-interdisciplinary-interpretation-of-the-baltic-sea/

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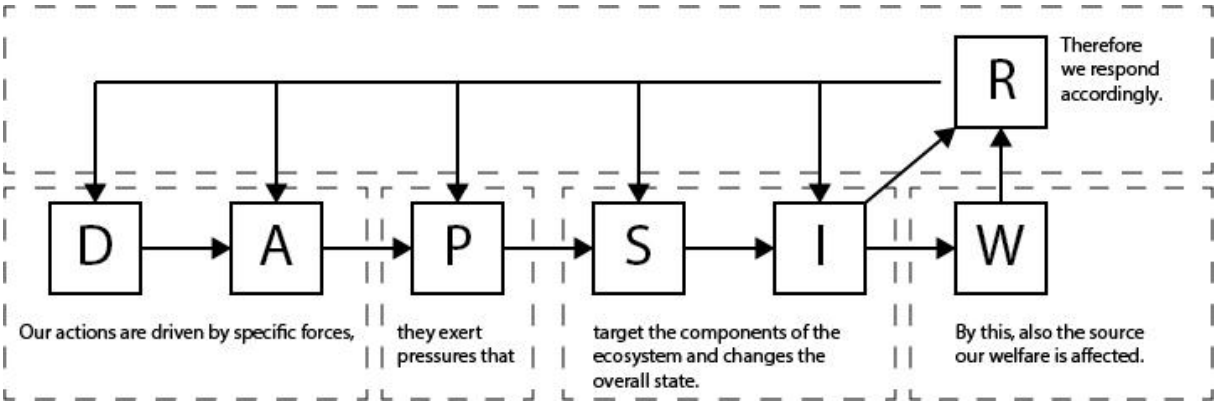

Figure 3: The narrative figure of the overall DAPSI(W)R-Rationale.

It should be noted here that only the Activity and State / State-Change components can be understood on their own, as all other knowledge components are only meaningful in a relation to others, ultimately to Activities or State / State-Change.

However, the full rationale of the framework is never found in resources for information about the ocean. Not even just logical fragments, but disconnected components of them are used in actual resources. They are build up from the individual framework components. If translated into messages, these individual components of the framework would read like this:

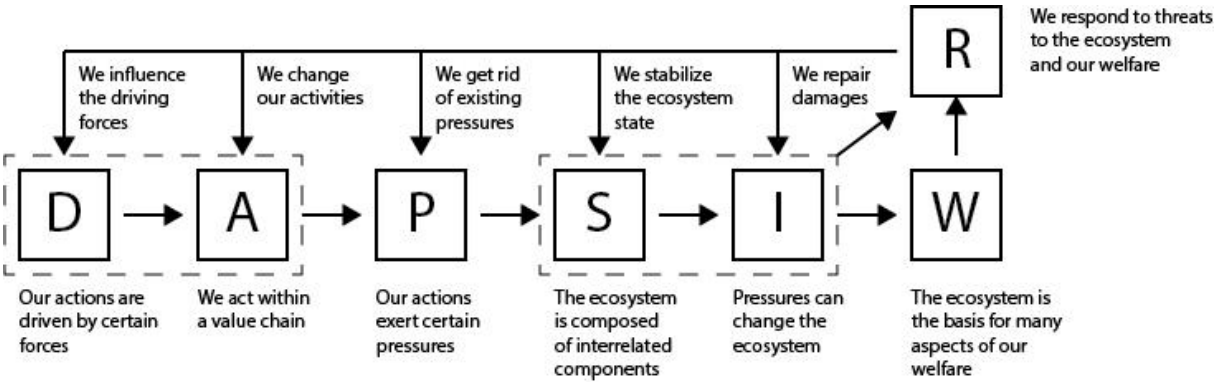

Figure 4: Individual DAPSI(W)R components translated into messages of ocean literacy resources.

It should be noted that the response component varies in terms of messages depending on the component it targets.

Derivative narrative figures and their key messages

In the following part, we describe some narrative figures that do not necessarily follow the inner logic of the framework, but can be found in actual information resources. We also assign key

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messages that can be drawn from these narrative figures based on the individual messages shown above.

1. WE ARE TO BLAME FOR THE DEGRADATION OF THE ECOSYSTEM

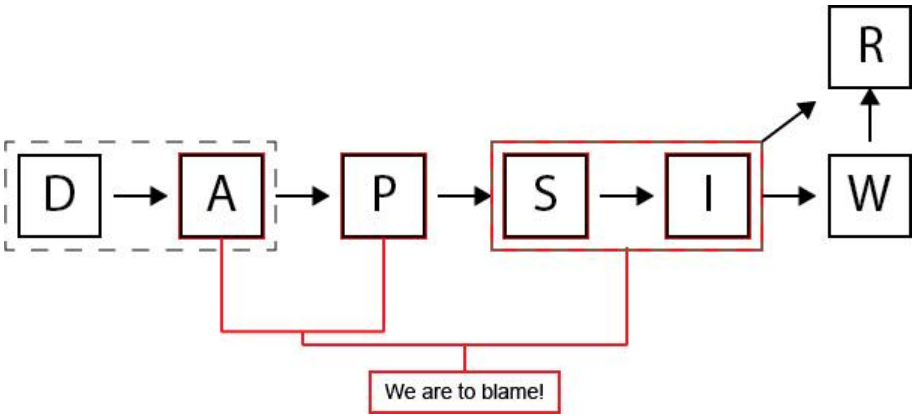

Figure 5: The narrative figure "we are to blame for the degradation of the ecosystem".

This narrative figure highlights certain environmental impacts in the ecosystem as well as pressures and pressure exerting activities. It stays within the logic of the framework. Still, driving forces behind activities are not emphasized, therefore these activities appear arbitrary. Also, this narrative figure does not provide actual or potential responses to the problem. It purely raises awareness for the issue, without contextual explanations or potential responses. By this it stays in the realm of morals, pointing towards certain activities or actors that harm nature, not necessarily us.

A real-life example of this narrative figure comes from the ballast water case.

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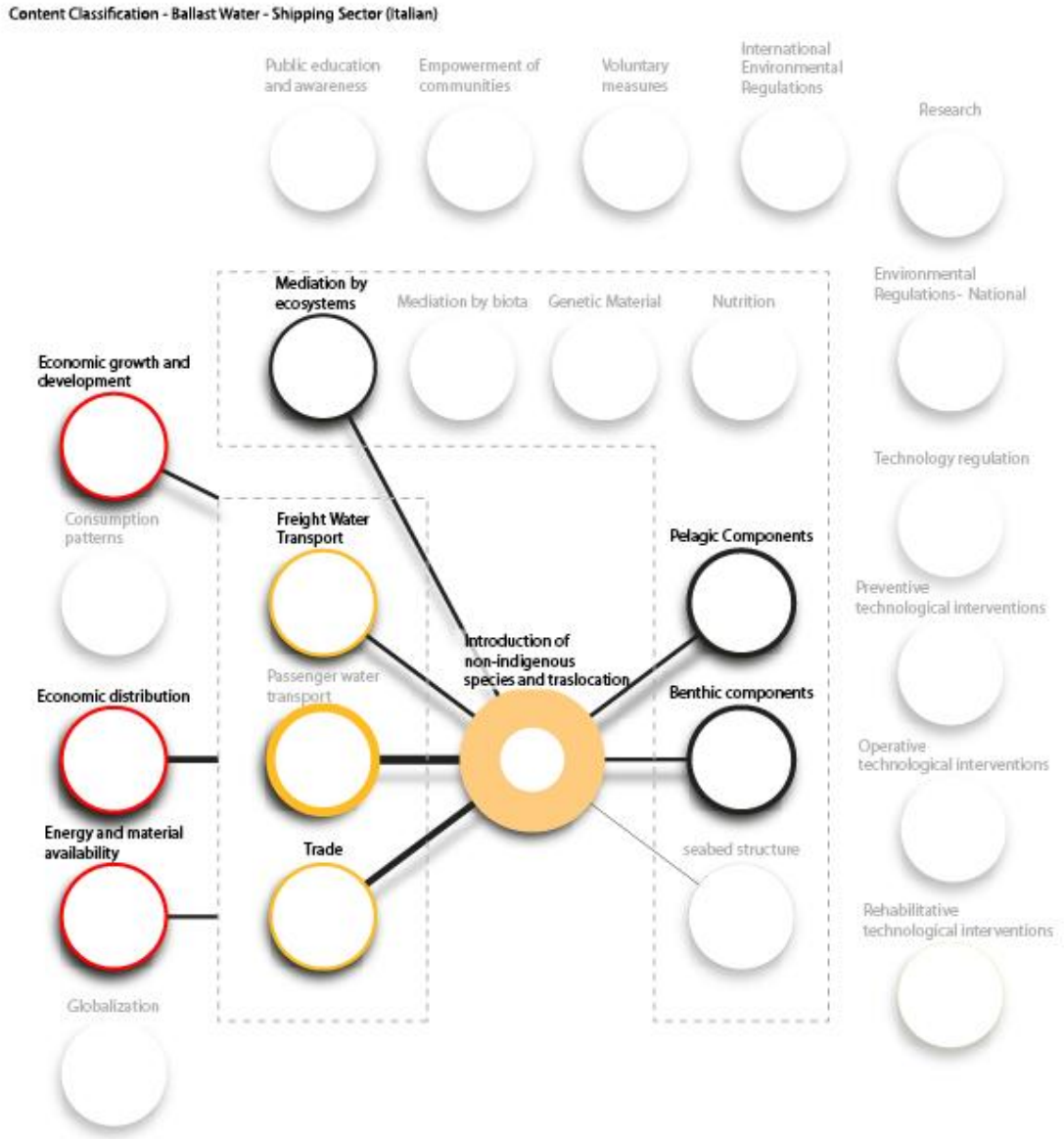

Figure 6: Real-life example of the narrative figure "we are to blame […]" from the ballast water case in Italy.

Summed up communications in Italy show that emphasis is given on the relation between activities, pressures and the ecological state. In this example, some ecosystem services are mentioned (mediation by ecosystems), as well as driving forces behind the activities. The basic message still stays the same though: We are hurting the ecosystem! Appropriate responses are not given, although in the case of ballast water they are actually available, especially for the shipping sector.

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2. WE ARE AFFECTED BY CERTAIN PRESSURE EXERTING ACTIVITIES

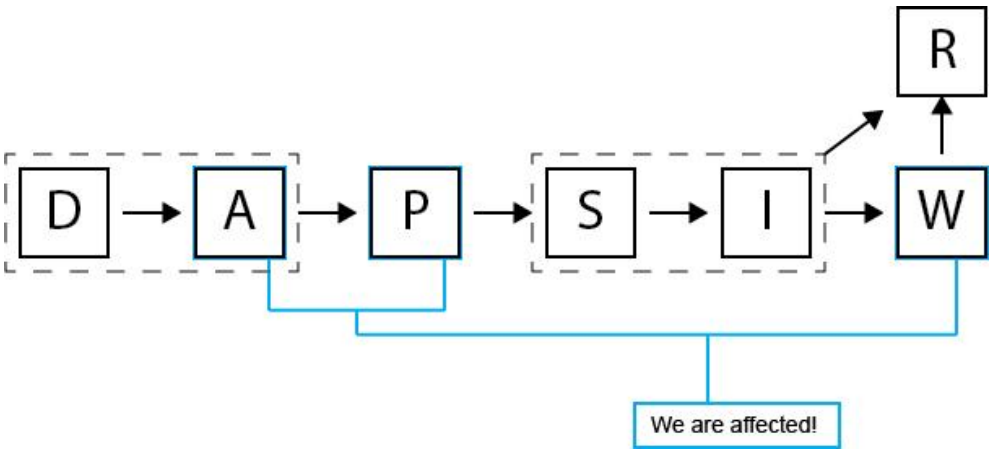

Figure 7: The narrative figure "we are affected by pressure exerting activities".

Although welfare aspects are highly related to the concept of ecosystem services one can find information on marine problems that lack a reference to ecologic relations. This narrative figure, focusing on activities, pressures and welfare aspects, leaves out driving forces, the relations between ecosystem components as well as potential responses. Like the above narrative figure, this one also raises awareness for a problem, without contextual explanations or potential responses. In this case, though, it lacks an explanation for the relation of the ecosystem and welfare aspects. In contrast to the narrative figure above, it accuses certain activities or actors of harming welfare.

A real-life example comes from the micro-plastic and cosmetics case (see fig. 8). Although, summed up visualizations of the content of communication on microplastic are more complex, the image above is a common representation of how the issue is tackled. The example comes from a single German information resource, that lacks any kind of information on the environmental effects of microplastic as well as societal responses. It mainly conveys the message, that microplastic is digested by animals that in turn get eaten by humans. Thereby, the release of microplastic is only as a threat to human health.

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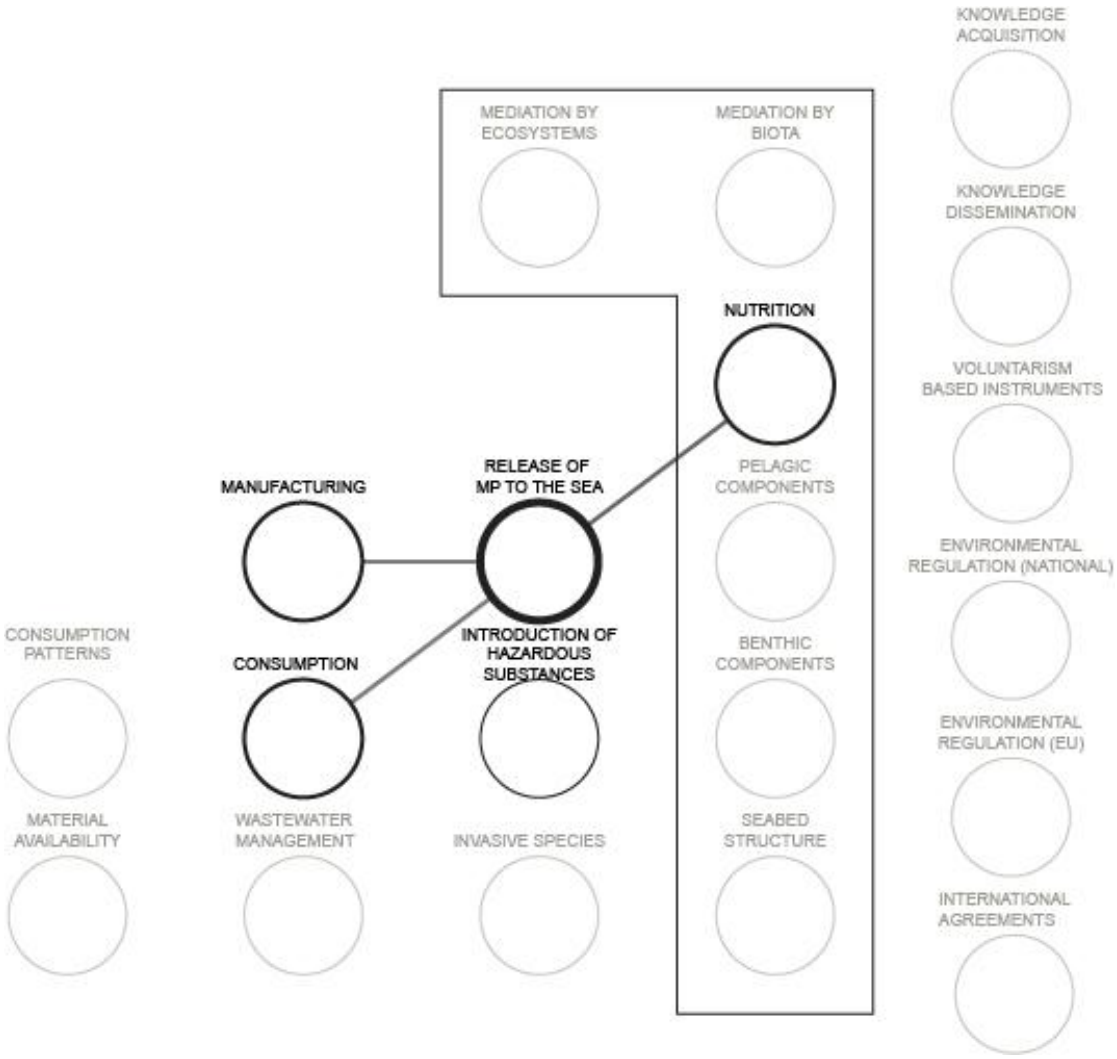

Figure 8: Real-life example of the narrative figure " we are affected by pressure exerting activities " from the microplastic case in Germany.

3. WE CREATE PROBLEMS IN THE ECOSYSTEM THAT AFFECT US

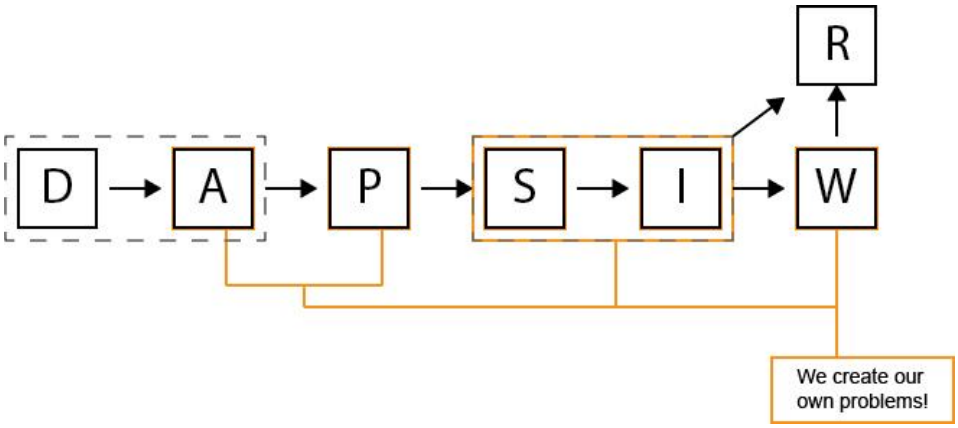

Figure 9: The narrative figure "we create problems in the ecosystem that affect us".

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The most mature narrative in this series includes both an ecological reference and welfare aspects. It stays in the logic of the framework. This narrative figure connects the relationship from activities up to welfare aspects without breaking the causality. As it still lacks a description of actual or potential responses to the problem, as well as the driving forces behind the activities, it stays in the realm of awareness raising, even though concrete responses could be available.

A real-life example of this narrative is given by the analysis of French communications on fisheries directed at retailers. This group of economic actors has its place within the value chain of fishing and fish consumption downstream of the pressure exerting group, the fishermen.

Figure 10: Real-life example of the narrative figure " we create problems in the ecosystem that affect us" from the "sustainable fisheries" case in France.

As can be seen, the sum of all analyzed communications does not mention driving forces behind the activity of fishing nor any potential or actual responses. Also, ecological interdependencies are left out. The message of this is, that the selective extraction of species

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by fisheries creates problems for fish populations and ultimately for the consumption of them. Problems are therefore created not only for the environment but for welfare aspects too. Interestingly, the same narrative has been found targeting the same group in Portugal, too.

4. WE REFLECT ON THE HARM THAT HAS ALREADY BEEN DONE

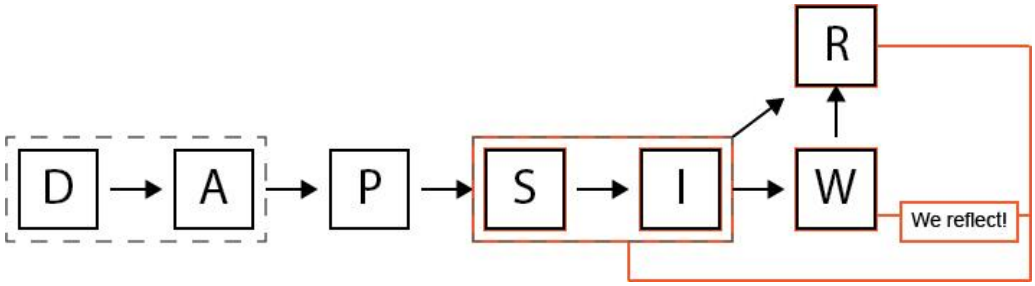

Figure 11: The narrative figure "we reflect harm on that has already been done".

With this figure, it does not matter if environmental impacts or welfare impacts are emphasized. More importantly, it leaves out the whole chain of human influence from driving forces to exerted pressure. It does, however, include potential responses to the problem. As the human influence is absent in the narrative, these responses are more or less impotent in terms of solving the problem. They have to focus on social and cognitive responses that demand for more information on the causes of reflected problems.

We find a similar example in resources from different key stories, i.e. from the ballast water case. Here, the resource speaks about ongoing investigations into the effect of invasive species present in the ecosystem. It includes content on environmental as well as welfare aspects. It does not include, however, information about pressure exerting activities, nor potential responses other than the research itself. Strictly speaking this resource is not a resource for knowledge on ballast water, as the activity plays no role in it. The message this resource conveys is that, there is a reflection on the degradation of the ecosystem ongoing.

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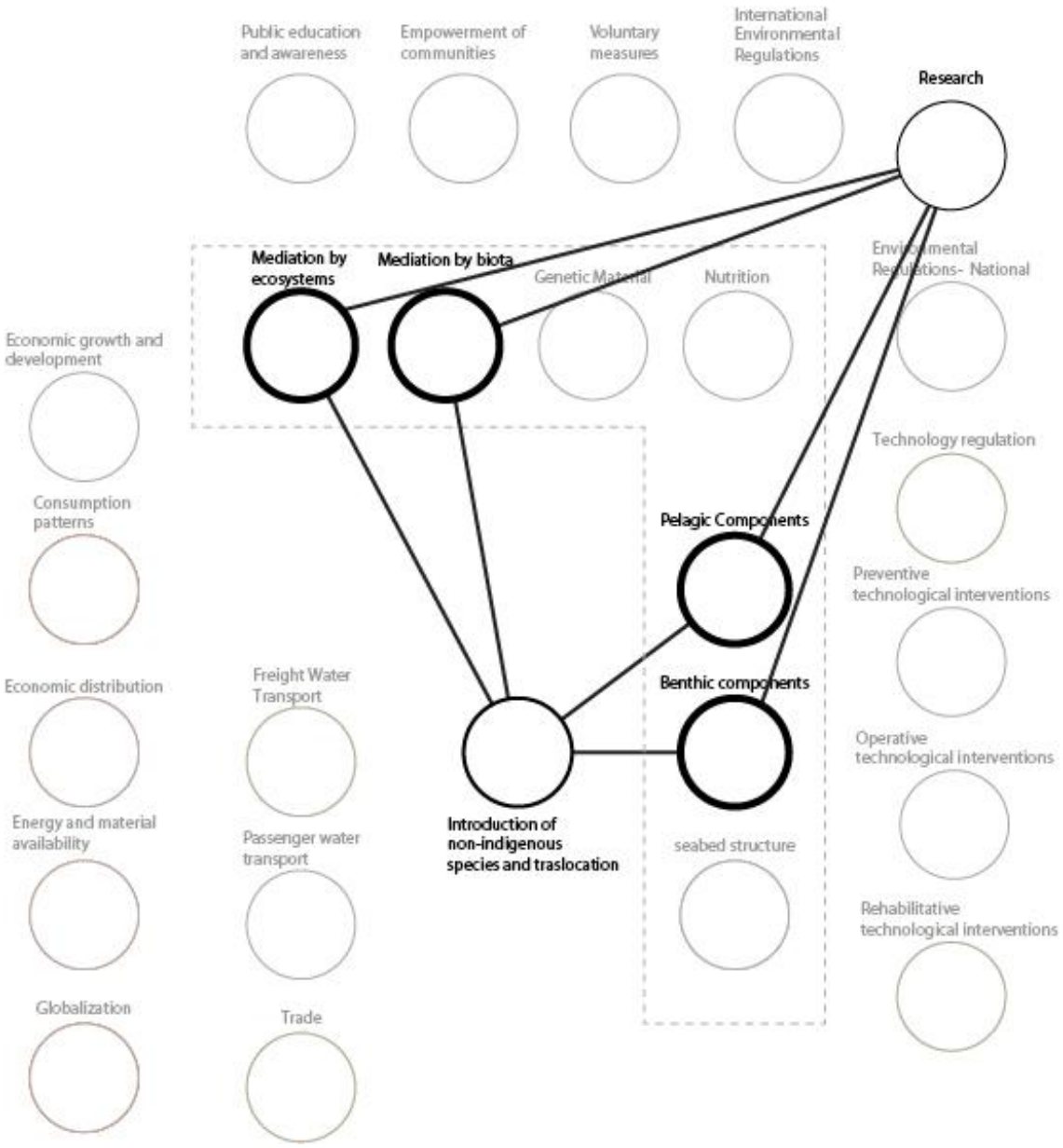

Figure 12: : Real-life example of the narrative figure "we reflect harm on that has already been done" from an internation resource on the ballast water case.

5. WE CARE ABOUT FOR HARM THAT HAS ALREADY BEEN DONE

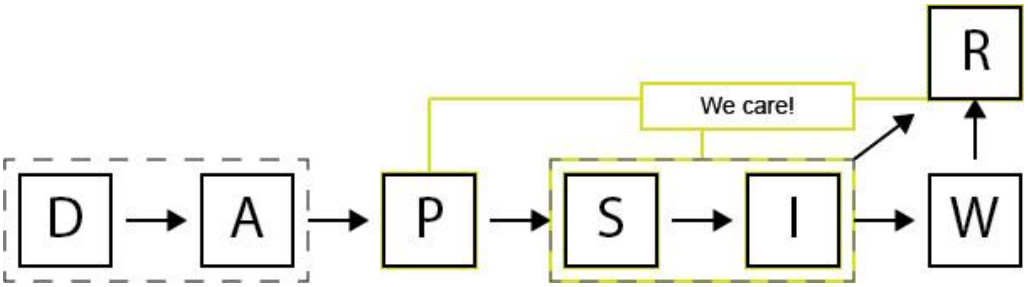

Figure 13: The narrative figure "we care for the damage that has already been done".

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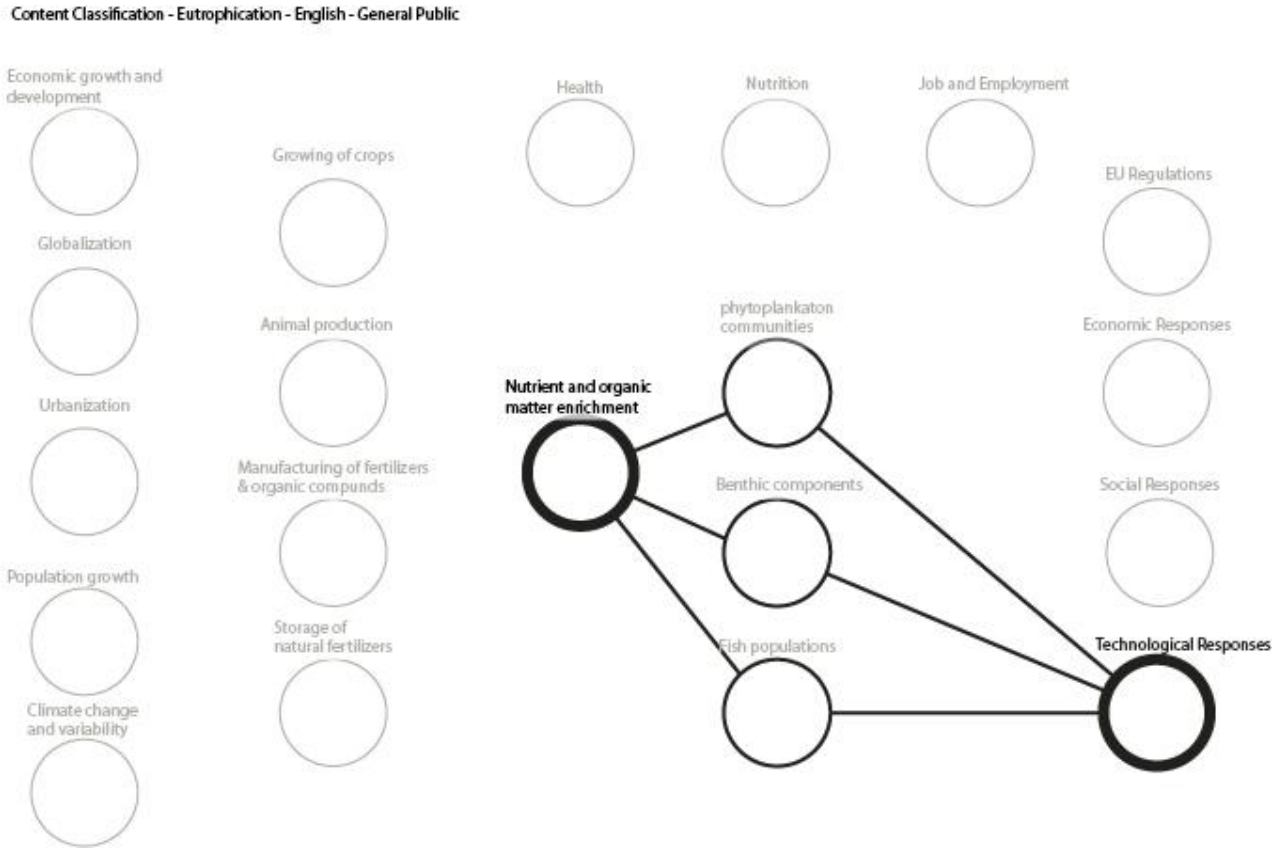
Like the one above (see fig. 10), this narrative figure focusses on responses to changes in the ecosystem, and pressures that cause these changes. It is also highly related to narrative figure 1 (“We are to blame”), as it focusses only on ecological relations without a reference to welfare aspects. Responses highlighted by this kind of narrative figure are meant to work actively to heal the ecosystem as a way of caring for nature without mentioning our own interest. Within this narrative, the causes for the degradation are absent. Therefore, this narrative does not include potential responses that prevent processes of degradation in the future.

This is exemplified in the following real-life communication:



In this single-source visualization no pressure exerting activities are mentioned. The resource simply reflects on eutrophication as a phenomenon, that threatens the marine environment in the Baltic Sea. To reduce this problem technological responses are mentioned that could help to clean the environment. As no activities behind the pressure are mentioned, the resource serves as a pure information on technological solutions to environmental challenges. No action is required by the society.

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6. WE CAN CONTROL PROBLEMATIC ACTIVITIES

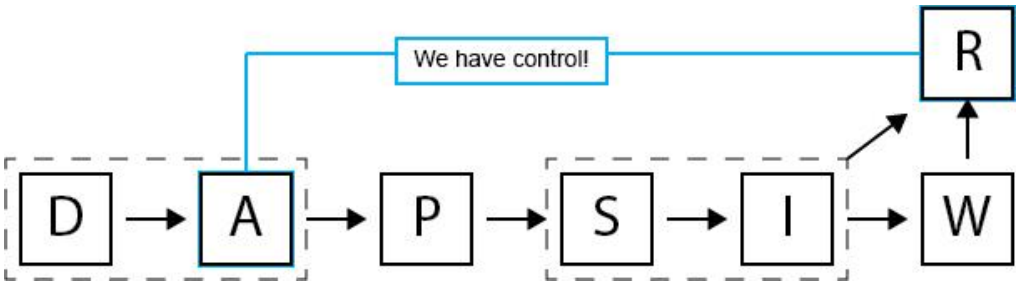

Figure 14: The narrative figure "we can control problematic activities".

In contrast to the above, this figure makes a connection between actual or potential responses and activities. By this, it points out, either the need for controlling these activities or the actual practice of doing so. Within this narrative, activities are not seen in a societal context as their driving forces are not mentioned. Even though this figure might be found in connection with descriptions or explanations of ecological interrelations or welfare aspects, it often lacks them. In its purest form the figure suggests control over activities that are problematic, without further explanations given.

This narrative figure is exemplified by the communications on eutrophication in Germany.

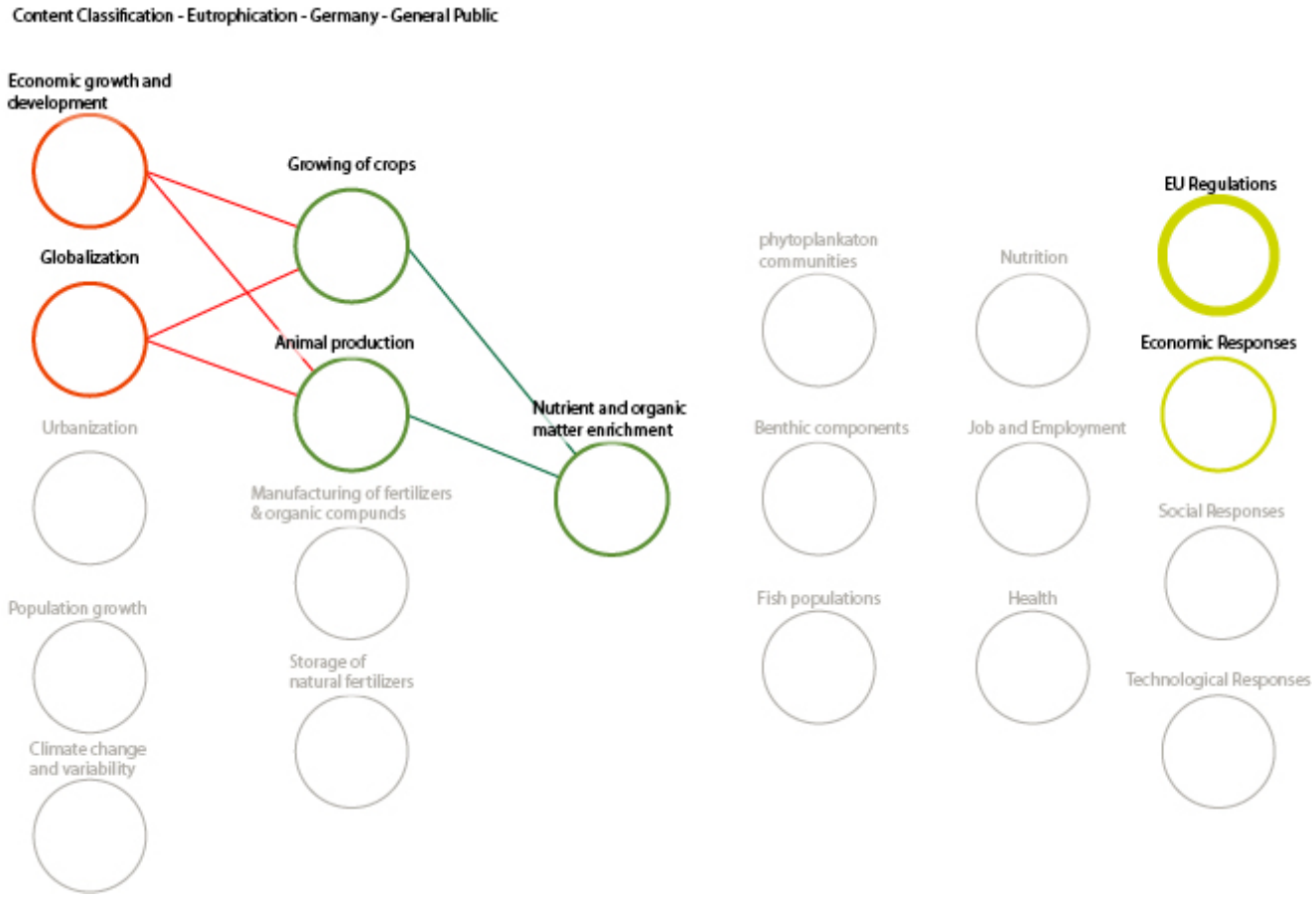

Figure 15: Real-life example of the narrative figure " we have control over problematic activities" from the "eutrophication" case in Germany.

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Although this example includes driving forces behind the problematic activities, it clearly leaves out all environmental and welfare aspects. It emphasizes eutrophication as a problem, but doesn't explain in which way it is a problem. Mentioned responses include European regulations and economic responses conveying the message that control of the problematic activities is given or a more fundamental change is needed. This example could also be read as the following narrative figure.

7. WE NEED A FUNDAMENTAL SOCIETAL CHANGE

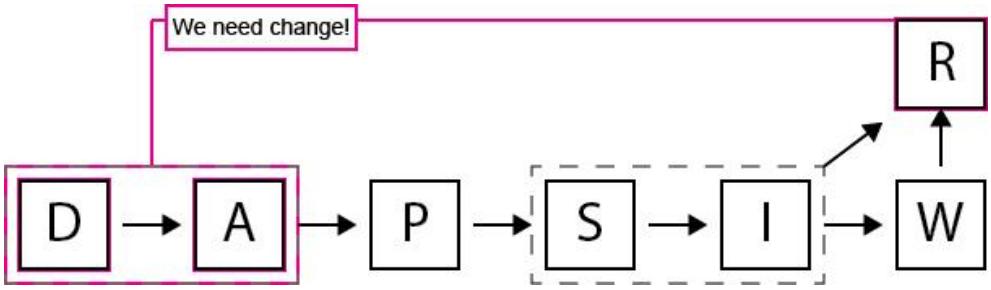

Figure 16: The narrative figure "we need a fundamental societal change".

By highlighting driving forces that steer problematic human activities, this narrative figure points towards a more fundamental change. Like the one above, this narrative might occur in connection with descriptions of ecological relations. But in contrast to figure 12, the responsibility is shifted towards more abstract driving forces that cannot be easily controlled.

No real-life example is available for this narrative figure, but it is clear, that there are narratives in existence that call for a change of consumption patterns regarding fish or energy, instead of trying to regulate or control the activities.

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Narrative figures and target groups

What was said in the last chapters, was not intended to portray one narrative figure as better or more effective than the other. There is not one approach to communicating marine issues that is better or more meaningful than the other, as long as the contents of the communication correspond to the truth. The description of the interdependencies of knowledge and emotion also showed that there is no complete separation between knowledge and emotional qualities in the communication of marine issues. Almost all possible forms of communication can be formulated in such a way that they also address emotions. It should be clear, though, that there are great differences when talking about emotional qualities in relation to the human-ocean-relationship, some for example correspond to fear, other to a sense of beauty.

However, not all narrative figures are useful to target a relevant group. Within the concept of ResponSEAble, the aim of ocean literacy is to enable people to change their behavior through understanding of their own responsibilities. Although we all share a common responsibility in our lives, different actors bear different responsibility for the ocean. Different actors should be targeted accordingly, i.e. in a way that helps them to understand their concrete responsibility and gain knowledge on potential ways to change their behavior.

This notion combines the description of emotional qualities that support the willingness to change and the knowledge how to change. In principle, this is also inherent in the narrative figures we have identified. Still the question remains, which narratives are the right ones to target a specific audience in relation to concrete responsibilities towards the ocean? The answer relies on three conditions:

1. Is the target group the same group that has to change its behavior and be more responsible and ocean literate to improve the human-ocean relationship? Or is the target group an intermediate group that needs to increase its ocean literacy to put pressure on the group that must change its concrete behavior?

2. What are the appropriate possible responses towards specific challenges facing the environment and human welfare, i.e. what is the right behavior change. Which component of the DAPSI(W) framework should it target?

3. Are the appropriate responses known to the target group?

These conditions form the basis for the following table in which the appropriate narrative figures are listed. When looking at the table, it should be considered that professional actors, social actors and regulatory actors are always also individuals. If the respective actors are aware of appropriate responses but do not implement them, different reasons must be considered. Messages to overcome potential ignorance of ecological interconnections are assigned to the individual actors.

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Table 1: Key messages assigned to the main categories of responses to ecological challenges and potential target groups.

		RESPONSES ARE NOT KNOWN		RESPONSES ARE KNOWN
		PRESSURES ARE EXERTED BY THE TARGET GROUP	PRESSURES ARE EXERTED BY ANOTHER GROUP	PRESSURES ARE EXERTED BY THE TARGET GROUP OR BY ANOTHER GROUP
REMOVE PRESSURES / STABILIZE THE STATE / REPAIR IMPACTS	INDIVIDUAL ACTORS	I can help to repair damages in the marine ecosystem. I can help to stabilize the marine ecosystem. I can help to remove pressures from the marine ecosystem.		The marine ecosystem is composed of interrelated components. Pressures can change the marine ecosystem. The marine ecosystem is the basis for many aspects of our welfare. **Question: What are individual 'costs' for the restoration of the marine ecosystem. What are individual benefits?**
	SOCIAL ACTORS		We can repair damages in the marine ecosystem together. We can stabilize the marine ecosystem together. We can remove pressures from the marine ecosystem.	The marine ecosystem is composed of interrelated components. Pressures can change the marine ecosystem. The marine ecosystem is the basis for many aspects of our welfare. **Question: What are 'costs' for the individuals and the society for restoration of the marine ecosystem. What are benefits?**

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		RESPONSES ARE NOT KNOWN		RESPONSES ARE KNOWN
		PRESSURES ARE EXERTED BY THE TARGET GROUP	PRESSURES ARE EXERTED BY ANOTHER GROUP	PRESSURES ARE EXERTED BY THE TARGET GROUP OR BY ANOTHER GROUP
	REGULATIVE ACTORS		We can repair damages in the marine ecosystem. We can stabilize the marine ecosystem. We can remove pressures.	The marine ecosystem is composed of interrelated components. Pressures can change the marine ecosystem. The ecosystem is the basis for many aspects of our welfare. **Question: What are 'costs' for individuals and the society for restoration of the ecosystem. Who pays for the restoration and what are the benefits?**
	PROESSIONAL ACTORS			
CHANGE ACTIVITIES	INDIVIDUAL ACTORS	I can change my activities (consumption).	Activities are driven by driving forces I act within a value chain. My activities are related to those of others. I can have influence on problematic activities through a governance system.	The marine ecosystem is composed of interrelated components. Pressures can change the ecological state in a negative way. The marine ecosystem is the basis for many welfare aspects. **Question: What are the 'costs' for the individual for a behavior change. How can these costs be compensated?**
	SOCIAL ACTORS		We can change individual and economic activities through technical, social, financial and regulative responses.	The marine ecosystem is composed of interrelated components. Pressures can change the ecological state in a negative way. The marine ecosystem is the basis for many welfare aspects. **Question: What are 'costs' for individuals, the society, and the economy for a change of activities.**

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		RESPONSES ARE NOT KNOWN		RESPONSES ARE KNOWN
		PRESSURES ARE EXERTED BY THE TARGET GROUP	PRESSURES ARE EXERTED BY ANOTHER GROUP	PRESSURES ARE EXERTED BY THE TARGET GROUP OR BY ANOTHER GROUP
				How can these costs be compensated and what are the benefits?
	REGULATIVE ACTORS		Individual and economic activities can be changed through technical, social, financial and regulative responses.	The marine ecosystem is composed of interrelated components. Pressures can change the ecological state in a negative way. The marine ecosystem is the basis for many welfare aspects. **Question: What are 'costs' for individuals, the society, and the economy for a change of activities. How can these costs be compensated and what are the benefits?**
	PROESSIONAL ACTORS	Economic activities can be changed (technical responses) A change of activities can be supported (financial responses) A change of activities can be forced (administrative responses)	Within a value chain, problematic activities can be influenced by other economic actors.	Within a value chain, problematic activities can influence other actors. **Question: What are 'costs' for economic actors for a change of activities. How can these costs be compensated and what are the benefits?**
INFLUENCE DRIVERS	INDIVIDUAL ACTORS	I can influence the forces that drive problematic activities, my own and of others.		
	SOCIAL ACTORS		We can influence the forces that drive problematic	

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		RESPONSES ARE NOT KNOWN		RESPONSES ARE KNOWN
		PRESSURES ARE EXERTED BY THE TARGET GROUP	PRESSURES ARE EXERTED BY ANOTHER GROUP	PRESSURES ARE EXERTED BY THE TARGET GROUP OR BY ANOTHER GROUP
			activities together.	
	REGULATIVE ACTORS		The forces that drive problematic activities can be influenced.	
	PROESSIONAL ACTORS			

Narrative figures and their different possible functions for communication

As described in deliverable D3.1, and D3.2 the five media functions of McQuail (2010) were integrated into the theory of collecting ocean literacy resources for the media analysis. These five functions are defined in the following table:

Table 2: The five functions of media (McQuail, 2010).

Information	Providing information about events and conditions in society and the world. Indicating relations of power. Facilitating innovation, adaptation and progress.
Correlation	Explaining, interpreting and commenting on the meaning of events and information. Providing support for established authority and norms. Socializing. Co-ordinating separate activities. Consensus building. Setting orders of priority and signaling relative status.
Continuity	Expressing the dominant culture and recognizing subcultures and new cultural developments. Forging and maintaining commonality of values.
Entertainment	Providing amusement, diversion and the means of relaxation. Reducing social tension.
Mobilization	Campaigning for societal objectives in the sphere of politics, war, economic development, work and sometimes religion.

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As the *"correspondence between function (or purpose) and precise content of media is not exact, […] one function overlaps with another, and the same content can serve different functions" (ibid.),* these functions can also not be put in a clear correspondence with the narrative figures of this analysis. For all narrative figures, however, some functions can be excluded. The description of interrelationships of environmental components, or mere notion that human induced pressures are exerted on parts of the environment, will not lead to any rational mobilization. They can be entertaining though.

The following table summarizes the potential correspondence between key messages and functions of communication.

Table 3: Key messages of the DAPSI(W)R framework and their potential communicative function.

Message in terms of the DAPS(W)R Framework	INFORMATION	CORRELATION	CONTINUITY	ENTERTAINMENT	MOBILIZATION
Overall rationale	X	X	X	X	X
Human activities aim at the production of goods or services for the human society. They rely on natural resources.	X	X	X	X	
The statement above does not include any description of challenges or problems caused by human activities. No mobilization or even awareness raising can be drawn from this statement					
The environment consists of complex interrelationships of chemical, physical and biological components	X	X		X	
This statement does not refer to the chain of human influence. It does not support societal continuity or mobilization for change.					

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Message in terms of the DAPS(W)R Framework	INFORMATION	CORRELATION	CONTINUITY	ENTERTAINMENT	MOBILIZATION
Human induced pressures are exerted on an environmental state in a dynamic equilibrium	X	X		X	
The statement refers to human induced pressures, but does not identify exerting activities nor any impacts. Neither continuity nor mobilization are covered.					
If the components of the environmental state cannot compensate for the pressure applied, the overall state changes	X	X	(X)	X	(X)
The statement refers to human induced pressures, and includes an explanation for an overall state change. Still it does not identify exerting activities nor any welfare aspects. Continuity and mobilization might be inherent functions but they are not explicit.					
Environmental impacts lead to changes in natural resources or ecosystem services.	X	X		X	
The statement refers to an overall state change and depending welfare aspects. It does not identify pressure exerting activities nor pressures. Continuity and mobilization cannot be functions of this statement as no object for change is given.					

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Message in terms of the DAPS(W)R Framework	INFORMATION	CORRELATION	CONTINUITY	ENTERTAINMENT	MOBILIZATION
There are responses to changes in the state of the ecosystem or changes in natural resources or ecosystem services.	X	X	X	X	X
The statement explicitly refers to a changing environment and ecosystem services as well as human responses to this change. It explicitly covers continuity and mobilization.					
We are to blame for the degradation of the ecosystem	X	X		X	
The statement informs and explains without any consequences for human activities. It does not cover continuity or mobilization, but might be entertaining to some.					
We are affected by certain pressures	X	X		X	
The statement informs and explains without any potential or actual responses. It does not cover continuity or mobilization, but might be entertaining to some.					
We create problems in the ecosystem that affect us	X	X	(X)	X	(X)
The statement informs and explains about interdependencies of human activities, the ecosystem and welfare aspects. It does not mention responses, and does not cover continuity or mobilization explicitly. It can be entertaining.					
We reflect the harm that has been already done	X	X	X	X	
The statement informs and explains the reflection of the degradation of the marine ecosystem. It does not function as a mobilization, but shows aspects of societal continuity.					

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Message in terms of the DAPS(W)R Framework	INFORMATION	CORRELATION	CONTINUITY	ENTERTAINMENT	MOBILIZATION
We repair damages that have been already done	X	X	X	X	
The statement explains and informs about concrete actions to repair damages in the marine environment. It does not necessarily call to action, but supports continuity.					
We control problematic activities	X	X	X	X	X
The statement explains and informs about existing or potential ways to control problematic activities. It supports continuity and does not call to action.					
We need a fundamental societal change	X	X			X
The statement explains and informs about driving forces behind problematic activities and potential or actual responses. It is basically a call for action.					

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Flow of Information between senders and receivers

In addition to the DAPSI(W)R messages identified and described above, another important factor for the analysis of the knowledge system is the identification of senders and receivers of information in the process of communication. Within the approach of ResponSEAble, this identification is based on the classification system of actors (for a full description of this classification system see deliverable D3.2).[3]

The flow of information between senders and receivers is complex and multi-faceted in many key stories and target countries. Different information is sent from a large number of senders to as many recipients. The following figure illustrates this with the example of sustainable fishing in Portugal.

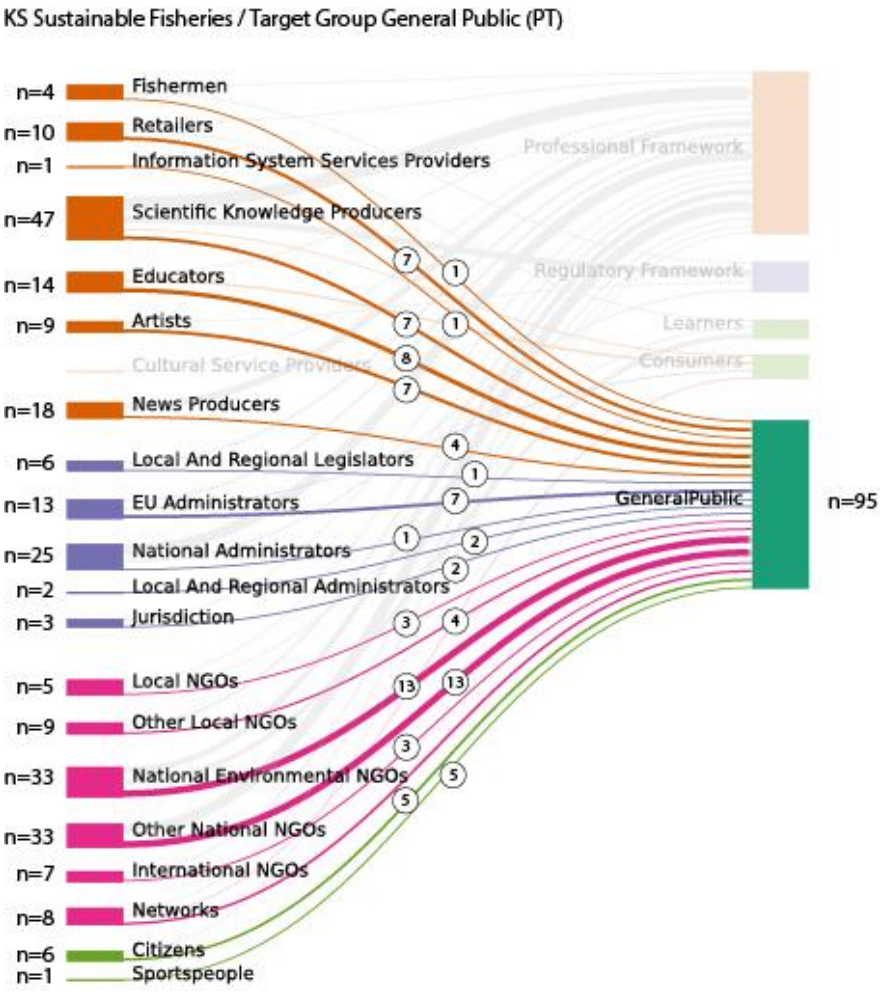

Figure 17: Information flow between senders and the public on the "sustainable fisheries" case in Portugal.

[3] WP3 has developed a classification for media genres based on the concepts of communicative practices and media degrees. These concepts serve as a classification matrix of a wide range of media types. The classification system has been illustrated in depth in deliverable 3.1. Due to challenges in the interview parts of WP2 and WP3, the data on relevant media types or information beyond the internet is limited. Therefore, we exclude the results of the analysis here.

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Even if a single receiver group is isolated in the display, the number of transmitters is extensive. The same applies to the isolation of a single receiver group. The main question here is how to interpret the large amount of communications. What does this complex picture tell us about the knowledge system on marine issues? How do we utilize the analysis for the creation of targeted ocean literacy resources on our key stories?
Within the scope of ResponSEAble, it is important to approach these question through the following steps.

Which groups are key to a positive change in the key stories ?

Work package 2 of ResponSEAble identified the following groups as the most influential to implement a positive change in the respective key stories (for a detailed description of the analysis see deliverable D2.2)

Table 4: ResponSEAble key stories, the target regions and identified key actors for a positive change.

Key Story	Region	Key Actors
Eutrophication and agriculture	Baltic, Black	Agricultural Producers Wholesalers Decision-makers
Sustainable Fisheries	Atlantic	The Public Wholesalers
Ballast water/invasive species	Baltic, Black, Med	Shipowners European and National Legislators Marine Equipment Suppliers and Manufacturers of paints and coatings
Marine Renewable Energy	Atlantic	The Public Investors (public & private)
Microplastics and cosmetics	EU-wide	Cosmetic Producers NGOs Decision Makers
Coastal development/tourism	Med	Local/ regional public-private tourism promotion consortia National marine industry association

How do different groups communicate with each other?

In terms of the functions of communication between different actors some assumptions can be made:

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Individual actors are likely to play a major role in mobilizing other groups to react to a marine or environmental problem, including other individuals. In their function as individuals they are less likely to inform other groups on complex issues, but may pass information on to other individuals. Also, Individual actors play a key role in expressing continuity aspects (i.e. forging and maintaining commonality of values) with each other, as well as other groups.

Social actors usually play an important role in informing other actors from all spheres on marine or environmental challenges, as well as in explaining relevant issues. They also play a role in mobilizing individuals and other social actors.

Regulative actors inform others and maintain or forge a common cultural practice between all groups.

Professional actors inform others on their practices and new developments. They also support the maintenance or development of professional practices.

The following table summarizes the functions that are most likely to be occupied by specific actor groups in their communication with other groups.

Table 5: Potential functions of communication between different societal actor groups.

	Individual Actors	Social Actors	Regulative Actors	Professional Actors
Individual Actors	Information Correlation Continuity Mobilization	Continuity Mobilization	Mobilization Continuity	Mobilization Continuity
Social Actors	Information Correlation Mobilization	Continuity Mobilization	Information Correlation	Information Correlation
Regulative Actors	Information Continuity	Information Continuity	Continuity	Information
Professional Actors	Information Correlation	Information Continuity	Information Continuity	Information Continuity

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If we assign these communicative functions to the illustration of information flows towards the General public, a key actor group (as consumers) in the fisheries case, we come to the following picture.

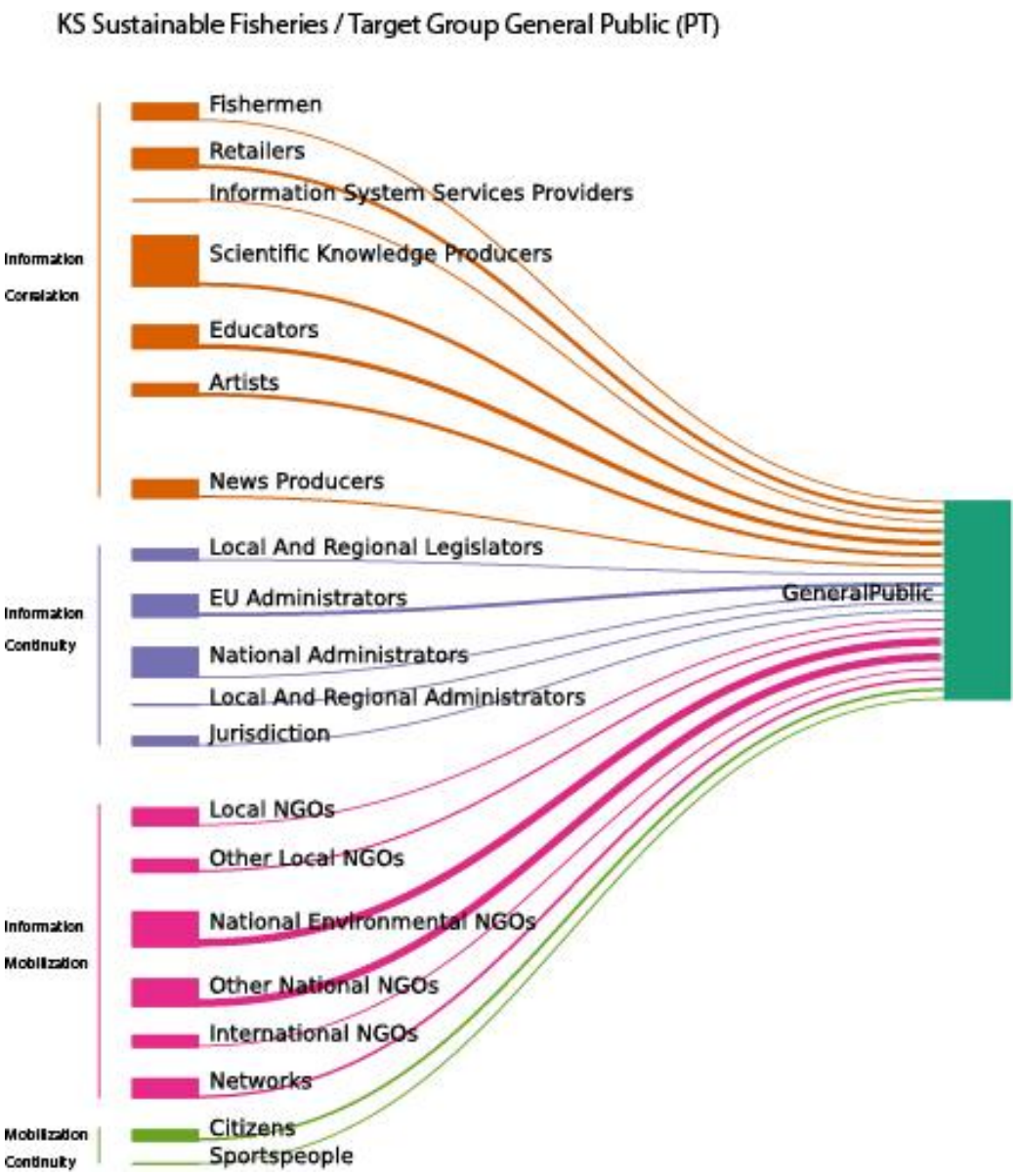

Figure 18: Communicative functions assigned to the Information flow between senders and the public on the "sustainable fisheries" case in Portugal.

Here, we find that all communicative functions are in principle covered, although *Information* on the issue is covered multiple times, more often than calls to action or mobilization, explanations or correlation, and social continuity. From a wider perspective, it might be said, that the subject of Sustainable Fisheries is covered in Portugal, not only in terms of content, but also in terms of communicative function and senders of information.

The respective content graph also supports this finding:

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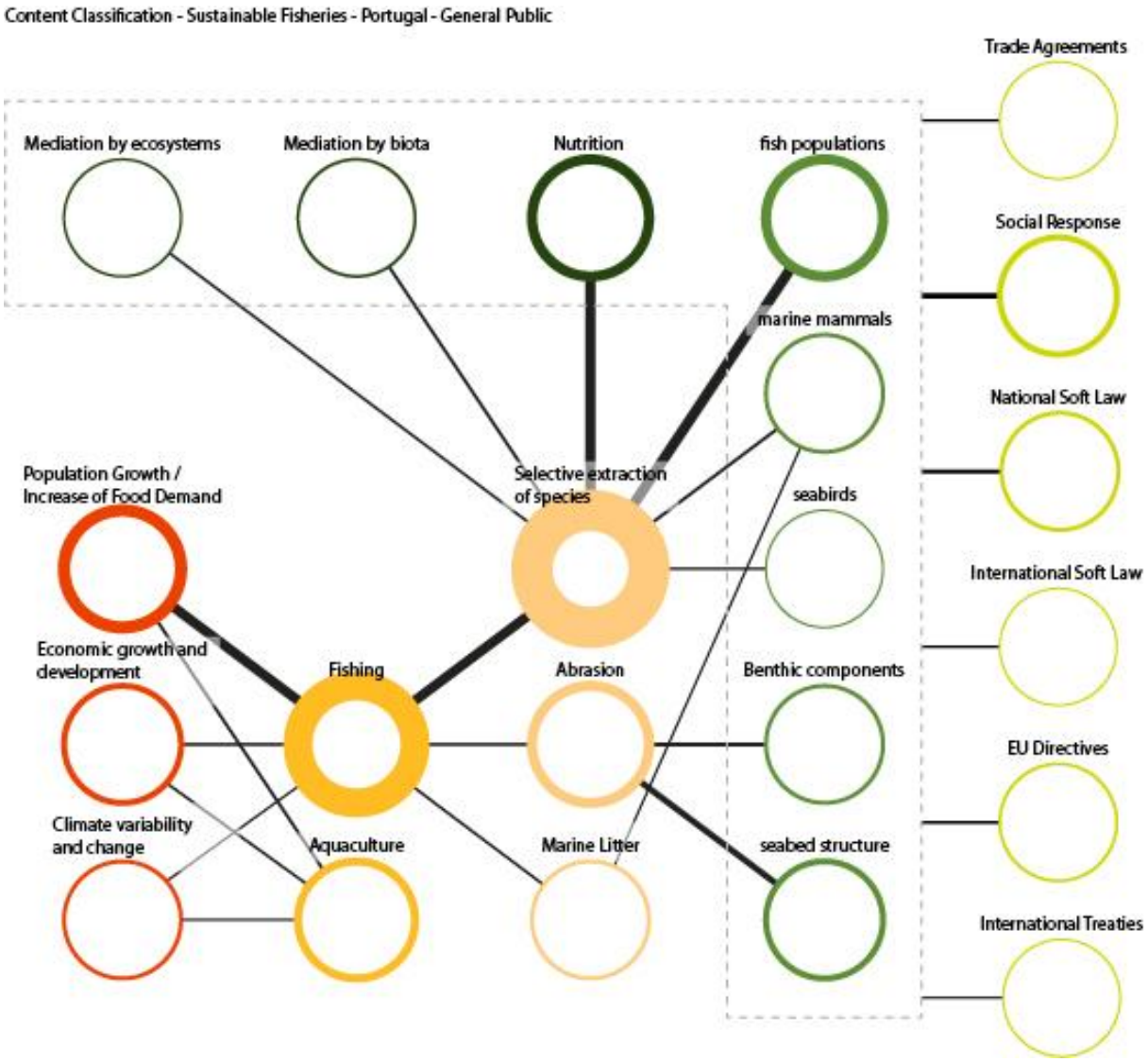

Figure 19: Illustration of the content of summed up communications on the „sustainable fisheries“case in Portugal.

In contrast to the findings of the fisheries case, the information flows on eutrophication in Latvia shows a different picture. Here, the information flow towards crop and animal producers are limited to Information from only two actor groups.

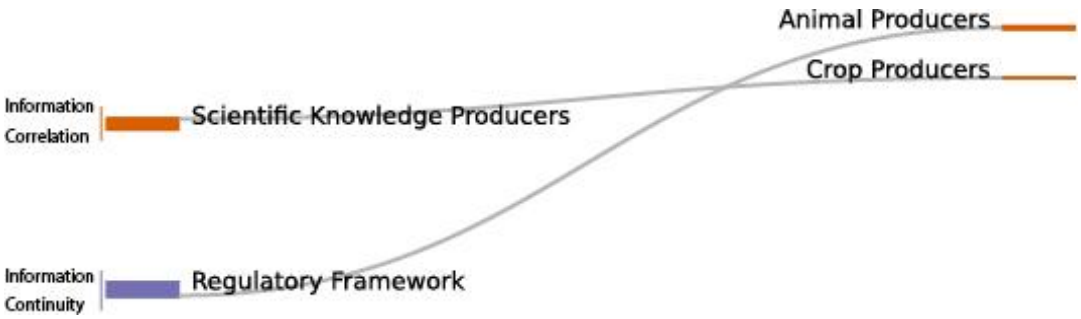

Figure 20: Communicative functions assigned to the Information flow between senders and crop as well as animal producers on the "eutrophication " case in Latvia.

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If we look at information targeting the general public, considering that farmers are also a part of it, the picture changes slightly.

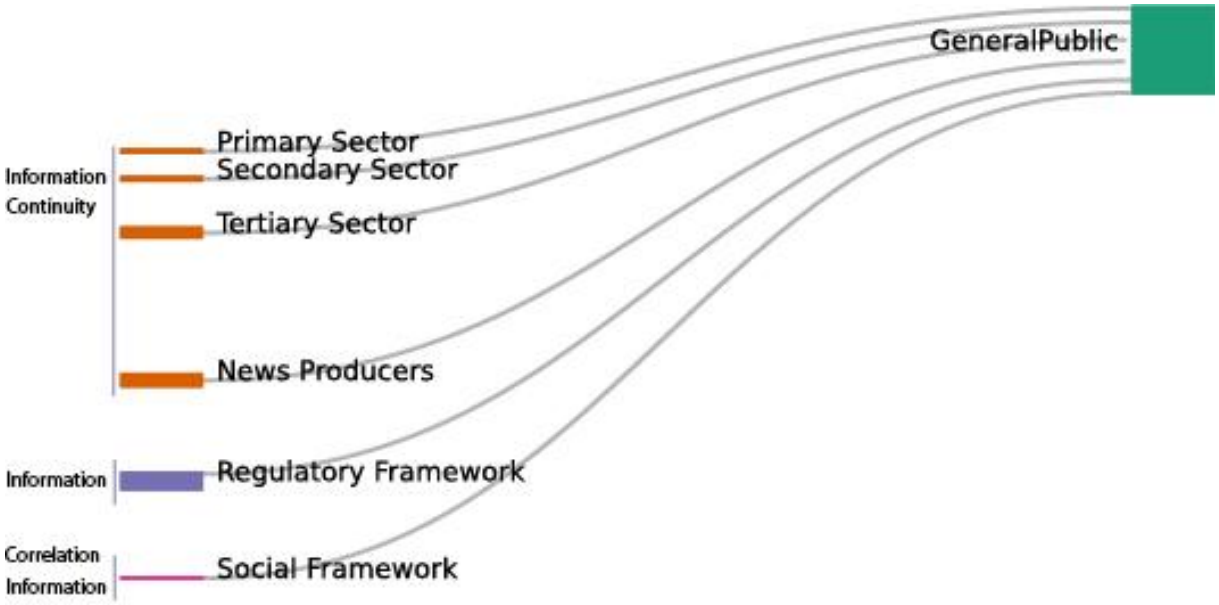

Figure 21: Communicative functions assigned to the Information flow between senders and the public on the "eutrophication " case in Latvia.

However, based on the illustration of the communicated knowledge, we can also see, that information is limited to activities, pressures, and some responses. The whole context of changes to the environment and impacts on welfare aspects are excluded. Therefore, correlation is weak in this example. **Mobilization is non-existent** based on the examples we gathered.

What is the right balance between knowledge and motivation?

It is fair to say, that knowledge of actual responses is a prerequisite to implement a response. It is also fair to say that knowledge on the impacts of problematic activities, environmental or welfare impacts, is a good start to find some motivation to change ones' own behavior. But motivation can also be drawn from a sense of beauty of an intact ecosystem that can only be created by a certain degree of understanding. Finally, the feeling of a common value set with society or even a part of society is motivational. Such feelings can in fact be supported by the face of a celebrity on campaigning material or by awareness raising materials that are shared by friends on social media. In these cases, not environmental knowledge, but knowledge of actual responses that can be implemented by individuals are the key to a behavior change.

We would argue that a mix of senders from different actor groups, communicating different aspects of the story with different functional purposes is beneficial for an actual and recognizable change, in that they support an increase of understanding as well as motivation to implement the

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knowledge. It seems unlikely that a single voice can produce both. It seems much more likely that many voices can produce a common discourse, in which the individual can find him or herself according to his his or her individual degree of understanding and motivation.

Mirroring the what is communicated: The effect analysis

Communication is a social act in which two sides are actively involved. On the one hand, the transmitter of communication communicates with a certain intention (communicative function). On the other hand, we have the recipient, who takes up certain messages against the background of his or her information environment and classifies them according to his interests, education, personal value sets and social role (for a detailed description of this see deliverable D3.3).

To understand the extent to which the diversity of voices and content is heard and classified by the recipients of the communication, we have conducted relatively open discussions with representatives of different social groups. In doing so, the aim was to describe the respective information environment and to examine the perception of the state of the ocean in general and with respect to the key stories. Challenges have been met in this task due to the intended relatively open interview setting. Both individual and professional actors seemed to be unwilling in many cases to talk freely about their perception of ocean-related communications and their own understanding of the sea.

Still, results support the assumption that actors tend to take up information and knowledge based on their societal role. In general, we have seen that people who were interviewed as part of the public, or individuals, were not able to determine the source of information on particular key stories or marine genres in general. Their information environment is diffuse in two ways. On the hand, they people are picking up information without remembering to search for it in social media, the internet and television. On the other hand, they were not able to clearly classify and retain what they have learnt.

In contrast, economic actors showed more clarity about their sources of information and what they learned from them, because they were looking for information regarding their profession and have a differentiated perception against the background of their pre-knowledge and education. Also, economic actors showed a clear tendency to look for information and knowledge within their own professional networks and sometimes in scientific resources.

This finding leads to two conclusions. Firstly, a basic educational grid is helpful to classify and retain new information. This knowledge is not new but rather the basis of a classical education system with a focus on good general education. Regarding knowledge on the ocean or the human-ocean relationship, however, it clearly points to the meaning and benefit of the classical ocean literacy concept with its seven fundamental principles. Knowing these principles would certainly support the uptake and classification, and thereby keeping of new knowledge on the ocean.

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Secondly, these results show that different aspects of the human-ocean relationship do not have to be mediated in the same knowledge resource. As economic actors are first and foremost informed by their professional network, the information that is approaching them is also more closely linked to the professional challenges. Based on the content analysis we have made, we can say that the further the professional challenges are removed from the visibility of the general population, the less they deal with concrete challenges for the ecosystem. I.e. this is true for the cases of ballast water and eutrophication. We see that communications towards professionals in these key stories barely touch the challenges for the ecosystem, but are limited to activities, exerted pressures and regulative, technological and economic responses. As citizens and consumers, the public in general are the receivers of more diffuse information and knowledge through random sources on social media and television, a wide spread discourse on different aspects of the human-ocean relationship from a broad variety of societal transmitters is to be seen as more effective than narrow and streamlined communications.

On the other hand, it was clear in different settings that the state of the seas is perceived as bad by many individual conversation partners, the reasons for this view being rather diffuse. Many times, invisible threats were mentioned as a personal concern, pointing towards hazardous substances in the sea, that might cause health issues etc. These invisible threats could not be qualified in many cases. On the other hand, a highly-touched subject was marine litter on the beaches. More complex understandings of the state of the marine ecosystem was barely found, except for some individuals. This is true for both individuals, as consumers and citizens, as well as professionals from different key stories. Again, professionals tended to show an understanding of the necessity to improve and regulate pressure-exerting activities, without really showing and understanding of the complex ecosystem relations the pressures target. Again, the ignorance towards complex interrelationship, or just the existence of complex interrelationships, supports an ocean related science literacy approach as exemplified in the US ocean literacy concept.

Many respondents expressed that they see themselves as powerless to change the problems in the sea. This view was either taken by individuals who saw themselves as outside the pressure exerting value chains, or by professionals who expressed that their economic segment would do enough or not be the segment that has a large share of the problems. It is this point, where the value chain approach of ResponSEAble and ultimately the development of a concept for responsible ocean literacy has the biggest benefit for a positive societal change regarding the human-ocean relationship.

Assessment of existing ocean literacy resources on all Key Stories

To assess how sufficient existing knowledge communications regarding the various key stories are, a number different aspects must be considered. **It should be asked if, the relevant actor groups are targeted sufficiently in terms of**

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1. Their societal role (individual actors, social actors, professional actors)

Every person plays a variety of roles in society. A professional economic actor is also a citizen, a consumer and potentially a learner. Furthermore, he or she is a social being and by that a sender of information in the social act of communication. We have shown, that some messages are more likely to be considered by people in their role as individuals, i.e. messages concerning the beauty of the marine environment etc. Other messages, i.e. economic or technical solutions to environmental challenges are more likely to be targeted at professional actors, and often lack the effort to support emotional qualities like a sense for beauty. Therefore, it is our understanding, that **not one communication targeting one group of** actors, but **a multitude of communications targeting different societal roles of people** is sufficient to support a societal discourse that ultimately leads to a behavior change in society

2. An appropriate balance in the variety of potential messages

In addition to the aspect mentioned above, communications vary in their communicative function for society. We have shown, that existing ocean literacy resources highlight different sides of the same story in terms of the DAPSI(W)R framework. Some highlight the need for reflection, others point out actual responses to existing environmental problems to problematic economic activities. It is not purposeful to place the whole narrative of a key story in a single communication, or to repeat the same part of the narrative again and again. Also, as different actor groups are more likely to target others with specific functions of communication, a broad variety of senders of information is beneficial.

Just as a multitude of communications is useful, **a broad distribution of different messages as well as a broad variety of senders is helpful to support a genuine social discourse.**

3. Comprehensive coverage of content (DAPSI(W)R)

We have shown that a behavior change is more likely to be triggered by emotional qualities, than by pure fact based scientific understanding. Still, emotional qualities and knowledge on the human-ocean relationship are not completely separated. Especially information on the marine ecosystem and its interrelated components, welfare aspects for the human society as well as technical and economic possibilities are most likely to trigger emotional qualities that can be utilized for a behavior change. That is, if also actual or potential responses are available from the resources of information. **In contrast to those who believe that target groups do not have to understand everything, but just have to act correctly, we think that understanding supports a behavioral change not least because of the inherent emotional qualities.**

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Furthermore**, knowledge of potential or actual responses** to challenges of the human-ocean relationship is indispensable for a behavior change to the better. In the light of the different roles of actors and the desired variety of messages, these responses do not necessarily need to be part of every communication or ocean literacy resource, but the must be available somewhere.

A comprehensive coverage of knowledge in terms of the DAPSI(W)R framework through the variety of messages is therefore to be supported.

KEY STORY	COVERAGE OF DIFFERENT ACTOR GROUPS / SOCIETAL ROLES	BALANCE / VARIETY OF MESSAGES	COVERAGE OF CONTENT (DAPSI(W)R)
MICROPLASTIC IN COSMETICS	Very Low: Highly untargeted information (general public).	Medium: Many resources originating from social actors and news producers.	Low: Information on ecosystem components and potential impacts mostly missing, knowledge gaps are not expressed, highly focused on consumer behavior and economic / regulative responses.
SUSTAINABLE FISHERIES	Very High: All societal roles are targeted.	Very High; identified key actors (fishermen, retailers, consumer / public) are targeted by a broad variety of senders.	Varying coverage depending on target group and country: **Consumers:** Low in France and UK, mainly focused on pressure and welfare aspects (nutrition); high in Portugal, including state components, drivers, and a broad variety of responses. **Fish Farmers:** highly activity, pressure and welfare related, including pressures and some responses. **Retailers:** Highly Pressure-Welfare related.
MARINE RENEWABLE	High; Many societal roles are targeted, individual	Generally High in Portugal; Low in UK, except for the	Very High in Portugal

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KEY STORY	COVERAGE OF DIFFERENT ACTOR GROUPS / SOCIETAL ROLES	BALANCE / VARIETY OF MESSAGES	COVERAGE OF CONTENT (DAPSI(W)R)
ENERGY	actors mostly as the public.	producers of MRE.	Very High in UK for producers Very Low in UK for public
AGRICULTURE AND EUTROPHICATION	Low, highly focused on farmers and administrations	Very Low, identified key actors are targeted by a very small number of senders	Very low, very little information on ecosystem components and welfare aspects. Limited coverage of responses.
BALLAST WATER AND INVASIVE SPECIES	Relatively High; Most societal roles are targeted with variations between assessed countries / languages.	Relatively Low; identified key actors (shipping professionals, scientists, administrations) are targeted by a relatively low number of senders.	Highly activity and pressure-focused; state and welfare aspects are covered, responses are mostly covered in economic and regulative terms, no social responses.
COASTAL TOURISM	Relatively High, but the selected key actor groups are missing	Relatively High, but the analysis shows differences (probably based on data quality)	Coverage of ecological challenges is high, coverage of responses is rather low, mainly pointing towards social responses.

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What is responsible ocean literacy?

The concept of ocean literacy was developed as a support for marine education in the k-12 curriculum of highschools in the United States. As such, it has significantly strengthened the societal understanding of the ocean and the related challenges and opportunities. However, in the original concept references to the knowledge areas on human activities and reflection are only present as broad subordinate concepts of one of the seven ocean literacy principles.

The seven essential principles of ocean literacy[4] are:

1. The Earth has one big ocean with many features.
2. The ocean and life in the ocean shape the features of Earth.
3. The ocean is a major influence on weather and climate.
4. The ocean made Earth habitable.
5. The ocean supports a great diversity of life and ecosystems.
6. The ocean and humans are inextricably interconnected.
7. The ocean is largely unexplored.

A brief look into the subordinate "fundamental concepts" is enough to recognize that the original concept is largely an ocean-related variant of **science literacy**. This is especially true for the ocean literacy principles 1-5 and 7, whereas principle 6 opens the concept for political and social approaches. Although there is nothing to be said against the approach of science literacy, a scientific education of the general population and certain key actors is not decisive for a change in behavior.

Most of the “fundamental concepts” subordinated to the sixth principle relate to ecosystem services and welfare aspects of the human-ocean relationship, some to human activities, pressures and impacts, and some to potential responses to environmental challenges. Within these concepts the different categories of activities, pressures, impacts, welfare aspects and responses are not clearly differentiated. Individual responses are just briefly mentioned in a more ethical way.

Within the context of the human ocean relationship, the seven ocean literacy principles play only one of many parts for a positive change of the individual and society towards a more responsible and sustainable connection to the ocean. They do not point out to actual activities and responses that could guide actors towards a responsible behavior regarding the seas. As such the ocean literacy principles stand in contrast to the approach of ResponSEAble to support a behavior change of societal actors in Europe.

There are several possibilities to face this discrepancy between both approaches. On the one hand, there is, of course, the possibility to separate the approach of ResponSEAble from the context of (science) ocean literacy and to place it in the realm of marine citizenship. On the other

[4] http://www.coexploration.org/oceanliteracy/documents/OceanLitChart.pdf

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hand, it is possible to open the concept of ocean literacy for other areas of knowledge and communication to describe the whole context of the human-ocean relationship.
We stand on the viewpoint, that not only scientific understanding supports the *readability* of the ocean and its relationship to the human society, but also an economic, technical and political understanding, and not least also artistic reflections. Therefore, we argue, that the concept of ocean literacy as a concept for understanding the significance of the ocean and it relation to us should be broadened. One way we could move forward with this, would be to detach the sixth principle from the others and create a concept of **responsible ocean literacy**. This concept should be based on three pillars: **(1) marine sustainability principles**, **(2) ocean principles**, and **(3) responsibility principles**. The remaining ocean literacy principles take the place of ocean principles. Marine sustainability principles would then include economic and technical knowledge that supports sustainable developments in the marine and maritime economy. Finally, the third pillar would focus knowledge on individual, social, and political responsibility, including actual and potential individual, social, and political responses to environmental challenges. It would also refer to artistic and scientific forms of reflection.

This approach is certainly a great task, which cannot be carried out here and probably also not in the further course of the project. At this point it serves as a proposal for the further development of a pan-European implementation of the valuable advances of the ocean literacy movement, and as a needed complement to the approaches of **Blue Growth** and **Blue Skills**.

Conclusions

This is the final report of the WP 3. In this work we have aimed to make a fruitful contribution to the further discussion of the development of the use of the ocean and our common responsibility by presenting how the distribution of knowledge on the human-ocean relationship are distributed through society, what functions they serve, and what messages they send.

WP3 has worked with developing further classification of types of knowledge we use when communicating about human-ocean relations. The main contribution of this work has been the following:

The **'narratives' of messages of communication have been developed** to match the potential and actual combinations of knowledge components that arise from from the DAPSI(W)R framework. 7 main ocean narrative or narrative figures have been identified. These were applied to identify main existing narratives in each key story and communication gaps that can be targeted.

The **link between the messages-narratives and target groups** has been analyzed and gaps between have been identified. These will be taken into further consideration when developing the ocean tools to target the right groups with right type of knowledge to increase the effectiveness of

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ocean literacy. Based on analysis of the data that has been collected (both media analysis and interviews) the **following conclusions can be made to be taken further in WP5 of the project.**

Microplastic in Cosmetics: The key story is lowly covered in terms of different target groups, the variety of messages, and in terms of content, but bears a high value to illustrate the human-ocean relationship. Therefore, it would be beneficial to support an expansion of the thematic focus on all areas of concern, including the value chain of cosmetic production, the interrelationship or ecosystem components, political, economic and social responses.

Sustainable Fisheries: The key story is highly covered in terms of different target groups and the variety of messages. The coverage of content varies between different countries and target groups. Focusing on consumption related messages is not recommended as these are mostly covered by existing resources and campaigns. Retailers and especially retailers that are willing to support sustainable fisheries might be targeted to deepen their understanding of ecological relationships and economic challenges.

Marine Renewable Energy: The key story is highly covered in terms of different target groups. The variety of messages varies in different countries, especially regarding the public in general. The coverage of content is low, especially on the ecosystem state components, welfare and responses. A broad increase of the understanding of relations between the technology and ecosystem components, the potential impacts also in regard to other ecosystem components and stories might be useful. Also, a clear systemized view on responses of the public, citizens and consumers can be supported.

Agriculture and Eutrophication: The key story is lowly covered in terms of different target groups, the variety of messages, and in terms of the content. The effect of the pressure eutrophication is barley explained, the actual ecosystem effects as well as welfare effects are not explained. The key story has a huge potential to broaden the understanding of the relation between a globalized economic segment and a local environmental feature, the Baltic Sea, with its complex ecological relations. A broad increase of the understanding of relations between the globalized segment of the economy and ecosystem components, the impacts on the environment and welfare aspects is recommended. A clear and systemized view on the responsibilities of citizens and consumers can be supported.

Ballast Water and Invasive Species: The key story is highly covered in terms of different target groups. The variety of messages is relatively low. The coverage of content is highly activity and pressure focused, also welfare aspects are covered. Responses are limited to regulative and economic aspects. Social responses are absent. The key story has the potential to connect a highly-globalized segment of the economy to very local environmental and welfare impacts. Local information campaign connecting the two dimensions would be a welcome step to bridge a very distant pressure exerting activity with the local environment of people near to the sea.

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Coastal Tourism: The available data on covered target groups is limited. In principle, the coverage seems to be high. The variety of messages also seems to be relatively high. The coverage of content is high regarding environmental challenges, but not welfare aspects are covered, although this key story is highly welfare related. Responses are highly focused on social aspects. As mentioned, the key story is, in principle, highly welfare related. There is a potential to highlight the immediate connection between the health of the ocean and welfare aspects.

The last, but not the least, analysis and classification of types of knowledge that need to be communicated to increase ocean literacy in Europe showed that a move beyond the classic 'scientific' ocean literacy principles as developed in the USA is needed. In order to support a behavior change in Europe **we must move towards responsible ocean literacy, which includes knowledge on individual, social and political responsibility as well as reflections, emotions and actions in addition to the environmental and economic knowledge.**

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