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Deliverable 4.5
An Interactive summary Report of D 4.1 – D 4.4
WP's leader: UiB

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1. (Popular) Description of deliverable

Deliverable 4.5 was compiled to provide an accessible summary of information available in previous reports produced by Work Package 4, "Assessment, Iteration, Consilience & Integration". The work that is reported by this deliverable is essential to the internal integration of the project; it also plays a significant role in bringing into the project perspectives and insights from other projects as well as those of external observers. The deliverable provides a way of assessing the degree to which this work is taking place.

This work was carried out as described in the description of deliverables: "An Integrative Summary Report of D.4.1-D.4.4: Report on i) Evaluation of conceptual and mathematical models, ii) Scenario building iii) Knowledge and information exchange between Ocean-Certain and beneficiaries of other projects on Ocean-Certain project results. iv) Outcomes of the dialogs between managers, policy makers and stakeholders of the case areas, v) identification of key variables, drivers, indicators and knowledge integration". In addition to summarizing Deliverables 4.1-4.3, it also updates them to the extent possible, although this was beyond the stated requirement of the deliverable; it also includes a brief summary of the information collected concurrently for the writing of D4.4.

D4.5 is meant to be one of several deliverables monitoring Task 4.2 "Consilience workshops with stakeholder and beneficiaries of other projects: Stakeholders and beneficiaries of other projects will assess OCEAN-CERTAIN's project results e.g. DSS during annual two-day-workshops. These workshops will mainly consist of a scientific dialogue with managers, policy makers and stakeholders of relevant geographical case studies. The other deliverables monitoring this task are D4.1-D4.4, and D 4.6. It is also to be monitored by milestone M39.

2. Summary of contribution of involved partners to deliverable

NTNU collected data, summarized the deliverables and wrote the report. Other partners supplied input to the original documents summarized here and to the updated document; see D4.1-D4.4 for information that is more detailed.

3. Summary and update of D4.1

3.1 Introduction:

This section summarizes and updates D4.1, "Report of annual workshops for knowledge and information exchange".

3.2 Materials and Methods

This report is based on D4.1 and on more recent information from Work Package leaders and the project leadership on relevant events.

3.3 The Summary and Update

3.3.1 Summary

D4.1 was delivered on 30.11.2014 and summarized events up to and including that date. OCEAN CERTAIN was initiated 1 November 2013, with a "kickoff meeting" in

Amsterdam. The first annual workshop for knowledge and information exchange was held 20th-21st June 2014 in Bergen, Norway. This workshop was the joint effort of UiB and NTNU; it was held on those dates so that participants could also participate in the IMBER Open Science Conference held in Bergen immediately following (23-27 June 2014). This was the only meeting on which D4.1 reported.

The workshop agenda was structured to include presentations by all partners and also by invited guests who presented information on other projects and ongoing scientific work of interest. All work package leaders informed the project on the status of their work package, setting the stage for the exchange of information and discussion of work package needs. For example, WP1, charged with developing data mining and knowledge discovery tools, explained where they stood with respect to data sources in the key topic areas and a useful general discussion on the further data needs for WPs 1 and 2 were discussed. The presentation by WP1 its explaining its tools and methods was particularly enlightening for other participants. The key tool under development is a form of Literature-based Knowledge Discovery. This kind of tool requires a long time to develop. The end result will be the development of a tool that can "read" natural text (that is text not prepared in any way for computer analysis). A necessary part of that tool is the use of experts in coding the meaning of published articles, a time-consuming process, to construct an ontology (the particular language/vocabulary employed in the field). WP1 updated the project with respect to this aspect of the project: coding was at this time under way as scheduled and very preliminary results are encouraging. One obstacle to the ultimate development of this tool was identified as legal and other barriers to access of full texts: at this time, only fully accessible abstracts can be coded for use in this work.

WP 3 presented the results of the work for D3.1 which focused on identifying marine resources that from the vantage point of published information should be critical for the selected case studies. This information provided insights to WP2, which subsequently selected some key marine species on which to focus its work. This information will be useful in the models under development in WP2, specifically, the ECOPATH- and ECOSIM-based models that will couple lower and upper trophic level marine systems and also explore how changes in marine resources can affect local communities. Developments here were on target and data requirements with respect to other WPs were outlined. WP 5, which will develop a decision-support system, depends upon input from both WP 3 and WP 5 in order to create a tool that can be of real use to the target communities.

WP 3 also presented the core work package methods that were to be used to solicit from stakeholders their perception of how their socio-ecological system functions: Systems Thinking (ST) and the Bayesian Belief Network (BBN). In order to better acquaint project members with these methods, as well as to gain knowledge from project members, Murat Van Ardelan and Rachel Tiller conducted a session employing these methodologies. The results supplied information that was to be used in the stakeholder and manager workshops scheduled for the year following this project meeting.

WP 5 presented a mock-up of the Decision Support System that is under development. WP 5 demonstrated how this is to work and explained the input needs it has with respect to other aspects of the project. Model development was at this time on schedule, but WP 5 was eager to have input from other WPs.

Much of the workshop focused on aspects of the natural science side of the project, in particular structures and functions of planktonic communities and the difficulties involved in studying the impacts of changes in temperature dynamics and pH; and the ocean carbon pump. Key and cutting edge models on these topics were presented at the meeting by invited participants and by project participants. There was a lively discussion about how gaps in knowledge about the biological pump could be filled.

WP 4, charged with "consilience" presented an introduction to one of the biological pump main drivers, maritime plankton food webs and the main experiemental and modelling challenges to understanding the system. WP 4 leader Frede Tingstand (UiB) demonstrated what kinds of responses are expected with different drivers to the system and how modelling and field results can confirm these hypotheses or take a turn for the unexpected to create new questions.

In addition to the internal speakers from within the consortium, the meeting also consulted with external researchers, to learn from these and to give information about the project. Invited speakers were:

1) Stephanie Dutkiewicz, from MIT, who presented "How changes to environmental drivers may alter marine phytoplankton habitats and community structure" using modelling tools;
2) Louis Legendre, Laboratoire d'Oceanographie de Villefranche, who presented "The Microbial Carbon Pump (MCP), DOC and their relevance to climate change, their interaction with different environmental drivers, such as changing pH and temperature";
3) Juan Carlos Miguel from the radioecology Laboratory (IAEA), Monaco, talked about "The biological pump and tracers"; and
4) Dag Slagstad, from SINTEF Fisheries and Aquaculture, who presented Ocean Certain's sister project ICE-ARC and its Arctic Ecosystem Model.

Details of the event are recorded in D4.1. A mock-up interface for the DSS was presented by WP5. The general idea was appreciated although a number of recommendations were made that can help tune the design of the phase I DSS (expected by month 30). For example, a glossary and information of uncertainty were considered to be useful, and that indicators could be presented by time series.

3.3.2 Update

The first annual workshop was held in Trondheim, Norway 27-28 of January of 2015. Partner NTNU who made all arrangements hosted it. The project coordinator attended via Skype from Svalbard, where he was located during this term. The meeting started with an Executive Board Meeting, where communication was brought up as an issue in the consortium. Deliverables were also discussed, specifically relative to who had the actual responsiblity for the deliverable – not just the work package. It was also specified that the 18 month report would be due in May the same year and that a lot would be expected from the consortium at that time. This was also the second time third time Stephanie Dutkiewich attended the meeting, after the kick off as well as the Consilience meeting. This was a very technical meeting in that many issues relative to the working and communication were brought up and discussed by the consortium members. It only

lasted two days, and was very concise and clear. All WP leaders summarized the work they had to this point, and Tanya Tsagaraki updated the consortium on the Mesocosm experiments in Patagonia with pictures and stories. Also, she talked about the plans for the next mesocosms in Svalbard the coming summer of 2015.

The second annual workshop was held in Kiel, 17-18 November 2015. It was hosted by partner GEOMAR which made many of the arrangements; the NTNU-based project leadership was heavily involved in arranging the workshop, which was followed by a project "General Assembly" on 19 November. The following is a summary description of that workshop and its results, focusing on issues of knowledge and information exchange and issues with respect to the internal integration of the project.

The Kiel meeting focused on project integration and on actions required in the wake of the first periodical report of OCEAN CERTAIN. It was attended by two members of the Scientific Advisory Board who presented their impressions and evaluations at the end of the workshop: Stephanie Dutkiewicz of MIT and Richard Bellerby of the Norwegian Institute for Water Research.

As noted, the Kiel meeting took up issues specific to the First Periodical Report of the project. However, this report touches upon these only in the degree to which they relate to the knowledge and information exchange issues of relevance to the update of D4.1. Focus on the findings of the First Periodical Report rather dominated the gathering, but other productive work also took place.

Each of the work package leaders and. frequently task leaders and other WP participants, presented the status of their work packages, making sure to note where work with other work packages has taken place and where further work needed to be done. While much work has taken place in the interval between project-wide meetings, it was broadly acknowledged that more integration was needed.

A list of models and other deliverables and their status is found in Appendix A. Here is a note on deliverables related to models or models:

WP	Deliverable	Status/comments on models
1 Data mining and LBKD	D1.1	on time
	D1.2	Delayed, split into two manuscripts. More workshops planned for exchanges with WP 2,3 and 5. New due date is end of February 2016.
2 Modelling		Low Trophic Level models presented, two climate scenarios (RCP8.5 and 4.5), two acidification scenarios and two fishing scenarios will be used. Iron speciation is quantified. Coupled model operational deadline Oct 16.
	D2.9	"Report on the results of the arctic experiment is delayed". The new due date is January 2016.
3 Social Economics		Integration with WP5 has been discussed, and a procedure proposed.
	D 3.4; D 3.5; D3.9	Delayed. See below.
4 Consilience		1: there is no experimental work on the biological pump, data mining could be used here; 2: the integration with WP3 is unclear, and not visible in

		WP4. The problem has been discussed, but the role of WP4 remains unclear. Upcoming milestone D4.5 – summary of interactions will discuss the exchanges between WP1 and WP2, WP1 and WP3, and WP3 and WP5. The WP leader contributions are needed before 01.12.15 for timely completion of this deliverable.
5 Decision support system		a metamodelling approach will be used, this is in line with the description for task 5.3 in the DoW, so no amendment is needed. The focus will now be on the integration with WP3, the indicator for the BP efficiency for the DSS will be reconsidered in view of the comments made by the advisory board.
	5.4	delivery date changed to the end of May 2016, to give the WP3 partners some time to reflect on the DSS functionalities (the phase I DSS will only be available by the end of April).
	5.6	D5.6: delivery date changed to the end of September 2016, to ensure the workshops have been finished, and results available

The role of WP 3 (Socio-economic analysis) became a particular focus of discussion at the workshop. It was the consensus at the meeting that the WP needs better integration into the rest of the project. There is a need for closer work between WP3 and WPs 2 (Quantification of Impacts and Feedback) and 5 (Decision Support System), with WP 4 (Assessment, Iteration, Consilience & Integration) playing a large role in facilitating that interaction. Specifically, more work needs to be done in linking the lower trophic level foodweb to the resources upon which stakeholders rely; this and formulation of the core concerns of stakeholders is also needed by WP 5. It was also clear that while WP 3 had a clear understanding of how integration was to take place, this understanding was not generally shared by other project participants. While work is occurring to integrate the foodweb work undertaken in WP2 to stakeholder concerns, such work is not occurring with respect to the biological pump. In short, WP3 must do a better job interacting with the other WPs. It should be noted that at Kiel, extensive discussions took place between WP3 and WP 2 and between WP3 and WP5 to clarify integration issues and to plan for closer work in the first half of 2016.

Deliverable	Title	Original due date	New Due Date
D 3.4.	Report on local stakeholders perceptions in Turkey	M 18 (April 2015)	February 2016
D. 3.5	Report on local stakeholder perceptions in Chile	M 20 (June 2015)	February 2016
D. 3.9	Report on Climate skepticism in EU, Norway, Chile, Turkey and localities	M 24 (October 2015)	February 2016

With respect to knowledge and information exchange, much activity has taken place between WP 1 (Data Mining and Knowledge Discovery) and WP2 where WP2 guided WP1 for creating use cases for Literature-Based Knowledge discovery (LBKD). These cases are used to improve and test the knowledge discovery algorithms. WP1 and WP2 have also collaborated during the selection of journals to include in the literature corpus, as well as identification of the important words in the terminology covering biology and chemistry parts of the Ocean-Certain domain. A workshop has taken place in Trondheim in October 2015 to discuss to manually simulate the use cases where natural scientist in Trondheim an Bergen came together with computer scientists working on LBKD. Several meetings between natural scientists in Trondheim and LBKD researchers took place in 2014 and 2015. Murat Van Ardelan has also contributed to the supervision of some MSc students working on the LBKD task.

WP 2: WP 2 presented the status of work on its model linking the lower and upper trophic levels. A separate workshop has taken place between WP 2 and WP 5 (Amsterdam 2015) in order to develop the models that underlie the creation of the Decision Support System (DSS). It was acknowledged that such a workshop should also take place between WPs 3 and 5. WP2 (CEFAS) will liaison with Juan-Carlos Molinero (GEOMAR, WP1) with respect to the local (Reloncaví) Ecopath model found by WP1. Discussions at the meeting led to the decision that CEFAS reconsider the way it is dealing with the high acidification scenarios; and to consider top predators for the Mediterranean model.

WP 4 has the lead responsibility for integrating the various aspects of the project. The WP leader acknowledged the need for more integrative work particularly with respect to WP3.

WP 5 as noted above has had a separate workshop with WP 2, and seeks a similar workshop in the near future with WP3. The leader of WP5 also expressed an interest in working more closely with WP6. Note that during the Kiel workshop, WP3 and WP5 outlined a plan for closer collaboration and also as to how the two work packages will join forces to work together for the second round of stakeholder workshops in the first half of 2016. The integration of WP 3 with WP5 is very much related to the work of WPs and plans were made to enhance the collaborative work among the three.

WP6 (Dissemination) stated the need for much more input from the other WPs in order to improve dissemination of information about the project in all areas. A detailed dissemination plan is generally sought.

In addition to the review of requirements relating to specific aspects of the project, new work done by the project was also presented. Antonio Cuevas presented the Mesocosm work of OC; Aud Larsen of UiB (Norway) presented work done in concert with the MICROPOLAR and CARBONBRIDGE projects. Jacopo Chiggiato of CNR-ISMAR (Italy) presented the findings of the Mediterranean research cruise, and Sukru Besiktepe of DEU-IMST (Turkey) did the same for the Rhodes Gyre cruise.

Science Advisory Board member Richard Bellerby presented his evaluation on the second day of the workshop. It is beyond the scope of this summary to present all of his comments; here it should be noted that he underscored the need for the better integration of the project and urged more frequent meetings among key participants with respect to

core issues: Joint WP workshops should take place and the development of a common language should be consciously done. He questioned the dominance of WP3 in certain respects as well as the relative weak focus on the biological pump aspect of the project. Natural scientists should also be integrated into the stakeholder workshops, something which he believes has not taken place thus far in the project. He also urged more learning from other projects. Stephanie Dutkiewicz, who joined the project meeting for the third time, noted an improvement in communication among the parts of the project compared to her previous view of the project and offered specific suggestions with respect to the scientific work.

3.4 Discussion

The 2014 meeting in Bergen was judged by project participants to be highly successful in meeting project needs. The meeting provided a constructive platform to discuss project-related matters and contributed substantially to the different work packages. In addition, Stephanie Dutkievicz and Louis Legendre agreed to participate in the project's Scientific Advisory Board (SAB).

The January 2015 meeting in Trondheim was the first milestone meeting, and occurred at a time when few results available and few deliverables had been submitted. It was however a critical meeting where the consortium was given the opportunity to reconnect and WP leaders could make more concrete plans with not only their own work package attendees, but also learn how to move towards integration with WP5, which was clearly demonstrated and discussed during the meeting. Practical things, like deadlines and basecamp and dissemination were more of a focus at this meeting. Stephanie Dutkievicz of the advisory board was in attendance, but there was not a lot of scientific feedback to contribute during this meeting.

The 2015 meeting in Kiel was a critical meeting taking place as it did in the middle of the project when the strengths and weaknesses of the work being carried out could be identified and dealt with. The meeting showed that good work is being carried out but also that there are areas that need to be addressed. In particular, the biological pump aspect of the project should receive more attention, the role and activities of WP 3 should be clarified and intensified, and the project's internal communications can be improved. The Ocean Certain leadership (at the project and work package levels) have taken these insights on board and are undertaking steps to address these issues.

3.5 Conclusion

The project meetings have been extremely useful and important for the project but have also revealed that more meetings should be taking place at the work package and task level. Communication among the social science and natural science aspects of the project can be improved. The project leadership is addressing the need for improved communication and cooperation among the various aspects of the project. The input from the advisory board has also been extremely useful and demonstrates the importance that such a board can have for a project such as Ocean Certain. More efforts should be made to involve board members who can advise on the social science side as well.

4. Summary and Update of D4.2

4.1 Introduction

The following is a summary of D4.2 in compliance with the stated goal of the deliverable as described in the DOW. It adds an update of topic in order to report on the furtherance of the work the deliverable reports on, which is important to the work of the Ocean Certain project.

4.2. Materials and Methods

This deliverable draws upon D4.2, other deliverables (D3.3 and D3.7) and update reports of the leaders of the Ocean Certain work packages.

4.3 Results: The Summary and Update of D4.2

4.3.1 Summary of D4.2

D4.2 was described as "Report of Meeting to receive advice and info from Key Stakeholders (KS) and KDTG: Report of meeting to receive advice and info from KS and KDTG for identification of key variables, drivers, indicators and knowledge integration."

Deliverable 4.2 was delivered 31 October 2014. At that time, a single, but important meeting had taken place and D4.2 made an extensive report on the nature and outcome of that meeting. Highlights of the report are summarized here. Details can be found in D4.2.

The World Ocean Council (WOC) is associated with the Ocean Certain project. It is a cross-sectoral initiative that focuses on "Corporate Social Responsibility" and has as its goal "to help promote collaboration and interaction between industries to address impacts, reduce conflicts and develop proactive ocean sustainability." At the end of September 2014 (28^{th}-30^{th}), the WOC held the "Business Form on Ocean Policy & Planning" in New York City. By arrangement with the WOC, the OC project held a voluntary workshop for members of the WOC who would be attending the Forum. OC members then attended much of the subsequent forum. The WOC was chosen both as an associate of the project and for this workshop because it brings together a wide array of businesses and others who have a major stake in the oceans and their management. At this Forum, businesses and representatives of a wide range of public bodies and organizations were present, including from the European Commissioner for Research Innovation and Science, the US National Oceanic and Atmospheric Administration, Canada's Department of Fisheries and Oceans and the United Nations. In hindsight it can be concluded that the backgrounds and needs of the participants of the WOC Business Forum were not completely consistent with the academic activities and problems studied in the OC project although a mutual interest was clearly expressed. For example, the marine sector has a strong interest in mapping underwater cables and pollution by harbored vessels, information which OC cannot provide. Nevertheless, the systems thinking approach and tools such as BBNs and FCMs have an added, generic value for the communications between scientists and the marine sector representatives.

The purpose of the workshop was both to inform members of the WOC community about the OC project, but also to listen to the concerns of business and of public bodies. The workshop started with a presentation of the OC project but then opened the floor to comments and responses from the attending audience. In addition, the workshop used participatory modelling techniques to construct a "mental map" of the socio-economic system in which participants live and then to select and evaluate the key determinants of the primary issue of concern for these stakeholders. The techniques of System Thinking (ST) and Bayesian Belief Networks (BBNs) used in the workshop are describe thoroughly in D4.2.

The results of the workshop were instructive. While the workshop began with a focus on the changes in the oceans that are likely to take place due to climate change and other stressors on the oceans (alterations in the foodweb, the function of the biological pump, sea surface temperature, acidification, water quality, water pollution and algal blooms) and other features of the social vulnerability model developed for D3.2 (general vulnerability model), workshop participants chose to focus on the importance of fishing activities and the availability of decision-making tools. The "decision-making process" became the priority focus of the BBN exercise, with participants selecting as key determinants of a good process: "knowledge", "governance" and "stakeholder ownership". Key factors that participants selected as impacting that trio of factors were: the involvement of industry and business, the community and science (knowledge); inclusive, accountable and transparent processes and political support (governance) and relevance, involvement and support (stakeholder ownership). The clear common theme in the discussion was that success in achieving sustainable policy was in good, inclusive and open management based on a broad knowledge base.

Partners NTNU, VITO, TALCA and UiB participated in setting up and running the workshop.

4.3.2. D4.2 Update

Since D4.2 was delivered, a series of stakeholder workshops have been held. These workshops are a part of the core work of WP 3, which focuses on socio-economic analysis, and which connects stakeholders and communities to the rest of the project. In addition, workshops with managers have also been held ("managers" are understood to be important stakeholders but are dealt with separately from "end users" in Ocean Certain). These workshops are designed to capture the core interests and concerns of stakeholders, thus ensuring that these are considered in the project's analyses.

Project members have also participated in other meetings that have included KS and KDTG. These are summarized in D4.3 (covered in section) and D4.4 (covered in section). Sections 5 and 6 serve as summaries and update on other contacts and meetings with KS and KDTG. This section focuses on workshops held with stakeholders and managers since D4.2 was delivered in October 2014.

The workshops were designed to focus on the concerns of three economic sectors which are especially connected to the oceans and which are therefore presumably most likely to be affected first and most directly by changes in the conditions of the oceans; the fishing, aquaculture and tourist industries. These economic sectors are located in local communities adjacent (to the extent possible) to the areas of the oceans in which the

other work of OC is being done. The three communities are: Çeşme, Turkey (a Mediterranean community), the Relancoví fjord area in Chile, and in the area around Tromsø, Norway (the city of Tromsø and the island community of Senja). WP3 has scheduled 2 rounds of workshops with all the economic sectors in all three communities.

All workshops to-date have employed the same methods:

Cognitive model building: Using a pre-selected suite of system drivers (climatic and non-climatic) as a starting point and with one of the researchers acting as the workshop facilitator, the participants identify those elements that these drivers have direct or indirect (through other elements) influence on in their system. The participants are then facilitated through the process of identifying available management options and connecting these into the system.

Bayesian belief network model building: Using the cognitive map, a priority management issue (i.e. an element within the map that the workshop participants believe is the most important issue for management in the context of their sector/location) is selected for further exploration through the BBN development process. Selection of this priority issue can be an element taken directly from the cognitive map or represent a 'theme' or aggregation of several elements captured within the map. It is important that its selection is a consensus choice amongst the participants, a process that might require negotiation between participants. Finally, it is also important that a clear and consistent understanding of the selected priority issue is achieved across all of the participants and the workshop facilitator. Starting with the priority issue, the workshop participants are lead through a structured process of adding primary- (elements that directly influence the priority node) and secondary- (elements that directly influence the primary elements and therefore indirectly influence the priority node) levels of causality to the priority issue. All elements within this 'causal tree' are converted to variables by discretizing them with two states each (a desirable and undesirable state). The number of parent1 variables for a child2 variable is constrained to a maximum of three this is a pragmatic approach to limiting the parameterization requirements for the CPTs that quantify the BBN (Richards et al., 2013). Here, it can be mentioned that a second technique for the extraction of stakeholder knowledge in the project will be used: Fuzzy Cognitive Mapping (FCM). Both BBNs and FCMs use mental maps to capture the causalities governing the system. The main difference are that FCMs impose instead of extract causality, can deal with feedback, and require less quantitative input. The development of FCMs and analysis of scenarios will be a joint exercise with the WP3 partners, and the outcomes will be used to integrate the social-economic aspects in the DSS model framework (see D4.9).

This method is described in detail elsewhere (see for examle Richards et al., 2013).

4.3.2.1 Norway

The first workshop in Norway was held in November 2014 This was a"door-opener" with representatives from fisheries, aquaculture, management and the scientific community. The function of the workshop was to make sure that the parameters of the workshop were suitable to the locality, rather than simply imposing a framework developed by "specialists" (in this case, Ocean Certain researchers). The result of the workshop was to change the starting point of the discussion for subsequent stakeholder/manager meetings in Norway to reflect the concerns of local people. The

new starting point (those factors identified by workshop participants as the primary "drivers" of their socio-economic system) for the workshops became: 1) aquaculture management laws, 2) carbon cycle in the ocean; 3) sea surface temperature; 4) coastal zone management; 5) water quality; 6) water pollution and 7) algal blooms. Note, however, that many of these factors do overlap with the "general vulnerability model" that was initially developed as guidance for the workshops.

This first workshop selected as its "primary issue" coastal zone management CZM). The three factors identified as most important in achieving good coastal zone management (a good state was identified as one in which conflict is minimized) were: 1) accessibility of knowledge; 2) a "resourceful" municipality; and 3) a "legitimate" CZM process. Accessibility of knowledge was in turn dependent upon: 1) Open and free research; 2) the dissemination of new and updated research; and 3) understandable data. A legitimate CZM process depends upon; 1) the inclusion of all stakeholders; 2) transparency and 3) "dynamic" continuity.

The second workshop was held at the end of June 2015. This workshop focused on the fishers living in the four small communities on the island of Senja in Troms country. This was a recommendation of the "door-opener" workshop and the decision was also influenced by the need to hold the workshop at a time of year when many other fishers were not available. Four fishermen attended the workshop; while this is a low number, these participants were selected and recommend as representative of the community. This group selected as their primary issue access to "new species or migratory paths". The three factors selected as most likely to influence this are: 1) updated management; 2) enough capital; and a large enough market. "Updated management" was in turn, in their understanding, most likely to be influenced by: 1) the power/influence of the fishing industry; 2) humble (as opposed to arrogant) researchers; and 3) available money. The presence of "Enough capital" would be impacted by: 1) a fishing industry with a good reputation; 2) a good ability to communicate; and 3) good "competence". A "large enough market" is thought to depend upon: 1) how much meat is produced; 2) the purchasing power of consumers; 3) marketing that "hits the sweet spot".

Sensitivity analysis then indicated that "capital" was the most influential factor in the "tree" of factors. Among the secondary factors, "ability to communicate well" was the most significant.

The third workshop took place at the end of June 2015 and focused on the aquaculture industry. This workshop also took place in Senja for reasons discussed above. After the ST session, participants of this workshop selected as their priority issue "Flexible and accessible area for aquaculture". The key determinants of achieving this were understood to be: 1) "updated communication of knowledge"; 2) a positive attitude about aquaculture on the part of the local population and 3) management with "political will". The key determinants for "updated communication of knowledge" were held to be: 1) positive media perception of aquaculture; 2) available resources; 3) "good knowledge about industry" as a part of "competence in the school system. The key determinants of "a positive attitude about aquaculture on the part of the local population" were held to be: 1) knowledgeable schools; 2) the sponsoring of local sports teams by aquaculture firms; and 3) the existence of aquaculture "show rooms". The key determinants of "management with 'political will' were held to be: 1) the degree of stakeholder

"prioritization"; 2) the degree to which stakeholder conflicts are minimized through cooperation; and 3) high competence.

The subsequent sensitivity analysis revealed that Stakeholders tended to agree that "management with 'political will'" was the most important factor in determining access to the area aquaculture requires. With respect to the secondary level, i.e, what the key determinant of "management with 'political will' are, there was some disagreement among participants, with the resolution of "stakeholder conflicts" and "stakeholder prioritization' both attracting selection as the key determinant. The resolution of stakeholder conflicts, however, was the most influential. The attitude of the local population was also important.

The fourth workshop, for the tourism industry, was held at the beginning of August 2015, with three representatives of "NHO Reiseliv", which is an organization for those working for the tourism industry in Norway. The three participants were selected by the leader of the organization as representative of the local chapter of the organization.

The tourist industry proved to be the least interested in marine conditions, and stressed that it is the "northern lights" that draw tourists to the area rather than marine resources of any kind. Non-marine activities such as dog-sledding and snowmobile trips were also mentioned as major "draws". This led participants to focus even less on marine conditions than did the other groups. This group selected "communication" of the weather/temperature conditions of the area as "stable, increasing and safe". Most likely to impact that were the following primary factors: 1) "a 'supplemental' long distance, fast train travel to Tromsø"; 2) the "political will to act" and 3) the existence of additional (supplemental) fast boats to Tromsø. Most likely to impact "a 'supplemental' long distance, fast train travel to Tromsø" are these factors: 1) whether politicians see this as necessary; 2) "market for train communication"; and 3) technological development. Most likely to impact the "political will to act" are these factors: 1) tourists that want to come to Tromsø; 2) making "holistic" development of the industry a priority; and 3) a political elite that is knowledgeable about the industry. Most likely to impact the "supplemental fast boat to Tromsø" are the following factors: 1) that politicians see the necessity of it; 2) technological development and 3) a market for such a boat. Clearly, the right weather conditions were critical, but "communication" – i.e., transportation—was the most important issue that might be impacted by management. Getting politicians on board was equally clearly a factor of major importance in ensuring that good transportation exists.

A fifth workshop was also held because additional stakeholders of importance were identified who did not fit into the three categories of the "fishing", "aquaculture" or "tourism" sectors. The two stakeholders who attended (of the seven who were originally scheduled to attend) represented the industry that supplies services to both the fishing and aquaculture sectors. Their primary issue was "the continued existence of their community". The three factors selected as most likely to impact this are": 1)"predicable and long-term management of the resource base"; 2) the nature of the welfare system (whether it "follows the times" or remains "centralized like today" and 3) accessible public resources. The factors that were in turn held to be most likely to influence the "predicable and long-term management of the resource base" are: 1) whether Northern Norway was represented in the national government; 2) positive and synergistic cooperation across industry; 3) industry involvement in research. The factors held most

likely to impact a suitable welfare system are: 1) whether schools are given political priority; 2) a smaller and cheaper bureaucracy; and 3) realistic ambitions. The factors held most likely to impact "accessible public resources" are: 1) a flexible public support system; 2) technology (available and reliable) and 3) taxes (sustainable, adjustable).

The sensitivity analysis revealed that participants held the resource base to be the most influential factors, followed by (in order) public resources and the welfare system. Of the secondary factors, "local schools" proved to be the most influential factors, followed by "national government", and "cooperation across industries".

The sixth workshop was for the government managers of the fisheries and aquaculture sectors. These participants selected "management expertise" as their priority issue (that is, whether such expertise was "national and complete" or "fragmented"). The three factors they judged to have the most potential impact on this priority issue are: 1) "industry understanding of a holistic decision support tool", 2) "stable working conditions in management" and 3) "fair and predictable framework and regulations". The factors they held to be most likely to impact "industry understanding of a holistic decision support tool" are: 1) inclusive dialogue, 2) a shared knowledge base and 3) a shared computer system. The factors held to be most likely to impact "fair and predictable framework and regulations" are: 1) a "merged" inspection agency model; 2) managers who are "one step ahead" and 3) the existence of "reasonable" decisions and regulations. The factors they held to be most likely to impact "stable working conditions in management" are: 1) income level; 2) the status associated with employment; and 3) "updated instructions."

A sensitivity analysis was also performed, and these results are detailed in the deliverable for WP3 – D3.6.

4.3.2.2. Chile

The first workshop in Chile was for local fishermen. Participants in this workshop selected "productive capacity" as their priority issue. The three factors that were most likely to impact this factor were held to be: 1) "fish mortality"; 2) the condition of "natural spawning banks"; and 3) the "quality of the species". The factors most likely to have the most impact on "mortality" were held to be: 1) oxygen in the water; 2) water temperature; and 3) the abundance of prey. The factors held to be most likely to impact the condition of the "natural spawning banks" were: 1) reproductive capacity; 2) prey (plankton) and the "renewal" of natural spawning banks. The factors held to be important with respect to the "quality of the species" are: 1) degree of contamination from salmon (aquaculture); 2) the presence of prey species; and 3) the presence of residual contamination.

The second workshop in Chile was held for members of the local community. These participants selected "tourism" as their priority issue. The three factors they chose as having the most impact on tourism are: 1) hotel capacity; 2) tourist attractions, and 3) publicity for tourism. The three factors that were held to be most important with respect to hotel capacity are: 1) development funds; 2) easy access to such funds; and 3) entrepreneurship. The three factors that were held as most likely to impact "tourist attractions" are: 1) support from the authorities; 2) community organization and 3)

training with respect to tourism. The three factors that were held to be most likely to impact "publicity" were held to be: 1) information; 2) web pages and 3) tourist services.

In the workshop for Chilean managers, participants selected "vulnerability of coastal communities as their as their priority issue. The following factors were held to be most important with respect to that issue were: 1) "sustainability"; 2) research; and 3) Governance. The three factors they held to most impact "sustainability" are: 1) "resilience"; 2) "carrying capacity" and 3) "productive activity. The three factors most likely to impact "research" are: 1) financial resources; 2) focus and 3) capacity. The three factors held to be most likely to impact "governance" are: 1) legal framework; 2) coordinated institutions and 3) the constructive participation of users (ie, resource users)

4.3.2.3. Turkey

The first workshop in Turkey focused on the aquaculture sector. Participants in this workshop selected as their priority issue "increase in the cost of production." The factors held to be most likely to impact this factor are: 1) improvements in raw materials for feed and feed consumption; 2) internationally respected governmental subventions and promotions; and 3) subventions for Research and Development. The factors that were thought to be of most importance to "improvements in raw materials for feed and feed consumption" are: 1) substitutions (fishmeal) for raw materials for feed; 2) revisions in legislation about feed, and 3) improvement in feed digestibility. The factors that were held to be of most importance with respect to "internationally respected governmental subventions and promotions" are: 1) efficient lobbying; 2) improvement in the organization of the sector; and 3) "reasonable financial supports". The factors held to be of most importance with respect to "subventions for Research and Development" are 1) Horizon 2020; 2) collaboration between industry and universities and 3) research projects for regional development.

The second workshop in Turkey focused on the fishermen's cooperatives. Participants in this sector selected "potential production sites" as their priority issue. The factors they thought would most likely impact that are: 1) Marine spatial planning; 2) expertise on carrying capacity; and 3) improvement in consideration of land-based logistics. The factors they held to be most likely to impact "Marine spatial planning" are: 1) stakeholder participation; 2) data availability and 3) integration of central and local administration. The factors they held to be most likely to impact "expertise on carrying capacity" were: 1) data availability; 2) standard models and procedures and 3) control and surveillance: The factors they judged to be most likely to impact "improvement in consideration of land-based logistics" are: 1) logistic operations; 2) an efficient legal framework and 3) the provision of correct infrastructure.

Other workshops that were to be held have been delayed and may be cancelled; if cancelled, alternative strategies will be arranged and reported on.

4.4 Discussion

The workshops have been extremely useful in helping Ocean Certain researchers understand how local stakeholders navigate their socio-ecological systems. It is clear, however, that local stakeholders are frequently not interested in the same issues as are Ocean Certain researchers. However, the function of the workshops is to understand the

adaptive capacity of local communities, not to tell local people what they should be concerned about. While the workshops can serve important educational purposes, that is not their primary function. Instead, it is to find out what local people (including local authorities) perceive to be important to them in securing their livelihoods and maintaining their societies. Understanding what local people find important can help policy makers and scientists find better points of contact with people in local communities, which can help policy makers address issues that concern them, even if those issues fall outside the interest and knowledge of scientific experts.

The schedule imposed by the needs of research and the integrity of an integrated research plan have not always fit the situations and needs of stakeholders. Workshops in Turkey have proved particularly difficult for political and economic reasons. At the second project workshop in Kiel, a strategy was developed to find a substitute for the workshops that had been planned but which have not yet been carried out. The project will soon begin with its scheduled second round of workshops and it is important that issues surrounding workshops are resolved quickly

4.2 Conclusion

This part of the deliverable has met the objectives set for it: it has summarized previous reports and has gone beyond the deliverable description by also updating the information presented in D 4.2. This report provides a useful overview of what the project has done and also suggests what it should do with respect to meetings with KSs and KTDGs.

5. Summary and update of D4.3

5.1 Introduction

D4.3 is described in the DOW as "Report of meeting with other projects focusing on coupling FW and related biogeochemistry to socio-economy for identification of key variables, drivers, indicators and knowledge integration." The section is summary of that previous report as well as an update on the work that D4.3 reported on.

5.2 Materials and Methods

The summary draws upon D4.3, which was completed 14 August 2015. It is supplemented by more recent reporting from WP leaders when relevant.

5.3 Results – The Summary and the Update

5.3.1 The Summary

D4.3 reported collaboration and/or meeting with the following projects:

1. ICE-ARC: OC collaboration with ICE-ARC takes place on a serious of levels and via various pathways. OC partner GEOMAR collaborates with the Greenland Institute of Natural Resources (GINR) which in turn is a partner institution in ICE-ARC (Ice, Climate, Economics – Arctic Research on Change) an EU 7th FP project. NTNU collaborates with ICE-ARC at the managerial and project levels. Collaboration in this setting means cooperative research, the sharing of data and results and attendance wat

each other's meetings. In addition, SINTEF (now associated with OC as a third-party, and with NTNU has many links) collaborated on a project application for the Norwegian Research Council.

2. COMPARE (Impact of climate variability on zooplankton community structure and function in estuarine ecosystems): This project is funded by the Portuguese national funding agency. OC interaction with COMPARE occurs via OC partner GEOMAR. This has led to collaborative writing efforts. One article had been submitted for a second review and a second article was planned at the time that D4.3 was written.

3. MED-JELLYRISK (funded by the ENPI-CBC MED, the new European Neighbourhood Policy, Cross-border Cooperation in the Mediterranean Sea): OC partner GEOMAR closely cooperates with the program. At the time D4.3 was written, one joint manuscript was underway.

4. The Institute of Marine Research, Swedish University of Agricultural Sciences: This institution (in particular, Professor Michele Casini, responsible for the Swedish component of the Baltic International Trawl Survey headed by ICES) is also working with GEOMAR. The institution has made available data on the Baltic Sea pelagic food web.

5. Taiwan: OC partner GEOMAR also collaborates with the National Taiwan Ocean University (NTOU). Professor Jiang-Shiou Hwang made available long term food web data collected in the East China Sea and this data has been presented in the OC General Assembly as information about a complementary ecosystem to the target sites (Pagagonia, the Arctic and the Mediterranean Sea). Activities taking place at the time D4.3 was written included cooperation with respect to data mining focussing on the strength of climate influence on key components of the food web and obtaining a global quantitative picture of the interactions among climate, hydrology and the food web. One joint manuscript had been sent to review and a second was planned at the time D4.3 was written.

6. BIOACID II (Biological Aspects of Ocean Acidification): This project is funded by the German Federal Ministry of Education and Research. Experimental project from this project were to be included in a general data set to be supplied to OC's WP 2 (Quantification of Impacts and Feedbacks).

7. CINTERA: (A cross-disciplinary integrated eco-system eutrophication research and management approach): This project was funded by the Norwegian Research Council. This project laid the ground work for the cooperation of several members of the OC project and also served to develop participatory workshop methodology used in OC:

8. WGCOMEDA (ICES Working Group on Comparative Analysis between European Atlantic and Mediterranean marine ecosystems to move towards and Ecosystem-based Approach to Fisheries): This is an ICES working group in which members of OC participate.

9. A.I. CLIMATE: This project was sponsored by the Norwegian Research Council. In this project, an "app" was created for use in stakeholder workshops. It was used in CINTERA (see above) and subsequently in OCEAN CERTAIN.

10. SPICOSA (Science and Policy Integration for Coastal System Assessment): Under the auspices of this 6th FP EU project, the modelling principles (de Kok et al., 2015) and software used in this project will be used by WP5 for the design of the DSS.

11. Blueprint for a System Dynamics Model of Flanders (2015): OCEAN CERTAIN builds on the models developed in this project, which was funded by the Flemish Environment Agency (VMM-MIRA). The blueprint was completed by the end of 2015 and is the first attempt to model the 'System Flanders' in an integrated way, combining demography, economics, environment and climate change. The experience obtained with the design and implementation of this complex model are invaluable for the DSS development in OC.

12. DEVOTES (DEVelopment Of innovative Tools for understanding marine biodiversity and assessing good Environmental Status): This program is funded in part by the EU's 7th FP. OC partner DEU-IMST is also a partner in this project. The two project share information connected with human pressures and climate change.

13. MicroPolar (μP: Processes and Players in Arctic Marine Pelagic Food Webs – Biogeochemistry, Environment and Climate Change): OC partner the University of Bergen (UiB) is a partner in MicroPolar. MicroPolar worked together with Ocean Certain to conduct a joint experiment in the Marine Lab in NyÅlesund/Kings Bay in June-July 2015.

14. "Fisheries and Environmental Integration": This is a DEFRA UK Government project which of which CEFAS is a member. OC hand this project havs similar areas of interest and cooperation takes place through CEFAS:

5.3.2. Update of D4.3

Partner VITO updated aspects of numbers 10 and 11, above. Partner CEFAS reported participation in a workshop held by the National Engineering Research Council of the UK, entitled "Changing Arctic Ocean Announcement of Opportunity. This took place on 5 November 2015. No other updates were received by the time this deliverable was ompleted.

6. Summary of D4.4

6.1 Introduction

The Deliverable 4.4 is entitled "Report of meeting on interaction with Target Audience (Key Stakeholders and KDTG)." In order to understand the meaning of the report, it is essential to define these terms. Though there are some overlaps, Ocean Certain has divided its stakeholder efforts into Key Stakeholders and Key Dissemination Target Groups. Their definitions are as follows:

Key Stakeholders (KS) are comprised of experts from Member States Competent Authorities such as:
European Environment Agency (EEA);

a) Regional Sea Commissions (e.g. UNEP-MAP, HELCOM, OSPAR, CPPS);
b) NGOs; and
c) other relevant socio-economic groups related to the activities to performed in WPs 3, 4 and 5.

Key Dissemination Target Groups (KDTG) is a category stakeholders that is composed of all interested societal groups such as

a) scientists;
b) regional authorities;
c) environmental managers;
d) regulators (Members States and EU Level);
e) NGOs (e.g., European Climate Foundation "ECF"); and
f) the general public.

We consider the following dissemination tools for the purposes of reaching out to KS and KDTG:

a) press releases,
b) pamphlets,
c) fact sheets,
d) posters,
e) scientific papers and/or reports published,
f) participation in national and international scientific conferences, including
g) joint workshops/sessions with other projects.

6.2. Summary of dissemination activities, listed by work package:

WP1

1. **20. Juni 2014; Bergen, Norway**
   Erwin Marsi and Pinar Öztürk,
   "Text Mining & Literature based Knowledge Discovery briefing",
   Ocean Certain WP4 Consilience meeting, Bergen 19-20 June 2014

2. **June 24, 2015: London, UK**
   Pinar Öztürk, Erwin Marsi and Natalia Manola "Can Computational Knowledge Discovery Tools Speed up Scientific Discovery?", LIBER Annual Conference 2015, Session 3: Data Exploitation and Reuse.
   https://www.dropbox.com/s/d5a22v6enmlliu9/Liber-Presentation-London2015.pdf?dl=0

3. **September 19, 2015: Lisbon, Portugal**
   Erwin Marsi and Pinar Öztürk,
   "Extraction and generalisation of variables from scientific publications", Empirical Methods in Natural Language Processing (EMNLP2015).

https://www.dropbox.com/s/lnd43zxfxrlesq8/emnlp15_em_po_poster.pdf?dl=0

WP2

1. **23-28 February 2014, Honolulu, Hawaii, USA**
   "Phytoplankton populations response to iron-siderophore combinations in Patagonian fjords". Iriarte JL, Ardelan M, Cuevas LA, González HE, Sánchez N. Ocean Science Meeting 2014.

2. **23-28 February 2014, Honolulu, Hawaii, USA**
   "Effect of ammonium addition on the microbial food web structure and community composition of the osmotrophs in the Comau Fjord in southern Chile". Olsen LM, Klaudia Hernández, Ardelan MV, Iriarte JL, Sanchez N, Gonzalez HE, Tokle N, Olsen Y. Ocean Sciences Meeting 2014.
   http://www.eposters.net/pdfs/effect-of-ammonium-addition-on-the-microbial-food-web-structure-and-community-composition-of-the.pdf

3. **13-14 March 2014**
   "Plankton dynamics in Patagonian fjords: The possible impacts of global change on food webs and biological pump in an uncertain ocean". H.E. González, J.L. Iriarte, M. V. Ardelan, L.A. Cuevas, N. Sanchez, N. Silva, L. Castro & G. Daneri. WORKSHOP LIA MORFUN. "Functional and community response to environmental changes in marine environments: assessing the problem from a pluridisciplinary perspective" Universidad de Concepcion, Chile.

4. **20 June 2014, Bergen, Norway,**
   "Ocean-Certain Lower trophic level modelling "
   Sonja van Leeuwen, CEFAS
   Ocean Certain WP4 Consilience meeting, Bergen 19-20 June 2014

5. **20 June 2014, Bergen, Norway,**
   "Ocean-Certain WP2 Modelling Overview "
   Robert Thorpe, CEFAS
   Ocean Certain WP4 Consilience meeting, Bergen 19-20 June 2014

6. **23-27 June 2014, Bergen, Norway,**
   "Chilean Patagonian fjords: The possible impacts of global change on plankton food webs and biological pump in an uncertain ocean." H.E. González, J.L. Iriarte, M. V. Ardelan, L.A. Cuevas, N. Sanchez, N. Silva, L. Castro, G. Daneri & Y.Olsen. IMBER Symposium

7. **23-27 June 2014, Bergen, Norway,**
   "Ocean Food web Patrol – Climate Effects: Reducing Targeted Uncertainties with an Integrated Network (OCEAN-CERTAIN)" Ardelan M.V., Sommer U., Thorpe

R., Bailey[c] J. , Thingstad T.F., de Kok, J-L., BIzsel. K.C. Öztürk P., Marsi E., Bratbak G., Turner D., Hoffmann L., Besiktepe S., Chiggiato J., González H.E., Iriarte J. L. Vadstein O., Tiller R. Richards R.G. Salgado H. Engelen G., Olsen Y. IMBER Symposium.

8. **4- 14 November 2014. Barcelona, Spain.**
   "Carbon Fluxes Of Two Pelagic Communities In The North Chilean Patagonian Coastal System". Pavés, H.J., González H.E., Christensen V. Ecopath 30 years "Modelling ecosystem dynamics – beyond boundaries with EwE". In: Ecopath 30 Years Conference Proceedings: Extended Abstracts. Fisheries Centre Research Reports (UBC) 2014 Volume 22 Number 3: 198-200.

9. **4- 14 November 2014. Barcelona, Spain.**
   "Trophic Impact and Keystone Species In Two Pelagic Communities In The North Chilean Patagonian Coastal System". Pavés, H.J., González H.E., Christensen V. Ecopath 30 years "Modelling ecosystem dynamics – beyond boundaries with EwE". In: Ecopath 30 Years Conference Proceedings: Extended Abstracts. Fisheries Centre Research Reports (UBC) 2014 Volume 22 Number 3: 178-180.

10. **5 November 2015**
    Changing Arctic Ocean Announcement of Opportunity: NERC Workshop; Jurys Inn, 245 Board Street, Birmingham, B1 2HQ UK; for a NERC audience (National Engineering Research Council, UK).

WP3

1. **June 21, 2014: Bergen, Norway**
   Systems Thinking Bayesian Belief Network Results from Amsterdam 2013
   Rachel Tiller, NTNU
   Ocean Certain WP4 Consilience meeting, Bergen 19-20 June 2014

2. **June 21, 2014: Bergen, Norway**
   WP3 Socio-economic analysis – Our Tasks and Links to OC Project
   Jennifer Bailey, NTNU
   Ocean Certain WP4 Consilience meeting, Bergen 19-20 June 2014

3. **26-27 March 2015: Trondheim, Norway**
   Playing with Climate Change? Uncovering strategic behavior using stakeholder workshops and Bayesian Belief Networks
   Hugo Salgado, Talca
   GameFish workshop, Trondheim

4. **26-27 March 2015: Trondheim, Norway**
   Introduction to "Game Fish" – A Seminar on Choice in the Fisheries Sector
   Jennifer Bailey, NTNU
   GameFish workshop, Trondheim

5. **June 26th, 2015: Amsterdam, Netherlands**
   Using local knowledge to improve modelling of environmental politics
   Rachel Tiller, Russell Richards and Jean-Luc De Kok
   Mare Conference: People and the Sea VIII: Geopolitics of the Oceans – panel entitled: "Knowledge Production for Governance".

6. **September 24th 2015, Trondheim Norway**
   Interdisciplinary Research between the Social Sciences and Natural Sciences in Sustainability: Project experience and theoretical ambitions.
   Jennifer Bailey, NTNU.

WP5

1. **June 19th 2014, Bergen Norway**
   WP5 – System conceptualisation & functional design of DSS
   Jean-Luc de Kok and Lieve Decorte
   Ocean Certain WP4 Consilience meeting, Bergen 19-20 June 2014

2. **September 24th 2014, New York City, USA**
   Decision Support – Matching Science and Policy
   WOC Business forum
   Jean-Luc De Kok

3. **August 25-26, 2015: Amsterdam, Netherlands**
   A system dynamics model for the DSS
   Jean-Luc De Kok
   WP5 task 5.3 and 5.4 – consilience meeting

7. Dissemination & exploitation

This deliverable has not been published, and no future publication is planned.

This deliverable can be used by OC project researchers to monitor their own targets with respect to project collaboration and for general information.

Appendix A: List of models and other deliverables and milestones and their status

REFERENCES

de Kok, J. L., Engelen, G., and Maes, J. 2015. Functional design of reusable model components for environmental simulation -- A case study for integrated coastal zone management. Environmental Modelling and Software, 68: 42-54.

Richards, R., Sano, M., Roiko, A., Carter, R. W., Bussey, M., Matthews, J., and Smith, T. F. 2013. Bayesian Belief Modeling of Climate Change Impacts for Informing Regional Adaptation Options. Environmental Modelling and Software, 44: 113-121.

APPENDIX : List of models, databases and other related milestones and deliverables and their status

MS nr.	MS Name	WP	Delivery Month	New Delivery Month	Comments
46	Stakeholder mapping and database operational	6	4		Database operational
1	Workshop on data screening,aggregation and reconstruction	1	6		Report to Ocean Certain Community
20	Meeting for designing and scheduling the experiments and field study	2	6		Minutes of meeting
27	Determinantion of key search concepts of LBKD in socio-economy	3	8		Report
5	Annotated text corpora (resource)	1	9		Resources
38	Development of GT application to BBN	3	9		Development of GT application to BBN 3 9 Report and application in case studies
28	Construction of initial general model of socio-economic vulnerability	3	10		Model
25	Start of the Eastern Mediterranean Field Study	2	12	29	ships log entry
26	Start of the Western Mediterranean Field Study	2	12	22	ships log entry
21	Start of the Patagonian Experiment	2	13		Field log active
2	User interface for Data Mining	1	15		Software
6	Domain ontologies (resource)	1	15		Resources
41	DSS Qualitative Design ®	5	18		Report
22	Start of the Arctic Experiment	2	19		Field log active
3	DM: Statistical analysis of regional FW complete	1	20	28	Data and graphs for manuscript
31	Completion of ST/BBN end-user workshops	3	21		Report (description to be changed)

32	Completion of the three ST/BBN managers' workshops	3	21	29	Report
39	Intermediate stage integration between natural sciences and socio-economics under different scenario	4	23	27	Integrative Summary Report of D4.1-D4.5 completed
10	Mathematical model, quantifying the microbial component of the pelagic food web.	2	24		Model available
11	Coupled lower and higher level trophic models capable of integrating the ecosystem impacts of divers	2	24		Model available
14	Calculations of key species concentrations expressed as functions of temperature, salinity and other	2	24		Dataset available
15	Time series of key species concentrations from observational data relating to fieldwork and mesocosy	2	24		Dataset available
16	Provision of data on organic complexation of metals in seawater under changing physical conditions (	2	24		Dataset available
17	Provision of data to enable construction of calibrated/validated coupled models for the case study a	2	24		Dataset available
18	Provison of data from fieldwork at sea to enable validation/calibration of ecosystem models	2	24		Report on dataset
19	Summary of observed changes in physical ocean and foodweb properties.	2	24		Summary Report
30	Completion of national vulnerability surveys	3	24		Report
33	Completion of media mining	3	24	28	Integrated in Models and Reports
34	Incorporation of climate skepticism and cohesion/division variables into general and local models	3	24	28	Incorporation into Model