



EU FP7 Project CREAM
Coordinating research in support to application of
EAF (Ecosystem Approach to Fisheries) and
management advice in the Mediterranean and Black
Seas

Deliverable 6.2

Executive Report of the final meeting including the
discussion regarding how to build an operational
scientific network for implementing EAF in the
Mediterranean and Black Sea

Start date of project: 01/05/2011 Duration: 36 months

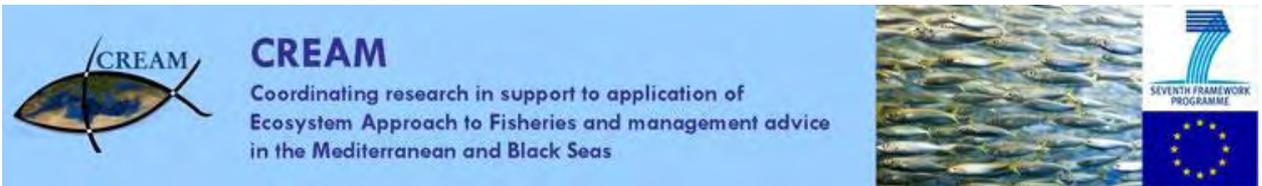
Due date of deliverable: 30/11/2013

Lead partner for deliverable: IRD (France)

WP leader: Philippe Cury

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1 Summary of the report

This report is the main outcome of the second workshop of WP6 entitled “Building an operational scientific network for implementing EAF in the Mediterranean and Black Sea” held in Split (Croatia) in October 2013.

The workshop was organized by Work-Package 6 of the coordination action CREAM (“Coordinating Research in Support to Application of Ecosystem Approach to Fisheries and Management Advice in the Mediterranean and Black Seas”), funded by the EU Seventh Framework Programme.

The main aim of the workshop was to discuss how to build an operational scientific network for implementing EAF in the Mediterranean and Black Sea. Here we summarize the discussions and conclusions of the workshop, and we present the recommendations and future initiatives proposed to advance EAF in the Mediterranean and Black Seas region.

This workshop followed a previous workshop in 2012 entitled “Scientific Strategy for a Global Approach to Promote Regional Ecosystem-based Approach to Fisheries (EAF) in the Mediterranean and Black Seas” that was held in Sète (France) in July 2012. This first workshop aimed at discussing what is needed to advance on a robust scientific strategy to promote EAF in the Mediterranean and Black Seas.

2 Agenda of WP6 2nd Workshop

The second workshop of WP6 entitled “Building an operational scientific network for implementing EAF in the Mediterranean and Black Sea” and held in Split (Croatia) in October 2013 was organised as a two days meeting.

A total of 22 participants from CREAM attended the workshop. They represented CREAM partners from Spain, Greece, Italy, France, Morocco, Tunis, Rumania, Bulgaria, Russia, Ukraine, Egypt, Croatia, Malta and Cyprus (**Figure 1**). The list of participants to the workshop can be found in Annex 1.

The agenda of the workshop, including main presentations and speakers was as follows:

8th of October 2013
09.00 - Welcome to participants and domestic arrangements – <i>Dunixi Gabiña</i>



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in the Mediterranean and Black Seas



09.10 - Presentation of the workshop – <i>Pilippe Cury</i>
09.30 - Summary of 1st WP6 workshop: recommendations for EAF – <i>Marta Coll</i>
10.00 - How can we move from single fish stocks towards EAF in a smoothed manner – <i>Philippe Cury</i>
Discussion
11.00 - Coffee break
11.30 - CREAM WP contributions to build an operational EAF network
Contributions from WP2 – CIBM leader or representative – <i>Paolo Sartor</i>
Contributions from WP3 – IFREMER leader or representative – <i>Joel Vigneau</i>
Contributions from WP4 – CSIC leader or representative – <i>Jordi Lleonart</i>
13.00 - Lunch
14.30 - Implementing EAF in South Africa: an overview – <i>Astrid Jarre</i>
Discussion
15.30 - Examples of co-management in the Catalan Sea – <i>Jordi Lleonart</i>
16.00 - Summary of WP6 EAF current implementation form – <i>Marta Coll</i>
16.30 - 18.00 - Discussion: what needs to be implemented in the Mediterranean and Black Sea?

9th of October 2013

09.00 - Recap from day 1 – <i>Philippe Cury & Marta Coll</i>
09.30 - Implementing the move from single fisheries to EAF in South Africa – <i>Astrid Jarre</i>
Discussion: applicability and limitations for the Mediterranean and Black Sea



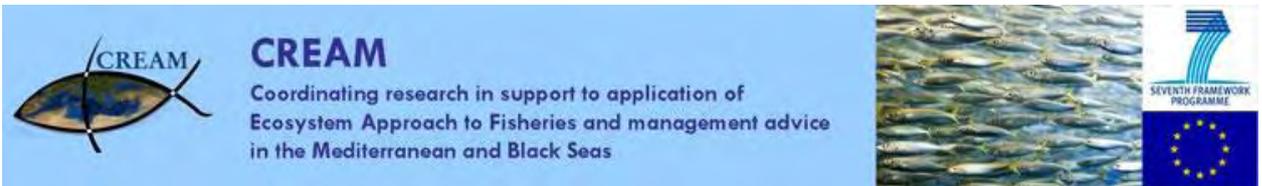
10.30 - On-going and future EAF initiatives in the Mediterranean and Black Sea:
Developing and communicating indicators: IndiSeas and MSFD – <i>Marta Coll</i>
Discussion: how countries can contribute to IndiSeas?
Scenario building: what should we do? – <i>Philippe Cury</i>
Discussion: a global Mediterranean and Black Sea strategy to develop scenarios in a global change context
11.00 - Coffee break
11.30 - Discussion: Building the operational network EMBASEAS
Contributions by country: what could be implemented?
First EMBASEAS Newsletter: Content and funding
CREAM+ - funding opportunities and projects
Others and open discussion
13.00 – Lunch
(Departure after lunch)

3 Meeting minutes of WP6 2nd Workshop

During the meeting a series of presentations were followed by sufficient time for discussion between participants. Below a summary of the discussions is presented.

Dr. Astrid Jarre, from the Ma-Re Institute of University of Cape Town in South Africa, and with a great expertise on the implementation of EAF in South Africa, was able to join the workshop and presented informative contributions that provided “food for thought” for the group to fuel the discussions.

In Annex 2 we present the meeting minutes of the workshop, including summaries of each section and individual contributions of participants to the workshop. The presentations given through the workshop are also available with this report.



4 Deliverables of the workshop

As a result of this workshop, the following deliverables were produced:

Deliverable 1: Minute notes and presentations compiled during the workshop that inform on key issues to take into account to move forward the operational EAF in the Mediterranean and Black Sea region (See Annex 2). During the discussion, the development of the first EMBASEAS newsletter was discussed. This newsletter should help outreach CREAM results and future collaborations of the network.

Deliverable 2: Operational EAF tables by country. Before, during and after the workshop, each CREAM participant compiled a table on relevant information regarding operational EAF. In each table, and by main fisheries, essential information on current initiatives towards EAF was summarized. The final version of the tables available by the time this report needed to be produced are provided in Annex 3.

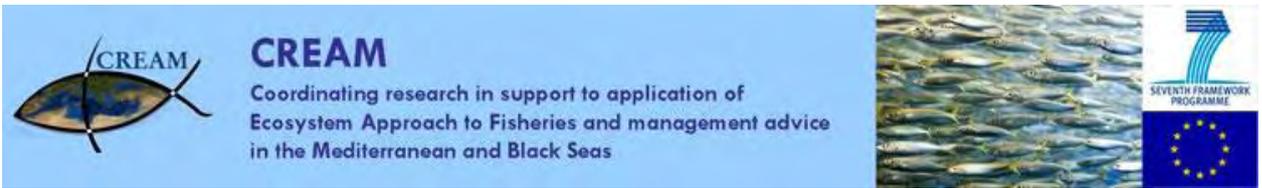
During the workshop it was also considered the suitability to prepare a second scientific peer-reviewed paper informing about the outcomes of the workshop. The group decided to decide on this publication after all the Operational EAF tables had been revised and analysed.

In addition, and as a result of the first WP6 workshop, and as a public outcome of the first workshop, a peer-review publication was published in *Reviews in Fish Biology and Fisheries* (Annex 4).

5 EMBASEAS: a new scientific network to promote EAF in the Mediterranean and Black Seas

As a result of the discussion during this workshop and the previous one, it was clear to the group that a visionary and coordinated scientific network to promote operational EAF initiatives, created by the scientific community following a bottom-up approach in the Mediterranean and Black Seas, is needed. The proposed network, named EMBASEAS (the network aiming at being an ambassador to promote EAF in the Mediterranean and Black Seas), should add value to the current situation. Discussion on how to envisage such a scientific network, and who would be key players in the network, followed.

The network should be independent and individually based, but with clear links to regional bodies such as GFCM, FAO, the EU Joint Research Centre, as well as with non-governmental organizations promoting EAF. Key players of the network should be those interested scientists of different disciplines, participating as independent individuals, rather than as national or institutional representatives. The network should have strong links with local and regional organizations involved in EAF initiatives, and

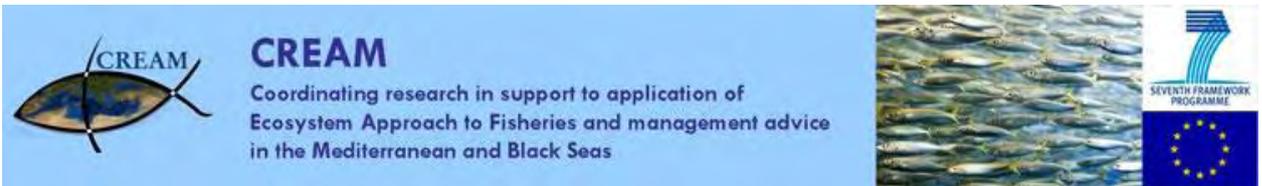


seek the involvement of other stakeholders such as professional and recreational fishers, other users of the marine environment, naturalists, local experts, and policy makers.

The discussion of the group was also on how to build such a network with the consolidation of a regional scientific vision, with a clear scientific strategy, and plan (including a diversified toolbox), to promote the rendering the scientific aspect of EAF in the region operational (. Such a network should have the capability to define a clear, strong, and shared vision for EAF in the region. This could be achieved by gaining a broader view on the EAF implementation strategy, in particular by keeping track of what needs to be pursued to ultimately ensure a good status of the Mediterranean and Black Sea ecosystems. The network should identify key objectives and topics, and establish a road map of coordinated actions to accomplish them. The scientific network should also aim to promote the coordination of scientific activities, to date local or fragmented, in an efficient way, using local initiatives but contributing to the regional vision. This would bridge different geographical scales and promote the use of innovative tools such as models, indicators, scenarios, and other integrative tools. The methodology and manner of linking the initiatives from the local to the regional level can be a considerable challenge for the network.

In the short term, the network could start as a coordinated action of scientists to promote the scientific approach of EAF by coordinating activities, and improving the capacity of developing science for EAF in the region. The network should promote concrete scientific actions considering available data, tools, and initiatives at different geographic scales to improve process-based ecological knowledge in the area. The group identified several novel topics and initiatives with added value to the network (e.g., the ecology and impact NIS, cumulative impacts, the impacts of specific fishing gear). One of the first tasks of a coordinated scientific initiative would be to identify, document, and promote successful case studies in the region. This could help establish bridges between scientists, policy makers, and other users of the sea, in a transversal way dealing with the best territorial management unit (Figure 2). Other potential immediate activities include the documentation of initiatives, the sharing of already available information and scientific capabilities, the improvement of the training capabilities, and the capacity building of the scientific community and stakeholders, and the establishment of mechanisms to disseminate knowledge to end users.

In the medium-long term, the network should aim at promoting the implementation of an EAF (from the local to the regional level), and providing scientific advice on EAF to inform adaptive management in the region, where at present only stock assessment advice is taken into account (if at all). Thus, the ultimate goal of the network should be to link management advice to good scientific information, thus creating a knowledge-based management approach. By establishing successful liaisons with local and regional organizations and initiatives, needing scientific advice to promote EAF, the scientific network could contribute to the management of territorial units and provide a stable platform to share successful stories, resources, ideas, and expertise. The network could facilitate the discussion of common problems and possible solutions with local



applicability in a coordinated manner and under a common regional vision and strategy. Scientists involved in early practices of EAF could find in the network a suitable platform for networking among themselves to learn tactics on how to implement EAF at the local level, while also building a strategy at regional level. Such a network would face the challenge of delivering and coordinating at the regional strategic level what can be effectively done at the local tactical level, while influencing the decision making process at different geographic scales (Figure 2). The ultimate goal should be to link management advice to good scientific information and transform policy strategies and goals into operational objectives. Another important role of the network would be to anticipate the needs of stakeholders – both local communities and managers - and the problems that may occur in the future.

The network should also be used as an opportunity to anticipate the future and invest in tools such as generic and validated models and indicators. In this manner scientists would be able to contribute to initiatives and calls for predicting the dynamics of the ocean, and building scenarios of socio-ecological systems (in cooperation with initiatives such as IPBES). Indeed, it is already clear that in a few years, scientists will have to provide scientific advice on possible future scenarios and the available alternatives to avoid adverse changes in ecosystems and ecosystem services, integrating data on ecology, climate, socioeconomics, and demographics. These tools will enable us to investigate the future of the region, and analyse how to reconcile long-term objectives with local constraints (exploring trade-offs with a suite of socioeconomic and ecological objectives) following the successful initiative of the Intergovernmental Panel on Climate Change. There is thus a clear need to start building on the capability to integrate, modify, improve, innovate, fit and calibrate complex models and frameworks, which will require the promotion of data integration, harmonization, and accessibility. The scientific community has to advance towards can build a roadmap of coordinated actions to develop a common strategy and advance towards the future; and the EMBASEAS network may be a good opportunity to achieve this.

The group decided to develop a series of immediate activities to promote EMBASEAS:

- (i) The distribution of workshop material and discussions using scientific literature, and the CREAM website (<http://www.cream-fp7.eu/>). This distribution should be kept after the end of CREAM initiative;
- (ii) The development of a newsletter to promote the activities of the network, and inform EAF initiatives in the Mediterranean and Black Seas region;
- (iii) The design of a website to present and promote EMBASEAS;
- (iv) The coordination of efforts to answer to future research calls at the European level to fully implement the scientific network envisaged by the group;

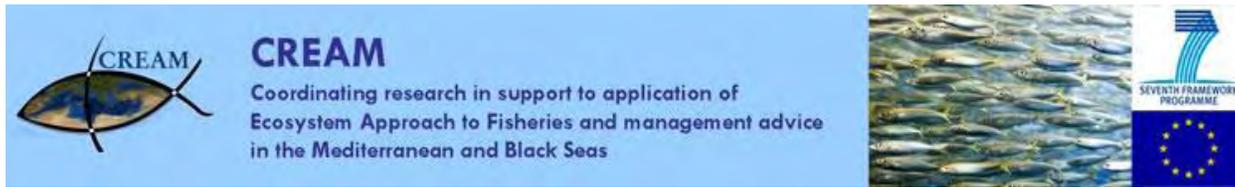
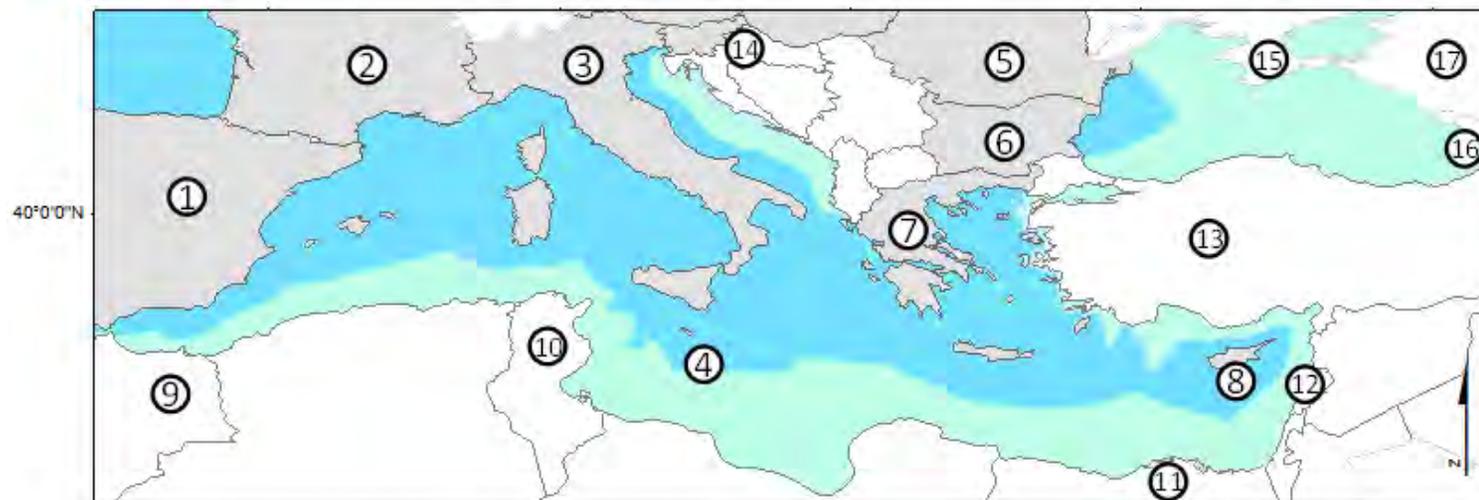


Figure 1. The Mediterranean and Black Seas region, and countries participating in the coordination action CREAM. Countries of the European Union (EU) are highlighted in grey and the EU waters are highlighted in dark blue. Non-EU countries are in white and non-EU waters are in light blue.



CREAM countries: 1. Spain, 2. France, 3. Italy, 4. Malta, 5. Romania, 6. Bulgaria, 7. Greece, 8. Cyprus, 9. Morocco, 10. Tunisia, 11. Egypt, 12. Lebanon, 13. Turkey, 14. Croatia, 15. Ukraine, 16. Georgia, 17. Russia.

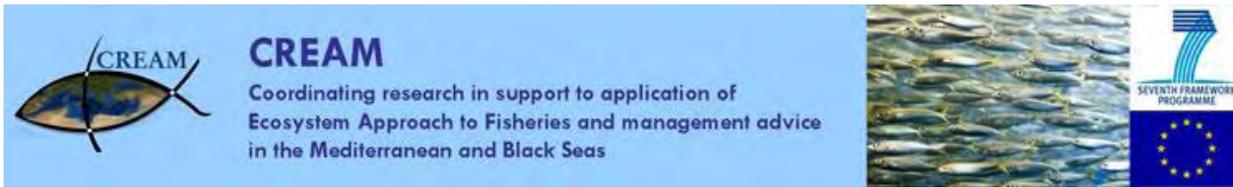
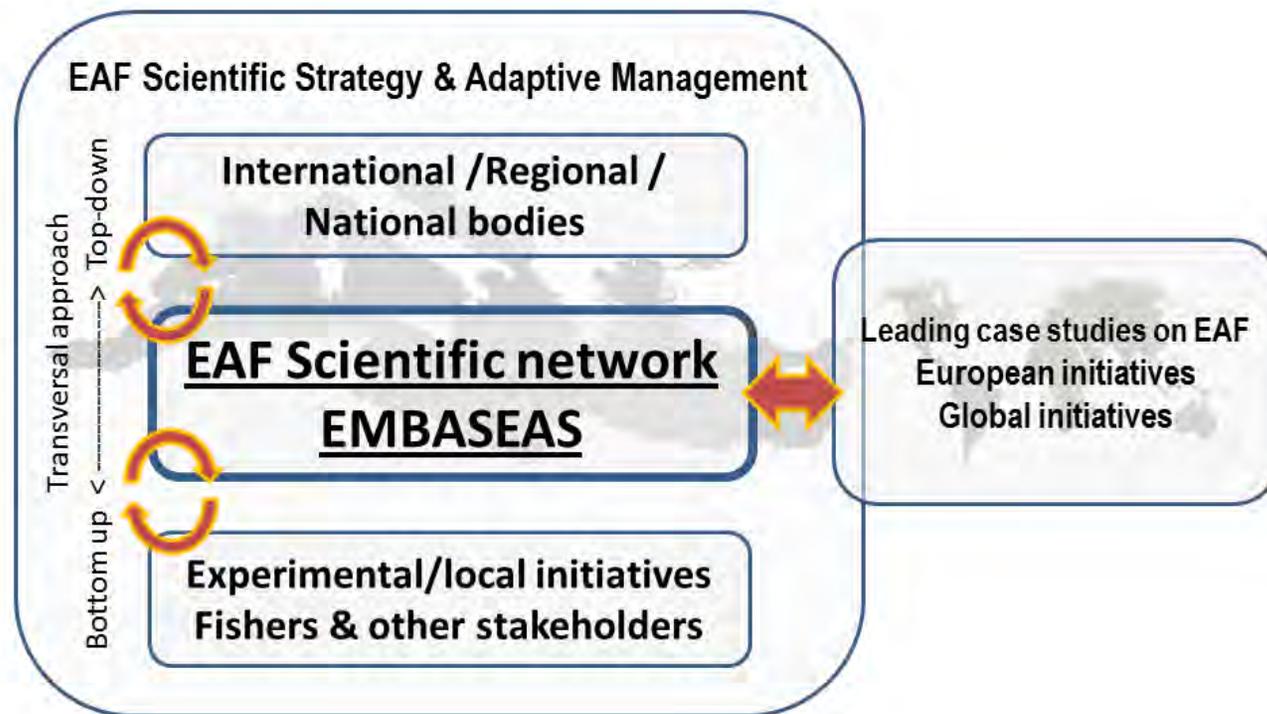


Figure 2. The Ecosystem Approach to Fisheries (EAF) scientific strategy and links to promote adaptive management in the Mediterranean and Black Seas region envisaged by the group.





6 Annexes

Annex 1. List of participants to the workshop

Annex 2. Minutes of the meeting

Annex 3. Operational EAF Tables by partner

Annex 4. Reprint of peer-review publication resulting from the work of WP6



7 Annex I. List of participants to the workshop

- AFES - Abdel-Fattah EL-SAYED.** Oceanography Department. Faculty of Science. Alexandria University. Alexandria. Egypt. Tel.: +20 34843172. E-mail: afmelsayed@gmail.com
- AJ - Astrid JARRE.** Ma-Re Institute. John Day Building. University Avenue. University of Cape Town. Rondebosch, 7701, RSA E-mail: ajarre@gmail.com
- AT - Adnan TOKAÇ.** Fisheries Faculty. Ege University. 35100 Bornova, İzmir. Turkey. Tel.: +90 232 3111307. E-mail: adnan.tokac@ege.edu.tr
- BT –Borys TROTSENKO.** Southern Scientific Research Institute of Marine Fisheries and Oceanography (YugNIRO). Ukraine. E-mail: island@crimea.com
- CM - Christos MARAVELIAS.** Institute of Marine Biological Resources and Inland Waters. Hellenic Centre for Marine Research. Agios Kosmas. 166 04 Hellinikon, Athens. Greece. Tel.: +30 210 9856700. E-mail: cmaravel@ath.hcmr.gr
- CP - Carlo PIPITONE.** Consiglio Nazionale delle Ricerche. Istituto per l'Ambiente Marino Costiero. Sede di Castellammare del Golfo. Via Giovanni da Verrazzano, 17. 91014 Castellammare del Golfo (TP). Italy. Tel.: +39 0917829740 - +39 0924 35013. E-mail: carlo.pipitone@iamc.cnr.it
- DG - Dunixi GABIÑA.** Instituto Agronómico Mediterráneo de Zaragoza / CIHEAM. Av. Montañana, 1005. 50059 Zaragoza. Spain. Tel.: +34 976716000. E-mail: iamz@iamz.ciheam.org
- FC – Francesco COLLOCA.** University of Rome “La Sapienza”. Department of Animal and Human Biology. Italy –E-mail: francesco.colloca@uniroma1.it
- GB - Giorgos BAYADAS.** Department of Fisheries and Marine Research. Ministry of Agriculture, Natural Resources and Environment. Vithleem street, 101. 1416 Nicosia. Cyprus. Tel.: +357 22807815. E-mail: gpaiatas@dfmr.moa.gov.cy
- GM - GHORBEL, Mohamed.** Institut National des Sciences et Technologies de la Mer. Port de pêche. 2060 La Goulette. Tunisia. Tel.: +216 71735848. E-mail: Ghorbel@instm.rnrt.tn
- JB - Jose M^a BELLIDO.** Instituto Español de Oceanografía. Centro Oceanográfico de Murcia. Varadero, 1. 30740 San Pedro del Pinatar. Spain. Tel.: +34 968 180500. E-mail: josem.bellido@mu.ieo.es
- JL – Jordi LLEONART.** Institut de Ciències del Mar. Consejo Superior de Investigaciones Científicas. Passeig Marítim de la Barceloneta, 37-49. 08003 Barcelona. Spain. Tel.: +34 932309500. E-mail: leonart@icm.csic.es



- JV – Joël VIGNEAU.** IFREMER – Institut Français de Recherche et Exploitation de la Mer. France. E-mail: joel.vigneau@ifremer.fr
- MC - Marta COLL.** UMR EME 212 IRD/UM2/IFREMER. Centre de Recherche Halieutique Méditerranéenne et Tropicale. IRD - IFREMER & Université Montpellier II. Avenue Jean Monnet, BP 171. 34203 Sète Cedex. France & Institut de Ciències del Mar. Consejo Superior de Investigaciones Científicas. Passeig Marítim de la Barceloneta, 37-49. 08003 Barcelona. Spain. Tel.: +34 932309500. E-mail: mcoll@icm.csic.es
- MP – Marina PANAYOTOVA.** Department of Marine Biology and Ecology. Institute of Oceanology. Bulgarian Academy of Sciences. "Parvy maj" street, 40. 9000 Varna. Bulgaria. Tel.: +359 52370486. E-mail: mpanayotova@io-bas.bg
- NFM - Nicholas FLORES MARTIN.** Capture Fisheries Section. Fisheries Control Directorate. Ministry for Resources and Rural Affairs. Barriera Wharf. Valletta, VLT 1970. Malta. Tel.: +356 22921257. E-mail: nicholas.flores-martin@gov.mt.
- NV – Nedo VRGOC.** Institute of Oceanography and Fisheries. Šetaliste Ivana Meštrovića 63, 21000 Split, Croatia. E-mail: vrgoč@izor.hr.
- PC - Philippe CURY.** UMR EME 212 IRD/UM2/IFREMER. Centre de Recherche Halieutique Méditerranéenne et Tropicale. IRD - IFREMER & Université Montpellier II. Avenue Jean Monnet, BP 171. 34203 Sète Cedex. France. Tel.: +33 499573234. E-mail: philippe.cury@ird.fr, philippe.cury@ifremer.fr
- PS – Paolo SARTOR.** Consorzio per il Centro Interuniversitario di Biologia Marina ed Ecologia Applicata "G. Bacci", Livorno. Italy. E-mail: psartor@cibm.it
- ST - Said TALEB.** Cooperation Division. Institut National de Recherche Halieutique. 2, rue de Tiznit. 20000 Casablanca. Morocco. Tel.: +212 522297329. E-mail: taleb@inrh.org.ma
- TR - Tristan ROUYER.** UMR EME 212 IRD/UM2/IFREMER. Centre de Recherche Halieutique Méditerranéenne et Tropicale. IRD - IFREMER & Université Montpellier II. Avenue Jean Monnet, BP 171. 34203 Sète Cedex. France. Tel.: +33 499573247. E-mail: tristan.rouyer@ifremer.fr
- TZ - Tania ZAHARIA.** National Institute for Marine Research and Development "Grigore Antipa". Mamaia Bvd., 300. 900581 Constanta. Romania. Tel.: +40 241540870. E-mail: tzaharia@alpha.rmri.ro
- VT - Vjekoslav TICINA.** . Institute of Oceanography and Fisheries. Šetaliste Ivana Meštrovića 63, 21000 Split, Croatia. E-mail: ticina@izor.hr

8 Annex II. Minutes of the meeting

2nd Workshop of WP6: Building an operational scientific network for implementing EAF in the Mediterranean and Black Sea

Split, Croatia, 8-9 October 2013

MINUTES OF THE MEETING





First day of the workshop - 8TH of October. Morning session

Chair: Jordi Lleonart; Rapporteur: Tristan Rouyer & Marta Coll

09:00	Welcome and introduction to the Institute of Oceanography and Fisheries of Split	N. Vrgoc
	Welcome to participants and domestic arrangements <i>(0.Opening_D. Gabiña.pdf)</i>	D. Gabiña
	Presentation of all participants	
09:15	Presentation of the workshop and agenda <i>(1.CREAM_agenda.pdf)</i>	P. Cury
9:30	Summary of 1st WP6 workshop: Scientific Strategy for a Global Approach to Promote Regional EAF <i>(2.1stWS_MColl.pdf)</i>	M. Coll
10.00	How can we move from single fish stocks towards EAF in a smoothed manner <i>(3.From single stocks to EAF_PCury.pdf)</i>	P. Cury

Discussion - summary:

The need to define the boundaries of the ecosystem and the scale at which it needs to be considered has been brought up. Apparently some work has been done on that, for instance by JRC. However this issue depends on the scientific question at hand as well.

It was underlined that the shift from single stock assessments to an ecosystem approach should not lead to an opposition, as they are complementary. In the Mediterranean, more and more stocks are assessed on a single stock basis and with an increasing quality. It was stressed that single species management schemes are already complex to set up, particularly for shared stocks,



but constitute a starting point. It was underlined that the difficulty for the transfer of knowledge between managers and scientists made the implementation of single-stock approaches more complex. In addition, while scientific knowledge is not used, politicians and managers often make short-term decisions that are not strict enough as they are guided by vague statements such as “within conservation levels”. It was stressed that a better communication was needed between scientists and politicians so that EAF would take off more easily. It was pointed out that social sciences showed that teaching children about a given measure usually increased its long-term impacts. Kids can then in turn tell their parents what to do.

It was also mentioned that compared to the Mediterranean, in South Africa (SA) having to deal with multiple countries was not an issue. It was mentioned that ICES also tried to channel different countries so that they will talk together, such as in the Baltic. In SA, attempts to sit NGOs and stakeholders at the same table, for instance through the Marine stewardship council (MSC), were successful. It was brought up that it usually isn't in the Mediterranean and Black Seas. It was underlined that in SA this helped to keep the discussion on ecosystem grounds, for instance if it wouldn't have been the case discussions on bycatch issues may have been overlooked. It was a long process in SA but it helped to keep the discussion open about ecosystem issues. In SA the certification raised some public awareness, but it didn't mean that people were ready to pay extra for the improved quality resulting from the certification.

The discussion then moved on the ban on discards for regulated species, as it can affect seabirds that feed on it. It was pointed out that objectives have to be set for the management, such as which kind of seabird has to be protected. It was raised that trawl fisheries are multispecific and that a certification would need to be for the whole fishery and not for a single species/stock. It was underlined that fishermen put the pressure on each other to stick to the rule. In SA some boats have been kicked out. The certification for small scale fisheries, such as in the Mediterranean and Black Sea, was put forward as a difficult matter.

Discussion - contributions:

T. Rouyer - The Mediterranean is a collection of ecosystems, we need to think well on how to integrate the information from each system.

A. Jarre - There are subsystems in the South African region as well, and we struggle a lot as well. But ICES shows that this can be done. Success comes from the experience of countries working together (the boundaries used for analysis can be management or ecologically based).

M.Coll - The ecoregions is a concept that is already defined and discussed at various levels. For example, JRC of EC has a division of European Seas in ecoregions.

J. Vigneau - Single stock will remain as a fundamental brick of the house we are building in EAF.



P. Cury - Totally agreed with J. Vigneau. We need to move slowly, but also realize that in the Mediterranean Sea we have multispecies fisheries and we do not have stock assessment for many of the stocks exploited. But single stocks are not enough.

J. Vigneau - Is the MSC certification a way of doing business as usual with some green aspects?

A. Jarre - The experience of South Africa is good. The MSC certification is what kept some ecosystem issues in the agenda in the case of South Africa, for example, with the trawling fishing fleet that is mainly dedicated to exporting. So, in SA the MSC worked to incorporate ecosystem objectives in the agenda and was instrumental to stop the “economics is more important than anything else” argument.

P. Cury - Some stakeholders stronger disagree with each other, and they fight with each other. But if you do not produce a platform for research where different stakeholders are involved you lose the different views. NGOs are key players, you like them or not. MSC is also a key player you like them or not. We need to put them in the table. It is a long process. It took 15 years to recognise that seabirds are important to be considered for the fisheries management, for example. But we succeeded.

C. Maravelias - Is MSC big in SA?

A. Jarre - MSC is not known so well for supermarket consumers, but there is another certification that is working well. It will take some time to work in consumers; it is like what was happening in the 1970s and 1980s in Europe.

G. Bayadas - A target group for capacity building can be children. They are not considered as stakeholders but they can have a long term impact on society. Adults do not have the same capacity to absorb new information that younger people.

A.F.El-Sayed - Real stakeholders are a headache. In Egypt we have been suffering from years from the ones that catch anadromous species. They are declining but nobody is doing anything. It is a long term process to educate young people too. The capacity of stakeholders in Egypt is very low as well, they need to be educated to understand the importance of EAF.

J. Leonart - Children can play a role in EAF. After a campaign in Spain on TV about not having small fish, children were asking their parents not to buy small fish.

J. Leonart - Regarding birds, in Spain there is a dependency between trawling discards and seabirds. Seabirds do not feed directly on seafood, but on discards generated by trawling. So when there is no trawling, some seabirds suffer.

P. Cury - These interdependencies are something to consider in the EAF for sure.

M.Coll – Seabirds in the Ebro Delta region increased due to protection of their breeding grounds in the protected area. They adapted to eat discards when they were around but they will have to



adapt to eat other things if discards are less available. There are also negative impacts of fishing for bycatch of seabirds (from different fleets) and direct competition for food.

A. Jarre - We consider critically endangered seabird species (gannets and penguins). They have IUCN considerations. There are also some seabirds that feed on discards, but that do not need protection because they are abundant, so for us are less important in the concept of EAF. The seabirds discussion needs to consider different objectives and specific targets. Gulls in SA have been increasing due to a rubbish dam and then they prey on penguin eggs and chicks, so this is a problem as well. So we consider seabirds if they are critically endangered or critically dependent on prey.

J. Bellido – The current discussion on discards is about commercial and regulated species. Not about all the species captures.

J. Bellido - I have a question regarding certification of hake in SA. It is caught by trawling, so what is happening with the other species? How is the MSC being developed?

A. Jarre - We have inshore trawl, offshore trawl and pelagic long line. The certification of hake was initiated with offshore trawl and inshore trawl. The inshore trawl is a classical multispecies fishery and hake is the least of the problems. In order to keep MSC certification in hake, the offshore trawlers are putting pressure in the inshore trawlers to stop discarding. They are achieving things that the government did not get. The industry is dealing with the issue because the government is not involved. So in this case the industry is contributing to do things better.

J. Bellido - How do you certify a single species with an ecosystem component? Is not committing the same mistake?

A. Jarre - Yes, but it is through this process that you can identify the ecosystem issues of the fisheries.

P. Cury - How can we certify small scale fisheries and pelagic fisheries? This would be important in the Mediterranean in the future, how to certify fisheries in the region. There will be a big issue when the business only wants certified fisheries. We will need to say something about certification of fisheries in the Mediterranean, considering the ecological and socioeconomic relevant criteria.

F. Colloca - The single species comment is important. We need not to forget the single species approach. We have very bad assessment results: more than 90% of the stocks in the Mediterranean Sea are overfished. But we do not have any management plans in the Mediterranean stocks, no plans for shared stocks, etc. So we need management plans for these species first of all. The science is not lacking, but we need the managements to do things, to allow management plans. We could apply simple management plants to start, but managers do not develop any management plan.



M.Coll – Another important issue is the enforcement of already available rules. In the Mediterranean sea there is a big issue of governance.

10:00	<p>CREAM WP contributions to build an operational EAF network</p> <p>Contributions from WP2 (<i>4.WP2_PSartor.pdf</i>)</p> <p>Contributions from WP3 (<i>5.WP3_JVigneau.pdf</i>)</p> <p>Contributions from WP4 (<i>6.WP4_JLleonart.pdf</i>)</p>	<p>P. Sartor</p> <p>J. Vigneau</p> <p>J. Leonart</p>
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Discussion - summary:

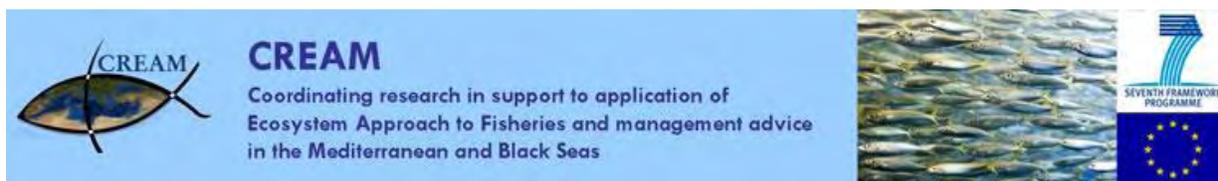
For deliverable 3.3, It was shown that GFCM already did a substantial work on indicators in their “Report on proposed indicators, models, methodologies and reference points for EAF”.

Awareness has been raised about a new aspect of data access as high-profile journals are going to publish data. Therefore data is going to be checked and validated and it will be possible to cite it. This is likely to facilitate and simplify data access and change current habits.

It was underlined that in terms of data access, it exists different funding for data collection depending on countries. For instance, the Data Collection Framework (DCF) provides funding for European countries, but the situation is different for the southern shelf. The importance of assessment methods for data poor situations was underlined.

The publication of the Mediterranean and Black Seas data in high-profile journals, as exposed earlier, was seen as a good thing. However, the need for a unified data format was underlined, so that data would be as comparable as possible across countries. The existence of international formats could provide a reference for such an initiative. Attention was brought on the fact that such an approach will be complex for small and scattered datasets.

Initiatives at the Mediterranean and Black Seas scale already exist as the DCF intends to build a regional database in which data could be made available under a certain level of aggregation. However, in many cases, the source of funding regulates data access within written rules and the data is not totally freely available, as it is the case for the DCF. It was underlined that data use and data sharing is therefore not only up to the scientists, but often up to the initial agreement with the funding source, which can be political as well. Past projects (EVOMED, FAR WEST) aimed at gathering data at a regional scale within the Mediterranean and Black Seas. It was noted that many of the past work is forgotten and data is not stored anywhere easily accessible.



It was mentioned that in the Mediterranean and Black Seas only a few stocks are actually considered as shared stocks and that it has the consequence to limit data sharing between countries. However, it was underlined that it might exist several cases for which stocks are likely to be shared but that it hasn't been proven yet (Adriatic sardine, hake in the Gulf of Lions,...). For instance very different species, such as hake and sardine, share the same spatial limitations. This was seen as an issue to address within an EAF implementation and that it was already tackled within the EU funded MAREA project (STOCKMED sub-project).

The discussion moved then back to data access and particularly to the access to the MEDITS survey data. Views were diverse, but it was generally said that access to the MEDITS data was complex even though it was funded with public money. The importance of making data easily available for scientific purposes was stressed.

Discussion - contributions:

M. Coll – The indicators are important for the EAF and they will be relevant not only at the European countries level, but also at the Mediterranean level as a whole. Currently, the General Fisheries Commission of the Mediterranean Sea (GFCM) is developing a comparison of indicators proposed under the context of the Marine Strategy Framework Directive (MSFD), the Barcelona Convention, and RAC-SPA.

P. Cury - Regarding the data available and needed to perform EAF, things are going to change in the future. There will be data papers in big journals to publish the meta data (Science, Nature, etc.). Currently, data access is a nightmare, and now the game is changing. Soon, the data that is not published will not be useful.

P. Cury - Part of our game will be to consider our work in common, to do something together instead of all working individually.

J. Bellido - Data issues and access on Mediterranean European and non-European countries regarding data will be different because the rules will be different. For example, in Mediterranean European countries we have the unified data collection framework.

J. Leonart – This is a big issue and we will be faced with lots of problems. To bring data together and make it comparable is really difficult.

T. Rouyer – The SFTEC within JRC is starting to do that by harmonizing data collected by different member states of the European Union.

J. Vigneau – This harmonization should be an objective for the long term plans for EAF.

J. Leonart - The problem is that even in the same country there are problems in data sharing and challenges in data management and merging.

P. Cury - Yes, in general data access is very difficult or impossible.



T. Rouyer - In principle the data collected by main institutions is available.

J. Vigneau - In general, data that is non-sensitive is also difficult to share.

P. Cury – In the future this will change, the data owners will be able to publish their datasets (for example in a paper in Nature) and then the data can be used and cited.

J. Bellido - This is not new, there are groups working on how to share data (see for example INSPIRE project, <http://inspire.jrc.ec.europa.eu/>), it is marine and terrestrial data.

J. Leonart - The problem is that not many shared stocks are available in the Mediterranean Sea, that is why data is not being shared. It does not make much sense to share it because stocks are mainly in national waters.

T. Rouyer - We do not know if it is the same stock or not, there is the need to look at that. The knowledge about shared stocks is not large.

M.Coll - There is no biological reason for not sharing the data, it is a personal decision. I agree with T. Rouyer that there is no information about connectivity and shared resources in the Mediterranean Sea. This needs to be investigated.

V. Ticina – For example, sardine and anchovy in the Adriatic Sea are examples of shared stocks.

J. Leonart - Yes, same things happen between France and Spain.

J. Bellido - We need a definition of stocks before we discuss shared stocks.

J. Leonart - We only consider shared stocks when fishing fleets share the stock but not when the stock is shared between countries.

F. Colloca – The Stock Med project will revise the boundaries in the stocks. Another problem is the loss of memory from project to project, this is a big weakness of European projects. A lot of initiatives are forgotten and new projects start from the beginning again.

P. Sartor - A lot of local and regional projects are forgotten too, not only European projects.

M.Coll - Local problems as well, many projects are going to be forgotten because data is not compiled in a common place.

J. Vigneau - MSFD indicators are going to be important and we will be gathering data. In France there was a lot of people joining forces to calculate them.

M.Coll – It is a pity this has not happened in other regions, such as in Spain where the studies on MSFD have been not collecting information from the past and have mainly focussed on studies developed within one single institution (IEO) instead of integrating the knowledge generated in different institutions within the country. This is limiting a lot what the MSFD indicators can inform on.



C. Maravelias - Totally agree with Marta, this is happening in many cases, also in Greece. The problem is that the institutions that are in charge of calculating the MSFD indicators are understaffed and underfunded and there is no resources to do things well.

P. Cury - Maybe a rationalization of the process is needed.

J. Leonart - This is what they say it should be done.

V. Ticina - The data collection issue and the data access is a policy issue.

P. Cury - We should push to have common papers on sharing data to show it can be done.

G. Bayadas - There should be more pressure from the scientific community to share data and ask for shared access to data.

J. Vigneau - It is the right moment to make a requirement to the European Commission. We are paid by public money, so we should be doing public science.

M. Coll - Our first workshop already talk about this a lot, and the paper we wrote about the paper in Reviews in Fish Biology and Fisheries has a section on this (see Coll et al. 2013, page 423, section 'Data-poor and data-poor access regions: our Achilles' heel').

P. Cury - We are one of the few disciplines that we are not sharing the data, we have complex issues to address and we cannot access the data. We will shot ourselves on the foot if we do not change this soon, this is an important issue that needs urgent solving.

A. Jarre - I totally agree with Philippe and what we are doing in SA with some success is to make sure people understands that we are looking at a complex problem, we point out at the data we need, but if it is not available, then we do expert judgements. Then people that has the data comes out and wants to share the data to look at the specific issue and discuss the results that were previously gotten using expert judgement. It really works.

First day of the workshop - 8th of October. Afternoon session

Chair: Joël Vigneau; Rapporteur: Marina Panayotova & Marta Coll

14:30 Implementing EAF in South Africa: an overview



	<i>(7.Implementing EAF in SA_AJarre.pdf)</i>	A. Jarre
15:30	Examples of co-management in the Catalan Sea <i>(8.Sonso case study_JLleonart.pdf)</i>	J. Lleonart

Discussion - summary:

A case study of co-management was presented for sand eel in Spain. Questions about biological interactions and impact on forage fish were asked. A question was asked about fishermen who are, in that case, organized by harbour and with representatives. It was underlined that in that case fishermen enforce the rules themselves, for instance one boat was excluded for not following the rules. The example was successful as the fishermen cut down their effort during the study and were making more money than before. It was noted that the case study was not an example of a full holistic/ecosystem management, as it was a co-management case-study for sand eel only.

Discussion - contributions:

M.Coll - This is a question for J. Lleonart regarding the sonso example. How do you take the ecosystem effects into account, for example, what is the importance of sand eel as prey?

J. Lleonart - This issue was included yet, but maybe in the future. The ecological role may not be too large because it is a very coastal species.

G. Bayadas - It is very interest initiative, but in my opinion it is not an EAF initiative because it does not consider ecosystem components.

J. Lleonart – Bu the co-management is also part of EAF, we cannot forget.

V. Ticina - What is the ecological role of this species in the ecosystem?

J. Lleonart - Probably they are forage fish but they are not very abundant, so we think that the role is not very important.

A. Topaç- In our case in Turkey the beach seine was prohibited because there was a lot of discards being generated.

16.00	Summary and discussion of WP6 EAF operational table form <i>(9.EAF operational tables.pdf)</i>	M. Coll
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Discussion - summary:

The discussion was launched on the usefulness of the table to be filled and on how to improve it. It was generally seen as a good initiative, but it was asked to circulate the table a second time, after some clarifications. For instance some scientists did not think about concerns that other scientists listed but think these are relevant to their ecosystem. It was suggested that the “EAF concerns” should be summarized and that the gears/fleet selected would be reduced and follow the DCF level 6. The aim of the table was to have common “EAF concerns” emerging across countries. It was clarified that the table was about what was actually done in terms of EAF. It was suggested that maybe this table provided enough for a preliminary risk analysis, following the methodology employed in SA. Clarifications were asked about the last two columns of the table, as implementations are not up to scientists who usually only suggest ways to proceed to decision makers. It was said that these columns should be filled with “realistic wishes” for implementation from a scientific point of view. However, this matter was not settled at the end of the discussion.

Discussion - contributions:

C. Maravelias - This is a good initiative and would be good to be able to think more on the table with a prelist of EAF issues identified by the group.

P. Sartor - This is interesting for a preliminary overview. The list of the gear to be mentioning in the table could be standardized with an official list and maybe less fleets, so we all follow the same protocol.

J. Bellido - Maybe we could brain storm on the EAF concerns.

T. Rouyer - The table would have more focus on the EAF concerns.

M. Coll - These are very useful comments. The aim is the operational EAF, so the table has to be filled in thinking on what has been identified and what has been done in the context of EAF.

J. Bellido - I would suggest to reduce the fishing fleet list to bigger categories, such as industrial, recreational, artisanal, etc.

A. Jarre - You are looking at different issues, and this is an element of Ecological Risk Analysis (ERA). With this information a pre-ERA could be made and a preliminary analysis on the impacts could be produced. You could also perform a preliminary risk ranking.

T. Rouyer - It is a good idea to provide the list of fleets for the second version of the table.

A. Tokaç - The column talking about the possible implementation is very unclear.



M. Coll - This column aims at compiling expertise information on what is possible to be done taking into account the general context in the country and the EAF issue identified. It has to be a realistic possibility, not a scientific ideal that is unlikely to be adopted.

J. Bellido - Be could include a scientific advice on the short term on what could be done.

M. Coll - With all these comments I will revise the EAF operational table and send them to all participants to review the first version that they sent to WP6. Thanks for all the feedback.

General discussion: what needs to be implemented in the Mediterranean and Black Sea?

Discussion - summary:

During the presentation and discussion, J. Vigneau drew a map of ideas that was discussed by the group.

The identification of the most important stakeholders was immediately brought up, as well as at which stage they should be participating. It was noted that from the SA perspective, larger organizations participated more easily than smaller ones, which joined up at a later stage. It was underlined that the involvement of stakeholders was one of the most difficult and challenging issues in the Mediterranean and Black Seas, as they were usually not interested in their business rather than to find a common solution. It was suggested that social scientists could help on identifying the relevant persons and ways to solve that issue. Clarification about what is meant by “stakeholders” was asked. Vessel owners, fishermen, traders and decision makers were identified as linked and important stakeholders. It was noted that whether or not institutions were representative was not clear.

The next steps/initiatives mentioned were diverse. The identification of the stakeholders, a way to contact and invite them to participate to discussions, the set-up of a generic framework, the design of a roadmap between scientists and stakeholders. It was mentioned that a list of persons involved in the administrations already existed and that an attempt of getting in touch with them will be made. It was also noted that CREAM, as a group, can deliver a message such as bringing stakeholders together, and deliver a possible framework. It was noted that the problems and the person associated should be identified to avoid getting stuck. Conversely, it was pointed out that “allies” also exist and that they should also be identified. It was noted that consumers have to be involved, for instance in terms of fisheries certification, should probably be the case for EAF. Consumer organizations can be strong and participate. Opportunities should be identified.

The important role of the “front runner” was underlined and it was noted that this role was played by scientists in SA. It was suggested that CREAM/EMBASEAS could be the front runner



for the EAF implementation in the Mediterranean and Black Seas. It was noted that in the Mediterranean and Black Seas it will be difficult for the front runners to get an unambiguous direction while keeping a certain degree of freedom. For instance in Europe, the commission and governments can have different positions and the multiple administrative layers can be problematic. The fact is that governments already know about the need for an EAF but they do not act.

It was noted that fishermen were usually not interested in participating into this kind of procedures unless they had trouble to solve. It was pointed out that fishermen had already quite a lot of problems to solve. It was underlined that fishermen are not the only users and stakeholders, but only one facet and that the other players can still be brought in. It was noted that fishermen will have to join in as there are not anymore the most important group. The need to present things in a very concrete way was expressed as EAF related matters are very abstract for fishermen. Concrete outputs of EAF in terms of fisheries management are needed along with a tool for fishermen so that they can get into the mind-set of the approach. The need to create a new dynamics was expressed and it was noted that in France, fishermen are changing their mind-set, slowly, but they do. It was noted that an EAF implementation can also provide employment. The “GAP” project (Closing gap between fishermen and scientists) was brought to attention as it has interesting insights to be looked at, with case studies in Spain.

In the Black Sea area it was noted that the CREAM project has done a lot and provides a basis for a more detailed future project. They insisted on the need to create a unified data format. They suggest that some action should be develop to deal with the authorities at the local level and at higher level, in order to push for EAF in all kind of fisheries, even inland. The important role of the Black Sea commission in term of research was underlined as it was successful in coordinating research, setting up multilateral agreements... In Turkey some important EAF concerns were identified. Stock assessments are conducted for the whole BS and presented at the GFCM. Implementation of some measures regarding EAF, such as a minimum mesh size enforced in turbot fishery. However more coordination is needed among countries, but it is hard. Romanian scientists pointed out that fisherman are the key players and that scientists should change their language to improve communication with fishermen, such as a practical tool to change the perception of the fishermen. In Egypt and Morocco, the concept of EAF is very theoretical and improving public awareness about it is needed. It was pointed out that in some countries from the southern shelf illiteracy is high, people do not necessarily speak a good English and different ways of communication are needed. It was also pointed out that tourism in Egypt is very important and that some way to bring them in should be found. In Morocco, EAF is not an utopia but will be hard to implement.

Discussion - contributions:



G. Bayadas – To make EAF operational in the Mediterranean Sea we need to identify the important stakeholders. Astrid, how do you identify the stakeholders in SA? How do you identify the stakeholders to attend your meetings?

A. Jarre - You have to look at your unit of management and then include the groups that are somehow involved in the issue. It is easy for the big groups, but difficult for the smaller groups. To get the right stakeholders is a lot of work. There are some social scientists working on that that can help a lot to identify and involve the right stakeholders.

C. Pipitone - The presentation from A. Jarre about South Africa was very nice but you said that in a country like SA can be done, then in the Mediterranean Sea can be done too. The involvement of stakeholders can be really complicated in the Mediterranean Sea, maybe even more than SA. And this is a real problem. It is a very difficult situation.

A. Jarre - It is difficult but not impossible. I would send a couple of social scientists and ask them to go and identify who is competent and who can do staff, and who cannot do staff. You need to identify the competent people that can do things.

P. Cury – In the Mediterranean the number of stakeholders and number of countries makes things complicated. We (EMBASEAS) cannot say what specific things countries have to do in their countries, but we can deliver a possible message for implementing EAF in the region as a whole. EMBASEAS should be about doing things at the Mediterranean and Black Sea level together, not about local specific issues. Communicate what is important for EAF: for example, bringing all the stakeholders together is important. These are broad messages that can be useful in the Mediterranean and Black Sea. We need a global framework for EAF and as a network we can deliver those messages. Can we deliver some clear broad general messages on how to operate EAF at the Mediterranean level?

S. Taleb - What do you mean by fishermen? In Morocco there are fishers, there are vessel makers, and there are traders. The three are very important. So we should be broad in the definition of fishers. The other issue are the state institutions and all the stakeholders involved in this level.

G. Bayadas - Thinking on the conference to be organised by CREAM, how do we get any industry stakeholders to participate? Is this well organised?

D. Gabiña - Yes, they were identified by different people from CREAM so we have been collecting your suggestions and we have been inviting people.

J. Vigneau - The final CREAM conference can be a very nice forum to identify issues and agree on a general road map.

M.Coll – A question for A. Jarre. Was the SA EAF process a bottom up or a top down approach ?



A. Jarre - It was a mixture of things, when we started it was the right time and the right place, and it was a mixed of needs and wills.

M. Coll - In the context of A. Jarre presentation this morning, could EMBASEAS be the front runners of this process in the Mediterranean and Black Seas? Could we see ourselves as the bottom up and top down players ?

J. Leonart - We need to be aware that fishers are not interested in EAF unless there are problems, and the administration neither. We will be alone.

M. Coll - This may be true, but we also have to realize that fishers are not the only stakeholders that should be involved in this process and we should include other stakeholders in the discussion.

P. Cury - We need to create new dynamics and a new way to see the fishing activity. We should find other ways to create jobs. We need to make the issue dynamic and positive.

A. Jarre - There is a European project, GAP project, that is going very well and they are trying to do a bit on what we are discussing. They have Spanish, Portuguese and Italian case studies.

M. Coll - Yes, this is true, and in our institute there are some colleagues involved in this project.

G. Bayadas – I agree with M. Coll that fishers are one important group but not the only one.

S. Taleb - About EAF and fishers, the most important thing is that with EAF we need to provide tools for fishers to adopt the ecosystem approach. We need to be concrete about the issues that they can do to manage their fisheries.

J. Vigneau - This could be frame by « How Fishers can appropriate the EAF principles » ?

S. Taleb -Yes, this is appropriate. And in addition, the management is a big issue as well.

A. Jarre - This is one of the outcomes of the training courses in our SA case. Management is essential to the success of EAF.

J. Bellido - The concept of front runners is very important. In SA is there any support for the front runners? In Europe the front runners are not really supported, either at the National or European level.

A. Jarre – In SA there is some that help by some institutions, but others do not help.

M. Coll - I agree we have to be critic, and we have to realize that there is also people that is willing to help: we need to identify the capable ones. Regarding the non-supportive ones, there will always be good and bad people. But we need to identify allies and the possibilities.

G. Bayadas - We need to identify allies also in other stakeholders such as consumers. They can also help implementing EAF. We need to know how to identify good opportunities.

J. Vigneau - What about the Black Sea colleagues? What do they think we should do?



B. Trotsenko - CREAM is already identifying a lot of issues that are very relevant to the Black Sea. The Black Sea commission is developing also nice activities.

A. Tokaç - Turkey is also doing some things regarding dolphins and collisions with dolphins since this is a big problem in Turkey.

M. Panayotova - In Bulgaria there is the identification of EAF issues and now the scientific advice group has also accepted some measures at the GFCM level. Some of the measures in the EU waters are also enforced. In the regional level, we have some implementation of EAF.

T. Zaharia - We need a common language with the fishers because if we do not speak the same language of the fishers EAF will be a scientific exercise but will be difficult to implement.

A. El-Sayed - The concept of the EAF does not exist in some countries such as in Egypt, Lebanon and Morocco. So we need to improve the awareness of the stakeholders, otherwise the issue does not exist. In Egypt as well, most of the fishers are illiterate, so we need to have common language to speak with them. Otherwise all the efforts will be useless. In addition, tourism in the Mediterranean Sea is a big factor that needs to be tackled. Most of the coast is occupied by tourism and they generate a lot of conflict that need to be taken into account.

S. Taleb - EAF in Morocco is similar. There is a big problem now with the economic crisis. So the economic growth is a big issue and EAF may be seen not interesting or less important.

18:00 Closing of the workshop - day 1

Second day of the workshop - 9th of October. Morning session

Chair: José Maria Bellido; Rapporteur: Paolo Sartor & Marta Coll

09:00 Recap from first day of workshop
(10.Recap first day.pdf)

P. Cury & M.
Coll



Discussion - summary:

The following main aspects were discussed:

- Involvement of a wider range of stakeholders;
- Capacity building for EAF;
- Incentives to develop EAF;
- Public awareness: a greater effort is needed by the scientists: to improve the communication;
- A wide approach is needed by Mediterranean and Black Seas in order to allow for comparison, interrogation and reporting at any level.

Discussion - contributions:

P. Cury - We have summarized some ideas from yesterday on things that need to be promoted to make EAF operational. One is the inclusion of a wide range of stakeholders in the discussion.

D. Gabiña - The international conference that is going to be organised by CREAM will be a good opportunity to involve stakeholders (ministries, fishers sector, etc.).

M.Coll - What are the criteria to bring stakeholders to the CREAM conference?

J. Leonart – It would be good not to invite those politicians that will change in new elections

M.Coll - NGOs should be there too, right? Are they invited formally?

M.Coll – To know who to invite we need to know what is the aim of the symposium.

J. Leonart - I agree this is a good question, what is the aim?

D. Gabiña - The aim of CREAM is the aim of the symposium, promote EAF and create capacity to advance towards EAF in the region.

G. Bayadas - It is important that we have one clear message to deliver in the conference.

P. Sartor – Do we know the content of the conference that is being planned?

J. Leonart - The list of the contributions is the one sent by all participants of CREAM, but there will be some that will not be there because they have not delivered the papers. The papers for the special volume of *Scientia Marina* needed to be finished by the end of October.

P. Sartor – So there is no agenda yet?

C. Maravelias – It could be interesting to see the contributions that have been proposed so far.

J. Leonart - I have the abstracts but can not say much right now.



M.Coll - I think that EMBASEAS as the new network of CREAM should be presented and also the results of all the work packages. Maybe it could be good to have presentations by the different work package leaders in the conference, even if they do not publish their contributions in *Scientia Marina*.

J. Leonart - The symposium is about disseminating ideas around EAF, so the abstracts sent are about some EAF issues such as quality of data, indicators, models, etc.

G. Bayadas - We need to be convinced first that we need a change in the way fisheries are managed before we translate our messages to the stakeholders.

D. Gabiña - Maybe now it is the time to start thinking about the agenda and to make sure we have a good feeling about what will be presented.

D. Gabiña - The presentations have to be very applied and have to be for scientists and non-scientists because the conference will be a dissemination conference, not only a scientific conference.

P. Sartor - All the abstracts received will be presented? And how many will be CREAM or external?

M.Coll - Do we have room at the conference for presenting CREAM work? In the case of our research group, we submitted various work from students, but not necessary work for disseminating CREAM results.

J. Leonart - I am going to show you the list we have so far that have been presented to the CREAM conference, by main topic of EAF.

G. Bayadas - It is very important to have all the topics well represented.

P. Cury - CREAM is a concerted action and the idea is to promote the EAF scientific strategy. We cannot lose track since it is not the aim of the concerted action. But it is a good idea to have the WP leaders to present the EAF framework together at the conference.

J. Leonart - The proposal of G. Bayadas is good, but if we want to have the book in the symposium we do not have time now.

D. Gabiña - Yes, the book has to be out before the project finishes.

C. Maravelias - I think the proceedings have to have results from the project, results of each WP should be there. My impression now is that this is not going this way.

M.Coll - Maybe we could have some conference proceedings additional to the *Scientia Marina* special issue to complement the contents there.

D. Gabiña - There is no time now, but we could have some keynote speakers in the conference that can cover key points regarding EAF.



J. Leonart - The aim of the conference will be to disseminate the EAF concepts.

D. Gabiña – Regarding the second point of the summary, the capacity building for EAF, CREAM training courses will be important here. There will be two courses, one for scientists and one for managers and stakeholders. I will send a reminder to the group about these courses. CREAM partners were also asked to provide names of students and stakeholders that could be interested in these courses.

P. Sartor - Did you get a lot of suggestions on what stakeholders to involve ?

C. Maravelias - The invitation to stakeholders stated that it will be very unlikely that they will be funded so a lot of them did not show interest because of that. I think that the invitation should be more positive.

P. Cury - We talked about GAP yesterday and it would be good to invite them to the CREAM conference.

M. Coll – This is a good idea and should be easy because at the Institute of Marine Science there is a group that participates in GAP (the group led by Dr. Francesc Sarda) so for them should be easy to participate.

C. Maravelias - There are other projects that are relevant from the EU as well.

A. El-Sayed – Regarding the incentives for EAF (ecolabeling, international agenda, global pressure, etc), these have to be discussed further, what should be done.

M. Coll - The incentives sometimes are external to us or to the process and we can take advantage of them when it is the good time for it.

A. El-Sayed - The public awareness has to be also pushed by the government, not only by the scientists. They alone cannot do much.

P. Cury - Scientists are key to the EAF process. We are key to the process to bring the information out to the public, extract simple messages through the media.

G. Bayadas - The role of NGOs can be important as well for the public awareness, as well targeted groups such as consumers.

M. Coll – And how to attract media? For example, in CSIC we have press releases that can be useful because they are sent to all the media after. During the EAF CREAM conference, we could use these mechanisms to outreach the project and the conference.

A. Jarre – The development of small video clips with the key speakers may be very interesting and it is a good way to disseminate the conference. It has a big impact.

D. Gabiña - We need to contact some good professional journal to pass the message of the conference and help us disseminate the outputs of the conference.



P. Cury - For the symposium we could deliver a flyer on CREAM, maybe the first newsletter. This is important.

09:30 **Implementing the move from single fisheries to EAF in South Africa - A. Jarre** A. Jarre
 (11.Implementing EAF in SA(2)_AJarre.pdf)

Discussion - summary:

During this presentation a continuation concepts and ideas posed to the group during the previous day by Dr. Astrid Jarre on EAF implementation in South Africa was presented and further discussed.

Discussion - contributions:

P. Sartor - I like the idea of the small puzzle and start small and then can be start applying it. We are also responsible to deliver clear messages (for example, we need to say that the fishing effort has to be reduced). Another message is selectivity problems in the Mediterranean and the Black Sea. These are clear messages, and are realistic to be implemented. Some of the European regional funds are important to start co-management. Try to push fishermen to use these funds for the management.

A. Jarre - In SA we had to reduce fishing effort, it was a big measure, but you have also to think on the plan for that people that cannot fish anymore. What do they do when they stop fishing?

J. Vigneau - I like the picture of the 1960s and today and see how people adapts to the situation and that the memory is short. We can do much better of what we can do now. Another thing is that we need to think that EAF is the best approach for human activities, we need to be prepared to answer in an EAF way.

M.Coll - I agree with all this. I like also the concept of the tool box and the need to mix different methodologies.

10.30 **On-going and future EAF initiatives in the Mediterranean and Black Sea:**
Developing and communicating indicators: IndiSeas and MSFD M.Coll
 (12.IndiSeas and MSFD_MColl.pdf)



Discussion - summary:

During this presentation the international initiative IndiSeas was presented. IndiSeas aims at selecting, evaluating and testing a series of ecological and socioeconomic indicators to assess the impacts of fishing on marine ecosystems. In addition, the framework and indicators proposed under the MSFD were also presented.

Discussion - contributions:

P. Sartor - Do you work with reference points for indicators? Are they important?

M.Coll – This is an essential issue. We are now working on this issue by developing modelling exercises.

P. Cury – IndiSeas is a nice initiative that works. The group works hard and produces results.

B. Trotsenko - The Adriatic Sea is only the Italian part and we need to include the Croatian part too in the analysis.

M.Coll - Totally right, and it would be very good to include new Italian partners that are no longer in the project, and new partners from other countries of the Adriatic Sea and any other Mediterranean and Black Sea region.

11:30 Scenario building: what should we do?
(13. Scenario building_PCury.pdf)

P. Cury

Discussion: a global Mediterranean and Black Sea strategy to develop scenarios in a global change context EAF working group

Discussion - summary:

During this presentation the opportunity of building scenarios of the future ocean was presented to the public, introducing the IPBES international initiative. Later on the group further discussed about this issue on the Mediterranean and Black Sea context.

Discussion - contributions:

A. El-Sayed – The development of scenarios is going to be a huge challenge and we really need to work together to succeed on this.



P. Cury - It is true, this is a huge work and I hope we will succeed.

M.Coll – I think that EMBASEAS could play a role in this by working in a coordinated mater.

P. Cury - In the marine environment we are more integrated already than in the terrestrial ecology, it is very exciting for young people and will have a direct effect in management.

A. Jarre - What will be the challenge of funding, how is the funding going to be channelled?

P. Cury - There will be plenty of money for small and large projects at the international level. We need to propose things quickly so when calls are out there we are ready to propose things. I will keep CREAM partners informed.

11:30 General discussion: Building the operational network
 EMBASEAS

Discussion - summary:

Finally, the workshop ended discussion different issues on how to make EAF operational in the Mediterranean and Black Sea and how to disseminate the results of CREAM initiative, such as the newsletter and the CREAM conference in 2014.

Discussion - contributions:

D. Gabiña – The first EMBASEAS newsletter could be funded by the project, but it is better to make it electronic to be able to distribute it easily.

D. Gabiña - The format is also important, we can use a pdf or a website-newsletter. This second option is much less costly and easy to product. It could be integrated in the CREAM website

J. Leonart - A newsletter will need somebody to work on it permanently. And we will need to be periodic.

D. Gabiña - It could be two newsletters per year. But the website is easier to maintain.

J. Leonart - The continuity is important. Maybe a blog is more useful?

M.Coll – A blog needs to be maintain even more recently and it is obvious if they are not active. I think it depends on the activities for CREAM+

D. Gabiña - The idea is to ask for projects under the Horizon2020. There are some possibilities there.



1-The most promising is a coordination and support action BG11-2014. There is no geographic area explicit in this.

2-SFS 9 – 2014/2015 - Towards a gradual elimination of discards in European fisheries / Towards a Science-based regionalisation of the Common Fisheries Policy

3-BG2-2015-Forecasting and anticipating effects of climate change on fisheries and aquaculture. Research and innovation action

The other possibilities to base CREAM+ is with funding from other organizations. FAO and Zaragoza could fund some activities, for example they could fund the newsletter. FAO system of networks SCORNA, three are FAO-Zaragoza. That could be another option. GFCM may have other possibilities as well.

J. Leonart - The objective of CREAM is to create and facilitate a network for the implementation of EAF activities in the Mediterranean Sea. Is EMBASEAS the same as CREAM+?

M. Coll - It should be yes, they are different ways of calling the continuation of CREAM initiative when CREAM dies.

J. Leonart – To keep CREAM working under CREAM+, the coordination actions is better for the network.

P. Cury - EU wants bigger projects with 5-10 million euros. The call will be open 11 December and will be open for 3 or 4 months.

S. Taleb - Is this only for European countries? Or what would happen with Southern Mediterranean.

D. Gabiña - Now there is no restriction for partners from no European countries.

S. Taleb - Would be interesting to have a project for all the Mediterranean, we should discuss with FAO.

M.Coll - It is very hopeful to have a bit of funding. It could be used to pay the newsletter, fund some training and some meetings.

D. Gabiña - Why not? This would be very good. What it would be done is that WP6 should establish the possible framework for the network, and in Zaragoza we can propose concrete activities to work on this to talk with Bianchi.

S. Taleb - There are also interests from NGOs to fund some of these initiatives about EAF in the Mediterranean and Black Sea. MAVA foundation for nature is an example.

P. Cury - If we go for a call for 5 million euros, we need to merge with another group. Euromarine+ could go for this call, maybe this would be an opportunity. As soon as somebody knows about other groups it would be important to communicate it to the group.

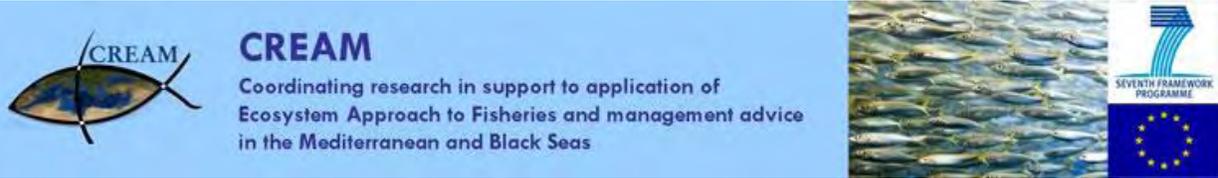


D. Gabiña - As soon as the documents from Horizon 2020 are out I will send them to all the group. If there is a need to organize a meeting we can try to meet again, we can ask permission for that under WP6 framework.

J. Vigneau - They want to shorten the time between opening the call and starting the project, it has to be one year.

P. Cury – To finish with this workshop, we present here a new small initiative: an analysis on Global Trends in Marine Biodiversity in Africa, Mediterranean and Black Seas. We could produce a nice paper in two workshops. This would allow us to work together and present to the scientific community and the stakeholders that this collaboration is essential.

17:00 Closing of the workshop



9 Annex III. Operational EAF Tables by partner

Table about operational implementation of EAF in the Mediterranean Sea

CREAM partner: Partner 14 IO-BAS

Name of country: Bulgaria

Name of ecosystem	Name of fishery	EAF Concern	Management measures implemented to counteract EAF concern	Scientific follow- up of EAF implementation	Feasible implementation in 1-2 years	Feasible implementation in 5 years	Desirable management measures to be implemented	Observations
Coastal zone Continental shelf zone	All	Fishing during the spawning period	Seasonal Fisheries ban	none	none	Identification of spawning and nursery areas for the key species	Designation of fisheries closures at identified spawning areas	
Coastal zone Continental shelf zone	Bottom trawl	Low selectivity, overfishing , physical disturbance of sea bed	Prohibition for use of bottom trawls	none	none	none	none	Illegal fishing by bottom trawls occurs along BG Black Sea coast
Coastal zone Continental shelf zone	Beam trawl	Low selectivity, physical disturbance of sea bed	Use of beam trawls restricted to certain zones	none	Assessment of impact of the gear on benthic communities	Reduction of areas	Ban for usage of beam trawls	The usage of Beam trawls was permitted in 2012 without any assessment of their impact on the sea bed and on benthic communities
Coastal zone	Pelagic trawl	Protection of species	Designation of MPAs and	Assessment of state of species	Official designation of	Elaboration of management	Implementation of management	

Continental shelf zone	(near bottom use), Beam trawl	and habitats	NATURA 2000 sites	and habitats, proposals for enlargement of 6 SCIs and 3 new SCIs	proposed SCIs	plans	plans, Monitoring and assessment of species and habitats conservation status	
Coastal zone Continental shelf zone	Other small scale fisheries (gillnets)	Low selectivity	Increase mesh size	none	Assessment of by-catch of small sized fish	Reduction of by-catch	Implementation of no-take zones	Gillnets for turbot fisheries
Coastal zone Continental shelf zone	Other small scale fisheries (gillnets)	By-catch of marine mammals	none	none	Discussion with decision makers for use of acoustic deterrent devices on gillnets	Assessment of by-catch; Reduction of by-catch	Implementation of legislative base; usage of acoustic deterrent devices	Gillnets for turbot fisheries
Coastal zone Continental shelf zone	Pelagic trawl; Other small scale fisheries (gillnets)	Overfishing	Quotas and TACs, licences	Regional Stock assessments, scientific surveys	Reduction of quotas for some species and introduction of quotas for the rest of overfished species	Reduction in fishing effort	Management plans for some species	
Coastal zone Continental shelf zone	All	Unknown quantity of discards	none	none	Estimation of discards by fleets and gears	Discussion with stakeholders about reduction of discards	Implementation of management measures for reduction of discards	
Coastal zone Continental shelf zone	All	IUU fishing	VMS system to vessels over 15 m length	none	Discussion with policy makers about necessity to reduce IUU	Implementation of management measures for reducing IUU	Improving control to avoid IUU fishing	

					fishing	fishing, VMS system to vessels under 15 m		
Coastal zone Continental shelf zone	Pelagic trawl (near bottom use), beam trawl, Bottom trawl	Physical disturbance of seabed	Ban for use of bottom trawls, restriction of usage of beam trawls	Initial assessment of physical pressure of mobile gear on the seabed, formulation of environmental targets for physical pressure (MSFD implementation)	Discussion with policy makers to implement measures reducing the physical pressure	Introduction of restriction measures on fishing effort	Ban for usage of Beam trawls	
Coastal zone Continental shelf zone	All	By-catch of small sized fish	Minimum allowed landing size of fish	none	Monitoring of commercial landings	Implementation of measures for reduction of small sized fish	Implementation of No-take zones	

Table about operational implementation of EAF in the Mediterranean Sea

CREAM partner: Abdel-Fattah M. El-Sayed

Name of country: Egypt

Name of ecosystem	Name of fishery	EAF Concern	Management measures implemented to counteract EAF concern	Scientific follow-up of EAF implementation	Feasible implementation in 1-2 years	Feasible implementation in 5 years	Desirable management measures to be implemented	Observations
Continental shelf	Bottom Trawls	<ol style="list-style-type: none"> Over fishing. Low selectivity of fishing gears. Negative effects on fishing and spawning grounds 	<ol style="list-style-type: none"> Closing fishing season (may-June) Closing area Not issuing any new fishing licenses 	<ol style="list-style-type: none"> Assessment of mortality reduction Stock assessment Determining the appropriate mesh sizes Identifying the legal length at first capture for some economic species to Control the mesh size 	<ol style="list-style-type: none"> Discovering new fishing area (Deep sea trawling) Common agreements with the neighbouring countries for fishing in their waters. 	<ol style="list-style-type: none"> Aquaculture-based fisheries Using modern, safely designed fishing nets. Prohibiting fishing and marketing of undersized fish sizes. 	<ol style="list-style-type: none"> Prohibiting fishing and marketing of undersized fish sizes. Aquaculture-based fisheries 	A number of publications appeared on stock assessment of some commercial fishes
Continental shelf	Bottom Trawls	By catch of poisonous Lessepsian fishes	Prohibiting marketing of poisonous fishes	Biological and stock assessment evaluation of poisonous fishes	Increase fishing activities for stock reduction of poisonous fishes	Identifying spawning grounds and time for stock reduction of poisonous fishes	<ol style="list-style-type: none"> Discovering the spawning ground and spawning time for stock reduction of poisonous fishes Paying More attention to public awareness over poisonous fishes 	<ul style="list-style-type: none"> Puffer fish catching, cleaning and marketing is prohibited by law. A number of death accidents has been recorded due to puffer fish consumption in the past few years.
Continental shelf	Purse seines	Over fishing	<ol style="list-style-type: none"> Closed season (may-June) Closed area Not issuing any new fishing 	<ol style="list-style-type: none"> Stock assessment of purse-seined fishes. 	<ol style="list-style-type: none"> Control light intensity and power of winches of the fishing vessels Identifying, jointly 	<ol style="list-style-type: none"> Aquaculture-based fisheries Prohibiting fishing and marketing of 	<ol style="list-style-type: none"> Application of Vessel Monitoring System (VMS). Prohibiting fishing and marketing of 	

			licenses		with neighbouring countries, new fishing areas 3-Identifying the legal length at first capture for economic fishes to Control the mesh size	undersized fishes. 3- Land and Marine inspection for fishing vessels and fishing gears (VMS).	undersized fishes.	
Coastal area	Purse seines	Destruction of bottom habitat	None	None	Assessment of catch structure	1. Prohibiting coastal fishing at less than 2 miles from shore line. 2. Prohibiting fishing at less than 50 m depth	Prohibiting coastal fishing at less than 2 miles from shore line or at depth less than 50 m.	
Upper slope	Purse seines	Discards of sardine	none	none		Assessment of total discards	Put a strategy/plan for discards reduction	
Coastal area	Beach seines	Destroyed bottom habitat	Prohibiting fishing by beach seines	None	Assessment of catch structure of beach seine	1. Monitoring the effects of beach seining on bottom habitat 2. Increase coastal guards patrolling	3. Assessment of catch structure of beach seine 4. Monitoring the effects of beach seining on bottom habitat.	
Continental shelf	Surface long line	By catch of seabirds and turtles	non	Non	Inspection of the impact of long lines of seabirds and turtles	Modifications in fish hooks to reduce mortality of turtles and seabirds	Changes in fish hooks to reduce mortality	
Coastal Lagoons	Gill nets	Overfishing of anadromous/ catadromous spawners	Prohibiting fishing of migratory spawning species (eel, mullet, seabream and seabass, etc) during spawning migrations.	None	1-Updating fishing legislation 2-Increase coast guards patrolling	1. Releasing hatchery-produced seeds into the wild. 2. Increase coast guards patrolling	1. Releasing hatchery-produced seeds into coastal waters 2. Increase coast guards patrolling	The resolution No. 321/2012) which regulates the collection of marine fish seeds for aquaculture needs has been amended by the resolution No. 592/2012. The new amendment added more restrictions on fishing marine seeds

Table about operational implementation of EAF in the Mediterranean Sea

CREAM partner: Tristan ROUYER _____ Name of country: FRANCE

Name of ecosystem	Name of fishery	EAF Concern	Management measures implemented to counteract EAF concern	Scientific follow- up of EAF implementation	Feasible implementation in 1-2 years	Feasible implementation in 5 years	Desirable management measures to be implemented	Observations
Gulf of lions	Bottom trawl	- Very few discards data - fish caught young	Fisheries restricted area [but I am not sure this is actually a management measure]	none	none	Discards ban		
Gulf of lions	Pelagic trawl	- a few sardines and anchovies reaching commercial size - effort reported on	none	none	none	none		

		demersal species						
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Table about operational implementation of EAF in the Mediterranean and Black Seas

Your name: Tania Zaharia

Name of your country: ROMANIA

Name of ecosystem	Name of fishery	EAF Concern	Measures implemented to counteract concern	Scientific follow up of EAF implementation	Possible implementation in 1-2 years	Possible implementation in 5-10 years	Management actions	Extra information
Continental shelf	Pelagic trawling	Low selectivity	Increase mesh size	Common stock management (reduction of fishing effort at BS level)	Implementation of common assessment of stocks	Implementation of MPAs network at BS level	Improve the selectivity of pelagic trawls	none
Continental shelf	Beam trawl	Low selectivity	Increase mesh size	Impact assessment on benthic fauna	Scientific monitoring on benthic fauna	Discussions regarding the opportunity of using the gear	Improve the selectivity of beam trawls	none
Continental shelf	Bottom long line	Low impact	none	Scientific advice regarding keeping the number of gears within safe limits	none	none	Maintaining ratio between number of fishing gears and respecting of prohibition periods and areas	none
Continental shelf	Beach seine	Low impact	none	Scientific advice regarding keeping the number of gears within safe limits	none	none	none	none
Continental shelf	Other small scale fisheries	By-catch of cetaceans	Optimal sizing of the yarn thickness	Reducing fishing effort (no. of gears); Scientific advice regarding keeping the number of gears within safe limits	Generalizing the use of pingers; Discarding individuals below the minimum legal size	Implementing the Action Plan of the national and regional conservation of cetaceans; Discussions with fishermen on the need to protect the fishery fauna	Respecting of prohibition periods and areas; Improving of fishing gears design; Decreasing fishing effort.	none

Table about operational implementation of EAF in the Mediterranean Sea

CREAM partner: Ege Univ. Name of country: Turkey

Name of ecosystem	Name of fishery	EAF Concern	Management measures implemented to counteract EAF concern	Scientific follow- up of EAF implementation	Feasible implementation in 1-2 years	Feasible implementation in 5 years	Desirable management measures to be implemented	Observations
Continental shelf	Bottom trawl	Low selectivity	Increase mesh size and using square mesh instead of diamond mesh	1-Use of 40 mm square mesh optionally instead of 44 mm diamond mesh in trawl codend 2- the number of mesh in codend cannot be more than half of mesh number in the tunnel part	The use of 90 degree turned diamond mesh netting for trawl codends	Standardization of trawl codends and attachments	None	The use of ninety degree turned diamond mesh netting for trawl codends can potentially be one of the alternative ways to satisfy both the fisheries management and the fishermen.
Continental shelf	Bottom trawl	Over fishing	Limited by licences	the fishing pressure on stocks at least hold steady	None	None	Considering spatial based fisheries management and EAF, certain number of trawl vessels may be permitted in	New fishing vessels for marine fisheries have been permitted only on condition that it replaced a vessel removed from the fleet.

							certain areas	
Continental shelf	Bottom trawl	Spawning period	Spatial and temporal closures	Assessment of population recovery	None	None	None	150 days non-stop closed season between April 15 th and September 15 th .
Continental shelf	Bottom trawl	Discard regulation	None	None	None	None	Over all discard may be completely landed although some part of catch are under MLS and non-marketable	None
Continental shelf	Bottom trawl	Discard and by-catch of demersal species	Spatial closures 1- 1,5 to 3 miles from the coast depending on the area 2- Trawling is not allowed in the Eastern Black Sea 3- There are also many restriction areas along the Mediterranean coast of Turkey.	Assessment of population recovery	None	None	None	Some of bays and gulfs along the Turkish Mediterranean coast could be completely closed for the bottom trawl fishing
Continental shelf	Purse seine	Over fishing	Limited by licenses	the fishing pressure on stocks at least hold steady	None	None	None	New fishing vessels for marine fisheries have been permitted only on condition that it replaced a vessel removed from the fleet.

Continental shelf	Purse seine	Spawning period	Spatial and temporal closures	Assessment of population recovery	None	None	None	135 days non-stop closed season between April 15 th and August 31 th
Continental shelf	Purse seine	By-catch and discard	depth restriction Purse seine fishing is not allowed shallower water than 24 m	Reducing by-catch and discard	None	None	None	None
Continental shelf	Other small scale fisheries	By catch of species	Increasing mesh size	Reducing by-catch	None	36 mm minimum mesh size in trammel nets will be implemented in September 1st 2016	None	Trammel net
Continental shelf	Other small scale fisheries	The capture of common sole and flounder individuals under MLS	Increase mesh size 80 mm minimum mesh size for trammel nets used for common sole and flounder	Assessment of mortality reduction	None	None	None	Trammel net fishing for common sole and flounder
Continental shelf	Other small scale fisheries	The capture of turbot individuals under MLS	Increase mesh size	Assessment of mortality reduction	None	400 mm minimum mesh size in entangled net used for turbot fishing. This technical measure will be implemented in September 1st 2016.	None	Entangled net fishing
Continental	Other	By-catch	All kind of	Reducing by-	None	None	None	Gill net and

shelf	small scale fisheries	and discard problem	monofilament nets are banned	catch and discard				trammel net fishing
Continental shelf	Other small scale fisheries	By-catch and discard problem	depth restriction Fishing with encircling nets deeper than 22 m are banned between April 15 th and August 31 st	Reducing by-catch and discard	None	None	None	Encircling net fishing
Continental shelf	Bottom long line	Reduce by-catch and mortality	Increase hook size Gape distance of hooks used in long line fishing cannot be less than 7.2 mm	Increase hook size to reduce mortality	None	None	None	None
Continental shelf	Surface long line	Reduce by-catch and mortality	Increase hook size Gape distance of hooks used in long line fishing cannot be less than 2.8 cm	Increase hook size to reduce mortality	None	None	None	Surface long line for tuna and swordfish
Continental shelf	ALL	Over fishing	Reducing the fishing capacity Buy-back program	reducing over fishing pressure on the stocks	Buy-back program is in practice since 19 th June 2012. (It is still going on)	None	None	None

			Designation of NTZs					
Continental shelf	Pelagic trawl	Over fishing	None	None	None	None	None	None
Continental shelf	Tuna and swordfish seine	Over fishing	<p>Fishing operations for Tuna seine nets in Turkey are only allowed within the fishing periods specified by the ICCAT</p> <p>All authorized Tuna seiners and boats for transporting cages are equipped with an operational VMS</p>	None	None	None	None	Fishing operations for Tuna seiners generally take place in the southern waters of Mediterranean
Continental shelf	Spearfishing with scuba	Overfishing, illegal fishing, unreported	Spearfishing with scuba equipment is banned.	None	None	None	None	<p>Spearfishing with artificial light is banned</p> <p>Any kind of spearfishing activities are banned in some areas such as NTZs, military zones.</p>
Continental shelf	Blast fishing	Habitat and biodiversity damage	It is strictly banned in Turkish Seas.	None	None	None	None	None

Continental shelf	Beach seine	Discard problems	All kind of beach seine nets have been banned since 2001 in along the Turkish coast.	In order to protect littoral zone and to reduce discard problems	None	None	None	None
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10 Annex IV. Reprint of peer-review publication resulting from WP6

Coll, M., Cury, P., Azzurro, E., Bariche, M., Bayadas, G., Bellido, J.M., Chaboud, C., Claudet, J., El-Sayed, A., Gascuel, D., Knittweis, L., Pipitone, C., Samuel-Rhoads, Y., Taleb, S., Tudela, S., Valls, A., Participants, W., 2013. **The scientific strategy needed to promote a regional ecosystem-based approach to fisheries in the Mediterranean and Black Seas.** *Reviews in Fish Biology and Fisheries* 23, 415-434.

*The scientific strategy needed to promote
a regional ecosystem-based approach to
fisheries in the Mediterranean and Black
Seas*

**Marta Coll, Philippe Cury, Ernesto
Azzurro, Michel Bariche, Giorgos
Bayadas, Jose Maria Bellido, Christian
Chaboud, Joachim Claudet, et al**

Reviews in Fish Biology and Fisheries

ISSN 0960-3166

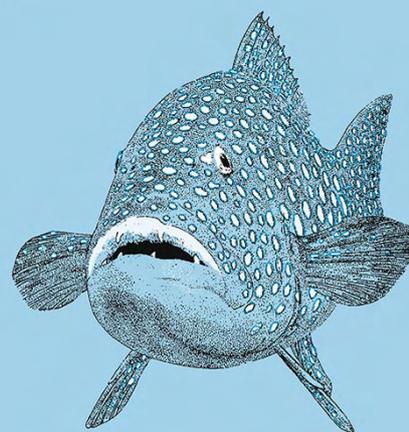
Rev Fish Biol Fisheries

DOI 10.1007/s11160-013-9305-y

**Reviews in
Fish Biology
and Fisheries**

VOLUME 23 NUMBER 1 2013

Editor **Jennifer L. Nielsen**



 Springer



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The scientific strategy needed to promote a regional ecosystem-based approach to fisheries in the Mediterranean and Black Seas

Marta Coll · Philippe Cury · Ernesto Azzurro · Michel Bariche · Giorgos Bayadas · Jose Maria Bellido · Christian Chaboud · Joachim Claudet · Abdel-Fattah El-Sayed · Didier Gascuel · Leyla Knittweis · Carlo Pipitone · Yianna Samuel-Rhoads · Said Taleb · Sergi Tudela · Audrey Valls · Workshop Participants

Received: 1 October 2012 / Accepted: 16 February 2013
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Abstract This manuscript is an outcome of the workshop entitled “Scientific Strategy for a Global Approach to Promote Regional Ecosystem-based Approach to Fisheries (EAF) in the Mediterranean and Black Seas” held in Sète (France) in July 2012. The workshop was organized by Work-Package 6 of the coordination action “Coordinating Research in Support to Application of Ecosystem Approach to Fisheries and Management Advice in the Mediterranean and Black Seas” (CREAM), funded by the EU

Seventh Framework Programme. The main aim of the workshop was to discuss what is needed to advance on a robust scientific strategy to promote EAF in the Mediterranean and Black Seas. Participants discussed a series of scientific recommendations for promoting the coordination of initiatives with the aim of contributing to an operational EAF. Discussion was carried out on (i) what can be learnt from case studies that promote EAF worldwide, (ii) how a scientific strategy for EAF can be built, and (iii) which are the future scientific networking activities to promote EAF. Here we summarize the discussions and conclusions of the workshop, and we present the recommendations and future initiatives proposed to advance EAF in the

Refer to the “Appendix” section for the complete list of “participants to the workshop” authors.

M. Coll (✉)
Institut de Ciències del Mar, Consejo Superior de Investigaciones Científicas, Passeig Marítim de la Barceloneta, n° 37-49, 08003 Barcelona, Spain
e-mail: mcoll@icm.csic.es

M. Coll · P. Cury · C. Chaboud
UMR EME 212 IRD/UM2/IFREMER, Centre de Recherche Halieutique Méditerranéenne et Tropicale, IRD-IFREMER and Université Montpellier II, Avenue Jean Monnet, BP 171, 34203 Sète Cedex, France

E. Azzurro
ISPRA, National Institute for Environmental Protection and Research, Sts Livorno, Piazzale dei Marmi, 2., 57123 Livorno, Italy

M. Bariche
Department of Biology, American University of Beirut, P.O. Box 11-0236, Beirut, Lebanon

G. Bayadas
Department of Fisheries and Marine Research, Ministry of Agriculture, Natural Resources and Environment, Vithleem street, 101., 1416 Nicosia, Cyprus

J. M. Bellido
Instituto Español de Oceanografía, Centro Oceanográfico de Murcia, Varadero, 1., 30740 San Pedro del Pinatar, Spain

J. Claudet
National Center for Scientific Research (CNRS), UR 3278 CNRS-EPHE CRIOBE, University of Perpignan, 66860 Perpignan Cedex, France

J. Claudet
Laboratoire d'Excellence “CORAIL”, Moorea, France

Mediterranean and Black Seas region. Participants to the workshop agreed that the achievement of a common vision regarding the Mediterranean and Black Seas region should be one of the first and most important elements towards a successful EAF. A common vision should recognise the need to promote the reconciliation of conservation and exploitation, and to aim for a good socioeconomic and ecological status. The vision should also promote the recovery of ecosystems and rebuilding of marine commercial stocks and predator species. EAF initiatives, carried out worldwide, illustrated that whilst the development of relevant science is essential to render the EAF process operational, the involvement of stakeholders is the key factor that characterises successful initiatives. This is especially important in the Mediterranean and Black Sea context, where many stakeholders show conflicting interests and associated trade-offs. During the workshop, it became clear that numerous overlapping and poorly coordinated initiatives for EAF exist in the region. The group discussed the integration of the existing initiatives in a coordinated manner and arrived to the conclusion that a scientific network to promote coordinated and operational EAF initiatives created by the scientific community is needed. Ultimately, the discussion was focused on how to build such a scientific network and how to proceed to consolidate the regional scientific vision, with a clear scientific strategy and roadmap, including a diversified toolbox. In the short term, the proposed EAF scientific network should (i) document and coordinate scientific initiatives, (ii) promote the sharing of scientific

information and capabilities, (iii) promote data availability, integration, harmonization, and interoperability, (iv) promote training capabilities and capacity building of the scientific community and stakeholders, (v) establish mechanisms to disseminate knowledge, and communicate EAF benefits, and (vi) promote concrete regional scientific initiatives. In the long run, the network should promote scientific advice on EAF to inform adaptive management, and promote EAF implementation at different geographical scales (from local to regional) using a transversal approach. The ultimate goal of the network should be to link management advice to good scientific information providing useful advice to address management objectives (i.e. present the trade-offs), and creating a knowledge-based management approach.

Keywords Ecosystem-based approach to fisheries (EAF) · Mediterranean and Black Seas · Scientific strategy · Scientific network · Roadmap · Toolbox · Coordination · Transversal approach

Background

The need to consider natural changes as well as human activities when analysing and managing marine resources highlights the need to adopt an integrated view of complex ecosystems. Since the productivity of marine resources depends on the ecological state of

A.-F. El-Sayed
Oceanography Department, Faculty of Science,
Alexandria University, Alexandria, Egypt

D. Gascuel
UMR Ecologie et Santé des Écosystèmes, Université
Européenne de Bretagne, Pole Halieutique Agrocampus
Ouest, 65 Route de Saint Brieuc. CS84215, 35042 Rennes
Cedex, France

L. Knittweis
Capture Fisheries Section, Fisheries Control Directorate,
Ministry for Resources and Rural Affairs, Barriera Wharf,
Valletta VLT 1970, Malta

C. Pipitone
CNR-IAMC, Sede di Castellammare del Golfo, Via
Giovanni da Verrazzano, 17., 91014 Castellammare del
Golfo (TP), Italy

Y. Samuel-Rhoads
Oceanography Centre, University of Cyprus,
P.O. Box 20537, 1678 Nicosia, Cyprus

S. Taleb
Cooperation Division, Institut National de Recherche
Halieutique, 2, rue de Tiznit, 20000 Casablanca, Morocco

S. Tudela
World Wide Fund for Nature (WWF) Mediterranean
Programme Office, Canada, 37, 08002 Barcelona, Spain

A. Valls
Fisheries Centre, University of British Columbia (UBC),
2202 Main Mall. V6T 1Z4, Vancouver, BC, Canada

ecosystems, not only the dynamics of target species, but also the dynamics of non-target organisms, trophic relationships and energy flows, environmental factors and human impacts have to be considered to manage our seas and oceans properly (Botsford et al. 1997; Cury et al. 2003; Duda and Sherman 2002; Cury et al. 2008). This can only be achieved through an Ecosystem-based Approach to marine resources Management (EAM), or when dealing specifically with fishing activities, the Ecosystem-based Approach to Fisheries (EAF) (Costanza et al. 1998; Pauly et al. 2002; Pikitch et al. 2004; Link 2011; Christensen and Maclean 2011).

Several national and international governmental bodies are actively promoting the sustainable management of marine resources, and the adoption of the EAF in order to address increasing amounts of anthropogenic pressures on marine environments and conflicts between multiple users competing for space and resources (FAO 2003; Garcia et al. 2003; Garcia and Cochrane 2005; Shannon et al. 2010; Smith et al. 2007; Link et al. 2011). International conventions, treaties and other legal instruments, such as the United Nations Convention on the Law of the Sea (UNCLOS), the Convention on Biological Diversity (CBD), the Agenda 21 of the United Nations, and the FAO Code of Conduct for Responsible Fisheries, promote EAF worldwide. At the European level, the promotion of a sustainable marine environment is now in the agenda of several on-going policies, such as the new Common Fisheries Policy (CFP) and the Marine Strategy Framework Directive (MSFD), which aims at achieving a Good Environmental Status (GES) in EU marine waters by 2020, at the latest (EC 2008).

Making progress towards the EAF is also a timely issue in the Mediterranean and Black Sea region (GFCM-SAC 2005; Cochrane and de Young 2002; Cochrane and de Young 2008; UNEP 2009). The Mediterranean basin is a complex region with high biological diversity and a long history of human activity (Blondel and Aronson 2005; Lotze et al. 2011). The landmasses surrounding this sea are heavily populated. The basin currently includes 21 modern countries with very different (and sometimes conflicting) socioeconomic and cultural traits, and some of the most renowned marine tourist destinations in the world. As a result of this complex socioeconomic and ecological context, the management of Mediterranean and Black Sea resources is seldom

coordinated and proactive, and actions are usually taken only after problems have appeared.

To move towards a sustainable use of marine resources, substantial effort and funding is going towards initiatives guided by EAF principles, which are aiming at contributing to the implementation of an EAF in the region. A relevant initiative to promote EAF is the coordination action CREAM (“Coordinating Research in Support to Application of Ecosystem Approach to Fisheries and Management Advice in the Mediterranean and Black Seas”), funded by the EU Seventh Framework Programme (<http://www.cream-fp7.eu/>). CREAM aims at:

- (i) Establishing guidelines for the application of the EAF in the Mediterranean and Black Seas;
- (ii) Creating an effective collaboration network among key players in fisheries research and management;
- (iii) Developing training and capacity building activities regarding data collection, and methodologies used in fisheries assessment and management.

Participants in CREAM include 22 national research institutes from 17 countries of the Mediterranean and Black Sea with a background in fisheries research, which provide advice to national, regional and international fisheries management organisms. CREAM includes eight European Union member states (Bulgaria, Cyprus, France, Greece, Italy, Malta, Romania, and Spain) and nine non-European countries (Croatia, Egypt, Georgia, Lebanon, Morocco, Russia, Tunisia, Turkey, and Ukraine) (Fig. 1). The project also includes one intergovernmental organisation, the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM), and seeks the active collaboration of five regional and international fisheries management organisms as external participants in order to identify gaps (in terms of data, knowledge, training, coordination). External participants to the project are the Food and Agriculture Organization of the United Nations (FAO), the General Fisheries Commission for the Mediterranean (GFCM), the Commission on the Protection of the Black Sea Against Pollution (BSC), the International Commission for the Conservation of Atlantic Tunas (ICCAT), and the Regional Activity Centre for Specially Protected Areas of the Mediterranean Action Plan of the United Nations Environmental Programme (UNEP RAC/SPA).

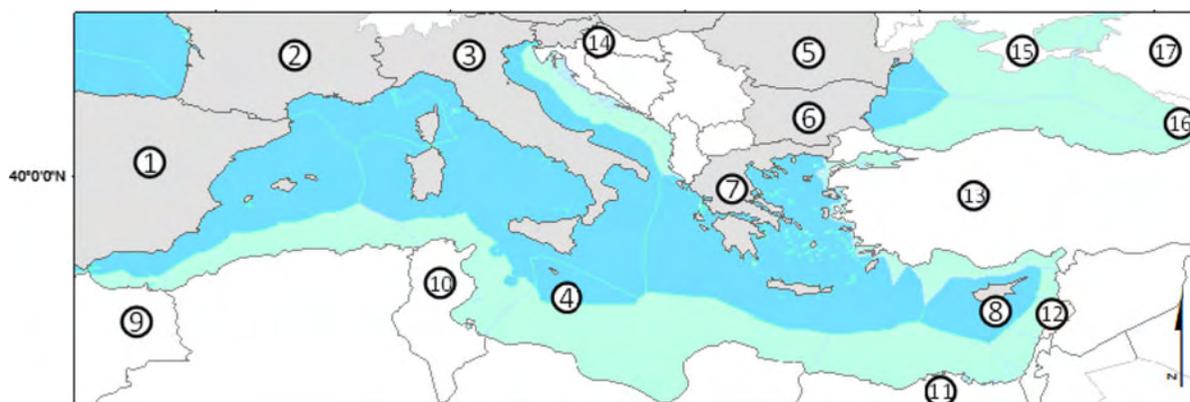


Fig. 1 The Mediterranean and Black Seas region, and countries participating in the coordination action CREAM. Countries of the European Union (EU) are highlighted in grey and the EU waters are highlighted in dark blue. Non-EU countries are in white and non-EU waters are in pale blue. CREAM countries are

numbered 1 Spain, 2 France, 3 Italy, 4 Malta, 5 Romania, 6 Bulgaria, 7 Greece, 8 Cyprus, 9 Morocco, 10 Tunisia, 11 Egypt, 12 Lebanon, 13 Turkey, 14 Croatia, 15 Ukraine, 16 Georgia, 17 Russia

CREAM is organized in six work-packages, with Work-Package 6 aiming at:

- (i) Strengthening the scientific basis for building a generic framework to implement EAF in the Mediterranean and Black Seas;
- (ii) Establishing a network that will coordinate scientific research to make EAF operational.

CREAM Work-Package 6 organised its first workshop on the 3rd and 4th of July 2012 in Sète, France. The workshop topic was the “Scientific Strategy for a Global Approach to Promote Regional EAF”, and was attended by 30 participants.

Participants to the workshop included CREAM partners and a series of recognised experts external to the project, who were invited to enrich the discussion and present interesting initiatives at a regional or international level (the full list of participants is provided in Appendix 1).

The attendees to the workshop learned from, reflected on and discussed about:

- (i) What can be learnt from case studies dedicated to promote EAF around the world?
- (ii) How a scientific strategy for an operational EAF in the Mediterranean and Black Seas can be built?
- (iii) What are the future scientific networking activities to promote?

To facilitate discussion and participation, three questions were posed in advance to the experts attending the workshop:

- (i) What are the existing and key scientific initiatives and tools that can contribute to EAF in the Mediterranean and Black Sea?
- (ii) What are the scientific gaps that need to be addressed to advance EAF?
- (iii) How do you envisage a scientific network for an operational EAF and who would be the key players?

Below we summarize the discussion, topics and conclusions of the workshop, and we present its recommendations, as well as proposed future initiatives to advance towards an operational EAF in the Mediterranean and Black Seas region.

The workshop

The workshop was organised in a series of sessions that included presentations dealing with key topics, followed by discussions. Following a review of EAF principles and objectives (FAO 2003, 2008; Pikitch et al. 2004; Sissenwine and Murawski 2004), the participants reflected on the need of a worldwide scientific EAF strategy, and its importance in the Mediterranean and Black Sea context, in particular. Additional presentations dealt with what could be learnt from worldwide case studies, and which international and regional initiatives and methods may be useful to contribute to EAF in the region. Special emphasis was placed on important topics in the Mediterranean and Black Seas

context, such as the quantification of the impacts of fishing (Tudela 2004), the spread and associated impact of non-indigenous species (Bariche et al. 2004; Azzurro et al. 2011), the multiple stressors and interactions of human activities (Coll et al. 2012; Claudet and Fraschetti 2010; Oczkowska et al. 2009), the evaluation of ecosystem services (Katsanevakis et al. 2011; Salomidi et al. 2012), and the need to move towards a spatially-based analysis of human activities (Giakoumi et al. 2012; Stelzenmuller et al. 2012).

During the workshop, novel initiatives at the European or international level were presented. These initiatives could contribute to the EAF application in the region by complementing the available toolbox. Initiatives presented included new research to promote ecological scientific knowledge for EAF (Cury et al. 2011; Lotze and Worm 2009; Pikitch et al. 2012), the incorporation of single species assessment in an EAF context (Colloca et al. 2012), and initiatives on ecological indicators and ecosystem assessments (such as the European MSFD and GES initiative, the STECF (Scientific, Technical and Economic Committee for Fisheries) expert working group on EAF management, and the IndiSeas project, EC 2008; Gascuel et al. 2012; Shin et al. 2012; Cardoso et al. 2010). Global modelling initiatives and scenario building (such as the NEREUS project and the new IPBES United Nations initiative, NEREUS 2012; IPBES 2012) were also introduced.

Relevant science is essential, but not enough

The group discussed worldwide initiatives towards EAF (including examples from Canada, South Africa, Australia, New Zealand and United States of America) (Shannon et al. 2010; Smith et al. 2007; Fletcher et al. 2010; Link et al. 2011; Curran et al. 2011; Lester et al. 2010). A comprehensive presentation reviewing what can be learnt from leading case studies, and the suitability of these initiatives to be applied in the study area was discussed. The revision looked at what science is actually used to do EAF in key case studies (what is proposed, what is done). Main elements analysed were the topics included in the EAF approach, the scientific toolbox deployed, what has been successful or challenging, and the main external factors conditioning EAF implementation (in a positive or negative way).

Case studies provided clear inspiration to advance EAF, but it was also clear that Mediterranean and

Black Sea socioeconomic realities differed considerably. South Africa was identified as the region with the most similarities to the Mediterranean and Black Sea circumstances due to some socio-economic features shared by both areas, in addition to some ecological ones (such as the importance of small pelagic fish in their fisheries). Therefore, both regions shared some similarities considering the topics included in the EAF approach, the toolbox and the external factors conditioning EAF. Other international or European initiatives that were presented, such as initiatives on ecological indicators like those mentioned above, and ecological modelling approaches (for example, applications of Ecopath with Ecosim, Atlantis, and Osmose models, Christensen and Walters 2011; Fulton 2010; Travers et al. 2007), were presented and positively valued by the group. Several applications of ecological models and indicators (Coll and Libralato 2012) have been developed or are being developed in the region and these will be important contributions to EAF. Links to these initiatives should be made explicit while developing a scientific strategy for EAF in the region (Fig. 2).

EAF case studies and initiatives illustrated that the development of relevant science based on a clear roadmap, utilizing a diverse toolbox, and with the capacity to adapt the tools and approaches as EAF is implemented, is essential if the EAF process is to succeed. However, the case studies also illustrated that relevant scientific basis is not enough. In fact, the key factor that characterises successful initiatives worldwide is the involvement of stakeholders in the EAF process (Shannon et al. 2010; Smith et al. 2007; Link 2011). Stakeholders need to be engaged throughout the process, from the development of methods, to the application of the science, i.e. the link of science to management, to the implementation of adaptive management measures, and the subsequent monitoring and assessment of the measures. This could be better achieved through coordination with multi-stakeholder co-management committees overseeing geographically delineated fishing grounds or particular fisheries therein. The group argued this territorial-based co-management is even more important in the Mediterranean and Black Seas context (Fig. 2), where many stakeholders exist and interact (commercial and recreational fishers, industry, non-governmental and governmental organizations, general public, etc.), exhibiting sometimes conflicting interests and trade-offs.

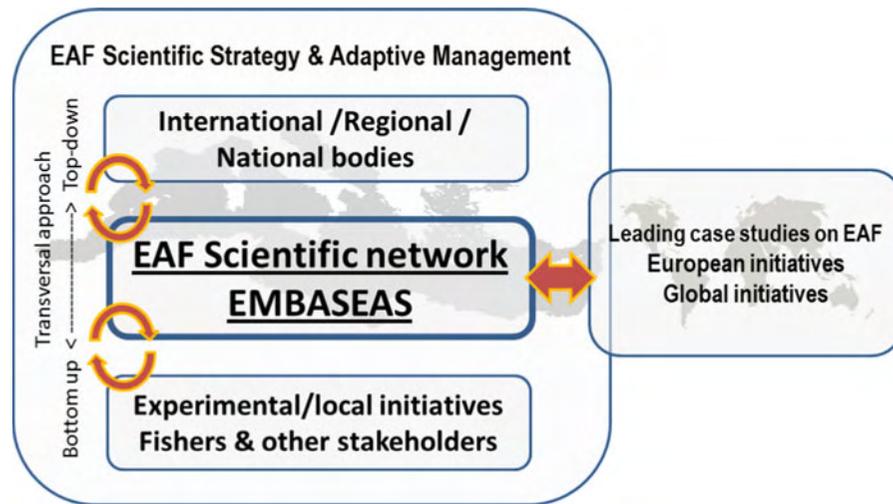


Fig. 2 The Ecosystem Approach to Fisheries (EAF) scientific strategy and links to promote adaptive management in the Mediterranean and Black Seas region envisaged by the group

In fact, early in the discussion, the group recognised that establishing the link between science and the implementation of adaptive management schemes is one of the most difficult issues to ensure the success of EAF. Although this is a key topic worldwide (Link 2011), few experiences show clear success in how to link scientific initiatives at local and regional scales to the societal needs of implementing management actions based on scientific advice in an adaptive manner. The documentation of examples and initiatives that advance towards the implementation of adaptive management and how to translate EAF general principles into concrete management activities is thus of outstanding importance. Unfortunately, successful initiatives in the Mediterranean and Black Seas are few, but the ones that exist set the examples on how to proceed (for example, pioneer case studies through the Mediterranean artisanal fishing platform, www.medartnet.org, and through the Network of Managers of Marine Protected Areas of the Mediterranean Sea, www.medpan.org). The group highlighted that one of the first tasks to pursue in the Mediterranean and Black Seas region should be to identify, document, and promote these successful case studies.

A coordinated scientific EAF initiative is needed

During the workshop, several initiatives, datasets, methods, as well as past and present projects that aim at directly or indirectly contributing to EAF in the

Mediterranean and Black Seas region were reviewed and discussed. Scientific initiatives included projects from national research institutions, collaborative bilateral projects and European programmes, initiatives of other regional bodies (such as FAO, GFCM, BSC, ICCAT, UNEP RAC/SPA, or the Mediterranean Scientific Commission CIESM), international projects on indicators and modelling, local and regional pilot studies, and non-governmental organizations activities (e.g., WWF, Oceana). A *status quo* revision is one of the aims of CREAM Work-Packages 2 and 3, which will serve to illustrate that several interesting efforts and initiatives are currently in place, although they are highly heterogeneous (CREAM-WP2 2012).

In fact, at an early stage of the workshop it became clear that numerous local and regional initiatives exist, which have highly overlapping themes and are poorly coordinated. As a consequence, final results may be undermined by redundancy and by creating confusion amongst end users and policy makers. Thus, the group discussed the need to promote the integration of these existing initiatives in a coordinated manner. It was recognized that substantial funding through European projects and national calls is being invested in promoting EAF, but that achievements are still modest due to the limited coordination and the lack of a regional common vision. Therefore, there is a real need to integrate what has been done and is being done, what has been achieved, with what is needed in the future in order to advance the application of EAF.

To progress towards this coordinated regional initiative, the group identified the need to achieve a clear and strong common regional scientific vision on what marine ecosystems in the region should be, according to specific criteria. The Mediterranean and Black Seas are dominated by a human landscape with conflicting interests; therefore the achievement of a common vision is one of the first and most important elements of a successful EAF. The group argued that the vision should recognise the need to promote the reconciliation of conservation and exploitation and to aim for a good socioeconomic and ecological status. Maintaining marine ecosystems in a healthy, productive and resilient condition will ultimately serve to sustain human uses and provide goods and services (Katsanevakis et al. 2011). Since the status of marine resources and ecosystems in the region is poor (Coll et al. 2010, 2012; Lotze et al. 2011; Abdul Malak et al. 2011; EC 2012), the vision should also promote the recovery of ecosystems, in general, and the rebuilding of marine commercial stocks and predator species, in particular.

A significant part of the Mediterranean and Black Seas region is located within European Union waters (Fig. 1). Therefore, the group discussed the need to synchronize the vision and the strategy towards EAF with what is being developed at the European level. Current and future policy developments of the new Common Fisheries Policy (CFP) and the Marine Strategy Framework Directive (MSFD) (EC 2008) will strongly influence the whole region. In addition, the application of the Barcelona Convention, the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (initiated in 1976), will not only affect European countries. The new European policy will also lead to the implementation of new targets in fish stock in order to reach abundances ensuring the maximum sustainable yield target by 2020 and to the monitoring of indicators related to the GES targets. Therefore, linking activities at the European level to the regional reality of the Mediterranean and Black Seas is vital, although likely to be challenging.

For an EAF to be successful at the Mediterranean and Black Sea level, the group also emphasized the importance of integrating different visions at different geographic scales, from local to regional levels. This notion promoted an interesting discussion about the geographic scale (or territorial management unit)

appropriate for science to be applied in order to better influence management of marine resources. The group suggested that science in the region should be developed with a transversal approach, where both bottom-up and top-down processes between science and management are needed to promote a scientific strategy integrating different geographical scales. Therefore, scientific initiatives should be able to respond to both local and regional issues using appropriate management units. The transversal view should aim at integrating these two approaches through consultation and cooperation. Science for EAF should be proactive and should establish numerous partnerships with both local and regional institutions, as well as strong links with international initiatives (Fig. 2).

Scientific achievements and obstacles in the road to EAF

To date, topics analysed in the Mediterranean and Black Seas region using an EAF approach included: (i) the impact of fishing on commercial species (Colloca et al. 2012), (ii) the impact of intense exploitation of small pelagic fish (Palomera et al. 2007), (iii) reduction of predators and ecosystem changes (Lotze et al. 2011), (iv) selectivity of fishing (Sardà et al. 2006), and by-catch and discarding issues in relation to EAF (Bellido et al. 2011), (v) endangered species (Tsounis et al. 2007), (vi) the modification of benthic habitats and habitat losses and degradation (Claudet and Fraschetti 2010), (vii) the impact of climate change and climate variability (Lloret et al. 2004; Sabatés et al. 2006), (viii) the impact of invasive species (Galil 2009, 2007), (ix) multiple impacts of human activities (including impacts of land-based activities) (Coll et al. 2012), (x) the biodiversity conservation and fisheries benefits of marine protected areas (García-Charton et al. 2008), and (ix) the socio-economic impacts of fisheries mismanagement and food security (Merino et al. 2007). These topics were in fact similar to topics identified in leading worldwide case studies.

The scientific toolbox used to tackle these issues included: (i) monitoring (mainly in EU countries), as well as stock assessment analyses and models, (ii) ecological and bio-economic models, (iii) data-based and model-based indicators, (iv) fleet-based approaches to assess both the ecological impacts and the socio-economic performances of fleets; (v) spatial datasets

and analysis of diversity, threats, and management proposals, and (vi) knowledge from expert judgement and local ecological knowledge. These initiatives have contributed to the advancement of EAF in the region by providing: (i) ecosystem analyses at local and sub-regional scales, (ii) integrated knowledge on the status of several commercial species, (iii) knowledge on ecosystem effects of fishing and ecosystem functioning at local/regional scales, (iv) a set of available ecological models and indicators to use, (v) knowledge on temporal and spatial patterns, and (vi) large potential of expert knowledge to inform EAF.

However, on-going results of CREAM work packages have illustrated that the capacity to address EAF issues in the region is generally low or medium depending on the areas and topics (CREAM-WP2 2012). During the workshop, the group identified and discussed general topics that need to be tackled to advance EAF in the region in the future. Important scientific challenges identified by the group include:

- Lack of long-term data and spatial datasets, since data on several topics and areas are missing and there are data accessibility issues;
- Lack of data quality measures and uncertainty analyses;
- Limited knowledge on human impacts related to fisheries aside from direct fishing impacts (invasive species, aquaculture, habitat destruction, litter pollution from fishing vessels), as well as other human impacts (including land-based activities), the impact of climate change, and how they interact and accumulate;
- Lack of methods to integrate knowledge and ecosystem research results in management processes, such as risk assessments methods, marine strategy evaluation procedures, or harvest strategy rules integrated in adaptive management procedures.

The group listed basic scientific knowledge that is lacking in the process to advance EAF in the region. The outcome was a long list of issues and topics, evidencing the fact that basic gaps of knowledge from the region can be found in all topics, from physical-oceanography and ecological topics, to social and economic issues. These topics include:

- (i) The description of basic ecological processes and patterns: such as abundance and distribution of marine resources, natural refuges and

habitats, migration of species, information on the stock structure and stock connectivity in relation to fisheries management and the location of MPAs, location of nursery and spawning areas, basic ecology of predators and their ecological needs (e.g., minimum prey needed), basic data on taxa indirectly affected by fishing (sharks, seabirds, marine mammals), basic data on the ecology of small pelagic fish and invertebrates (prey of predators), invasive species, endangered species and data deficient species, and data on ecosystem functioning and biodiversity patterns at the community level (mainly species, phylogenetic and functional diversity);

- (ii) The effect of anthropogenic pressures and the interaction of stressors and drivers: such as the effects of multiple stressors including their synergies, the effects of environmental variability, the impact of aquaculture on capture fisheries, and land-based human pressures on marine fisheries, the ecological impact of management plans and MPAs, and the potential for recovery of resources and ecosystems;
- (iii) Socio-economic subjects: such as the quantification of ecosystem services, total catch and by-catch, real fishing effort, economic evaluations (including true cost of fisheries mismanagement, non-market costs, the sensitivity of ecosystems to public policies, and market/non-market incentives), fishing fleet behaviour, and how to combine socioeconomic and ecological evaluations in a fleet-based approach.

Gaps are also found in methodologies and tools needed to complement the toolbox for EAF. In this regard, the group discussed several methods that are already applied worldwide that could be adapted to be used in the Mediterranean and Black Seas region. The need for an improvement of scientific methods includes: (i) further standardization of stock assessment methods and harmonization of methods and data, (ii) the extension of indicators and definition of reference points, directions and targets (both limits and thresholds), including the development of indicators of stock status in data poor situations, (iii) the further development of modelling capabilities and scenarios including key human drivers to join global efforts in predicting the future of the oceans, and (iv)

the creation or adaptation of tools to incorporate ecosystem research results into the management process. This requires the promotion of a regional toolbox with new and adapted methodologies to span the whole range of approaches needed (Fig. 3), including monitoring, evaluation, and adaptive management.

Whilst it is evident that the scientific community has the obligation to fill the identified scientific gaps and to develop the required toolbox, a pragmatic approach is clearly required. The group acknowledged that while it is essential to reduce gaps of data and methods, it should be recognised that there will always be gaps in the knowledge and information required to contribute to EAF. Nevertheless, policy makers need to make the best decision they can using the available information. This calls for a pragmatic combination of the precautionary approach, especially when data on basic elements and processes is very limited, with the use of those tools and data which are readily available to provide the best possible scientific advice. Therefore, in addition to promoting the completion of important scientific gaps, the group recognised that it is essential to:

- (i) Promote low cost practices for collecting data and developing tools;
- (ii) Promote collaborative efforts and improve coordination;

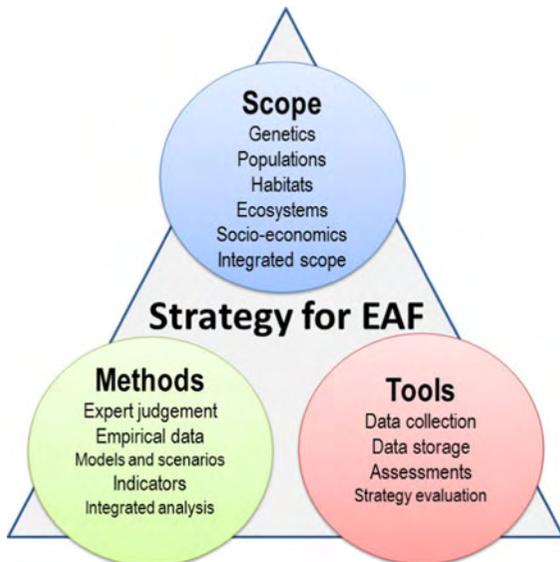


Fig. 3 The toolbox needed to advance a regional scientific strategy for Ecosystem Approach to Fisheries (EAF) in the Mediterranean and Black Seas region (adapted from Smith et al. 2007)

- (iii) Complement but avoid repeating existing scientific initiatives;
- (iv) Deal with limited financial means and allocation of funds with an effective use of resources.

Data-poor and data-poor access regions: our Achilles' heel

Data access (both availability to new data and access to existing one) is a hindrance to scientific inputs for EAF. The CREAM work packages dealing with initiatives and data that contribute to the EAF are in the process of identifying several regions where data are less abundant (CREAM-WP2 2012). Although countries that are included in the EU Data Collection Framework are more prone to be in the possession of fisheries data, it is clear that basic data regarding abundance, biodiversity, and other relevant parameters is still highly heterogeneous in the region. CREAM is mapping the available resources in order to identify areas and topics that need special attention. This will be a substantial contribution to the delineation of a scientific roadmap, and ultimately to generate some of this lacking data.

However, a large amounts of knowledge are already available, including data collected through the Data Collection Framework Initiative of the EU (such as fisheries independent data from the MEDITS and MEDIAS demersal and pelagic surveys, respectively), national projects, regional bodies, other scientific initiatives (such as initiatives from CIESM, IUCN, FAO regional projects and ICCAT), and large-scale initiatives to collate and integrate datasets (such as GEOBON, <http://www.earthobservations.org/geobon.shtml>, the European contribution to databases for Biodiversity, ECOSCOPE, <http://www.ecoscopebc.ird.fr>, knowledge based on exploited marine ecosystems, and Marine Knowledge 2020 EU initiative, http://ec.europa.eu/maritimeaffairs/policy/marine_knowledge_2020/index_en.htm). Despite these initiatives, most of these data are not available to the scientific community at large. Therefore, an additional problem to the data-poor situation in the Mediterranean and Black Seas is the limited accessibility to datasets by end users. In fact, it has been recognised that the region is suffering from an endemic problem of data ownership and accessibility. This issue highlights a serious problem of efficiency when developing

science to contribute to EAF, impairs the ability to calibrate oceanographic and ecological models, prevents the calculation and standardization of indicators, and overall provides a negative image of the scientific community.

The issues of data availability and access are two major problems that need to be solved in harmony. If public data ownership and data accessibility is not ensured in the future, forthcoming data acquisition initiatives will have limited applicability and contribution to the EAF process in the region. This issue needs to be solved quickly, especially in the current context of limited resources. This requires a major effort from scientists and policy makers to ensure that existing data are accessible with good metadata after being harmonised, standardized, and checked for quality. In the “global information era”, ensuring data availability, interoperability, and quality should be a compulsory requirement accompanying any publicly-funded initiative.

Novel topics and initiatives with added value

Five important topics that add value to the need for a coordinated scientific EAF initiative in the Mediterranean and Black Seas region at a regional scale were highlighted. These topics include: (i) the issue of quantifying the real impact of fisheries by integrating knowledge on different fishing fleet segments and from different areas, (ii) the need to deal with the accelerating non-indigenous species spreads and impacts, (iii) the complexity of considering multiple human impacts, their cumulative effects and interactions, and how they impact productivity patterns, (iv) the need to consider spatial planning and integrated coastal zone management in future analyses moving towards an ecosystem-based spatial approach, and (v) the need to advance our capability to fully quantify ecosystem services and to accurately inform policy makers and society.

Quantification of the real impact of fishing

Access to data and information on the different fishing fleets operating in the region is difficult. In most cases, data available only covers official landing statistics that do not consider discards, catch that is sold on the black market or is used for consumption of fishers and relatives, and illegal catches, all components of IUU

(Illegal, Unregulated and Unreported catches). IUU catches are caused by a lack of control by countries and regional organizations on fishing activities, due to inappropriate or insufficient operational plans and disciplinary measures for those not following the rules, and due to lack of political will (Zeller and Pauly 2007). IUU practices impair the correct assessment of exploited marine species, and complicate or even defeat the development of suitable management actions. They can also have important socio-economic impacts due to conflicts with legal activities, and especially with artisanal and subsistence fishing. This is a fundamental issue in the Mediterranean and Black Seas region where IUU activities are large (Tsikliras et al. 2007; Le Manach et al. 2011).

Despite IUU, official landing statistics aggregated at country level have limited information value since they give no indication of regional landing statistics, and hence can usually not be matched to stock units for stock assessment purposes. The only regional dataset freely available is the GFCM capture production dataset for the region, released in 2010 (<http://www.fao.org/fishery/statistics/software/fishstat/en>). Biological stock related variables are required in order to carry out stock assessments and to calculate the vast majority of indicators based on fisheries dependent data. Such data is only collected in sufficient detail for a limited number of species at present. In addition, different countries and regional bodies use different data collection protocols and levels of data aggregations, creating additional challenges for scientists attempting to combine data and perform the analyses at the relevant regional scale for shared stocks. Moreover, data on fishing effort is either not available or very difficult to access. In Europe, high resolution fishing effort data is in fact being collected by national authorities since the introduction of the Vessel Monitoring System (VMS), but such data remains unavailable to scientists (Hinz et al. 2012). Moreover, recreational and artisanal fisheries, which are of high importance in the region, are frequently not included in official statistics by country (Tudela 2004).

In addition to these limitations associated with the calculation of single species target reference points, the multi-gear and multi-species nature of Mediterranean and Black Sea fisheries remains a further stumbling block to quantifying the real impact of fishing. In the region, fishers routinely set out with a number of gears, catching a multitude of species in a

single fishing trip (Caddy 2009). The quantification of the real impact of fishing should take into account the multi-gear nature of fisheries, and the resulting high interaction between gears and fleet segments since most of the main target species are exploited by more than one fishing technique or strategy, each often concentrating on individuals of different sizes during different seasons. This poses a considerable challenge with regards to the collection of accurate fisheries data.

Multispecies stock assessments require a vast amount of detailed data, including information on predation mortality rates, and diet data to take into account trophic relationships when calculating species interactions (Magnusson 1995). For the region, such data is not always available and methods to combine the results of single species stock assessment remain in their early stages (Maravelias et al. 2011).

Until the quality of data on fishing activities improves, the capacity to properly evaluate fishing impact on commercial stocks through multi-species reference and target indicators such as the maximum sustainable yield and the side effect of gear selectivity, as well as the impact on non-commercial species, habitats and ecosystems, will be very limited. A coordinated scientific EAF initiative at a regional scale could play an important role at promoting practical measures such as setting up a regional database for fisheries data, as well as integrative studies that deal with the real quantification of seasonal catch and fishing mortality rates, and the impact of multi-species fishing by gear segment.

Non-indigenous species spreads and impacts

The Mediterranean and Black Seas region are not only important hot spots of marine biodiversity, but also hot spots of xeno-diversity. So far, 660 multicellular non-indigenous species have been recorded (Galil 2009), and this number can be as high as 1,000 species when unicellular taxa and Atlantic migrants are considered (Zenetos 2010). Non-indigenous species (NIS) can have different origins and impacts and they may arrive using different pathways (such as canals, mariculture and aquaculture, shipping, etc.). Some NIS can establish large population, replace indigenous species, and attain commercial importance. Due to the increasing speed and dimension of this phenomenon (Galil 2009; Zenetos et al. 2010), which is probably being

exacerbated by climate change (Lejeusne et al. 2010; Bianchi 2007; Azzurro 2008), there is an urgent need to collect basic information on the biology and ecology of NIS.

However, detailed information on what the effects of NIS on fisheries and other human activities are is missing. We do not know what effects fisheries have on the establishment of NIS populations, and we do not have a complete view of the changes provoked by NIS on natural habitats and ecosystems. For this reasons, it is difficult to estimate the true cost of NIS. As a matter of fact, past opportunities of monitoring and tracking the consequences of NIS in a coordinated way were lost, but, due to cooperation between scientists and local populations, the use of Local Ecological Knowledge (LEK) has recently illustrated new possibilities to retrieve historical data (Azzurro et al. 2011). Therefore, a coordinated scientific EAF initiative in the region in collaboration with current efforts (such as CIESM Tropical Signals Program, <http://www.ciesm.org/marine/programs/tropicalization.htm>) could help promote the monitoring and coordinated collection of data. Questions such as how marine biodiversity is changing and what are the present and future impacts of NIS that cannot be tackled at local scales without losing the real perspective of the phenomenon. This is of special importance if we want to be able to correctly assess the good environmental status of the region, and improve our knowledge on process-based ecological knowledge. A coordinated EAF initiative could also help increase the awareness of this important topic and the potential associated socioeconomic regional consequences.

Multiple human impacts and interactive effects

The scientific community made substantial progress in the identification and quantification of multiple human threats that impact marine diversity, habitats, and ecosystems in the region (Claudet and Fraschetti 2010; Coll et al. 2010; Lotze et al. 2011; Coll et al. 2012; Giakoumi et al. 2011; Sala et al. 2012, <http://globalmarine.nceas.ucsb.edu/mediterranean/>). There is currently increasing knowledge on the identification, quantification, and distribution of these multiple stressors. Various EU projects in progress (such as Pegaso, <http://www.pegasoproject.eu/>, or CoCoNET, <http://www.coconet-fp7.eu/>) will likely contribute substantially to this knowledge.

However, the way these multiple stressors may interact and combine to impact productivity patterns of marine ecosystems is hardly known (Sala et al. 2000). Multiple impacts may interact and their effects may accumulate, acting synergistically or antagonistically at different ecological levels, from species to community, and ecosystem levels. A comprehensive understanding of these impacts and their interactions is lacking, although it seems that synergistic effects are frequent (Folt et al. 1999; Crain et al. 2008), but see Darling and Côté 2008 for additional discussion (Darling and Côté 2008). Multiple impacts are distributed in a heterogeneous way in the region (Halpern et al. 2008; Coll et al. 2012), and the interaction of these impacts will thus not occur the same way everywhere, and it may affect productivity differently. Moreover, future changes of current human activities (such as climate change, or the invasion of new species), and the appearance and spread of new activities, will likely challenge our current understanding. Additionally, even if some new approaches are currently developed in the frame of the MSFD, the way we can use this knowledge to derive indicators and reference points to inform management remains to be fully explored. A coordinated scientific EAF initiative in the region, in collaboration with existing efforts, could contribute to the documentation of multiple threats data and to the analysis of current and future multiple impacts. Such data is at present frequently scattered and has different spatial and temporal resolutions. This could be achieved by establishing partnerships between data providers and data analysts. To tackle some of these scientific challenges there is a growing need to use and develop novel methodologies of data integration, assimilation and modelling at different scales, taking into account uncertainties in data and processes (Parravicini et al. 2012; Christensen et al. 2012).

Quantification of ecosystem services

To apply the EAF efficiently, there is the need to evaluate and understand socioeconomic costs and benefits of management interventions, in addition to ecological impacts (Katsanevakis et al. 2011). Assigning values to the marine environment allows assessing the management alternatives. Values can be assigned to the economic value of extracted resources, the provision of environmental services, and to marine biodiversity. However, not only market but also non-

market values of the environment have to be taken into account, which is not a simple task because not all ecosystem services are traded on markets and have direct monetary values. The alternatives to monetary valuations are non-monetary assessments that attempt to understand the cause, distribution, and strength of socioeconomic values (for example, by developing assessments using other units such as weight to potential areas of conflict and consensus). Nowadays, there are different techniques that can be applied (Katsanevakis et al. 2011), although there are little examples applied to the Mediterranean and Black Seas region. Another difficulty is how to link resources and habitats to different goods and services since data are not always available and comprehensive (but see an attempt to link habitats to services in European seas, Salomidi et al. 2012).

To make progress for an EAF, the full quantification of the impacts of human activities on ecosystem goods and services including the socioeconomic component is a must. This is of particular importance in complex ecosystems such as the Mediterranean and Black Seas, where food security is a crucial aspect of EAF, and there is thus a real need to quantify the risks of mismanagement, and the benefits of good management. A scientific coordinated EAF network in the region could contribute to the development of regional socioeconomic evaluations, and ensure that forecasting ecological models and indicators are linked with policy scenarios including projections of employment, and population trends.

Spatial analyses and management

It is well recognised that the EAF approach needs to take into account the spatial dimension, while bridging regional to local scales (Fig. 2). Spatial management initiatives, including but not limited to MPAs, are useful tools to contribute to the spatial management process (Katsanevakis et al. 2011; Stelzenmuller et al. 2012). In the Mediterranean and Black Seas region, recent years have witnessed an increase in spatial analyses of ecological and socioeconomic data with the aim of contributing to the integrative knowledge that we have on ecosystems and how best to advance towards sustainable management and habitat protection (Maiorano et al. 2009; Giakoumi et al. 2011).

However, spatial analyses in the region have mainly been carried out in the context of MPAs and

no-take zones. Therefore, there is a need to adopt a more integrative view of the spatial dimension by including other areas, taking into account scientific gaps when performing spatial analyses, including information at different scales. New analyses should include the spatial extent of different, and sometimes conflicting, human activities (for example, fishing effort by fishing gear, including in particular the distribution of bottom trawling and other destructive fishing gear, shipping lanes, the location of permanent structures on the seafloor such as pipelines, cables, wind farms, tourist areas, protected areas, etc.), as well as current and future spatial management initiatives to propose an adaptive spatial approach to the management of human activities. Multi-stakeholder co-management on territorial management units would allow for an accurate integration of the spatial dimension in the management of fishing activities therein. This would result in a rational time and area management of fishing effort and technical measures ranging from, for example, no-fishing zones to seasonal and/or geographical gear closures.

A regional scientific EAF initiative could contribute towards the coordination and analyses of data in a spatial framework, and could integrate important lessons from successful local case studies to inform EAF regionally. This should be done in collaboration with initiatives that aim at establishing systems of territorial-based co-management, and promote experiments of EAF application, and co-management at the local scale.

To improve our capability to spatially analyse complex topics, there is a need to use and develop novel spatial methodologies, such as marine spatial planning and ocean zoning, and new tools such as remote sensing, spatial quantitative analysis, telemetry, and spatial modelling (Giakoumi et al. 2012; Katsanevakis et al. 2011; Stelzenmuller et al. 2012). Spatial management has obvious links to the other topics and initiatives with the added value mentioned above.

Proposing an EAF new scientific network called EMBASEAS

As a result of the discussion during the workshop, it was clear to the group that a visionary and coordinated scientific network to promote operational EAF

initiatives, created by the scientific community (thus following a bottom-up approach) in the Mediterranean and Black Seas, is needed. The proposed network, named **EMBASEAS** (the network aiming at being an ambassador to promote Eaf in the **M**editerranean and **BL**ack **SE**AS), should add value to the current situation. Discussion on how to envisage such a scientific network, and who would be key players in the network, followed.

The network should be independent and individually based, but with clear links to regional bodies such as GFCM, FAO, the EU Joint Research Centre, as well as with non-governmental organizations promoting EAF. Key players of the network should be those interested scientists of different disciplines, participating as independent individuals, rather than as national or institutional representatives. The network should have strong links with local and regional organizations involved in EAF initiatives, and seek the involvement of other stakeholders such as professional and recreational fishers, other users of the marine environment, naturalists, local experts, and policy makers.

The ultimate discussion was centred on how to build such a network with the consolidation of a regional scientific vision, with a clear scientific strategy, and plan (including a diversified toolbox), to promote EAF in the region (Figs. 2, 3). Such a network should have the capability to define a clear, strong, and shared vision for EAF in the region. This could be achieved by gaining a broader view on the EAF implementation strategy, in particular by keeping track of what needs to be pursued to ultimately ensure a good status of the Mediterranean and Black Sea ecosystems. The network should identify key objectives and topics, and establish a road map of coordinated actions to accomplish them. The scientific network should also aim to promote the coordination of scientific activities, to date local or fragmented, in an efficient way, using local initiatives but contributing to the regional vision. This would bridge different geographical scales and promote the use of innovative tools such as models, indicators, scenarios, and other integrative tools. The methodology and manner of linking the initiatives from the local to the regional level can be a considerable challenge for the network.

In the short term, the network could start as a coordinated action of scientists to promote the scientific approach of EAF by coordinating activities, and

improving the capacity of developing science for EAF in the region. The network should promote concrete scientific actions considering available data, tools, and initiatives at different geographic scales to improve process-based ecological knowledge in the area. The group identified several novel topics and initiatives with added value to the network (e.g., the ecology and impact NIS, cumulative impacts, the impacts of specific fishing gear). One of the first tasks of a coordinated scientific initiative would be to identify, document, and promote successful case studies in the region. This could help establish bridges between scientists, policy makers, and other users of the sea, in a transversal way dealing with the best territorial management unit (Fig. 2). Other potential immediate activities include the documentation of initiatives, the sharing of already available information and scientific capabilities, the improvement of the training capabilities, and the capacity building of the scientific community and stakeholders, and the establishment of mechanisms to disseminate knowledge to end users.

In the medium-long term, the network should aim at promoting the implementation of an EAF (from the local to the regional level), and providing scientific advice on EAF to inform adaptive management in the region, where at present only stock assessment advice is taken into account (if at all). Thus, the ultimate goal of the network should be to link management advice to good scientific information providing useful advice to address key management objectives (i.e. present the trade-offs), and creating a knowledge-based management approach. By establishing successful liaisons with local and regional organizations and initiatives, needing scientific advice to promote EAF, the scientific network could contribute to the management of territorial units and provide a stable platform to share successful stories, resources, ideas, and expertise. The network could facilitate the discussion of common problems and possible solutions with local applicability in a coordinated manner and under a common regional vision and strategy. Scientists involved in early practices of EAF could find in the network a suitable platform for networking among themselves to learn tactics on how to implement EAF at the local level, while also building a strategy at the regional level. Such a network would face the challenge of delivering and coordinating at the regional strategic level what can be effectively done at the local tactical level, while influencing the decision making process at

different geographic scales (Fig. 2). The ultimate goal should be to link management advice to good scientific information and transform policy strategies and goals into operational objectives. Another important role of the network would be to anticipate the needs of stakeholders—both local communities and managers—and the problems that may occur in the future.

The network should also be used as an opportunity to anticipate the future and invest in tools such as generic and validated models and indicators. In this manner scientists would be able to contribute to initiatives and calls for predicting the dynamics of the ocean, and building scenarios of socio-ecological systems (in cooperation with initiatives such as IPBES, Larigauderine and Mooney 2010). Indeed, it is already clear that in a few years, scientists will have to provide scientific advice on possible future scenarios and the available alternatives to avoid adverse changes in ecosystems and ecosystem services, integrating data on ecology, climate, socioeconomics, and demographics. These tools will enable us to investigate the future of the region, and analyse how to reconcile long-term objectives with local constraints (exploring trade-offs with a suite of socioeconomic and ecological objectives) following the successful initiative of the Intergovernmental Panel on Climate Change. There is thus a clear need to start building on the capability to integrate, modify, improve, innovate, fit and calibrate complex models and frameworks, which will require the promotion of data integration, harmonization, and accessibility. The scientific community has to advance towards building a roadmap of coordinated actions to develop a common strategy and advance towards the future; and the EMBASEAS network may be a good opportunity to achieve this.

Immediate activities and priorities

Finally, the group decided to develop a series of immediate activities to promote EMBASEAS:

- (i) The distribution of workshop material and discussions using scientific literature, and the CREAM website (<http://www.cream-fp7.eu/>);
- (ii) The development of a newsletter to promote the activities of the network, and inform EAF initiatives in the Mediterranean and Black Sea region;

- (iii) The design of a website to present and promote EMBASEAS;
- (iv) The coordination of efforts to answer to future research calls at the European level to fully implement the scientific network envisaged by the group;
- (v) The organization of a second meeting during 2013, with the principal aim of discussing ways to operationally build the scientific network EMBASEAS, and expand CREAM objectives.

Acknowledgments The organizers of the workshop wish to acknowledge all CREAM partners that actively participated in the workshop. Those CREAM partners who could not attend the workshop but sent their contribution for discussion by the group are also acknowledged (F. Colloca, J. Lleonart, A. Mikhayluk, V. Shlyakhov, B. Trotsenko, J. Vigneau). Sincere thanks also go to all external experts that participated in the workshop, those that could not attend but sent their contributions (F. Renaud), and external experts that provided additional knowledge (A. Bundy, B. Fulton, S. Libralato, L. J. Shannon, Y.-J. Shin). Sincere thanks also go to colleagues from IRD that helped in the organization of the event. CREAM participants to the workshop were funded by the coordination action CREAM. MC wishes to thank the funding of IRD and the Spanish Research Fellowship program “*Ramon y Cajal*”.

Appendix 1. List of participants to the workshop authors

a) CREAM participants

BARICHE, Michel. American University of Beirut, Department of Biology, P.O. Box 11-0236, Beirut, Lebanon. Tel.: +961 323742. E-mail: mb39@aub.edu.lb

BAYADAS, Giorgos. Department of Fisheries and Marine Research. Ministry of Agriculture, Natural Resources and Environment. Vithleem street, 101. 1416 Nicosia. Cyprus. Tel.: +357 22807815. E-mail: gpaiatas@dfmr.moa.gov.cy

BELLIDO, Jose M^a. Instituto Español de Oceanografía. Centro Oceanográfico de Murcia. Varadero, 1. 30740 San Pedro del Pinatar. Spain. Tel.: +34 968 180500. E-mail: josem.bellido@mu.ieo.es

CHABOUD, Christian. UMR EME 212 IRD/UM2/IFREMER. Centre de Recherche Halieutique Méditerranéenne et Tropicale. IRD-IFREMER & Université Montpellier II. Avenue Jean Monnet, BP 171. 34203 Sète Cedex. France. Tel.: +33 499573246. E-mail: christian.chaboud@ird.fr

COLL, Marta. UMR EME 212 IRD/UM2/IFREMER. Centre de Recherche Halieutique Méditerranéenne et Tropicale. IRD-IFREMER & Université Montpellier II. Avenue Jean Monnet, BP 171. 34203 Sète Cedex. France & Institut de Ciències del Mar. Consejo Superior de Investigaciones Científicas. Passeig Marítim de la Barceloneta, 37-49. 08003 Barcelona. Spain. Tel.: +34 932309500. E-mail: mcoll@icm.csic.es

CURY, Philippe. UMR EME 212 IRD/UM2/IFREMER. Centre de Recherche Halieutique Méditerranéenne et Tropicale. IRD-IFREMER & Université Montpellier II. Avenue Jean Monnet, BP 171. 34203 Sète Cedex. France. Tel.: +33 499573234. E-mail: philippe.cury@ird.fr, philippe.cury@ifremer.fr

EL-SAYED, Abdel-Fattah. Oceanography Department. Faculty of Science. Alexandria University. Alexandria. Egypt. Tel.: +20 34843172. E-mail: afmelsayed@gmail.com

GAAMOUR, Adel. Institut National des Sciences et Technologies de la Mer. Port de pêche. 2060 La Goulette. Tunisia. Tel.: +216 71735848. E-mail: gaamour.adel@instm.rnrt.tn

GABIÑA, Dunixi. Instituto Agronómico Mediterráneo de Zaragoza/CIHEAM. Av. Montañana, 1005. 50059 Zaragoza. Spain. Tel.: +34 976716000. E-mail: iamz@iamz.ciheam.org

KAVADAS, Stefanos. Institute of Marine Biological Resources and Inland Waters. Hellenic Centre for Marine Research. Agios Kosmas. 166 04 Hellinikon, Athens. Greece. Tel.: +30 210 9856700. E-mail: stefanos@hcmr.gr

MAKHARADZE, Guranda. Water Ecology and Fisheries Research Institute. Rustaveli Avenue, 51. 6010 Batumi. Georgia. Tel.: +995 577232281. E-mail: guranda_guka@yahoo.com

MÉRIGOT, Bastien. UMR EME 212 IRD/UM2/IFREMER. Centre de Recherche Halieutique Méditerranéenne et Tropicale. IRD-IFREMER & Université Montpellier II. Avenue Jean Monnet, BP 171. 34203 Sète Cedex. France. Tel.: +33 499573205. E-mail: bastien.merigot@univ-montp2.fr

PACE, Marie Louise. Capture Fisheries Section. Fisheries Control Directorate. Ministry for Resources and Rural Affairs. Barriera Wharf. Valletta, VLT 1970. Malta. Tel.: +356 22921257. E-mail: marie-louise.pace@gov.mt

PANAYOTOVA, Marina. Department of Marine Biology and Ecology. Institute of Oceanology.

Bulgarian Academy of Sciences. “Parvy maj” street, 40. 9000 Varna. Bulgaria. Tel.: +359 52370486. E-mail: mpanayotova@io-bas.bg

PIPITONE, Carlo. Consiglio Nazionale delle Ricerche. Istituto per l’Ambiente Marino Costiero. Sede di Castellammare del Golfo. Via Giovanni da Verrazzano, 17. 91014 Castellammare del Golfo (TP). Italy. Tel.: +39 0917829740+39 0924 35013. E-mail: carlo.pipitone@ iamc.cnr.it

RADU, Gheorghe. National Institute for Marine Research and Development “Grigore Antipa”. Mamaia Bvd., 300. 900581 Constanta. Romania. Tel.: +40 241540870. E-mail: gpr@alpha.rmri.ro, gradu@alpha.rmri.ro

SAMUEL-RHOADS, Yianna. Oceanography Centre. University of Cyprus. POBox 20537. 1678 Nicosia. Cyprus. Tel.: +357 22893984. E-mail: rhoads.yianna@ucy.ac.cy

SBRANA, Mario. Consorzio per il Centro Interuniversitario di Biologia Marina ed Ecologia Applicata “G. Bacci” Viale Nazario Sauro, 4. 57128 Livorno. Italy. Tel.: +39 0586 260723. E-mail: msbrana@cibm.it

TALEB, Said. Cooperation Division. Institut National de Recherche Halieutique. 2, rue de Tiznit. 20000 Casablanca. Morocco. Tel.: +212 522297329. E-mail: taleb@inrh.org.ma.

TOKAÇ, Adnan. Fisheries Faculty. Ege University. 35100 Bornova, İzmir. Turkey. Tel.: +90 232 3111307. E-mail: adnan.tokac@ege.edu.tr

VENDEVILLE, Philippe. UMR EME 212 IRD/UM2/IFREMER. Centre de Recherche Halieutique Méditerranéenne et Tropicale. IRD-IFREMER & Université Montpellier II. Avenue Jean Monnet, BP 171. 34203 Sète Cedex. France. Tel.: +33 499573246. E-mail: Philippe.Vendeville@ifremer.fr

b) External experts attending the workshop

AZZURRO, Ernesto. ISPRA. National Institute for Environmental Protection and Research. Sts Livorno. Piazzale dei Marmi, 2. 57123 Livorno. Italy. E-mail: eazzurr@gmail.com

CLAUDET, Joachim. National Center for Scientific Research (CNRS), Laboratoire d’Excellence “CORAIL”. USR 3278 CNRS-EPHE CRIOBE., University of Perpignan., 66860 Perpignan cedex., France, & Laboratoire d’Excellence “CORAIL”, France. Tel.: +33 468662194. E-mail: joachim.claudet@gmail.com

GASCUEL, Didier. UMR Ecologie et Santé des Écosystèmes. Université Européenne de Bretagne. Pole Halieutique Agrocampus Ouest. 65 Route de Saint Brieuc. CS84215, 35042 Rennes Cedex. France. E-mail: didier.gascuel@agrocampus-ouest.fr

PÊTRE, Elise. World Wide Fund for Nature (WWF) -France. Fisheries Officer. 1 carrefour de Longchamp. 75016 Paris. France. Tel.: +33 624650313. E-mail: epetre@wwf.fr

ROUYER, Tristan. UMR EME 212 IRD/UM2/IFREMER. Centre de Recherche Halieutique Méditerranéenne et Tropicale. IRD-IFREMER & Université Montpellier II. Avenue Jean Monnet, BP 171. 34203 Sète Cedex. France. Tel.: +33 499573247. E-mail: tristan.rouyer@ifremer.fr

UMR EME 212 IRD/UM2/IFREMER. Centre de Recherche Halieutique Méditerranéenne et Tropicale. IRD-IFREMER & Université Montpellier II. Avenue Jean Monnet, BP 171. 34203 Sète Cedex. France. Tel.: +33 499573205. E-mail: isabelle.terrier@ird.fr

TUDELA, Sergi. World Wide Fund for Nature (WWF) Mediterranean Programme Office. Canuda, 37. 08002 Barcelona. Spain. E-mail: studela@atw-wwf.org

VALLS, Audrey. Fisheries Centre. University of British Columbia (UBC). 2202 Main Mall. V6T 1Z4, Vancouver, British Columbia. Canada. E-mail: a.valls@fisheries.ubc.ca

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