ICES WGISUR REPORT 2016

ACOM/SCICOM INTEGRATED ECOSYSTEM OBSERVATION AND MONITORING

ICES CM 2016/SSGIEOM:27

REF. ACOM AND SCICOM

Working Group on Integrating Surveys for the Ecosystem Approach (WGISUR)

26–28 January 2016

Hamburg, Germany

ICES International Council for the Exploration of the Sea

CIEM Conseil International pour l'Exploration de la Mer

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Contents

Executive summary

The Working group on integrating surveys for the ecosystem approach (WGISUR) met 26–28 January 2016, in Hamburg, Germany. The meeting was attended by 7 people, representing Germany, Canada, England, Portugal, France, and the Netherlands. Last minute, representatives from the USA and Norway had to cancel their participation due to snowstorm and illness.

The final report of this WGISUR 3-year cycle will be presented as a separate document as it meant to be a guidance document for all developing ecosystem monitoring (monitoring of one or more components of the ecosystem), whether from scratch or by adding tasks to current surveys. There are different pathways towards ecosystem monitoring, depending on reporting requirements and budgets. Three entry points for the collection of a wide range of marine ecosystem data are presented: (a) development of a new integrated ecosystem monitoring programme, (b) modification of existing monitoring programmes/surveys to collect ecosystem information, and (c) adding data collection to an existing survey or monitoring. The suitable option depends on a number of factors, e.g. the monitoring objectives, the scope for adapting current objectives, existing monitoring programs with tasks that have to be carried out in future. In addition the multiple levels of management (international, national, local) with overlapping/variable scales of requirements and interests (e.g. fisheries, biodiversity) play a role.

No real progress was made on the collaboration with Integrated Ecosystem Assessments (IEA) groups (ToR d), and so, no coherent output could be delivered by WGISUR within the running period. Based on the force-field analysis carried out at the 2014 meeting, it was concluded that relationships between ICES IEA groups and WGISUR should be established or improved so that there is a framework whereby the IEA groups can provide information on data- and knowledge gaps with respect to ecosystems and WGISUR can advise how best to collect, store, handle, etc. the data. However, as the IEA groups still seem to be finding their way there has been limited collaboration. From the Workshop to Plan and Integrate Monitoring Program in the North Sea in the 3rd quarter (WKPIMP, 22-26 February 2016) a list of needs for Q3 North Sea monitoring will become available. This may serve as a starting point for more collaboration with IEA groups.

The group evaluated its progress over the last three years and concluded that there are reasons to continue the work, slightly moving the scope from ‘providing guidance on the development of ecosystem monitoring programmes’ to ‘providing guidance on the evaluation of ecosystem monitoring programmes’ and ‘implementation of the guidance developed in (2011-)2014-2016’.

1 Administrative details

Working Group name

Working group on integrating surveys for the ecosystem approach (WGISUR)

Year of Appointment within the current three-year cycle

3

Reporting year concluding the current three-year cycle

2016

Chair(s)

Ingeborg de Boois, Netherlands

Meeting venues and dates

21–23 January 2014, Nantes, France, (9)

27–29 January 2015, Copenhagen, Denmark, (10)

26–28 January 2016, Hamburg, Germany, (7; originally 9 but two last minute cancellations due to snowstorm and illness)

WGISUR 2016 trying to lining up

The 2016 WGISUR meeting took place on 26–28 January 2016 in Hamburg, Germany. The meeting was attended by 7 people, representing Germany, Canada, England, Portugal, France, and the Netherlands. Last minute, representatives from the USA and Norway had to cancel their participation due to snowstorm and illness. Over the last three years, the attendance in numbers and countries represented has been fairly constant. Participants from Canada, Norway and USA help this group to keep a wider scope than 'MSFD only' when talking about ecosystem monitoring.

The group has been very active, not only during meetings in which everyone made significant contributions by presenting ongoing work and actively participating in discussions, but also in sharing the expertise with others outside WGISUR (e.g. in the institutes and in EU projects).

The participation over the years was fairly constant. The group size (approx. 9) allows plenary discussions as well as subgroup work. In a considerably larger group plenary discussions would be more difficult.

2 Terms of Reference a) – d)

Table 2.1 WGISUR terms of reference

ToR	Description	Background	Science Plan topics addressed	Duration	Expected Deliverables
A	Provide guidance on the adaptation of existing surveys to provide ecosystem data	a) Science Requirements b) Advisory Requirements c) Requirements from other EGs	1.2, 1.4, 1.5, 1.7, 2.1, 2.4, 2.5	3 years	CRR
B	Provide guidance on the development of an ICES ecosystem survey approach	a) Science Requirements b) Advisory Requirements	1.2, 1.4, 1.5, 1.7, 2.1, 2.4, 2.5	Year 2	CRR
C	Identify issues common to all surveys, set up workshops and manage them as appropriate	a) Science Requirements c) Requirements from other EGs	1.2, 1.4, 1.5, 1.7, 2.1, 2.4, 2.5	yearly	Workshop Report
D	Liaise with IEA groups, and others as appropriate (e.g. CWGMSFD), over data product needs and specification	a) Science Requirements b) Advisory Requirements c) Requirements from other EGs	1.2, 1.4, 1.5, 1.7, 2.1, 2.4, 2.5	yearly	List of data product needs

Although the ToRs mention that two CRRs would be created based on the WGISUR work, the group decided in 2016 that there is a need to publish the group's outcomes quickly. Furthermore, the field of ecosystem monitoring evolves rapidly so there is a strong wish to create a "living" document that can be easily updated instead of a 'fixed' CRR. In the light of the EFARO/ICES Meeting on Cooperation in Surveys and Data Collection the WGISUR results should be easily available in due time.

As for ToR d), see chapter 5.

3 Summary of Work plan

Table 3.1 Summary of WGISUR work plan

Year 1	Workshop report, identify next workshop
Year 2	Workshop report, Provide data product needs
Year 3	Completion of CRR

4 Summary of Achievements of the WG during 3-year term

Dissemination of results:

- Ingeborg J. de Boois, Donald Clark, David Demer, Elena Eriksen, Lawrence C. Hufnagle, Sven Kupschus, Kelle Moreau, Ana Moreno, Dave Reid, Jens Ulleweit, Kai Wieland, 2015. Making choices: the way forward from single-stock survey to integrated ecosystem survey. ICES CM 2015/C:06. ICES ASC oral presentation.
- Ingeborg J. de Boois, Donald Clark, David Demer, Elena Eriksen, Lawrence C. Hufnagle, Sven Kupschus, Kelle Moreau, Ana Moreno, Dave Reid, Jens Ulleweit, Kai Wieland, 2015. The jigsaw of integrated surveys for the ecosystem approach. ICES CM 2015/C:16. ASC poster presentation.

Tools developed by WGISUR:

- A checklist for new platforms suitable for ecosystem monitoring and research was developed in 2014, and refined in 2015.
- The flow diagram for development of an ecosystem survey was refined in 2015.
- A guidance document for scientists outlining the steps for moving towards ecosystem monitoring (see Annex 6). The document will be made available as a stand-alone document.

Activities initiated by WGISUR:

- Workshop to plan an integrated monitoring plan in the North Sea in the 3rd quarter (WKPIMP, February 2016). The workshop builds upon the objectives and the resources of the current 3rd quarter North Sea IBTS and will be co-chaired by WGISUR and WGINOSE[1] (February 2016)
- Joint ASC session with WGFAST[2] 'Ecosystem monitoring in practice' (2015); The session was attended by approximately 50–70 participants. Contributions included 14 (15) talks and 5 posters and addressed three core areas of innovative ecosystem monitoring techniques: (1) novel methods and datasets to be applied/examined when following an ecosystem approach in monitoring; (2) studies recently or currently conducted applying measures to follow a more holistic approach to ecosystem monitoring; (3) new joint survey programs focusing on combining or expanding existing surveys to broaden measurements of ecosystem parameters and e.g. marine strategy framework descriptors in an ecosystem survey. The full report is available here.
- Joint meeting with ICES Data Centre during WGISUR 2015, on data handling, storage, collation and combining data for ecosystem assessment. During the meeting ICES Data Centre presented the ICES Data Portal. WGISUR decided that this is a useful tool. The data portal is an easy facility to investigate which data are available in areas of interest, and data can be selected either using the data portal or one of the underlying ICES databases. WGISUR phrased two requests for which request forms have been sent to the ICES Data Centre directly after the 2015 meeting:

1 Working Group on Integrated Assessments of the North Sea (WGINOSE)

2 Working Group on Fisheries Acoustics, Science and Technology (WGFAST)

  - Link hydrographical data to data in DATRAS, based on spatial and temporal overlap.
  - Link hydrographical data to data in the eggs and larvae database, based on spatial and temporal overlap.
- Joint meeting with WGISDAA[3] during WGISUR 2014, resulting in:
  - The discussion of the potential impacts of additionally collected ecosystem data on survey fisheries abundance indices, as well as how to quantify these impacts and what the possible impacts might be on stock assessment results that use the survey abundance indices, and
  - While the expectation might be a possible loss in precision of the fisheries abundance indices, mitigation of this kind of impact might be possible depending upon the type of survey design being used. In addition, the additional ecosystem variables being collected may actually be used to improve the precision of the abundance indices by helping to explain temporal and spatial variation.

A full overview of the results of this activity can be found in the WGISDAA 2014 report.

Other results:

- In 2014 the group carried out a force field analysis to get insight into the relation between WGISUR and other groups within and outside the ICES community. Both the joint ASC session with WGFAST and the joint activity with ICES Data Centre resulted from this exercise. The outcome of the analysis helps WGISUR to consider its position in a rapidly changing field.

5 Final report on ToRs, workplan and Science Implementation Plan

The final report of this WGISUR 3-year cycle will be presented as a separate document as it meant to be a guidance document for all developing ecosystem monitoring, whether from scratch or by adding tasks to current surveys. The first draft is available in Annex 6. In this document, guidance is given on the development of ecosystem monitoring: monitoring of one or more components of the ecosystem. There are different pathways towards ecosystem monitoring, depending on reporting requirements and budgets. Three entry points for the collection of a wide range of marine ecosystem data are presented: (a) development of a new integrated ecosystem monitoring programme, (b) modification of existing monitoring programmes/surveys to collect ecosystem information, and (c) adding data collection to an existing survey or monitoring (Figure 5.1). The suitable option depends on a number of factors, e.g. the monitoring objectives, the scope for adapting current objectives, existing monitoring programs with tasks that have to be carried out in future. In addition the multiple levels of management (international, national, local) with overlapping/variable scales of requirements and interests (e.g. fisheries, biodiversity) play a role.

3 Working Group on Improving use of Survey Data for Assessment and Advice (WGISDAA)

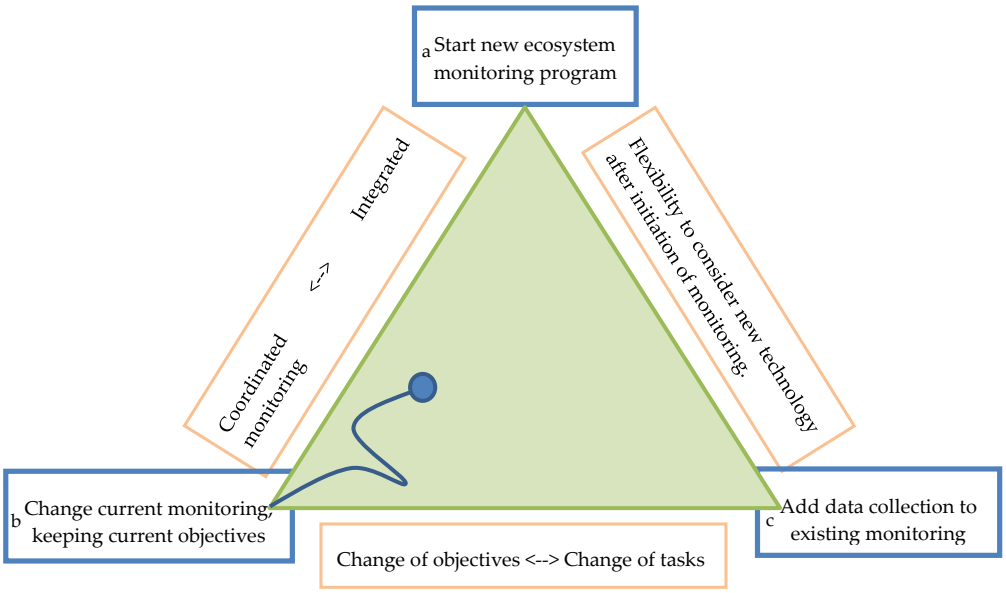

Figure 5.1. The continuum of ecosystem monitoring planning developments. Blue boxes (a, b, c): entry points. Example path (blue line and dot) shows the iterative development of the optimal solution through the considerations of the framework flexibility constraints and technical analytical considerations.

No real progress was made on the collaboration with IEA groups (ToR d), and so, no coherent output could be delivered by WGISUR within the running period. Based on the force-field analysis carried out at the 2014 meeting, it was concluded that relationships between ICES IEA groups and WGISUR should be established or improved so that there is a framework whereby the IEA groups can provide information on data- and knowledge gaps with respect to ecosystems and WGISUR can advise how best to collect, store, handle, etc. the data. However, as the IEA groups still seem to be finding their way there has been limited collaboration. From WKPIMP (February 2016) a list of needs for Q3 North Sea monitoring will become available. This may serve as a starting point for more collaboration with IEA groups.

6 Cooperation

6.1 Cooperation with other WG

In 2014, a joint meeting with WGISDAA took place during the WGISUR 2014 meeting in Nantes.

In 2015, a combined WGISUR/WGFAST ASC session 'Ecosystem monitoring in practice' was arranged.

In 2016, WGISUR initiated the workshop WKPIMP, which will be co-chaired by WGISUR and WGINOSE.

6.2 Cooperation with Advisory structures

In 2015, ICES Data Centre joined part of the WGISUR meeting to discuss data handling, storage, collation and combining data for ecosystem assessments.

6.3 Cooperation with other IGOs

No collaboration with IGOs took place in the running period, but in the self-evaluation, it was considered. See Annex 4, point 12.

7 Summary of Working Group self-evaluation and conclusions

The group evaluated its progress over the last three years and concluded that there are reasons to continue the work, slightly moving the scope from 'providing guidance on the development of ecosystem monitoring programmes' to 'providing guidance on the evaluation of ecosystem monitoring programmes' and 'implementation of the guidance developed in (2011-)2014-2016'.

A copy of the full Working Group self-evaluation is included in Annex 4.

Annex 1: List of participants

NAME	ADDRESS	E-MAIL
Ingeborg de Boois (chair)	IMARES PO Box 68 1970 AB IJmuiden the Netherlands	Ingeborg.deboois@wur.nl
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Jens Ulleweit	Thünen Institute Institute of Sea Fisheries Palmaille 9 22767 Hamburg Germany	jens.ulleweit@ti.bund.de

Annex 2: Recommendations

No recommendations

Annex 3: Preliminary Multi-Annual WGISUR Terms of Reference 2016

Working group meeting draft resolution for multi-annual ToRs (Category 2)

The **Working Group on Integrating Surveys into ecosystem monitoring programmes** (WGISUR), chaired by *Name, Country*, will work on ToRs mentioned below and generate deliverables as listed in the Table below.

The draft resolution will be discussed and finalized during an intersessional WGISUR web meeting as the group was not able to agree on the chair and exact terms of reference during its annual meeting in January 2016.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2017	23–25 January 2017	IJmuiden, The Netherlands	Interim report by *Date Month* to SSGIOEM	Chair and to be elected in June 2016; final ToRs to be decided on in June 2016
Year 2018			Interim report by Date Month to SSGIOEM	
Year 2019			Final report by Date Month to SSGIOEM	

ToR descriptors

ToR	Description	Background	Implementation plan topics addressed	Duration	Expected Deliverables
a	Provide guidance on evaluation of ecosystem monitoring programmes	The work of the group directly relates to goals 1, 2, and 3 of the ICES Strategic Plan (pages 14–15). Specifically, WGISUR work is strongly linked to the last bullet point under goals 1 and 2 (page 14)	25, 30, 31	3	Suggestion: to have a large impact this could be a review paper in a journal, otherwise a kind of SISP manual might be suitable
b	Identify topics common to all surveys, organize workshops	There are strong links with the various survey EGs.	26, 27, 28	3	Workshop report(s)
c	Initiate workshops and evaluate workshop results	There are strong links with the various survey EGs.	31	3 In year 1: evaluation of WKPIMP	
d	Undertake joint initiatives with IEA groups e.g. on data use.	Stronger links with IEA groups will be created by joint activities on specific topics.	25, 27	3	tbd

Summary of the Work Plan

Year 1	Evaluation of WKPIMP results, identify lessons learned and implement those in existing guidelines and ongoing processes
Year 2	tbd
Year 3	Provide a guidance document on the evaluation of integrated monitoring programmes.

Supporting information

Priority	High. Integrated ecosystem monitoring will lead to better exosystem understanding. The topics covered by WGISUR are mentioned in the ICES Strategic Plan. The working group will provide guidance to those collecting data as well as to data users on integrated ecosysem monitoring. There is a clear momentum for guidance on (evaluation of) ecosystem monitoring, and the implementation of the current guidance, e.g. the EFARO/ICES initiative and the proposals for pilot studies related to that initiative.
Resource requirements	The focus for the next period will be on providing guidance on evaluating ecosystem monitoring, and application of the current guidance. As ecosystem monitoring programmes are being developed and becoming operational, data analyses will develop in near future, giving the opportunity to provide guidance on monitoring evaluation based on those examples.
Participants	The group is normally attended by 10–15 members and guests. Participation from all ecoregions is important. Participants should be able to evaluate the ecosystem monitoring programmes. (shift of scope) The group likes to explicitly state that there is a strong wish to keep the current participation from Norway, Canada, and USA next to EU countries, as this prevents that the group narrows down 'ecosystem monitoring' to 'MSFD monitoring'.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	Yes, in general terms (e.g. goal 3 in ICES Strategic Plan)
Linkages to other committees or groups	SCICOM, Survey based WGs under SCICOM, WGECO and other ecology based WGs, IEA WGs under SCICOM, and DIG
Linkages to other organizations	Not yet, but there is a strong wish to involve OSPAR and HELCOM in the work of this group.

Annex 4: Copy of Working Group self-evaluation

Working Group name. Working group on integrating surveys for the ecosystem approach (WGISUR)

Year of appointment. 2016

Current chair. Ingeborg de Boois, Netherlands

Venues, dates and number of participants per meeting.

21–23 January 2014, Nantes, France, (9)

27–29 January 2015, Copenhagen, Denmark, (10)

26–28 January 2016, Hamburg, Germany, (7; originally 9 but two last minute cancellations due to snowstorm and illness)

WG Evaluation

If applicable, please indicate the research priorities (and sub priorities) of the Science Plan to which the WG make a significant contribution.

The work of the group directly relates to goals 1, 2, and 3 of the ICES Strategic Plan (pages 14–15). Specifically, WGISUR work is strongly linked to the last bullet point under goals 1 and 2 (page 14).

In bullet form, list the main outcomes and achievements of the WG since their last evaluation. Outcomes including publications, advisory products, modelling outputs, methodological developments, etc.

Dissemination of results:

- Ingeborg J. de Boois, Donald Clark, David Demer, Elena Eriksen, Lawrence C. Hufnagle, Sven Kupschus, Kelle Moreau, Ana Moreno, Dave Reid, Jens Ulleweit, Kai Wieland, 2015. Making choices: the way forward from single-stock survey to integrated ecosystem survey. ICES CM 2015/C:06. ICES ASC oral presentation.
- Ingeborg J. de Boois, Donald Clark, David Demer, Elena Eriksen, Lawrence C. Hufnagle, Sven Kupschus, Kelle Moreau, Ana Moreno, Dave Reid, Jens Ulleweit, Kai Wieland, 2015. The jigsaw of integrated surveys for the ecosystem approach. ICES CM 2015/C:16. ASC poster presentation.

Tools developed by WGISUR:

- A checklist for new platforms suitable for ecosystem monitoring and research was developed in 2014, and refined in 2015.
- The flow diagram for development of an ecosystem survey was refined in 2015
- The final report of this WGISUR 3-year cycle will contain guidance for those developing ecosystem monitoring, whether from scratch or by adding tasks to current surveys.

Other results:

- In 2014 the group carried out a force field analysis to get insight in the relation between WGISUR and other groups within and outside the ICES community. Both the joint ASC session with WGFAST and the joint activity with ICES Data Centre resulted from that exercise. The outcome of the

analysis will help WGISUR to consider its position in a rapidly changing field.

Has the WG contributed to Advisory needs? If so, please list when, to whom, and what was the essence of the advice.

Not directly, as that is not mentioned as a specific role for WGISUR. WGISUR members however contributed to the EFARO/ICES Meeting on Cooperation in Surveys and Data Collection (held in January 2016) and will be involved in the process following from that meeting.

Please list any specific outreach activities of the WG outside the ICES network (unless listed in question 6). For example, EC projects directly emanating from the WG discussions, representation of the WG in meetings of outside organizations, contributions to other agencies' activities.

WGISUR was represented in the EU project 'Towards Joint Monitoring in the North Sea and Celtic Sea' (JMP NS/CS, 2014/2015) and in the project "Time for Truly Integrated Monitoring for Ecosystems" (TIME) compiled under the joint Defra (UK) strategic evidence partnership fund (MF1231) and Cefas Seedcorn funding (DP330) in support of the project "Developing fisheries surveys to incorporate other ecosystem monitoring requirements: saving money and improving advice".

Please indicate what difficulties, if any, have been encountered in achieving the workplan.

No real progress was made on the collaboration with IEA groups. Based on the force-field analysis carried out at the 2014 meeting, it was concluded that relationships between ICES IEA groups and WGISUR should be established or improved so that there is a framework whereby the IEA groups can provide information on data- and knowledge gaps with respect to eco-systems and WGISUR can advise how best to collect, store, handle, etc. the data. However, as the IEA groups still seem to be finding their way there has been limited collaboration.

Future plans

Does the group think that a continuation of the WG beyond its current term is required? (If yes, please list the reasons)

Yes. The development of ecosystem monitoring is an important topic and many people inside the ICES community are trying to either change current surveys into ecosystem surveys or even ecosystem monitoring programs, or adding data collection tasks to current surveys. ICES will need experts to provide guidance in these processes, especially because the interest in ecosystem monitoring is likely to increase as the IEA groups establish their methodologies.

WGISUR sees the focus for the next 3-year period on providing guidance on how to evaluate the performance and suitability of ecosystem monitoring plans and programmes, and application of the guidance documents it has developed in the past. As ecosystem monitoring programmes are being developed and becoming operational, data analyses will develop in the near future, giving the opportunity to develop guidance on evaluating monitoring plans and programs based on those empirical examples.

WGISUR considers the potential conflict between ICES monitoring priorities and national monitoring priorities (e.g. as a result of national monitoring obligations under MSFD in EU MSs) as the major challenge to move towards more integrated monitoring and assessment of ecosystems. Both ICES and national authorities consider ecosystem monitoring a high priority, but the more detailed objectives in what to sample and when do not always link up, and importantly differ between nations.

WGISUR is in a good position to advise on reconciling the differences, but the group does not have the authority to make changes to surveys.

WGISUR clearly sees a continued requirement for guidance on (evaluation of) ecosystem monitoring, e.g. the move towards more ecosystem focused fisheries independent surveys (e.g. surveys under WGIPS), and EFARO/ICES initiative and the proposals for pilot studies related to that initiative.

Terms of reference for the next period:

- Provide guidance on evaluation of ecosystem monitoring plans and programmes
- Identify topics common to several surveys, organize workshops and evaluate the workshop results
- Initiate joint initiatives with IEA groups e.g. on data use

Naming: WG on integrating surveys into ecosystem monitoring programmes (WGISUR)

If you are not requesting an extension, does the group consider that a new WG is required to further develop the science previously addressed by the existing WG.

Maybe. Although WGISUR sees a continuation of the group, it also sees a need for additional groups, i.e. groups that coordinate ecosystem monitoring by Ecoregion. In 2014 it was recommended that SCICOM investigates the need for Ecosystem survey expert groups (maybe by Ecoregion, e.g. WGMSFDemo). WGISUR defines its role as an advisory board for ecosystem surveys, but does not see how in its current form coordination of Ecosystem surveys by region, data transmission from the surveys to the IEA groups would fit in the activities of WGISUR. The people carrying out the surveys need to have a forum to exchange experiences, coordinate ecosystem surveys within Ecoregions, exchange and collate data and data processing methodologies. There should be a close link between the IEA groups and the ecosystem survey expert groups as well as a close link between the ecosystem survey expert groups by Ecoregion and WGISUR.

WGISUR does not yet have a concrete view on how to practically arrange this. The best way forward seems however to organize a web meeting between the chairs of survey groups under SSGIOEM, WGISUR, and the IEA groups. At this meeting the following can be discussed:

a) if there is a need for coordinating groups for ecosystem monitoring (preferably linked up with the respective IEA) now;
b) if there will be a need for those groups in (near) future;
c) and how to organize this.

What additional expertise would improve the ability of the new (or in case of renewal, existing) WG to fulfil its ToR?

Over the last years, WGISUR has contributed to many initiatives to develop ecosystem monitoring programmes (e.g. EU projects 'TIME' and 'Towards a Joint monitoring programme in the North Sea and Celtic Sea'), or optimize current monitoring programmes. Many tools and methodologies have been developed, e.g. by WGISUR but also in EU projects and by national institutes (often in bi- or trilateral international collaboration), but often the plans are not taken further. The group has not yet a clear view if there is a need for participation of people at the 'decision level'. WGISUR would encourage participation from IGOs (e.g. HELCOM, OSPAR) to broaden its basis.

Participation from all ecoregions is important.

Participants should be able to evaluate the ecosystem monitoring programmes. (shift of scope, WKECES as example)

The group likes to explicitly state that there is a strong wish to keep the current participation from Norway, Canada and USA next to EU countries, as this prevents that the group narrows down 'ecosystem monitoring' to 'MSFD monitoring'.

Which conclusions/or knowledge acquired of the WG do you think should be used in the Advisory process, if not already used?

The current ecosystem advisory process is only qualitative. As ICES moves towards a more quantitative ecosystem advisory process, the input of WGISUR will become more important.

Annex 5: Agenda 2016 meeting

TI, Hamburg, Germany, 26–28 January 2016

Tuesday 26 January

9.00 Getting computers ready, saying hi to old friends, etc.

9.30 Start of the meeting

- Welcome (Ingeborg)
- Logistics (Jens)
- Who's who?

10.00 What can we expect? (Ingeborg)

- Short history on WGISUR (if needed)
- Multi-annual ToRs (see also Annex I): planning for the last year

ToR a: Provide guidance on the adaptation of existing surveys to provide ecosystem data.

ToR b: Provide guidance on the development of an ICES ecosystem survey approach

ToR c: Identify issues common to all surveys, set up workshops and manage them as appropriate

ToR d: Liaise with IEA groups, and others as appropriate (e.g. CWGMSFD), over data product needs and specification

10.30 Coffee

11.00 Linkages with other projects/groups:

- Feedback from IEA groups (volunteers?)
- Survey groups if any topic occurs (volunteers?)

11.30 Evaluation of ASC 2015 session

11.45 Defining tables of content CRR1 and CRR2 (or in other form than CRR)

12.30 Lunch

13.30 Collating information for final product (subgroups):

- Chapter 'starting new integrated ecosystem monitoring'
- Chapter 'change current monitoring into ecosystem monitoring'
- Chapter 'add data collection to existing monitoring'

14.30 Discussion on draft text final product

15.30 Tea

16.00 Continue subgroup work on final product (subgroups):

- Chapter 'starting new integrated ecosystem monitoring'
- Chapter 'change current monitoring into ecosystem monitoring'
- Chapter 'add data collection to existing monitoring'

17.30 Wrap-up, plans for Wednesday

18.00 end of day

Wednesday 27 January

9.00 Continue subgroup work on final product

- Chapter 'starting new integrated ecosystem monitoring'
- Chapter 'change current monitoring into ecosystem monitoring'
- Chapter 'add data collection to existing monitoring'

10.30 Coffee break

11.00 Discussion on draft text final product

12.30 Lunch

13.30 Preparation WKPIMP; probably in subgroups -Follow-up of WGISUR 2015 exercise

14.00 Continue working on preparation WKPIMP, and final product (subgroups)

15.30 Tea

16.30 Review final product texts (subgroups)

17.00 Wrap-up, plans for tomorrow

17.30 end of day

Thursday 28 January

9.00 start

- Direction of WGISUR, review self-evaluation
- Terms of reference 2017-2019
- Workshop proposal 2017 (if any)
- ASC 2016 presentations
- Review report WGISUR
- In other Words 'integrated monitoring'; output to ICES website, Linkedin, Facebook
- Picture

10.30 Coffee

11.00 Review text guidance document

12.00 Lunch

13.00 Subgroups

15.15 Chair election and next year's meeting

15.45 Wrap-up, action list

16.00 end of meeting

Annex 6: First draft end product

1. Introduction

In this document, guidance is given on the development of ecosystem monitoring: monitoring of one or more components of the ecosystem (chapters 1–6). In chapter 7 a checklist is presented for important aspects when building a new research vessel for ecosystem monitoring.

1.1. Three options for moving towards integration of ecosystem monitoring programmes

There are different pathways towards ecosystem monitoring, i.e. depending on reporting requirements and budgets. This document uses three options as entry points for the collection of a wide range of marine ecosystem data: (a) development of a new integrated ecosystem monitoring programme, (b) modification of existing monitoring programmes/surveys to collect ecosystem information, and (c) adding data collection to an existing survey or monitoring (Figure 1.1). The suitable option depends on a number of factors, e.g. the monitoring objectives, the scope for adapting current objectives, existing monitoring programs with tasks that have to be carried out in future. In addition, the multiple levels of management (international, national, local) with overlapping/variable scales of requirements and interests (e.g. fisheries and biodiversity) play a role. This means that in general there is no 'good' or 'bad', and not even a 'better' or 'worse' option, the main criteria is whether it is fit for purpose and efficient given the circumstances.

This document describes how ecosystem monitoring can be planned and carried out for each of the three options, which act as entry point. It is important to realize that in many cases the actual monitoring is somewhere on the edges, or even in the middle of the ecosystem monitoring planning triangle.

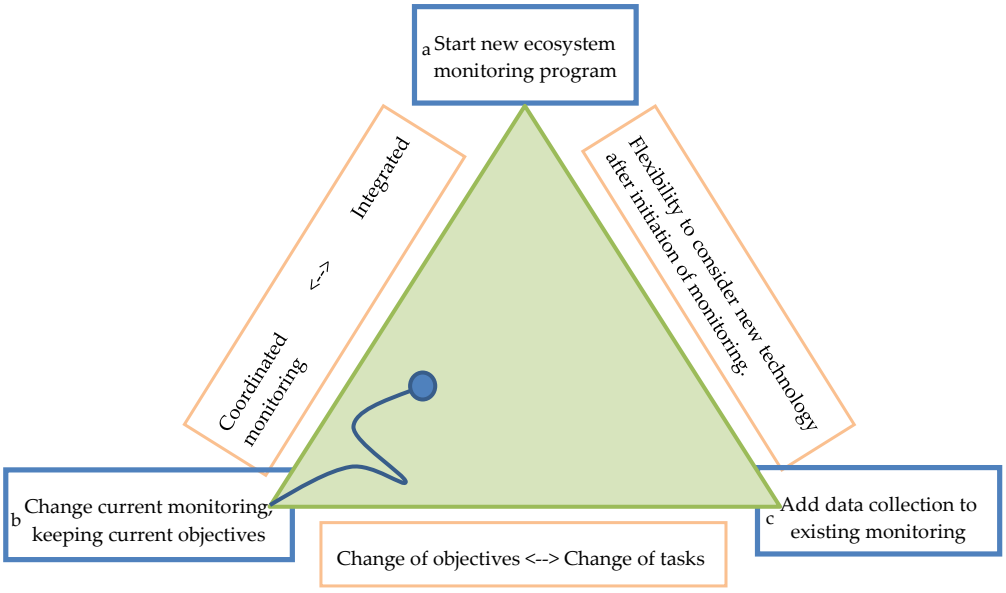


Figure 1.1 The continuum of ecosystem monitoring planning developments. Blue boxes (a, b, c): entry points. Example path (blue line and dot) shows the iterative development of the optimal solution through the considerations of the framework flexibility constraints and technical analytical considerations.

The identification of the most appropriate option (corner of the triangle) will guide the process of the redesign and advance towards finding the optimal solution. The three entry points are not the only options; in reality the planned changes may fall somewhere in the continuum between those points, i.e. somewhere in the green area represented by the surface of the triangle.

It is important to note that the things to consider and scope differ between the options, as does the value of the outputs so that they are not strictly comparable.

Option c) adding data to current monitoring need only considers a single survey at a time, while option b) changing existing monitoring including (part of) its original objectives as well as new objectives considers one or multiple surveys, but always in the context of the wider monitoring activity. Option a) developing a new integrated ecosystem monitoring programme considers these components, but also changes in other data collections as well as how the data are analysed specifically to maximize the information content in survey collections.

Box 1: Definitions

Indicator: Quantitatively defined metric representative of an ecosystem state with respect to a specified objective, e.g. Good Environmental Status (GES).

Time series: Comparably collected set of monitoring data with defined periodicity used to calculate a specific index or indices.

Ecosystem monitoring: monitoring of one or more components of the ecosystem

Coordinated ecosystem monitoring: More efficient ecosystem monitoring by sharing platforms to collect the necessary ecosystem components according to independent sampling designs.

Integrated ecosystem monitoring ***survey***: data collection on more than one ecosystem component, explicitly considering the processes that link the sampled components in the sampling design.

Integrated ecosystem monitoring ***programme***: The combination of multi-platform, multi-scales integrated data collection, for the evaluation of ecosystem status and the monitoring programme.

Objective: monitoring goal

Task: concrete actions to be carried out during a survey.

The challenges for the three options differ: starting a new ecosystem monitoring programme means finding the optimal compromise for the different components of the monitoring (e.g. in sampling design, gear, frequency, timing) to meet the overall objectives for 'assessment of the ecosystem'; modifying a current survey into ecosystem monitoring while keeping current objectives means optimizing the trade-off for the separate objectives, and continuation of time-series related to the current objectives; adding new tasks to existing surveys without changing the primary objectives means choosing where to draw the line as there is a limit to what can be added to a survey.

Adding some additional task to a survey (see section 1.6) is much less costly and burdensome than reorganising all of monitoring (see section 1.4) because the scope of considerations is much smaller. However, the Workshop on Evaluation of current ecosystem surveys, WKECES (ICES, 2012b) concluded that for technical reasons alone it is not possible to conduct a full ecosystem monitoring programme on a single survey. Therefore, in reality all options will require these steps, just not explicitly as part of the survey planning, so that the total complexity of moving to ecosystem monitoring is likely to be the same for all options.

1.2. Definitions

Relevant definitions can be found in Box 1. The current literature on integrated ecosystem monitoring uses the same or similar terms for different activities or designs. To avoid confusion with this loose terminology we provide the definitions to highlight hierarchical improvements in information value from increasingly integrated monitoring.

For ecosystem monitoring it is important to determine the lowest common denominator with regards to options for change. In recognition of the flexibility in relation to current and anticipated fisheries and ecosystem management objectives WGISUR attempted to cover the different potential entry points by characterizing the potential for adaption/change. These options for change are based on assumptions about the degree of flexibility around current fisheries survey objectives.

- Changes of objectives and prioritization (option a);
- Retention of objectives but flexibility on tasks to fulfil those objectives plus addition of new objectives (option b);
- Retention of tasks to fulfil current objectives but flexibility on adding tasks within current design (option c).

1.3. Things to consider before designing an ecosystem monitoring programme

To ensure resources are spent in the best way possible, the following topics should be discussed before starting the process:

1.3.1. Decision-making

a) Who (authority, institute, person) decides in which form the ecosystem monitoring will take place? That is, who decides which entry point in Figure 1.1 should be taken, and who decides on the subsequent implementation of the proposed programme?

   Although the responsibility for the decision-making may depend on the extent of changes, it should be clear to all people involved in the process who will take the final decision of in which form the monitoring is going to take place.

b) Who should provide advice on the ecosystem monitoring programme? Data users, especially when current objectives still should be met while the suite of monitoring objectives (and as a result survey design) changes, need to be involved in the agreement on the final plan.

It should be clear at all times that decisions on priorities have to be made prior to going to sea, and that survey leaders are informed about and understand the priorities.

1.3.2. Data integration

Independently from which option is chosen, the ambition of ecosystem monitoring should always be that data collected can be integrated or at least easily combined. That means that one should consider data storage and accessibility (can all parties involved access all the monitoring data?) and that, when different data types will be collected on one 'station', this should be easily retraceable (the easiest option is to use an identical station name throughout all sampling carried out on that particular station).

1.3.3. Feedback on operational data collection and use

To ensure ecosystem monitoring is fit for purpose, a link between data end-user and data providers should be established before the monitoring starts. Feedback on the usability of the data collected has to take place, as well as feedback on the operational aspects of the integrated surveys. Based on the feedback, the plan can be altered when needed.

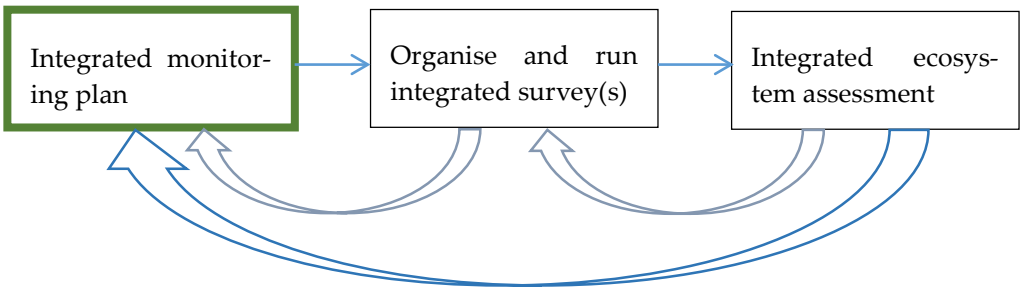


Figure 1.2 Process from monitoring plan to integrated ecosystem assessment. (ICES, 2015)

1.4. Create new ecosystem monitoring programme (option a)

1.4.1. Reasons to choose this option

This option is recommended in situations where there is little ecosystem monitoring or monitoring of any kind in place or where the advisory requirements have evolved rapidly. At the heart of the approach sits the belief that ecosystems are highly connected through ecosystem processes which need to be understood in order to provide effective management advice. When ecosystems interactions are high and the emphasis is on the ecosystem approach it is likely that the ultimately chosen compromise for design and implementation will reside closer to this option than the other two.

This option is *not* recommended when there is a need for a monitoring approach to only fulfil the minimum requirements for a specific purpose (e.g. MSFD). When the continuity with existing monitoring programs has a high priority in the short term this approach is unlikely to provide the desired outcomes.

Opportunities

- Provides an opportunity to revisit the aims and objectives in relation to the ecosystem under consideration;
- Provides the opportunity to examine and seamlessly incorporate new methodologies and technologies into monitoring;
- Allows the evaluation of the survey program in the context of other available data sources, increasing efficiency in maximizing the effectiveness of the use of costly surveys;
- Provides maximal gains in process understanding because it is designed to examine the full range of contrast within ecosystems;
- Uses the understanding of the relationship between ecosystem processes to minimize the uncertainty in sampling design and therefore becomes efficient at interactive systems;
- The ecosystem relationships should provide stability to the monitoring process allowing more flexibility in the development of a long-term monitoring programme.

Risks

- Where current monitoring programmes exist:
    - substantial changes to these time-series are almost inevitable. In the short term this will result in a loss of precision and potentially accuracy of stock assessments. In the long-term threats to time-series are greatly reduced where these can be linked through eco-system processes.
    - there is a risk of trying to fix things that were not broken, i.e. changing things that we are already doing well (change for the sake of changes).
    - when priorities/objectives are unchanged this option is likely to be less efficient than other options.
- Where no current monitoring exists and where there is little understanding of the dominant ecosystem processes in the short term there will be substantial increases in costs, which will only decline if ecosystem connections are demonstrable.

1.4.2. Important topics

- Prioritize objectives prior to the survey. Consider what is known/important in the ecosystem. What processes dominate quantitatively and what processes vary systematically.
- Data collections are interdependent in their use. Changes to specific collections will have wide-ranging impacts. A centralized overview of monitoring is essential and therefore requires buy in at a high political level in order to avoid undermining the benefits.
- Investigate data collection from other sources, or by involving third parties (e.g. water sampling from oil rigs)

1.5. Redesign a monitoring programme keeping the current objectives (option b)

1.5.1 Reasons to choose this option

One of the reasons may be a long-term shift of monitoring objectives, while current objectives continue to exist. There is a wish to collect more information for the same budget (personnel, money, and ship time). Another reason may be that an evaluation of the current survey suggests that the monitoring effort for the current objectives can be used in a more efficient way, freeing resources (money, personnel, and/or ship time) for other data collection.

Opportunities

- The re-prioritization of objectives gives a number of opportunities leading to optimized efficiency of monitoring program at all levels:
    - optimizing coordination at national and international levels;
    - clarifying current objectives, evaluate current data use, and develop new objectives;
    - modernising existing sampling methodology, e.g. automation, new nets, and continuous sampling.
- Current processes for coordinating and data deliverables are maintained, e.g. ship planning, personnel training, and on-board organization.

- Easier to maintain continuity of data time-series for current objectives, e.g. assessment of a certain stock.

Risks

- Change in survey design may require standardization with previous datasets or methods of calculation, in order to warrant analyses of temporal changes across the point in time when the survey design was altered.
- Loss in data quality/precision/quantity with respect to current objectives could occur due to compromise for new objectives.
- Survey design might not be optimal/suitable for new objectives or become less optimal for current objectives.
- Sampling methodology might be compromised for some objectives.
- Possible changes in organization, e.g. ship planning, personnel training, and on-board organization.
- Flexibility to fulfil sampling programme may decrease, e.g. in case of bad weather.

1.5.2 Important topics

Initial conditions

- Evaluate the current survey first. Consider aspects such as: Has the survey been apt to inform sufficiently on its key objectives? If not, which elements of the key objectives are not covered completely? Also consider current data use and whether its full potential has been realized, if not why?
- Evaluate which of the possible data sources to address the objectives are the most robust/reliable ones, or in which combination they would best be used (e.g. compare quality of survey data and commercial landings or catch data; or survey data from various survey sources or plankton samples from vertical hauls or CPR).
- Get information on the requested quality of data for the current (and future) objectives. In many cases, clear targets for the required quality or precision of survey estimates do not exist yet. Therefore, this task will often call for either:

    a) definition of (desired) targets by data users (towards option c) in section 1.6 (add data collection to existing survey), or
    b) definition of optimized targets by survey operators and coordination groups (towards option a) described in section 1.4).

- Prioritize survey objectives. If priorities have changed between initiation of the survey and now, consider the process described in section 1.4 (create new ecosystem monitoring).
- How does the redesign of programme impact current time-series?

Aspects of acceptance of new survey design and its implementation

- Who is responsible for implementation of the changes? On whose request does it happen, and who can decide if the survey design can be changed?
- Follow flow-diagram as mentioned in Figure 3.1; the basis of the planning of the survey design needs to be done onshore, only decisions that require

short term input should be done at sea, preferably using a clear instruction how to prioritize objectives.

1.6. Add data collection to existing monitoring (option c)

1.6.1 Reasons to choose this option

This option could be selected, rather than option b) redesigning your survey, if the main aspects of the survey design cannot be modified. If this requirement is of paramount importance, then adding data collection to the existing monitoring may be the best available approach. Also when the requirement to collect additional data is part of a short-term project then collecting it during an existing monitoring program may be the most feasible option.

For this approach to succeed there must be time and support available to collect additional information during the survey, or additional resources must be available to add to the existing survey resources (see table of data collection and analysis costs).

If the objective does not require additional sampling and entails extracting additional information from the samples already collected (like stomach contents or fin clips from fish caught in a survey), then this could simply be a matter of ensuring sufficient time is available for additional data collection between sampling events. Alternatively, time spent on some tasks could be reallocated to free-up personnel to focus on novel data collection. A review of existing protocols may indicate potential opportunities to free-up time without negatively affecting the objectives of the program.

If there is funding available to support collection of additional data, it may also be possible to extend the duration of a survey, or take additional people on board to allow the collection of these data. If the objectives are compatible with the existing survey program and a review of the additional time, costs and expertise required to include this objective indicate it is feasible, this may be more cost-effective than other options for addressing this need.

Opportunities

- Maintains existing time-series; as the original survey does not change due to the additional data collection, the data use and analysis can be carried out as before.
- It is likely that the original survey schedule can be kept, unless resources become available for extension of the survey period.
- Available on short notice especially when additional data collection entails extracting additional information from the original samples.
- Provides a good way to evaluate the benefits of collecting the additional data and may facilitate integration of the survey towards ecosystem monitoring in the longer term.
- Cost/benefit balance for the survey is improved as more data are collected during the survey.

Risks

- The survey design may be suboptimal for additional parameters.
- Additional tasks come always with a price = additional resources (e.g. workload, personnel, specific skills, storage capacity, preparation time, or analysis time) may be needed.

- Priority of the additional data collection may be lower than meeting the original objectives, so in case of delays, e.g. bad weather, it is likely that the additional data collection will not take place.
- Adding activities to a survey increases the risk of failing to meet the minimum requirements for the original objectives.

1.6.2 Important topics

- Review the constraints placed upon the survey/data collection; original objectives are priority, unless resources (e.g. money, ship time, personnel) become available for additional tasks.
- Prioritize objectives to ensure the order in which things may be dropped in case of time lost is established in advance. Mostly the original objectives will be paramount, and it should be evaluated if the additional objectives result in an unacceptable risk to the likelihood of achieving the primary objectives.
- What opportunities exist for enhancing the survey through integrating ecosystem monitoring objectives? Can option b) be used as entry point?
- What is the value of the additionally collected data? This is especially important when the sampling scheme is suboptimal or unsuited for the new parameters measured.

2. Framework for setting up a monitoring programme

The next chapters describe the design of ecosystem monitoring for each of the three options using the approach developed by WGISUR. In this chapter, this framework is explained.

Figure 2.1 Flow diagram for the development of ecosystem monitoring (ICES, 2012a)

3. Create new monitoring programme from scratch (option a)

3.1. Applying the stepwise approach

3.1.1. Problem identification

The overall objective is ecosystem monitoring. Compared to other approaches, integrated ecosystem monitoring places more emphasis on agreeing to the more abstract objectives and does so at a higher level so that a lot of the work is front loaded in step one. The likely benefits of the approach are inversely proportional to the available knowledge of a specific ecosystem so that complex analyses on how the ecosystem components interact is a vital part of the process and this has to take place before further steps are possible.

The fully integrated approach accepts that monitoring resources are such that the ecosystem monitoring program development requires considering a series of trade-offs that focus on maximizing the degree of ecosystem understanding. As such, the high-level objective is simple; however, the detailed understanding of how this translates into an actual monitoring plan is considerably more complicated. Starting by what is important in an ecosystem presupposes that we know something about the ecosystem and that it has some relevance to the information that is required from a policy and legislative perspective.

It is not possible to determine appropriate prioritizations for monitoring and detailed objectives at this step at the level of the data user. High level (advice customer) buy-in on the principles of the approach and acceptance of the associated risks are essential to successful development of integrated monitoring. A detailed and convincing analysis of available data despite its current weaknesses in integration is vital. The higher degree of ecosystem interactions, the higher will be the benefits of such a monitoring program.

There are however, substantial benefits to the improved cooperation of ecosystem experts later on in the flow diagram so that the additional time requirements in this step are compensated for. Getting this step right is essential to ensure overall success of the approach.

3.1.2. Framework

Because objectives are set at a high level with an agreement at the policy level, much of the task at this step now subsumes to technical implementation. Current survey coordination frameworks and technical expertise can be efficiently used to implement ecosystem monitoring programs. It is likely that appropriate data storage structures and facilities that ease the integrated data use need to be further developed to get the most out of the approach.

3.1.3. Survey objectives

In this case the step encompasses setting the objectives of the entire monitoring programme. As with step two (section 3.1.2) much of the work in determining the process that need measuring is accomplished in step one. As a result, the current step reduces to the practical implementation and the choice of specific gears, spatial and temporal units to provide information on the processes, which cannot be effectively monitored by less costly platforms (e.g. buoys).

Special consideration should be given to ensure surveys provide the link between the various data collections on less flexible platforms. The main considerations for planning are the logistics constraints (ICES, 2012b), appropriate methodologies and platforms that can provide the data for the ecosystem monitoring program.

3.1.4. Survey design

In this case the step is the design of the entire monitoring programme. The ecologically relevant areas and periods determined in step 1 (section 3.1.1) provide a good starting point for the survey design. Resource constraints and survey objectives (step 3, section 3.1.3) provide rough estimates of the sampling levels that can be achieved. Based on this, a decision on the most appropriate monitoring program design and the design of each survey (e.g. stratified random/systematic for station sampling) considering variances and biases is made.

3.1.5. Pilot study

Because integrated monitoring is inherently flexible, considered changes based on routine evaluation of the monitoring program (step 7, section 3.1.7) continually improve the monitoring program in relation to its objectives. In this sense, each survey is partially a case study. Initially operational implementations could be tested on a smaller scale as a case study.

3.1.6. Survey(s)

Conducting the surveys according to the plan in ideal circumstances is relatively straightforward. However the multidisciplinary nature increases the logistic complexity, particularly with regards to potential weather impacts. As a result, it is likely that the job of survey leader will require additional skills and development to ensure consistent delivery of objectives.

Making a step change to integrated monitoring does allow a more rapid development of the monitoring program so that new methodologies/sensors can be incorporated without the 'standardization' constraints in existing surveys. In addition, full integration of monitoring means the program possesses flexibility, allowing it to be continually up to date with technological advances.

3.1.7. Use of results

Along with step 1 (section 3.1.1) this is the most effort intensive part of the development towards the successful completion of this approach. Although all entry points require an evaluation tool, only in this approach is it an essential part of the process itself and therefore specifically mentioned here.

In a fully integrated ecosystem monitoring programme survey data can only be evaluated in relation to all other available data sources. Their value in the provision of advice is only within the context of the ecosystem understanding as a whole. Therefore it is essential that alongside with the development of the monitoring an integrated ecosystem assessment is developed. The integrated assessment provides the important connection between survey scientists, policy customers and legislative entities providing across the advisory process.

3.2. Practical support

In 2012, an evaluation of ecosystem surveys was carried out by WKECES (ICES, 2012b). The report presents the strengths and weaknesses for a number of surveys in different ecoregions.

4. Redesign a monitoring programme keeping current objectives (option b)

4.1. Applying the stepwise approach

4.1.1. Problem identification

For this option, evaluate the current programme through its capacity to meet current objectives and identify aspects that require improvement or could be improved, considering wider ecosystem dynamics/characteristics. Additionally, it should be evaluated if any parts of the current programme already meet the new objectives, e.g. reanalysis of existing data could be (partly) sufficient. The evaluation can also contain considerations of which of the possible data sources to address the objectives are the most robust/reliable ones, or in which combination they would best be used.

Define the reasons for the intended change, and the data end-users connected to the new objectives, and relate to literature and appropriate models in particular for new objectives in order to specify the needs for the quantity and quality of the data to be collected. Alongside with this, specifying the ecosystem to be studied is a crucial part.

Define current and new objectives for monitoring program in general terms and specifically for current and expected (future) data products, e.g. indicators.

Prioritize objectives in order to decide which objective(s) would are leading in optimizing the monitoring programme.

Agree on prioritization with end-users.

4.1.2. Framework

As the current objectives are kept in this option, first list the survey elements which are fixed, i.e. are defined by the primary objectives. These could (but not in all cases do) include timing, frequency, spatial coverage, trawl gear. Vice versa, specify survey elements that may be modified, possibly but not necessarily including survey duration, spatial coverage, research vessel.

List existing resources of programme. Resources include at least ship time, on board capacity, money, personnel.

Specify current national/international cooperation and identify new opportunities. Improved collaboration may lead to shifts in tasks by different parties, depending on the facilities and the capacities.

List additional resources needed for new objectives, and consider using the table mentioned in 6.1.2 to check if the whole process is covered.

Define operational priorities (based on step 1, section 4.1.1), accounting for available resources to create a realistic plan.

4.1.3. Survey objectives

As in this option multiple surveys may be involved, the objectives for all surveys in the monitoring programme should be set.

List the selection of ecosystem components (pelagic, demersal, etc.) -based on the definition of the ecosystem defined in 4.1.1- to be covered and sampling methods to be used for each component.

It is recommended to check coherence of operational objectives across surveys and other observation platforms in order to identify possible synergies between currently unlinked monitoring efforts.

As objectives will be added to the monitoring programme, draw a list of the current expertise as well as the new/additional expertise needed to collect the data on board as well as the expertise needed for sample processing (if any) after the survey. Also, incorporate the processing of large amount of data, e.g. acoustic information, video images.

Define and prioritize objectives, and the operational tasks based on priorities defined in section 4.1.2. This includes defining the minimum requirements for survey deliverables as well as development of a method to prioritize objectives (e.g. what can be dropped) under specific adverse conditions at sea or in case of technical problems.

4.1.4. Survey design

This step includes all surveys in the programme. First, identify the alternative survey plans that might be more suitable for accommodating new objectives than current plan and quantitatively compare alternative survey plans with current one using existing data for current objectives, simulations, etc.

All survey plans have to be discussed with all parties involved, especially the data collectors and end-users, and select most appropriate given objectives and constraints. If necessary, adapt plans till agreement is reached.

Before moving on, check that final plans for all surveys are in line with steps 1-3 (sections 4.1.1-4.1.3).

4.1.5. Pilot study

Test if the data can be collected as planned. This may incorporate operational tests as running two gears simultaneously or following each other.

Test newly collected information: analyse samples, analyse data, run models. Take into account different primary units for different sampling strategies. Also test if the current objectives still can be met.

Consider if altering the previous survey design, and meanwhile build in an option for running a trial version of the new design first, is possible. This allows for comparison of both designs and, where needed, intercalibration.

4.1.6. Survey(s)

Carry out redesigned surveys.

4.1.7. Use of results

Exchange information with collaborating parties, evaluate the survey and list lessons learned/options for operational improvements.

Evaluate new programme with collaborating parties in terms of practical feasibility, organization of on board operations, further training needs, etc.

Analyse data, where possible compared with previous design. Evaluate whether expected redesigned programme meets all objectives and compare results (precision etc.) to results from previous programme and revise as appropriate.

Exchange data and disseminate information collected (including survey report; lessons learned from revising design) between all parties involved, and disseminate results to third parties as appropriate.

4.2. Practical support

In February 2016, the Workshop to Plan an integrated monitoring programme in the North Sea will take place (WKPIMP). The option used as basis for this workshop is to Redesign a monitoring programme keeping its original objectives.

In 2014–2015 three EU funded projects (BALSAM, JMP NS/CS and IRIS-SES) have been carried out. The scenarios studied in these projects followed the approach of optimizing current monitoring keeping current objectives, and sometimes adding new objectives (Shepherd *et al.*, 2015).

5. Add data collection to an existing survey (option c)

5.1. Applying the stepwise approach

5.1.1. Problem Identification

The original survey objectives are defined and accepted. For many surveys, the opportunity exists to increase the degree to which they can contribute to ecosystem monitoring. Improving the degree of integrated ecosystem monitoring in the objectives of a survey increases the scope of its relevance to ecosystem studies, thus increasing the value of the survey as a monitoring tool.

Identify knowledge gaps, which could be addressed during the survey. These additional objectives must be determined and prioritized. Additional objectives will be assessed in relation to the ecosystem monitoring goals. If an additional objective require additional vessel time or alterations to the cruise track, these additions should be reviewed in the fashion expected for a new or redesigned sampling program (see sections 1.5 and 5). If it is an added task, the review needs simply assess the time required in relation to available vessel time.

5.1.2.Framework

Define the available opportunities within the existing survey and refer to the WKCATDAT table for assessing the requirements in personnel, expertise, time, and money, to address potential data collection. Determine if any additional resources (funding or other form of support) are available to assist in accomplishing the additional objective. Accepting that the initial objectives will remain as 1st level priorities, develop the logistic plans for new (second level) sampling objectives.

5.1.3. Survey objectives

Define the operational prioritization to include additional tasks and the expertise needed to accomplish them. Ensure that original priorities are not compromised. If additional resources are needed to accomplish a new goal, the methods, and timing should be examined and harmonized with the existing survey plan.

5.1.4. Survey Design

The general survey design is already in place. Detailed sampling plan should be reviewed to ensure new tasks are included and do not jeopardize the primary goals.

Check to ensure that the plans remain consistent with output from section 5.1.1 and 5.1.2.

5.1.5. Pilot Study

Undertake new sampling during the survey to assess operational practicalities associated with integrate new gears or methodology. If necessary, reassess the methodology employed or prioritization of the new objectives.

5.1.6. Survey

Go for it!

5.1.7. Use of results

Review the impact of the new sampling on the performance of the survey in addressing its primary objectives. If the addition has been a success, that is, it has had no detrimental impact on the original survey objectives and completion of the additional tasks is considered to be feasible in general, consideration should be given to including the new task or objective among the primary objectives of the survey. If this is the case then it will have equal priority to the pre-existing objectives in reviewing how to achieve your goals during a survey if some cutback is required. If it will remain as a secondary goal, then the level of priority should be made clear.

Assess if the new objectives are feasible and the results meet requirements. If samples or data are not immediately used, ensure that a proper storage is available and that the plans are in place to make use of these samples/information before continuing the collection in future.

Evaluate the prioritization of additional sampling objectives and determine if there is still the opportunity to address more of the additional objectives from the list of priorities.

5.2. Practical support

Marine litter data collection from IBTS: as part of the data collection for the EU Marine Strategy Framework Directive (MSFD) during the IBTS in the North Sea litter from the GOV catch is being collected, sorted, identified, and measured. The data collection started as a pilot, but in the implementation phase of the MSFD, funding from national governments became available in the Netherlands, France, and England. As a result, this data collection now is one of the survey objectives on a national level. It requires extra manpower but no extra sampling.

For the EU project MAFCONS (2003–2006) and its predecessor EU project Monitoring biodiversity (1999–2000) during the Q3 North Sea IBTS and the Dutch Beam Trawl Survey in the North Sea, additional samples were collected using a 2-meter beam trawl (both projects) and a grab (MAFCONS). Approximately a week additional ship time was funded via these projects, as well as additional personnel. The sampling with the regular fishing gear as well as the gear(s) for the EU projects was carried out at the location of a standard survey trawl, as information on the fish and benthic communities had to be linked in the data analyses for each station. By funding some additional ship time, the time loss by adding activities on a trawl station was com-

pensated, and the full survey could be carried out including additional objectives for a relatively low additional budget.

During the Q1 North Sea IBTS an additional net was placed on the MIK net (so-called MIKey-M net, van Damme *et al.*, 2014). In addition to catching small herring larvae, the MIKey-M gave the possibility of undertaking winter spawning sampling on the IBTS. The sampling in itself did not take extra resources, but the analysis in the lab after the survey was covered.

6. Building new research vessels for ecosystem monitoring

6.1 Introduction

When planning to build a new research vessel, one should grab the opportunity to make it as useful as can be. For this reason, a checklist was developed by WGISUR in 2014. When needed, the checklist can be modified to be fit for purpose.

If the checklist feels too much like a fixed framework, first have a brainstorm session, e.g. by creating a mindmap. This may give insight in the different aspects of the new vessel.

6.2. How to use this checklist?

The checklist is presented in section 6.3.

a) Answer the questions in step 1 (reasons to build the platform). For flow diagram 'How to develop an ecosystem survey', see Figure 2.1.
b) Answer the questions in step 2 (technical specifications).
c) Check if the answers of step 1 and step 2 are in line with each other. If not, adapt one or both lists.
d) Go through step 3a, 3b, 3c, and 3d.
e) Check if the answers of all steps are in line with each other. If not, adapt one or more lists.
f) Think about and write down priorities of the objectives, and the related specifications. This may be useful when budget for the platform is limited and choices have to be made.
g) If you miss any important issue in the lists below, feel free to contact the chair of WGISUR.

Warning: be aware that it may not be possible to carry out all different sampling methodologies on one single platform. Fully developed ecosystem monitoring cannot be carried out on a single platform anyway, so think well about the purpose of building the new ship (step 1).

6.3. The checklist

Step 1: Reasons to build the platform

Before the decision to build a new vessel can be made, the following questions have to be answered:

1. What are the main objectives for the activities to be carried out on the platform? It is preferred that the objectives of ecosystem monitoring and research are defined in an international context.
2. Which area will be the main operation area of the platform? E.g. inshore vs. offshore, size of the sampling area.
3. What are the primary objectives for the platform?
4. Is building one platform sufficient to meet the objectives?
5. Would it be better to invest in two (or more) platforms, and if yes, should they have similar characteristics or should they be complementary?
6. What are the possibilities for collaboration with other organisations/countries to carry out activities having lower priorities?
7. When and how often will the monitoring/research takes place? Does this influence the decisions following from questions 3 a-c?

The list above should be used iteratively in combination with the checklist below, to identify if all ecosystem monitoring and research objectives can be met on a single platform.

Step 2: Technical specifications

1. Which equipment (gears, instruments) will be used?
    a. Which facilities are needed to handle the equipment?
        i. cranes
        ii. winches
        iii. dropkeel
        iv. …
    b. What is the maximum vessel speed needed for the survey?
    c. In what depth range is the equipment going to be handled?
    d. Where can the equipment be stored if not used?
    e. Which technical constraints apply to the operation of the equipment?
        i. noise levels
        ii. power
        iii. minimum/maximum speed during operation
        iv. ship's stability
        v. staying on position
        vi. …
    f. How much flexibility is needed:
        i. Which equipment will be used simultaneously?
        ii. How often will equipment switches occur during the survey?
2. What is the geographical survey area?
    a. minimum/maximum depth (→ draft)
    b. oceanic conditions
    c. ice conditions
1. How much room is needed for:
    a. container labs
    b. safe gear handling
    c. storage
    d. helideck

Step 3a: Safety and environmental requirements

1) General
   a) clean ship
   b) emission levels
   c) air circulation/condition
   d) smoking areas
2) Scientist safety
   a) Safety training
      i) before going to sea
      ii) on board drills; where will they take place?
   b) Will samples be carried around?
      i) lifting limits
      ii) lifting support
   c) Which chemicals are going to be used?
      i) How many fume cabinets are needed?
      ii) How many local exhaust vents should be installed?
      iii) Where should the local exhaust vents be installed? (i.e. depending on the nature of the chemicals)
      iv) How much storage capacity for chemicals is needed?
   d) Where will the main working areas be located?
      i) Inside the ship, think about:
         - daylight
         - stability
      ii) On deck, think about:
         - safe gear deployment location
         - visibility
      iii) Which personal protection equipment will be needed?

Should there be storage capacity for personal protection equipment?

Step 3b: Scientific equipment

1) Which equipment is going to be used simultaneously?
2) How often will equipment switches appear during the survey?
3) How much space is needed to store the equipment?
4) Who is responsible for maintenance of the equipment?
5) Where will the maintenance/reparation of the equipment take place? (e.g. workshop)
6) Is registration of underway registration required?
7) Fixed equipment
    i) CUFES
    ii) Sonar
    iii) Receiver for autonomous devices
    iv) Ferry box
    v) Hydroacoustic instruments attached to the ship/dropkeel
    vi) ADCP
8) Deployable equipment
    a) Which deployable instruments will be used?
    b) What do you need to deploy the equipment?
        i) Cranes
        ii) Winches
        iii) …
    c) Equipment connected to the ship
    d) Autonomous equipment:
        i) Which equipment will be used?
        ii) How will the equipment be located?
9) Communication facilities
    a) On-board
        i) Scientist-scientist
        ii) Scientist-crew
    b) Platform to outside
        i) Land (institute)
        ii) Information sources outside the vessel (e.g. satellite images, other platforms)
    c) Internet
    d) Intranet
10) Data
    a) Storage
    b) Backup
    c) UPS (uninterruptible power supply)
    d) Capture
    e) Transmission

Synchronization sea <-> land

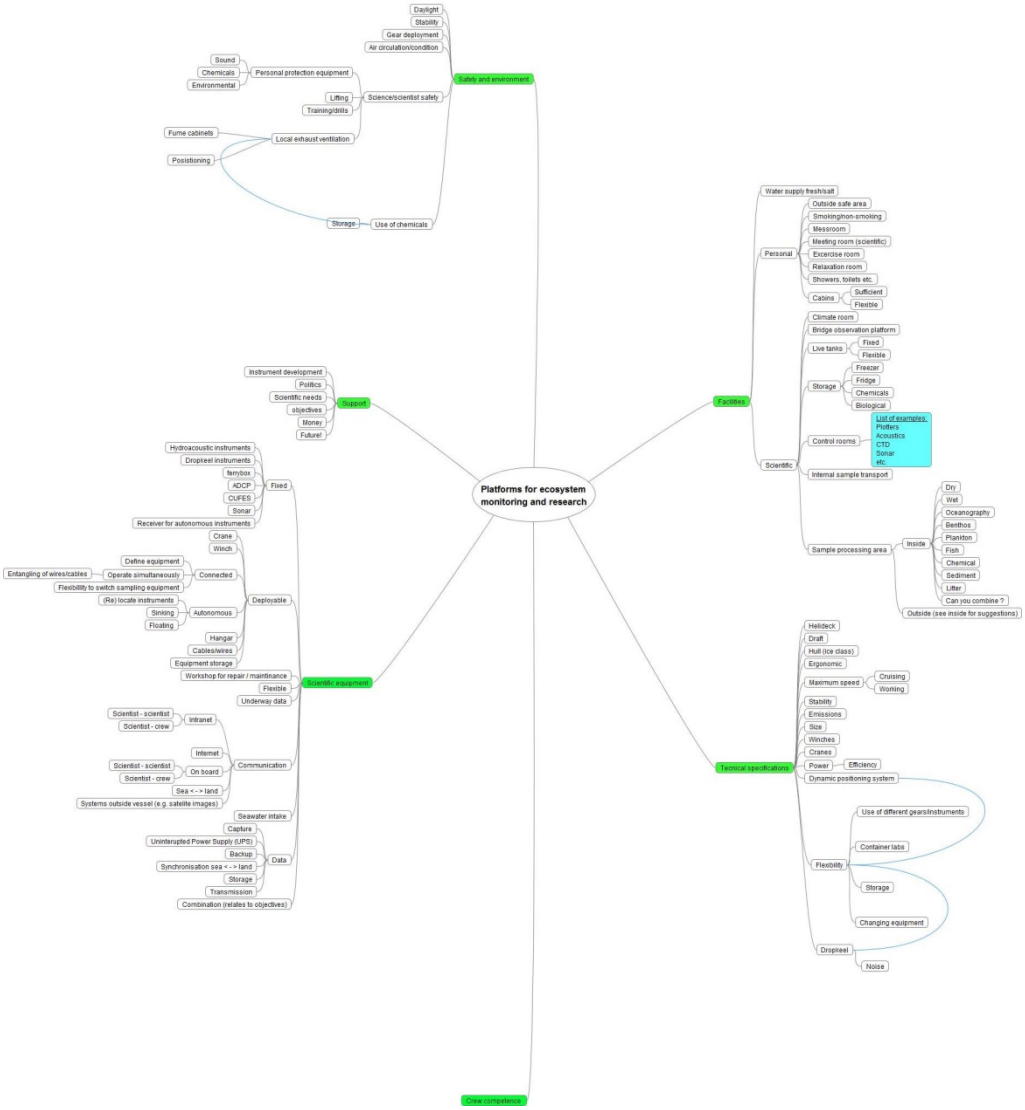
Step 3c: Scientific facilities

1) How will samples reach the location for analysis? Is transporting after collection problematic?
2) Which processing will take place simultaneously?
3) Which processing cannot be combined? (e.g. because of use of chemicals)
4) Where is (fresh/sea)water supply needed?
5) Live tanks:
    a) Size
    b) Design
    c) Flexible or fixed
6) Control rooms:
    a) Where should they be allocated?
    b) How many control rooms?
7) Outside sample processing facilities
    a) Dry processing facilities
        i) Fish
        ii) Benthos
        iii) Sediment
        iv) Plankton
        v) Oceanographic
        vi) Chemical
        vii) Litter
        viii)…
    b) Wet processing facilities
        i) Fish
        ii) Benthos
        iii) Sediment
        iv) Plankton
        v) Oceanographic
        vi) Chemical
        vii) Litter
        viii)…
8) Inside sample processing facilities
    a) Dry processing facilities
        i) Fish
        ii) Benthos
        iii) Sediment
        iv) Plankton
        v) Oceanographic
        vi) Chemical
        vii) Litter
        viii)…
9) Wet processing facilities
        i) Fish
        ii) Benthos
        iii) Sediment
        iv) Plankton
        v) Oceanographic
        vi) Chemical
        vii) Litter
        viii)…

Step 3d: Personal facilities

1) Sleeping
    a) How many scientists will be on board?
    b) Individual cabins vs. shared cabins? Think about:
        i) trip duration
        ii) shift work
        iii) flexibility with respect to number of beds
        iv) male/female scientists
2) Personal hygiene
        i) Showers: personal showers vs. shared
        ii) Toilets
        iii) Lavatories
        iv) Laundry
3) Meeting rooms: think about sharing with crew vs. scientists only
    a) Relaxation: inside and outside
    b) Exercise room
    c) Scientific meeting room
    d) Messroom

6.4. Example of a mindmap about development of platforms suitable for ecosystem monitoring and research



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