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

29 May - 1 June 2018

St. Andrews, Canada

ICES
International Council for the Exploration of the Sea

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Contents

Executive summary

The 2018 meeting was held at the St Andrews Biological Station, Fisheries and Oceans Canada (DFO), St. Andrews, Canada from 29 May-1 June 2018. The meeting was attended by four delegates from four countries and was chaired by Ralf van Hal (the Netherlands). As main activity, the middle two days of the meeting, WGISUR participated and advised in a planning meeting of the US and Canadian survey group. WGISUR was invited to attend this meeting and requested to advice the US/Can group on their plans to combine their groundfish surveys and to develop them into an ecosystem survey.

As introduction WGISUR presented the work done in previous years and gave a presentation on an example of a running Ecosystem Survey in the Bartenz Sea. The US/Can group presented their plans for combining and the reasons for the coordination and aligning the methods of their surveys. The main reasons were economic and efficiency, along with an expansion in the area with a consistent data collection. By making a more efficient survey, they expect to get the possibility to do additional monitoring as part of their fish survey and the requested some guidance on this from WGISUR.

The US/Can group presented a lot of interesting work that they had done related to combining their survey. This was work on gear experiments, comparative fishing and survey design. This work is very relevant to ICES surveys like the IBTS, which are dealing with very similar issues now.

The US/Can group plans on an Ecosystem Survey were still limited, despite a lot of talk about and interest in ecosystem work. For the US survey, it was still not certain if the "spare time" created by the efficiency improvements would be available for additional work or that it would lead to a cut in sea time/budget. This search for support for additional data collection is a reason that the plans for additional work focused on data implementable in current fish stock surveys rather than a broader view on understanding the ecosystem and with that providing knowledge on fish stocks. This focus is understandable especially as the meeting participant were mostly stock assessments and survey experts. The concepts of the Ecosystem in the Barentz Sea and how support for such an approach had developed and how the Ecosystem survey results are used in various assessments and project has been a large part of the advice provided by WGISUR to US/Can process.

Besides that a large number of smaller topics has been discussed in the meeting, among which the development of acoustic surveys, equipment in use, survey design, data storage and further cooperation with ICES.

1 Administrative details

Working Group name

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

Year of Appointment within the current cycle

2018

Reporting year within the current cycle (1, 2 or 3)

1

Chair(s)

Ralf van Hal, Netherlands

Meeting venue

St Andrews, Canada

Meeting dates

29 May–1 June 2018

2 Terms of Reference

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2018	29 May-1 June	Saint Andrews, New Brunswick	Interim report by 13 July to ACOM-SCICOM	2 days meeting of core group only, 2 days meeting to evaluate Canada/USA ecosystem survey plans
Year 2019	June	Bremerhaven, Germany	Interim report by 17-21/6 or 24-28/6 to ACOM-SCICOM	2 days meeting of core group only, 2 days working on how to organize integrated monitoring in the North Sea
Year 2020	TBD	TBD	Final report by Date Month to ACOM-SCICOM	2 days meeting of core group only, 2 days working on evaluation of Norwegian Sea ecosystem monitoring in relation to IEA and survey results.

ToR descriptors

ToR	Description	Background	Implementation plan topics addressed	Duration	Expected Deliverables
a	Provide guidance on the development of ecosystem monitoring surveys and/or 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).	20, 25, 26, 27, 28	3 (focus in year 1)	after Year 3 a CRR on evaluation, use and improvement of ecosystem monitoring plans, surveys and/or programmes following up on the 2017 CRR
b	Provide guidance and advice on the shift from surveys to 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), and stronger links to IEA groups.	20, 25, 26	3 (focus in year 2)	after year 3 a CRR on evaluation, use and improvement of ecosystem monitoring plans, surveys and/or programmes following up on the 2017 CRR

c	Evaluation of ecosystem monitoring surveys and/or 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).	20, 25, 30, 31	3 (focus in year 3)	after year 3 a CRR on evaluation, use and improvement of ecosystem monitoring plans, surveys and/or programmes following up on the 2017 CRR
d	Provide an opportunity for exchange of experiences on development and evaluation of ecosystem monitoring		26, 28, 30	3 (ongoing)	CRR

3 Summary of Work plan

Year 1	Review and provide guidance on the plans for the integrated USA/Canada ecosystem survey
Year 2	How to organize integrated monitoring in the North Sea (e.g. how to make use of the different surveys in the area and how to organize regional collaboration)
Year 3	Evaluation of Norwegian Sea ecosystem monitoring; prepare final output in CRR format

4 List of outcomes and achievements of the WG in this delivery period

- Participation of WGISUR in a planning meeting of the US and Canadian survey group.
- Presentation by WGISUR in the meeting on conceptual ideas developed by the group over the last years on how to organize, coordinate and manage an Ecosystem Survey.
- Presentation by WGISUR in the meeting on an ongoing ecosystem survey in the Bartenz Sea, focusing on the lessons learned in that survey.
- Provided guidance and advice to the US/Canada process on their plans in development for coordinating their survey and extending in to include ecosystem topics.
- Provided advice to the US/Canada process on developing ecosystem thinking and with that considering the fisheries survey as a potential ecosystem survey, not only seeing it as platform to add a random number of monitoring topics related to other ecosystem aspects than fish.

5 Progress report on ToRs and workplan

We dealt with "Review and provide guidance on the plans for the integrated US/Canada ecosystem survey". With this activity we worked on the ToR's a,b, and d. ToR c evaluation of ecosystem surveys was not dealt with this year. The meeting with the US/Can delegations was a successful opportunity for exchange of experiences on development and evaluation of ecosystem monitoring.

The overall approach to developing a coordinated survey and moving towards an Ecosystem Survey is being approached by the two nations. Canadian and US Scientists recognize the strength of standardizing and coordinating their efforts to better monitor the combined survey area and develop an Ecosystem Survey.

The bigger picture on developing ecosystem surveys was discussed during the two day sessions, but it also provided the opportunity to discuss smaller topics. In the following sections, a number of those discussions are described.

Support for developing an ecosystem survey

The presentations given by the US and Canadian participants indicated that the main reasons for the coordination between the US and Canada and aligning the methods of their surveys were economic or efficiency reasons, along with an expansion in the area with a consistent data collection. The combined surveys will cover a geographic range of 20o of latitude along the Atlantic coast of North America, allowing researchers to work with a consistent dataset extending from Cape Hatteras to Cape Breton. The presented benefits for cooperation were:

1. Currently a large geographic overlap, which can be reduced to make both surveys more efficient while simultaneously increasing the spatial extent of coordinated data collection and the range over which analyses can be conducted;
2. Both countries have had difficulties completing their total survey coverage in recent years;
3. A reduction in coverage outside National waters; staying closer to the home harbours in case of technical failures and reducing the steaming to a port in their respective countries for crew changes;
4. In case of large technical failures having both surveys operating similarly might provide a back-up plan.

The fifth reason was that the time saved through cooperation would provide the opportunity to collect additional (ecosystem) data. Concern was expressed, particularly by American biologists, that this perceived benefit may not be realized since a reduction in the area covered could for them lead to a reduction in sea time, rather than time for collecting additional data. This is something that WGISUR has observed more often and is a real risk. The scientists are considering more efficient use of the time at sea in order to collect additional data, while at a managerial level this is perceived as a possibility to save money. As a result, the additional data are not collected and in years with bad weather, it becomes even more difficult to collect all the required fish data. Actually creating a risk for the continuation of the time-series.

The presentations did not give an impression that there is a clear consensus, or management directive, to move to an integrated ecosystem monitoring approach to surveys. Everyone in the meeting said there is a lot of talk on the ecosystem approach and there is definitely a lot of interest in additional ecosystem data to be collected by the fish survey. This is very similar to the European situation. However, when it comes to

decisions or investments to get it actually operational there seems to be resistance or at least a lot less support.

This lack of support is a serious threat for establishing an ecosystem survey (or a fish survey collecting data for an ecosystem approach). A similar support issue was discussed by WGISUR last year (ICES, 2017). Last year's recommendation was to clarify how end-users, specifically management end-users, of the ecosystem data could use the information of the integrated ecosystem surveys. Thus, WGISUR advises to include the end-users in the discussions on how these surveys could collect additional ecosystem information and especially in the discussions on which additional data will be collected and get their support for the additional data collection. This means involving managers and persons involved in ecosystem advice. It also means involving experts on other fields than fish (surveys). The current meeting was dominated by experts on stock assessments and surveys, with one Oceanographer and one ecosystem modeller. While many fisheries biologists are framing their assessments in an ecosystem context, involving more experts from other fields is likely to increase the necessary support for expanding survey objectives. When a multidisciplinary team state together that the data that will be collected will be useful for their research and will be useful for the ecosystem approach, it will create broader support than the same message from a narrower disciplinary group. In the European situation some fish surveys collect or have collected additional data, which might have been relevant to other research fields, but because the other research fields were not involved they distrust the data collection (not done by "real" experts) and are unwilling to support it. While bringing the different expertise together might lead to interesting cooperation and interesting ideas for the collection of the data (Shepherd et al. 2016).

The current limited support for redesigning the survey for a new and broader set of objectives resulted in discussions on what might theoretically be collected additionally. This was similar to the discussions that have taken place in WGISUR in past years. WGISUR has developed overviews of data collection options and associated costs for additional data collection. This can lead to disjointed augmentation of data collection rather than collecting data from an ecosystem perspective (the whole foodweb, or abiotic data affecting the fish). As wish lists tend to result in support by only a small number of persons and to discussions on prioritizing, (my idea is more important than yours), it is advised to combine these wish lists and develop a plan that links the wishes conceptually providing integrated ecosystem data. The links might also show that collecting various combinations of data results in more knowledge than collecting the same data separately. The exercise might lead to a clearer decision framework, making the decision on which activities will be done more transparent and building support for the initiatives.

An understanding that the survey is one unit, and not single parts executed at the same platform, irrespective of different scientific fields and programs, is imperative to organisation at all levels related to all aspects of the survey, including the funding organizations and institutional leaders. Organization and cooperation at all levels are important, also internationally when needed (as in a joint survey as the US/Canada ecosystem survey discussed here). The survey should be organized by a team of people with the relevant expertise on the different ecosystem components monitored. This team should have complementary responsibility for the different tasks during planning, execution, and reporting of the survey.

This unity should also be reflected in data storage, reporting, and other data products. Integrated analyses and data products are particularly valuable. Over time the build-up of parallel time-series of data from different components will enable studies and

projects to focus on processes. If done properly, over time the survey will be an economical asset and attract more funding for both the execution of the survey and research on the results.

It is also important to disseminate and present the survey and the results in as many channels as possible, increase the interest and support for the survey.

Survey design

One of the most valuable properties of ecosystem surveys is: parallel observations, i.e. corresponding in space and time, of the state of ecosystem components at the proper spatial and temporal scale (i.e. related to the components you observe and the processes they are involved in). In the long run this allows inference about and monitoring of, ecosystem processes.

As a first principle, the survey should cover the geographic extent of the ecosystem, which is to be monitored. It should also cover a specific time period optimal for monitoring the components and processes in focus.

When the area of interest is defined, there are several options for the survey design. Some examples are spatially stratified random, spatially stratified regular and regular grid.

The purpose of stratification is to homogenize the statistical population within the strata. Then sampling effort can be adjusted within each stratum according to the expected variance. One consequence of this is that the variance of an estimate for the whole survey area is stabilized and that the precision of that estimates increases. The challenge with spatial stratification in an ecosystem survey is to find a strata system that suits all the components you wish to monitor. This challenge also allies to single species surveys if the geographical distribution of the monitored component changes over time. Also, in a random stratification design, the allocation of stations may end up making coverage of the whole survey area inefficient and differing between years. It may also hamper effective sampling of continuous observations, as the vessel track lines become irregular, instead of representing transects.

A regular grid makes a consistent (annually) systematic coverage of the survey area easier. It is a compromise suited for parallel observations of different components, but you might lose some precision of estimates of single components. In such a design it is easy to implement transect sampling. It is important to ensure synoptic coverage in time, i.e. that stations close to each other in space are not sampled at very different time. A systematic succession of the survey along geographical or other gradients is also easy to implement if needed. This design also facilitates other methods to analyse the data, such as GAM or spatial statistics.

It can be combined with stratification (stratified regular design) to allow varying effort between strata and facilitate reporting of results by subsystems or areas. This might also facilitate systematic planning of the survey coverage, different allocation of effort, and systematic and planned reduction of survey area or effort in case of obstacles due to technical problems, weather etc.

Another option is to stratify parts of the survey area for specific purposes, e.g. acoustic coverage of capelin in the Barents Sea with transects in a predetermined stratum. Depth stratification in areas with heterogeneous bathymetry can also be implemented.

Combination of trawl and acoustic monitoring in the survey design

A lesson learned from the discussions about the joint CAN-USA ecosystem survey is that the combination of acoustic monitoring and trawl monitoring needs special considerations. In the case of a random stratified design (as currently implemented in this survey) it is important to ensure that sample units of sufficient size are taken (e.g. a lower limit of the length of consistently sailed nautical miles). One solutions to this includes ensuring acoustic coverage of a minimum distance in the same direction before and after the trawl station and treat both sections as one primary sampling unit. Another would be to cross the station with acoustic sampling and return to take the trawl sample. In such a design, spatial autocorrelation between sampling units needs special attention, to obtain proper variance estimates.

A regular stratified design would allow setting up transects for acoustic monitoring while simultaneously taking the trawl samples. In such a design, it is possible to establish strata covering parts of the survey area, which are then covered systematically, ensuring high precision of the estimates.

For acoustic abundance estimation of pelagic or midwater fish and macrozooplankton, regular sampling with pelagic/midwater trawl is an absolute requirement to obtain biological samples to allocate the acoustic scatters to species and size/age groups.

Canada/ US Ecosystem Survey Fisheries Acoustics

As part of developing an Ecosystem Survey, Canadian Scientists have begun exploring using acoustics to develop a Pollock (Saithe) Biomass. Pollock are good candidates for an acoustic survey and the work being done is being approached in a careful and methodical way. We advise ground trothing of Pollock be conducted by a midwater trawl rather than relying on bottom trawl catch data as fish caught in the bottom trawl may not fully represent the population being measured acoustically. Bottom trawls may not be fully sampling the more pelagic schooling Pollock. Some unknown proportion of the fish caught in the bottom trawl are not seen acoustically due to the bottom acoustic dead zone and offsets used to prevent bottom return intrusion in to the acoustic biomass estimates. The Pollock population may be uniform enough that this method is sufficient but it would be nice to prove that with some midwater trawls. That being said we think this is important and useful data being collected to expand the knowledge of the Ecosystem and Pollock and it should be supported and continued. We recommend considering Geostatistics so that more of the transects run for the bottom trawl survey could be used and provide a stronger biomass estimate. This is an interesting project and great progress has been made with few resources. This is a prime example of using existing surveys to develop a new survey for additional species. This work is moving towards developing a true Ecosystem Survey.

Acoustics could be used to make some observations of habitat, especially bottom typing, or mapping using multibeam sonars, and defining areas that may be untrawlable but potentially important to fish stocks.

To help with coordinating your acoustic survey efforts we recommended the Fisheries Engineering and Acoustic Technologies (FEAT) Team at the NWFSC as a strong group that could provide advice and guidance. Collaboration between NWFSC FEAT and East Coast scientists from DFO and NOAA would strengthen survey on both coasts. Additionally, looking at the Pacific Hake International Treaty Management Process, which involves NOAA. DFO, Industry, NGOs and outside experts to manage Pacific Hake. Some of what was developed and agreed to may be useful for the East Coast Canada/US Fisheries Management and Survey efforts.

Data and output

For a joint survey, it is important to store data so that it is easily available to all contributors and potential user groups. It is also important that reports and data products reflect that the survey is a unit, irrespective of different countries, programs, and subjects. Furthermore, it is important to disseminate and present the survey results in as many channels as possible. This will over time increase the interest and good reputation of the survey. Integrated analyses and data products are particularly valuable, as is dissemination of results in a web-based forum, to increase the reach of the summary analyses.

6 Revisions to the work plan and justification

The plan for the first year was successful and as it currently looks we will be able to organize a North Sea meeting in 2019 and a meeting on the evaluation of the Norwegian Sea ecosystem survey in 2020.

The Working Group should consider a global approach to Ecosystem Surveys, with all members participating even if the area being reviewed is not part of their own usual survey efforts. The process, questions and concerns raised are common to us all and the power of the Working Group is developing solutions together for the community as a whole.

7 Next meetings

Year 2 (2019): 2 days meeting of core group only, 2 days working on how to organize integrated monitoring in the North Sea. The two days on the North Sea survey can best be combined with WKNSIMP chaired by Kai Wieland. Discussion about this are ongoing about synchronization of the agenda, venue and date.

Annex 1: List of participants

List of participants WGISUR

Name	Institute	Country (of institute)	E-mail
Ralf van Hal	Wageningen Marine Research	The Netherlands	Ralf.vanhal@wur.nl
Donald Clark	Fisheries and Oceans Canada St. Andrews	Canada	clarkd@dfo-mpo.gc.ca
Geir Odd Johansen	Institute of Marine Research Nordnes	Norway	geir.odd.johansen@imr.no
Lawrence Hufnagle		USA	lawrence.c.hufnagle@noaa.gov

List of participants US/CAN workshop

Name	Institute	Country (of institute)	E-mail
Irene Andrushenko	St Andrews Biological Station, DFO	Canada	
Melanie Barrett	St Andrews Biological Station, DFO	Canada	
Kirsten Clark	St Andrews Biological Station, DFO	Canada	
Adam Cook	Bedford Institute, DFO	Canada	
Allan Debertin	St Andrews Biological Station, DFO	Canada	
Jamie Emberley	St Andrews Biological Station, DFO	Canada	
Monica Finley	St Andrews Biological Station, DFO	Canada	
Catherine Johnson	Bedford Institute, DFO	Canada	
Ryan Martin	St Andrews Biological Station, DFO	Canada	
Quinn McCurdy	St Andrews Biological Station, DFO	Canada	
Philip Politis	NEFSC, NOAA	USA	
Gregor Reid	St Andrews Biological Station, DFO	Canada	
Catriona Regnier-McKellar	St Andrews Biological Station, DFO	Canada	

Annex 2: Recommendations

Recommendation	Adressed to
1. The US/Canadian process of combining the two surveys and developing them into one ecosystem survey required and will require work which might be of relevance for the work planned by the IBTSWG and WGISDAA on the survey design of the IBTS survey(s): - US/Can is working on analyses to show the impact of changes in their survey design on the outputs of the stock assessments. - The Canadians have planned a large effort in comparative fishing related to changing their gear design, and are assessing the impact of changing the gear on the stock assessments. It is recommended that WGISDAA and IBTSWG assess the work done by the US/Can process, as it is likely relevant to their own planned work. If relevant, it might be worth working together on these similar issues.	WGISDAA, IBTSWG
3. The US survey and the Canadian lobster survey are using, and the Canadian groundfish survey will be using the same new gear. The consideration for the choice for this particular gear might be of relevance for the ongoing discussion in the IBTSWG for changing the currently used GOV to a more consistent one. As the similarities between the surveys are large (similar target species, comparable sediments), it is recommended that the IBTSWG reviews these considerations and considers the gear chosen by the US/Canadians as an option for the IBTS.	IBTSWG
4. The US/Canadian survey programs are discussing options for storing and providing access to their trawl survey data. This is the same type of data as is stored in DATRAS, and it would be worthwhile considering DATRAS for the storage of these data. In the near future ecosytem data will be available from these surveys, which could be stored in other databases such as DOME.	ICES data center
5. The US/Canadian surveys are moving from being two national surveys to a coordinated international ecosystem survey. The groups involved in this coordination have asked for support from ICES. As the surveys are very similar to the IBTS, it is recommend to invite US/Canadian participants to the IBTSWG and consider incorporating their surveys in the IBTSWG.	IBTSWG
6. Recommend that relevant ICES expert groups review plans for data collection and coordination of US/Canadian surveys in NW Atlantic, and give advice on survey design, and data requirements for ecosystem monitoring and modelling.	WGNARS, WGIPS, WGINOR, WGZE

Annex 3: US/Canadian cooperation

Canada and the US are in the process of moving from two separate ecosystem surveys partially overlapping in space to a joint survey, commencing in spring 2020.

The approach which is being proposed is to move towards an integrated ecosystem monitoring program by augmenting existing sampling, rather than designing a new monitoring program. The initial objective is to coordinate the surveys of the two countries, resulting in broader geographic coverage than either survey has on its own. This will provide some time savings by reducing spatial overlap, creating opportunities for expanding the range of data collection modalities undertaken. In addition, since the suite of biological data collected on these surveys is not identical, a broader range of integrated ecosystem monitoring data will be available if the surveys are coordinated. Once a coordinated survey can be put in place, the opportunity will be there to further diverge in data collection in some areas, broadening the range of data collected.

Canada has a survey which covers Georges Bank and areas farther east in March and the US has a separate survey which covers Georges Bank and farther west in April. The surveys are very similar. Data collected by these surveys are used combined in a number of fish and invertebrate stock assessments and in Oceanographic modelling; however, limited joined coordination is in place.

At its origin, the Canadian survey was designed based on the US survey. Both surveys employ a stratified random sampling design, with bottom trawling and oceanographic sampling conducted at each station. When the Canadian surveys started, the same trawl was used as the US used at that time. The US has changed their trawl since then; however, the similarity in general design means no large-scale changes are required to allow for join coordination.

Canada is getting a new research vessel which is expected in 2019. Comparative fishing is planned between the existing vessel and its replacement, so this provides an opportunity to switch trawl to what the US is now using. To allow the data to be used seamlessly, the intention is that the two surveys will move to identical stratification. This will mean the data from the two surveys can be combined as a single index, which will provide data from Cape Hatteras to Cape Breton, a range of 20o in longitude.

This coordination was first proposed in 2007 at a Canada US Joint Science Workshop. Progress stalled, primarily because the Canadian vessel replacement was put on hold but with the vessels now under construction, the opportunity to conduct comparative fishing and move to a joint survey is again available. It has primarily been a bottom–up process; the scientists involved in these surveys believed that cooperation might lead to the collection of more precise and scientifically robust data, while the greater geographic coverage would help in monitoring changes in species distribution. Senior management have given their support for the project and recognize that some additional planning will be required on an ongoing basis to maintain the coordination and data sharing arrangements.

With the support of both countries, a number of meetings have taken place, discussing this cooperation. Currently, it was at a stage where a meeting could be organized to solidify the plans for stratification and general spatial coverage and summarize the general objectives for trawl catch sampling and for acceptable tow diagnostics. These benefitted from review but are details which are straightforward to determine.

This meeting was also a forum for discussing how to address broader ecosystem sampling/monitoring objectives in the available time at sea and how to manage the international coordination and data sharing. These were the aspects of the US/Can meeting where the input of the ICES WGISUR was expected to be most helpful. Along with the working group's defined goal of Integrating Surveys for the Ecosystem approach, WGISUR members have a wealth of experience in coordinating joint surveys and managing shared data and can advise on protocols to establish and pitfalls to avoid in this process.