

Missing surveys and catch data for Covid-19 disruption – some recommended methods and reporting requirements.

This document contains two pieces of information for working groups that encounter issues caused by missing data as a result of the Covid-19 disruption:

1. Proposed approaches to provide ICES advice in the absence of 2020 data in one or more survey abundance series.
2. Template for reporting deviations from stock annex caused by missing information from Covid-19 disruption

1. Proposed approaches to provide ICES advice in the absence of 2020 data in one or more survey abundance series.

With the occurrence of COVID-19 in 2020, a number of scientific surveys for use in ICES stock assessments have been disrupted. In most ICES assessments, this disruption of the surveys in 2020 will only impact in the assessments to be conducted in 2021. However, there are a number of assessments that actually make use of surveys conducted in-year (a 2020 assessment makes use of a survey conducted earlier in 2020).

In cases where a survey used in a stock assessment has not been conducted, it becomes impossible to conform exactly to the methods described in the stock annex to conduct the assessment. In extreme cases, the assessment simply cannot be updated. The following describes some generic guidance for providing advice in these cases in 2020. In all cases where the stock annex was not followed, this should be adequately documented in the expert group report.

Category 1 and 2 stocks

1) All survey indices missing:

When all survey indices are missing for the most recent years, an update of the assessment is not possible. In these cases, advice could be provided by using the results of the previous assessment (e.g. using the results of the 2019 assessment) and making a two-year projection. For the first of the interim years (2019), the actual catch-at-age from the 2019 fishery would be used to calculate the 2020 interim year beginning of the year numbers.

2) Incomplete index because one or more surveys are missing.

In many cases, a number of surveys are combined to derive an index of abundance for use in a category 1 assessment. In such cases, it may be possible to ‘fill-in’ the index for the year where one of the survey is missing through a model-based approach. One such approach recently developed is the vector autoregressive spatio-temporal (VAST; Thorson 2019) model that can be implemented using the publicly available VAST (www.github.com/james-thorson/VAST) package. This was used in the case of Black-bellied anglerfish in Subarea 7 and divisions 8.a–b and 8.d (ank.27.78abd). Other models such as generalized linear models (GLMs) have also been used as a method of imputation for missing strata in surveys but they require some assumptions on the distribution of catches (see Rago 2005)

3) No survey for the most recent year of an index but other indices available.

In these cases, the index can still be used in the assessment providing that the model can deal with missing values for an index. It should be noted that this could be problematic if the missing value is used to provide an estimate of recruitment.

Alternatively, the index with missing data for 2020 could be left out of the model. This should only be done after a comparison showing that leaving the survey out produces results that are comparable with an analysis that uses all surveys. Comparisons between the previous assessment conducted with all indices and a similar assessment but without the index that is missing data in 2020 would be instructive in that regard.

Category 3 and 4

1) All survey indices missing:

If the advice is biennial and uses the current year survey (note that most advice in cat 3-4 would not be using the 2020 surveys), updated advice could be provided using the most recent data (in 2020, this would be using the survey index up to 2019). This would mean updating the advice on the basis of one additional point only instead of two.

If the advice is annual and uses the current year survey, then there is no additional information. In these cases if the advice was due, to consider the PA buffer (done every 3 years) then advice could be given by applying the PA buffer. If the PA buffer was not to be considered then advice would remain unchanged but the advice sheet should indicate that the survey information was not available.

2) One or more surveys missing in the calculation of a combined index.

Normally, the individual indices would first be normalized to a common period then would be averaged to produce a combined index. In the case of one or more surveys missing in this index in a particular year, the average is calculated over the available surveys. This approach has been used previously when a survey that was part of a combined index was not available.

References:

- Thorson, J. T. 2019 Guidance for decisions using the Vector Autoregressive Spatio-Temporal (VAST) package in stock, ecosystem, habitat and climate assessments. *Fisheries Research* 210:143-161
DOI: 10.1016/j.fishres.2018.10.013
- Rago, P. 2005. Fishery independent sampling: survey techniques and data analyses *In* Musick, J.A.; Bonfil, R. (eds) *Management techniques for elasmobranch fisheries*. FAO Fisheries Technical Paper. No. 474. Rome, FAO. 2005. 251p. (<http://www.fao.org/3/a0212e/A0212E16.htm#ch12>)

2. Template for reporting deviations from stock annex caused by missing information from Covid-19 disruption.

1. Stock:
2. Missing or deteriorated survey data:
(Also indicate also the reliance of the assessment on this data i.e. which other survey data was available)
3. Missing or deteriorated catch data:
(Indicate proportion of total catch reported/sampled, by metier if appropriate)
4. Missing or deteriorated commercial *LPUE/CPUE* data: (where commercial *LPUE/CPUE* are used in the assessment indicate the impact of the disruption on these data)
5. Missing or deteriorated biological data: (e.g. maturity data)
6. Brief description of methods explored to remedy the challenge:
7. Suggested solution to the challenge, including reason for this selecting this solution: (clearly document changes from the normal procedures in the stock annex)
8. Was there an evaluation of the loss of certainty caused by the solution that was carried out?
(Please describe)