

**7<sup>th</sup> Meeting of the Data Quality Working Group (DQWG)**  
**University of New Brunswick, Fredericton, NB, Canada, 16-18 July 2013**

Discussion paper for 7<sup>th</sup> meeting of IHO-DQWG:

**The effect of cartographic generalization on data quality portrayal**

submitted by Leendert Dorst (NLHO), 7 June 2013

Comments (in red colour) from Jeff WOOTTON, Australian Hydrographic Service

The data quality indicators that DQWG develops for S-101 should not include the uncertainty of generalizations to a smaller scale, as the largest scale chart should be used during the execution of a voyage. **Agree**. Smaller scale charts are intended to be used to plan a voyage. This makes the generalization process of the small scale chart irrelevant.

One could take this idea one step further, by claiming that the cartographic generalization should not be included in the indicator at all. The depicted quality should be the quality of the data<sup>1</sup>, the generalization process only serves to make the data depiction more functional for the navigator. (A minimum depth of X meter still has the same uncertainty if it is moved for optimal visibility. **This is not done (for soundings). Even though there are methods of indicating a sounding out of position on a paper chart, there is a statement in S-57 for ENC that soundings must not be depicted out of position. In terms of depth contours, these are an interpolation of the source regardless of the scale, and any risk in terms of generalization is catered for in the specifications for depiction of contours (i.e. shoal biased)) This way, the indicator becomes a description of a physical maritime area, which is not necessarily a charted maritime area: the indicator could be assigned to a surveyed area that is not visible in any chart.**

The aspect of scale/generalization should be discussed in detail by DQWG. If DQWG does not provide guidelines about this, there could be a similar issue as with temporal degradation for CATZOC: a lack of consistency between HOs, leading to reduced trust in the quality indicators.

There are three options:

1. the effect of generalization to any scale should be included in data quality indicators;
2. the effect of generalization to the largest-scale chart of the area should be included in data quality indicators;
3. the effect of generalization should not be included in data quality indicators. **This is my preferred option – see below.**

Ravi Peters of Delft University of Technology (NL) gives a well-formulated view, partly based on the view of the authors of a cartography book. I have included the relevant text as an appendix.

The DQWG is invited to discuss this topic, to select the most appropriate option, and to promote this option for use in future nautical charting.

**As stated in para 2 above, the depicted quality should be the quality of the data, the generalization process only serves to make the data depiction more functional for the navigator. There are fairly rigorous rules in terms presentation of, and subsequent generalizing through scales, of source data. IHO S-4 clauses B-403 – Generalization, clause B-410 – Representation of Depth – General, clause B-411 – Depth Contours and Shallow Water Tint, and B-412 – Soundings. The general nautical cartography principle is to compile and generalize in terms of providing the safest picture (i.e. "shoal biased"), while providing**

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<sup>1</sup> Following the outcome of the CATZOC-discussion of agenda item 5a of the 4th meeting, this quality of data includes digitization errors, errors due to continuous changes in the seabed, datum transformation errors, and effects of events.

the mariner with the best "picture" of the topography of the seafloor within the scope of the scale of the chart.

The mariner, when evaluating the quality of the data depicted on a nautical chart in terms of where they should or should not go; or what additional precautions they should take into account in terms of confidence, under-keel clearance and visual navigation, wants to know the characteristics of the source data used to provide them with the representation that the nautical cartographer has provided. Therefore, they would like to know:

- The accuracy of the data depicted (in terms of the vertical and horizontal); and
- An indication as to the possibility of seafloor features not being identified.

In terms of the depiction, this is a function of the expertise and quality control and assurance processes in the nautical cartographic process of the producing authority. The role of the nautical cartographer is based on a rigorous process and set of international and national Standards, and is aimed at representing the available source data as faithfully as possible. The process and Specifications are designed to negate (and where necessary err on the side of safety) as much as possible any impact on the final representation of the source data on a product for the mariner. Therefore any adjustment of a quality indicator to incorporate a function of the nautical cartography process should not be considered in terms of what the mariner needs to know – this quality should already be assured through the expertise of the nautical cartographer and the quality control/assurance processes of the producing authority.

**Appendix:** quote from MSc thesis Ravi Peters, "A Voronoi- and surface-based approach for the automatic generation of depth-contours for hydrographic charts". Delft University of Technology, December 2012, page 88:

The question remains on how (...) information on uncertainty is used and affected by the hydrographer that draws the hydrographic chart; the process of generalization. To my best knowledge the IHO does not state anything on this, other than referring to hydrographic practices such as mentioning the geographic extent, quality description (using so-called Zone Of Confidence (ZOC)) and datedness of the surveys that were used to draw the map (sometimes that is also done for individual navigation-critical features). Still, the process of generalization (...) inevitably causes displacements in boundaries of map features. Does that affect the error in the modeled surface? Kimerling and Muehrcke (2009) argue that saying that positional displacement caused by cartographic generalization is error, misses the whole point of generalization, i.e. to perform meaningful alterations of feature geometry to improve the overall legibility and usefulness of the map. Hydrographic chart products (...) also state in capital letters "Always use the largest scale chart appropriate". Evidently, less generalization is applied to large scale charts, these are thus closer to reality, than to smaller scale charts, which primarily serve to provide a more simplified and clutterless overview of a large area.

This document is available at:

[http://www.gdmc.nl/publications/2012/Automatic\\_generation\\_depth-contours.pdf](http://www.gdmc.nl/publications/2012/Automatic_generation_depth-contours.pdf).

The details of the reference are:

A. J. Kimerling and P. Muehrcke, "Map use: reading and analysis". ESRI Press Academic, 2009. (Does anyone have a copy of this book?)