



**International Hydrographic Organisation
Baltic Sea Hydrographic Commission**

**The Baltic Sea Harmonisation Working Group
(BSEHWG)**

Final report
[1 September 2008]



Resume

At the 12th conference of the Baltic Sea Hydrographic Commission (BSHC) in June 2007, the need for a study of the level of harmonisation of the Baltic Sea Electronic Navigational Charts (ENCs) was recognised. This is considered critical for safe navigation and to ensure that the ENCs are used as widely as possible when sailing in the Baltic Sea. Therefore the Baltic Sea ENC Harmonisation Working Group (BSEHWG) was established with the main purpose of identifying and analysing existing inconsistencies in Baltic Sea ENCs and proposing solutions to avoid inconsistencies.

The work has resulted in a number of recommendations. Following are the recommendations related to production of ENCs and recommendations related to the future work with implementation of harmonised ENCs.

Recommendation 1: Navigational purpose *Overview*

- 1a) *Overview* navigational purpose should be in harmony with other navigational purposes within the producers' portfolios.
- 1b) The *Overview* cell should be harmonised with adjacent cells in the North Sea.

Recommendation 2: Navigational purpose *Harbour and Berthing*

The *Harbour* and *Berthing* navigational purposes should be in harmony with other navigational purposes within the producers' portfolios.

Recommendation 3: Use of Compilation Scale

On the Baltic Sea, the following values for the compilation scales should be used:

180,000	(<i>General</i>)
90,000	(<i>Coastal</i>)
22,000	(<i>Approach</i>)

Recommendation 4: Exceptions in the use of Compilation Scale

If a Hydrographic Office (HO) wants to use a compilation scale other than those recommended above, it may do so if all the following conditions are met:

- i) the value used is in line with the intention of the IHO CL 47/2004
- ii) use of it is agreed bilaterally with neighbouring HO(s) concerned, in order to avoid inconsistencies at the border, and
- iii) every effort is made to minimise possible inconsistencies due to deviations from the recommended compilation scale.

Recommendation 5: Use of SCAMIN

BSHC should adopt the guidelines as stated in the Annex J.

Recommendation 6: Contour intervals

- 6a) The BSEHWG proposes that the BSHC establishes a Working Group to study possibilities for Harmonisation of the Conveying and Presentation of Depth Information for both ENC's and paper charts.
- 6b) Meanwhile, if the IHO recommended contour intervals are not applicable, or if additional intervals are needed, implementation should be agreed bilaterally/multilaterally so that possible inconsistencies to the mariners could be avoided.

Recommendation 7: Harmonisation of features continuing/extending over national borders

All BSHC countries should ensure that bilateral agreements are in place with their neighbouring countries concerning harmonisation of features continuing/extending over national borders.

Recommendation 8: Checking harmonisation before launching new ENC's

All BSHC countries should check and carry out harmonisation before launching updates or new editions of ENC's.

Recommendation 9: Buffer zones along the national borders

All BSHC countries should check that there are no gaps between cells at national borders by establishing a buffer zone of up to 5 metres, if necessary.

Recommendation 10: Adoption of new versions of ENC related standards

The BSHC should agree on joint plans and time schedules for the adoption of new versions of ENC related standards (e.g. S-57 Ed. 3.1.1 or S-101).

Recommendation 11: Adoption of new object classes

The BSHC should agree on joint plans and a time schedule for the adoption of new object classes on their products.

Recommendation 12: The use of objects to ensure consistency

12a) BSHC should encourage all countries to make further studies of the use of objects in the Baltic Sea ENC's and report to the following BSHC meeting.

12b) BSHC should decide on proper actions to ensure ENC consistency as far as possible.

Recommendation: 13: Special circumstances

If found necessary it is possible to deviate from the recommendations. When doing so, the relevant HO should make every effort to minimise the effect of any inconsistencies that may occur. This should be done through bilateral/multilateral agreements and through harmonisation of data in order to ensure that no serious disharmony is introduced to the ENC's.

Recommendation 14: Promotion of regional approaches

BSHC should ask the IHO Committee on Hydrographic Requirements for Information Systems (CHRIS) to consider appropriate actions to recommend other Regional Hydrographic Commissions (RHCs) to adopt regional implementations to IHO consistency recommendations within their sea areas.

Recommendation 15: Training and education

All relevant bodies are encouraged to continue the education of mariners regarding '*ECDIS*', '*ECS*', '*ENC*' and '*Electronic chart*'.

Recommendation 16: Follow-up of implementation

All BSHC countries should follow the time schedule for the implementation of all relevant recommendations as stated in Annex L.

Recommendation 17: Reporting of the implementation of the recommendations

BSHC members should report annually to BSHC Conferences on the implementation of these recommendations.

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1. The BSEHWG

1.1 Background

At the 12th BSHC Conference in June 2007, the need for a study of the level of harmonisation of the ENC's in the Baltic Sea region was recognised. The study should support ENC consistency and a common level of IHO data quality. This work is considered critical to making ECDIS more user-friendly, expanding the use of ENC's and ECDIS and increasing the safety of navigation on the Baltic Sea.

Therefore the BSHC established the BSEHWG with a task to identify and analyse existing inconsistencies within ENC's in the Baltic Sea and propose solutions to avoid inconsistencies in the future. This work has been carried out in accordance with existing guidelines and recommendations issued by the IHO and the RENCs.

The BSEHWG was established immediately after the 12th BSHC Conference; all nations of the Baltic Sea were invited. The Working Group has been chaired by Denmark and its membership includes Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, (Russia) and Sweden.

Three workshops have been held in Copenhagen - the first in January 2008, the second in March 2008 and the third in June 2008. All have had the aim of developing concrete solutions for harmonisation of ENC's. At the final workshop, the BSEHWG fulfilled its mission and completed a report for the 13th BSHC Conference.

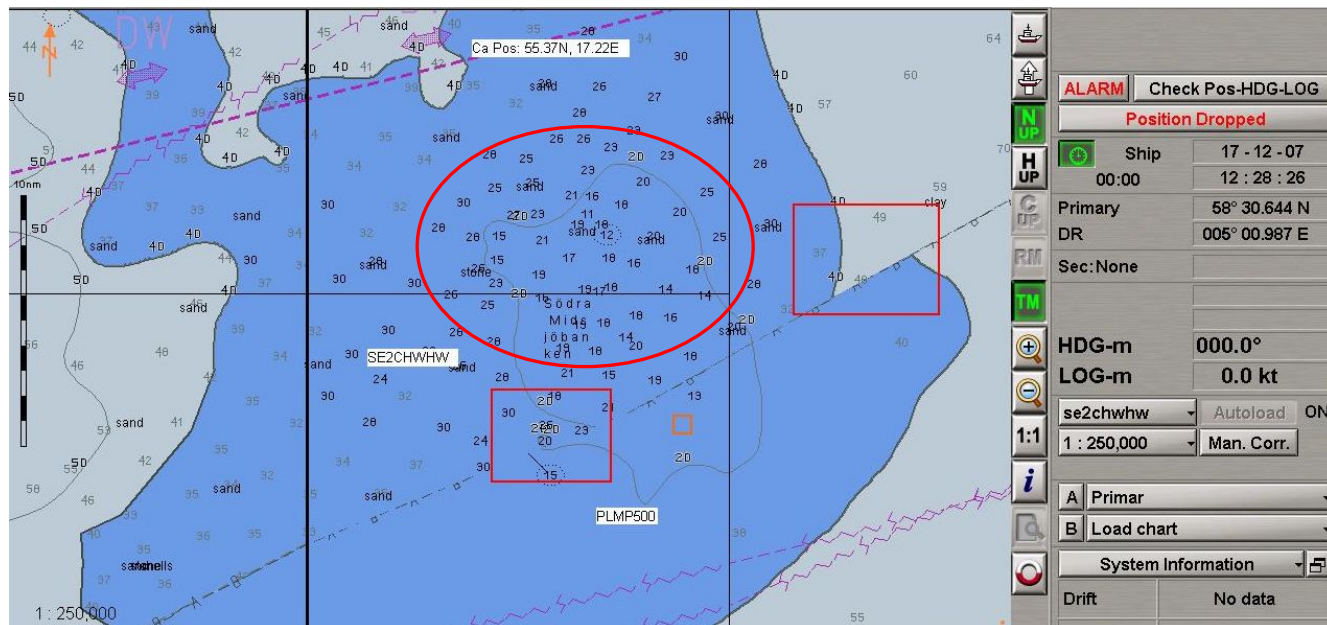


Fig. 1.1 Examples of inconsistencies between Swedish and Polish ENC's shown on an ECDIS display.

Figure 1.1 demonstrates some examples of inconsistencies between Swedish and Polish ENC's shown on an ECDIS display. The red ellipse shows the differences in the density of soundings. The two red boxes show gaps in the 20 metre depth contours/areas and the 40

and 50 metre depth contours/areas. Sweden uses 40 metre contours and Poland uses 50 metre contours.

1.2 Terms of Reference

At its 12th Conference, the BSHC recognised the need to study the harmonisation of the ENC's in the Baltic Sea in order to ensure ENC consistency and a common level of IHO data quality. Therefore the 12th BSHC Conference established the BSEHWG with the task to study the level of harmonisation of the ENC's in the Baltic Sea.

This was decided with reference to:

- IHO Work Programme 2008 – 2012: Task 3.3.4 ENC Production, Distribution and Update,
- IHO CL 32/2007: Recommendations for Consistent ENC Data Encoding,
- WEND Report to the XVII IH Conference [CONF.17/WP.3 Page 6] and
- WEND principle 2.8.

The Working Group should:

- Identify and analyse existing inconsistencies in Baltic Sea ENC's.
- Propose solutions and measures to avoid inconsistencies in the future.
- Arrange a harmonisation workshop by the end of 2007 with the aim of developing concrete solutions for harmonising the ENC's.
- If necessary, propose amendments to the IHO and RENC recommendations.
- Present a final report to the BSHC. This should include an action plan with specified time schedule for future ENC harmonisation.
- If deemed feasible, send reports to relevant IHO and IMO bodies.

Procedure

- The Working Group is open to all BSHC Members and Associate Members; all are strongly encouraged to contribute to the work of the BSEHWG.
- The BSEHWG should be chaired by one of the Member States, as elected at the Conference.
- The BSEHWG should work as far as possible in accordance with existing guidelines and recommendations issued by the IHO and the Regional Electronic Navigational Centres (RENCs).
- When feasible, the BSEHWG should consult the World-wide Electronic Navigational Chart Database (WEND) Task Group, CHRIS Committee and its Working Groups or other relevant bodies.

- The BSEHWG should inform the NSHC and the NHC to harmonise with the North Sea ENCs as far as possible.
- The members of the BSEHWG should have access to unencrypted ENCs.
- The work of the BSEHWG will be carried out primarily by correspondence (via e-mail). The members are strongly encouraged to reply without unnecessary delay.
- The BSEHWG should report to the BSHC 13th Conference.

1.3 Baltic Sea ENCs and the BSEHWG Membership

Under the International Hydrographic Organisation there are 15 Regional Hydrographic Commissions (RHC), among them the Baltic Sea Commission (BSHC). All the countries around the Baltic Sea are members or associate members of the BSHC. The current coverage of the Baltic Sea ENCs can be seen in Figure 1.2.

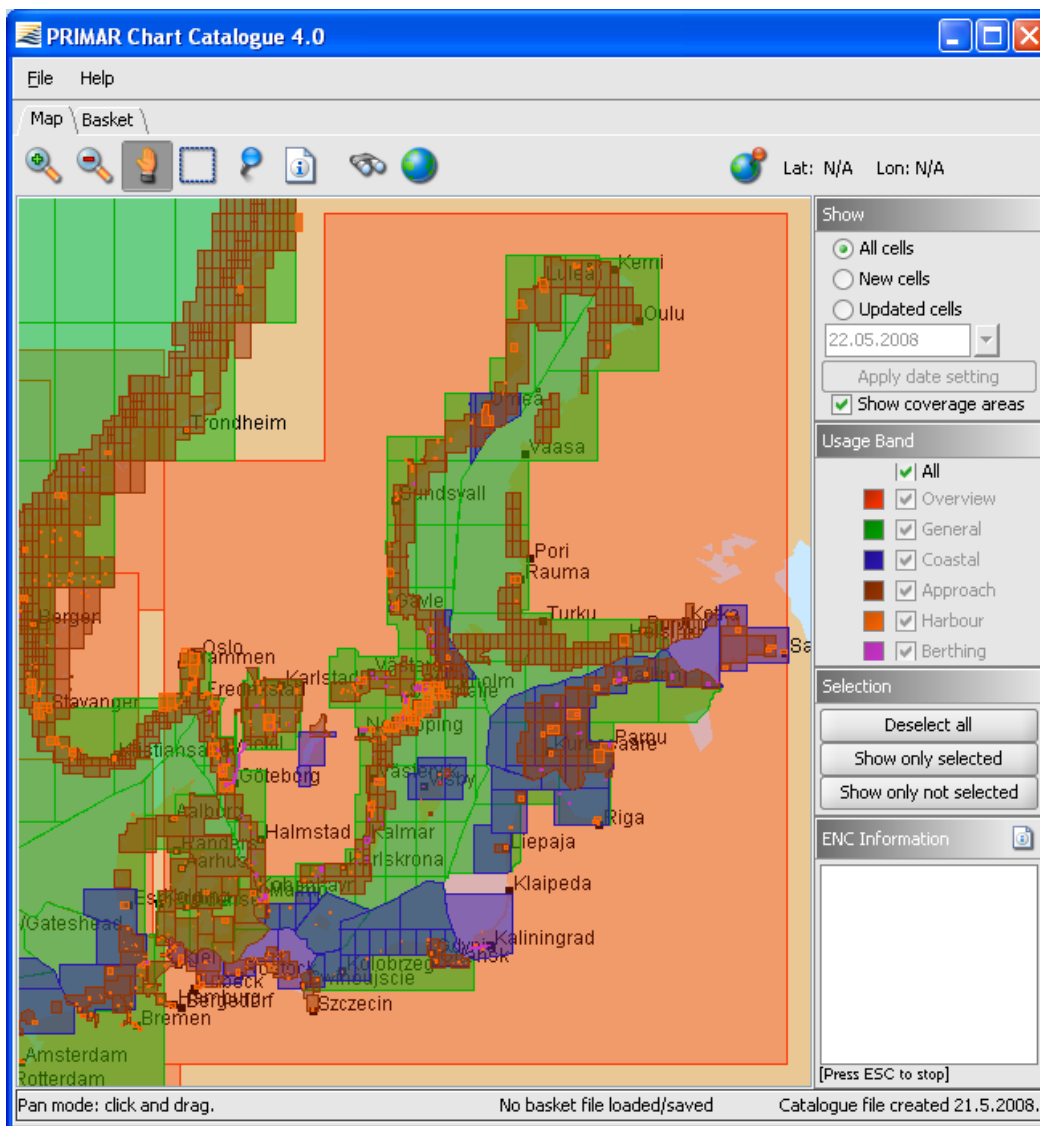


Fig. 1.2 ENC Coverage on the Baltic Sea

1.4 BSEHWG Work Plan

The BSEHWG Work Plan and time schedule were approved at the 12th BSHC Conference in Klaipeda in June 2007. A diagram showing the Work Plan can be seen in Figure 1.3.

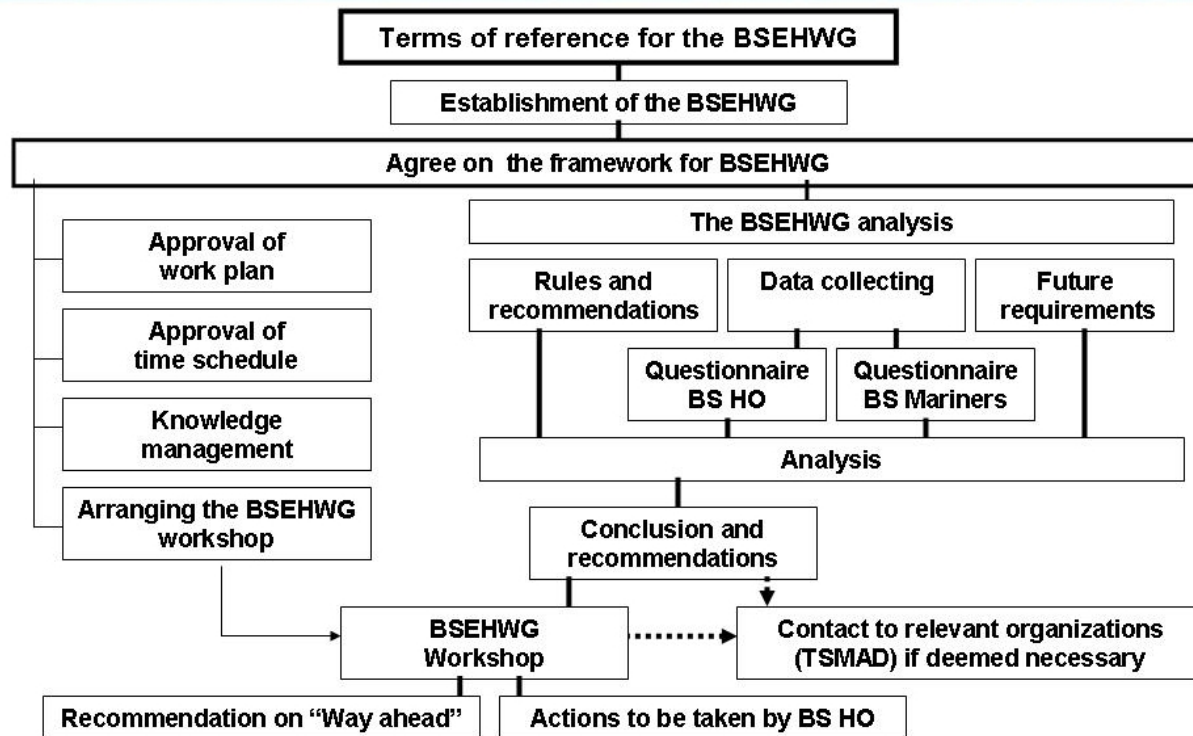


Fig. 1.3 The BSEHWG Work Plan

1.5 Conduct of the BSEHWG work

1.5.1 Communication within BSEHWG

Denmark, Estonia, Finland, Germany, Latvia, Poland and Sweden have participated in the work of the BSEHWG.

1.5.2 BSEHWG Meetings

An important issue for the working group has been to share knowledge and experience. This has been done at the three workshops. An additional meeting was held in connection with the second workshop with the purpose of exchanging experience with ENC production.

A questionnaire was sent out to the Baltic Sea Hydrographic Offices prior to the first workshop in January 2008. The questionnaire dealt with the use of ENC and the results were discussed

at the workshop. After the workshop a questionnaire was sent out the mariners sailing in the Baltic Sea and the results were discussed at the second workshop in Copenhagen late March. After this workshop a follow up questionnaire with some clarifying questions was sent to the Baltic Sea Hydrographic Offices. Based on the analysis from these questionnaires, the identified inconsistencies and the knowledge of the BSEHWG members, the BSEHWG developed and agreed on 17 recommendations to improve ENC consistency and avoid inconsistencies in the future. The BSEHWG discussed and approved the draft report at the third and final workshop in Copenhagen on 11 June 2008.

1.5.3 Liaison with IHO bodies and RENCs

The ENC harmonisation actions within the BSHC were reported to the 1st Extraordinary WEND meeting on 30 October 2007 (*Doc. X-WEND1-05C*). The WEND noted the report and encouraged appropriate regional cooperation. The WEND Committee strongly encouraged HOs to follow the IHO guidelines on consistency of ENC data, especially the use of SCAMIN and noted that RENCs and RHCs have a vital role to play in ensuring the consistency of ENCs. The Committee also agreed that ENC coverage and consistency are of equal priority.

WEND Task Group

The WEND Task Group met at the end of January 2008 to prepare the IHO's contribution to IMO NAV/54. At this meeting, Finland discussed possible contribution to this work. The WEND Task Group was not expecting any reports from RHCs and thus there was no need to include BSEHWG findings in the IHO report to NAV/54. The IHO report to NAV54 will include a statement that there are some harmonisation activities going on in some RHCs, without further details.

Committee on Hydrographic Requirements for Information Systems (CHRIS)

The BSEHWG work was reported by Denmark, Finland and Sweden to the CHRIS19 meeting in November 2007 (*Doc. CHRIS19-06.1D*). The main concern was the proposed new rules on the use of the Scale minimum (SCAMIN) attribute. The CHRIS supported BSEHWG's work. The BSEHWG was invited to report on the ENC Consistency issue to CHRIS20 in order to take the group's findings and recommendations into consideration.

More specifically, these Member States considered that the Transfer Standard Maintenance and Application Development (TSMAD) recommendations in Doc. CHRIS19-06.1C are not mature enough, and that more testing is needed before they can be accepted. Sweden reported that The Baltic Sea Hydrographic Commission has established a Baltic Sea ENC Harmonisation Working Group (BSEHWG) that will report by the end of July 2008. The findings and recommendations from the BSEHWG were requested for consideration. Canada and Germany supported these views, indicating that this issue should be resolved before CHRIS-20 in November 2008. France also supported this position, stated that France does not currently apply SCAMIN and suggested that another possible solution be developed. A solution may be a common set of rules on SCAMIN that would be applied at the ECDIS display level rather than ENC compilation. This did not receive support – it being considered as unwise to allow the level of display to be determined by the wide variety of OEM software used in ECDIS.

CHRIS 19 outcome:

- The Committee endorsed the revised version of “*Recommendations for Consistent ENC Encoding*”, as an Annex to S-65 – *ENC Production Guidance*, noting its importance in support of the recent IHC resolution on ENC coverage and consistency.
- The Committee invited the BSEHWG to report on ENC Consistency to CHRIS-20. (Action 19/8 – BSEHWG).

Transfer Standard Maintenance and Application Development Working Group (TSMADWG)
France presented a paper regarding the SCAMIN issue to the TSMAD 16th meeting on 5-9 May 2008 in Cape Town, South Africa.

North Sea Hydrographic Commission (NSHC)
Denmark presented the current status of the BSEHWG work at the 28th NSHC meeting on 21-25 April 2008 in Elsinore, Denmark.

Nordic Hydrographic Commission (NHC)
Denmark presented the current status of the BSEHWG work at 52nd NHC meeting on 6-8 May 2008 in Norrköping, Sweden.

Regional Electronic Navigational Centres (RENCs)
The current status of the BSEHWG work was reported at the Joint Technical Experts Working Group (JTEWG) meeting on 15 April 2008 in Stavanger, Norway.

1.5.4 Liaison with other HOs

The chairman of CHRIS (UKHO) has continually been informed on the Working Group's progress and attended the final workshop in June.

1.5.5 Liaison with private companies

BSEHWG intended to examine how private companies (e.g. Transas, Jeppesen) handle the inconsistencies between countries, but did not succeed in acquiring information on this topic. However, the BSEHWG noted that it is not possible to have better ENCs than source data.

2. Background information

2.1 Relevant regulations

Presentation of ECDIS and ENC

Electronic Navigational Charts consist of digitised data conforming to the IHO's S -57 ENC Product Specification, which records all the relevant charted features necessary for safe navigation, such as coastlines, bathymetry, buoys, lights, etc. The basic unit of geographic coverage (analogous to a paper chart) is termed a cell. An Electronic Chart Display and Information System (ECDIS) will convert the ENC into a System ENC (SENC) in an internal format optimised for efficient display.

Within the ECDIS, the features and their attributes (e.g. position, colour, and shape) can be selectively displayed and queried, creating the potential to manipulate the chart image displayed on screen.

This not only provides ENC users with control over what level and type of detail they wish to see, but can also be linked to other onboard systems to provide additional features such as automatic warning alarms and indications.

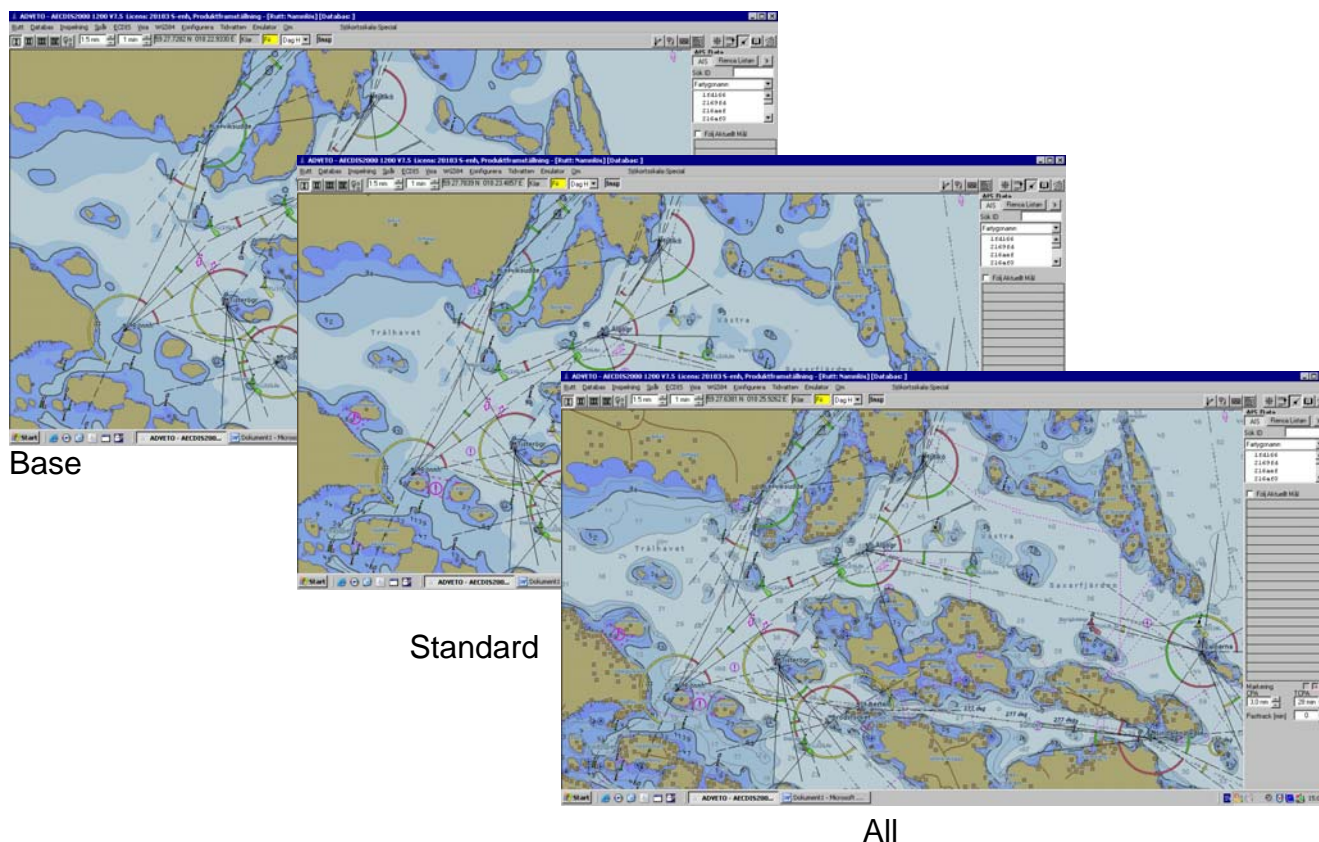


Fig. 2.1 shows various levels of details displayed from the same cell.

IHO Circular letters

The IHO has published three Circular Letters on ENC harmonisation issues: CL 47/2004: Improving ENC Consistency, CL 32/2007: Improving ENC consistency and CL 64/2007 Consistent Encoding of ENCs. These include Guidance on ENC harmonisation, especially related to the use of Compilation scale and SCAMIN. However, these documents do not give enough guidance for detailed consistent implementation.

S-52 Display Standard

While S-57 defines what information can be encoded and how it is to be structured, it says nothing about how that data can be displayed. When ENC data is used in an ECDIS, this is defined within S-52. This specifies not only the symbology to be used but also the full range of conditional rules that govern their use.

S-63 Data encryption

The IHO publication S-63 includes the IHO Data Encryption Scheme. This describes the role and functions needed for ENC protection and safe distribution. The IHB will act as a Schema Administrator.

S-100, S-101 Future ENC standards

The IHO is developing future ENC standards. The S-100 describes the IHO Geospatial Standard for Hydrographic Data. Draft Version 0.0.0 was published in January 2008 for comments. The S-101 will be ENC Product Specifications and intended to be released after S-100 has been released. IHO S-57 Edition 3.1 will continue to be used for many years to come- even after S-100 has been released. As such, Hydrographic Offices should continue to produce S-57 ENC data to meet IMO ECDIS Performance Standard requirements, and to maintain world-wide ENC coverage. Any future ENC Product Specification will take several years to develop after publication of the S-100 base standard.

Official Vector Charts

ENCs are official vector-based electronic charts designed to meet the relevant chart carriage requirements of the Safety of Life At Sea (SOLAS) convention. When displayed within certain parameters and using a type approved ECDIS, ENCs fully satisfy SOLAS chart carriage requirements, and so can be used as the primary means of navigation.

Presentation of relevant regulations

The IHO S-65 provides guidance for ENC production. Below are some extracts from S-65. Relevant regulations of the IHO publication S-65 are listed in Annex B.

The Safety of Life at Sea (SOLAS) convention of the International Maritime Organisation (IMO) includes a number of pertinent requirements:

- That nations shall publish nautical information necessary for safe navigation; this includes systematic updating with all necessary safety-critical information
- That ships shall carry nautical charts. The use of an ECDIS meets this requirement. Such charts (paper or electronic) shall be “issued by or on behalf of a Government

authorised hydrographic office or other relevant government institution”; in other words they must be ‘official charts’.

The IMO’s ECDIS Performance Standard further mandates that “*The chart information to be used in ECDIS should be the latest edition of that originated by a government authorised hydrographic office, and conform to IHO standards.*”

In order to be a legal equivalent of paper charts, the ECDIS must be type approved in accordance with Standard 61174 of the International Electrotechnical Commission (IEC) and have appropriate backup arrangements.

Responsibilities of Hydrographic Offices for Producing ENCs

The responsibilities of Hydrographic Offices for the production and distribution of ENCs are defined in the WEND principles. (M-3, Resolutions of the IHO, K2.19) as follows:

- The preparation and provision of digital data and its subsequent updating for waters of national jurisdiction.
- Validating the data.
- Employing a recognised standard of quality management (e.g. ISO 9000) to ensure high quality of the ENC services.
- Ensuring compliance with all relevant IHO and IMO standards and criteria (including IHO S-57, IHO S-52, or their replacements).
- Providing timely updates to the ENC for the mariner.

Reference is made throughout this document to the relevant WEND principles that support some of the stages of the ENC production processes. For full details of the WEND principles refer to M-3 - Resolutions of the IHO, Resolution K2.19, Principles of the Worldwide Electronic Navigational Chart Database (WEND).

3. Study of current situation

Some examples of how different countries are encoding their ENCs are given in section 3.1. These examples illustrate some of the inconsistencies caused by the use of different depth contours and depth areas, the different use of compilation scale, different data content and the heterogeneous use of SCAMIN.

The BSEHWG has sent questionnaires to Baltic Sea Hydrographic Offices and to mariners on the Baltic Sea to get information on the encoding of ENCs and found inconsistencies. These questionnaires are dealt in sections 3.2 and 3.3 below.

3.1 Found Example cases

The following illustrates two cases of inconsistency in the Baltic Sea between Finland and Sweden (Bay of Bothnia) and two example cases found by PRIMAR.

More example cases found between Finnish and Swedish ENCs can be found in [Annex C](#) and additional cases found by PRIMAR can be found in [Annex D](#).

Case1: Display scale: 1:25 000
SWE cell: SE4CJ4YO compilation scale: 1:22 000
FIN cell: FI4DJ76O compilation scale: 1:25 000

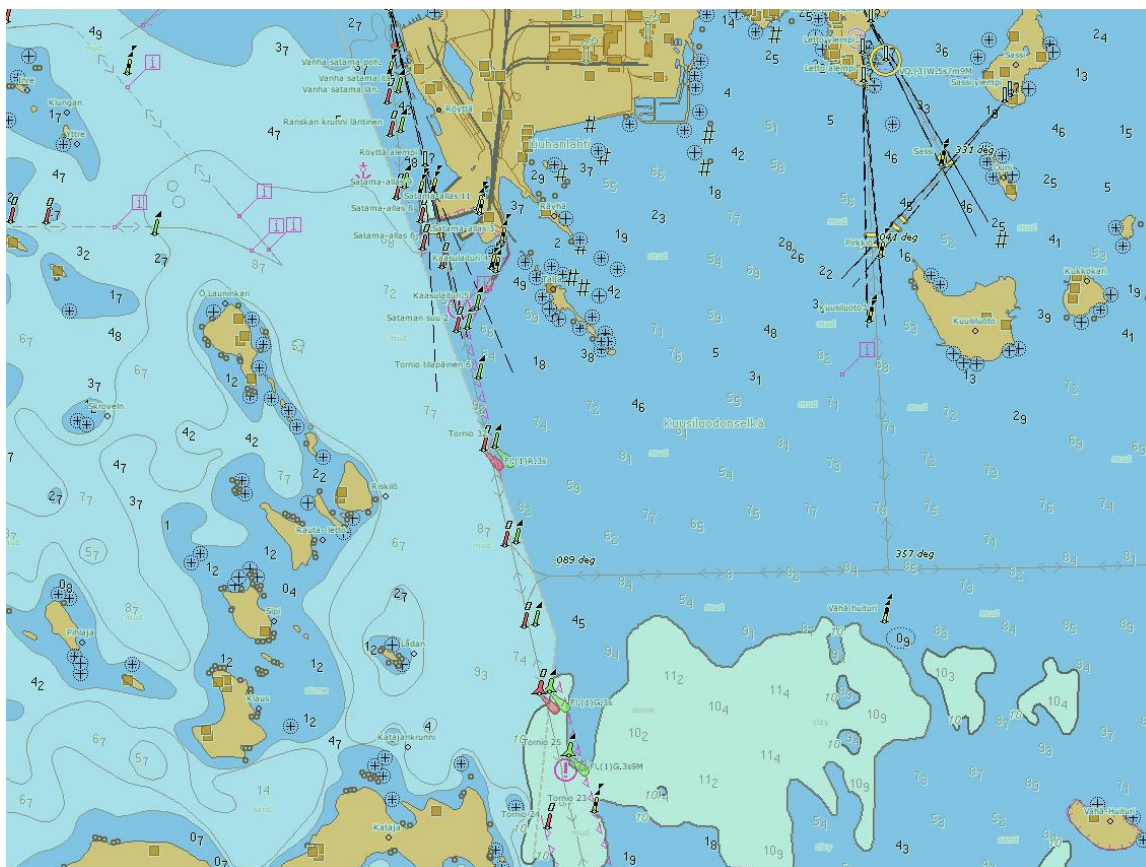


Fig. 3.1 shows discontinuing depth areas between Finland and Sweden

Case 2: Display scale: 1: 326566
 SWE cells: SE2CIIQ4, SE2CIEA4 compilation scale: 1:90 000, 1:90 000
 FIN cell: FI29ARCW compilation scale: 1:180 000

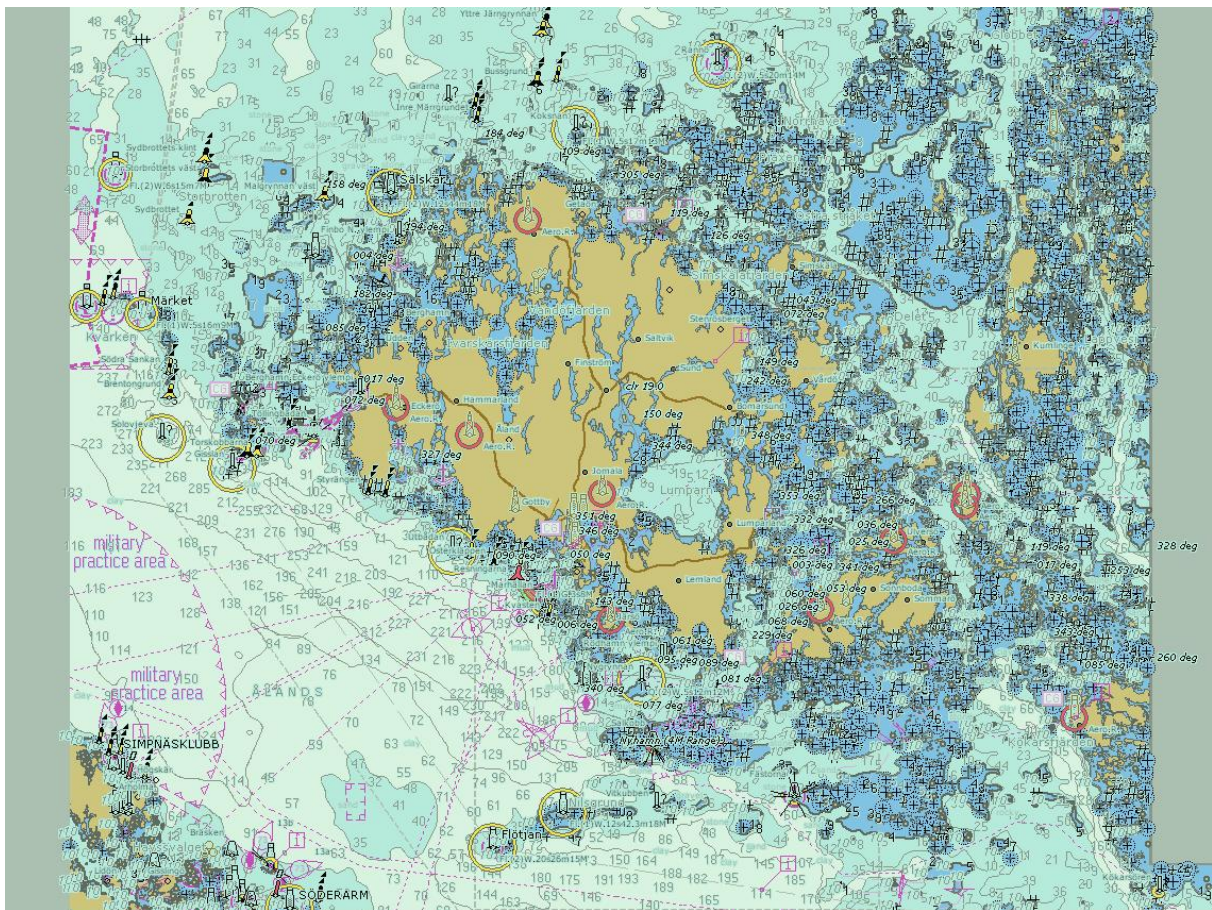


Fig. 3.2 shows cluttered display. Point objects clutter the display on Finnish side.

Comments:

There are a lot of point objects (especially rocks) in the Finnish cell.
 The density of soundings is also high.

Case 3: Display scale: 1: 400 000 and 300 000
 FI cell: FI29GOFW SCAMIN value for Cable, submarine: 349 999
 EE cell: EE203053 SCAMIN value for Cable, submarine: 699 999

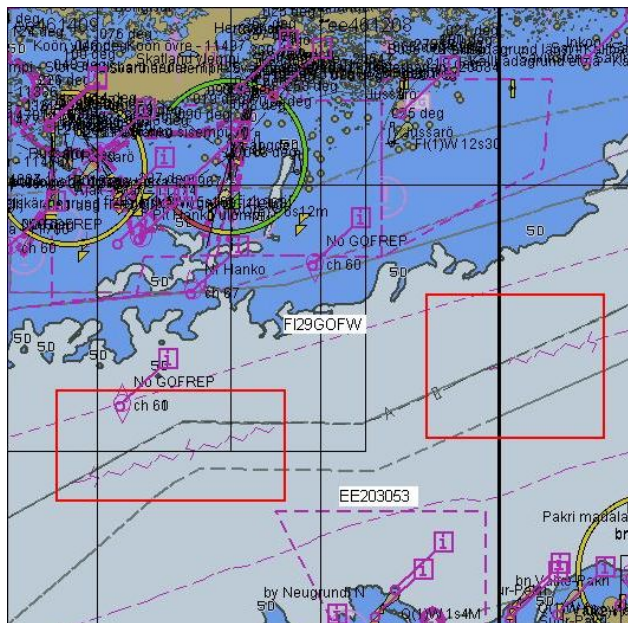


Fig. 3.3

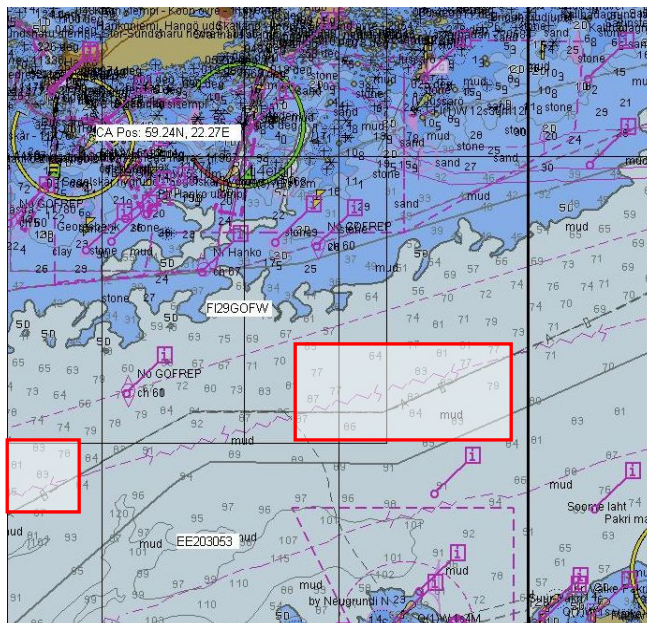


Fig. 3.4

Different SCAMIN values causes that the cable isn't visible in both cells with a display scale 1: 400 000 (Fig. 3.3) but visible in both cells with a display scale 1: 300 000 (Fig. 3.4).

Case 4: Display scale: 1: 400 000 and 300 000
 SE cell: SE2CHWHS SCAMIN value for Cable, submarine: 349 999
 PL cell: PL2MP500 SCAMIN value for Cable, submarine: 2 999 999
 DK cell: DK2BORN SCAMIN value for Cable, submarine: none



Fig. 3.5

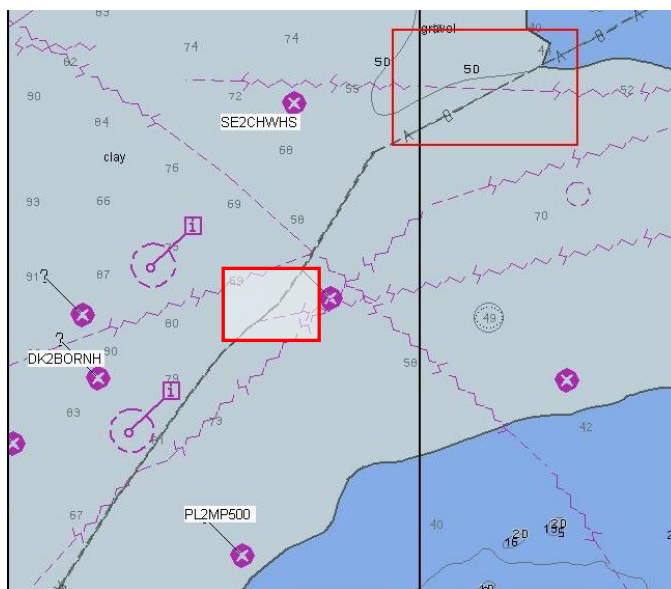


Fig. 3.6

Different use of SCAMIN values in the Swedish and the Polish cells and no use of SCAMIN in the Danish cell. The 2 cables furthest down are cut at the border. The cable at the top isn't visible in both cells with a display scale 1: 400 000 (Fig. 3.5) but visible in both cells with a display scale 1: 300 000 (Fig. 3.6).

3.2 Questionnaire to Baltic Sea Hydrographic Offices

The BSEHWG prepared two sets of questionnaires to ascertain a status of ENC coverage and use in the Baltic Sea region. One set of questionnaires was sent to the Baltic Sea Hydrographic Offices and dealt mainly with ENC coverage in waters along borders and technical details on the use of ENCs. Information from all countries except Russia and Lithuania was obtained. Annex E provides the full text of the questionnaire. Annex F provides a complete spread sheet of answers from each Hydrographic Office. The most important issues and answers are listed below.

Following of IHO recommendations for compilation scale (Q.4)

- The majority of the BSHC Hydrographic Offices are implementing the IHO recommendations for compilation scale or intend to do so in the near future. However, the following values differ from the IHO recommendations: 2 000, 5 000, 7 500, 10 000 and 25 000.
- This could be one of major obstacles to obtaining consistency in the future.

Assigning the ENCs to the six different navigational purposes (Q.5)

- Only Poland is completely fulfilling the IHO recommendations for the navigational purposes.

Use of the attribute SCAMIN (Q.6)

- All BSHC countries except Denmark are encoding their ENCs with the attribute SCAMIN.
- However, there none of the countries are following the suggested IC-ENC SCAMIN rules. Only a few countries have encoded the attributes in similar ways. See details in the SCAMIN spreadsheet, Annex G.
- A spread sheet regarding the use of SCAMIN based on the IHO Circular Letter 64/2007 was sent to each Baltic Sea Hydrographic Office. The Hydrographic Offices were asked to indicate values where they differ from the recommendations in CL 64/2007.
- The use of the attribute SCAMIN was so unique in each country that it was found feasible to propose a regional way for the Baltic Sea to use the attribute SCAMIN.

Depth contour intervals used in ENC production (Q.7)

- Today none of the Baltic Sea Hydrographic Offices apply the same depth contour intervals.
- This issue is highly related to paper charts and harmonisation may require much work.
- No country expressed plans to change the use of their depth contour intervals in the near future.

Encoding of objects Cable submarine (CBLSUB) and Cable area (CBLARE) (Q.13)

- The use of the objects CBLSUB and CBLARE differ from country to country.
- Sometimes this causes inconsistencies at borderlines. One reason could be the different use of compilation scale and use of navigational purposes.

Exchange of borderline data with neighbouring countries - the use of a 5 metre overlapping buffer zone (Q.19)

- All countries exchange border data in some way with at least some of their neighbouring countries or intend to do so in the future.

Agreed to edit data on neighbouring country's area (Q.26)

- Poland and Estonia have agreed that if important waterways are split by national borders, then the neighbouring Hydrographic Offices are permitted to edit data on behalf of the other.

3.3 Questionnaire to mariners sailing on the Baltic Sea

Based on the results from the questionnaires to the Hydrographic Offices, a second questionnaire was sent to mariners who sail on the Baltic Sea using ENC's (see [Annex H](#)). The questions dealt with the use of ECDIS and ENC's. This questionnaire was intended to acquire information on how mariners experience ENC consistency and if they have any problems with the existing ENC's. We received 25 responses; 21 were valid. The complete questionnaire and responses can be found in [Annex I](#).

The majority of the responding mariners are satisfied with the use of ECDIS and ENC's and don't have any problems with the current presentation or consistency between neighbouring countries.

The most important issues and answers are listed below.

90 % of the mariners use ECDIS onboard.

73% of the mariners who use ECDIS use ENCs (Q.3b)

Those mariners who do not use ENCs in ECDIS reported following comments:

Comments from the mariner: Not global coverage. Not same marine mark [navaids] as on paper chart and ENC. In some cases big differences between marks (boarder lines for anchorage areas, land marks or some other areas, and TSS.) on paper chart than on ENC. Generally system working better with ECDIS not ENC.

Reply from the BSEHWG: *Global coverage continuously expanding. It is true that there are some differences in ECDIS and paper chart symbolisation, but both have been designed to give optimal readability and performance in their respective media.*

73% of the mariners using ECDIS and ENCs reported having no problems concerning the presentation in the ECDIS display. (Q.4a)

27% of the mariners using ECDIS and ENCs reported some problems concerning the presentation in the ECDIS display.

The following problems were described:

Comments from the mariner: There is too much information especially on larger scales. Overview becomes messy and hardly useable. VTS and reporting lines and points are not clear enough - gets muddled up with shooting areas and special areas etc.

Reply from the BSEHWG: *The issue of cluttered presentation is addressed by the BSEHWG Recommendations regarding SCAMIN.*

Comments from the mariner: Wrecks with unknown depth and wrecks with less water than specified for shallow water are presented with the same symbol. The problem with the cells to Kaliningrad has just been solved. The ECDIS did not show contents of cells even though permits were available.

Reply from the BSEHWG: *Wrecks with unknown depth are potentially dangerous, so the presentation makes sense. If different symbols are regarded as necessary, then this is an issue for S-52. However, the problem could be solved if the VALSOU of the wreck always was encoded. However, this could be a laborious task for HOs. The problem with permits should be solved with the ENC distributor.*

Comments from the mariner: When buying charts in ECDIS the Sound charts are shown in a square but when receiving you only get the Danish side of the Sound. You also have to buy the Swedish charts in order to have full coverage. It could be great if Hydrographic Offices in DK and SE joined charts in order to buy cells with entire Sound

as coverage. Same occur also in other countries. This is the problem with ECDIS. Only UK makes useful cells without interest of its own nation.

Reply from the BSEHWG: According to the WEND principles each country produces ENC's of only their own national jurisdiction, and therefore the cells cannot be joined across boundaries. The RENCs and ENC distributors offer services covering this issue.

3.4 Man-made interfaces

Some of the problems regarding the inconsistency could be lack in the mariners' education regarding 'ECDIS', 'ECS', 'ENC' and 'Electronic chart'.

The BSEHWG has not studied this issue.

4. Analysis of current situation

4.1 Status in the Baltic Sea

Based on the questionnaires described in Chapters 3.2 and 3.3, the current status of the issues of greatest importance for future harmonisation of ENC's are given below.

- Denmark:** There is sufficient ENC coverage of the waters along the borders. ENC's have not been produced from scratch. The recommendations for compilation scale follow the IHO recommendations. The SCAMIN attribute is not used in ENC production. The use of navigational purposes differs from the recommendations from IHO.
- Estonia:** There is sufficient ENC coverage of the waters along the borders. In some cases ENC's have been produced from scratch. The recommendations for compilation scale follow the IHO recommendations. The SCAMIN attribute is used in ENC production. The use of navigational purposes differs from the recommendations from IHO.
- Finland:** The planned adequate coverage has not yet been reached on waters along the borders to Sweden and Russia. ENC's are produced from the same database as paper charts, not from scratch. Compilation scales do not completely follow the IHO recommendations. The SCAMIN attribute is used in the ENC production.
- Germany:** There is sufficient ENC coverage of the waters along the borders. Some ENC's have been produced from scratch. Settings of navigational purpose, compilation scale and SCAMIN vary from IHO recommendations but the deviance is so small that it has no effect for handling data in an ECDIS. All borders have 5 m overlap and are harmonised with neighbouring ENC's.
- Latvia:** There is full ENC coverage of the waters along the borders. In most cases large scale ENC's have been produced from scratch. The recommendation for compilation scale follows the IHO recommendations. The SCAMIN attribute is used for the ENC production. The use of navigational purposes differs from the recommendations from IHO.
- Poland:** There is sufficient ENC coverage of the waters along the borders. ENC has not been produced from scratch. The recommendations for compilation scale follow the IHO recommendations. The SCAMIN attribute is used for the ENC production. The use of navigational purposes corresponds to the recommendations from IHO.
- Sweden:** There is sufficient ENC coverage of the Swedish waters. In some areas the information in the ENC's have been produced from scratch. The compilation scales follow the IHO recommendations, but the navigational purposes differ from the recommendations for some of the navigational purposes.

In general the ENC coverage on the Baltic Sea is sufficient along the borders. The recommendations for Compilation Scale from IHO are followed in some countries and not in others. Although the SCAMIN attribute is used in general, the code is not the same for each object, so there is still an inconsistency. The use of navigational purpose differs in general from the recommendations from IHO.

The BSEHWG noted that the ENC cells in navigational purposes “Harbour” and “Berthing” are disjointed, and no obvious inconsistencies exist. However, these navigational purposes should be in harmony with other navigational purposes within the producers’ portfolios.

4.2 Issues considered by the BSEHWG

The IHO has published three Circular Letters on ENC harmonisation issues as mentioned in chapter 2. However, these documents do not give enough guidance for detailed consistent implementation.

The BSEHWG decided consider the issues listed below. These are listed according to their estimated priority. The priority is defined as a view of reliability and general view of the ENCs and not as a real danger for collision etc.

- 1. Compilation scale and Navigational purpose**
- 2. Scale minimum (SCAMIN)**
- 3. Depth contour intervals and depth areas**
- 4. Harmonisation of features continuing/extending over national borders**
- 5. Checking of harmonisation before launching ENCs**
- 6. Buffer zones along national borders**

Compilation scales and Navigational purpose

The problem of lack of harmonisation in compilation scales and navigational purposes between two countries will be that one cell will become overscaled at certain zoom levels and the data will appear cluttered. Further, there will be inconsistency in the presentation of data (and density of data) between the two cells.

The harmonisation of the navigational purposes *Harbour* and *Berthing* is less critical in the Baltic Sea. Data in these navigational purposes only cover waters of one country. The effects of disharmony between different countries are therefore limited. It is regarded as more important to be able to display the special conditions of each harbour in the best way than to achieve complete harmonisation.

Scale minimum (SCAMIN)

If SCAMIN is not used, the features may become cluttered on an ECDIS screen. This reduces the visibility considerably when zooming out. By implementing a common way to encode the attribute SCAMIN, the inconsistencies between neighbouring countries could be avoided.

The BSEHWG believes that a complete harmonisation of the use of SCAMIN may not be possible worldwide. From the mariners' point of view this may not be a major obstacle. It is more important that the harmonisation has been done as far as possible at a regional basis. The BSEHWG has worked towards the development of regional interpretations of the IHO recommendations for the Baltic Sea which do not require too many resources to implement, and which could be automated.

The BSEHWG proposes this approach to be considered for other sea areas by other Regional Hydrographic Commissions.

Depth contours and depth areas

Use of different contour intervals and depth areas causes the most visible inconsistencies on ECDIS display. Harmonisation of these gives great benefits to mariners.

However, the BSEHWG has noted that depth contours and depth areas are related to the source data and the content of databases, and would be very resource- and time- consuming to change.

Harmonisation of features continuing/extending over national borders

Some features, e.g. Cables or Cable areas, do not continue smoothly – or at all - over national borders. This may reduce the reliability of ENC's to their users.

This issue should be relatively easy to fix bilaterally or multilaterally within a relatively short period of time.

Buffer zones along national borders

In case of even small gaps between two cells, some ECDIS systems will, when passing this gap, immediately zoom out to the “world wide chart”. To avoid this effect, it is critical that the ENC's are cross-checked with a 5 metres overlap of their national borders.

4.2.1 Compilation scale and Navigational purpose

Present status:

Most of the Baltic Sea countries are following the recommendations set at the IHO CL 47/2004 (and its revised version CL 32/2007). However, these specifications do not have unique recommendations, in that they have more than one recommended value for compilation scales. This causes inconsistencies between the ENC's of neighbouring countries. To avoid these inconsistencies, it was agreed that more specific recommendations are needed.

Recommendation according to CL47/2004 is as following:

Navigational Purpose	Name	Scale Range	Available Compilation Scales	Matching Scale Ranges
1	Overview	<1:1,499,999	3,000,000 and smaller 1,500,000	200 NM 96 NM
2	General	1:350,000 – 1:1,499,999	700,000 350,000	48 NM 24 NM
3	Coastal	1:90,000 – 1:349,999	180,000 90,000	12 NM 6 NM
4	Approach	1:22,000 – 1:89,999	45,000 22,000	3 NM 1.5 NM
5	Harbour	1:4000 – 1:21,999	12,000 8000 4000	0.75 NM 0.5 NM 0.25 NM
6	Berthing	> 1:4000	3999 and larger	< 0.25 NM

Table 4.1 shows the difference Compilation Scales according to each Navigational purpose

The current use of Compilation Scales and Navigational purposes for each country in the Baltic Sea:

	COMPILATION SCALE				
	General	Costal	Approach	Harbour	Berthing
IHO Recommendations	350 000 700 000	90 000 180 000	22 000 45 000	4 000 8 000 12 000	> 4 000
FINLAND	180 000	N/A	25 000	12 000	N/A
SWEDEN	90 000	45 000 (50 000)	22 000 (30 000)	8 000 12 000	2 000 4 000
ESTONIA	250 000	90 000	45 000	10 000 25 000	2 000 5 000 7 500
POLAND	350 000	90 000	22 000	4 000 8 000 12 000	N/A
GERMANY	N/A	50 000 – 150 000	20 000 – 50 000	2 000 – 20 000	> 5 000
LITHUANIA	No info?	No info?	No info?	No info?	No info?
DENMARK	180 000 350 000	(45 000) 90 000	22 000 45 000	4 000 8 000 12 000	N/A
LATVIA	180 000	90 000	22 000	7 500 8 000 10 000	2 000 5 000
RUSSIA	No info?	No info?	No info?	No info?	No info?

Table 4.2 shows the different use of Compilation Scales and Navigational purposes for each country

The lack of harmonisation in compilation scales and navigational purposes between two countries will cause a cell to turn to “overscale status” at certain zoom levels, and the data will appear partly obscured. There will also be inconsistency in the content of data (and density of data) between the two cells. See an example in Figure 4.1.



Fig. 4.1 Over scale shown near borderline between two countries ENC's

It was agreed that there should be one set of recommended, common compilation scales.

Navigational purpose *Overview*

There is only one *Overview* cell on the Baltic Sea and thus there is no need for harmonisation of this navigational purpose. Therefore, it is not presented in table 4.2. However, the *Overview* navigational purpose should be in harmony with other navigational purposes within the producers' portfolios. The *Overview* cell should be harmonised with adjacent cells in the North Sea.

Recommendation 1: Navigational purpose *Overview*

- 1a) *Overview* navigational purpose should be in harmony with other navigational purposes within the producers' portfolios.
- 1b) The *Overview* cell should be harmonised with adjacent cells in the North Sea.

Navigational purposes *Harbour* and *Berthing*

The harmonisation of the navigational purposes *Harbour* and *Berthing* are less critical in the Baltic Sea. The reason is that data in these navigational purposes in principle only cover one country's waters and are generally not joined to other nations' ENC's. The effects of disharmony between different countries are therefore limited and unlikely to cause inconsistencies affecting the navigator's display.

It is regarded as more important to be able to display the special conditions of every harbour in the best way than to achieve complete harmonisation. However, the *Harbour* and *Berthing* navigational purposes should be in harmony with other navigational purposes within the producers' portfolios.

Recommendation 2: Navigational purpose *Harbour* and *Berthing*

The *Harbour* and *Berthing* navigational purposes should be in harmony with other navigational purposes within the producers' portfolios.

Navigational purposes *General*, *Coastal* and *Approach*.

Compilation scale 180,000 for *General* navigational purpose does not accord with the recommendations of CL 47/2004, but it was estimated that this fits most appropriately to the situation of the Baltic Sea. It was also noted that most of the BSHC countries already use this value and the remaining HOs are considering the possibility of changing to this value.

Compilation scale 90,000 for *Coastal* navigational purpose is in accordance with the recommendation of CL 47/2004 and most of the BSHC countries already use this value.

Compilation scale 22,000 for *Approach* navigational purpose is in accordance with the recommendation of CL 47/2004 and most of the BSHC countries already use this value.

It was decided that common compilation scale values should be used in navigational purposes *General*, *Coastal* and *Approach*.

Recommendation 3: Use of Compilation Scale

On the Baltic Sea, the following values for the compilation scales should be used:

180,000	(<i>General</i>)
90,000	(<i>Coastal</i>)
22,000	(<i>Approach</i>)

Recommendation 4: Exceptions in the use of Compilation Scale

If a Hydrographic Office (HO) wants to use a compilation scale other than those recommended above, it may do so if all the following conditions are met:

- i) the value used is in line with the intention of the IHO CL 47/2004
- ii) use of it is agreed bilaterally with neighbouring HO(s) concerned, in order to avoid inconsistencies at the border, and
- iii) every effort is made to minimise possible inconsistencies due to deviations from the recommended compilation scale.

4.2.2 Scale minimum (SCAMIN)

SCAMIN is a significant point where inconsistency of presentation is one of the most conspicuous problems for end-users. Each country has a unique way of assigning the SCAMIN attribute to objects and choosing navigational purpose and compilation scale. This gives a very significant inconsistency in its presentation in ECDIS.

The unique ways of encoding this attribute range from not using the attribute at all to using it in such a way that the presentation of the ENC is similar to the paper chart. The S-65 ([Annex B](#)) recommends using SCAMIN in a more complex way where the selection is displayed in higher detail when different attribution criteria are chosen.

Between these is an easy and simple method that could be assigned automatically by using a selection at object level. This method is also immediately implementable in all participating countries and therefore the BSEHWG proposes that this approach should be used on the Baltic Sea. The proposal is in line with the Circular Letter 47/2004.

[Annex J](#) gives additional guidance for the use of SCAMIN to Circular Letter 47/2004 in order to improve ENC consistency in the Baltic Sea.

Recommendation 5: Use of SCAMIN

BSHC should adopt the guidelines as stated in [Annex J](#).

4.2.3 Depth contour intervals and depth areas

Current status:

It is noted that there is a variety of depth contour intervals and corresponding depth areas on the Baltic Sea ENCs. The following intervals are in use:

Depth Contours	0	2	3	4	5	6	10	15	17	20	30	40	50	100	150	200
Denmark		X		X		X	X		(X)	X	X	X	X	X		
Estonia	X	X			X		X			X			X	X		X
Finland							X			X		(X)	X	X		X
Germany	X	X	(X)		X		X		(X)	X	X	(X)	X			
Latvia		X			X		X	(X)		X			X	X	(X)	X
Lithuania																
Poland		X			X		X	X		X			X	X		
Russia																
Sweden			X			X	X	X		X		(X)	X	X		X

Table 4.2: Contour intervals in use in Baltic Sea Hydrographic Offices.

These values are in accordance with the IHO recommendation (M-4 Section B-411):

The standard series of depth contour lines to be charted is: drying line (where tides are appreciable), 2, 5, 10, 20, 30, 50, 100, 200, 300, 400, 500, 1000, 2000 m, etc. The 2 and 5 m contours may be omitted where they serve no useful purpose. It is not necessary for the complete sequence of contours to be shown, e.g. on steep slopes and around isolated pinnacles.

Supplementary contours, e.g. at 3, 8, 15, 25, 40, 75 m and multiples of 10 or 100 m may be shown, if the available data permit, to delineate particular bathymetric features where soundings would otherwise be the only depth information over a large area, or for the benefit of particular categories of shipping. The 2500 m contour may be required for measuring continental shelf limits (see UNCLOS Article 76).

Other contours: In waters where the 4 or 6 metres contours have been surveyed and charted these contours may be shown in place of the standard ones, provided they are labelled with their values (even where otherwise defined by a shallow water tint).

If there are any inconsistencies in the contour intervals between neighbouring countries it should be treated bilaterally.

The most important issue is the harmonisation of depth areas that may have a shallow water colour on ECDIS display. These have caused the most obvious inconsistencies. The contours drawn by a single line without a depth area may not create so clear inconsistencies even if they do not match.

However, it should be noted that the depth areas as well as the depth contours are highly related to the existing source data, the content of databases and existing intervals on printed charts. If depth areas and contour intervals are changed in ENCs, this will likely require updates to the corresponding paper charts. The BSEHWG believes that, for Hydrographic Offices, it may be difficult to change the depth contour intervals and it may take a long transition period. Thus the BSEHWG proposes that the BSHC establishes a Working Group for Harmonisation of the Conveying and Presentation of Depth Information for both ENCs and paper charts.

Meanwhile, if the IHO recommended contour intervals are not applicable, or if additional intervals are needed, implementations should be agreed bilaterally/multilaterally so that possible inconsistencies to the mariners could be avoided.

Recommendation 6: Contour intervals

- 6a) The BSEHWG proposes that the BSHC establishes a Working Group to study possibilities for Harmonisation of the Conveying and Presentation of Depth Information for both ENCs and paper charts.**
- 6b) Meanwhile, if the IHO recommended contour intervals are not applicable, or if additional intervals are needed, implementation should be agreed bilaterally/multilaterally so that possible inconsistencies to the mariners could be avoided.**

4.2.4 Harmonisation of features continuing/extending over national borders

There are several features that cross or extend over national borders, including e.g. Cable, submarine, Cable areas, Caution areas, Restricted areas, Military practice area and Traffic Separation schemes.

Recommendation 7: Harmonisation of features continuing/extending over national borders

All BSHC countries should ensure that bilateral agreements are in place with their neighbouring countries concerning harmonisation of features continuing/extending over national borders.

4.2.5 Checking harmonisation before launching new ENCs

It is important that HOs consult their neighbouring countries about the harmonisation of new ENCs or new editions before launching or publishing them. Appropriate procedures and communication for this should be established on a bilateral or multilateral basis.

Recommendation 8: Cheking harmonisation before launching new ENCs

All BSHC countries should check and carry out harmonisation before launching updates or new editions of ENCs.

4.2.6 Buffer zones along the national borders

The aim of establishing a 5 metre buffer zones along national borders will ensure that there are no gaps or overlaps between neighbouring ENCs.

Recommendation 9: Buffer zones along the national borders

All BSHC countries should check that there are no gaps between cells at national borders by establishing a buffer zone of up to 5 metres, if necessary.

4.3 Issues to be considered by the BSHC

To ensure that the previous recommendations are followed in the best manner, the following recommendations to the BSHC are proposed for BSHC approval.

4.3.1 Harmonise the adoption of new versions of ENC related standards

The BSEHWG has noted that there are different plans to adopt new versions of ENC related standards, e.g. S-57. In order to have consistency among future versions of ENC related standards, a harmonised time schedule for adopting new versions is needed. It is recommended that the BSHC agrees on these harmonised time schedules.

Recommendation 10: Adoption of new versions of ENC related standards

The BSHC should agree on joint plans and time schedules for the adoption of new versions of ENC related standards (e.g. S-57 Ed. 3.1.1 or S-101).

4.3.2 Harmonise the adoption of new object classes

The BSEHWG has noted that there is a need to have harmonised plans for adopting new object classes when the need arises (e.g. on PSSA areas, NEWOBJ, etc.) on the Baltic Sea ENCs and other products. It is important to use same information and similar layouts on additional general information (e.g. on PSSA areas) on the Baltic Sea ENCs and other products. It is recommended that the BSHC agrees to harmonise these plans and time schedules.

Recommendation 11: Adoption of new object classes

The BSHC should agree on joint plans and a time schedule for the adoption of new object classes on their products.

4.3.3 Harmonise the use of objects

The BSEHWG has noted that countries have different objects in use or that they use the same objects in different ways, as is the case with *unused cables*. The use of objects on the Baltic Sea ENCs and other products should be harmonised.

Recommendation 12: The use of objects to ensure consistency

12a) BSHC should encourage all countries to make further studies of the use of objects in the Baltic Sea ENCs and report to the following BSHC meeting.

12b) BSHC should decide on proper actions to ensure ENC consistency as far as possible.

The BSEHWG has noted some special circumstances where exceptions to these recommendations may be needed.

Recommendation: 13: Special circumstances

If found necessary it is possible to deviate from the recommendations. When doing so, the relevant HO should make every effort to minimise the effect of any inconsistencies that may occur. This should be done through bilateral/multilateral agreements and through harmonisation of data in order to ensure that no serious disharmony is introduced to the ENC's.

4.3.4 Promotion of regional approaches

The BSEHWG believes that its recommendations may be valuable for other sea areas and recommends that other RHCs try to define regional implementations to IHO consistency recommendations in their regions. BSHC is willing to share its experiences on this issue.

Recommendation 14: Promotion of regional approaches

BSHC should ask the IHO Committee on Hydrographic Requirements for Information Systems (CHRIS) to consider appropriate actions to recommend other Regional Hydrographic Commissions (RHCs) to adopt regional implementations to IHO consistency recommendations within their sea areas.

4.3.5 Analysis of the consequences of the inconsistencies to mariners

The questionnaire to mariners and its findings are described in section 3.3. The majority of the responding mariners are satisfied with the use of ECDIS and ENC's and don't have any problems with the current presentation or consistency between neighbouring countries.

The replies to the questionnaire to mariners demonstrate significant confusion regarding the differentiation of "ECDIS", "ECS", "ENC" and "Electronic chart". All relevant bodies are encouraged to continue the education of mariners. These may include Hydrographic Offices, IHO RHCs and Committees (CHRIS, WEND) and their Working Groups, RENCs, etc.

Recommendation 15: Training and education

All relevant bodies are encouraged to continue the education of mariners regarding 'ECDIS', 'ECS', 'ENC' and 'Electronic chart'.

4.3.6 Reporting the implementation of the recommendations

The BSEHWG believes that monitoring the implementation of these recommendations is important. The Baltic Sea countries should follow the time schedule for implementation, as agreed in [Annex L](#). The BSEHWG proposes that this monitoring should be a standing agenda item on BSHC Conferences and the BSHC Members should report this annually.

Recommendation 16: Follow-up of implementation

All BSHC countries should follow the time schedule for the implementation of all relevant recommendations as stated in [Annex L](#).

Recommendation 17: Reporting of the implementation of the recommendations

BSHC members should report annually to BSHC Conferences on the implementation of these recommendations.

4.4. Summary of Recommendations

A summary of recommendations is provided in [Annex L](#).

This annex also includes an estimated time schedule for the implementation of the recommendations.

The recommendations are in line with the IHO recommendations on ENC consistency (e.g. CL 47/2004, CL 32/2007 and S-65), except the use of compilation scale for General and for the use of SCAMIN.

4.5. Implementation plan

Proposed actions and time schedule

- | | |
|---------------|--|
| 8/2008 | BSHC/13 to approve the report and its recommendations
BSHC/13 to establish the Working Group as proposed in Recommendation 6 and to approve its TORs and ROPs |
| 9/2008 | BSHC to report to CHRIS/20 |
| ASAP | HOs to implement those recommendations that require no further studies. These are recommendations 1, 2, 3, 4, 5, 7, 8, 9 15, 16. |

Yearly BSHC members to report annually to BSHC Conferences on the implementation of these recommendations

5. Conclusions

The BSEHWG believes that it has found many practical recommendations. The recommendations are in line with relevant IHO recommendations. If these are implemented, the consistency of the Baltic Sea ENC's will be improved. This will foster a wider use of ECDIS and ENC's and thus increase the safety of navigation.
