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SOURCE DATA DIAGRAMS AND THEIR USE ON BRITISH ADMIRALTY CHARTS

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At the suggestion of the Hydrographers of Great Britain and France, the first International Hydrographic Conference was convened and opened in London on 24 June 1919; Hydrographers of 24 nations attended. The Charts Committee was chaired by Captain H.P. DOUGLAS, Royal Navy, then Assistant Hydrographer, U.K. He referred to the information about surveys given on published charts and stated that "The British Hydrographic Office particularly wished to urge that the date of the survey should be shown in the title" [1]. There was general support for this principle which was confirmed at the conference in 1926 and has persisted until the present day in the IHO Technical Resolutions B2.3 and B2.7. Its implementation is both simple and effective on a chart based entirely on a single survey but such cases are rare; most modern charts are a composite of information from a variety of sources and a simple listing of these, though of historic interest, is not necessarily very helpful to the mariner. For example, although it had a new edition as recently as October 1983, the British Admiralty chart 1364, "Cape Mesurado to Baffu Bay", on the west coast of Africa, was originally published in 1880 and carries a statement in the traditional form, as follows :

Cape Mesurado to Grand Kulloh by Commanders F. C. Learmouth and F. H. Walter R.N. H.M. Surveying Ship "Goldfinch" 1904-6.
East of Grand Kulloh by Captain C. E. Monro R. N., H.M. Surveying Ship "Mutine" 1907-9.
With soundings by Capt. A. T. E. Vidal R.N., H.M.S. "Ætna" 1836-8.
With additions and corrections to 1983.

FIG. 1

On the other hand, specific information about source data can be a factor contributing to safe navigation as the date of the survey, or a statement of the authorities on which a chart is based, is one of the many elements which a mariner must take into account when assessing the degree of reliance he can place on the charted detail.

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The direct link between the date of a survey and its dependability is based partly on the assumption that, as surveyors have always been limited by the capabilities of their instruments and equipment, it has been possible gradually to increase the accuracy and completeness of the work as, over the years, the instruments and surveying techniques have evolved and improved. The question inevitably arises — to what extent can the surveys of the past be considered adequate for the needs of today ? In 1978, the members of the North Sea Hydrographic Commission, appreciating the need, in their periodic review of the state of surveying of the North Sea, to have a common understanding as to what constitutes an "adequate comprehensive survey", concluded that "the assessment of adequacy of an existing survey is based on professional opinion which takes into account such factors as the general depths and nature of the area, the present use and expected future use of the area, the likelihood of wrecks and other obstructions and the limitations (if any) imposed by the techniques used during the survey". Having considered all these factors, an area would be classed as having had an "adequate comprehensive survey" if it is judged that detailed re-examination of the area is unlikely to be required in the foreseeable future. The members of the Commission also agreed that, if the seabed is subject to change, resurvey should take place at least every 10 years [2].

These NSHC conclusions underline the fact that the year date of a survey does not, *in itself*, constitute a reliable indication of the adequacy of the charted information. Moreover, when eliciting relevant details from his chart, each mariner has in mind his own particular requirements and circumstances. So it is not appropriate for the chart maker to try to give, on the chart, comprehensive evaluations of the various data included in the chart compilation.

Twenty-four years ago, Mr. R.J. BEATON, of the U.S. Navy Hydrographic Office (now Defense Mapping Agency) described chart evaluation as "an appraisal made for a specific reason before or after publication and it concerns the accuracy and adequacy with which the features of a portion of the earth's surface, including underwater topography, are represented". He went on to explain that "how the mariner evaluates each chart for his particular route is largely a matter of personal knowledge, experience and judgement. Some of the practical considerations that he may apply in determining a chart's worth include the identity and reputation of the publisher; chart scale and sheet limits relative to intended use; overlap on adjacent coverage including consistency of geographic graticule; lack of caution notes; currency of information and the amount of detail accurately and legibly presented with respect to the character of the sea bottom, safe channels, main terrain details, and other navigational features that ensure safe passage. The mariner weighs these factors, usually in the light of his own personal knowledge of the area, and makes prudent allowance for possible unreported or incompletely charted dangers" [3]. The effectiveness of such subjective judgement depends a great deal on the amount of relevant information available to the mariner and on his experience in using it. The 5th edition of "The Mariner's Handbook", published by the U.K. Hydrographic Department in 1979, contains in Chapter 3 some detailed advice to chart users on the appraisal of hydrographic information and assessment of its reliability.

However, charts are not used only by experienced mariners, and the chart maker must ensure that the facts presented and the means by which they are displayed give due warning to "proceed with caution" in those areas where the data

he has had to use in compiling the chart are less than adequate, particularly with regard to depths and depth contours. In 1960, Mr. BEATON emphasized that one of the purposes of his paper was to "advocate the portrayal of more complete and specific basic compilation data references" as this would increase the user's appreciation of the charted detail : one technique he described and illustrated was the compilation, or source data, diagram. Yet in the 24 years which have ensued, disappointing progress has been made in the use of such diagrams on new charts. Among member countries of the Chart Standardization Committee there was not a consensus in support of standardizing their use, and in the IHO Chart Specifications, there is only a brief reference to these diagrams; it is in paragraph 417.2 of Section 417 entitled "Areas with inadequate depth information" where useful advice is given on the use of special cartographic measures to put the mariner on his guard in areas with inadequate sounding data [4]. Where a chart includes areas with a scarcity of soundings or with broken depth contours, its limitations should be obvious. In the absence of such warning signs, a source data diagram helps to focus the attention of a mariner, unfamiliar with the water concerned, on the areas where wider safety margins would be prudent for his particular draught of vessel. The use of VLCCs, often operating with minimal underkeel allowance, has greatly increased the need for such appreciation of the inherent technical limitations of hydrographic surveys.

In the United Kingdom, the use of source data diagrams first arose out of a requirement defined by some chart users for a standard method of assessing the accuracy of the chart. A study of the problem indicated that, to assess and record the "reliability" of each chart, one must first establish a clearly-defined grading basis which takes into account not only the differing requirements of a wide variety of chart users but caters also for changes in the light of future developments in navigation and ship design. In these circumstances, the chart maker can best serve the interests of the full range of chart users by ensuring that any chart reflects the best available information as fully as possible, without disguising gaps in the data, thereby helping the mariner to make an intelligent, if somewhat intuitive, assessment of its adequacy for his particular needs. For that reason, in the U.K. Hydrographic Department, it was decided that, on source data diagrams, we would simply record the date, scale and source of the data used. In appropriate cases, further comments, for example "leadline survey", are added. In this respect, there is scope for giving more information in the manner used by the Australian Hydrographic Office in their Reliability Diagrams which include letters such as S (Sonar swept) and W (Wire swept), etc.; full details of this technique were given in the *I.H. Bulletin,* in March 1975 [5]. However, judicious use by the mariner of such supplementary information does require an understanding of the complex nature of hydrographic surveying with which chart users are not often acquainted. For example, there is a need to appreciate that charts based on leadline sounding data are not necessarily unreliable; also that, although a sonar search is a fundamental element in all modern surveys of areas with irregular seabed or with many wrecks or man-made obstructions, there are some flat regular areas where a sidescan sonar search is not essential and its omission does not render the survey inadequate and result in charts of doubtful reliability.

Shown in Fig. 2 is an example of the source data diagram now used on the British Admiralty charts. It is essentially a small-scale outline reproduction of the

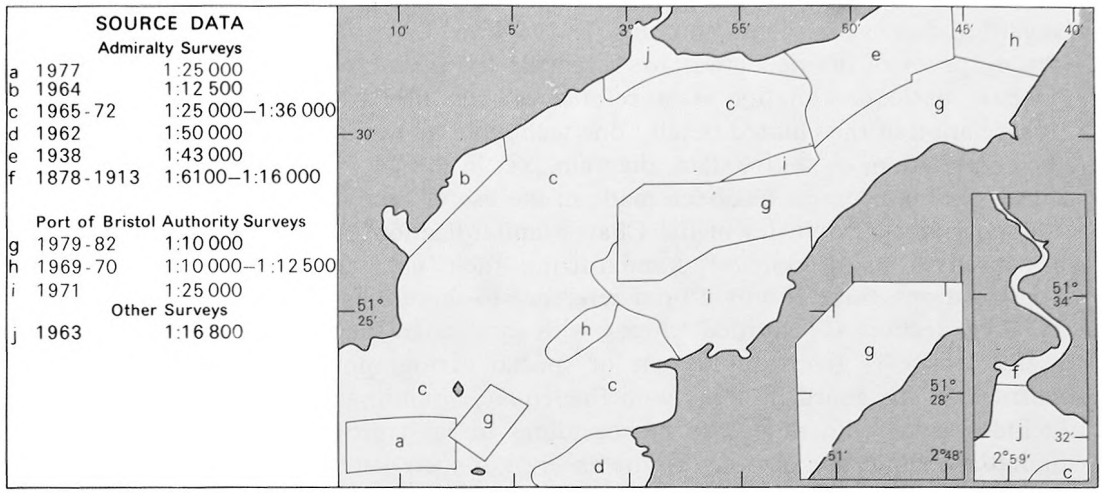

FIG. 2

chart itself — in this case chart 1176, Severn estuary, inner approaches to Bristol. The two inset plans, Newport and Redcliff Bay, are shown in their relative size and position. To avoid overloading the small diagram, it carries no graticule but the latitude and longitude ticks around the edge correspond to the meridians and parallels on the chart. So, if he wishes, the chart user can easily insert on the diagram, in pencil, a graticule which corresponds to that on the chart, thus facilitating correlation of locations under consideration. In inshore areas in particular, there may be so many sources that some have to be grouped under a single letter in the tabulation of SOURCE DATA.

This display can be compared with the more traditional way of recording the facts which was still in use when metric chart 1612, "Harbours and Anchorages on the east coast of England and Scotland" was compiled in 1974. The list in Fig. 3 draws attention to the fact that, unlike earlier Admiralty charts of British waters which were invariably based on surveys by the Royal Navy, modern charts depend on use of data from many sources.

It should be noted that the list did not give any indication of the scale of the survey, only its date. In the new edition of 1612, published in 1982, the list in Fig. 3 was replaced by a source data diagram similar in style to Fig. 2 which indicates the location of the various surveys, their dates, scales and, where appropriate, reference to "leadline survey".

Authorities: Berwick Harbour from an Admiralty survey of 1932. Eyemouth Harbour largely from a Hydraulics Research Organisation survey of 1955-6. Holy Island Harbour largely from an Admiralty survey of 1898. North Sunderland Harbour from an Admiralty survey of 1840 Runswick Bay from an Admiralty survey of 1898. Scarborough Bay largely from an Admiralty survey of 1901. Whitby Harbour from a local survey of 1967 inside the harbour and from an Admiralty survey of 1932 outside.

FIG. 3

Of even less help than the listing of surveys is the practice, frequently adopted on small-scale charts, of making a simple general statement "From the latest available information to 1984" when a significant part of this information may be of early vintage such as a reconnaissance or exploratory survey carried out in the early part of the 19th century. For example, when BA chart 2720, "The Flannan Isles to Sule Skerry", off Northwest Scotland, was originally published in 1979, the only source data information given was "From British Admiralty Surveys to 1971", even though some blank areas, broken depth contours and upright hairline soundings indicated that some inadequate material of a much earlier period than 1971 had been used in the compilation. The new edition of 2720, published in 1983, carries the much more informative source data diagram shown in Fig. 4.

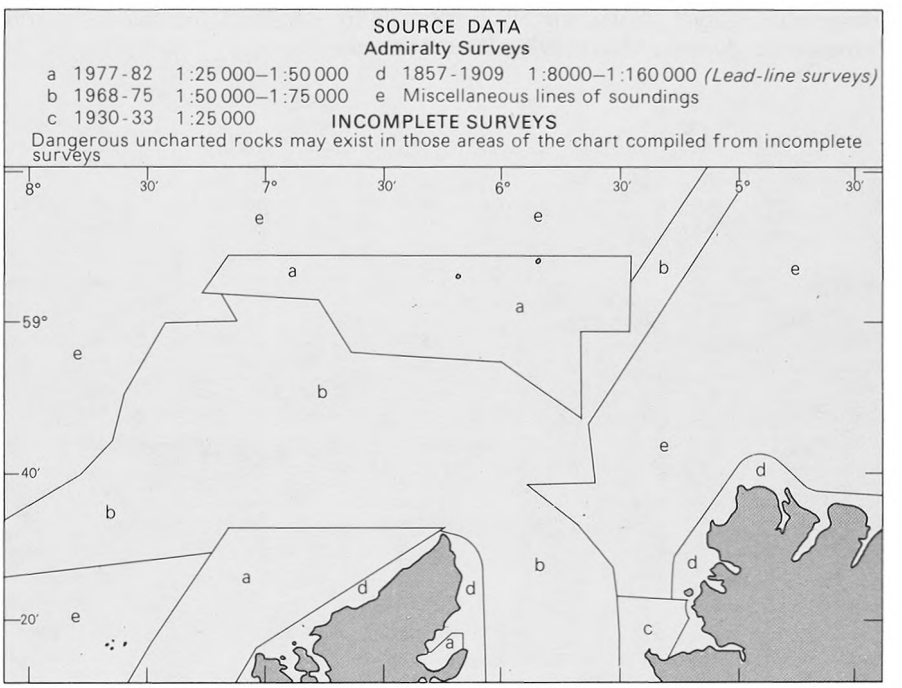

FIG. 4

It is now the policy of the U.K. Hydrographic Department to include source data diagrams on all charts for which the relevant information is available. It is apparent that other IHO members are also beginning to make use of similar diagrams, and examples have been noted on charts recently published by Australia, Canada, Denmark, India, Indonesia, Netherlands, New Zealand, Norway, Singapore, Spain and U.S.A. (DMA). Adoption of a policy by IHO via the Chart Standardization Committee, recommending member nations to include the source data diagram as a standard feature in all their published charts, would promote more widespread use of this technique and, thereby, provide the means of informing mariners more fully of the nature of the data incorporated in all the charts they are using.

REFERENCES

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