

Lewis Morris—an Early Welsh Hydrographer

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DURING the period prior to the formation of an independent surveying service as part of the Royal Navy, the making of hydrographic surveys was a haphazard affair often dictated by circumstances rather than as part of a well ordered and integrated scheme. Ordinary serving officers of the Navy were encouraged as part of their duties to obtain information relating to depths, sea-marks, time of tides, setting of the currents, &c.; especially when on a foreign station. In home waters, although the same directive applied, the Admiralty authorities also sought to improve the standard of charting by helping, and in some cases commissioning, private individuals to carry out hydrographic surveys of various parts of the coast. The valuable contribution made by these 'amateurs' is shown by the number of charts they produced, particularly during the first half of the eighteenth century. Although the printed charts have survived as a tangible record of their labours, little is known of the methods they employed and the difficulties that confronted them. In the case of Lewis Morris, however, the fact that he was an antiquary, literary scholar, philologist and mineralogist and attained greater fame in fields other than surveying, has meant that a considerable amount of his manuscript material has survived.¹ From a surveying standpoint this material includes a number of letters and memoranda sent by Morris to the Admiralty and other interested persons, the original manuscript plans of his survey of the Welsh Coast and a rough survey notebook in which he jotted down his observations while out in the field. The latter is probably unique as, for obvious reasons, field notebooks are inevitably destroyed as the finished product emerges. It is thus possible to obtain a well documented and comprehensive picture of the way in which a zealous individual like Morris set about the stupendous task of surveying hundreds of miles of coastline and inshore waters in the interests of safer navigation.

Lewis Morris was born in Anglesey in 1701 and as a youth he showed an aptitude for mathematics. His first opportunity as a surveyor came in 1724 when he was employed by Owen Meyrick, of Bodorgan, in making a series of estate surveys of the latter's holdings in various parts of Anglesey. The individual plans prepared by Morris are on varying scales and have been well executed in colour.² Although the surveys mainly covered inland situations, a number included stretches of the Anglesey coast. There is, for example, a detailed plan of Cemlyn Bay on the north coast of the island on a scale of seven chains to the inch. These estate surveys

of Morris are interesting in that obviously they provided him with practical experience of land surveying, experience which was to prove most valuable when he embarked on his much more ambitious hydrographic survey of the Welsh coast at a later date. In addition, his work so impressed Owen Meyrick that he was able to count on his former employer's assistance when he was trying to interest the Admiralty in his proposed scheme of charting.

After his appointment as a customs official in Holyhead in July 1729, Morris came into contact more and more with those engaged in sea trade with ports in south Wales and Ireland. At this time, owing to the deplorable state of the roads, commercial contacts between north and south Wales were almost entirely by sea, a situation which lasted until after 1750 when the Turnpike Trusts were formed.³ Morris was quick to realize that the charts then in use were inadequate and contributed to 'the melancholy account of shipwrecks and losses, so frequent on the coast of Wales'. As he wrote later in the Preface to his own atlas of harbour plans;

I cannot avoid observing in this Place that the English draughts of the coast of Britain and Ireland, which are now in the hands of Sailors and pass for new and correct charts, (I mean those that have come within the notice of my Observation) are evidently no other than imperfect Eye draughts, or else very corrupt copies of antient [*sic*] surveys; and which are on no account to be depended upon.

The solution, Morris argued, was to make a new survey of the whole of the west coast from Whitehaven as far south as Milford Haven.

The first reference to the proposal for an extensive hydrographic survey is contained in a letter which Morris wrote to Edward Samuel in October, 1736.⁴

Our Commissioners of ye Customs had once thought of sending me all around ye Sea Coasts, from Pembroke down to ye North to take an Hydrographical description of ye coast, but they dropt it, the charge being great and not to be done without ye consent of ye Treasury; I am put in a method to apply this winter to ye Boards of Admiralty and Treasury, and it is supposed it will be done: If so Please God, I shall come to ye Tops of some of your Hills to take Observations and make it my business to see you. But if this winter bears no fruit but Crabs as usual, adieu then.

The winter of 1736 only 'bore crabs' and it was not until June 1737, when in London, that he was able to put his proposed plan before the Secretary of the Admiralty. Although his ideas received lukewarm approval from the Lords Commissioners, a certain amount of opposition came from Liverpool shipowners who were already committed to supporting two local surveyors, Messrs Fearon and Eyes, for a survey from the Solway to the Dee with a possible extension along the Welsh coast. Morris received a copy of this 'Representation of ye Merchants of Liverpoole' desiring that his survey might be superseded in August when

he had already begun it but nothing came of this and he was allowed to continue, although his sphere of operation was reduced to that part of the Welsh coast lying between Llandudno and Milford Haven.

The survey was begun on 4 July 1737 and although Morris at a later date gave the Great Orme's Head as a starting point, it is clear from his own survey notebook, that on that day he was at Beaumaris and 'commenced an intended survey of ye Isles of Anglesey'.⁵ The following day he went to Holyhead where he spent the time preparing his instruments for the survey. Among the instruments he mentions is the 'waywiser' or wheel, for measuring linear distances on land. After these preliminaries had been completed, the survey proper began on 9 July at Holyhead with a series of bearings on prominent objects for fixing purposes. Morris had originally intended, as far as the marine part of the survey was concerned, to use a sloop of about 20 tons to be paid for out of Navy Account. The cost, he estimated, would be about £450 a year, made up as follows:

Five men's salaries at £20 per annum	£100	0	0
A mate	£30	0	0
Provisions, &c. for seven	£102	7	6
Yearly repairs to ye vessel at 30sh. per ton	£30	0	0
Surveyor's salary at 10sh. per day	£182	10	0
	<hr/>		
	£444	17sh.	6d.

As an alternative and less expensive method, Morris proposed to obtain the use of one of the Custom House cruisers 'but upon my application to the Commissioners of the Customs, this was not granted. Seeing that my own Masters would not give me any encouragement, with much difficulty I got my Lords Commissioners to allow me 5sh. a day, which I accepted of in order that I might show their Lordships a specimen of my Performance (tho' too scanty to bear my expenses as I told them).' With such a small allowance Morris probably had no alternative but to seek help from local boatmen when time and opportunity offered. Throughout the month of July 1737 he made his way along the south-west coast of Anglesey interspersing land mapping with small coastal surveys. Thus on 16 July Morris was at Rhoscolyn 'taking observations of ye coast bearing'. Three days later we find him at Llangwyfan Bay sounding and sketching in the coastal detail. The entry in his notebook for the day clearly shows that fixing by marine compass was the basis of his hydrographic surveying (Fig. 1). The isolated church situated on a drumlin in the centre of the bay was, even at that time, in danger from the sea and the protective walling around it can be seen in the sketch made by Morris. From Llangwyfan he continued south-eastward towards the southern entrance to the Menai Strait and by the end of the month his preliminary sea survey of that part of the coast between Holyhead and Caernarvon was complete.

Lewis Morris next began his land survey by making a traverse along the roads and tracks near the coast. In his own words 'The instrument I made use of for measuring distances was the wheel or waywiser. My Angles and Bearings I took by a Theodolite on which there is a Telescope mounted with a Spirit Level and Double Sextant. My Stationary Distances are all reduced to Horizontal Lines and in closing my Plan of

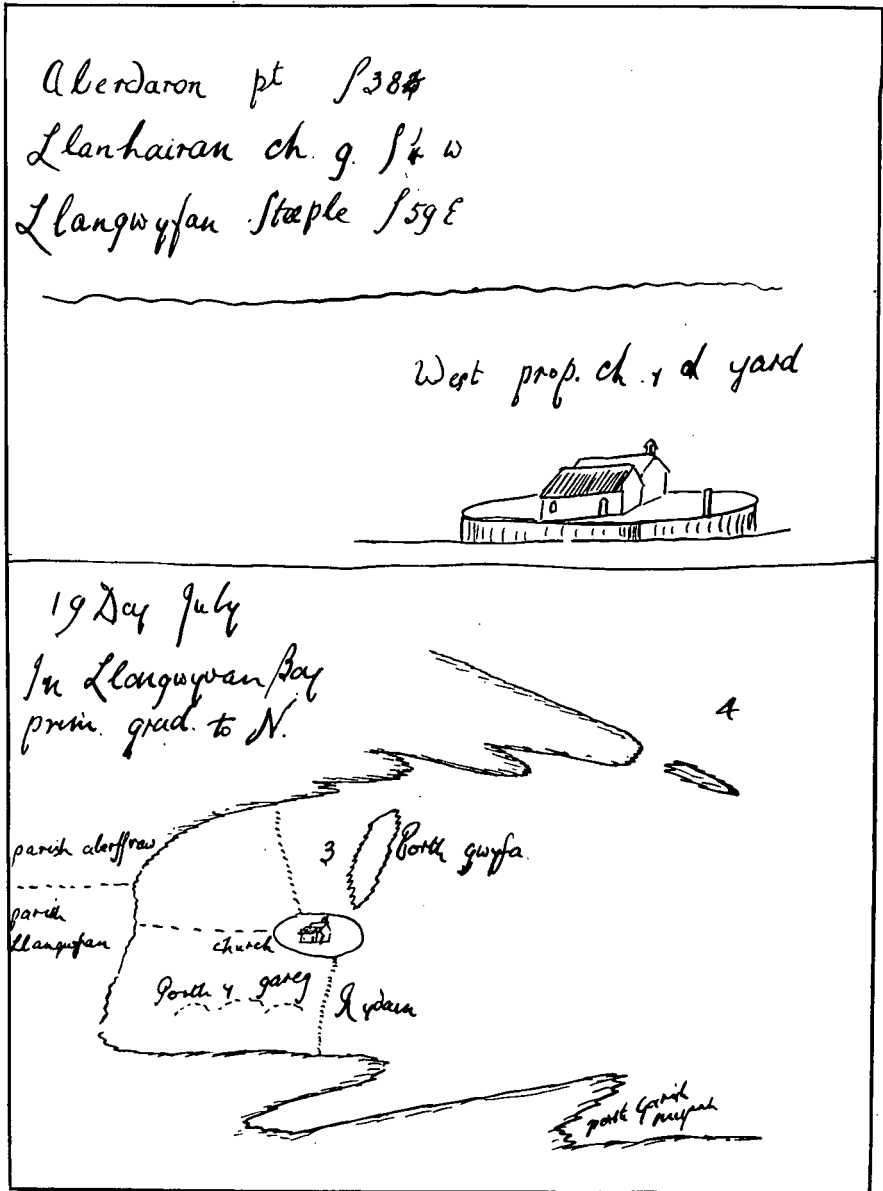


Fig. 1. A page of Lewis Morris's survey notebook covering part of the south-west coast of Anglesey (pp. 30-31 of Welsh Coast, Survey Notes, National Library of Wales MS. 607 D).

Anglesey, the Bearings and Distances agreed as Exact as in the smallest survey'.⁶ On the first day he covered a total distance of over nine miles and three furlongs, entering each observation and measurement in his survey book. Morris favoured the double-line method of recording his traverse observations and a page from his notebook is not unlike one of today for a quick route survey (Fig. 2). The rapidity of the survey is shown by the fact that within four days of leaving Holyhead he had reached the shores of the Menai Strait once again and on 9 August he was making




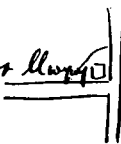


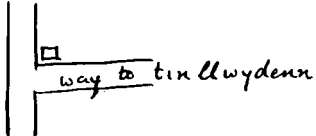

  H ^{os} ∞	<i>m. f. p.</i> 6:2:36	∞ Hoys 
	6:6:20	
Llangadwaladr Ch. v Glebe H ^o	0 129°	Snowden Hall 137½
	6:7:16	151° 45' 
Llanveiran Ch.		
Carn' ∞	7:1:0 7:1:12	way off to Llanveiran
	7:2:00	∞ H Bowen

Fig. 2. Part of the chain survey notes made by Lewis Morris covering the road from Aberffraw to Hermon Cross roads (pp. 122-123 of Welsh Coast, Survey Notes, National Library of Wales MS. 607 D).

angle observations with a theodolite from the Eagle Tower of Caernarvon Castle. From there he proceeded along the shores of the Menai Strait reaching Llanvair by the 15th of the month. At this point the entries in his notebook end but it is apparent that Morris continued his observations until 8 October when the Navy Board paid him £19 to cover his 76 days of survey at the rate of 5s. a day.

Up to this stage the survey operations had gone relatively smoothly and Morris was able to spend the winter of 1737 in Holyhead working on his observations and preparing an initial draft of his survey. When the latter was complete he was able to forward to the Admiralty a manuscript folio containing eleven charts with accompanying sailing directions. The charts were on varying scales ranging from 1 in. to a mile for the general survey of the whole island to 33 in. to the mile for a detailed plan of the harbour at Holyhead. The eight charts covering the coast of Anglesey and the mainland between Conway and Caernarvon Bar were drawn on a scale of 2 in. to a mile (Fig. 3). Morris titled his folio *Cambria's Coasting Pilot* and as it was intended 'to show my Lordships a Specimen of my Performance' it ended with a plea for continued support.

I humbly lay these my first Essays before your Lordships both as being your own Right and to show the usefulness of a survey of the Kind and though these charts are not so perfectly completed in the Variety of Soundings, motion of Tides and Appearance of Land from Sea, as I could wish, and as they shall be before they are made publick (my time this Season not permitting and by reason I was not able to bear the Expense of a Vessel). Nevertheless your Lordships will be able to Judge by what is done, to what perfection a survey may be brought if due Encouragement is given to enable me to go on. I humbly hope your Lordships will take this into account and give me what additional assistance your Lordships shall think proper, either in allowing me a small Vessel or a supply to enable me to Hire one, as to your Lordships Superior wisdom shall seem meet.

Up to that time, Morris had overcome the difficulty of not having a vessel by calling on the assistance of 'the most antient seamen and fishermen and others in the neighbourhood to give me the proper Names and the best account they could, of Sunken Rocks, Shoals, &c. additional to my own knowledge of the coast from the Experience and observation of many years; These Men I have hired with their Boats, who went with me upon the very Rocks, &c. to take Bearings and Soundings as far out to sea as was safe to go in such small vessels'. The plea for a vessel by Morris was ignored by the Admiralty authorities and there followed a period of frustration during which time he made repeated requests for assistance. Thus in May 1738, at the beginning of a new surveying season he wrote to the Secretary of the Admiralty but received no reply. A further letter of 13 July met a similar fate. Meanwhile, encouraged somewhat by verbal assurances that all would be well, Morris continued his charting, combining a land survey with whatever observations he was able to make at sea. By the end of August he had reached as far south as Barmouth and

he was again moved to write to the Secretary of the Admiralty 'desiring to know whether I was again to proceed on my survey or to desist, as I depended on their Lordships goodness for a further encouragement and that I could not go on with sea observations without an allowance for a boat and hands'. On this occasion he received a reply from Mr. Burchett, Secretary to the Admiralty,

by word of mouth from Mr. Whormby (of Trinity House) that he thought it proper I should go on in ye Land Survey till my Lords Commissioners of ye Admiralty were at leisure to consider it, and when he saw convenient he would lay my letters before the Board. He owned that I ought to have a Boat and Hands, but thought four men sufficient to take my observations. Upon this I proceeded to ye south as far as Strumble Head in Pembrokeshire.

In November Morris returned to Holyhead and again spent the winter digesting his observations and making fair copies of his surveys, although they were, in his own estimation, 'Imperfect for want of a proper vessel to take ye sounding, setting of ye tides, prospect of ye Coast, &c.' As soon as conditions were suitable for hydrographic surveying once more, Lewis Morris renewed his request for a vessel but again his letter was ignored. Worse was to follow for on 20 May 1739, his employers, the Commissioners of the Customs, ordered that he was to have no further leave of absence without the express wish of the Lords of the Admiralty. As this was not forthcoming Morris was forced to abandon his scheme of charting, at least temporarily and nothing further was done during the summer of 1739. The situation remained in this static state for a further two years during which time Morris tried once again to persuade their Lordships to provide him with an adequate survey vessel and also pay him the £50 owing for the survey work during the summer of 1738.

It is likely that the coastal survey of Wales would have remained in this uncompleted state but for the timely intervention of Owen Meyrick who, it will be recalled, had once employed the young Morris as an estate surveyor. Meyrick was able to use his influence with Thomas Corbett, M.P. at the Admiralty Office to persuade him to place the matter before the Board. The great stumbling block was the provision of a vessel and it is not clear whether Morris succeeded in this request even when the survey was resumed in 1742. A letter dated April 1743 contains the statement that Morris had offered to buy a prize sloop from the Customs Board for £43 10s. and that it should be sold to him provided 'that nobody will give more'. The subsequent correspondence does not tell us whether Morris was successful but it is noteworthy that his later surveys of the Pembrokeshire coast, including Milford Haven, were more accurate and contain more hydrographic information than his earlier charts of the coast of North Wales. In 1744 when Morris had reached as far as Tenby, the war with France brought the survey to a halt and it was never resumed. As he had never really intended proceeding beyond Milford, to all intents the project was complete. The fact, however,

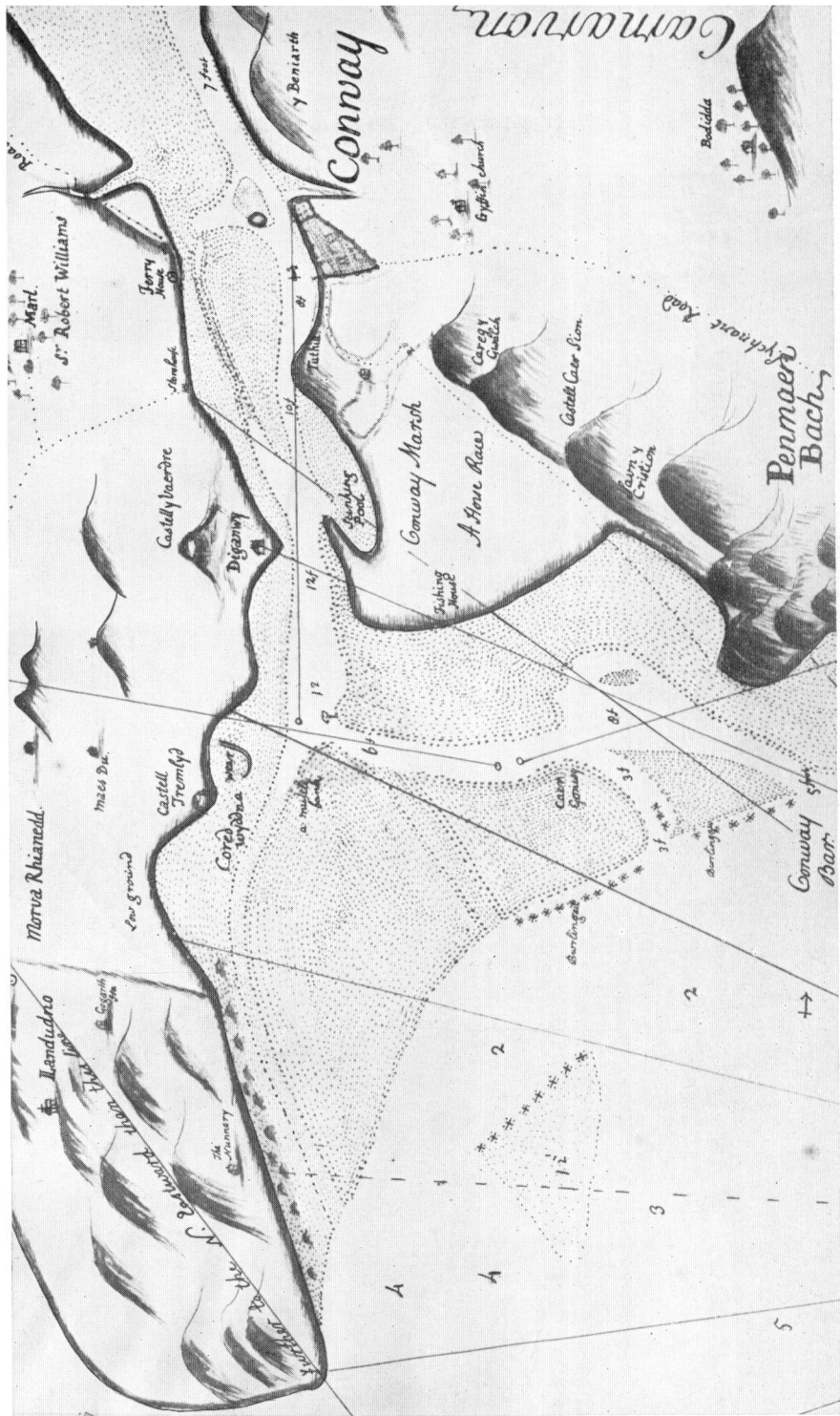


Fig. 3. Part of one of the manuscript surveys in Cambria's Coasting Pilot.

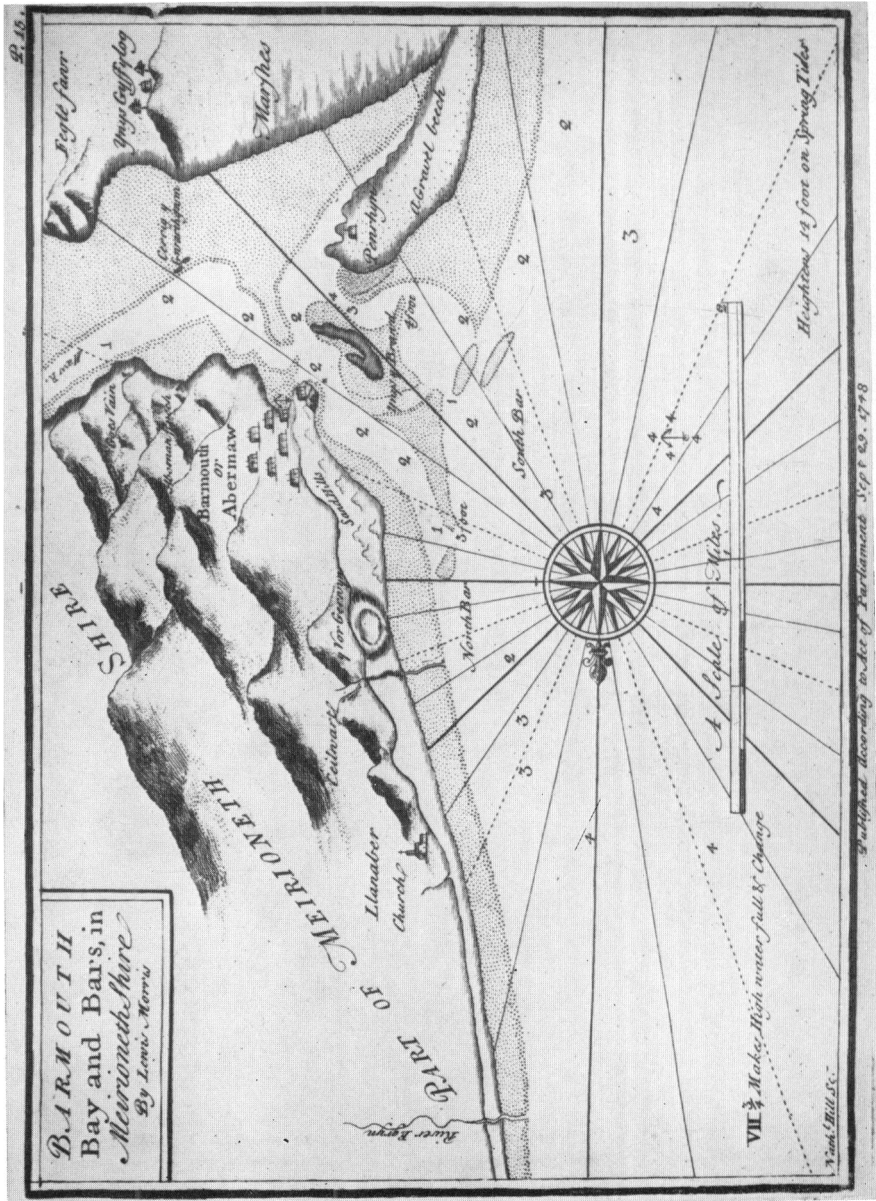


Fig. 4. One of the plans contained in Plans of Harbours, Bars, Bays and Road in St. George's Channel, published September 1748 by Lewis Morris.

that the Admiralty gave as a reason for not publishing the charts straight away that the surveys were still incomplete suggests that Morris might have extended his original plan so as to include the Bristol Channel coasts, had more favourable conditions prevailed.

After the practical survey was completed Morris returned to Holyhead where once again he spent some time drafting his surveys and making a fair copy of his charts. These were then sent to the Lords Commissioners of the Admiralty as the second volume of *Cambria's Coasting Pilot*. The Admiralty at this time, however, were preoccupied with other matters and the whole project was shelved for the next few years. In the intervening period Morris was not inactive and he began to make enquiries about the publication of his charts. As was the customary practice at that time, Morris was allowed to have his charts engraved privately, the expense being met out of the subsequent sales. As early as 1742, when it looked as though the survey would never be completed, he visited the eminent engraver, Emmanuel Bowen, at the Progress of Ye Ship in Smithfield, London and discussed with him the cost of buying copper plates, their engraving and prints pulled from them. The scale of charges as noted by Morris was as follows:⁷

	£	s.	d.
1. Elephant paper for Maps and agree to have the outside Quires compleat, to be bought per Ream	2	0	0
2. Each plate of copper polished of the size of a sheet of Elephant (i.e. 27" × 22") per pound		2	4
3. Engraving the maps of South Wales	50	0	0
4. Being six sheets of Elephant and the cost of a seventh for Arms and Decorations, which comes per sheet or plate	7	3	0
5. Close work, such as the map of England, the size of an Elephant sheet, the graving	10	10	0
6. Open work such as Sea charts of ye coast will be done per Elephant sheet from three to four		3	10
7. Printing this size per hundred prints, being about a days work		6	0

Any intention Lewis Morris might have had of continuing the survey faded as the years passed since he was last surveying in Tenby Roads. In 1748, therefore, he resolved to issue his charts as they stood and once more he went to Emmanuel Bowen to discuss the engraving and printing. The economic climate at this time was much more favourable, so much so that the Admiralty was anxious that Morris should not only publish his general chart of the Welsh coast and St. George's Channel but also his plans of harbours and bays as well. The latter, Morris tells us, were prepared originally for his personal use 'to refresh my memory in case of Storms or other sudden Disasters, when on my Survey'. Morris acceded to the wishes of the Lords Commissioners and a small volume of 25 plans measuring 10 in. × 7 in. and on scales varying from $\frac{1}{2}$ in. to 8 in. to a mile was published at the same time as the general chart in September

1748 (Fig. 4).⁸ Both proved popular and in great demand with subscribers for the atlas of harbour plans numbering 1230.

The harbours chosen by Morris for inclusion in his atlas were determined by their usefulness from a trading and navigational standpoint. He undoubtedly surveyed many other harbours and creeks and although he stated that 'these may possibly be made public hereafter', they were in fact never published and remain in manuscript. Morris also made a survey of Aberystwyth Roads in connection with a scheme to build extensive harbour works in the bay but although this was superior to the chart included in the volume of harbour plans, it, too, has lain unpublished.⁹

The standard of accuracy achieved by Morris in his charting is not great but this is to be expected in view of his limited resources especially for the marine part of the survey. Set against contemporary charts of adjacent areas, for example those of Fearon and Eyes covering the Lancashire coast, they compare favourably. The hydrographic survey of the coast of Wales was one of the earliest in which a theodolite was used for fixing landmarks. It antedates, by almost a decade, the better known survey of the Orkney Isles by Murdoch Mackenzie (senior) where similar attention was paid to an accurate land survey as an essential preliminary to the truly marine part of the survey. This insistence on the part of Morris for a detailed survey using the most accurate instruments then available is all the more remarkable when it is remembered that he was largely self-instructed in the art and science of surveying. Although he picked up the rudiments of land surveying while employed at Bodorgan, his knowledge of hydrographic surveying must have been largely gleaned from books and not as the result of serving an apprenticeship under the watchful eye of an experienced marine surveyor. It is interesting to note that when an inventory of his library was made just before his death in 1765, books on navigation and survey figured prominently in the list. At the end of his life, he had in his possession copies of the following books:

- Great Britain's Coasting Pilot* by Greenville Collins, 1693
- Hondius's *Atlas*, Volume 2, 1636
- Leybourne's *Surveying*, 5th edition, 1722
- Newhouse's *Navigation*, 1718
- Dr. Dee's *Preface* and Bourne's *Inventions*
- Figure of the Earth*, 1738
- Norwood's *Doctrine of Triangles*, 1631
- Benjamin Martin's *Logarithms*, 1740
- Seller's *Navigation* 1669 and 1718
- Whiston's *Longitude*, 1714
- Bohun's *Geographical Dictionary*
- Digges's *Pantometria*, 1571
- Lambarde's *Perambulation of Kent*, 1656
- Kelly's *Navigation*, 1727
- Barlow's *Survey of Tides*, 1715
- Wilson's *Navigation*, 1736

Further evidence that Lewis Morris was well versed in the many facets of navigation is provided by the MS. notes which accompanied his *Cambria's Coasting Pilot*. In Volume 1 Morris compared the merits of the plain and Mercator chart.

Many of particular provinces or small tracts of land are generally laid down with their meridians and parallels in right lines and equidistant which is called the Plain Chart Projection, the inclination of the meridians towards the Pole being insensible in short distances. But when any large tract from north to south is to be projected it must be done by enlarging the degrees of latitude proportionately towards the Pole (otherwise the Bearing of Places will not correspond with their distances) which is called Mercator's or Wright's projection. Of the first kind is the following survey which method is found more commodious for the Coasting Pilot.

In Volume 2, the manuscript notes are much fuller in scope and there are twelve chapters covering such subjects as the variation of the compass, the motion and velocity of the tides, tide tables and their construction, a table of civil and lunar months for the years 1743 and 1744 and its use in the calculation of the tides.

Even before the publication of his chart and plans in 1748, Lewis Morris had, to all intents, retired from the hydrographic scene. His wide range of interests inevitably led him into new fields and after a short period as Superintendent of Crown Lands in Wales, he was appointed as Superintendent of Lead Mines in Cardiganshire. In this capacity he prepared a large plan on a scale of three inches to a mile (approx.) showing the lead mines of North Cardiganshire at the request of Thomas Wallis, the Surveyor General of H.M. Land Resources, a testimony of his continued interest in cartography if not specifically in hydrography.¹⁰ Meanwhile, his charts were in great demand and we are told by his son, William, that by 1761, all were sold out. They remained the standard equipment for the navigation of the Welsh coast until the end of the eighteenth century and even then it was thought worthwhile to issue a new edition of both the general chart and the atlas of plans. His son, William, undertook the revision and although he had the harbour plans re-engraved, they were not significantly altered even though by this time they must have been considerably out of date. William Morris, however, added a number of fresh charts of those ports of the coast not previously covered by his father. In North Wales a chart of Liverpool Bay was included as well as a plan of Amlwch Harbour in Anglesey, the latter having assumed great importance in connection with the export of copper ore from the nearby Parys Mountain. Along the Bristol Channel coastlands, plans of Carmarthen, Burry Roads and Swansea Bay were included in the 1801 edition. In spite of these additions, the newly revised atlas did not have the success of its predecessor for by now the era of official hydrography was about to begin and finally seal the fate of the 'amateur' hydrographer.

ACKNOWLEDGMENTS. The author wishes to express his gratitude to the librarians at the Admiralty, the National Library of Wales, and University College, Bangor for providing facilities for examining documents relating to Morris's surveys. Thanks are also due to Professor E. G. Bowen for help and encouragement in the present study.

NOTES AND REFERENCES

¹ His manuscript material is now scattered, documents relating to his activities as a hydrographer being preserved in the Admiralty Library, British Museum, National Library of Wales and the library of University College, Bangor.

² Survey of Bodorgan estate 1724-27, Bodorgan MS. 1579. University College, Bangor.

³ E. G. Bowen (editor) *Wales, a Physical, Historical, Regional Geography*, 1957, p. 220.

⁴ H. Owen (editor) *Additional Letters of the Morrisises of Anglesey*, Y Cymmrodor 49, Part 1, p. 49.

⁵ *Welsh Coast, Survey Notes*, National Library of Wales, MS. 607A.

⁶ Preface to *Cambria's Coasting Pilot*, Volume 1, Admiralty Library Ve 76.

⁷ Lewis Morris, Additional MS. 604D, p. 58 National Library of Wales.

⁸ Both the general chart and the atlas of harbour plans achieved a wide circulation and copies exist in the British Museum, Admiralty Library, National Library of Wales and the Library of the Royal Geographical Society.

⁹ Additional MS. 14908, British Museum.

¹⁰ Lewis Morris, MS. Plan of Lead Mines in North Cardiganshire, Map Room of the National Library of Wales, Aberystwyth.

Professor E. G. R. Taylor writes:

Mr. Robinson's valuable paper will invite many readers to scan afresh the magnificent collection of marine charts assembled by Miss Blewitt in *Surveys of the Seas*. They may refer, too, to the useful background material in the chapter on Cartography contributed by Mr. R. A. Skelton to Vol. IV of Dr. Singer's new *History of Technology*. It would be interesting to know whether Lewis Morris mentions the maker of his telescopic theodolite which he must have procured in London. Whether also he has anything to say about how he fixed his position when observing from a boat. Murdoch Mackenzie is the first to describe the station-pointer by which an off-shore point could be determined by resection. He used besides an accurately measured base line and a system of triangles which made his charts much superior to any that Lewis Morris could draw from his running traverse. Captain James Cook also made himself master of the method of triangulation about twenty years after Morris and his fine charts of Newfoundland and St. Lawrence waters were the result. Morris's work is transitional between such charts as these and the disappointing work of Greenville Collins.

The Welshman's book-list is very intriguing. Did the pioneer Elizabethan textbook *Pantometria* lie on his father's shelves and give him his taste for applied mathematics? Or did he get this with other old books at the popular London book auctions? William Bourne's *Inventions and Devices* goes back to 1578, while John Dee's *Mathematical Preface* written for the first English Euclid first appeared in 1570, but was more than once reprinted as a separate book.

William Lambarde's *Perambulation of Kent* was a topographical work with a county map, published in 1576, and did not deal with surveying. The first edition (1669) of John Seller's *Navigation* is now a great rarity, but it was often reprinted, as were the writings on the same subject of Captain Daniel Newhouse, Henry Wilson and Joshua Kelly. The last two were among the earliest school-masters aboard ship.

Among Lewis Morris's contemporaries, William Whiston (expelled from Cambridge) had become a popular lecturer on applied mathematics. He had played a part in the establishment of the famous prize for the longitude, but his own book on the subject did not win it. Benjamin Martin was also a prolific lecturer and writer, although by profession an optical instrument maker in Fleet Street. The work entitled *The Figure of the Earth* was the English edition of M. de Maupertuis' *Discourse* on that subject delivered to the French Academy of Sciences after his return from measuring an arc of the meridian in Lapland. The French savant pays generous tribute to Richard Norwood (one of whose books Morris possessed), for Norwood, a surveyor and teacher of navigation, had earlier made a remarkably close measure of the degree. Altogether Morris's mathematical bookshelf well matches Mr. Robinson's description of him as an antiquary and literary man as well as a public-spirited chart-maker.