

## **Walter Hoxton's 1735 description of the Gulf Stream**

**by P. L. Richardson<sup>1</sup>**

### **ABSTRACT**

In 1735 Walter Hoxton, on his chart of Chesapeake Bay, gave an early and accurate description of the western Gulf Stream. Hoxton's pioneering measurements by ship-drift of the mean limits, direction and speed of the Gulf Stream were the first to show that the Stream is a narrow, swift boundary current which leaves the coast near Cape Hatteras and turns eastward near 38N latitude. The Hoxton description of the Stream antedates by 35 years the Franklin-Folger chart of the Stream.

### **1. Introduction**

Benjamin Franklin and Timothy Folger prepared the first chart of the Gulf Stream generally recognized to be good and had it printed in 1769-70. Thirty-five years before that, however, a remarkably good description of the western Gulf Stream was published by Walter Hoxton on a chart he made of the Chesapeake Bay dated 1735. Although the geographical limits of his chart did not extend offshore to the Gulf Stream, positions, directions and speeds of the currents are given so that they could be added to charts of the Atlantic by mariners themselves. When Hoxton's description is plotted, the result is an accurate picture of the western Gulf Stream (Fig. 1). On his chart Hoxton refers to the "Northeast Current"—the name Gulf Stream, used by American fishermen, was only later (in 1762) adopted by Franklin for this current (DeVorse, 1976). Hoxton's early description is scientifically and historically noteworthy because it is the first known to show the Gulf Stream to be a narrow and swift western boundary current that flows northeastward past Cape Hatteras to 38N latitude where it turns eastward.

### **2. Walter Hoxton**

Walter Hoxton was born in 1699 and lived in Poplar, in the County of Middlesex, England (now part of London) (Reid, 1952). He was the son of another Walter Hoxton, ship captain in the London-Chesapeake trade. In 1725 the younger Hoxton was first mentioned as a ship captain engaged in shipping tobacco from Maryland to his cousins John and Samuel Hyde of London. In 1734 Hoxton was

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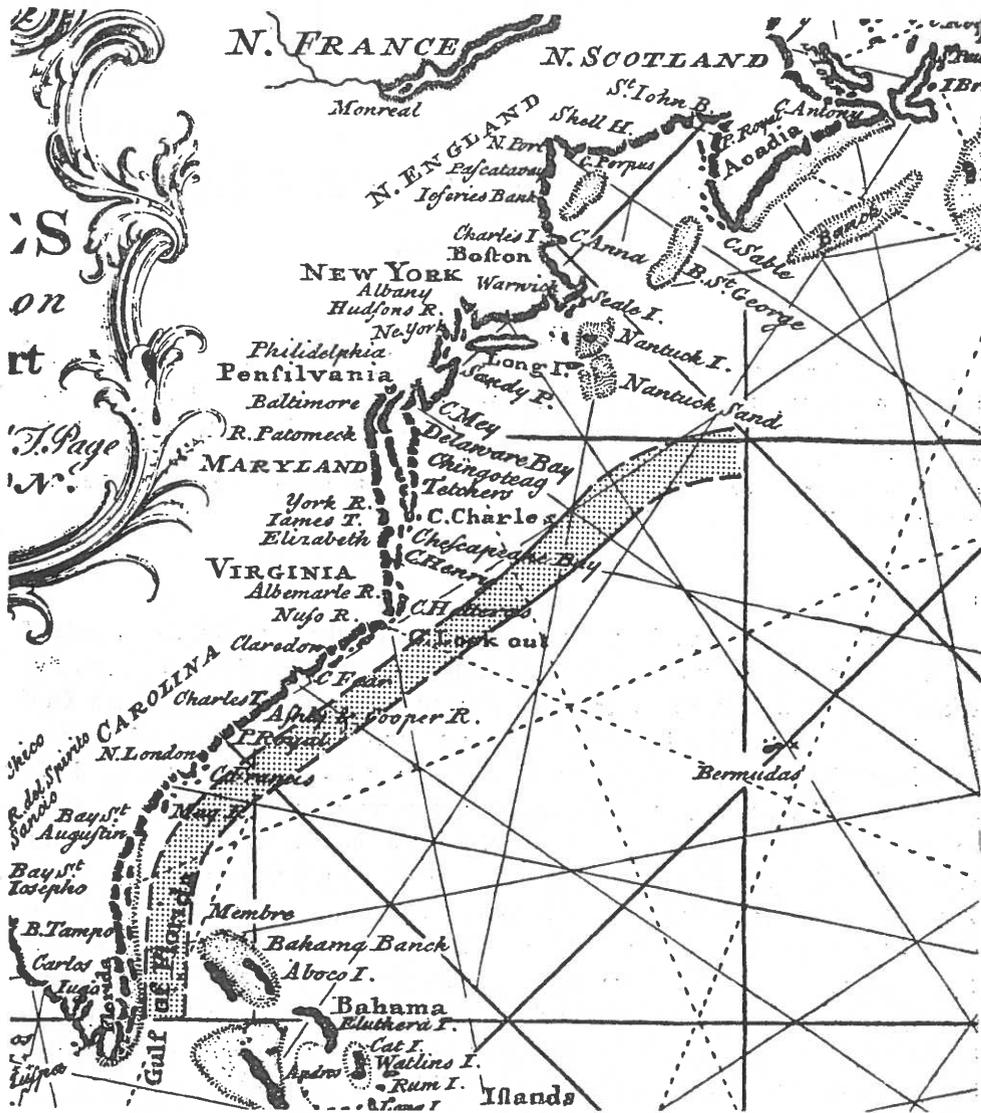


Figure 1. Chart of the Gulf Stream based on Walter Hoxton's description of this current given on his 1735 chart of the Chesapeake Bay. Solid lines run through Hoxton's listed limits of the Stream, dashed lines are from his comments. The width of the Stream east of Cape Henry is approximately 100 km. Base chart is one a mid-18th century navigator might have used; it is titled "The Generall Chart of the West Indies on E. Wrights projection" and is from the English Pilot, The Fourth Book, London, 1749, plate 3 (courtesy of The British Library).

commander of the ship *Baltimore* which carried 900 hogsheads of tobacco and had a crew of 35 men. He had two plantations—600 acres on the Eastern Branch of the Potomac and 100 acres in Anne Arundel County.

### 3. Hoxton's 1735 Chesapeake chart and description of Gulf Stream

The Hoxton chart was the first large-scale mariner's chart of Chesapeake Bay which gave detailed soundings and sailing directions. An earlier mariner's chart, Thorton and Fisher's chart of Virginia, Maryland, Pennsylvania and New Jersey, published in 1706, is on a small scale and was probably not much aid to navigation. Hoxton's chart was an excellent piece of work, perhaps the best hydrographic chart of any part of colonial America at that time (Middleton, 1953).<sup>2</sup>

In the upper left corner of the Hoxton map is the following legend: To the Merchants of London Trading to VIRGINIA and MARYLAND this Mapp of the BAY of CHESEPEACK with Rivers Potomack, Potapsco North East and part of Chester is humbly Dedicated & Presented by Walter Hoxton, 1735.

To the right of the legend are the following notes concerning the Gulf Stream: An Attempt towards Assertaining the Limits Course & Strength of the North East Current on the Coast of VIRGINIA.

It is generally known by those who Trade to the Northern parts of America that the Current which comes out of the Gulph of Florida runs constantly along the Coast of Carolina and Virginia and considerably further to the Northward varying its Course as it is obstructed by the Shores.

Now if the said Current always runs nearly in the same part or space of the Ocean (as from a great Number of Tryals and Observations which I have made in 23 Voyages to Maryland, I have reason to think it does) the knowledge of its Limits Course and Strength may be very useful to those who have occasion to sail in it as:

1st. Those who are bound to the Northward may make use of it to their advantage, and those bound to the Southward may know how to avoid it, and for want of this knowledge many ships bound to Virginia have been driven to the Northward of the Capes contrary to Expectation, and so lost the benefit of a Southerly Wind which might have carried them in.

2d. When by observations of the Lattitude or Tryal in your Boat you find you are in the Current, the Part of the Ocean it runs in and your Lattitude being known, you may judge pretty nearly your distance from the Land. In the Current are strong Riplings & if the Wind blows between the N<sup>o</sup> & E<sup>t</sup> it make a very Irregular & Dangerous Sea.

2. Hoxton printed his chart in London; it was sold by W. Betts and E. Baldwin. Four examples of the chart are known—two in the British Museum, one in the Public Record Office, London, and one in the Maryland Historical Society (Middleton, 1953). The chart and notes on the Gulf Stream were copied by Anthony Smith and issued by Sayer and Bennett in London in 1776. Smith's version was reproduced by the U. S. Defense Mapping Agency in 1979.

Underneath I have set down the Eastern & Western Limits or bounds of the said Current from Latt<sup>d</sup> 35°00'N<sup>o</sup> to Latt. 37°30'N<sup>o</sup> according to my Observations, which it may not be amiss to Prick down in your General Charts, and draw the boundary Lines and altho I may probably Err a few Leagues, yet I doubt not but it will be of service to Brother Mariners (especially to those who are Strangers to this Coast) and by their further Observations its Limitts may perhaps hereafter be more exactly known.

Latt <sup>d</sup> N <sup>o</sup>	Western Limits Diff. Longitude from Cape Henry	Eastern Limits Diff. of Longitude from Cape Henry	Breadth of the Current East & West in degrees of Longitude
35° 00'	1° 20' E <sup>t</sup>	3° 00'	1° 40'
35° 30'	2° 09' E <sup>t</sup>	3° 50'	1° 41'
36° 00'	3° 10' E <sup>t</sup>	5° 10'	2° 00'
36° 30'	3° 50' E <sup>t</sup>	5° 50'	2° 00'
37° 00'	4° 30' E <sup>t</sup>	6° 30'	2° 00'
37° 30'	5° 10' E <sup>t</sup>	7° 17'	2° 07'

The Current setts in the above Lattitudes N<sup>o</sup>E<sup>t</sup> (variation allow'd) about 32 miles in 24 hours but in Latt<sup>d</sup> 38°00'N<sup>o</sup> it turns off more Easterly. There is no Current between the N<sup>o</sup>E<sup>t</sup> Current and the Soundings, but in the Soundings is a Southern One which runs Generally about half a mile p Hour, tho Sometimes Stronger.

Also to the Eastward of the N.E. Current there is a Southern Current of about half a mile p hour, and much broader than the N<sup>o</sup>East Current.

#### 4. Discussion

Hoxton's description of the Gulf Stream is the result of one man's efforts to systematically and accurately measure the set of his ship during twenty-three cruises that crossed the Stream. Using this technique he was able to infer the average location, size and speed of the Stream. He also described the countercurrents found on both sides of the Stream.

Hoxton's velocity observations consisted of the northward set in the Stream determined from the difference between latitude sights and dead reckoning positions. Since chronometers had not yet been introduced, it was impossible for him to measure longitude accurately enough to determine eastward current set. He inferred the northeastward current from the direction of the edges of the Stream; the positions of each edge he could get by knowing their distance from shore based on dead reckoning. A letter by Hoxton, dated December 29, 1731, and read before the Royal Society of London sheds some light on his technique of navigation (see Elton, 1732). The letter concerned Hoxton's comparison of a quadrant with a

levelling bubble to his Davis's quadrant which he evidently used regularly. "And I further declare that I observed with your quadrant both by the sun and stars in all various sorts of weather I met within my late voyage to and from Maryland (without regarding the horizon) with as great exactness as with Davis's when the sun and horizon were clear." Thus Hoxton was obviously concerned with accurate navigation and was one of the first navigators to use a bubble quadrant at sea. Probably it helped him to obtain more frequent fixes and current measurements.

Hoxton's estimate of the mean speed of the Stream, 1.3 knots or 32 miles in 24 hours as he gave it, and his estimate of the speed of the inshore countercurrent, 0.5 knots, are equivalent to the speeds given by a recent atlas that shows ocean currents measured by the ship drift technique (Naval Oceanographic Office, 1978). Although he correctly describes a countercurrent on the offshore side of the Stream, his value (0.5 knots) is larger than those usually given for that region. The mean speeds represent values averaged between successive fixes, usually one-half to one day apart, and over many cruises. Greater speeds than these are found in the narrow high speed core region of the Stream—4 to 5 knots.

Hoxton's location of the Stream matches well with modern determinations from drifting buoys and subsurface temperatures (Richardson, 1981); it also accords with measurements made from ship drift (Wyrski *et al.*, 1976; Naval Oceanographic Office, 1978) although his charted width (100 km) is narrower than that frequently given for the mean Gulf Stream. It is clear that Hoxton gave the limits of the higher speed central region of the Stream, and was not describing the outermost limits of the northeastward velocity.

Hoxton's picture of the Gulf Stream was apparently ignored by the British (and has since been ignored by oceanographers). It was up to Benjamin Franklin and Timothy Folger in 1769-70 (Franklin, 1786; Richardson, 1980a,b) to plot the course of the Stream in order to try to prevent British packets from stemming it on their way to the American colonies. At nearly this same time DeBrahm (1772, see DeVorse, 1976) published his chart of the Stream, also to aid mariners. It is entirely possible that DeBrahm and Franklin had seen Hoxton's Chesapeake chart and that they made use of it in constructing their own cartographic descriptions of the Stream. DeBrahm was Surveyor-General of the Southern District of North America, the region from the Potomac to Florida, and he should have been well acquainted with the chart.

Each of these first three views of the Stream was drawn from different kinds of measurements. Hoxton's, as we have seen, was based on northward ship drift, Franklin and Folger's was based on Nantucket whaler's knowledge (whale captures along the Stream, relative drift between ship and whaleboat), and DeBrahm's was apparently the result of visually following the Stream on a single cruise from South Carolina to 38.5N and then extrapolating its course eastward. A comparison of these three charted Gulf Streams (Fig. 2) shows that DeBrahm's diverges from

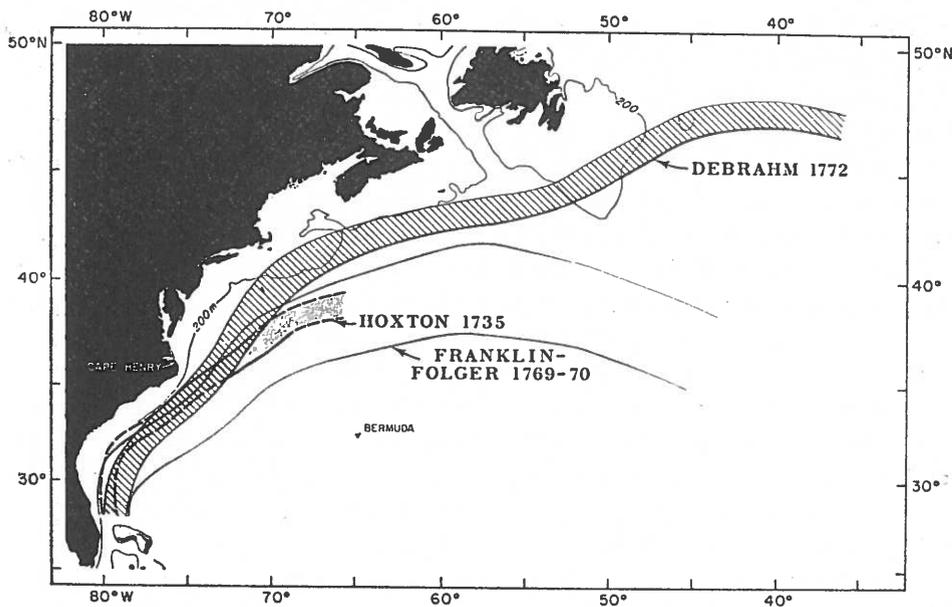


Figure 2. Superposition of three early views of the Gulf Stream. Hoxton's (1735) was based on northward ship drift, Franklin and Folger's (1769-70) was based on Nantucket whalers knowledge (whale captures along the Stream, relative drift between ship and whaleboat) and DeBrahm's (1772) was apparently the result of visually following the Stream from Florida to 38.5N and then extrapolating its course eastward. Since the longitude of land on the DeBrahm and Franklin-Folger charts is in error in several places, distance from shore to the Gulf Stream was used along the east coast from Florida to Cape Hatteras. Hoxton avoided the longitude problem by giving his limits of the Stream relative to a nearby known point of land, Cape Henry.

the others by running more northward and crossing Georges Bank and the Grand Banks of Newfoundland. On his chart, DeBrahm showed the Stream to run along the southern edge of the Newfoundland Banks which he incorrectly plotted nearly 9° west and 1° north of its real position. The incorrect location of the Stream flowing over or against the banks could have misled mariners and might have caused those sailing westward to deviate their course southward and into the real location of the Stream.

Both Hoxton and Franklin and Folger agree on the (correct) general location of the Stream; the major discrepancy is one of width. The difference is probably that Franklin and Folger were attempting to show the edges of the time varying Gulf Stream whose envelope of meanders increases eastward to 55-60W (Niiler and Robinson, 1967; Hansen, 1970; Richardson, 1981). Hoxton was evidently using a higher threshold velocity in order to delineate the edges of the time-mean Stream.

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