

Did the *Half Moon* ever reached Albany?

by Patrick Landewe, Saugerties Lighthouse Keeper
MA, American Studies, Saint Louis University

Henry Hudson's voyage on the *Half Moon* in 1609 is a foundational story for New York State, yet many basic facts about the journey are still in dispute. One of the foremost questions persists as a longstanding source of confusion: how far upriver did Henry Hudson sail in the *Half Moon*? Basically, there are two competing interpretations. One interpretation was outlined by Samuel Miller in 1809 to commemorate the bicentennial of Hudson's voyage, stating: "It is evident, from the whole account, that the boat [not the ship] went as far as where the city of *Albany* now stands."¹ In 1824, Joseph Moulton and John Yates argued for the rival interpretation that the ship itself reach Albany, and the boat went higher up.² Many historians and biographers are strategically vague so as to dodge this question. Those that do offer an answer often naively side with the Moulton-Yates interpretation that the *Half Moon* reached Albany. However, an examination of primary documents reveals that the preponderance of evidence favors the Miller interpretation and demonstrates that the ship *Half Moon* reached a point near Kinderhook while the ship's boat with a handful of crew members ventured to the vicinity of present-day Albany.³

The following comprehensive review of the available evidence may seem overwrought but is necessary to settle the questions decisively. For the sake of narrative flow, historians and biographers of Hudson often omit their full arguments, and few have taken the time to spell out how they arrived at their conclusions. Explicitly showing calculations and detailing rationale will hopefully dispel any doubt as well as offer opportunities for lessons in math and geography.

¹ "Hudson appears to have sailed up the river a little above where the city of *Hudson* now stands and beyond that point he himself never ascended. Not considering it as safe to proceed further with his ship, he sent a boat with five hands, (the mate who had the command of the expedition being one,) to explore and sound the river higher up. The boat proceeded eight or nine leagues beyond where the ship lay at anchor; but finding the soundings extremely irregular, and the depth, in some, places not more than seven feet, it was judged unadvisable to attempt any further progress. It is evident from the whole account that the boat went as far as where the city of *Albany* now stands." Miller, Samuel, "A Discourse Designed to Commemorate the Discovery of New York by Henry Hudson; Delivered before the New York Historical Society, September 9, 1809," New York: I. Riley, 1810, 18, https://www.google.com/books/edition/A_Discourse_Designed_to_Commemorate_the/CLJEAQAAMAAJ.

² Moulton, Joseph White., Yates, John Van Ness, *History of the State of New-York: Including Its Aboriginal and Colonial Annals*, New York: A.T. Goodrich, 1824, 244-249, https://www.google.com/books/edition/History_of_the_State_of_New_York/hRI_FqnZ4zIC.

³ Admittedly, I had already arrived at my own conclusion based upon the evidence when I came across Edward Collier's *A History of Old Kinderhook* which spelled out the case for Kinderhook as the location of the final anchorage. Collier, Edward Augustus, *A History of Old Kinderhook from Aboriginal Days to the Present Time: Including the Story of the Early Settlers, Their Homesteads, Their Traditions, and Their Descendants; with an Account of Their Civic, Social, Political, Educational, and Religious Life*, New York: G. P. Putnam's sons, 1914, 2-7, https://www.google.com/books/edition/A_History_of_Old_Kinderhook_from_Aborigi/GIY-AAAAYAAJ.

Sources: Primary sources for the 1609 voyage of the *Half Moon* include fragments from Henry Hudson's journal quoted by Johannes De Laet in *Nieuwe Wereldt*⁴ as well as Robert Juet's own journal.⁵ The Hudson fragments include telltale details paired with latitude readings that provide the ship's position on certain dates. Juet's journal contains navigational data such as depth soundings, landmark descriptions, compass courses, and distance reckonings. A frequently cited secondary source is Emanuel Van Meteren's brief summary of the voyage: "Their ship finally sailed up the river as far as 42° 40'. But their boat went higher up."⁶ Satisfied that this latitude for the ship conveniently coincides with that of Albany, those favoring the Moulton-Yates interpretation accept this data point at face value, along with Juet's distance reckonings, to the exclusion of other data. However, when properly considered in the context of early seventeenth century navigation and cartography, Juet's reckonings and Van Meteren's account actually lend support to the Miller interpretation that the scouting boat, not the ship *Half Moon*, reached the latitude of present-day Albany.

Soundings: The Moulton-Yates interpretation is contradicted by river depths. Acknowledging this conundrum, Moulton and Yates imagined a shallower draft for *Half Moon* and deeper soundings for the river in support of their interpretation that the ship reached Albany. They were writing in 1824 before dredging and channelization altered the river depth between Hudson and Albany, so they recognized the difficulties encountered by ships in that river section, which prompted their speculations in order to get the *Half Moon* to Albany with a stretch of the imagination.⁷ Although the river has been modified during the intervening centuries, it is still possible to get a rough idea of the actual conditions met by the *Half Moon* by consulting historic descriptions and charts.⁸ In 1625, when describing the navigable reaches of the river, Johannes De Laet wrote, "Finally, the Hart's Reach succeeds as far as the Kinderhoeck; at this place and beyond, the river at its greatest depth has but five fathoms of water, and generally only two or three."⁹ This description is confirmed by the *Noort Rivier* chart of 1639 which

⁴ Johan De Laet, "New World," *Narratives of New Netherland, 1609-1664*, (New York: Charles Scribner's Sons, 1909), 48-49, https://www.google.com/books/edition/Narratives_of_New_Netherland_1609_1664/cL8LAAAYAAJ.

⁵ "Juet's Journal of Hudson's 1609 Voyage," *Purchas His Pilgrimes*, transcribed by Brea Barthel, London: Henrie Fetherstone, 1625, 581-595, <http://halfmoon.mus.ny.us/Juets-journal.pdf>.

⁶ Van Meteren, Emanuel, "On Hudson's Voyage," *Narratives of New Netherland, 1609-1664*, (New York: Charles Scribner's Sons, 1909), 7-9, https://www.google.com/books/edition/Narratives_of_New_Netherland_1609_1664/cL8LAAAYAAJ.

⁷ Moulton and Yates, *History of the State of New-York*, 244.

⁸ Depth soundings were relatively accurate compared to other navigational measurements such as distances from dead reckoning. Comparing Juet's journal with historic charts, the reported soundings closely align, plus or minus a fathom here or there to allow for differences in tide heights or natural shifts of sediment. Soundings generally reference the minimum depth available.

⁹ De Laet, Johan, "New World," *Narratives of New Netherland, 1609-1664*. United States: Charles Scribner's Sons, 1909, 46, https://www.google.com/books/edition/Narratives_of_New_Netherland_1609_1664/cL8LAAAYAAJ.

indicated 2-fathom soundings in several areas from Kinderhook to Fort Orange.¹⁰ These soundings roughly correspond to shoals, or bars, marked on 19th-century charts, including Coeyman's Bar, Castleton Bar, Campbell's Bar, Winnie's Bar, VanWies' Bar, Papscaee's Bar, and Cuyler's Bar.¹¹ Could the *Half Moon* have theoretically navigated these shallow depths to reach Albany? Possibly, but with obvious difficulty.¹² Could the *Half Moon* have passed over these shallow bars with only a few feet of water under its keel without eliciting comment from Juet in his journal?¹³ Undoubtedly not, and quite the contrary, Juet mentioned that they "had no lesse water then five fathoms" on September 19th approaching their northernmost anchor site in the river, which would place the *Half Moon* no farther than Kinderhook. The next day, on September 20th, while the ship remained at anchor, a few of the crew went upriver in the the boat to take soundings and encountered "but two fathomes water," the first of the series of channel-wide bars, or "overslaughs."¹⁴

End of Navigation: On September 22nd, Juet described how once again some of the crew took the boat upriver to sound. Departing in the morning and not returning until

¹⁰ Joan Vinckeboons, *Noort Rivier in Nieu Neerlandt*, [?, 1639], Map, <https://www.loc.gov/item/2003623406/>, Library of Congress.

¹¹ Preliminary Chart of Hudson River, Sheet Number 3 from Poughkeepsie to Troy, New York, 1863, No. 9, 1:40000, <https://historicalcharts.noaa.gov/jpgs/AR09-00-1863.jpg>. See also "A TABLE: Giving the comparative depths of water over the bars, shoals, and prominent points between New Baltimore and Albany," *Reports of the New York Harbor Commission, of 1856 and 1857*, United States: C. S. Westcott & Company, printers, 1864, 177, https://www.google.com/books/edition/Reports_of_the_New_York_Harbor_Commissio/4QJMAQAAMAAJ.

¹² "The channels, however, were very crooked in places, very narrow, and of such difficult navigation that the grounding of boats was, it might almost be said, the rule and not the exception." "Improvements of the Hudson River, New York," *Report of the Chief Engineers*, U. S. Army, 1882, 641-642. "We confess to a profound admiration for the skill of the theoretic pilots two hundred and forty years after Hudson who, under these conditions of unknown tortuous channels and innumerable shoals navigate a ship of eighty tons, which drew too much water for the bars of the Delaware and hesitated and grounded at Sandy Hook with its ten feet of water, to the vicinity of Albany, and thence send a small boat twenty four miles or more up the rapids." Collier, *A History of Old Kinderhook*, 6.

¹³ The draft of the *Half Moon* was 8 or 9 feet or thereabouts, based upon Juet's report of running aground in 8-1/2 feet of water as the ship exited the lower bay and returned to sea on October 4th. Previously, on August 28th, the *Half Moon* passed over "ten foote water" when entering Delaware Bay, and that same depth when encountered on September 3rd discouraged the crew from steering the ship over a shoal at the mouth of the lower bay of New York Harbor. Apparently, any sounding two fathoms or less was worrisome for the ship's crew. As a "best guess," the replica *Halve Maen* was built in 1989 with an average draft of approximately 8-1/2 feet and a maximum draft of 9-1/2 feet.

¹⁴ Originating from the Dutch, the term "overslaugh" indicated "where sandbars suddenly interrupt the free navigation of rivers, as in the Overslaugh in the Hudson below Albany, the dread of all skippers." Schele de Vere, M., *Americanisms: the English of the New World*, New York: Charles Scribner & Company: 1872, 81. See also "Overslaugh Bar" near river mile 140 below Normans Kill on the 1845 *Panorama of the Hudson River* by Willam Wade. "Overslaugh" was used specifically as the name of the bar near Albany (also known as the Upper Overslaugh to distinguish it from the Castleton Bar, or Lower Overslaugh), and more generally to refer to the series of obstructions below Albany. It was also used interchangeably with "bar," as in "Coeyman's Overslaugh." Unsurprisingly, after modern dredging of the river channel, Hudson's biographers are apt to overlook the obstacles to the *Half Moon* reaching Albany which were once obvious to earlier historians.

after nightfall, the boat traveled eight or nine leagues upriver and found “an end for shipping to goe in.”¹⁵ This description is a strong indication that the boat had reached the vicinity of the future site of Albany. Historically, the head of navigation was Albany and remained so until the construction of the Erie Canal.¹⁶ The Dutch built their fort there, and, according to De Laet, “Higher up it becomes so shallow that small skiffs can with difficulty sail there.”¹⁷ The *Noort Rivier* chart of 1639 indicated soundings as far as Fort Orange and no farther, another clue that this was considered the head of navigation.

If the *Half Moon* was anchored at Albany, as some believe, the boat could not have continued the distances reported due to natural barriers on the river. The head of tide was six miles upriver, and the confluence with the Mohawk River was seven miles. The Hudson River was blocked by rapids upriver from the confluence (reportedly with a drop of about twenty feet),¹⁸ and the Mohawk River was blocked by the falls at Cohoes. The boat could not have passed these barriers without an arduous portage. Those who subscribe to the Moulton-Yates interpretation and notice this contradiction merely adjust the reported distance from the eight or nine leagues reported by Juet to two or three leagues (or six miles). However, the ship’s boat already scouted two leagues upriver the previous day, and this second scouting trip, if launching from Albany, would have been mostly redundant.¹⁹ Based on the length of time and distances reported by Juet for this excursion, the *Half Moon* was likely anchored some distance below Albany while the boat reached the end of navigation.

Absent from Juet’s journal is any indication of a major tributary corresponding to the Mohawk River. Also, early Dutch maps and charts do not show the confluence of

¹⁵ Juet reported that the boat’s crew “found but seuen foot water, and vnconstant soundings.” The 1863 chart shows 7-1/2 feet of water over Cuyler’s Bar near Albany.

¹⁶ A description of the Hudson River from the early nineteenth century stated: “It is navigable for ships to Hudson, for large sloops to Albany, ... and for small sloops to Troy, at the head of the tide, 6 miles further.” Morse, Sidney Edwards., Morse, Jedidiah. *A New System of Modern Geography, Or, A View of the Present State of the World*. United States: George Clark, 1822, 116 & 121, [https://www.google.com/books/edition/A New System of Modern Geography Or A Vi/isYLS86fV_sC](https://www.google.com/books/edition/A%20New%20System%20of%20Modern%20Geography%20Or%20A%20View%20of%20the%20Present%20State%20of%20the%20World)

¹⁷ De Laet, “New World,” 47. De Laet erroneously stated that the fort (originally called Nassou, later Fort Orange) was at latitude 43 degrees. Apparently, he is repeating cartographic distortions in the *Hendrickson Figurative Map* of 1616, which is presumed to be one of his sources. See “519 Map of a part of New Netherland, in addition to the newly discovered country, baye with drye rivers, laying at a height of 38 to 40 degrees, by yachts called Onrust, skipper Cornelis Hendricx, van Munnickendam,” [?, 1616], Map, http://www.nationaalarchief.nl/onderzoeken/archief/4.VEL/invnr/519/file/NL-HaNA_4.VEL_519, National Archives of the Netherlands. Cartographic distortions will be discussed at length in a later section.

¹⁸ Collier, *Old Kinderhook*, 3-4.

¹⁹ In mentioning the rapids, Douglas Hunter called into question Juet’s report that the the ship’s boat traveled upriver 8 or 9 leagues, but the rapids are actually more evidence that the *Half Moon* never reached Albany. Hunter, Douglas, *Half Moon: Henry Hudson and the Voyage that Redrew the Map of the New World*, New York: Bloomsbury Press, 2009, 290n. See also: *Map of the northern parts of New York*. [?, 1758] Map. <https://www.loc.gov/item/73691805/>.

Mohawk River, a hint that Hudson or his crew never explored that far upriver.²⁰ According to Juet, the scouting party in the boat turned back due to “inconstant soundings,” with no mention of barriers such as the falls at Cohoes or rapids above Troy. With the ship anchored below Kinderhook, explorations by boat did not extend beyond the present site of Albany.

Latitude Reading and Landmark: The penultimate anchor site of the *Half Moon* on the river was at latitude 42° 18’ according to a fragment of Henry Hudson’s journal quoted by De Laet.²¹ This is located just above the Middle Ground Flats, a recognizable landmark described by Juet as “shoalds in the middle of the channell, and small Ilands, but seuen fathoms water on both sides.” Despite corroboration from two sources (Hudson’s latitude reading and Juet’s landmark description), some historians dismiss or ignore this pinpoint of the *Half Moon*’s anchor site in order to indulge erroneous computations of the ship’s voyage.²² Juet reported only two leagues (or 6 English miles) from this point to reach the final anchor site. The distance in river miles from 42° 18’ to 42° 40’ (Van Meteren’s latitude for the final anchorage) is twenty-five miles, a major discrepancy which calls into question the accuracy of the latitude quoted by Van Meteren.

Distance Reckonings: Robert Juet reported distances in *leagues*, and occasionally used English *miles*. These units are commonly understood to be the old British sea

²⁰ See Block Figurative Map and Hendrickson Figurative Map. The notable (but questionable) exception is the “Velasco Map” of 1610, which shows something that could be interpreted as a tributary. However, this was merely speculative and drawn in blue, indicating that it was based upon second-hand reports (“all the blue is done by the relations of the Indians”) and not necessarily on the first-hand observations of Hudson’s crew. “Velasco Map,” Archivo General de Simancas, 2588, fol. 25 (Velasco to Philip III, 22 March 1611), http://www.nyc99.org/1600/images/velasco_lg.jpg. The first reputable maps or charts to show the confluence of the Mohawk and Hudson Rivers were not published until the 1630s, namely the *Noort Rivier in Nieuw Neerlandt* and *Pascaert van Nieuw Nederlandt* of 1639 attributed to Joan Vinckeboons. *Pascaert van Nieuw Nederlandt Virginia, ende Nieuw-Engelandt verthonendt alles wat van die landin by See, oft by land is ondeckt oft Bekent*, [?, 1639], Map, <https://www.loc.gov/item/2003623405/>.

²¹ De Laet, “New World,” 49.

²² Douglas Hunter, in *Half Moon* asserted, “It would have been on of the voyage’s most reliable fixes, employing not only the noon sight that day but also star sights (if the sky was clear) on the nights preceding and following in the same anchoring place.” Hunter, *Half Moon*, 229. Inexplicably, on the very next page, Hunter cited Van Meteren’s latitude for the final anchorage and noted that “Juet’s estimates of leagues appear to be reasonably good for the river passage north.” However, Juet’s reported only two leagues to reach the final anchor site, but the distance in river miles from 42° 18’ to 42° 40’ is twenty-five miles, a major discrepancy ignored by Hunter. Even as he put forth contradictory evidence, Hunter continued to argue in favor of the interpretation that the *Half Moon* reached Albany.

league of 2500 fathoms (or 3 *London* miles), and the London mile of 5000 feet.²³ This is equal to 2.84 statute miles. Adherents to the Moulton-Yates interpretation of the voyage enlist Juet's reckoning of distances in support of their position, alternately citing or discounting his reported distances to suit their needs without any in-depth analysis. However, Juet's distance measurements were susceptible to errors that plagued sea navigation of that era. To be properly understood, they need to be considered alongside other available evidence and calibrated to recognizable landmarks.

In the early seventeenth century, the navigational practice of "dead reckoning" was inexact and served merely an auxiliary to finding a ship's position by more accurate means. Whenever latitude by observation or other definitive information was available, estimates from dead reckoning were adjusted accordingly.²⁴ In this manner, Juet "made account" of leagues run, occasionally commenting whether his account was "before the ship" or "the ship had out-runne" his account. However, along the river portion of the journey, Juet apparently did not rectify his account with the ship's observed position, or at least he did not comment on the matter. When analyzed and calibrated with latitude readings and known landmarks, Juet's reported distances along the river appear to be consistently "before the ship" and should be adjusted accordingly. Once corrected, Juet's distances fall into line with the other evidence that Henry Hudson sailed the *Half Moon* only as far as Kinderhook.

Method 1—rectifying Juet's dead reckoning using recognizable landmarks: On the downriver trip, the *Half Moon* returned through the Highlands on October 1st, and Juet mentions that it was a distance of 7 leagues total. From Stony Point to Breakneck Point, the actual measurement is 16 statute miles as taken from a chart or Google Earth. Dividing this measurement of 16 statute miles by 7 leagues yields a result of 2.29 statute miles for one of Juet's reported leagues.

²³ "But as I take it, we in England should allowe 60 myles to one degré: that is, after 3 miles to one of our Englishle leagues, wherefore 20 of oure English leagues shoulde answere to one degré....An English myle conteyneth 1000 pases, and euery pase 5 foote, and euery foote 12 ynches." "For an Englishle league doth containe .2500. fadome." Bourne, William, *A regiment for the sea*, London: Thomas Hacket, [1574?], 13th and 14th chapters, <http://name.umdl.umich.edu/A16510.0001.001>. See also the 1620 edition, https://www.google.com/books/edition/A_Regiment_for_the_Sea_Conteyning_Rules/VcRTdaDR3bEC. Prior to 1636, the measure of a degree of latitude was underestimated. See also Lochstoer, Captain J., "On the History of the Nautical Mile," extract from the *Norsk Tidsskrift for Sjovesen*, Horten, March 1934, 121, <https://journals.lib.unb.ca/index.php/ihr/article/download/28097/1882520852>.

²⁴ According to a 17th century navigation manual, "you must add or subtract by a due proportion to each distance run by your Log for as to fall into your Latitude by Observation," or position from a known landmark or charted soundings. Blackborow, Peter, *Navigation Rectified: Or, The Common Chart Proved to be the Onely True Chart: With an Answer to a Question Given by Some Navigatours in the Practical Part of Navigation...*, United Kingdom: John Hindmarsh, at the Golden Ball, against the Royal Exchange, 1687, 91, https://www.google.com/books/edition/Navigation_Rectified_Or_The_Common_Chart/qCdedActAKUC. See also Collins, John, *The Mariners Plain Scale New Plain'd: Or, A Treatise Showing the Ample Uses of a Circle Equally Divided, Or of a Line of Chords and Equal Parts, Divided Into Three Books Or Parts. Being Contrived to be Had Either Alone, Or with the Other Parts* United Kingdom: T.J., 1659, 21-22, https://www.google.com/books/edition/The_Mariners_Plain_Scale_New_Plain_d/jCRLAQAAAMAJ

This method can also be applied to the Long Reach. Juet described the Long Reach as 6 leagues in length. The distance from the middle of Crum Elbow to Danskammer Point is nearly a straight line of 13.3 statute miles. Dividing 13.3 statute miles by 6 of Juet's leagues equals 2.22 statute miles for every one of Juet's reported leagues.

Method 2—rectifying Juet's dead reckoning using two latitude readings: The result from Method 1 can be corroborated using another method. Two surviving fragments of Henry Hudson's log were published Johan de Laet's "New World," and a latitude readings was paired with each fragment. By comparing Hudson's fragments with entries in Juet's journal, we can determine the dates when the Half Moon was anchored at those latitude readings and measure the distance between the two.

De Laet states that in latitude 40° 48', local inhabitants brought "very fine oysters" to the ship. Similarly, Robert Juet reported on September 13 that four canoes approached the ship with a "great store of very good Oysters" (this at the first of two sites that the ship anchored that day). The Half Moon remained at this anchor site until the afternoon, which allowed for a noon latitude sighting from the sun.

In a second fragment, Hudson described a trip ashore in latitude 42° 18', stating: "I sailed to the shore in one of their canoes, with an old man, who was the chief of a tribe." This corresponds to Juet's journal entry for September 18th: "our Masters Mate went on land with an old Saugae, a Gouvernour of the Countrey." The Half Moon anchored here for two nights, which allowed for a noon sight as well as nighttime latitude readings from the Pole Star, assuming a cloudless night.²⁵

From the first time at anchor on September 13th to the anchoring site five days later on September 18th, Juet reported a total distance traveled of 47 leagues plus 5 miles. The total distance between these anchor sites is 112 statute miles as measured along the river on a chart or Google Earth. Using the total river miles, Juet's estimation of leagues can be rectified with the equation $47 \text{ of Juet's leagues} + 5 \text{ miles} = 112 \text{ statute miles}$.²⁶ The answer, rounded to two decimal places, is 1 Juet League = 2.26 to 2.28 statute miles,

²⁵ As previously noted, biographer Douglas Hunter counted this among the "voyage's most reliable fixes."

²⁶ In at least on instance, the "miles" reported by Juet were likely minutes of observed latitude. This was evidently the case on September 13th for the distance traveled from the overnight anchor site (when a celestial observation was possible) to the the noon observation later that the day. Converting the nautical miles to statute miles, the equation reads: $47 \text{ of Juet's leagues} + 5.755 \text{ statute miles} = 112 \text{ statute miles}$, with a result of 2.26 statute miles per league. Using London miles or statute miles instead results in 2.28 statute miles per league.

which nearly aligns with the result from Method 1.²⁷ Even allowing for some margin of error in the latitude readings, the result is less than 2.5 statute miles per league.

The range of results from both methods is 2.22 to 2.29 statute miles per estimated league, and the average result is 2.26 +/- 0.04 statute miles. The average Juet league of 2.26 miles can be put to the test on the remaining upriver journey. If predictive, the distance traveled from latitude 42° 18' to the final anchor point should place the *Half Moon* just below Kinderhook, aligning with reported soundings. Two of these Juet leagues (4.52 statute miles) puts the ship's final anchorage at Hudson River mile 123.8, a point between Nutten Hook and the middle of Cocksackie Island downriver from Kinderhook, as expected. For the distance scouted upriver by the ship's boat from the final anchorage on September 22nd, another eight or nine of Juet's leagues adds up to Hudson River mile 141.9 or 144.2, between Normans Kill and Albany/Rensselaer at Corning Nature Preserve).

Based on these examples, the value of Juet's league (on the Hudson River, at least) can be adjusted to an average of 2.26 statute miles, making the data more useful for plotting the day-to-day movements of the *Half Moon* on its voyage up and down the river. This value is two-thirds of today's standard accepted value for a nautical league. It is also about 80% of the historic British sea league. In other words, the percent error of Juet's reckoning on the Hudson River is about 20% when compared to the accepted value of the old British sea league. The fact that the result was the same (or nearly the same) for the shorter distances of the Highlands and Long Reach as well as for the longer distance of over 100 miles between the two latitude readings suggests a uniform deviation, or systematic error.

Perhaps, Juet relied upon an unconventional value for a league rather than the British sea league as commonly assumed.²⁸ Was there a disconnect between a sailors' practice at sea and the units published by cartographers, geographers, and mathematicians? More likely, Juet's judgement or method of measuring leagues was prone to blunders or

²⁷ As an additional exercise, these results can be compared with that of another method derived by equating Juet's reckoning of the Highlands on the upriver trip with his reckoning on the downriver trip. Sailing upriver on September 14th, the *Half Moon* reached "two Points" (Stony Point and Verplanck Point) and continued through the Highlands, which Juet reckoned 4.5 leagues plus 5 miles. On the downriver trip, Juet estimated that it was a distance of 7 leagues total. This information is sufficient to derive a round number for Juet's league in miles: 7 Juet leagues = 4.5 Juet leagues + 5 miles. This yields 2 miles per Juet league. If "English" miles of 5000 feet, this is 1.89 statute miles per reckoned league. If "English" miles of one minute of latitude, it equals 2.3 statute miles per Juet league.

²⁸ Michael Sullivan Smith scaled Juet's league to 2.2 miles based solely on the Long Reach. Smith's technique of calibrating Juet's leagues is instructive. My attempt to replicate his results prompted this review of the available evidence. Smith, "*Henry Hudson's Discovery*", [poster/map], 2008.

systematic errors which skewed values too low.²⁹ Interestingly, the discrepancies of Juet's leagues along the Hudson River are comparable to those of Samuel de Champlain's along the St. Lawrence River.³⁰

Hudson's or Juet's chosen method for estimating distance remains unknown, but any of the techniques available at the time were prone to error due to shortcomings of the measuring techniques, environmental factors, or misreadings by the observer. Even though the log line was available for measuring speed in the early seventeenth century, navigators continued to rely upon their own experience in estimating speed, leeway, and drift (the influence of surface currents).³¹ The log line was itself was plagued with instrumental errors and was enough of a problem that an entire section was dedicated to "Instructions to correct Distances given by the Log Line and Half Minute Glass" in an

²⁹ Is the corrected value for Juet's league measurement unique to the Hudson River portion of the voyage? Ascertaining a value for Juet's league at sea with the limited information provided in his journal is further complicated by the set and drift of currents. Juet reported multiple occasions when ocean currents interfered with the account of distance traveled. Only a few dates in the journal provide the bare minimum of data necessary (noon-to-noon observed latitudes, distance, and course) to calculate a league length. For instance, on July 26 and 27, Juet reported a change in latitude of 66 minutes (or 66 nautical miles), 27 leagues traveled on a southerly course. Assuming no influence from currents, this yields 2.44 to 2.49 nautical miles per league, which is nearer to the accepted value for the British sea league of 2.47 nautical miles. For an explanation of the "chip log" for measuring speed and the systemic errors of this method, see Moody, Alton B. (Lieutenant Commander, USNR), "The Nautical Miles," United States Naval Institute Proceedings, Vol. 75, No. 11, Annapolis: November 1949, 1257, <https://journals.lib.unb.ca/index.php/ihr/article/download/26967/1882519725/1882519964>.

³⁰ "An examination of his [Champlain's] recorded estimates of distance demonstrates great variation in the absolute length of his league. In his longer estimates on the high seas and Gulf of St. Lawrence, he comes close to the length of a Spanish league of 3.45 statute miles, dropping to about 2.5 to 2.8 statute miles on the St. Lawrence River and 2.1 statute miles inland. The range of standard deviations for these observations shows that he was inconsistent in his estimates. It is also probable that he was using more than one league on his maps; the Spanish marine league on the high seas, the French common league (2.43 statute miles) on the St. Lawrence River, and the French land league (2.13 statute miles) in the interior." Heidenreich, Conrad, "Mapping of Samuel de Champlain, 1603-1632," *The History of Cartography*, Volume 3, Part 2, Chapter 51, University of Chicago Press, 2007, 1543, https://press.uchicago.edu/books/HOC/HOC_V3_Pt2/HOC_VOLUME3_Part2_chapter51.pdf.

³¹ "As this brief review shows, seamen of four or five centuries ago would find no difficulty in working out the daily course made good and the position reached, provided they could make a correct estimate of the distance sailed along each leg of the traverse. But this involved knowing the speed of the ship, and right down to the mid-eighteenth century it was still usual to rely on the master's or the pilot's judgment. He knew his ship, and what she could do carrying such and such sail, under a fresh or a light breeze, with the wind on the poop or on the quarter, and so on. He had a rule of thumb for estimating leeway, and would help himself at most by noting the movement of foam alongside, or by throwing a chip overboard and timing its passage between two bolt-heads on the ship's side. As to the log line, Richard Norwood, when discussing it in his *Seaman's Practice* in 1637 declared that many sailors were either so cocksure of their judgment that they disdained to use it, or were shamed out of doing so because they feared to proclaim themselves 'young seamen', that is to say inexperienced pilots." E. G. R. Taylor, "Five Centuries of Dead Reckoning," *Journal of Navigation*, July 1950, <https://fermatlibrary.com/s/five-centuries-of-dead-reckoning>. See also Eric A. Ash, "Navigation Techniques and Practices in the Renaissance," *The History of Cartography*, Volume 3, Part 1, Chapter 20, 510, https://press.uchicago.edu/books/HOC/HOC_V3_Pt1/HOC_VOLUME3_Part1_chapter20.pdf

eighteenth century sailor manual to account for a faulty glass or log line.³² Environmental factors such as currents often skewed the apparent speed of the vessel, and thus increased the discrepancy between distance sailed through the water and distance over-the-bottom. Shifting tidal currents along the “river that flows both ways” likely complicated the reckoning of distances for the crew of the *Half Moon* as the ship’s apparent speed changed during tide cycles along the Hudson River. As a seasoned sailor, Juet may have tried to correct for the tidal current in his estimations but inadvertently overcompensated. Regardless of the source of error, the calculations outlined above show that Juet’s reckoning of leagues on the Hudson River was consistently less than the accepted value.

~~Even though Juet’s distances are less than 100% accurate, it does not warrant fudging or failing to show calculations. It certainly does not justify the exclusion or dismissal of other evidence in favor of fuzzy math.~~³³

Latitude-By-Account and Historic Dutch Maps

In reports of his previous voyages, Hudson noted and distinguished between latitude “by observation” (from celestial reading of the sun or Pole Star) and distances in leagues “by account” (based upon dead reckoning). When evaluating Hudson’s latitude readings quoted by De Laet, contextual clues suggest that these readings are latitude-by-observation. The same cannot be said for the latitude in Van Meteren’s synopsis of the voyage. He was not necessarily quoting anyone directly but merely providing a brief summary: “Their ship finally sailed up the river as far as 42° 40’. But their boat went higher up.” The addition the 8 or 9 leagues reported by Juet (unadjusted) for the boat’s upriver excursion measured along the river course would place the furthest extent of explorations in the vicinity of 43 degrees.

The latitude 42° 40’ for final upriver anchor site of the *Half Moon* is commonly assumed to be accurate merely because it coincides with the latitude of present-day Albany and appears to agree, more or less, with the measure of British sea leagues reported by Juet.³⁴ However, this is possibly a form of circular reasoning. If Juet’s estimate of

³² “To Correct Log Line and Glass.” BETTESWORTH, John. *The Seaman's Sure Guide, Or, Navigator's Pocket Remembrancer: Wherein are Given Such Plain Instructions in Every Useful Branch of Navigation, as Will in a Short Time Form the Complete Mariner, Etc.* United Kingdom: The Author, 1783, 30-33, https://www.google.com/books/edition/The_Seaman_s_Sure_Guide_Or_Navigator_s_P/eOJeAAAAcAAJ.

³³ Adding up Juet’s reported distances for river travel totals over 49 leagues plus 9 miles. Assuming a British sea league, this results in over 147 river miles, which would put the *Half Moon* above Albany with little room for the boat to explore further without a portage beyond the rapids above the confluence with the Mohawk River.

³⁴ Latitude 42° 40’ is Hudson River Mile 145.75. Juet’s reported leagues for the upriver voyage of the *Half Moon*, uncorrected and measured as British sea leagues, is approximately river mile 148. Another 8 or 9 leagues for the boat reaches river mile 170 to 173 in the vicinity of 43° north latitude. In addition to the latitude 42° 40’, Van Meteren mentioned that Hudson and his crew traveled “about fifty leagues up the river.” Similarly, Juet reported 49 leagues plus 9 miles along the Hudson River for the *Half Moon*, not counting the boat excursion upriver.

leagues and Meteren's latitude report appear to corroborate each other, it may be that the latter is derived from the former. Instead of latitude-by-observation, the latitude 42° 40' mentioned by Van Meteren could have been based upon latitude-by-account (reckoned from the course and distance traveled) or derived from a map based upon the account. As latitude-by-account, it would agree with Juet's report of leagues and mirror the accumulated error.

Given the state of navigation and cartography in the early seventeenth century, the errors of dead reckoning often carried over into distortions on maps and charts. Case in point—the figurative maps of Adrian Block and Cornelius Hendrickson erroneously located Fort Nassau (now Albany) at latitude 43°. ³⁵ De Laet, who was likely consulting one or both of these charts while writing his “New World,” placed the fort “at the uppermost part of the North River in the latitude of 43 degrees or thereabouts.” He also stated that Hudson and his crew “ascended the river to about 43 north latitude, where it became so narrow and of so little depth that they turned back.” ³⁶ Likewise, the introduction to Juet's journal published by Samuel Purchas stated that they traveled “up the Riuer neere to fortie three degrees.” ³⁷ While Van Meteren distinguished between the ship and the boat, De Laet and Purchas were ambiguous as to whether the latitude 43 degrees referred to just *Half Moon's* voyage or included the boat's upriver excursion. By noting that they turned back for lack of depth, De Laet was likely referring to the extent of the upriver exploration by boat where they found, in Juet's words, “unconstant sounding.”

The distortion of locating the Dutch fort at 43 degrees latitude persisted in subsequent charts and maps such as the *Pascaert van Nieuw Nederlandt* of 1639 and *Noort Rivier* chart of 1639. ³⁸ Once Van Meteren's latitude is placed in the context of these

³⁵ [Doetsz, Cornelis and Block, Adriaen], “520 Kaart van Nieuw-Nederland, benevens een gedeelte van Nova Francia en Virginia,” [?, 1614], https://www.nationaalarchief.nl/en/research/archive/4.VEL/invnr/520/file/NL-HaNA_4.VEL_520, National Archives of the Netherlands, see also, [https://commons.wikimedia.org/wiki/File:AMH-8564-NA_Map_of_Nieuw_Nederland_\(New_Netherlands\).jpg](https://commons.wikimedia.org/wiki/File:AMH-8564-NA_Map_of_Nieuw_Nederland_(New_Netherlands).jpg). “519 Map of a part of New Netherland, in addition to the newly discovered country, baye with drye rivers, laying at a height of 38 to 40 degrees, by yachts called Onrust, skipper Cornelis Hendricx, van Munnickendam,” [?, 1616], Map, http://www.nationaalarchief.nl/onderzoeken/archief/4.VEL/invnr/519/file/NL-HaNA_4.VEL_519, National Archives of the Netherlands. The upper right corner of the Hendrickson figurative map is missing, but the latitude scale along the right hand side can be extrapolated from the intact portion.

³⁶ De Laet, “New World,” 38 & 47.

³⁷ Purchas, 581, [image 624], <http://hdl.loc.gov/loc.rbc/rbdk.do403>.

³⁸ Vinckeboons, Joan, *Pascaert van Nieuw Nederlandt Virginia, ende Nieuw-Engelandt verthonendt alles wat van die landin by See, oft by land is ondeckt oft Bekent*, [?, 1639] Map, <https://www.loc.gov/item/2003623405/>. *Noort Rivier* chart of 1639: although latitudes are not demarcated on the chart, they can be derived using the given scale of “Duytsche Mijllen 15 voor Een Graedt” [15 Dutch miles for every Degree]. Measuring from the well-established latitude of 40° 30' for the main channel at “Godyns Punt” [Sandy Hook], Fort Orange is nearly 43°. Deliberately or not, the first map to show Fort Orange near the correct latitude (albeit on the wrong side of the river) was Hessel Gerritsz's *Nova Anglia Novum Belgium et Virginia* of 1630 prepared for De Laet's second edition of “Niewwe Wereld,” which nevertheless reported 43 degrees for the fort in spite of the map.

cartographic distortions, it neatly aligns with the bulk of the evidence that the *Half Moon* ascended the river no farther than Kinderhook. On the Hendrickson Figurative Map of 1616, the latitude 42° 40' is shown several miles downriver from the fort "Nassou" in the vicinity of "Hinnehoek" [Nutten Hook]. On *Pascaert van Nieuw Nederlandt*, the latitude 42° 40' falls between "Hinhoeck" and "Kinderhoeck." Likewise, when consulting the *Noort Rivier* chart, latitude 42° 40' (20 minutes, or 5 Dutch miles, to the south of Fort Orange) falls within the "Harts rack" below "Kinderhouck." As noted above, the difference of 20 minutes between De Laet's and Van Meteren's latitudes, when measured along the winding river, conveniently matches the 8 to 9 British sea leagues for the reported distance traveled upriver by the boat from the final anchorage of the ship.³⁹ In other words, Van Meteren and De Laet probably had the same general understandings of the voyage based upon similar source material and mirrored the navigational/cartographic errors of their sources. That is not to point to any particular map or document as a source for Van Meteren's summary of the voyage but to merely convey the extent of geographic knowledge of the Dutch in the early seventeenth century.

Conclusion

When the voyage of the *Half Moon* along the Hudson River is properly understood in the context of early seventeenth century navigation and cartography, the pieces of the historical puzzle neatly fall into place, revealing a clearer picture of the movements of the ship through the tidal estuary. Now, it can be stated with a full measure of confidence that Henry Hudson sailed the ship *Half Moon* upriver to a point below Kinderhook while the the "Master's Mate and foure more of the companie went vp with our Boat" to the vicinity of present-day Albany.

Q.E.D.

³⁹ No doubt adding the confusion, the difference of approximately 20 minutes latitude between the ship's anchorage and the boat's excursion is nearly the same as the error between these distorted latitudes and the actual latitudes. The error between De Laet's latitude of 43° for the Dutch fort to the actual latitude of Albany at 42° 39' is comparable to the difference between Van Meteren's latitude of 42° 40' for the final anchorage and the likely site below Kinderhook at 42° 21'.