The Gulf Stream

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The Gulf Stream, a vast and powerful Atlantic Ocean current, is first discernible in the Straits of Florida. In this area, the Stream is like a river 40 miles wide, 2,000 feet deep, flowing at a velocity of five miles an hour, and discharging 100 billion tons of water per hour. From the Straits of Florida, it takes a very narrow course up the North American coast to Newfoundland and then veers toward Europe (Fig. 1).

Within the Straits, the lateral boundaries of the Gulf Stream are fairly well fixed, but when it flows into the open sea its boundaries become indefinite. Northeast of Cape Hatteras, the Stream often forms great looping meanders which change position with time. The major axis of the Stream within the Straits of Florida is known to migrate laterally; that is, it moves closer to or farther from the coast.

As with most large natural phenomena, the Gulf Stream has given rise to a number of amazing legends--the products of much imagination and only a little knowledge. Early ideas were restricted by the very crude description of the Stream then available and, more importantly, by the fact that there was no well-developed knowledge of this physical characteristics--the velocity, volume, position, and variation of flow. It is not surprising that many of the early ideas advanced now seem absurd: ideas such as the formation each day of a huge mountain of water on the equator, this mountain carried westward and dispersed as strong currents along the coasts of the Americas. Another theory advanced a system of ocean circulation in which water at the surface flowed toward the North Pole (under the influence of some undefined force) where it was swallowed up into the earth, later to return to the surface through large springs. Today, these ideas are remarkable only because they are so completely fantastic. It is equally remarkable that in those days some shrewd observers deduced that the Gulf Stream is a reflection of forces caused by the wind pattern over the Atlantic Ocean, the earth's rotation, and the pattern in which the earth's surface receives heat at a much greater rate at the equator than at the poles.

No other oceanic feature has had more impact on the United States and Western Europe than the Gulf Stream. Marine commerce, naval defense, the Atlantic fishing industry have all endeavored to use this ocean current to their advantage since the days of early exploration.

The first record of the discovery of the Gulf Stream current is that of Ponce de Leon in his expedition in 1513 in search of the fountain of youth. The journal states that a current was observed which, though they had a good wind, they could not stem.

The Gulf Stream had a great influence on the colonization of North America in the early part of the seventeenth century. In 1606, the English divided their possessions into two parts: the northern part of Virginia (New England and vicinity), and the present North Carolina and Chesapeake Bay region. A company was established for each and commissioned by the King. The route used in reaching the first was that traveled in 1602 by Captain Bartholomew Gosnold, crossing the Atlantic on about the 40th parallel, while the southern expeditions held the old passage through the trades and Caribbean. The Dutch vessels bound to New York adopted the West Indian route, so that Nantucket really became the dividing line of travel, and a difference in destination of a degree in latitude necessitated a difference of 30 degrees in route. This seems to be accounted for by the real or imaginary assistance of the winds and currents in one instance and the impediment of the Stream in the other.

The need for knowledge concerning the limits of the Gulf Stream was shown by the length of time consumed in passages between the same ports in opposite directions. A voyage from Boston, Massachusetts, to Charleston, South Carolina, would sometimes take three or four weeks, while a return trip would frequently be made in one week.

Meanwhile, sailing captains and whalemen were gaining experience regarding the Stream. The whalers extended their search as far south as Bahama Bank and as far east as Newfoundland, or even to the longitude of the Azores. They discovered that the whales appeared to the north of a certain line and to the south of another line, and were rarely seen between the two, and these lines they concluded were the limits of the Gulf Stream. The whale fishery soon became the school of American navigators, particularly of New England vessels, and in this way knowledge of the Gulf Stream was introduced into the commercial traffic of the times. The American shipmasters, from their superior information on the subject of currents, inaugurated a change in the sailing route from Europe, by which they could save two weeks or more in the passage.

From England they crossed the Newfoundland Banks in about latitude 44 or 45 degrees, and then on a course inside the limits of the Stream.

In the year 1769 or 1770, an application was made by the Board of Customs at Boston to the Lords of the Treasury at London, complaining that the packets between Falmouth, England, and New York were generally a fortnight longer in their passage than the merchant ships between London and Rhode Island, and proposing that for the future they should be ordered to Newport, instead of New York.

Benjamin Franklin, then Postmaster General, was consulted, and it appeared strange to him that there should be such a difference especially when the merchant ships were generally more heavily laden and undermanned than the packets, and had from London the length of the river and channel to run before they left the land of England, while the packets had only to go from Falmouth. A Nantucket sea captain, which whom Franklin discussed the affair, believed this to be true owing to the fact that the Rhode Island captains were acquainted with the Gulf Stream, while the English packets were not. Franklin then compiled a chart of the Gulf Stream (Fig. 2), based on information obtained from the captain, adding directions for avoiding it in sailing from Europe to North America, and sent copies to Falmouth for the captains, who slighted it. Franklin did not press his new chart on the English captains after they had once rejected it, but suppressed it, for political reasons, until the conclusion of the War of Independence.

The Gulf Stream toward the end of the eighteenth century became a subject of scientific investigation and discussion. Franklin himself made observations of the temperature and sea water during a number of voyages and noted with regard to the Gulf Stream "that it is always warmer than the sea of each side of it."

By the middle of the nineteenth century, when systematic observations were begun, a wealth of information had been gathered from navigators' logs and from the observations of scientifically minded travelers. The most notable of these were conducted by the British Admiralty and the U.S. Navy.

The first systematic survey of the Gulf Stream was conducted in 1846 by the U.S. Coast Survey Brig WASHINGTON. The work of the WASHINGTON was followed in the late 1870's and 1880's by the voyages of exploration under the command of Lt. Cdr. Sigsbee and later under the command of Lt. J. E. Pillsbury. Pillsbury carried out oceanographic research work in the Gulf of Mexico and the Caribbean, and made exhaustive measurements of the Gulf Stream in the Florida Straits, obtaining sufficient data to

Intensive studies of the Gulf Stream coutinue so as to further an understanding of the meandering of the current, its principal sources, and the amount of water and heat transferred from south to north in the western North Atlantic. The Gulf Stream has a pronounced effect on the weather. A better understanding of its structure permits a better evaluation received from the sun in low latitudes.

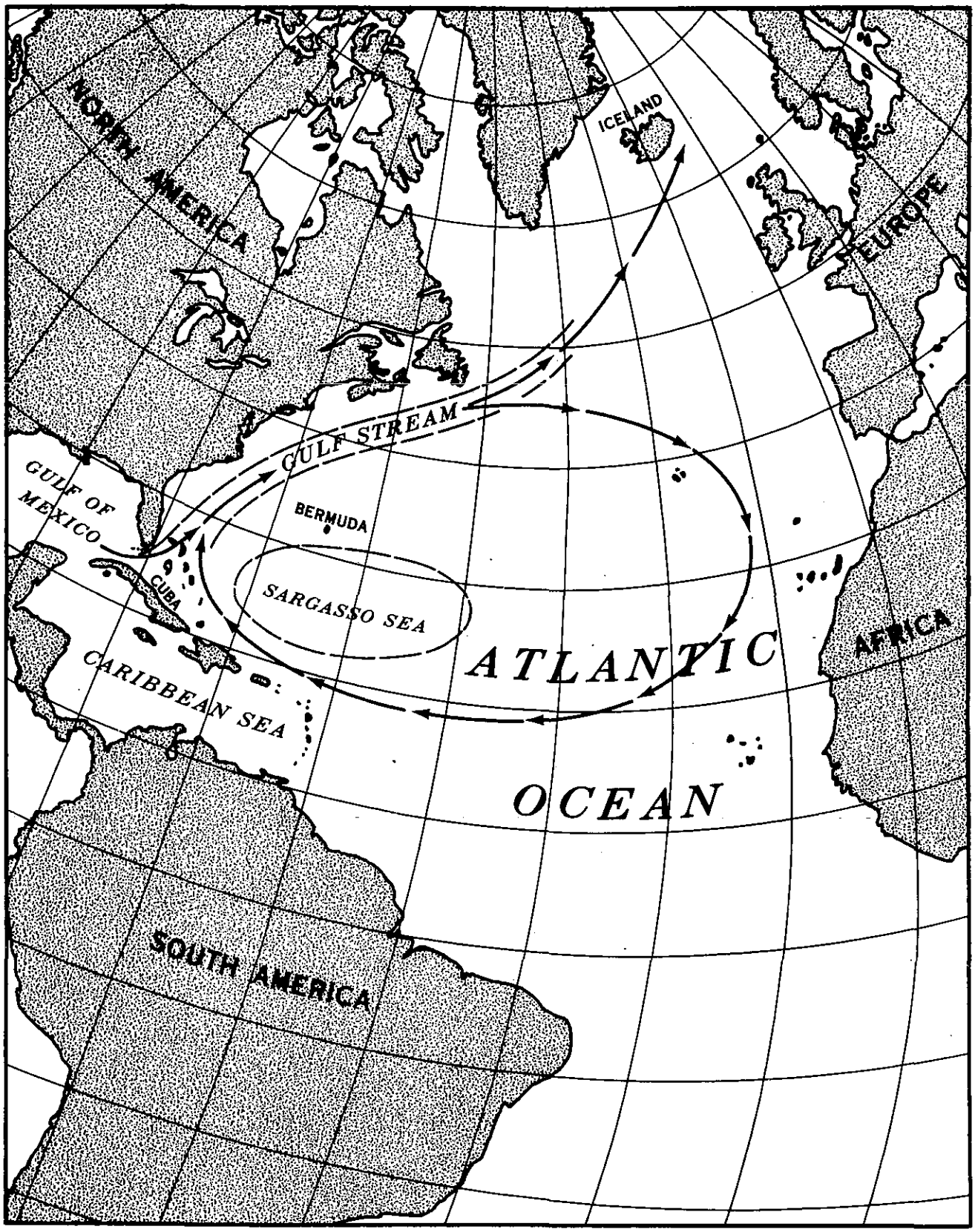
NORTH AMERICA
ICELAND
EUROPE
GULF STREAM
GULF OF MEXICO
BERMUDA
CUBA
SARGASSO SEA
ATLANTIC
AFRICA
CARIBBEAN SEA
OCEAN
SOUTH AMERICA

Fig. 1

BENJAMIN FRANKLIN'S MAP OF THE GULF STREAM

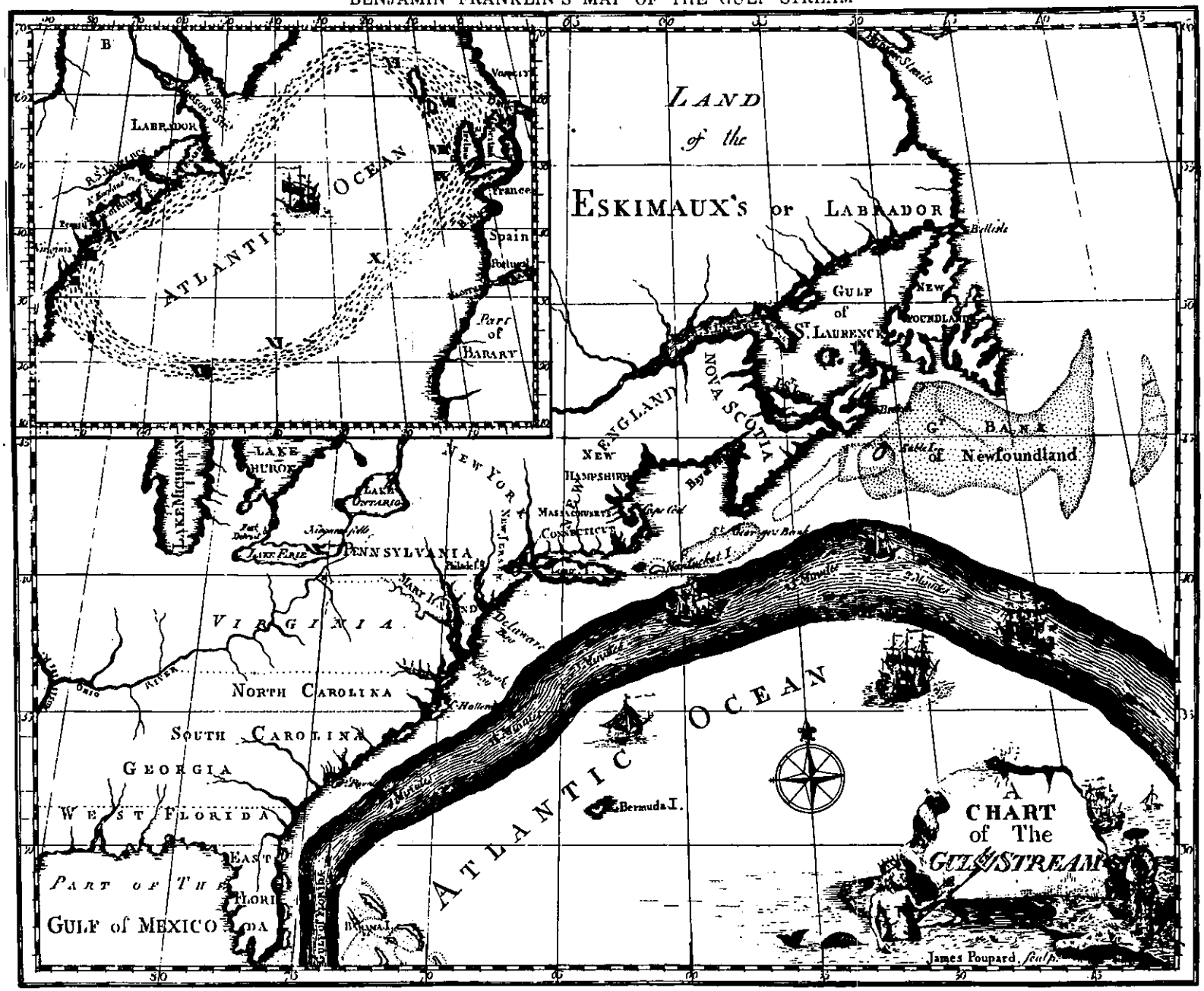

Fig. 2

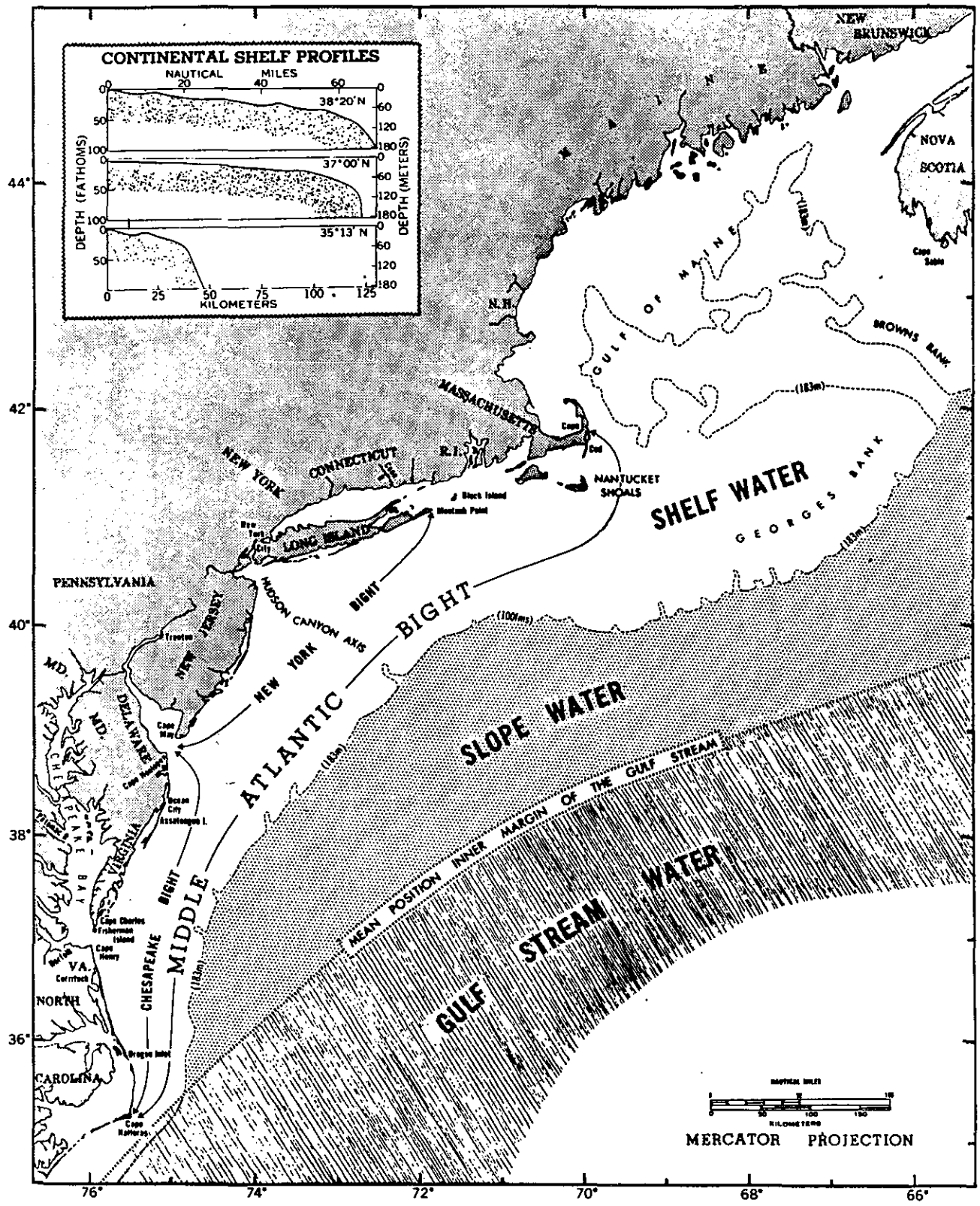
CONTINENTAL SHELF PROFILES
NAUTICAL MILES
38°20'N
37°00'N
35°13'N
DEPTH (FATHOMS)
DEPTH (METERS)
KILOMETERS
NEW BRUNSWICK
NOVA SCOTIA
GULF OF MAINE
BROWNS BANK
N.H.
MASSACHUSETTS
R.I.
CONNECTICUT
NEW YORK
NANTUCKET SHOALS
GEORGES BANK
SHELF WATER
LONG ISLAND
Block Island
Montauk Point
PENNSYLVANIA
NEW JERSEY
HUDSON CANYON AXIS
BIGHT
NEW YORK BIGHT
MIDDLE ATLANTIC
SLOPE WATER
MEAN POSITION INNER MARGIN OF THE GULF STREAM
GULF STREAM WATER
MD.
DELAWARE
VIRGINIA
CHESAPEAKE BAY
Ocean City
Assateague I.
Cape Charles
Fisherman Island
Cape Henry
VA.
NORTH CAROLINA
Oregon Inlet
Cape Hatteras
(100fms)
(183m)
MERCATOR PROJECTION
76°
74°
72°
70°
68°
66°
44°
42°
40°
38°
36°

Fig. 3