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THE CRAZY RIVER

When on the E. Coast of Fla., one is given the opportunity of making a casual observation of one of nature's outstanding phenomenon. This wonder is something which is huge, moves incessantly, and cannot be readily seen or heard. It is a giant river, flowing independently in the Atlantic Ocean-- called the Gulf Stream. Ships traveling South know it is there as they will keep rather close to shore so as to avoid the North current of the Stream, and conversely, those vessels going North will get in the Stream, and pick up the 3 to 5 knot favorable current. At times too, one can observe from the shore, ripples on the horizon, which are actually swells in the Stream, and the visable evidence that something is out there on the move.

To better appreciate the significance of the Stream, we should have some of its historical background, the movements of the sea, its georgraphy, it affect on climate and meteorology, navigational problems, and finally its political aspects, and its future.

Before exploring the whys, component parts, size, and speed of the Stream, I would like to whet your interst in the Crazy River by giving you a quick run-down of this phenomenon. All the rivers of the world do not match the volume of warm water which forms the ocean river called the Gulf Stream. Oceanographers reason that this giant river is set in motion by the earth's slow rotation eastward. The Spanish explorer Ponce de Leon, sailing from the Bahamas and thru Fla. waters in 1513, discovered it. Sailing northeastward off the Fla. coast, he and his crew were astonished to find that they were moving 3 knots faster than ships sailing closer to shore. In 1769, Benjamin Franklin found that canny Yankee captains reached England in two weeks less time than British ships. With no real beginning, and no positive end, this wayward current comes across from Africa, turns north off

X There it has a surface temperature of 80 degrees, and pours 25 times more water past a given point than all the streams of the earth. At its best the river is 50 miles wide, and 1500 ft. deep. With a surface temperature of 80 degrees, and trade winds blowing across it, it is a giant thrmostat for southern Fla., keeping the land warm in the winter, and tolerably cool in the summer. It surges north, northeast, leaving the coast and heading for Cape Hatteras. As it approaches Labrador, the Gufl Stream meets a challenger, ~~and~~ the Labrador Current coming down from the Artic. The confrontation is so abrupt that some vessels report a difference in temperature of 50 degrees between the bow and stern. Hot and cold creates fog. The Labrador Current, cooler and heavier tries to get under the Gulf Stream. This sometimes causes eddies 100 miles in radius. Any change in direction of the Gulf Stream, or the Labrador Current, could find Europe covered with snow, or growing palm trees. What we have now roughly outlined should provide a quick background of this mysterious Stream, so we will now proceed to some of the larger aspects, and consequences of this Crazy River.

The Gulf Stream, part fast-flowing, and fairly well defined, part a mere drift of a vast body of water, may well be called a Crazy River, but it is no crazier than the history that it has affected. The earliest known Greek geographical drawings have hints of a sea of weed which is called the Sargasso Sea, and hence an indication of voyaging into the Atlantic with the aid of the Canaries Current and the N. Equatorial Drift in 150 BC. The Phoenicians were probably familiar with the eastern parts of the Atlantic circulation, since they made voyages to Britain. This knowledge was no doubt passed on to the Arabs who, over a thousand years later, taught the Portugese. The only experience of the Guff Stream until the 15th Century was possibly during the voyages of the Norsemen around AD 1000. Settlements were

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then made in Greenland, and the Gulf Stream may well have been known for its assistance onthe journeys home. There is also some evidence that the Portugese were visiting the rich fishing grounds off Newfoundland, but in doing so must have experienced the fogs that occur where the Gulf Stream meets the cold Labrador Current. When Columbus was planning his trips, it was known that there must be land to the West because "sea beans" (the seed of a W. Indian plant) bamboo stems and coconuts were occasionally washed up on European shores, indicating both a source to the West, and a current moving eastward.

John and Sebastian Cabot sailed up the western side of the Atlantic as far as Labrador in 1497, and observed the counter-current which runs in a southwesterly direction between the Gulf Stream and the American Coast. Sebastian Cabot made the interesting observation that the beer in the hold of his ship fermented and turned sour because of unaccountable warmth below decks, which was due of course to the high temperature of the Gulf Stream. Apparently neither Columbus nor the Cabots connected the high temperature with the current. Columbus did, however, give the first authentic description of the Sargasso Sea, the idle hub of the N. Atlantic circulating system. He reported a seaweed-like grass floating in bushels around the ship, and hauled a bunch of it aboard. Some crabs were in the weed, and the sea was warm enough to tempt sailors to undress and go swimming.

Sebastian de Ocampo sailed around Cuba in 1509, and must have had to struggle against the Gulf Stream. However, no one reported the current, although it is so fast in that part of the world that it cannot be missed. Whatever the reason for the small amount of publication on the current, it was in 1513 thatJuan Ponce de Leon described the Fla. current, which is the fast moving beginning of the Gulf Stream. Peter Martye, a sixteenth century Italian, was the first person to give sensible thought to the Atlantic currents. He realized that the westward flowing N. Equatorial current must do one of three things. It could pile up large masses of water at the Brazilian coast, but the explorers of this area had never noticed such a phenomenon. There could be a passage to the Pacific, so that the Stream could continue around the world, and back into the Atlantic, but evidence from exploration was in favor of a continuous land barrier, This led Martyr to the third conclusion-- that the westward Atlantic current was deflected by the land and diverted thru the Fla. Straits, and up the coast of N. America. The next few years covered a period of intense activity inthe Caribbean area, and by 1519 the Spanish ships had discovered the trick of sailing with favourable currents all the way-- across the Atlantic to America with the Equatorial Current, and returning home thru the Fla. Straits, along the Gulf Stream as far as Cape Hatteras and then Eastward to Spain. Observations were also being made in 1606 that when the air was cold, a few hundred miles E. of Newfoundland, that the water was very warm.

More current observations were being made, but they were not realizing that the main Atlantic current system runs southward when it approaches Europe to give the wheel-like movement centered on the Sargasso Sea. It was Isaac Vossius in 1663 who first pronounced the ocena-wide, clockwise motion that operates in the N. Atlantic. The mechanism that made the water move was supposed to be a piling up of the sea at the Aquator by the sun. When the mountain of water which followed reached the American coast it was diverted north by the Trade Winds. This theory was soon followed by the first chart showing the Gulf Stream by Kircher in 1665.

Benjamin Franklin then came along with a publication showing the vast experience of the New England whaling skippers to produce his well known chart. Whales were observed to run along the sides of the Stream, not in the Stream; whales too, stayed on the edge of the Stream to avoid the affects of the current. However, Franklin attributed the Gulf Stream to a piling up of water at the American coast by the force of the prevailing trade winds. The trade winds do, of course, provide the driving force for the whole N. American circulation, and any variations in the level are caused by the winds. The circulation must however, be considered as a whole. Franklin did pioneer the use of water temperatures to define the boundaries of the Stream. He was followed by Maury, then Supt. of the U.S. Naval Observatory, who collected all wind and current data from ship's log books covering the period 1840-50, and summarized the results in a form which led to the modern system of ocean charts which indicate current flow as well as depth soundings. Direct measurements of the surface currents were made by observing the rate of drift of a ship, or by comparing the dead reckoning position with "fixes" obtained from star sights. Drift bottles were cast overboard, and then noted where they arrived on shore. Hollow copperspheres were used betweenthe Azores and Newfoundland, which showed indisputably the branching nature of the Gulf Stream, to Norway on the one hand, and to France on the other. Velocity of the current off Cuba, was determined to continue to a depth of 600 fathoms. Current speeds can be calculated from density variations, and therefore, salt content and temperatures must be taken into account. The end of the 19th century saw the development of modern methods of calculation, including a proper understanding of the part played by the forces associated with the earth"s rotation.

Some understanding of the geogrphy of the Gulf Stream is necessary to better comprehend the Crazy River. The waters of the sea are never still. The pull of the moon and the sun cause the tides to wash the coastlines of the world every day, with large differences in the height of the rise, influenced by the sea bed, and alternately laid bare and invaded by the sea at regular intervals. Wind acting on the sea surface provides the beautiful but awesome waves that may lap idly at the sea-shore, but which also show their fierce nature in storms at sea. The waves of the sea travel at speeds of up to 60 miles an hour, but there is no forward movement of the water. The waves on the sea surface are like the waves that can be sent along a rope by jerking one end. A Kink travels down the rope, and takes energy to the far end, but the rope is still in the same place when the wave has passed. The wind can make water move bodily from one place to another provided it is acting steadily in the same direction for a long time. The captains of the old windjammers knew that large areas of the ocean were subject to regular winds, such as the NE and SE trade winds. These two steady forces meet in the region of the Equator. The heat of the sun in the Equatorial region warms the air and makes it lighter, so it rises, to be replaced by air moving in from South and North. The rotation of the earth provides a sideways drag to give the resulting winds from the S. and N. their westerly direction. The steady blow of these NE and SE trade winds on the surface of the Atlantic causes two separate surface movements.

The westward moving Equatorial currents can travel unimpeded for only about three thousend miles before hitting land. When they bump into land, the S. Equatorial Current hits the eastern tip of S. America at the Brazilian cape, and splits into a southern part which flows down the Argentine coast, and the northern stream-- the Guiana Current, flowing along the northeast coast of S. America, past the mouth of the Amazon, and nearly up to Trinidad. These JOIN the N. Equatorial Current, and flow south of Haiti and Cuba. The Equatorial currents are forced to move northward, and come out in a gigantic squirt thru the fifty mile Fla. Straits, between Cuba and Miami. At the narrowest part of the Strait, the Narrows of Bimini, the flow of the current reaches to the sea bed at the depth of 1500 ft., ~~and passes thru at the rate of ten cubic miles per hour, or 700 million cubic feet per second~~. The speed varies from month to month, but reaches speeds of 7 miles per hour, and enough to fill a million bath tubs every second. The average volume of the Stream may double itself for a considerable period, when it would amount to 35 million cubic yards per seond. IN COMPARISON The Amazon which is the greatest river in the world, is content to discharge 155,000 cubic yards per seond. It should also be noted that the amount varies as evidenced in Dec., 1952, when its volume rose from 20 to 50 million cubic yards per second. The Stream's width is fifty miles, quarter of a mile deep, and its aim is northward along the Fla. coast. The dimensions of the Stream are so great that it maintains its entity for some thousand miles, and like the jet from a hose squirted into a pond, it mixes only slightly with the water thru which it flows because its volume is so large compared with the area of contact. As the speed gradually lessens, the Stream widens and becomes diffuse on account of eddies and fringe meanderings. The Stream meets a more gentle circulation which is called the Antilles Current, which is a part of a general clock-wise rotation of the surface waters of the N. Atlantic. The driving force is the wind, which in turn is maintained by the rotation of the earth. The earth's rotation helps to give the righ-handed motion to the ocean currents. Rotation brings into play Coriolis forces(natural inescapable phenomenon caused by the rotation of the earth, and applicaable and noticeable in any large body of fluid, air, or water) on anything that moves on the earth's surface, and in the northern hemisphere these tend to give a clock-wise motion. In general, the rotation of the earth, and the winds off the Newfoundland coast area maintain a wheel-like movement of water in the N. Atlantic. The hub of this wheel is the notorious Sargasso Sea, where ships were supposed to be captured in masses of seaweed, and where a solid land-like region of hard packed seaweed was supposed to exist. You can however, sail thru the Sargasso Sea without impediment, and without seeing much more evidence of the stagnant centre of the whirling Atlantic than some trails of yellow seaweed. This may be the breeding ground of the world's eels,and certainly has a geographical significance in being the axis of the Gulf Stream circulation.

We are not yet sure what makes the Gulf Stream kick eastward across the Atlantic. It may be a push off the Newfoundland coast, provided by the south-flowing cold Labrador Current, the Corliolis forces, or seabed rises and ridges which act as deflection plates. Continuing Eastward, the force of the current lessens, and on reaching Europe, the stream splits. Part must follow the wheel-like circulation of the whole N. Atlantic, while a segment reaches up to trail around Scotland, finally to die out around the approshees to Spitsbergen; this branch gives solace to the NW Scottish coast. Just a s a river flows slowly across a plain, so the Gulf Stream in its more mature phase loses its clearly defined boundaries and pursues a more diffuse life.

It should be recognized that the Gulf Stream is but a part of the vast circulation of the Atlantic, both on the surface as well as along the ocean floor. Ocean heating is on the surface, and a secondary effect is surface evaporation. Salty water is heavier, and therefore, sinks, which in turn, influence the Equatorial currents. Deep currents arise from the ice melting in the Artic and Antartic regions, which being heavier than the warmer surface waters, slide down gently from the Poles, and exist at depth in all latitudes. The deepest layer of warm upper water approaches 3000 ft. in the area of the Sargasso Sea.

The ciruulation of the deep waters is a slow process compared to the water movement apparent at the surface in rivers, or in currents such as the Gulf Stream. These deep water currents make their circuits in hundreds of years. The prime mover in the deep-water circulation is the sinking of cold Polar water, and the controlling factor of the current is the shape of the continental basins, with the land barriers determining the flow at the surface. The quiet deep ocean currents are most important to the world today. The circulation of the sea stirs up the waste that is dumped in the ocean and allows it to become so dilute that it is virtually lost. The overall circulation rate between bottom and upper water layers controls the rate of mixing to a large extent, and this is a figure that we must know if we are to do our waste dumping safely and sensibly.

Due to the difference of salinity, there is an unusualy current phenomenon at the Straits of Gibraltar. The Mediterranean is a warm sea with only one outlet to the Atlantic Ocean, and the surface evaporation tends to produce water with excess salt. There is a build up of water in the Mediterranean due to the supply from the rivers which empty into the sea. The outflow, because of the heavy salty water takes place in the bottom section of the STraits, and yet there is actually a flow inwards at the surface thru the STraits. This surface inflow from the Atlantic no doubt gave birth to many of the old myths about Atlantis.

When a current moves up to the surface, the water travelling along the sea-bed, it acts as a conveyor belt to bring rich nutrients to the near-surface layers of the water. These nutrients consist of decayed remains of sea animals and plants which fall to the bottom of the sea when the plants and animals die. The rule of life in the sea is that big fish eat little fish, and on down the line, which ends at minute organisms which float freely in the top few hundred feet of the sea, and which thrive and multiply on a diet of carbon dioxide and sea=water. It has always been a paradox, therefore, that there is very often very little fish life in the warm, bright Equiatorial waters, and that in the Polar regions is where the vast tonnages of fish are caught. The answer is of course that the warm Equatorial waters form a stable shallow surface layer, because the warm water is lighter than normal. It is only when currents move fromthe sea-bed, as they do in the Polar regions, and bring the necessary additives to the surface layers, that plenty of life can exist. Too much growth due to the excellent conditions for the start of the food chain may cause too many plants and animals to be produced, to such an extent that all the available oxygen dissolved in the sea water is used up. Fish then die, and decaying fish at sea putrify, form hydrogen sulphide, which in turn makes the lack of oxygen even worse. Similar cycles of nature take place in some rivers where life is stimulated by nutritious effluent from sewage systems, and by warm water from power stations. We know too well of the consequences of land-fertilizer run-offs, and effluents from some of our waste treatment plants, all of which are pushed around by sea-bed currents, but adversely affect the beginning of the food cycle. Various types of oil spills, whether accidental, or otherwise, also have their punishing affect on our food chains. Therefore, all water currents, not just ocean, are important these days both for the harvesting of fish fromthe sea, and for using the sea as a contpolled and where possible, productive rubbish-dump. The more we learn about the weather and how changes are triggered in respect of such phenommna as hurricanes, the more we find that the exchange of energy between wind and water is necessary to a full understanding both of local weather conditions, and long-term climatic changes. The currents, such as the Gulf STream, are the great stirrers of the oceans, and a knowledge of their influence is all-important in the forward planning of man's activities if he is to think at all of the future.

Some understanding, therefore, of the Stream's affects on climate, and meteorology, is essential in our study. The Gulf Stream is driven by the force of the wind on the surface of the water. Air and water on the earth interact in other ways than the direct effect of steady winds turning the surface layers of the water to start a regular ocean current. The sun beating down on the sea surface warms the water, and in turn a warm air layer is produced. The warm air is lighter than the colder air above it, and tends to rise. A circulation pattern of air is started. The air itself is too thin to be a great absorber of energy, and, therefore has to rely on land and water to collect its heat for it. Land is solid and fixed, and a very poor conductor of heat, so that it warms up quickly when it absorbs the sun's rays, while the surface layers of sea are constantly stirred so that the heat absorbed by the surface is shared with water underneath and other things being equal, the sea warms up less quickly than the land. All types of weather phenomena can of course develop from this interplay of these varying forces. IT IS INCreasingly important in weather forecasting that the ocean circulation should be thoroughly understood because the speed at which the sea can absorb excess energy from the air and the extent to which the whole volume of the sea acts as a reservoir of heat are among the unknowns in the mathematical and physical models of the atmosphere that are being contructed in order to work out the problem. The circulation of the ocean waters is affected by the earth's rotation, and by the steady winds at the earth's surface. These winds in turn depend upon the rotation of the earth, with ocean currents circulating clock-wise in the northern hemisphere, and COUNTER-clockwise in the southern. To make for better forecasting, new measurements of ocean circulation, the exchange of materials, and the recording of heat temperatures at the sea surface are constantly being developed.

The Gulf Stream has always been notable for its almost direct effects on climate in various parts of the earth. Unfortunately, the American continent is on the wrong side of the Gulf Stream. The prevailing winds are from the land to the sea in North America, so that the warm Atlantic waters cannot provide heat to improve winter climate for the Northeastern States of the U.S.A. This is why the winter in the New England States is much more severe than that of the south of France, or northern Spain, although they are all at the same latitude. Northwest Europe is bathed by the remnants of the northern branch of the Gulf Stream, and so gains a few degrees in water temperature. This in turn keeps the ice from moving far south in the winter, so that NORway is virtually ice free, while the Baltic Sea, far to the south, freezes in large areas every year.

There is another well-known climatic effect of the Stream. This occurs before the Stream moves over to perform its pleasant task of warming Britain and Scandinavia. Near Newfoundland, where the circulating current is swinging to the right before traversing the N. Atlantic Ocean, the Stream of warm water collides head-on with the cold Labrador Current. To what extent the Labrador Current pushes the Gulf Stream around to an easterly direction is not certain. The Newfoundland Bank could form a barrier to the deeper part of the current flow and thus help to divert the main stream.

The Labrador Current is a left hand member of a pair of outlets from the Artic Ocean. As the Gulf Stream pushes water along the coasts of Norway, and Spitsbergen, it must find an outlet, and it does via the east and west Labrador Currents coming down the east and west sides of Greenland. A finger of the Gulf Stream meets these descending Currents to bathe Greenland in comparatively warm water. All this succeeds in keeping a small part of the west coast of Greenland ice-free, so that permanent settlements there are possible.

The meeting of the Labrador Current and Gulf Stream is in the vicinity of the Newfoundland Bank, an area with a shallow continental shelf, which affords excellent fishing, but foggy conditions. Other than fog, there are uncontrolled obstacles more hazardous due to the fog. These are icebergs which have broken off from the glaciers in Greenland. To confound sea captains, the behaviour of the ice is not by any means regular from year to year. Any safe routes for shipping approaching Canada, and the U.S. are difficult to establish, although, with ice patrols, iceberg accidents are minimized.

Another chore of the Gulf Stream is the breaking up of the icebergs, and the pack-ice.

There is a great deal in common between the theory behind ocean current circulation and that of the atmosphere. Both air and water are fluids and obey the same physical laws relating to flow. The same model experiments used to find out how currents in the sea will behave are also used to demonstrate and investigate the flow of air in the atmosphere. As the earth rotates so the atmosphere swirls abo about the earth, and breaks into eddies which form little weather patterns of their own. In a similar way, the Gulf Streams spins off pockets of energy which move off to the side of the main stream, and may produce a significant current counter to the regular direction of the Gulf Stream.

Studies continue to be made on air movements, as well as Ocean Currents-- as the Gulf Stream, and with a better understanding of these variables, weather predictions will be made more accurately. IF WE CAn overcome the air problem then we shall almost certainly be able to do the same with the ocean currents. For example, a temporary strengthening of the Gulf Stream between 1928 and 1930, plus east winds to the south of Ireland, brought cold continental European weather to Britain. As the pocket of warm water moved farther north, it encouraged the southwesterly winds to bathe Britain in mild winters. This is an indication then of why both air and water movement must be understood if any advances are to be made, firstly in forecasting climatic changes, and possibly in the future, controlling them.

Behaviour of ocean currents are also very significant in navigational problems. One of the studies was made in 1950 by a group of six ships from Woods Hole Oceanographic Institution, the U.S. Navy Hydrographic Office, the U.S. Fish and Wildlife Service, and the Canadian Navy. The six recording ships were spaced at roughly equal intervals along the Gulf Stream, and they zig-zagged across the current's path while recording pertinent data. The tankers were equipped with Loran position-fixing apparatus, with positions recorded every hour, sea-surface temperatures, the state of the sea, and other meteorological observations. All of this was primarily concerned with surface movements. It was not until 1968, when Jacques Piccard, with the vessel, christened the BEN FRANKLIN, began studiesof the Gulf Stream's currents below the surface. The vessel was designed only as an underwater vehicle.

The Gulf Stream Drift Mission was planned to make a comprehensive set of tests and measurements for the U.S. Navy and the National Aeronautics & Space Administration. The submerged voyage of about 1500 miles was to last 30 days, starting with the initial dive off W. Palm Beach, then following the Gulf Stream almost parallel to the American coast until opposite Cape Hatteras. Hatteras was to be approximately the half way point, for from that area, the Stream swings towards the East across the Atlantic. Apparatus was mounted on deck to measure temperature, salinity, sound velocity and water pressure, as well as observations of the current speed and direction calculated from the BEN FRANKLIN, as determined by the two accompanying surface vessels. The vast amount of information gathered showed that the Gulf Stream does flow hundreds of feet below the surface, that it is a fast-moving body of warm water, that it meanders and eddies in the course of its progress around the Atlantic.

Studies of the ocean continue. The Scientific Committee for Oceanic Research, an international body which brings together scientists of all disciplines who study the oceans, has set up a working group with the self-descriptive title-- Mid-Ocean Dynamics Experiment, or MODE. The aim of the working group is to plan experiments for the 1970's and 1980's in order to provide observational data about medium-scale eddy processes in the ocean that can be related realistically to a mathematical picture of the circulation of the ocean. The results of this research will be the next step towards a better understanding of the ocean currents, and hence of the climate, weather, spread of pollution, and marine biological activity. The circulation of the oceans may well hold the key to our existence in the future, and projects like MODE should be encouraged to the full.

The Gulf Stream also has a profound affect on life within the sea, as well as plants and animals found on land rather than in the sea itself. In the sea, the range is great-- from plankton to shrimp-like animals called krill, to whales, giant squids, and hosts of others. Of the krill, it is reported that blue whales consume several tons of these each day, and that studies are being made to process krill for human consumption. The upwelling currents bringing nutrients to the shallow-water continental shelves, and aid in the development of many sea plants such as various types of sea-weed. In addition to sea-weed, another significant passenger in the Gulf Stream are the sea beans, which are washed up on the shores of southwest Ireland, and northwest Scotland. These beans are conspicious objects, and may exceed two inches in size. The wide distribution of the seeds and their continuing appearance finally convinced the scientific world that there was a sea transport mechanism which could raft floating material from the Gulf of Mexico to northwest Europe. Other passengers of the STream found on the shores of Ireland are blue snails, Portuguese-man-of war, together with wild flowers with origins in America. There is also evidence that aside from landing on the shores of Ireland, that countries south of Ireland-- Spain and the Mediterranean region have been blessed with related plants and flowers-- all carried by the Stream. Although the Gulf Stream is too warm to encourage the kind of fish which are the main catch of North American waters, it does extend the range of many W. Indian fish species far north, but is stopped by the Labrador Current. As to the Sargasso Sea, it should be noted here that if weed from Miami and New England coast can reach this area, it is probable that this central part of the N. Atlantic circulation acts as a sink for some of the liquid waste that is poured by the present generation of sea polluters. It is unlikely that any leak will occur, but if it does, any waste products will tend to go outwards towards the hub of the N. Atlantic circulation rather than to the U.S. Coast. It will be interesting to see whether or not there is any sign of oil spilt in the Atlantic accumulating in the Sargasso Sea.

The Gulf Stream is also the supplier of eels of Europe. Although eels look like snakes they bear no relationship to reptiles, and are fish. There are many types of eels, but the so-called fresh-water eel is associated with the Stream. These are flat, translucent leaf-like, with pinheads and large bodies, starting its life in deep water in the Sargasso Sea, east of Bermuda. They reach most of the rivers and ponds of northwest Europe, with the largest eel population found in Ireland. Here too, they put on a thick layer of fat, which is their food reserve for the long journey to the Sargasso Sea, their breeding ground. However, just as the salmon, the eels arrive at their bredding ground in an emaciated state. Fish scientists have found that the eel larvae finally make the sea voyage, and breed in overlapping areas of the Sargasso Sea. The value of the eel harvest in Ireland is about a quarter of a million pounds sterling per year, and from Ireland is shipped to England and northwest Europe where the eel is considered a delicacy.

Inasmuch as the political aspects of the Crazy River could have world-wide repercussions, let us look into some of the thinking on this subject. Mineral rights, and fishing rights have been under discussion for some time. Any argument against international ownership of sea beds, or claims of the continental slopes rest on the undoubted fact that it would be difficult for any would-be developer of ocenn-bed minerals to obtain a permit from a committee consisting of all the members of the United Nations. Possibly an international leasing arrangement could be worked out with royalties accumulating under the direction of the United Nations.

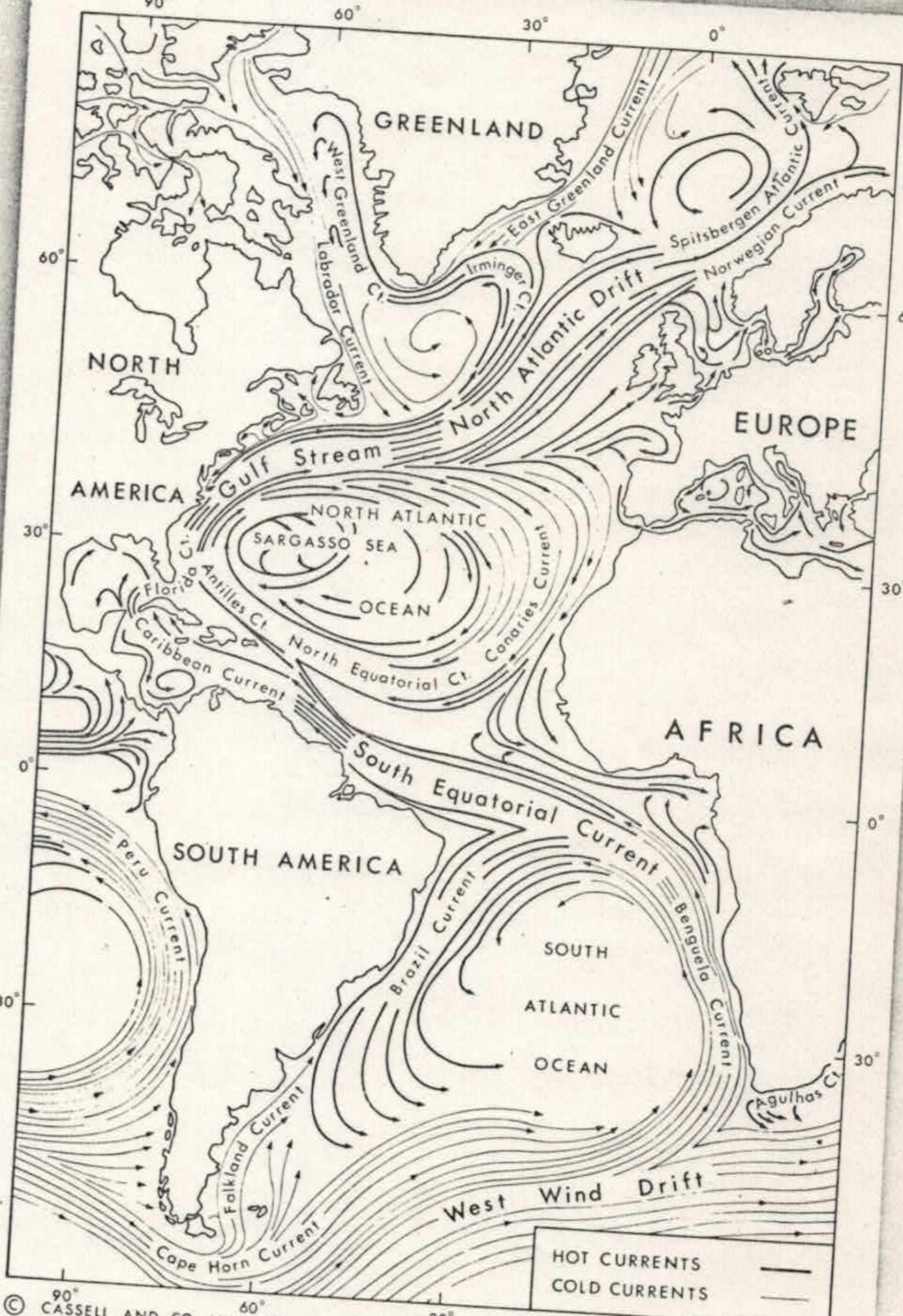
Much talk has taken place regarding the change of the course of the Stream. A Carroll Riker has been possibly the most prominent as a promotor for changing the Stream's course. In Jan. 1913, he presented to the Pres. of the U.S., and the Congress, his paper entitled " Conspectus of Power and Control of the Gulf Stream." The object of the Gulf Stream control was to stop the cold Labrador Current from the north intermingling with the warm waters of the Stream. The benefits would be elimination of the fogs in the Newfoundland area, secondly the removal of icebergs, and thirdly improved climatic conditions in the countries near the Artic Circle. The two currents were to be separated by a causeway 200 miles long, built out from Newfoundland along the Grand Banks, where the water is only 200 to 250 ft. deep. The causeway, or jetty would need to extend for 200 miles, forty miles wide, and tapering to three miles at the edge of the Grand BAnks, a total of 1000 sq. miles of filling to a depth of 250 ft. Riker determined that the sand being carried south by the Labrador Current would aid the development of this jetty. Scientific journals, and outstanding submarine constructors supported Riker's contentions for the success of his plans. There was opposition to Riker, and with the beginnings of World War I, and accompaning financial requirements, enthusiasm for further study drifted away.

Aside from ideas of changing the direction of the Stream, thoughts have been given to dam the Gibraltar Straits. By evaporation, the Mediterranean level would be lowered, land would be reclaimed, and head waters would develop on the Atlantic end for electric water power developments. These engineering pipe-dreams may never be accomplished, but it must be realized that they could be undetaken and with no more application of money and effort than the space programmes of Russia, or the U.S. This is why such natural phenomena as the Gulf Stream have political implications. Inasmuch as alterations in the flow of water in the oceans will affect many countries, some international control would seem adviseable.

The Gulf Stream deserves its popularity with mankind due to its benign influence on man's affairs. Since it is one of the most conspicuous currents in the world, it has attracted the attention of many investigators, and is probably the most studied example of ocean circulation. As knowledge of the water circulation of the sea increases, a doubt tends to arise as to whether the Gulf Stream should be considered as a separate entity,or if it would be better regarded as the outer edge of the general N. Atlantic circulation. The 2000 ft. thick body of water which is the Sargasso Sea drifts slowly to the south-west due to the action of ~~the action of~~ the wind and forces consequent ~~on~~ to the earth's rotation. This warm water is stopped from reaching the N. American coast by the Gulf Stream. The affect then of setting up a boundary for the Sargasso Sea, is of critical climatic importance to Europe, and thus the Stream is a small part of the whole system.

Claims are made that if the Stream were slowed down, milder climates would result in the north. One scheme to slow down the Stream's rate is the idea that the Stream should be put to work turning giant turbines situated in the Fla. Straits. The turbines would produce vast quantities of electric power, and by removing energy from the fast flowing current, the Stream system would be slowed down, resulting in a spreading of the warm tropical water and therefore, providing a larger source of heat for the winds to carry over Britain and Scandinavia.

In conclusion, may we summarize by saying that at the moment we do not know how much built in stability our earth's atmosphere and oceans possess. That is why forward-thinking scientists are pushing for international effort for experiments such as the Mid-Ocean Dynamics Experiments, for more observations of the atmosphere and of the ocean surface from satellites, and more studies of the body of the ocean by means of instruments from buoys or other devices tethered to the ocean floor. Since the "crazy river" has, and will play an important part in the lives of people who live on the land which borders the N. Atlantic, this account of the Gulf Stream is an unfinished report. The hope is that it has stimulated your interest in another one of those many wonders of our creator which we so easily take for granted, and little apprciate.


GREENLAND
West Greenland Ct.
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East Greenland Current
Spitsbergen Atlantic Current
Norwegian Current
Irminger Ct.
North Atlantic Drift
NORTH
AMERICA
EUROPE
Gulf Stream
NORTH ATLANTIC
SARGASSO SEA
OCEAN
Florida Ct.
Antilles Ct.
Canaries Current
Caribbean Current
North Equatorial Ct.
AFRICA
South Equatorial Current
SOUTH AMERICA
Peru Current
Brazil Current
Benguela Current
SOUTH
ATLANTIC
OCEAN
Agulhas Ct.
Falkland Current
West Wind Drift
Cape Horn Current
HOT CURRENTS
COLD CURRENTS