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# The Rainfall of Jamaica

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# The Rainfall of Jamaica

*This brochure, incorporating a topographical and annual and monthly rainfall maps of Jamaica, is published with the view to making up-to-date information on the rainfall of Jamaica available to the many sectors of the community to whom such data are of value. The previously available rainfall maps were compiled some 70 years ago and, perforce, were based on very limited records.*

*The project was initiated by Mr. Michael Nancoo, Ag. Assistant Director, Jamaica Division, West Indies Meteorological Services and sponsored by the Scientific Research Council. The rainfall maps were prepared under the direction of Mr. O. B. Rogers, Director of Surveys, by Mr. L. E. Saunders, Chief Survey Draughtsman, from data and isohyets supplied by the Meteorological Office at Palisadoes. The topographical map was adapted from one published by the Directorate of Colonial Surveys in 1953.*

*All the averages quoted in this booklet are based on data obtained at 562 rainfall stations during the period 1870-1960.*

The atmosphere receives its heat by conduction and by absorption of long-wave radiation from the earth. Although the upper layers of the atmosphere are closer to the sun, air becomes cooler as altitude increases. This is because the atmosphere is transparent to the short-wave radiation given off by the sun while the earth absorbs it. As a result the earth warms up by day and gives off long-wave radiation which the atmosphere then absorbs. This is why the air that is closest to the earth is usually warmer than that higher up.

The formation of clouds is due to the ascent and cooling of the air. Because warm air is less dense than cold air the hot air in the lower layers of the atmosphere is forced upwards. Rising air cools at the rate of about 5½°F per 1,000 feet; and, as air condenses when it is cooled to its dew point, air at a temperature of 85°F and a dew point of 75°F will condense if forced to rise to a height of 2,000 feet.

**Causes of rain**

The ascent of air may be due to:

1. Warming;
2. Juxtaposition of air masses of different temperature;
3. Contact with mountains;
4. Convergence in a line or area of air currents.

Cloud or rain resulting from the first of these is called convective, from the second frontal, from the third orographic, and from the fourth convergence rain.

**Convective rains**

The air in the lower layers of the atmosphere which has been heated by conduction will continue to rise so long as it stays warmer than the air through which it is rising and, depending on the initial temperature and the state of the upper atmosphere, may sometimes reach considerable heights—40,000 to 50,000 feet. On some afternoons the bulging white tops of clouds can be seen to be growing higher. Convective rains are more frequent in the northern summer months when heating of the land by the sun is more direct.

**Frontal rains**

Frontal rains are not common in Jamaica but they tend to occur during the northern winter, when the cold air from the north has to travel far south before it acquires a temperature similar to that of air originating in the tropics. The fronts are caused by the meeting of air from the "Arctic or Polar Regions" with that from "Tropical or Equatorial Regions". The former is denser and either undercuts the latter to form cold fronts or acts as a barrier which the tropical air overrides to form warm fronts.

**Orographic rains**

Because of its topography Jamaica is subject to frequent orographic rains, especially on the windward slopes of the mountains which form an ever-present barrier forcing the air to rise. In spite of this, however, orographic rains do not occur every day. The upward movement of air is necessary but not sufficient to cause precipitation. Other conditions must be present in the atmosphere through which the air is rising before rain is produced. The complete process of rain formation is discussed at varying lengths in textbooks on "Meteorology".

**Convergence rains**

If more air is coming into an area than that going out

of it a current of air moving upward is likely to result. During the summer months the ordinary prevailing winds and seasonal easterly winds converge on the island. The "Easterly Waves" affect Jamaica as squall lines moving from east to west. Hurricanes sometimes form on these lines, and rain is associated with their passage.

**Rainfall distribution**

The foregoing discussion provides a basis for understanding the general distribution of rainfall in Jamaica. An interesting exercise would be to copy the physical features map on transparent paper and superimpose this on any of the rainfall maps in this booklet. The orographic effect would stand out, showing a high rainfall region on the north-eastern slopes of the Blue Mountain range, and a relatively dry area in the rain-shadow of the Rio Minho basin.

A detailed analysis of the seasonal distribution of rainfall will show that rain in Jamaica due to fronts or convergence effects is a small percentage of the total rainfall. The bulk of the rainfall is due to convective and orographic causes. During the periods when there are no synoptic features (fronts, depressions, easterly waves) there is still likely to be rain on the Blue Mountain slopes and the central areas.

The physical features of the island cause the convective and orographic processes to work in conjunction. The mountain ranges run from east to west and divide the northern coastal lowlands from the southern. In the day convection causes the prevailing winds to blow towards the land from the south-east in the south of the island and from the north-east in the north. The cooler air from the sea only gradually acquires the warmer land temperatures and often reaches the mountain slopes at the moment when its temperature is just high enough for it to start rising. The mountains force the air to rise suddenly, and the sudden cooling of the air causes heavy cloud formation. Thus the clouds are larger than they would have been from convection alone. This is the explanation of the high rainfall in the mountains across the centre of the island. The north and south coastal areas do not benefit to any extent from either convective or orographic causes and have low rainfall. Except for some mountain areas, rain at nights is not frequent. This is largely because the convective process is not at work at night.

Jamaica may be divided into three rainfall zones:

1. A heavy rainfall area with an annual average fall of over 100 inches;
2. A moderate rainfall area with an annual average fall of 50–100 inches;
3. A low rainfall area with an annual average fall of less than 50 inches.

1. The zone of heavy rainfall includes the north-east section of the island, the Cockpit Country, and parts of the Parishes of Hanover and Westmoreland. The greatest concentration of rainfall in this zone is along the windward slopes of the Blue Mountain range and over the range itself. The idea that rainfall follows the mountains is well illustrated here.

2. The zone of moderate rainfall comprises that section of the north coast extending westward from Port Maria to Negril Point (but excluding a narrow strip of coastland between Discovery Bay and Montego Bay) and the central ridges in the heart of the island. In these sections the gradient from coast to interior is not as steep as in the north-east, and the rainfall is more evenly distributed.

3. The zone of low rainfall includes:
   1. The south coastal strip stretching from Bull Bay to Black River, and
   2. The narrow strip of land along the north coast between Discovery Bay and Montego Bay.

These areas have the least rainfall because (*a*) they are relatively flat and (*b*) they are not fully influenced by orographic rains. A marked dry area in this zone is in the south-west, in the parish of St. Elizabeth, with an average annual rainfall of less than 35 inches.

**Annual distribution**

The months of low rainfall are December, January, February and March, coinciding with the season of "cold fronts" which, as was explained earlier, does not appreciably affect the island's rainfall. Convective precipitation is reduced to its minimum and easterly waves are non-existent. Whatever rainfall occurs during this period is chiefly orographic and reaches its minimum in March with an island average of 2·90 inches.

The periods of highest rainfall occur in May and June and in August to November. The May–June maximum may readily be explained on the grounds of great convective activity. The August rainfall is due to convective activity and the passage of active easterly waves. The months of September, October and November owe their high rainfall to the passage of active easterly waves

combined with the general increase in the moisture content of the atmosphere in the Caribbean area. The highest average maximum is usually reached in October.

There is a transition period in April, when the rainfall steadily increases from the minimum reached in March to the summer maximum in May or June. A secondary transition period occurs in July, when the rainfall decreases slightly before the advent of the August to November rainy season.

**Average monthly distribution**

*January*
The north-eastern area, in the vicinity of the Blue Mountain range, has appreciable rainfall with a maximum of 30·21 inches. Other areas have very low rainfall, the minimum of 0·33 inches occurring in the south coastal areas.

*February*
The distribution of rainfall approximates that of January. In the north-east, however, the maximum is now only 15·30 inches and the minimum in the south coastal area has increased slightly.

*March*
This is the driest month of the year with an island average of 2·90 inches. In the north-eastern area the maximum is only 10·71 inches. However, rainfall has increased slightly in the interior of the western parishes, where a maximum of 5·44 inches occurs.

*April*
This is a month of transition from a dry to a wet season. The average maxima are higher, reaching 13·52 inches in the Cockpit Country and 24·49 inches in the north-eastern area.

*May*
A more even distribution of rainfall is the distinctive feature. The April increases are maintained. The central districts of the extreme western parishes (Westmoreland, Hanover, St. James) have high rainfall with a maximum of 35·77 inches. The south coastal area has averages varying from a minimum of 2·30 inches to a maximum of 8·62 inches.

*June*
The distribution of rainfall during this month remains very much the same as for the previous month except for an appreciable decrease in the Cockpit Country and the central districts of the extreme western parishes. The south coastal area shows a marked drying-out in sections, particularly in the central districts where minima of less than 2 inches occur.

*July*
There is a general decrease in rainfall throughout the island. There are two wet zones: the one in the east central districts with a maximum of 16·94 inches in the wetter north-east, and the other in the west central area with maxima of 12·72 inches in the Cockpit Country and 15·02 inches in the central parts of the extreme western parishes. The north and south coastal areas have the lowest rainfall with minima ranging from 0·76 inches in the south-west to 1·26 inches in the north-west.

*August*
There is a slight decrease in rainfall in the north-eastern area, the maximum being 18·67 inches. Elsewhere there is an increase in rainfall, particularly in the Cockpit Country, where the maximum is 16·84 inches.

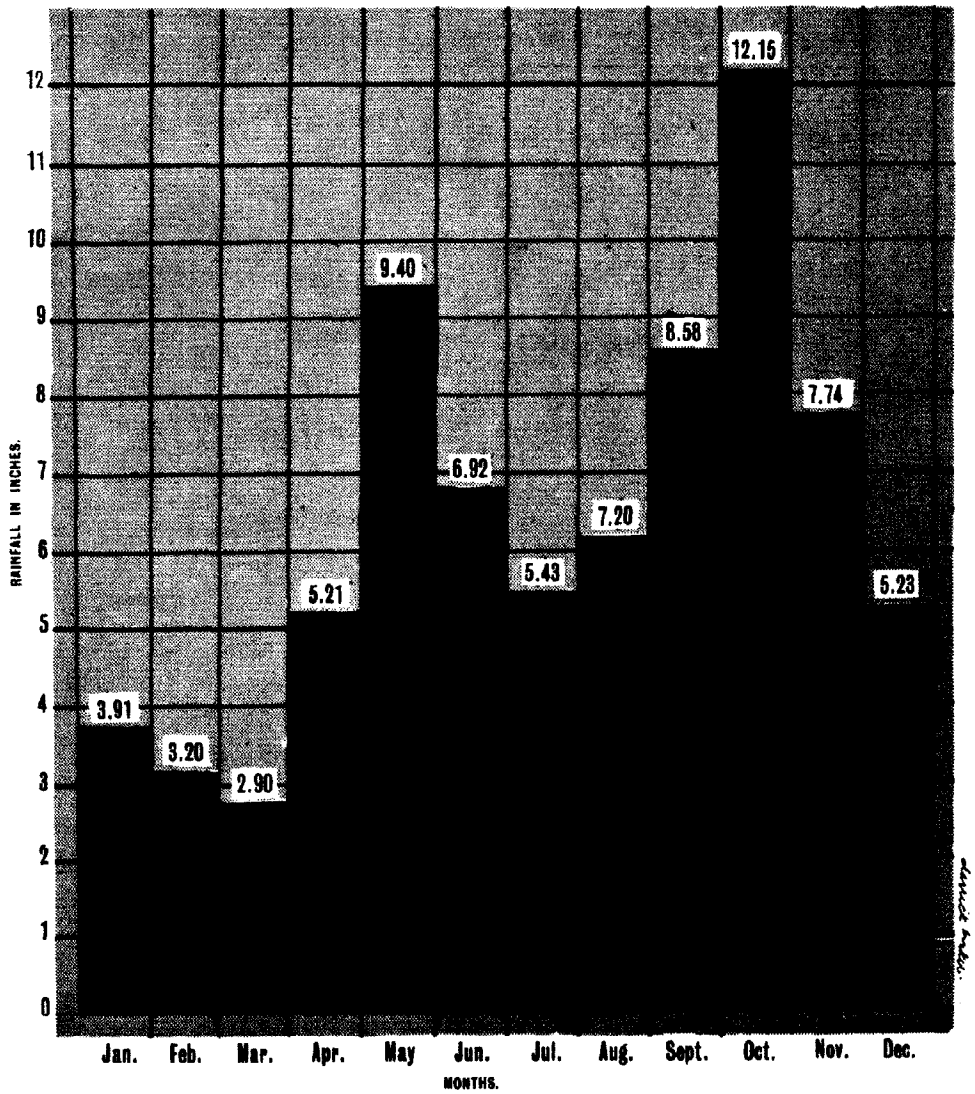
*September*
The increase in rainfall noted in August has now become general. The central regions have a maximum of 11·51 inches. The wet north-east zone continues to maintain the highest averages with a maximum of 26·03 inches. Two rainfall belts occur in the south coastal area: a very narrow coastal strip with averages ranging from 3 to 5 inches, and a broader zone having averages of from 6 to 10 inches and reaching a maximum of 11 inches in isolated places. The rainfall along the normally dry south coastal strip is approximately 1·5 inches higher than that of the north coast.

*October*
The island's maximum rainfall occurs in this month. A noticeable feature is the increase in the rainfall of the central areas where the average range from a high of 17 inches in central Manchester to a low of 5·62 inches in the Rio Minho valley.

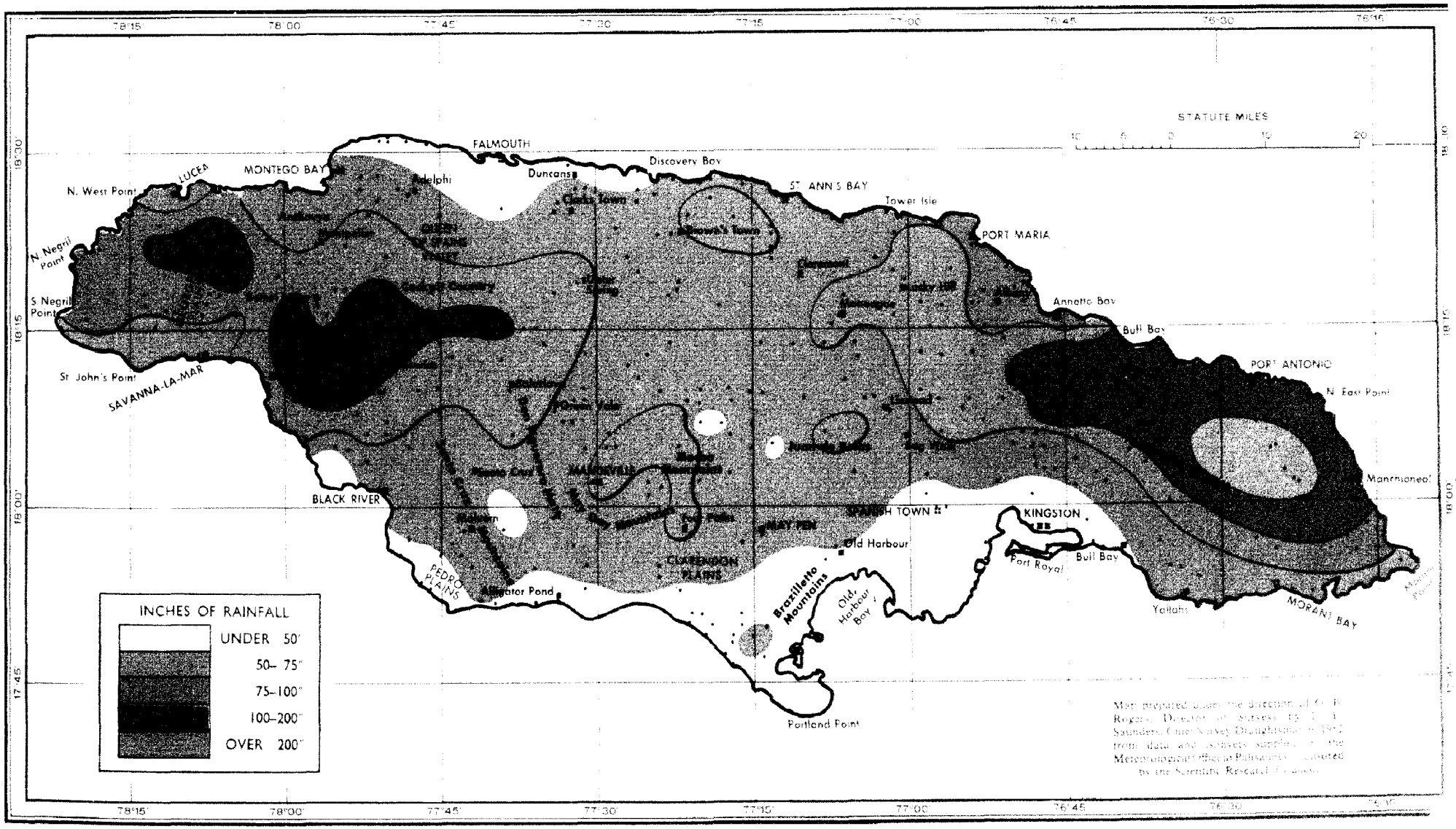
*November*
The north-eastern region has its maximum rainfall of 43·77 inches. Elsewhere the rainfall decreases especially in the western and central parishes. The greatest decrease is in the Cockpit Country.

*December*
Considerable decreases in rainfall occur in all areas. In the western and central districts the averages fall below 2 inches. The south coastal strip is essentially a dry region with average as low as 0·83 inches. The wettest region is still the north-east.

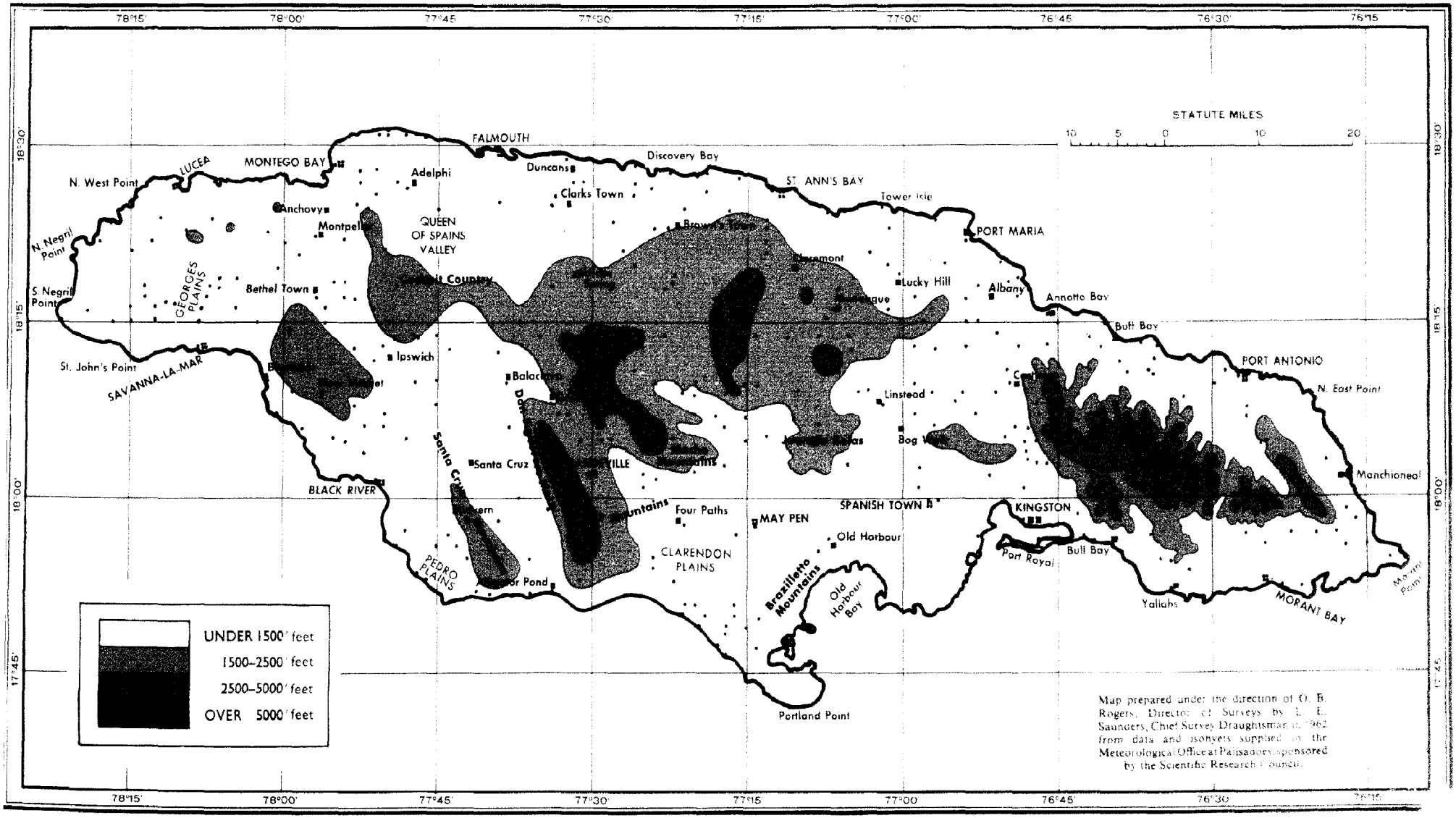
HISTOGRAM OF MONTHLY MEAN RAINFALL TOTALS
JAMAICA 1870–1960



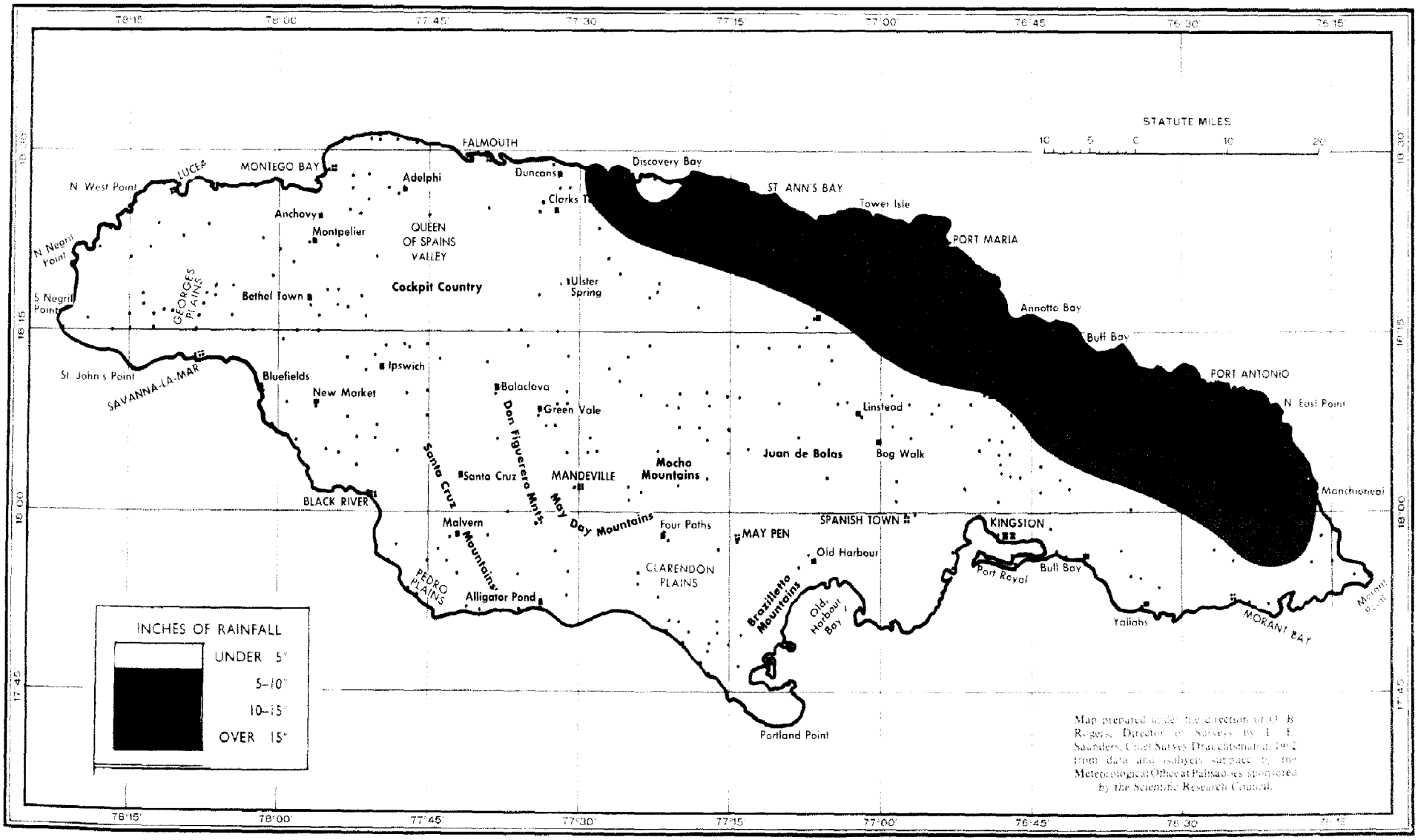
MAP SHOWING THE AVERAGE RAINFALL OVER JAMAICA FOR THE YEAR



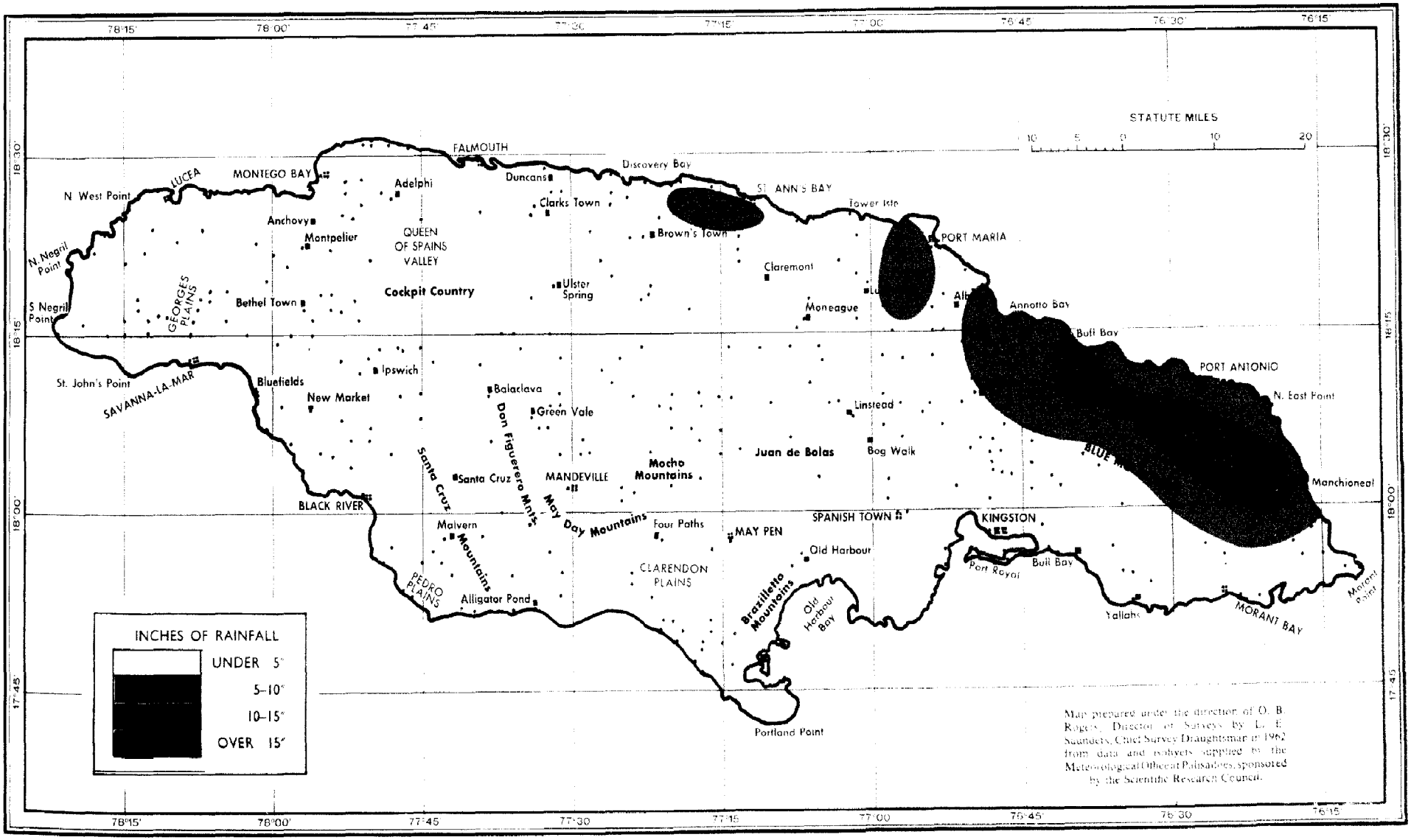
MAP SHOWING TOPOGRAPHICAL CONTOURS OF JAMAICA



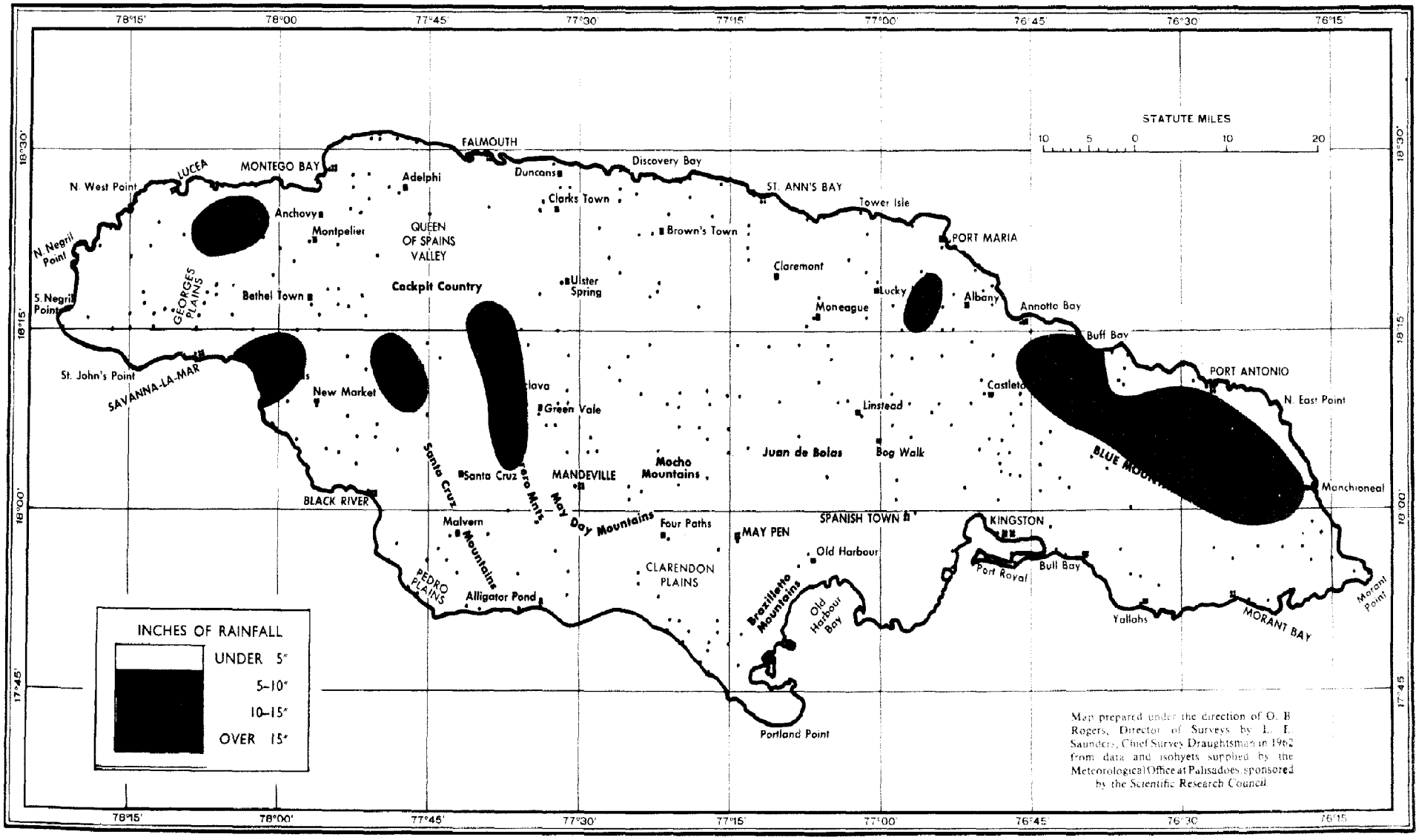
MAP SHOWING THE AVERAGE RAINFALL OVER JAMAICA FOR THE MONTH OF JANUARY



MAP SHOWING THE AVERAGE RAINFALL OVER JAMAICA FOR THE MONTH OF FEBRUARY

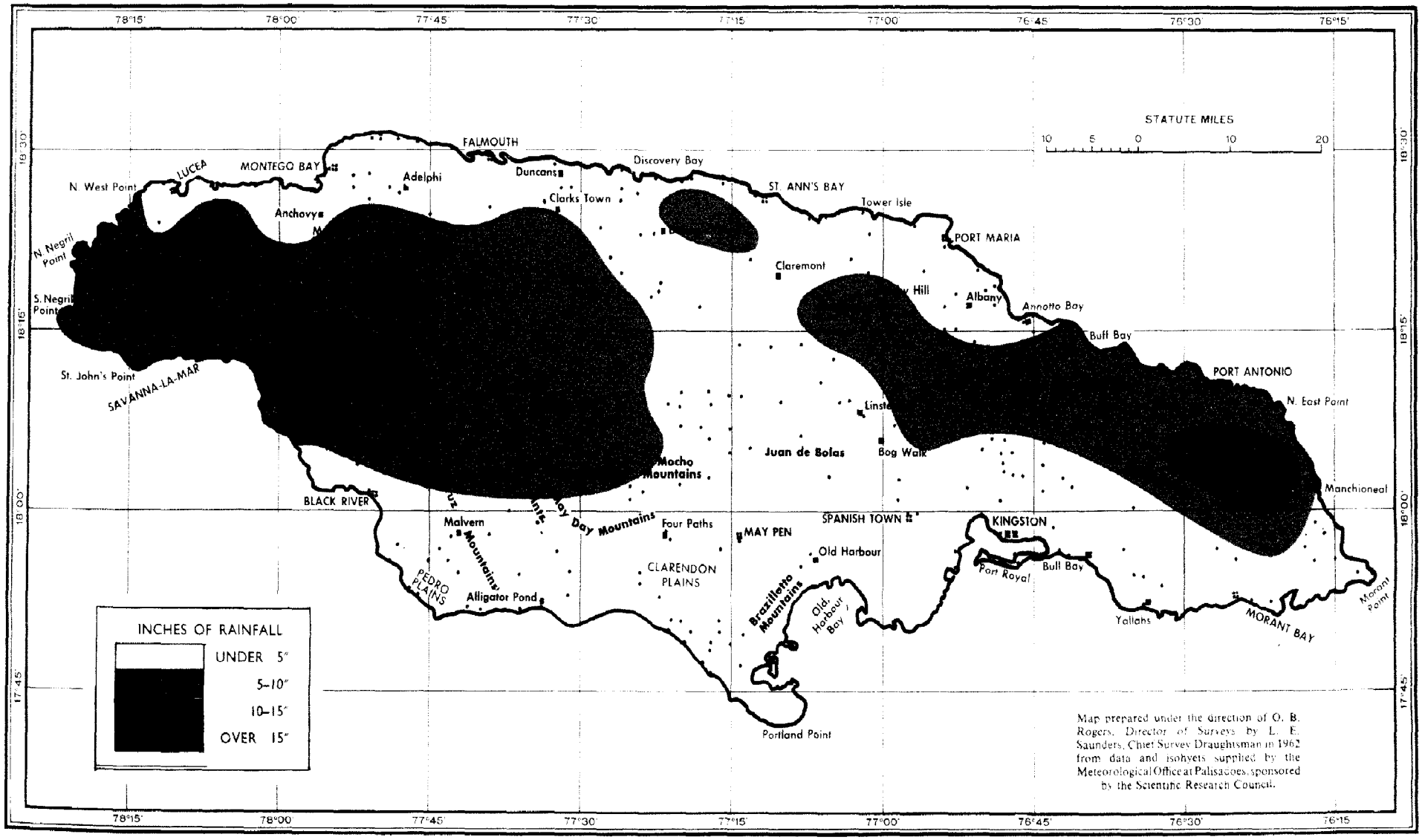


MAP SHOWING THE AVERAGE RAINFALL OVER JAMAICA FOR THE MONTH OF MARCH

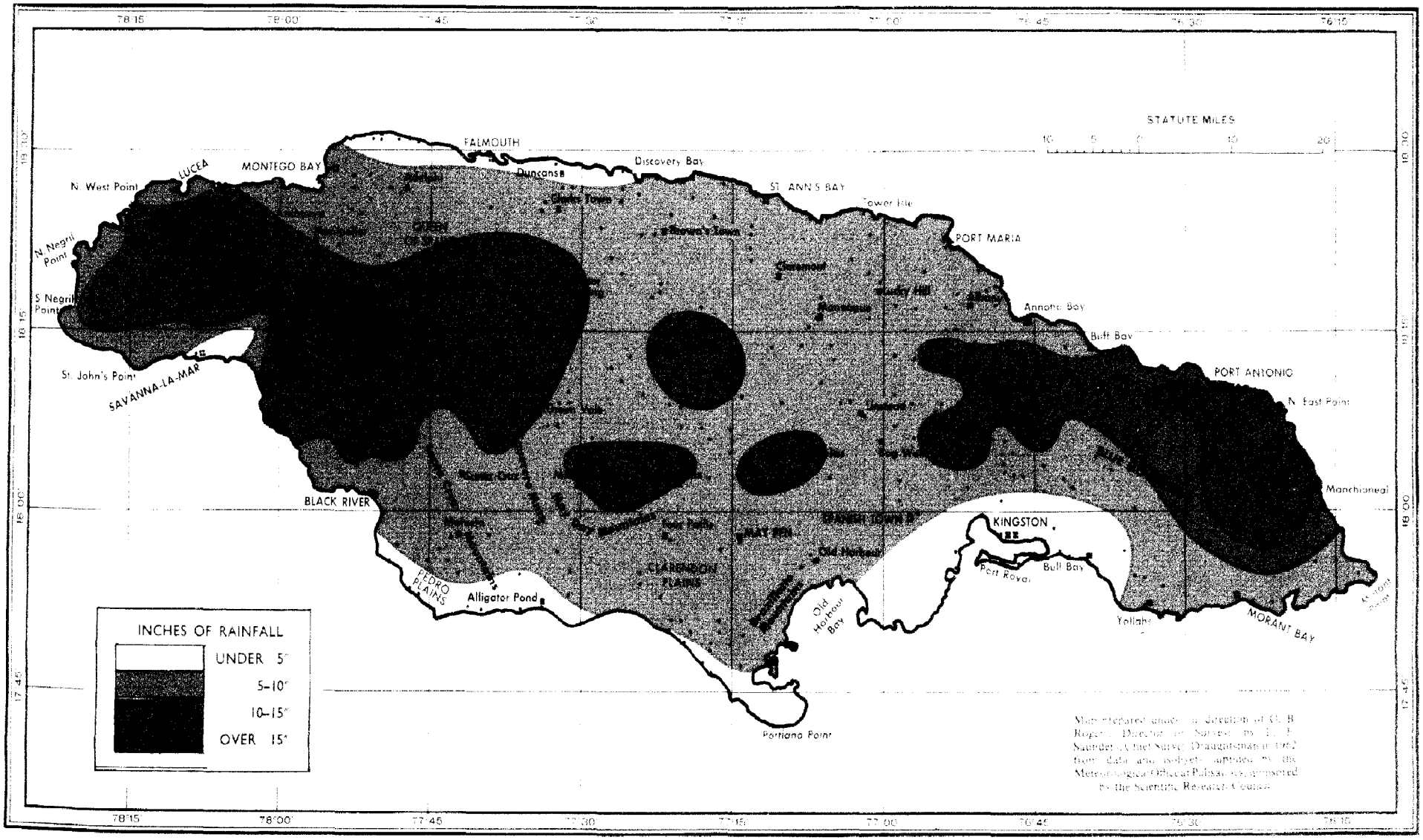



Map prepared under the direction of O. B. Rogers, Director of Surveys by L. E. Saunders, Chief Survey Draughtsman in 1962 from data and isohyets supplied by the Meteorological Office at Palisadoes sponsored by the Scientific Research Council

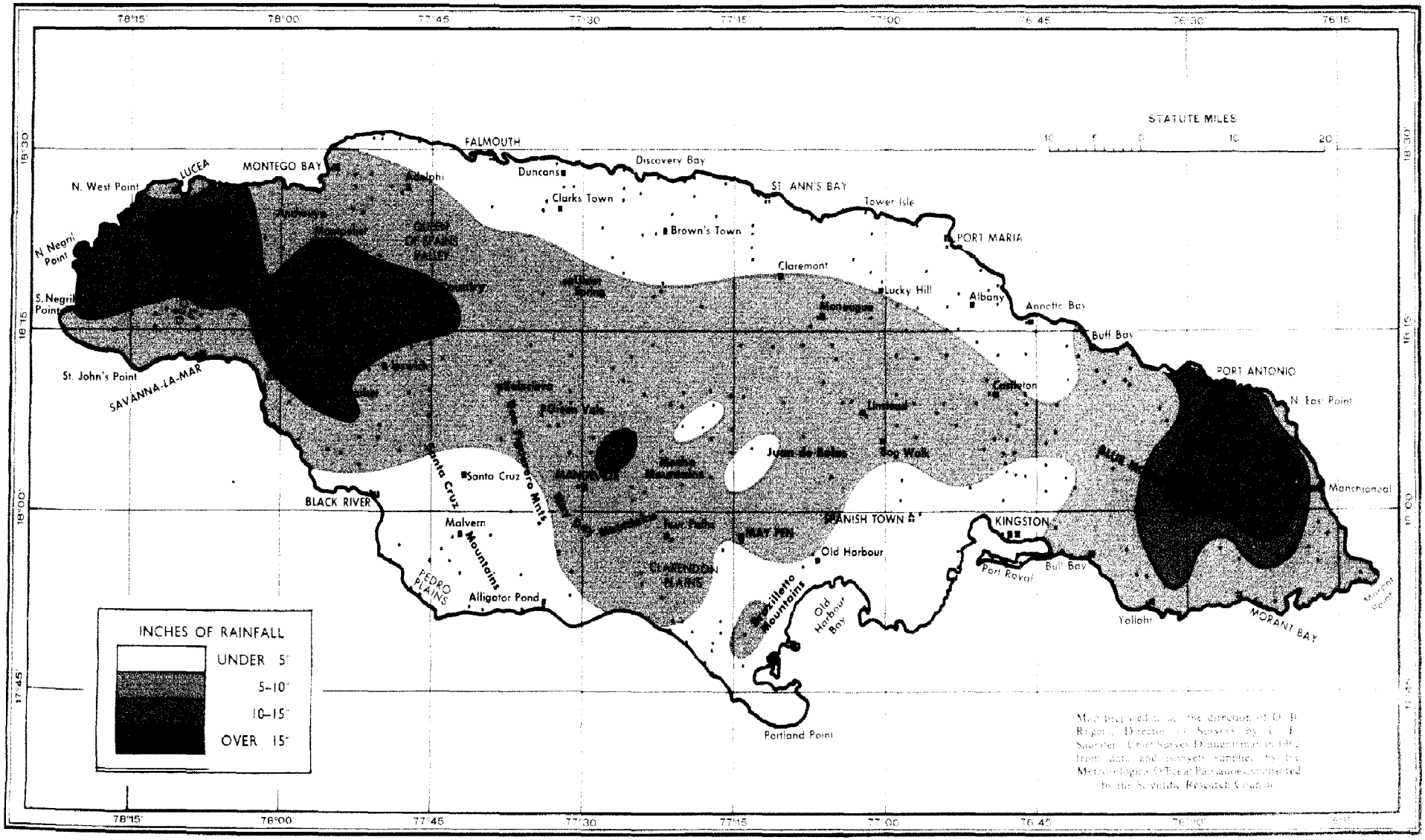
MAP SHOWING THE AVERAGE RAINFALL OVER JAMAICA FOR THE MONTH OF APRIL



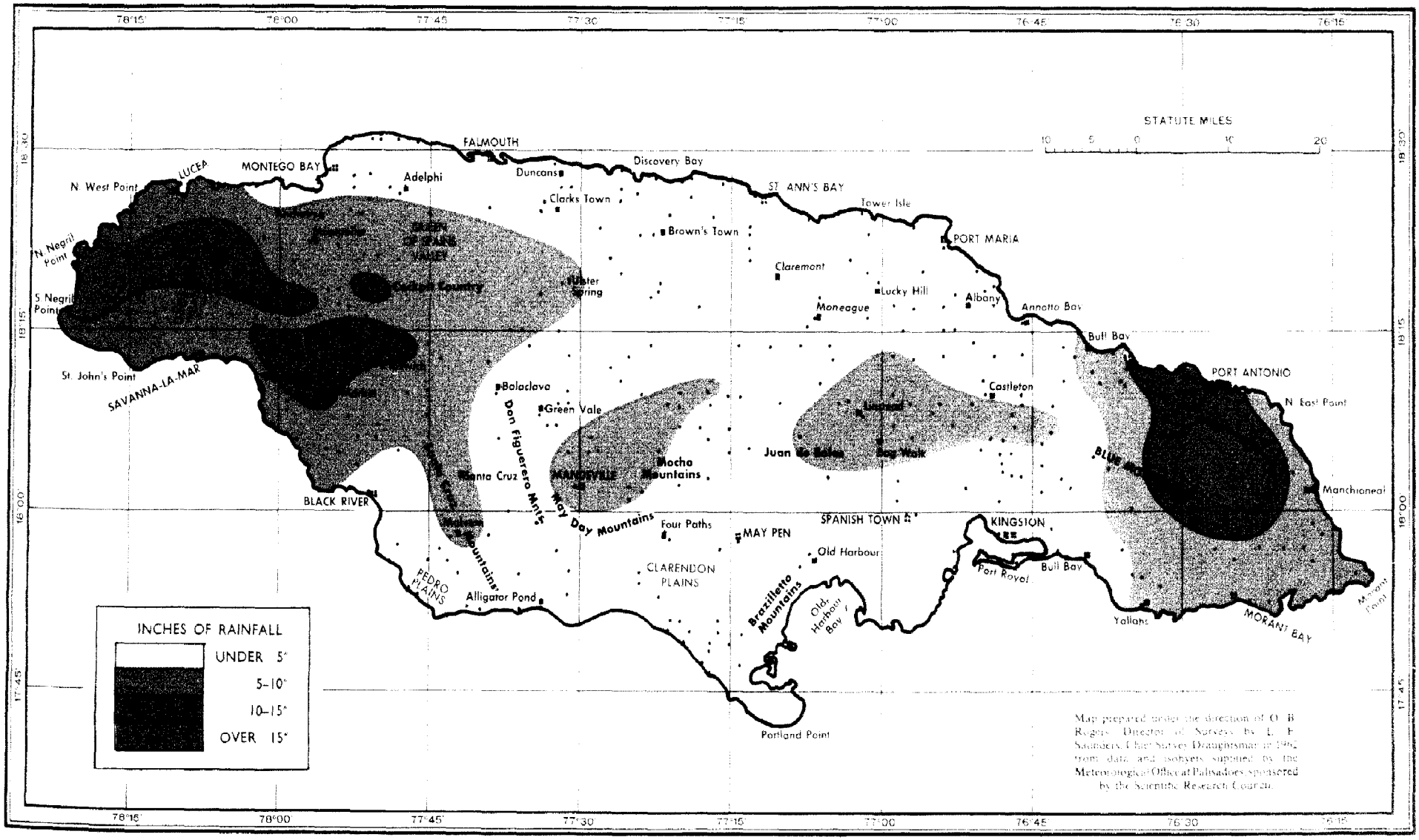
MAP SHOWING THE AVERAGE RAINFALL OVER JAMAICA FOR THE MONTH OF MAY



MAP SHOWING THE AVERAGE RAINFALL OVER JAMAICA FOR THE MONTH OF JUNE



MAP SHOWING THE AVERAGE RAINFALL OVER JAMAICA FOR THE MONTH OF JULY

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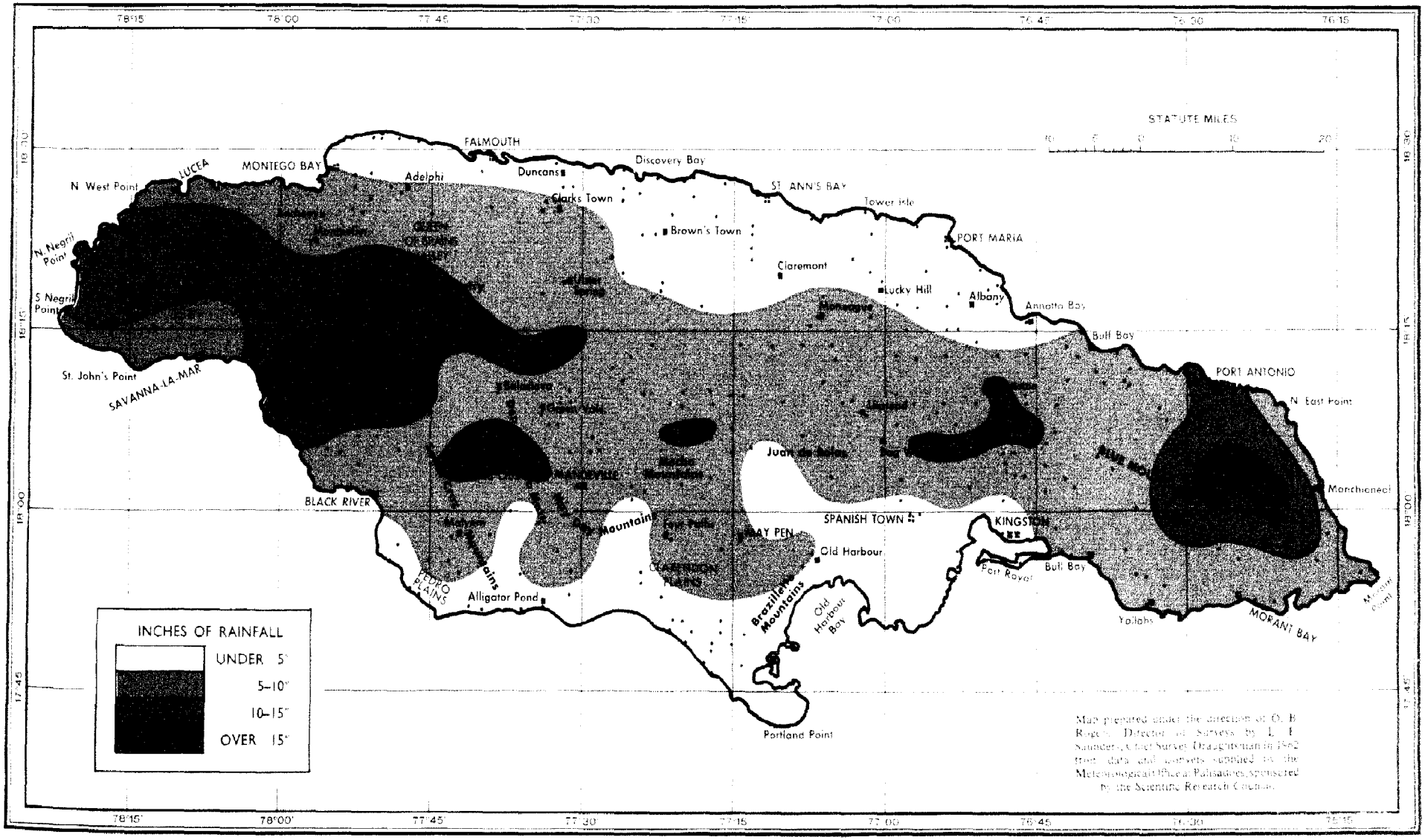
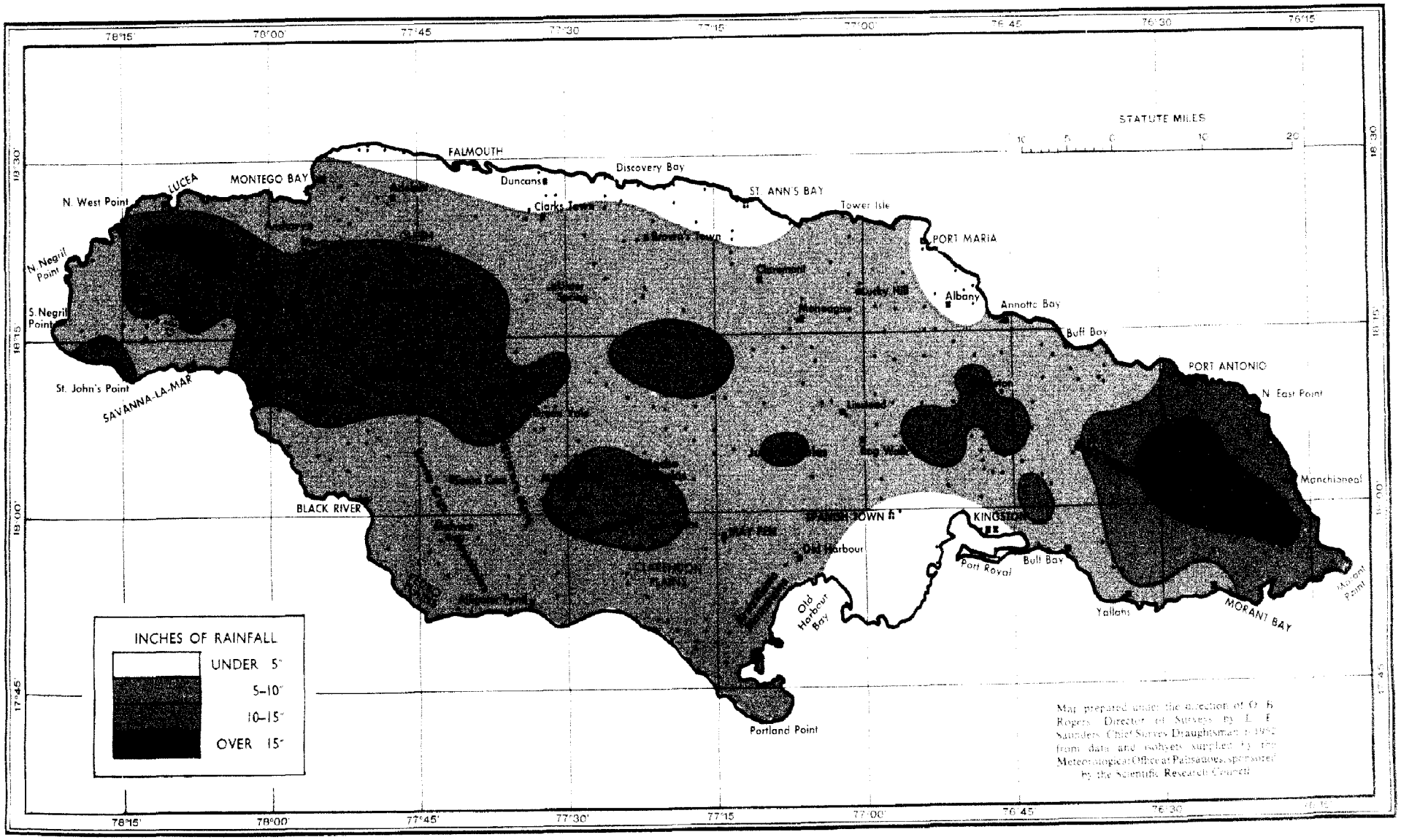
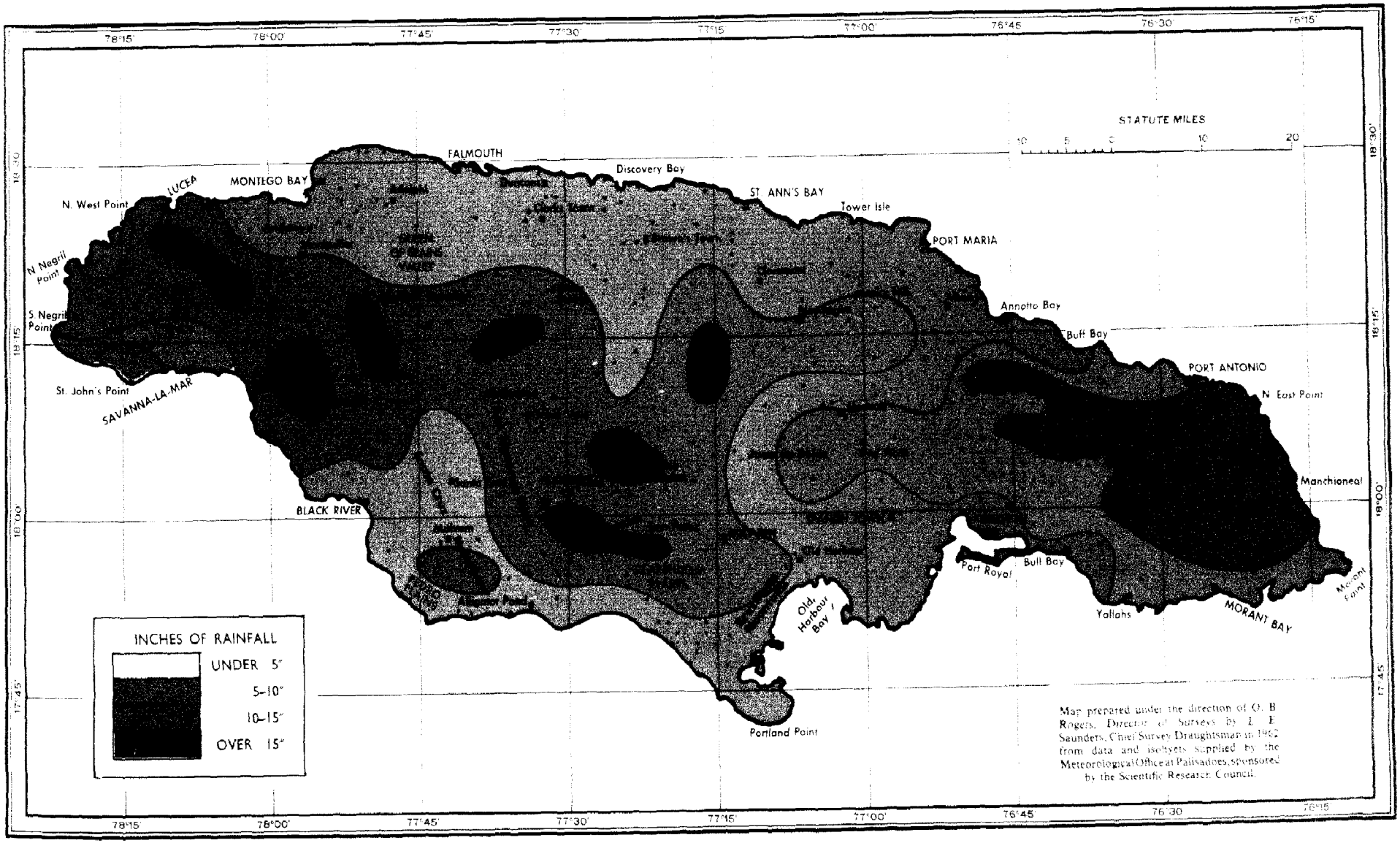
MAP SHOWING THE AVERAGE RAINFALL OVER JAMAICA FOR THE MONTH OF AUGUST



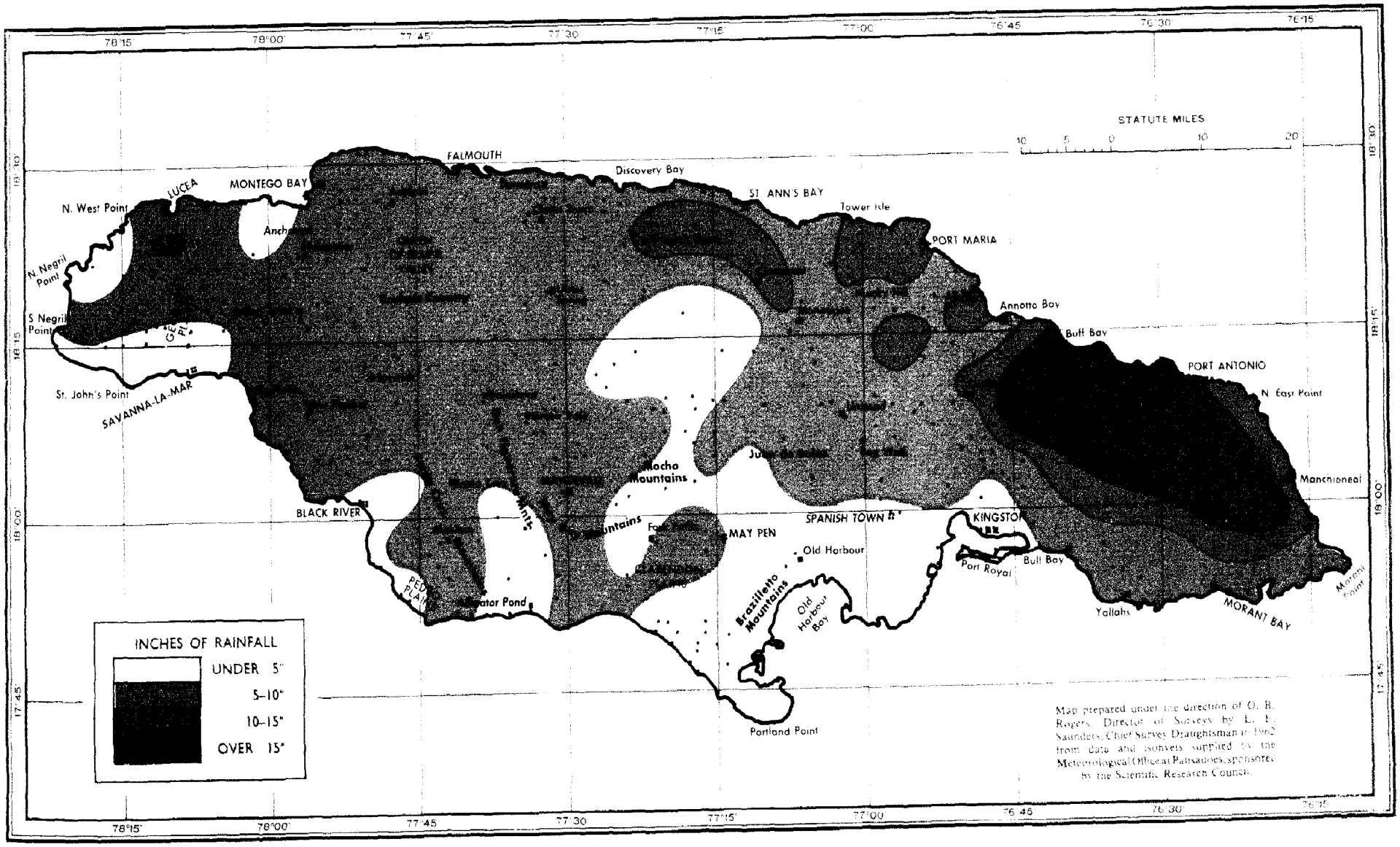
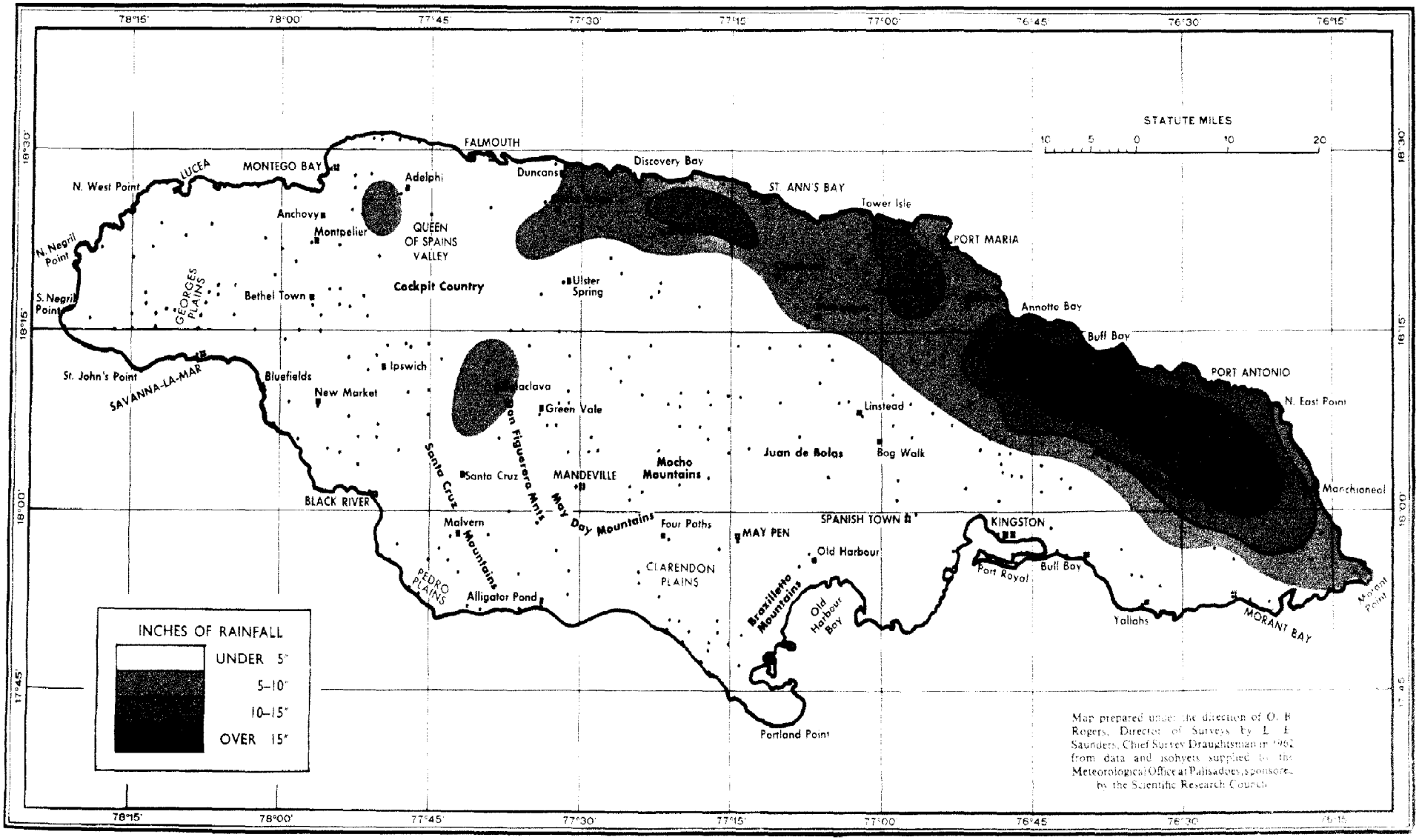
MAP SHOWING THE AVERAGE RAINFALL OVER JAMAICA FOR THE MONTH OF SEPTEMBER



MAP SHOWING THE AVERAGE RAINFALL OVER JAMAICA FOR THE MONTH OF OCTOBER



MAP SHOWING THE AVERAGE RAINFALL OVER JAMAICA FOR THE MONTH OF NOVEMBER



MAP SHOWING THE AVERAGE RAINFALL OVER JAMAICA FOR THE MONTH OF DECEMBER