8-175 PUNTA BURICA (8° 02′ N., 82° 52′ W., H.O. Chart 1018).—From Platanal Point to Punta Burica, 23 3/4 miles to the southeastward, the shore sweeps around in a gradual curve, with deep water extending far into the bight thus formed. Punta Burica lies at the southern end of a long, narrow peninsula that forms the western shore of Bahia Charco Azul. Along the middle of this peninsula is a group of hills 700 to 900 feet high. This point forms an excellent landmark from any direction and has been reported to be identifiable on radar, at a range of 18 miles.

8-176 ISLA BURICA, nearly 1/2 mile in extent, lies about 1/2 mile off Punta Burica, with which it is connected by a rocky reef. A black rock above water lies 1 1/4 miles northwestward and some sunken rocks lie southward of the islet, which should not be approached within the 20-fathom curve, or nearer than 1 mile.

Punta Burica may be seen in clear weather from a distance of 35 miles, and is thus an excellent landfall for vessels coming from either eastward or westward. The islet, being high and isolated, serves as an excellent object for recognition when making the land from seaward.

8-177 ISLA BURICA LIGHT is shown from white skeleton tower. When the tower is sighted it usually appears to be on the mainland.

8-178 TIDAL CURRENT.—In the vicinity of the point the flood current sets northwestward with some strength. In 1959, it was reported that a northerly set of over 1/2 knot was experienced in the vicinity of Punta Burica.

CHAPTER 9

THE COAST OF PANAMA FROM PUNTA BURICA TO CAPE MALA, WITH ADJACENT ISLANDS

9–1 BAHIA CHARCO AZUL (DAVID BAY (*H. O. Chart 1018*), lying between Punta Burica and Isla Parida, 30 miles eastward of the point, extends 16½ miles within the line joining the point and the island. The depths are great in the western part of the bay, but in the eastern and northern parts they are moderate, shoaling gradually toward the shore; in the eastern part the 10-fathom curve lies 5 to 7 miles offshore, whereas along the western shore it lies only about ¼ mile off.

The coast of Punta Burica turns sharply to the northward for 15 miles and then sweeps around to the east-northeastward 10¼ miles to Boca Espinos and thence east-southeastward 12 miles to Boca San Pedro. The coast between Punta Burica and Punta Balso (Feltus), 2½ miles to the northward, is fronted to a distance of ¼ mile to 1½ miles by a breaking shore bank, but between Punta Balsa and the mouth of Rio Rabo del Puerco, 12 miles to the northward, there is deep water close inshore, sheltered against the southwesterly swell. Even in the open part of the bay, however, anchorage is considered safe. The western shore of the bay is high, but the northern shore is low and cut by several rivers. The sandy beach serves as a highway for native traffic.

9–2 Tides.—For all practical purposes the times of the tide at Balboa may be used for the tides in Bahia Charco Azul without appreciable error, and the range ratio of 0.6 will give excellent practical results.

9–3 PUERTO ARMUELLES (*8°16'N., 82°52'W., H.O. Chart 5651*), situated close southward of the mouth of the Rio Rabo del Puerco, near the northwestern corner of Bahia Charco Azul, is sheltered from south through west to northeast. The southwest swell is shut out by Punto Burica, and inasmuch as the prevailing winds during the winter months are westerly, and as the northeasterly winds prevail during the summer months, no winds of great force blow into the bay. During the months of May and June a southeasterly swell is felt at the pier; it is usually rather light, but is sufficient to cause a vessel to pound against the pier. Ships are occasionally affected by ground swells which may come during any month of the year. These swells are caused by storms at sea many miles away. The currents are strong and erratic; a vessel moored at the pier has experienced a strong undertow which put a heavy strain on the mooring lines.

A prevailing southwesterly swell has been reported (1956). Vessels moor starboard side to the pier with their bows to sea so as to have at least 10 feet between the vessel and the pier.

9–4 Landmarks.—Because of a dense haze in the early morning, landmarks are particularly difficult to distinguish. The best landmark consists of two large aluminum-colored cylindrical tanks situated about 1,340 yards 270° from the head of the pier.

9-5 DEPTHS.—Depths in the approach to the port are deep. A least depth of 33 feet exists on the eastern side of the pier and a 600-foot vessel with a maximum draft of 30 1/2 feet is reported to be able to go alongside.

9-6 LIGHTS.—Two lights are shown from the head of the pier.

Obstruction lights are shown from two 103-foot radio towers located 1/2 mile west-northwestward of the head of the pier and from another radio tower about 1/2 mile northwestward of the pier. A light is shown from the church, about 1/4 mile west-northwestward of the pier.

9-7 This section has been deleted.

9–8 Anchorage.—There is no charted anchorage. Because of extreme depths in the general area vessels may anchor at the discretion of the Master. Vessels unfamiliar with the port usually do not anchor, but remain underway until the berth is available. Vessels are advised by radio when the berth is available.

Deep-draft vessels can anchor in about 18 fathoms, thick mud and shells with good holding ground, about 1 mile eastward of the head of the pier. This anchorage should be used with caution and constant soundings should be taken. Radar should be used for determining distance off the pier as landmarks for securing an exact position are limited.

Mooring buoys are used for breasting vessels off the northeastern side of the new pier. The inner buoy, closest to the pier, is reported to be connected to the pier by a submerged wire. Shore crews generally board the vessel to assist in mooring.

When berthing, vessels should not let go the anchor until the midship section (bridge) is between the outer and middle mooring buoys.

9–9 Foul area.—An area in which anchors may be fouled lies centered about 250 yards east-northeastward of the head of the new pier. Although the area is apparently not of large extent, its size has not been reported.

Pilots.—An unofficial pilot, a qualified employee of the Chiriquí Land Company, is available day or night. It is advisable to use his services as the entrance of this port requires a pilot. This pilot will go out in a launch, if requested, and board vessels about 1 mile southeastward of the pier.

9–11 Puerto Armuellers, a town with a population of about 10,700 (1964), stands on the western shore of Bahia Charco Azul, 14 miles northeastward of Punta Burica. It is a port of entry and an important shipping point for bananas, coffee, cattle, and other agricultural products.

Pier.—A screwpile pier projects out about 510 yards in a southeasterly direction from the shore abreast the town. On the eastern side of the pier depths of 33 to 46 feet prevail alongside the 448 feet of berthing space. The west side of the pier is available for small coastal vessels not over 100 feet in length and with 8 or 9 feet draft. It is provided with railroad tracks and has four gantry type conveyors for loading bananas. There is a 5-ton railroad crane available.

Repairs.—The town has a machine shop where very minor repairs can be effected.

Supplies.—Limited quantities of provisions may be obtained. A supply of about 300 tons of fresh water is available and may be procured from a pipe line on the wharf. Inasmuch as this water has a high lime content, it should be treated before being used as boiler water. The company maintains two ice machines capable of producing 4 tons of ice a day. There is a 4-inch Diesel oil pipeline for loading or discharging oil.

Communications.—Steamers of the United Fruit Co. make weekly calls at Puerto Armuelles, and those of several other lines call irregularly. The town is connected with Ciudad de David, Concepcion, and other places in the interior of Chiriqui Province by railroad. There is also airplane service to Ciudad de David and Panama. The Ciriqui Land Co. maintains a radio station at Puerto Armuelles. Telephone and telegraph facilities to Panama City are available.

Hospital.—At the town the Chiriqui Land Co. has a good hospital with a capacity of 100 beds; seamen will be accepted for treatment at this hospital.

9–12 Coast.—From the mouth of Rio Rabo del Puerco a bank with heavy breakers at low tide extends in a northeasterly direction for about 2 miles. The coast from Rio Rabo del Puerco extends northeastward for about 8 miles to Punta Corredor, and thence eastward about 3 miles to the Boca Espinos, which is the common outlet of Rio Chiriqui Viejo, Rio Piedra, and another small stream. The coast then takes a more southerly trend for 12 miles to Punta San Pedro.

9–13 The delta of the Chiriqui *(H. O. Chart 5651)*, lying on the eastern side of Bahia Charco Azul, northward of Isla Parida, is formed by numerous low islands that front the coast for a distance of 17 miles, extending from Boca San Pedro on the west to Boca Chica on the east; these islands are interconnected by extensive shoals that break heavily. Within the islands the low coast is a labyrinth of small streams and esteros.

9–14 Channels—Depths—Dangers.—The buoyed channel through Boca San Pedro is the most direct approach to Pedregal. The former channels, through Boca Chica and Boca Brava, have been reported (1964) silted and unusable.

The maximum safe draft through Boca San Pedro has been reported (1964) to be 12 feet.

In view of the many dangers along the channel, and the frequent changes to the river mouth, the services of an experienced local pilot are necessary.

9–15 PEDREGAL is a village at the head of navigation of the Rio Pedregal. It has a wharf about 200 feet long, with depths of 10 feet alongside, for small coastal vessels. It is connected with Ciudad de David, a city of 10,000 inhabitants, situated 4 miles to the northward, by a railroad line and a highway. Ciudad de David, the capital of the Province of Chiriqui, is a modern city with telegraph, telephone, radio and airplane communication with other parts of the Republic of Panama.

9–16 Isla San Pedra and Isla Sevilla, two of the largest islands in the delta of the Rio Chiriqui, are heavily wooded in places; elsewhere there are extensive tracts of grassland used for grazing cattle and horses. The only inhabitants are the cattle herders and a few nomadic Indian fishermen.

9–17 Isla Parida (*8°07′ N., 82°20′ W., H. O. Chart 5651*), lying about 12½ miles southeastward of Punta San Pedro, is well wooded, 429 feet high, and of irregular shape, about 4 miles long north-northeastward and south-southwestward, and 2½ miles wide in the widest part. A few natives live at the northeastern end of the island.

The only anchorage is at the northeastern end of the island, inside the 5-fathom curve, sheltered from the southward by the small Isla Gámez. At this anchorage there is a sandy beach where boats can land. To reach this anchorage from the eastward, from a position westward of La Viuda, Islas San Jose should be steered for, then left to the northward, and a course steered for the northern point of Isla Parida, keeping in depths of 7 to 10 fathoms but decreasing to 3½ fathoms as the anchorage is approached; at the anchorage the depths increase to 6½ fathoms.

Isla Parida is practically surrounded by numerous small islands and rocks, many of which lie on the shore bank that extends out from the island.

9–18 Bahia Chimmo, at the southwestern end of Isla Parida, is small and has depths of 2½ to 10 fathoms. The bay is fronted by Isla Santa Cruz; the entrance lies northward of this islet, as rocks extend from it southward to the shore. A reef also runs southward a short distance from some islets on the northern side of the bay.

9–19 Tides.—The mean high water interval at Isla Parida is 2h. 53m.; spring range 10 feet, mean range 8.2 feet.

9–20 Caution.—The southwestern point of Isla Parida should be given a berth of about 1 mile in order to avoid some sunken rocks, with deep water close outside them, that lie ¼ to ½ mile off the point.

9–21 La Bandera (Grono Rock), with less than 6 feet of water over it and 10 to 16 fathoms close around, lies about 4 miles southwestward of Punta Santa Cruz, the southwestern extremity of Isla Parida.

9–22 Islas Ladrones (*7°52′ N., 82°27′ W., H. O. Chart 1018*), situated about 14 miles south-southwestward of Punta Santa Cruz, the southwestern extremity of Isla Parida, are three rocky, barren islets, the largest of which is 246 feet high. All are comparatively steep-to and occupy an area less than 1 mile in extent. The islets have been reported to give good radar returns up to 20 miles. The only known dangers are some rocks extending from them to the northeastward for about 1 mile, and a rock awash 2¼ miles north-northeastward. A shoal, with less than 6 fathoms over it, extends about 1 mile northwestward from the rock awash.

For a description of Isla Montuosa, 26½ miles to the southeastward, see section 9–61.

9–23 Boca Brava—Bar (*H. O. Chart 5651*).—Boca Brava extends northward from the northern side of Isla Parida, between Isla Brava and Isla Sevilla. The banks and the channel across the bar alter so much and so frequently that, although there is now an 8-foot channel over the bar, it is not considered safe for vessels of more than 10-foot draft, and for them only at high water. Local knowledge should be acquired by a thorough boat exami-

nation at low water before attempting this channel. The chart and lead are the best guides. A beacon is situated on the shorebank 1¾ miles southward of Punta Brava.

Horconcitos, an unimportant village situated at the head of Estero de Horconcitos, about 22 miles above the bar of Boca Brava, is a cattle shipping place.

9–24 Parida and Palenque Anchorages are included between Isla Parida and Punta Bejuco, 9½ miles to the eastward. In these anchorages and their approaches there are numerous islands and rocks, but with the assistance of the chart little difficulty will be experienced in selecting an anchorage.

The islets which extend eastward about 5 miles from the southeastern extremity of Isla Parida terminate in Isla Bolaños and Isla Berraco, the two largest of the group. Some rocks under water lie ½ mile southeastward and another 1¾ miles east-northeastward of Isla Berraco. At about midway between Isla Bolaños and Islas San Jose are two detached rocks, Roca Linartes, 68 feet high, and Mogote Pajaros, and a small group of rocks the largest of which is called La Plaza. There are two other rocks in the group to which La Plaza belongs; the westernmost rock of the group is 2 feet high and lies about 420 yards westward of La Plaza. Two submerged rocks lie about 650 yards northwestward and a 2½ fathom shoal lies 330 yards east-southeastward of La Plaza.

9–25 Roca Linartes Light (*8° 07′ N., 82° 15′ W., H. O. Chart 5651*) is shown from a white concrete structure on the rock; the structure is very difficult to make out in the daytime.

9–26 Islas San Jose consist of four wooded islets, the northernmost and largest of which has an elevation of 247 feet and the southernmost and smallest an elevation of 20 feet; a rock lies close westward of the latter islet. A shoal area on which there is a submerged rock extends westward nearly ¼ mile from the western side of the group. A submerged rock lies close off the eastern side of the largest islet, and a 2¼-fathom shoal lies about 1,300 yards west-northwestward of the southernmost islet.

Isla Palenque lies off the southern side of Isla Brava, and Isla Palenquita lies off the southeastern point of Isla Palenque. The shoal water which limits the bay trends northeastward and southwestward from a position close westward of the latter islet.

Roca Buey is a dangerous rock of small extent in the middle of Palenque Anchorage, with soundings of 5 to 7 fathoms close to it; it uncovers at half tide, and does not show at all at high tide in fine weather. No well-defined landmarks can be given for this danger, but it lies about 1¼ miles 57° from the summit of the largest islet of the Islas San Jose.

Islas Monitas (Las Ensilladas) are two islets on a reef lying about 1 mile southward of Punta Bejuco; the southwestern islet has a close resemblance to a saddle. Because of the strong currents the channel between Islas Monitas and Punta Bejuco is not considered safe, although it has depths of 6 to 8 fathoms. For that reason vessels making for Palenque Anchorage generally pass to the southward of these islets.

La Viuda, lying 4½ miles 96° from Roca Linartes Lighthouse, is an isolated rock 15 feet high. A reef with three rocks above water and several submerged rocks on it extends from La Viuda for about ¾ mile in southeasterly direction. As this rock and reef are both steep-to, with soundings of 10 to 12 fathoms close around, great care is required to avoid them. It is said that vessels approaching Palenque Anchorage from the southward can generally identify La Viuda by the breakers, but whether this is the case or not, it is a very formidable danger.

9–27 Boca Chica, the channel between La Ventana and Los Sainos islets, lying 3½ miles northwestward of Punta Bejuco, is a narrow and dangerous entrance that is but little used, although it is practicable for small schooners of

light draft. It may be recognized by the rocks of La Ventana islet, which have been pierced by the sea.

The small village of Boca Chica, situated on the mainland abreast the eastern part of the Isla Brava, is connected with the village of Horconcitos, 7 miles to the north-northeastward, by a road. Small vessels can reach Boca Chica either through Boca Chica entrance or through Boca Brava and thence through Boca Chiquita, a small channel leading along the northern shore of Isla Brava.

9–28 Boca Chica Light (*8° 12′ N., 82° 13′ W., H. O. Chart 5651*) is shown from a white tower situated on the southwestern extremity of the more southerly of the two Los Sainos islets.

9–29 Coast (*H. O. Chart 1018*).—At 1½ miles eastward for a distance of 3½ miles to the mouth of the Rio San Lorenzo, where it again turns and extends in an east-southeasterly direction for 21 miles to Boca de Santiago. This coast line is broken by several streams, among which are the Rio San Juan and Rio San Juan Secas. Between November and March there is fairly good anchorage in depths of 6 or 7 fathoms, and, at about 2 miles off this stretch of coast. Small boats can land along here during this season, but between March and November the southwesterly swell prevents landing in small boats and makes the anchorage, at best, uncomfortable for vessels of any size.

Isla Venado, situated close eastward of the eastern side of the peninsula that terminates in Punta Bejuco, is said to be a good mark for vessels approaching from the eastward. Several islets and a number of rocks, above and below water, lie on the bank that extends eastward about 1½ miles from Isla Venado.

9–30 PUERTO NUEVO, consisting of an estuary into which Rio Santa Lucia, Rio Santiago, and a number of smaller streams discharge, is entered between Punta Entrada to the southward and Banco Belitre to the northward. Inasmuch as this estuary is protected on all sides, it affords excellent anchorage for small vessels. The best anchorage is in depths of 7 or 8 fathoms, mud, in the middle of the channel, about 1,000 yards eastward of Punta Entrada.

9–31 Punta Entrada Light (*8°05′ N., 81° 45′ W., H. O. Chart 5651*) is shown from a white concrete structure, 20 feet high, on the southern entrance point of Puerto Nuevo. The structure is difficult to make out, especially from vessels coming from the southeastward.

9–32 Landmarks.—The position of the entrance, from whatever direction approached, may easily be recognized by the peculiar formation of the Cerros Cayado hills, 300 feet high, which from a distance appear as separate islets. Sugarloaf Hill, situated 5 miles north-northwestward of Punta Entrada, is the most prominent landmark in the vicinity. Isla Silva de Afuera and Isla Silva de Tierra, low wooded islands situated, respectively, 4¼ miles westward and 1¼ miles west-northwestward of Punta Entrada, will be sighted upon closer approach.

Isla Intrusa, rocky and steep-to, lies on the northern side of the channel, within the entrance, 1 mile eastward of Punta Entrada and ½ mile southward of Punta Aguda (Belitre), the southern extremity of Isla Insolita.

Isla Robalo, 1,200 yards northeastward of Punta Aguda, is 820 yards long and 275 to 360 yards wide. A mud bank extends about 1200 yards south-southwestward.

Opposite the northern end of Isla Robalo the remarkable Cerros Dedo, about 1,500 feet high, extend in a northeasterly direction, the line of direction of the hills passing through Punta Entrada.

Isla Herron lies near the eastern bank of the river opposite the southern end of Isla Robalo.

9–33 Shoal water extends ¼ mile offshore on the southern and eastern sides of Puerto Nuevo, except for a distance of ¼ mile eastward of the light.

9–34 Depths.—The entrance channel has a depth of 5 fathoms at low water over a width of 400 yards. Vessels drawing more than 12 feet should not attempt to go past Isla Intrusa, but at high water vessels of not more than 12-foot draft can proceed up to San Juan Enfrente Wharf. Small schooners drawing about 4 feet can proceed up Rio Santa Lucia to the port of Remedios.

9–35 Directions.—In approaching Puerto Nuevo it is advisable to proceed on a northerly course for a position about ½ mile westward of Punta Entrada in order to avoid the shoals to the southward. When Isla Intrusa becomes open of Punta Entrada, steer for the islet, passing about 200 yards off the point. When Punta Entrada Light is abeam, steer through the middle of the channel, leaving Isla Intrusa to port and Isla Robalo to starboard.

9–36 SAN JUAN ENFRENTE situated on the west bank of Rio Santa Lucia about 3¾ miles above Punta Arenaita, the northern extremity of Isla Insolita; is a corral and loading wharf from which cattle are shipped. Vessels proceed to the wharf at high water but, if remaining there during low water, they rest on soft mud bottom. A small steamer calls at San Juan Enfrente about once a week to land supplies and load cattle.

The village of Remedios lies on the same bank of the river about 4 miles farther up.

9–37 Islas Secas (*7°58′ N., 82°02′ W., H. O. Chart 1018*), lying about 18 miles west-southwestward of Punta Entrada, consist of two islands and numerous islets and rocks, covering an extent of 5½ miles north and south and 3 miles east and west. The only known dangers among these islets are a number of sunken rocks whose positions are usually marked by breakers. Small vessels may find good shelter here, and landing may be effected on some of the islets. The best anchorage is stated to be in depths of 10 to 12 fathoms, sand.

La Bruja, a rock 2 feet high, situated about 3 miles eastward of the northern end of Isla Cavada, the largest of the Islas Secas, is a formidable danger, especially at night; the rock is surrounded by depths of 20 to 25 fathoms.

9–38 Islas Contreras (*H. O. Chart 1041*), a group of islands situated about 14 miles southeastward of Islas Secas and 9½ miles northward of Isla Coiba, consist of two principal islands, Isla Brincanco and Isla Uva, with many small islets and rocks. All of these islands are wooded, rocky, and uninhabited. The approaches to these islands are clear except for some detached rocks eastward and southward of Isla Uva. There are no good anchorages in the vicinity of these islands, but anchorage can be taken in a depth of 30 fathoms about ½ mile northward of Isla Brincanco. Small vessels may anchor in a depth of 14 fathoms in a cove on the northern side of Isla Brincanco.

Roca Prosper, a conspicuous rock lying about 1½ miles southward of Isla Uva, is 9 feet high and appears as a gray standpipe. A rocky reef lies about 1½ miles northeastward of Roca Prosper and 1¼ miles east-southeastward of the southern extremity of Isla Uva.

An area of foul ground extends northeastward to the reef, and northward to Isla Elva from Roca Prosper.

Roca Prosper was reported (1962) to lie about 1 mile northward of its charted position.

9–39 The coast (*H. O. Chart 1018*) between Punta Entrada, at the entrance to Puerto Nuevo, and Punta Guarida, at the entrance to Bahia Honda, 23½ miles to the south-southeastward, is very irregular in outline, being intersected by several rivers and indented by a number of small bays, of which the principal are Ensenada Pajaros, Ensenada Rosario, and Ensenada Monita, all of them open and exposed to winds from the westward.

Morro Negrito, situated 3 miles south-southeastward of Punta Entrada, on the western side of the shallow estuary into which Rio Tabasara discharges, lies at the southwestern end of a well-rounded peninsula, about 1 mile in diameter, which is occupied by a low hill of gradual ascent with the mainland shore to the northward by a very narrow neck. Between Punta Entrada and Morro Negrito the coast recedes considerably, forming an open bay which is free from outlying dangers, but its anchorage is not as good as that southward of Isla Silva de Tierra; Nuecas Rocks lie at the northern

end of this bay, but they lie within ¼ mile of the beach.

Between Morro Negrito and Punta Pajaron, 9 miles to the southeastward, the shore is fronted to a distance of ¾ to 1½ miles by a shore bank on which there are depths of less than 1 fathom in places; the southern part of this bank extends across the mouth of Rio Lovaina, which is not navigable. This bank is steep-to and should be approached with care, keeping outside the 10-fathom curve. This bank breaks heavily when the southwest swell is running.

Ensenada Pajaros, about 3 miles southward of the mouth of Rio Lovaina, between Punta Pajarón and Punta Muertos, is about 1 mile in extent, with depths of 5 to 18 fathoms. Due to rocks and lack of protection from swells, it is not a good anchorage.

Ensenada Rosaria (*H. O. Chart 1041*), separated from Ensenada Pajaros by a narrow peninsula ending in Punta Muertos, is recognizable by the isolated pointed hill terminating this point, and by Isla Muela, a small, round islet situated 1½ miles southward of Punta Muertos. Ensenada Rosario is not recommended as an anchorage. On the southern side of this inlet is Punta Rosario, and southward of that point is Ensenada Pixba, which affords a good anchorage for vessels up to 3,000 tons. Small boats can land at a sandy beach in Ensenada Pixba.

9–40 Punta Gorda, situated southward of Ensenada Pixba, is rounded, about 2¼ miles across, and steep-to; the 20-fathom curve lies only about 1 mile off the point. There are detached rocks off Punta Gorda and in the northern part of Ensenada Monita, but none of them is more than ¼ mile offshore.

Ensenada Monita indents the coast for about 1 mile at a position southward of Punta Gorda. Except for the rocks mentioned above there are no dangers in the bay, but, being open to the westward, the bay is not a good anchorage.

9–41 Isla Medidor (*7°45′ N., 81°35′ W., H. O. Chart 1041*), of irregular shape and moderate height, about 1 1/2 miles long and 1,000 yards in average width, lies about 2 miles northwestward of the entrance to Bahia Honda. It is separated from the coast to the northward by a narrow and rocky channel which may be used by boats, but is not recommended for larger vessels. Isla Pacora (Trucha), lying 800 yards southward of Medidor, is about 650 yards long and 100 yards wide. A reef extends about half way across the passage between Pacora and Medidor; it is therefore inadvisable for vessels to pass between these islands.

There is a fair anchorage for large vessels in a depth of 20 fathoms northward of the western end of Isla Medidor; the bottom is rocky, but the anchorage is fairly well protected against the prevailing winds between November and March. There is an excellent anchorage for boats in a bight on the northern side of Isla Medidor.

Isla Canal de Afuera, to the southwestward, is described in section 9–48.

9–42 BAHIA HONDA eastward of Isla Medidor, is an excellent harbor for vessels of the largest size, being deep, safe, capacious, and very easy of access. The entrance, between Punta Guarida and Isla Centinela, is 1,750 yards wide, and the anchorage area for large vessels is 1¾ miles long and ¾ mile wide. There are extensive mud banks at the eastern end of the bay, but elsewhere the shores are relatively steep-to.

9–43 Depths.—The depths between Punta Guarida and Isla Centinela range from 20 to 25 fathoms, gradually decreasing inside the bay to 10 or 15 fathoms westward of Isla Talon and 5 to 8 fathoms eastward of that island.

9–44 Punta Guarida, the northern entrance point, is bold and clear of dangers; the 20-fathom curve lies about 200 yards off the point.

Isla Centinela, a small islet forming the southern entrance point, lies 1,750 yards southward of Punta Guarida. The islet is surround-

ed by rocks which extend southeastward to Punta Jabali; a detached reef lies about 200 yards northeastward of Isla Centinela.

Isla Talon, lying in the central part of the bay about 1½ miles inside the entrance is about 1,350 yards long, north and south, and about 260 feet in height. Two small islets, Isla Calentador and Isla Espuela, lie, respectively, off the western side and the southern point of Talon; a shoal extends northwestward about ¼ mile from the former islet. Isla Talon divides the harbor into two anchorages, Bahia Chinche to the westward, and the much smaller Bahia Legamo to the eastward. On the northeastern side of the island a narrow channel, with a depth of 18 feet, connects the two bays.

Isla Chinche, a round and wooded islet, lies in the northern part of Bahia Chinche, about 600 yards from the shore; it is an excellent landmark. Inasmuch as a 3-foot shoal extends 200 yards southward of it, the islet should not be approached too closely. A bank with a least charted depth of ½ fathom extends northward nearly 200 yards from the islet.

9–45 Anchorage may be had in any part of the harbor, but the best berth for large vessels is in Bahia Chinche, with Isla Chinche bearing 345°, in depths of 11 to 15 fathoms, green mud, sheltered against all winds. The only dangers in this locality are a rocky 3-foot shoal lying about ¼ mile northward of Punta Guarida, a reef with a least depth of 4 feet extending from Punta Penosa, the 3-foot shoal extending 200 yards southward of Isla Chinche, and the shoal bank extending northwestward from Isla Talon. Bahia Legamo is clear of dangers, with an anchorage extent of 850 yards and depths of 5 to 7 fathoms, completely sheltered by Isla Talon.

9–46 Tides.—The mean high water interval at Bahia Honda is 2h. 52m.; the spring range is 10.8 feet, the mean range 8.7 feet.

9–47 Directions.—The entrance to the bay is rather difficult to make out from a distance, but it is so plainly marked by the islands, Canal de Afuera, Medidor, and Pacora that it is readily found. A vessel approaching from the northward should, after sighting Isla Canal de Afuera, pick up Isla Medidor and then steer a course to pass about 1,000 yards southeastward of Isla Picora, when the entrance should be opened.

A vessel approaching from the southward should head for Isla Medidor until the entrance is opened and Isla Talon sighted. When approaching from this direction two openings will be seen between Isla Centinela and Punta Jabali; the center of one of these openings bears about 0° and the other about 52°. These openings lead over shoal water and must not be mistaken for the entrance channel, which bears about 70°.

After the entrance is opened, head for a position about midway between Punta Guarida and Isla Centinela. After Isla Talon is sighted steer for the right tangent on course 70°. After Isla Chinche is sighted steer for it on course 345°. A good anchorage will be reached when Isla Calentador bears 90°.

The channel between Isla Medidor and the mainland and that between Isla Pacora and Isla Medidor are not recommended.

9–48 Isla Canal de Afuera *(7°42′ N., 81°38′ W., H. O. Chart 1041)*, 704 feet high, lies about midway between the northern point of Isla Coiba and the mainland; it may be passed on either side, the only danger being a reef extending ½ mile off its eastern side; on the outer part of this reef there is a black rock which almost covers at high water. Isla Afuerita lies close to the northwestern end of Isla Canal de Afuera. A rock lies about 600 yards off the middle part of the northern side of Isla Canal de Afuera, and another rock lies close northeastward of the northern extremity of Isla Afuerita. Shoal water surrounds both islands to a distance of about 500 yards, increasing to 1,700 yards off the western extremity of Isla Canal de Afuera.

Eastward of Isla Afuerita there is a fair small-vessel anchorage over a bottom of coral, sheltered against southerly and westerly

winds. Rocks make it dangerous for boats to approach the sandy shores of the islands from this anchorage.

9–49 Isla Rancheria, somewhat smaller than Isla Canal de Afuera, lies nearly 4¾ miles southwestward of the latter island and 2 miles eastward of the northern extremity of Isla Coiba. A clear channel ½ mile wide lies between Isla Rancheria and Isla Coiba; this channel is used by small coastal steamers, but, inasmuch as it is not marked and as there are rocks along each side, the use of this channel is not advisable.

A shore bank on which there are numerous islets and rocks surrounds Isla Rancheria. Off the western extremity of the island this shore bank extends northwestward for a distance of 1 mile. Aaron Rocks, consisting of Isla Coibita and a number of rocks southeastward of it, lie at the outer end of this northwesterly extension of the shore bank.

La Viuda, a dangerous pinnacle rock with a least depth of 4¾ fathoms over it, lies about 1,400 yards northeastward of the eastern extremity of Isla Rancheria.

9–50 ISLA COIBA (Quibo), which has a length of 21½ miles northwestward and southeastward and a maximum width of 13 miles, is the largest island off this coast. The interior is quite mountainous and is covered with forest, but there is some swampy land on the west coast. There are several anchorages around its shores, but no harbor in which vessels may be protected from all winds.

This island is used as a penal station, and it is forbidden to land on the island without permission of the Panamanian Government. The island has a population of about 200, most of whom are connected with the penal colony, which is situated on the eastern coast. Malaria is prevalent on the island. Good water is plentiful.

On the western side of Isla Coiba from Punta Baltasar, the northern extremity of the island, to Punta Hermosa, 11½ miles to the southwestward, the water is deep and the shore may be approached close-to, but there are few places where boats may land easily except during the months between November and March.

Punta Hermosa has been reported to give good radar returns up to 24 miles.

Ensenada Hermosa, the inlet immediately eastward of Punta Hermosa, is a fair anchorage at all times and an excellent one during the season when the swells come from the southwest. Anchorage may be taken in depths of 13 to 25 fathoms, green mud. To enter the inlet, head for the middle of the entrance on course 112° and anchor when the desired depth is reached; this course should head for Mount Coiba, a 1,400-foot elevation located about 2 miles from the shore of the inlet. There are some detached rocks about 200 yards off the bluff that terminates in Punta Hermosa.

9–51 Coast. — From Punta Hermosa the general trend of the coast is south-southeastward for 4¾ miles, then southeastward for 7¼ miles to Punta Brigida, and then east-southeastward for 11¼ miles to Punta Anegada. The water is deep close to the shore between Punta Hermosa and a point 2½ miles northwest of Punta Brigida; although there are several rocks along this stretch of coast they are all within ½ mile of the shore. From the point 2½ miles northwest of Punta Brigida to Punta Anegada the water shoals less rapidly, the 10-fathom curve being 1 to 1½ miles from the shore for the entire distance. South and west of Punta Anegada breakers extend offshore for about 1 mile during the season when southwesterly winds prevail.

9–52 Dangers.—Off the coast between Punta Brigida and Punta Anegada there are several dangers. The most formidable of these is

Hill Rocks, which are located 5½ miles west-southwestward of Punta Anegada; they are just awash at low water. At 2 miles north of Hill Rocks is Isla Barca; a rock, partly awash at low water, lies between this islet and the shore. Passage Rocks, located 2¼ miles westward of Isla Barca, are surrounded by 8 to 12 fathoms of water. Logan Rock is situated 1¼ mile northwestwrd of Passage Rocks. The area around Punta Anegada is treacherous, and the point should therefore, not be approached closely. Southward of the point shoals with depths of 3½ to 5 fathoms lie nearly 2 miles offshore.

A bank, with depths of 10 to 20 fathoms, lies about 16 miles southeastward of Punta Anegada.

9–53 Abnormal magnetic variation, amounting to 13° more than normal, was reported (1929) to exist southward of Isla Coiba, between a position 14 miles southeastward and another 12 miles south-southwestward of Punta Anegada.

9–54 Isla Jicarón, situated off the south coast of Isla Coiba, 4 miles southward of Punta Brigida, is a triangle-shaped island with a length of 3¾ miles, a greatest width of 3 miles, and a maximum elevation of 1,370 feet. It is heavily wooded, uninhabited, and has been reported to give good radar returns up to 20 miles. Canale de Jicaron is the passage between Isla Jicaron and Isla Coiba, but, due to the strong currents, its use is not recommended during thick weather; currents with velocities up to 2 knots have been observed in this channel. The passage is fairly deep. A bank of less than 10 fathoms lies across the channel from the coast of Isla Coiba to within 1 mile of Isla Jicaron. The least depth over this bank is 36 feet about 1 3/4 miles north-northwestward of Punta David.

Punta David, the northeastern extremity of Isla Jicaron, is clear and safe of approach, as is the entire eastern side of the island. There are numerous rocks and reefs around the northwestern extremity and within ½ mile of the western side of the island. There is also a dangerous group of rocks with depths of less than 6 feet over them 2 miles west-northwestward of Punta Ursula, the southern extremity of the island. The sea breaks occasionally over these rocks.

9–55 Anchorage.—There is good anchorage in depths of 10 to 12 fathoms, green mud, due south of Punta Brigida, with the left tangent of Isla Jicarón bearing 130° and the right tangent bearing 262°.

9–56 Isla Jicarita, close southward of Isla Jicaron, has a length of 1 mile, a width of 1/2 mile and an elevation of 445 feet. Isla Jicarita has been reported to give good radar returns up to 17 miles. The passage between Jicaron and Jicarita may be used by vessels drawing less than 8 feet, but its use is not recommended. The best landing place is in a small inlet on the western side of the islet.

In 1960, it was reported that an easterly set of about 1 knot was experineced in the vicinity of, and in the southerly approaches to, Isla Jicarita.

Caution.—Heavy breakers have been observed about ½ mile southward of Isla Jicarita. Mariners are advised to use extreme caution when near this area.

9–57 A light is shown from a white, pyramidal, lattice-work, steel tower, 50 feet high, with a day mark on two sides, situated on the southeastern extremity of Isla Jicarita.

9–58 The east coast of Isla Coiba, between Punta Anegada and Punta Baltasar, 21 miles to the north-northwestward, is indented by two bays, Bahia Damas and Ensenada Arenas. Between Punta Anegada and Punta Fea, 5 miles to the northwestward, the shore is fronted by a bank ¼ to 1 mile wids. Two rocks awash at low water lie about 2 miles eastward of Punta Fea and about a mile offshore.

9–59 Bahia Damas (*7°27′ N., 81°42′ W., H. O. Chart 1041*), between Punta Fea (del Cedro) and Punta Clara, is the principal anchorage of Isla Coiba. It is well sheltered from all directions except northeast to southeast. The main disadvantage of the bay is that it shoals rather rapidly; in places the depths decrease from 15 fathoms to 1 fathom within a distance of less than ¼ mile. Lack of navigational aids and outstanding landmarks make it difficult to fix a ship's position while entering the bay; the best fixes are obtained by taking tangent bearings

on nearby points of land. Punta Fea is easily made out from vessels approaching from the east or southeast.

Anchorage may he taken in depths of 15 to 25 fathoms, green mud, in the western part of the bay. In the southern part of the bay, northward or eastward of Punta Observatorio, there is a good anchorage, especially for small vessels.

The main station of the penal colony, with a prison, hospital, store, and workshop, is located on the northwestern shore of Bahia Damas. Practically everything that is brought to the island is landed in this bay.

9-60 Ensenada Arenas.—The northern side of Bahia Damas is formed by Punta Damas, a peninsula which has a width of 2¼ miles between Punta Clara and Punta Job, its southern and northern extremities, and extends out 2 miles from the general coast line. On the northern side of this peninsula is Ensenada Arenas. This bay, which shoals gradually toward the shore, affords anchorage in depths of 5 to 20 fathoms, gray sand.

The only dangers in approaching the anchorage in Ensenada Arenas are the Rocas Pesado, a group of rocks situated ¾ mile offshore at a position 3½ miles northwestward of Punta Job. At about 1½ miles northward of Rocas Pesado, nearly midway between those rocks and Isla Rancheria, are the Islas Cocos, a group of islets lying ¾ to 1½ miles off Isla Coiba.

9-61 Isla Montuosa (*7°28′ N., 82°14′ W., H. O. Chart 1018*), situated 21¼ miles westward of Punta Adelarda, the western extremity of Isla Coiba, is a heavily wooded, circular islet with a diameter of 1 mile and an elevation of 500 feet. The island has been reported to give good radar returns up to 22 miles. A rocky reef extends westward 1 1/2 miles and southward 1/2 mile from the islet, but the northern and eastern sides are clear of dangers.

Northward of the islet there is a fair anchorage, protected against southwesterly swells; the preferred anchorage is in a depth of 15 fathoms, with the left tangent of the islet bearing 170° and the right tangent bearing 230°.

9-62 THE COAST between Bahia Honda and Punta Brava, the western entrance point of Bahia Montijo, 20 miles to the east-southeastward, is rugged and has several detached rocks off it.

9-63 Anchorage.—Isla Coiba affords sufficient shelter so that vessels can generally anchor in depths of 15 to 25 fathoms within 1 mile of the shore anywhere along this coast as far eastward as Isla Artavio (*7°39′ N., 81°21′ W., H. O. Chart 1018*), situated about ¾ mile offshore at a position 7½ miles west-northwestward of Punta Brava. The heavy swells, however, make it inadvisable to anchor farther eastward. There is a fair anchorage for vessels of any size at about ½ mile off-shore in a position 1½ miles northeastward of the larger islet of the Islas Cativos, which lie 4 miles south-southeastward of Punta Jabali, the southern entrance point of Bahia Honda. Small vessels may anchor about 1½ miles northwestward of the same islet. At 3 miles northwestward of Isla Artavio there is a cove which affords anchorage to small vessels in depths of 2 to 10 fathoms.

9-64 Bahia Lorenzo, a small bay situated 5 miles northwestward of Punta Brava, extends about 1 mile within the general coast line, but is occupied by extensive shoal areas. Rio San Lorenzo, which may be entered only by boats, discharges into the head of the bay. Several small islets extend across the entrance to the bay. Heavy swells and the shoal depths, 1 to 3 fathoms, make the bay a poor anchorage. Vessels enter the bay at high water, keeping about 500 yards off the eastern shore at the entrance and gradually closing that shore until the distance off it has been reduced to about 50 yards near the mouth of the river. A small village stands on the west bank of the river, near its mouth.

9-65 BAHIA MONTIJO (*H. O. Chart 5650*) is at the head of the bight that is formed between Punta Jabali and Punta Mariato. The bay is about 17 miles long, north and south, and 5 to 14 miles wide. Near the middle of the bay is Isla Leones, and near the head of the bay and along the shores are several islands. Its entrance is fronted by Isla Cebaco, along the eastern end of which is the channel leading into the bay. By using this channel vessels can proceed over depths of not less than 27 feet to the anchorage westward of Isla Perdomo. Two large rivers, Rio San Pedro and Rio San Pablo, dis-

charge into the bay above Isla Leones; several smaller streams also empty into the bay, with the result that the water is always muddy.

Rio San Pedro is navigable as far as Puerto Mutis, about 11 miles above Isla Leones, by vessels with a length of not more than 100 feet and drawing not more than 11 feet. The channel is very narrow, in most places not more than 200 feet wide. Small boats can proceed up to Puerto Real, about 5 miles above Puerto Mutis.

Rio San Pablo is very tortuous, but at high tide a vessel drawing 10 feet has proceeded up the river as far as Sona, about 36 miles above Isla Leones. No one, however, should attempt either of these rivers without thorough local knowledge.

Tidal currents of varying velocity are felt throughout the bay. At the entrance they attain a velocity of 2 knots.

9–66 Punta Duartes, the eastern entrance point of Bahia Montijo, lies 5¾ miles southeastward of the eastern end of Isla Cebaco. Foul ground terminating in a 2½-fathom shoal extends westward 1½ miles from the point.

9–67 Isla Cebaco, fronting the entrance to Bahia Montijo, is an irregular-shaped island with a length of 14 miles and a maximum width of 3¼ miles. On the island there are several hills, the highest of which, situated 4½ miles from the southwestern end, has an elevation of 1,163 feet. Southward of Punta Zurrón, the southwestern end of the island, are several small islands and rocks; the southernmost of these, situated 1¼ miles southward of Punta Zurrón, is called Pilar de Sal from its resemblance to a pillar of salt. At 1 mile eastward of Punta Campana, the northeastern extremity of Isla Cebaco, is English Rock, a sunken danger that breaks at half tide. Caleta Cayman, a bight near the western end of the island, affords fair anchorage between the months of January and May.

9–68 Isla Gobernadora, situated inshore of the western part of Isla Cebaco at 2¼ miles southward of Punta Brava, has an area of about 2½ square miles, of which about one half is under cultivation. The highest hill on the island, with an elevation of 734 feet, is an excellent landmark for vessels approaching from the westward.

9–69 Anchorages.— Although shoal water extending northward from the eastern part of Isla Cebaco prevents large vessels from proceeding into the main part of Bahia Montijo from the western entrance, which lies northward of the western end of Isla Cebaco, there are two good anchorages for vessels of any size within that entrance, one to the northward and the other to the southward of Isla Gobernadora. The northern anchorage is protected against southerly winds and seas, while the southern anchorage is exposed only to the westward. The southern anchorage, with depths of 5 to 20 fathoms, green mud, is reached by proceeding on a northerly course past Punta Zurrón, the southwestern end of Isla Cebaco, until the eastern tangent of Isla Gobernadora bears 058°, and then steering to the desired anchorage on that course. The only charted danger between Isla Gobernadora and Isla Cebaco is a detached 1¼-fathom shoal situated 1⅛ miles southward of the eastern end of Isla Gobernadora.

9–70 Dangers. — In the eastern channel above English Rock and eastward of the shoal water extending northward from Isla Cebaco, the only dangers on the port side are the San Juan Rocks, which are awash at half tide and should be given a berth of ½ mile, an 18-foot patch about 1½ miles south-southeastward of San Juan Rocks, and a rock off the eastern side of Isla Leones. On the starboard side of the channel are a 16-foot patch about 2¼ miles southeastward of San Juan Rocks, the Islas Tres Hermanos, Whaleback Rock, awash, situated 1½ miles eastnortheastward of the southern end of Isla Leones, and Isla Perdomo, a small islet situated on the eastern shore bank 4½ miles above Whaleback Rock. A shoal with a least depth of 7 feet was reported in 1953 in the channel about 2/3 mile west-northwestward of Whaleback Rock.

A beacon is located on the middle San Juan Rock and another on Whaleback Rock.

9–71 Directions.—The eastern channel is the only one by which large vessels may enter Bahia Montijo proper. A vessel using the eastern channel should steer a course to pass about 1 mile eastward of English

Rock, taking care to avoid the foul ground off Punta Duartes. Thence steer a course to pass between the 16-foot and 18-foot patches southeastward of San Juan Rocks. Having passed about ½ mile eastward of San Juan Rocks, steer to pass westward of Whaleback Rock, taking care to avoid the 7-foot shoal about 2/3 mile west-northwestward of that rock. Thence, steer a mid-channel course. When the north tangent of Isla Leones bears 292°, a 348° course will lead to the anchorage westward of Isla Perdomo, where there is a depth of 6 fathoms, gray sand.

9–72 Pilot.—A pilot may be obtained at Isla Gobernadora.

9–73 THE COAST southward of Punta Duartes is low and indented by two bays with a small stream at the head of each. Islas Quebros, situated 6¼ miles south-southeastward of Punta Duartes, consist of a group of small rocky islets that extend southwestward 1¼ miles from the bluff projection of the coast separating the two bays. Both of the above-mentioned bays affords good anchorage from January until May, the northern in depths of 10 to 15 fathoms, gray or green sand, and the southern in depths of 5 to 20 fathoms, green sand. The southern bay, Bahia Arenas, is preferable because it is more sheltered and has better holding ground.

Punta Naranjas, situated 14¾ miles southward of Punta Duartes, is a bluff headland. Isla Naranjas, lying about 1 mile off the point is a rocky, wooded islet. A dangerous, rocky, 7-foot shoal, 40 yards in extent, lies 2,300 yards 300° from the center of Isla Naranjas. In spite of the heavy swell it is only occasionally marked by breakers, and then only at extremely low water.

There is good anchorage for small vessels in a bay 1½ miles northeastward of Isla Naranjas. Large vessels may find a comfortable anchorage at ½ to 1 mile north-northeastward of Isla Naranjas in a depth of 18 fathoms, green mud and sand.

9–74 Punta Mariato (*7°12′ N., 80°53′ W., H. O. Chart 1018*), 4½ miles southeastward of Punta Naranjas and 54 miles eastward of the southern extremity of Isla Jicarita, is a bold headland that marks a sharp turn in the coast; it is the beginning of the range of high coast land that terminates at Morro Puercos. It is reported that there are two red soil patches, one above the other, on the headland. These patches are conspicuous when seen from the southward.

Punta Mariata is a good landfall for vessels bound for Panama from the westward; by keeping under the land to the eastward of the point they avoid the southerly set out of the gulf.

The shore eastward of Punta Mariato, as far as Morro Puercos, is bold and steep-to. It is almost impossible for boats to land anywhere along it between the months of March and November, and it is very difficult at other times. About the only anchorage along it is off a small cove, situated about 7 miles westward of Morro Puercos; off this cove the water shoals more gradually than at other places along this coast.

9–75 Morro Puercos (*H. O. Chart 5579*), lying 27 miles eastward of Punta Mariato, is a lofty headland forming the termination of the range of high coast land, and has been reported to give good radar returns up to 22 miles. The water off this coast is deep close to the rocks for two-thirds of this distance, the 100-fathom curve lying within 2 miles of the coast; nearer Morro Puercos the 20-fathom curve is about 2 miles offshore. About 4 miles westward of the point and 1¼ miles from the shore there is a reef 1¼ miles long, east and west, and ¼ mile wide on which there are numerous submerged rocks. A 4¾-fathom shoal was reported to lie about 4 miles southeastward of Morro Puercos Light; about 1¼ miles northwestward of this shoal there is a 3½-fathom shoal with 4 fathoms about ¾ mile westward of it. A vessel reported (1955) striking a submerged object, believed to be an uncharted rock, about 4 miles east-southeastward of the light. Less water than charted is believed to exist in the vicinity of these shoals.

A light is shown from a pyramidal skeleton tower with a white day mark on two sides, situated on Morro Puercos.

9–76 Coast.—The coast from Morro Puercos to Punta Guanico, 7 miles to the northeastward, is indented by two bights, and between Punta Guanico and Punta Raya, 9½ miles to the northeastward, there is a much larger bight. The stretch of coast between Punta Guanico and Cape Mala, 22½ miles to the east-northeastward, is low and fronted to a considerable distance by moderate depths. Punta Guanico has been reported to give good radar returns up to 11 miles.

The western and northern shores of the bight between Punta Guanico and Punta Raya is fronted by a shore bank; the 5-fathom curve lies ½ mile to 2¼ miles off these shores. In tbe northwestern part of the bight is Isla Raya, a narrow islet 5¼ miles long. Rio Tonosi empties into the bight at a position 2¾ miles northwestward of Punta Guanica, and Rio Joaquin discharges at the southwestern end of Isla Raya. Tne shore bank at the eastern end of Isla Raya breaks heavily.

Isla Venado lies very close off Punta Raya, at a position 2¾ miles east-southeastward of the eastern end of Isla Raya. On the outer edge of a projection of the shore bank, at ½ mile southeastward of Punta Raya, there is a group of submerged rocks. A 2¾ fathom patch lies about ½ mile northeastward of the outermost of these rocks; in the western part of Ensenada Benao, the bight immediately eastward of Punta Raya.

A conspicuous **tower** stands about 4⅛ miles west-southwestward of Cape Mala.

9–77 Caution.—In 1926 a dangerous current was observed setting west-by-north near Cape Mala and west-southwest around Morro Puercos; the drift increased from 2 knots to 3½ knots between the points. It was reported (1958) that no apparent effects from a current were experienced.

9–78 Frailes del Norte, situated 4¾ miles southeastward of Punta Raya and 11 miles west-southwestward of Cape Mala Light, is a small, barren, flat-topped islet surrounded by depths of 22 to 25 fathoms.

9–79 Frailes del Sur, lying 2¼ miles south-southeastward of Frailes del Norte, is a similar islet with depths of 23 to 35 fathoms around it. A reef extends out about 200 yards off the northwestern end of Frailes del Sur, but with this exception both islets are steep-to and clear of dangers. These islets constitute a good mark for Cape Mala in clear weather, but, as the lead gives no warning of their proximity, in thick, squally weather they are dangerous to vessels keeping under the land westward of Cape Mala to avoid the current; under such conditions of visibility they should be given a wide berth.

9–80 A light is shown from a white pyramidal concrete tower, 33 feet high, on Frailes del Sur.

9–81 Banks. — Two submerged pinnacles close together, were reported (1946) about 2½ miles east-northeastward of Frailes del Sur Light. One of the pinnacles has a depth of 10 fathoms. and the other 23 fathoms.

CHAPTER 10

THE GULF OF PANAMA

10–1 GULF OF PANAMA (*H. O. Chart 1019*).—Cape Mala on the west and Pinas Point on the east may be considered the limits of the Gulf of Panama. The line between these points, running nearly east and west, is 108 miles long, and within this line the gulf recedes to the northward 92 miles, with the bay and city of Panama, Balboa, and the Pacific entrance to the Panama Canal at its head. Between the entrance points the 100-fathom curve trends slightly to the northward, the depths outside increasing rapidly to 1,000 and 2,000 fathoms, while within they descend gradually to the head. The Archipielago de las Perlas is entirely within the 50-fathom curve.

The Isthmus of Panama encircles the gulf. In a restricted sense the name of the isthmus is applied to the narrow crossing between Panama and Colon, the two other narrowest crossings being distinguished as the Isthmus of San Blas and the Isthmus of Darien; the widths of the isthmus at these points, in the order here given, are 31, 27 and 32 miles, the last distance being measured from the head of deep-water navigation at the mouth of the Rio Sabana in Rio Tuira at the head of Bahia San Miguel.

The whole isthmus is comprised in the Republic of Panama (including the Canal Zone), which extends from the Colombian boundary to the Costa Rican boundary.

Panama Bay has been reported to give good radar returns up to 25 miles.

10–2 Danger areas.—Certain areas in which air bombing and firing are carried out have been designated in the approach to the entrance to the Panama Canal from the Pacific. Notice is given by radio of the area involved and the time and type of firing.

10–3 Winds.—Between Cape Corrientes (latitude 5°29'N.) and Panama the prevalent winds are from the northward and westward, with frequent squalls from the southwest between the months of June and December. In the Gulf of Panama the winds are regulated by the seasons; the prevalent wind, however, is from the northward. In the fine season, commencing in December, the winds are regular and constant, bringing fine, dry weather. To the southward of the gulf they blow much harder, and off the coast of Veraguas, a province of the Republic of Panama lying between the Isthmus of Panama and the Isthmus of Chiriqui, a fresh gale (force 8, Beaufort Scale) in January and February is not uncommon. In April and May the northerly winds are less regular and have more westings in them, with calms, light sea and land breezes, and occasional squalls from the southwestward. In June the rainy season sets in and the southerly winds become stronger; still the northwesterly wind is mostly found after noon, and vessels sailing from Panama will generally have at all seasons a fair wind until southward of Capa Mala.

Between the Galapagos Islands and the coast, westward of the meridian of 80° W. and southward of the parallel of 5° N. the winds are between south and west all the year round, and, except between the months of February and June, they are of sufficient strength and duration to make navigation easy; but northward of latitude 5° N. and between 80° and 110° W. is a region of calms and doldrums, accompanied by rains and squalls.

10–4 Currents.—The Gulf of Panama is subject to irregular currents, partly caused by the formation of the land and partly influenced by

the Peruvian and Mexican Currents, according to the varying strength of each. Malpelo Island, which lies about 230 miles south-southwest from Cape Mala and has been reported to give good radar returns up to 19 miles, is surrounded by strong and rapid currents; these have been observed to set in opposite directions, sometimes to the northeastward and sometimes to the southwestward. A steady current has been found to set to the northward after passing Cape San Lorenzo, with a velocity of 24 to 36 miles per day, extending off-shore about 60 miles. This current sets along the coast following the direction of the land, enters and makes a complete circuit of the gulf and Panama Bay, and then sets, with considerable force, especially in the dry season, to the southward down the western side of the gulf, but here it may be reversed. (See sec. 10-59.) After passing Cape Mala it meets the Mexican Current from the west-northwestward, causing tide rips, eddies, and the short choppy sea met with at the entrance to the gulf.

The United States Scouting Fleet in February and March, 1926, experienced only negligible currents in the Gulf of Panama to the northward of Perlas Islands; to the southward of these islands and in the vicinity of the mouth of the gulf a westerly drift of about ½ to 1 knot was encountered.

10–5 Islands.—The islands in the Gulf of Panama which are of interest from a navigational standpoint are in the northern part of the gulf in four general groups, with Islas Bona and Otoque in one group; Taboga, Urava, Taboguilla in another; Flamenco, Perico, Noas, and Culebra in the third; and the Archipielago de las Perlas. Inshore and to the southward of the canal entrance are several others; but unless a vessel is out of the general track they are of little concern.

10–6 Cape Mala (*7°28′ N., 80°00′ W., H. O. Chart 5579*), which forms the western point of the entrance to the Gulf of Panama, is a low but bold point with outlying rocky ledges, having deep water close to them. The land from the northwest slopes gradually down to the sea at this point from a considerable distance, making the exact cape difficult to distinguish unless the breakers are seen. On opening the gulf around this cape a strong southerly set is generally experienced, especially in the dry season. Close northwestward of the light, stand auxiliary buildings, located on a small headland on the northwestern side of which is a landing pier.

A conspicuous tower has been reported about 4½ miles west-southwestward of Cape Mala.

Cape Mala has been reported to give good radar returns up to 17 miles.

CAUTION—SHOAL WATER.—A 28-foot shoal was reported (1951) about 9 miles 203° from Cape Mala. Searched for in 1965 it was not found and its existence is doubtful.

10-7 LIGHT.—A light is shown from a white skeleton steel tower, 100 feet high, situated on the cape.

10-8 RADIO TOWER.—A radio tower, painted red and white and from which an obstruction light is shown, stands close north-northwestward of the light tower.

10–9 Tides.—The mean high water interval at Cape Mala is 3h.06m.; spring range 10.5 feet, mean range 8.1 feet. At Isla Iguana the flood sets to the northward and the ebb to the southeastward, the latter being considerably the stronger, especially between the months of December and June.

10–10 Abnormal variation was reported (1944) southward of Cape Mala between latitudes 6°05′ N. and 7°05′ N., and between longitudes 79°30′ W. and 80°30′ W.

It was reported that the general trend is to increase the existing easterly variation by 4° to 5°.

10–11 This section has been deleted.

10–12 Explosives dumping area.—An explosives dumping area has been established eastward of Cape Mala. It lies between the parallels of 7°20′ N., and 7°30′ N., and between the meridians of 79°00′ W. and 79° 10′ W.

Magnetic disturbance.—In 1954, an unusually large magnetic disturbance was reported in the above-described explosives dumping area.

10–13 Isla Iguana, lying about 9 miles to the northward of Cape Mala, is a little higher than the adjacent coast and thus forms a conspicuous object. A ledge extends about 600 yards from its south point. The island is about 2½ miles offshore and in the middle of the channel between there is a depth of 13 fathoms.

Caution.—A vessel reported (1963) striking a submerged object, about 9½ miles east-northeastward of the northern extremity of Isla Iguana, with a depth of about 27 feet.

Isla Iguana has been reported to give good radar returns up to 14 miles.

10–14 Lights.—Rio Mensabe Light is shown at the mouth of the river of the same name and about 12¾ miles northwestward of Isla Iguana.

A light is shown, from a beacon on a white concrete hut, at Puerto Guarare, about 9 miles northwestward of Rio Mensabe.

10–15 Punta Lisa.—From Rio Mensabe the coast continues in a northwesterly direction for 18½ miles to Punta Lisa.

10–16 Light.—A light is shown from a red and white iron tower with a concrete hut, located on the south side of the entrance of Rio de la Villa, about 1½ miles westward of Punta Lisa.

10–17 Bahia Parita, between Punta Lisa and Punta Anton, 19 miles to the north-northeastward, has low shores covered with mangroves and fronted by mudflats. The land to the westward is also low with several hummocks. A number of small rivers discharge into the bay.

10–18 Estero Aguadulce—Light buoy.—This river discharges about 15 miles north-northwestward of Punta Lisa. Banco Negro Light Buoy, painted black, marked 'BN' and showing a flashing green light, is moored on the northern side of Banco Negro in the entrance to Estero Aguadulce.

10–19 Coast.—From Punta Anton the shore trends northeastward for 41 miles to Punta Chame and is formed by a continuous beach, named Playa Grande, which fronts a low wooded bank. There are depths of 4 and 5 fathoms about 2 miles off this beach, except south-southeastward of Cerro Chame, where there are only 4 fathoms at about 6 miles from the land, the edge of the bank extending from here to Punta Chame.

Farallon del Chiru Islet, 129 feet high, and several submerged rocks lie off this stretch of coast with depths of less than 6 feet. These rocks extend about ½ mile eastward and are marked on their northeastern side by a buoy.

10–20 Coast.—From the vicinity of Punta Calabazo to the mouth of the Rio Trinidad, north of Bahia San Miguel, the shore of Panama Bay is fronted by depths of 5 fathoms and less for about 3 to 10 miles offshore. There are mangroves along this entire coast except where interrupted by bluffs of the Rios Chiman and Chepo.

10–21 Islas Bona and Otoque, with Isla Estiva and Roca Redondo, form a group which lies about 6 miles southeastward of Punta Chame. They are cultivated and have a village, named La Goleta, in the bay on the western side of Otoque. Isla Bona, the southernmost of the group, is round, ½ mile in diameter, and consists of a single peak 685 feet high. Close south of Bona, and connected with it at low tide, is a group of rocks, two of which are 145 and 175 feet high, respectively. Isla Otoque is irregular in shape, 1 mile in diameter, and has two hills, slightly lower than that of Isla Bona. From the northward or southward the islands are more or less blended and do not appear as separate islands until they bear to the eastward or the westward. They form good landmarks for vessels entering this side of the bay. Anchorage in from 10 to 14 fathoms may be found in any part of the group, and all dangers are above water.

Roca Redondo lies about half way between Bona and Otoque.

Isla Estiva, just southward of the southwestern end of Otoque, is the remaining one of the group, and is of no importance.

10–22 Isla Bona Light is shown on Bald Rock Island, 500 yards southeastward of Isla Bona, from a white steel tower, 40 feet high.

Isla Bona has been reported to give good radar returns up to 20 miles.

10-23 Directions.—These islands should invariably be left to the westward, for while a channel exists to the westward of this group and of Taboga Island to the northward, it is more or less obstructed, and a vessel would pass close to several dangers which are avoided by keeping in the open water to the eastward of the islands, besides which, there is no distance saved by going inside.

10-24 Coast.—The coast from Punta Chame to Bruja Point, a distance of 15½ miles, forms a shoal bay with several outlying banks and rocky islets, and vessels should not approach this shore within the depth of 5 fathoms, which is in places 5 miles from the land. The Rio Caimito discharges at the head of the bay, about 12½ miles northward of Punta Chame. Vique Cove, with a small village, is 5 miles westward of Bruja Point. About a mile northeast of Vique is the lofty treble-peaked Mount Cabra 1,673 feet high, which is a conspicuous object for vessels bound to Panama. This hill is just westward of the Canal Zone boundary.

10-25 Bahia Chame, at the head of which the small river of the same name discharges, is nearly filled with large mud banks; the largest, the Cabra Loma, lying in the middle of the bay, has Tabor Island on it. Punta Chame, the southern point of the bay, is low and sandy, 5½ miles long and ½ mile wide; between it and Cabra Loma Bank is a convenient harbor, 2 miles long by ¾ mile wide, with from 3 to 8 fathoms water, there being 16 to 18 feet close to the beach.

On the southern side of Punta Chame is a beach named Playa Chame, with shoal water of less than 5 fathoms extending from 1 to 4½ miles off.

10-26 Light. — Pan de Azucar Light is shown from a hut located on the summit of an islet of the same name about 4½ miles northwestward of Punta Chame.

10-27 Tides.—The mean high water interval at Bahia Chame is 3h. 02m.; spring range 16.2 feet, mean range 12.5 feet.

10-28 Taboga Island (*8°47' N., 79°33' W., H.O. Charts 5002 and 5006*), the largest and most conspicuous island in this vicinity, lies about 6 miles south-southwestward of the canal entrance and 5 miles south of Bruja Point. It is about 2¼ miles long and its greatest width is 1 1/4 miles. The island has been reported to give good radar returns up to 19 miles. A cove on each side divides it roughly into two parts, the northwestern part being the larger and containing the highest peak, 1,010 feet in elevation. The smaller part to the southeastward rises to a ridge 665 feet in height, the northern slope of which is nearly bare of trees and shrubbery. The island is wooded and there is deep water close up to the shore within 1/4 mile on all sides. The town of Taboga is on the northeastern side of the island. Obstruction lights are shown from the summit of Taboga Island and have been reported to be visible at a great distance.

Off the northeast point of Taboga Island is the Morro of Taboga, a small island 200 feet high, connected with the main island by a sandy shoal. A light is shown from the northern extremity of Morro de Taboga.

A rock with a depth of 19 feet lies about 1½ miles northwestward, and a shoal with a depth of 29 feet about ¾ mile northward of Morro of Taboga.

An aeronautical radiobeacon is located about 1 mile northwestward of the southeastern extremity of Taboga Island. A conspicuous radar tower stands close southwestward of the radiobeacon.

10-29 Anchorage.—The anchorage off the village is convenient, being about 600 yards from the shore, in 10 fathoms, with the summit of Urava in range with the high cliff of Taboga, and the church bearing between 225° and 270°.

Anchorages, for vessels bunkering by barge, are located about ¾ mile northwestward of Morro de Taboga light, 1 mile north-northwestward and ½ mile southwestward of the light off the southwestern end of Taboguilla Island, and ½ mile westward of Terapa Island light.

10-30 Tides.—The mean high water interval at Taboga is 3h.; spring range 16.2 feet, mean range 12.5 feet.

10-31 Urava Island is less than ¼ mile to the eastward of Taboga, and is connected with it by a submerged reef having about 2 fathoms over it at low water. It rises evenly to a peak about 600 feet high except on its southeast side, which is nearly vertical for the half distance to the summit. The most noteworthy feature of this island is a narrow point running out to the southward, which is surrounded by a rocky ledge. Terapa Island, from

which a light is shown, is a small rock about ¼ mile off this point.

10–32 Taboguilla Island is about 1½ miles northeastward of Urava Island and 4¾ miles to the southward of the entrance to the Panama Canal and is a very important landmark. It is about 1 mile long and ⅔ mile wide, narrowing to a point at its northeastern end.

It rises to a peak 610 feet high, and is wooded. A shore reef extends out from the northern side of the island for a distance of nearly ¼ mile at its widest part. The eastern side is rocky and on it are two large rocks close to the shore. Four small islets lie near the southwestern point. A light is shown from the westernmost islet.

10–33 Taboguilla Island Light is shown from a white skeleton steel tower, 15 feet high, on a small island on the eastern side of Taboguilla Island.

10–34 Farallon Rock, 65 feet high, is about ¼ mile southward of Taboguilla; it is white and bare, with a well-defined projection on top.

10–35 Rocks.—Tabu Rock, with only 3 feet of water over it at low water, and another rock with 19 feet, lie halfway between Taboguilla and Urava Islands, just eastward of a line tangent to the southeastern sides; they are a danger to navigation.

10–36 Buoy.—A red and black horizontally-banded spar buoy equipped with a red reflector is moored off the southeastern side of Tabu Rock.

10–37 Landmarks.—These 2 groups of islands, namely, Bona and Otoque to the southward and Toboga, Urava, and Taboguilla to the northward, with Bona and Taboguilla in particular, constitute the most important landmarks and fixes after entering Panama Bay.

10–38 Melones Island, about ¼ mile long and 80 feet high, lies about 2½ miles northwestward of Taboga; it is flat on top, higher at its southern end; it is wooded and cultivated.

Melones Rocks, above water, lie ⅓ mile north-northwestward of Melones Island.

A rock, with 19 feet over it, lies 1⅛ miles 321°, and a 29-foot patch about 1,500 yards 005°, from Morro of Taboga.

10–39 Valladolid Rock is a barren whitish gray rock in two parts, the higher about 80 feet in elevation and conspicuous when in the sunlight; there is deep water all around it. It lies a little to the westward of a line joining Otoque and Taboga Islands, and about 6 miles northward of the former.

10–40 Chame Island, 2 miles northeastward of Valladolid Rock, is 315 feet high, wooded, and conspicuous. It has deep water close to.

10–41 Bombing target.— A wooden pyramidal bombing target, painted yellow, is moored about 3¼ miles westward of Chame Island.

10–42 Perique Rock, 55 feet high, lies immediately to the northward of Chame Island.

10–43 Bruja Point *(H.O. Chart 5006),* 3½ miles westward of the canal entrance, is a rocky projecting point which marks a turn of the coast. Venado Island, 150 feet high, Cocovi Islet, 20 feet high, and Cocoviceta Rock, 10 feet high, lie southwestward of the point, all within a distance of 1½ miles; Tortola and Tortolita Islets, 123 and 43 feet high, respectively, lie about 2 miles southeastward of the point and 3½ miles northward of Taboga; these islets are all within the 3-fathom curve. From Bruja Point to the city of Panama shoal water extends 2 or more miles from the shore and envelops all the islands this side of Panama Harbor.

The wreck of a sand barge lies about 1,200 yards northward of Tortolita Islet.

Several rocks, dangerous to navigation, are charted about 1,100 yards northwestward of Tortola Island.

10–44 Commission Rock, with a depth of 5 feet over it at low water, lies about ¾ mile southward of Tortola Islet.

10–45 Buoys.—A light buoy, painted red and black in horizontal bands and showing an interrupted quick flashing green light, is moored south of Commission Rock. A can buoy marked "CR" is moored northward of Commission Rock.

10–46 An aviation light is located about 1½ miles northward of Bruja Point. Several aviation lights are located in the vicinity of the Pacific approaches to the Panama Canal.

10–47 PANAMA CANAL APPROACH—Islands. A group of islands, important from a navigational standpoint, lies on the eastern side of the entrance channel and consists of the islands Naos, Perico, Flamenco, Culebra, and San José Rock.

Caution.—Numerous firing and bombing

ranges have been established in the vicinity of the approaches to the canal. These areas are dangerous to navigation only when they are being used. Consult the latest charts and Notices to Mariners for details.

10-48 San Jose Rock (8°54'N., 79°31'W., H.O. Chart 5006), 96 feet high, lies southeastward of Flamenco, the southeasternmost island of the group. It is an irregular gray mass and serves as an excellent landmark for anchoring off the canal entrance. There is deep water within ¼ mile of it but there is a rock with 14 feet over it at low water about 375 yards to the southeastward.

10–49 Flamenco and Perico are two islands ¼ mile apart north-northwest and south-southeast, lying about ½ and 1 mile, respectively, northwestward of San José Rock. They are approximately the same size, being about ¼ mile in diameter. Perico is 265 feet high and Flamenco is 368 feet high; the latter at a distance shows a symmetrical flat-topped conical outline. A signal mast is located on the summit of Flamenco Island (sec. 10–57).

A chain cable has been reported to lie on the bottom at 1.6 miles 163° from Flamenco Island Light, and vessels are advised not to anchor in this position.

10–50 Flamenco Island Light is exhibited from a square concrete pedestal, painted white, on the southwestern side of Flamenco Island. The light structure is of no use as a daymark.

10–51 Naos Island, about ¼ mile westward of Perico, is 700 yards long northwest and southeast, 300 yards broad, and 126 feet high. Culebra Island, about 335 yards long, north and south, low and covered with bushes, lies close southeast of Naos and is joined to it.

A breakwater has been constructed in a 272° direction for about 370 feet from the western side of Naos Island. Two lights, 6 feet apart, are vertically disposed on a pole on the outer end of the breakwater.

An area about 600 feet long, and 200 to 350 feet wide, at the head of a pier located 550 feet northward of the above breakwater, has been dredged (1944) to depths of 20 to 30 feet.

10–52 Breakwater.—Naos Island is connected to the southern extremity of the reclaimed land southeastward of Balboa by a breakwater which is continued to the southeastward from Naos Island, connecting that island with Perico and Flamenco Islands. The breakwater, about 2¼ miles in length, including the islands, varies from 20 to 40 feet in height above mean sea level, and is in general about 50 feet wide at the top. It serves a twofold purpose, to protect the canal entrance and keep it from silting up, and to furnish railroad connection between the islands and the mainland. The breakwater has been reported to give good radar returns up to 10 miles.

10–53 Batele Point, 1⅛ miles northeastward of Bruja Point, is the southern extremity, 102 feet high, of a large, round, hilly projection. Changame Island, surrounded by the Pulperia Reefs, with Peñamarca Rock at their northern end, lies 1.1 miles east-southeastward of Batele Point. Between Batele and Guinea Points is the leper colony of Palo Seco.

Guinea Point, 1½ miles northward of Batele Point, is the northern extremity of the hilly projection, 312 feet high, mentioned above.

Farfan Point, about 1 mile northward of Guinea Point, forms the northern entrance to the Farfan River.

10–54 Depths.—From Isla Bona to the canal entrance the depths shoal gradually, and, if at night or during a heavy rain or thick weather, there be any doubt about a vessel's position, she should anchor and wait for it to clear. Between Bona and Taboguilla Islands anchorage can be found in 20 fathoms.

Under no condition should a vessel go inshore of a line from Melones Island through Commission Rock (bearing 054°–234° and extending to the axis of the entrance channel to the canal.

10–55 Dumping ground.—The water to the southward and westward of the canal entrance is to be avoided for a distance of 1 mile to the seaward of the above-mentioned line, as dredged material from the canal channels has been dumped in this vicinity. The dump is marked by three light buoys, two painted red and black and one painted white, and all showing quick-flashing green lights. The position of these buoys is subject to change without notice.

Caution.—All small craft are warned to keep clear of the dumping area after sunset.

A pile covered at high water is located about 1.6 miles 202° from Flamenco Island Light.

10–56 Landmarks.—Mount Ancon forms the most conspicuous landmark for approaching the canal entrance. It is between Panama and Balboa and is the highest hill in the vicinity, being 654 feet in elevation. On the eastern slope the old administration building, of white stone with a red roof, is easily discernible. On a higher slope of the hill above the administration building is a concrete reservoir with a white coping which shows from seaward.

A conspicuous tower, on which obstruction lights are shown, is located on the western slope of the hill.

The southwestern face ot Mount Ancon has been divested of vegetation and was once a rock quarry; the remainder of the hill is wooded.

One of the most conspicuous landmarks is a white concrete smokestack, 150 feet high, on Mala Point, just southward of Mount Ancon. Another conspicuous stack is described under Panama Harbor.

Sosa Hill *(8°57′ N., 79°34′ W., H. O. Chart 5006)*, 370 feet high, lies between Mount Ancon and the canal, and around its base stands the city of Balboa, the Pacific terminal of the canal.

10–57 Signal stations.— There are signal stations on Flamenco Island and Sosa Hill with which incoming vessels can communicate. All vessels are required to identify themselves to the Flamenco Island Signal Station before being allowed to enter within a 3 mile radius of Flamenco Island or the Canal Zone.

The Flamenco Island Signal Station is equipped with a radiotelephone. The call letters are WHC (Whiskey Hotel Charlie), and the operating frequencies are:

Channel 1, (2182 kc.) calling and distress.
Channel 4, (2638 kc.) calling and operating.
Channel 6, (2486 kc.) calling and operating.

Vessels desiring to communicate with the signal station should call and listen on either Channel 1, 4, or 6. The signal station will answer on the same channel the vessel uses for calling. If contact is made on Channel 1, the vessel will be directed to shift to Channel 4, or 6 for communicating.

The signal station is restricted to operational messages concerning the marine operations of the Panama Canal.

10–58 Merchant ship anchorage.—The following area in the vicinity of the Pacific entrance to the Panama Canal has been designated as the merchant ship anchorage:

An area bounded on the south by a line drawn due east from the midchannel lighted whistle buoy, hereinafter described, located in latitude 8°51'50" N. and longitude 79°30'00"W., to longitude 79°28'00"W.; bounded on the southwest by a line drawn between this buoy and the Canal entrance buoy No. 2; bounded on the northwest by a line drawn between Canal entrance buoy No. 2 and the northwest tangent of San Jose Rock, this line extended to latitude 8°54'31" N.; bounded on the north by a line drawn due east from Flamenco Island Light to longitude 79°28'00"W.; and bounded on the east by longitude 79°28'00" W.

The southwest corner of this anchorage, in latitude 8°51′50″ N. and longitude 79°30′00″ W., is marked by the midchannel lighted whistle buoy, which is painted in black and white vertical stripes.

A nun buoy, painted red and black in horizontal bands, is moored in 32 feet of water in the merchant ship anchorage about a mile east-southeastward of San José Rock.

A restricted anchorage area has been established in the Pacific Entrance to the Panama Canal. The area is bounded by the following lines: on the southeast by a line drawn between the midchannel lighted whistle buoy and the entrance buoy No. 2, then northnortheastward to San Jose Rock; on the northeast by a line drawn between San Jose Rock, through the Signal Station on Flamenco Island to a point on the breakwater about 250 yards northwest of Naos Island; on the northwest by a line drawn between the breakwater through buoys No. 9 and 10 to 8°54'16"N., 79°33'36"W., then through Changame Island to 8°52'58"N., 79°32'34"W.; on the southwest from the last point mentioned above through lighted buoy "X" to the midchannel light whistle buoy.

The anchorage for vessels carrying explosives lies about 1½ miles east-northeastward of Tortolita Island.

Bunkering anchorages (sec. 10–29).

All vessels bound to Balboa Harbor or through the Panama Canal are boarded by a boarding officer. (See sec. 10–72.)

10–59 Currents.—There is a current of variable strength, but fairly constant in direction, setting to the westward across the head of Panama Bay and thence to the southward between Taboga Island and the mainland. This current when combined with the ebb tide has a velocity of from 1 to 2 knots at the time of spring ebbs between and to the westward of Taboga and Otoque Islands. It reduces the velocity of the flood current, and its strength is less over the same area. Between Taboga and Otoque Islands the tidal currents, both flood and ebb, vary greatly in direction at different stages of the tide, and cross currents flowing east or west are frequently encountered near the shores of the islands and in the vicinity of Valladolid Rock.

In the vicinity of Punta Chame tide rips have been observed. Between Cape Mala and Isla Bona vessels are frequently set out of their course by the currents, and in thick weather it would be better to lay a course to pass 5 miles eastward of these places. With a steady southeasterly wind the current is westerly, and vessels should be more particular to set a course to keep well clear of Isla Bona. Between Cape Mala and Isla Bona it has been observed that the current, particularly in strong flood tides, sometimes reverses and sets to the northward and westward.

Current-direction observations were made at three locations in Panama Bay between Taboga and Flamenco Islands. Those observations indicate that the general direction of tidal current is approximately parallel to the canal axis. Surface currents of an incoming tide were found to be more from the eastward, especially at the observation point nearest Flamenco Island, indicating that tidal curents here are affected by winds and the coastwise current in Panama Bay. The maximum current velocity observed in this section of the bay was less than 0.6 knot.

10–60 Winds.—In this vicinity the seasons, temperature, barometer, winds, and rainfall are slightly modified by local conditions. The northeast trades blow offshore at the entrance and the southeast trades on-shore. The force of the northeast trades is modified and lessened by crossing the Isthmus, and are not so strong as at Colon. Northers are practically unknown, and with the exception of sharp wind squalls that sometimes accompany heavy tropical rains, and a strong trade wind occasionally, both of which make it rough for small craft, there is no danger to be anticipated, and vessels can ride in safety throughout the year at single anchor and with a moderate scope of chain.

10–61 Directions. — Steamers from South American ports should lay a course either to sight Cape Mala Light or leave it about 15 miles on the port hand, while those from the northward should round the cape at a distance of about 5 miles, depending upon their reckoning and the state of the weather. Thence, in both cases, they should lay a course to pass Isla Bona on the port hand and then round Taboguilla Island on the same side, keeping it about 2 miles on the port beam, until its north end bears 225°; from this position the group of islands at the entrance will be roughly in range with the summit of Mount Ancon bearing 332°. If this latter course be followed until San Jose Rock bears 000°, about ½ mile, a good, convenient anchorage will be found in 8 fathoms, soft bottom, off the entrance to the canal.

Inasmuch as the depths decrease gradually from about 20 fathoms northeast of Isla Bona to 7 to 9 fathoms in the vicinity of the entrance to the canal, the lead is of much assistance in approaching in thick weather. If there be any doubt as to position, a vessel should anchor in 10 fathoms, which will be within 2 miles of the canal entrance.

10–62 ENTRANCE CHANNEL TO PANAMA CANAL AND BALBOA HARBOR *(H.O. Charts 5006 and 5000)*.—The channel leading from the deep water of Panama Bay to Balboa and to the entrance to the canal passes between Guinea Point on the port hand and Naos, Culebra, Perico, and Flamenco Islands on the starboard. This channel is about 6 miles long, 500 feet wide, and has a controlling depth of 40 feet (1961) as far as Miraflores Locks. The project depth is 42 feet. The breakwater (sec. 10–52) lies about 850 yards eastward of and nearly parallel to the axis of the channel.

10–63 Range lights.—Two lights in range bearing 321°45′ lead through the entrance channel from the sea to Balboa. The front light is shown from a concrete tower, 26 feet in height,

situated on the west bank of the canal opposite Balboa. The rear light, shown from a concrete tower, 100 feet high, situated 2⅛ miles from the front light.

Range lights, about 600 yards apart and in range bearing 160°35′ lead southbound vessels through Balboa Reach, northward of Balboa. The front light is shown from a beacon on the western side of the channel, opposite La Boca, and the rear light is shown from a beacon on Farfan Point. Similar range lights are shown at the northern end of the reach for northbound vessels.

All range lights in the Panama Canal show green lights.

10–64 Light buoys and lights.—The channel is, in general, marked by light buoys, arranged in pairs at intervals of about ½ mile.

The midchannel entrance buoy, a lighted whistle buoy painted in black and white vertical stripes, is moored slightly northeastward of the channel axis about 2 miles southeastward of the channel entrance.

The two light buoys at the channel entrance are as follows: No. 1 Light Buoy, on the port side, is black and shows a flashing white light, No. 2 Light Buoy, on the starboard side, is red and shows a flashing red light.

Light beacons are situated on the port side, west of Balboa, and on both sides of Balboa Reach.

The oil crib at La Boca is marked by two lights.

Two piers, southeastward of the oil crib, have lights at their outer ends.

Lights are shown from the Balboa Ferry slips.

Two obstruction lights are shown from a tank on a supporting tower, 89 feet high, situated about 1 mile westward of the front range light leading through the entrance channel. The tank and tower are painted alternately in squares of orange and aluminum.

10–65 Bridge—Overhead Clearance.—The Thatcher Ferry Bridge crosses the entrance channel about 400 yards northward of Farfan Point, and has an overhead clearance of 201 feet at mean high water. The center of the bridge is marked by 2 lights shown vertically.

10–66 Caution.—An area about ½ mile wide, in which anchoring or stopping is prohibited, has been established across the approach channel to the canal, and extends northeastward to the breakwater. The limits of the area are indicated by dashed lines on the chart.

Cables and pipelines are laid across the channel a little less than ¼ mile southward of Thatcher Ferry Bridge and about ¼ mile northward of the bridge is a similar area.

Mooring areas.—A mooring area, with a width of about 100 yards, is established on the northeastern side of the approach channel, between lighted buoys Nos. 14 and 16. Light buoy 14½ marks the channel about midway between light buoys 14 and 16.

A similar area, about 200 yards wide, lies on the southwestern side of the channel, between lighted buoys Nos. 13 and 15. The southwestern limit of this area is marked by can buoys, Nos. 13A, 13B, and 13C. Light buoy 13 1/2 marks the southern side of the channel between light buoys 13 and 15.

10–67 BALBOA HARBOR (*8°57′ N., 79° 34′ W., H. O. Chart 5000*), just inside the canal entrance on the east side, is an artificial harbor which will be enlarged as commerce may demand. There is little anchorage space in the harbor and most vessels must go alongside the wharves.

10–68 Depths.—The depths in the harbor are from 31 to 45 feet.

10–69 Tides.—The mean high water interval is 3h. 05m., spring range 16.4 feet, mean range 12.6 feet.

10–70 Currents.—Observations upon which the following remarks are based were made in February and March 1918, during spring tide periods.

The highest current velocities were observed in the entrance channel, along the reloader wharf, and in the vicinity of the oil pier. The maximum surface current velocity observed was approximately 1.5 knots, at a point in the canal channel opposite the Panama Railroad dock, on an outgoing tide. The maximum current velocity observed below the surface was approximately 1.3 knots at a depth of 30 feet at a point opposite the oil pier, on an incoming tide.

Tidal currents were found to be very sluggish around Docks 14 to 19 and in the inner harbor basin.

The northerly winds tend to accelerate the surface currents of outgoing tides and to retard the surface current of incoming tides. At a point just off the upper end of the reloader wharf a fresh northerly wind was observed to reverse the surface current of an incoming tide, but at depths of 20 feet or more the winds do not seem to affect the tidal flow.

In general, the stronger tidal currents in the harbor flow in directions approximately parallel to the course of the Canal. Notable exceptions to this rule are found in the steady set of outgoing currents toward the upper end of the reloader wharf and the tendency of the tidal currents near the oil pier to cross the channel, forming an acute angle, following the dredged channel of the old French canal.

The direction of the slower currents at several locations around the docks and in the inner harbor basin is undoubtedly variable, as the direction was observed to shift with varying pulsations of the tidal flow.

Strong tidal currents are encountered in the canal channel, but they follow the general direction of the canal and should not hinder navigation except by retarding or accelerating the speed of passing vessels.

Tidal currents in the vicinity of the inner ends of the reloader wharf seem to be troublesome, especially during a falling tide, as the steady set of the current toward the inner end of this wharf increases the difficulty of handling ships approaching or leaving the coal wharves by drifting the vessels toward the wharf. Northwest winds increase this drifting tendency.

Currents in the vicinity of the oil pier are troublesome also. These currents cross the canal channel diagonally. Falling tidal currents tend to drift approaching ships against the pier, while the rising tidal currents are reversed and tend to drift approaching ships away from the pier.

10–71 Pilotage is compulsory when entering or changing berth. Approaching vessels pick up pilots outside the entrance to the dredged channel.

10–72 Quarantine—Boarding officer.—See section 10–86 for applicable quarantine regulations.

Arriving vessels will be boarded off the seaward end of the dredged channel by a boarding officer. The boarding officer performs the functions of admeasurer for the purpose of determining Panama Canal tolls; makes inspections for the purpose of insuring compliance with quarantine, immigration, and customs laws and regulations; and acts as deputy shipping commissioner, as required.

Vessels arriving at the terminal ports of the Panama Canal will be boarded upon arrival unless, in the case of the arrival of such vessel after 6:00 p. m., prior notice is given by the vessel or its agents that boarding upon arrival is not desired.

When a vessel is not boarded immediately on arrival, it shall anchor in the anchorage area designated by the Governor and await the boarding officer.

10–73 Signal for ships afire.—Ships afire in port and *not underway* may sound a 5-blast whistle or siren signal. The signal consists of five prolonged blasts (each of 4 to 6 seconds duration) and may be repeated at intervals to attract attention. This signal is not a substitution for, but may be used in addition to, other means of indicating fire aboard a vessel.

10–74 Port Captain.—The Port Captain has charge of all matters in relation to shipping both for the canal and the terminal ports, and questions in relation thereto should be referred to him. He will give information, in writing or otherwise as requested, on matters relating to the canal, harbor, navigation, weather, lights, tolls, measurement, provisions, supplies, coal, cables, or other subjects of interest. His office is on the third floor of the Pacific Terminal Building, Balboa, in the immediate vicinity of pier 18.

10–75 BALBOA and Balboa Heights, the seat of the administration of the Panama Canal, consist principally of the administration buildings, drydocks, repair shops, storehouses, coal and oil stores, the residences of canal employees, and other buildings devoted to canal activities.

Wharves.—On the eastern side of the harbor are the wharves and repair shops, and the drydock. The wharves afford in all 24 berths of varying lengths, with depths alongside sufficient to accommodate all classes of vessels. Pier 18, at the head of the harbor, is the only general cargo wharf, and has depths alongside from 33 to 47 feet.

The naval station, located on the western side of the channel, has three piers, each about 700 feet long. They provide two 600-foot berths and three 500-foot berths, with depths alongside of 22 to 39 feet (1960). Pier 3, the southernmost, has a steam crane of 14 tons capacity.

A concrete pier where oil is discharged is located on the eastern side of the entrance channel at La Boca. Tugs and lighters are available.

Repairs.—The main shops and repair plant are situated at Balboa in the immediate vicinity of the drydock, between it and the commercial piers, and have ample installation and capacity for making extensive repairs of any kind on the largest vessels.

Drydocks.—There are three drydocks located at Balboa. The largest is 1,044 feet long, 108 feet wide, and has a depth of 41 feet. In 1959, this drydock was reported in a semi-operational status.

Floating Cranes.—Five floating cranes, the largest with a capacity of 250 tons, are available.

Salvage.—A salvage service operated by the canal is available for prompt assistance to vessels within a radius of a thousand miles of the canal. Seagoing tugs or a wrecking tug with requisite equipment are dispatched on short notice.

Fuel.—The coaling plant at Balboa is southwestward of the drydock and has a very great capacity. Vessels can be bunkered at a rate of from 100 to 500 tons per hour.

There is a storage capacity for great quantities of fuel oil and diesel oil at La Boca. The oil crib is reserved primarily for the use of tankers discharging to the storage tanks, but it can also be used as a bunkering berth.

Supplies.—Supplies of all kinds, including fresh and cold storage fruit and provisions, ship's stores, etc., can be obtained in unlimited quantities on application to the Port Captain or the boarding officer.

Fuel and diesel oil are available at all major berths. Berths No. 6 and 7 are primary bunkering berths.

Water can be obtained for both drinking and steaming purposes alongside of the wharves or at the anchorage outside.

Communications.—Balboa is connected with Panama City, Colon, and the Canal Zone by telephone; to Ancon and Panama by both electric and steam railroads, and is the Pacific freight terminus for the Panama Railroad from Colon.

Radio.—See section 10–79.

Chronometer comparisons can be made at the office of the Port Captain.

Meterological table.—See appendix II.

Deratization.—See section 1–19.

Branch Hydrographic Office.—A U.S. Navy Branch Hydrographic Office is located at Panama Canal Company Building 1001 (P. O. Box 5087), Cristobal, Canal Zone.

10–76 THE CANAL ZONE may, in general terms, be defined as a strip of land 10 miles wide, extending from the Atlantic Ocean to the Pacific Ocean across the Isthmus of Panama. The United States exercises sovereignty over this territory through the Governor of the Panama Canal, but the cities of Colon and Panama and their harbors are excluded, except as to quarantine and sanitation.

The ports of entry for the Canal Zone are Cristobal, on the Atlantic, and Balboa, on the Pacific.

International Rules of the Road are applicable seaward of a line connecting Channel Buoys 1 and 2 and extended to the Canal Zone boundary lines at the Pacific Entrance in Panama Bay. The **Steering and Sailing Rules**, of the *Rules and Regulations Governing Navigation of the Panama Canal and Adjacent Waters*, are to be complied with northwestward of this line.

Special regulations — Steering orders. — Steering orders on all vessels operating in Canal Zone waters shall be given in the direct sense, and the terms "Right" and "Left" shall be used; that is, when the ship is going ahead an order containing the word "Right" shall only be used when it is intended that the wheel, the rudder blade, and the ship's head shall all move to the right, etc.

10–77 THE PANAMA CANAL (*H.O. Chart 5000*), a lock-type canal traversing the Isthmus of Panama in a southeasterly direction for approximately 45 miles; connects Limon Bay on the Atlantic side with Panama Bay on the Pacific side. The canal is largely made possible by the Gatun Lake watershed and the Chagres River, which lie about in the middle of the Isthmus of Panama. The greater part of the canal channel is at the level of Gatun Lake, the surface of which is 85 feet above sea level.

In transiting the canal a vessel is raised in three steps, or lockages, to the level of Gatun Lake and is subsequently lowered in three steps to sea level on the other side of the isthmus. The flights of locks are in duplicate, enabling vessels to pass in opposite directions simultaneously.

10–78 Aids to navigation. — The general scheme of lighting and buoying the canal includes the use of range lights, generally green, in the longest reaches and lighted buoys and beacons along the sides, showing, in general, red lights on one side and white on the other. Each long reach has a double range, a head and a back range, so that a vessel going in either direction will have a range ahead. The range towers are cylindrical con-

crete structures, set a little starboard of the axis of the canal so that if vessels going in opposite directions keep on their respective head ranges, they will have ample room to pass.

Vessels should habitually keep as nearly as possible on the center line of the prism in Gaillard Cut and in the 500-foot reaches, and favor the center line in the 800-foot reaches. In the 1,000-foot reaches the ranges should be habitually followed.

Lighted buoys and beacons are placed along the sides of the canal and across Gatun Lake at intervals of a little less than 1 mile and at all turns. In many parts of the canal unlighted buoys are placed between the lighted buoys. Lights on aids indicating turns are flashing.

In Gaillard Cut the canal prism is lighted by electric lights spaced 1,000 feet apart on each bank, suspended from the bank so that the lights are 6 feet above the water level and mark the edge of the prism of the canal. All these lights are fixed white on the east bank and red on the west bank.

The buoys are colored in accordance with the system in use in the United States, with red buoys on the starboard hand on entering from seaward, and black buoys on the port. The lock at Pedro Miguel is the dividing line between the Atlantic and Pacific systems; that is to say, having passed through the lock, red and black buoys will be found on sides of the channel opposite to those on which they were before reaching the lock.

The aids to navigation are numbered in five sections: (1) From the Atlantic entrance to Gatun Locks; (2) Gatun Lake from Gatun Locks to Gaillard Cut; (3) Gaillard Cut; (4) Miraflores Lake; (5) from the Pacific entrance to Miraflores Locks.

In connection with the dredging operations and to mark temporary obstructions, small red or black wooden buoys are placed from time to time on their respective sides of constricted channels.

Detailed descriptions of all aids, courses, and distances through the various reaches of the canal and information on particular currents which may be expected at various places in the canal are given in the "Pilots' Handbook", issued by the canal authorities to all pilots. (*See also H. O. Chart 5000.*)

10–79 Pilots.—Except when exempted by the Governor, no vessel shall pass through the canal, enter or leave a terminal port, or maneuver within the Canal Zone waters without a Panama Canal Company pilot on board.

Pilotage for vessels in transit through the canal is free; but should any vessel, while in the Canal Zone waters, discharge or receive frieght, passengers, or make a port of call, such vessel is liable for pilotage fees.

The pilot assigned to a vessel shall have control of the navigation and movement of such vessel; however, this does not exonerate the master from the precautions required by the ordinary practice of seamen, and he or his qualified representative must be present at all times on the bridge to keep the pilot informed of handling peculiarities of the vessel. If the master and the pilot assigned to his vessel differ in the interpertation of a rule or regulation the master must accept and obey the pilots interpertation.

Pilots meet incoming vessels off the seaward end of the dredged channel. Boarding officials will also board with the pilot.

10–80 Radio.—The Governor of the Canal Zone has entire control of radio communication in the Canal Zone so far as concerns or affects vessels in harbors and other waters of the Canal Zone or the navigation of such waters, except vessels owned or operated by the United States Army or the United States Navy. This control is exercised through shore radio stations operated by the Navy Department, which stations are referred to as the shore stations. Dispatches from vessels in Canal Zone and adjacent waters shall be forwarded through Balboa Radio Station, call letters "NBA."

RADIO INSTRUCTIONS—ARRIVAL.—Vessels bound for the Canal Zone are required to give the Port Captain at Cristobal or Balboa 48 hours advance notice by radio of their estimated time of arrival at either terminal port. All items of

required information not previously communicated through agents or otherwise shall be transmitted to the Port Captain via shore radio station as indicated in H.O. Pub. 117B Radio Navigation Aids, Section 812, using the phonetic alphabet letters to identify the items required.

The following additional information shall be transmitted via radio to the Port Captain from all vessels as applicable:

(a) Vessels approaching from the Pacific shall report actual time of passing Cape Mala (7°28' N., 80°00' W.) and speed.

(b) Vessels approaching from the Atlantic shall report 12 hours prior to arrival any change of one hour or more in the expected time of arrival.

(c) Any other matters of importance and interest.

Timely receipt of the required information will facilitate the transit or docking of your principal's ships. Failure to comply with this regulation may subject a vessel to costly delay since vessels which do comply will receive priority of service and handling over those which do not.

Communication between vessels in the Canal Zone and other vessels or places.—Except as authorized by authority of the Govenor, and except as regards vessels operated by the United States Army or the United States Navy, all radio communication between vessels in the Canal Zone and other vessels or places whether within or without the Canal Zone shall be carried on by forwarding through the shore station which shall be designated; and, with such exceptions, no vessel in the Canal Zone, or person on board any such vessels, shall do any radio broadcasting, or shall, otherwise than by forwarding through the designated shore station, transmit any radio communication.

Additional information.—Vessels which will transit or stop at Balboa on the day of arrival will be informed by radio message from Port Captain Balboa as to the time when the vessel should be ready for getting under way for transit or entry to Balboa.

Naval vessels which remain at anchorage for the night will be notified daily, via "NBA" primary ship to shore frequencies of the schedule and time each vessel will get underway on the following day, either for transit or entry to Balboa.

Merchant vessels at anchorage will be called on 500 kc. or 2182 kc. and above information given on a working frequency designated by Radio Balboa.

10–81 **Arrival.**—The canal authorities desire vessels to arrive, if possible, off the entrance in the early morning or forenoon. In order to transit the canal on the day of arrival vessels must reach the entrance not later than the following times: Cristobal Inner Harbor (Atlantic), 1:30 p. m., Balboa Inner Harbor (Pacific), 2:45 p. m. From the anchorage at Balboa to the inner harbor is about 40 to 45 minutes, so that ships should reach the anchorage by 2 p. m. On slack days, when traffic is light, it is possible to dispatch ships from Balboa as late as 3 p. m.

Priority of arrival is a consideration, but does not govern the order in which vessels are dispatched through the canal. Passenger vessels are given preference.

10–82 Transit-Rules and Regulations.—Each vessel visiting the Canal is furnished a copy of the *Rules and Regulations Governing Navigation of the Panama Canal and Adjacent Waters* for which the master is required to give a written receipt or sign a statement that he has a copy on board. This publication and additional publications distributed to shipping contain detailed information on rules, regulations, tariffs, measurments, etc.

10–83 Authorized Speed of Transit.—The following speeds shall not be exceeded by vessels in transit through the Canal:

	Knots
Atlantic entrance to Gatun Locks	12
Gatun Lake in a 1,000-foot channel	18
Gatun Lake in an 800-foot channel	15
Gatun Lake in a 500-foot channel	12
When rounding Buoy No. 17 in Gatun Reach northbound	10
Gaillar Cut (in the straight reaches):	
Vessels under 300 feet in length	8
Vessels 300 feet or more in length:	
In 500-foot channel	8
In 300-foot channel	6
(or as near 6 knots as possible on dead slow or in order to maintain steerageway)	
Gamboa: When passing reserve fleet basin, concrete dock, or floating crane berth; and when entering Gaillard Cut	6
Miraflores Locks to Buoy No. 14	6
Buoy No. 14 to Pacific entrance	12

A vessel in Canal Zone waters at locations other than those specified in this section, including Gatun Anchorage, when rounding Bohio and Darien Bends, Miraflores Lake, and in or near the locks, shall not exceed a speed that is safe under the existing circumstances and conditions, except in an emergency.

It has been reported (1957) that the average time for ocean-to-ocean transit of the canal is 12 to 18 hours.

10–84 General Information.—The Canal Marine Bureau has adopted the following standards to determine the number of locomotives or "mules" to be assigned a transiting vessel. Overall lengths are indicated:

Up to 350 feet	4 locomotives
Up to 499 feet	6 locomotives
499 feet or over	8 locomotives

Supertankers, ore carriers over 585 feet by 79 feet, and large passenger vessels will normally "lock in" with 10 locomotives, either loaded or in ballast.

Two canal seamen and a boatswain are assigned to each locomotive. Meals must be provided these seamen when aboard during transit at regular meal hours.

The Pilot aboard shall be furnished a meal, in addition to the regular meals, between the hours of 2200 and 0400 if the vessel is transiting the Canal during such hours.

Four manila mooring lines shall be kept ready for use during transit. These lines shall be of suitable size and strength to be used in case of an emergency such as a power failure in the locomotives or breaking of a towing cable. They are to be distributed as follows: one on each bow and one on each quarter of the vessel. During transit vessels shall use manila, hemp, or synthetic lines for mooring to piers, lock walls or buoys.

A vessel shall keep at least one boat ready for lowering, for the purpose of handling lines.

Both anchors are to be ready for letting go at all times during transit.

Ships officers shall insure that personnel not engaged with locking are to stand clear of all gear and equipment used in conjunction with locking. The Canal Company will not be responsible for injuries resulting from non-observance of this rule.

Note.—Vessels transiting the canal will find additional information and descriptions of the Atlantic temrinal in H.O. Pub. 20.

10–85 Vessel limitations.—The maximum size commercial vessel which may currently transit the canal on a regular basis is 835-foot length, 104-foot beam, and 39-foot draft (TFW) provided the design and handling criteria are met.

The largest vessel which has transited the Canal (1939) was 936 feet in length and 102 feet in beam. Vessels with a beam of 109 feet have been taken through but require special handling.

Drafts of over 36½ feet (TFW) are authorized to individual ships in reply to written requests to Chief, Navigation Division, Panama Canal Company, Box 5012, Balboa,

Canal Zone, after the vessels' underwater hull designs have been examined and the handling characteristics have been assessed, based upon actual transit of each vessel.

The maximum draft allowed to transit the Canal depends on the depth of water in Gatun Lake. Since the depth of Gatun Lake varies with the seasons, the latest information on canal draft limitations should be consulted before a deep-draft transit.

In 1965 the maximum draft allowed to transit ranged between 34 1/2 and 39 feet.

TRANSIT DRAFT ALLOWANCES.—For vessels with beams of not greater than 102, 104 and 106 feet, which meet the criteria, the following draft allowance is permitted on a regular basis:

Gatum Lake Level (feet)		TFW Draft (feet)	
over 86 1/2	39 1/2	38 1/2	37 1/2
86 to 86 1/2	39	38 1/2	37 1/2
85 1/2 to 86	38 1/2	38 1/2	37 1/2
85 to 85 1/2	38	38	37 1/2

Any vessel with a beam of 104 feet or greater requires special permission to transit. The widest beam acceptable for regular laden transit of commercial vessels is 106 feet.

For initial transit the draft of a vessel of over 85-foot beam will be limited to 35 feet (TFW) until handling characteristics are established. After each successful transit a 1-foot increase in draft is allowed until the maximum draft for that particular vessel is reached.

Ship owners, operators, or agents desiring vessels under their cognizance to make transits with drafts of greater than 36½ feet (TFW) should correspond with the Chief of the Navigation Division, Panama Canal Company not later than 2 weeks prior to the loading of the vessel for transit. For initial laden transits a hull plan must be furnished with complete bilge keel information. Specifications and criteria may be received from the Canal Company upon request.

Sister-ships with the identical hull, propulsion, steering, and mooring characteristics of a vessel which has made regular successful transits, may make their initial transit at 1 foot less than the allowable draft.

The Panama Canal Company should be informed sufficiently in advance of each expected initial transit of such large vessels and of expected repeated transits.

10–86 **Quarantine.**—All vessels are subject to quarantine and until granted free pratique shall fly a yellow flag from the foremast head and shall observe all other requirements of vessels actually quarantined. Provisional pratique will be granted those vessels not held in quarantine but subject to further procedure or observation; the termination of provisional pratique places the vessels in quarantine. Free or provisional pratique may, under special conditions, be withdrawn by the quarantine officer. Masters of all vessels should familiarize themselves with all the quarantine regulations and requirements for both the Canal Zone and the ports of Colon and Panama in the Republic of Panama.

10–87 **Pratique by radio.**—The quarantine officer in charge may grant pratique by radio to a vessel upon the basis of information regarding the vessel, its cargo and persons aboard, received prior to arrival of the vessel, when in his judgment, and in accordance with instructions, the entry of the vessel will not result in the introduction, transmission or spread of communicable diseases.

10–88 Time.—Standard time of the seventy-fifth meridian is kept throughout the Canal Zone.

10–89 This section has been deleted.

10–90 This section has been deleted.

10–91 **Communication.** — The Canal Zone has direct cable communication with New York, via Guantanamo, Cuba. Other cables are laid to Port Limon and Puntarenas in Costa Rica, Cartagena and Buenaventura in Colombia and Santa Elena in Ecuador.

There is telephone service throughout the Canal Zone.

There is commercial air service across the Isthmus between Balboa and Colon.

The Panama Railroad traverses the Isthmus from Colon to Panama, its course being on the eastern side of the canal. It is operated in connection with the Panama Canal, of which it is an important adjunct, and has modern roadbed and equipment, including oilburning locomotives.

10–92 Canal publications.—The following publications are furnished free; for the first named of these the master is required to give a written receipt or sign a statement that he has a copy on board:

Rules and Regulations Governing Navigation of the Panama Canal and Adjacent Waters.

The Panama Canal Tariff.

Rules for the Measurement of Vessels for the Panama Canal.

Condensed Information Pamphlet of the Panama Canal Company.

Rules for Docking Vessels in Drydocks Belonging to the Panama Canal Company.

10–93 Branch Oceanographic Office.—There is a United States Naval Branch Oceanographic Office located in building No. 87 at the U.S. Naval Station, Rodman, Canal Zone.

10–94 PANAMA HARBOR (*8°58'N., 79°32' W., H.O. Charts 5000 and 5006*).—Paitilla Point, 1¼ miles northeastward of the city of Panama, is a black, rocky promontory with two hills over it, and between them is a rivulet which admits boats at high water. Rocky ledges extend 300 yards off the point.

The harbor, between the point and the city, recedes about ¾ mile to the northwestward and has depths of 8 feet and less. There are mud flats at the head.

It is here that much of the minor trade of the gulf is carried on by native craft which consist mainly of dug-out canoes.

A conspicuous black smokestack, 180 feet high, stands at the south side of the city.

Danaide Rocks, four patches of conical rocks, lying 2½ miles south-southeastward of Paitilla Point, have a least depth of 11 feet over them. These shoal spots are favorite fishing places, and canoes seen in their vicinity should be avoided by vessels, as they may be fishing on the rocks.

Shallow depths of 17 to 25 feet lie within ½ mile southeastward of the rocks.

Sulphur Rocks.—A dangerous reef, about ¼ mile in extent, lies 1½ miles south-southeastward of Paitilla Point. There are depths of 6 and 9 feet over the reef. A shoal with 2¾ fathoms lies about ½ mile eastward of Sulphur Rocks.

Buey Ledge, seen only at half tide, is the northeastern extremity of the rocky reef, with a width of from 500 to 1,000 yards, that surrounds the eastern and southern shores of the peninsula occupied by the city. Immediately southward of Buey Ledge, which lies 900 yards eastward of the Northeast Bastion, a deep indentation in the reef forms a bay in which, after half flood, there is easy landing on the sandy beach in front of the Monks Gate. The reef is marked by iron posts.

Within about ¼ mile southeastward and eastward of the southeastern part of the above reef there are dangerous rocks, some of which dry. Among these rocks are Taboga and Knocker Rocks.

Knocker Light Buoy, painted black and showing a flashing red light, is moored outside the above-mentioned dangerous rocks.

Tres Hermanas Rocks are a cluster of rocks, the highest of which dries 11 feet, lying about ½ mile to the southward of the Southeast Bastion of the old fortifications. A narrow spit, with 5 to 6 feet on it, extends 2/3 mile southward from the rocks, and westward of it are numerous shoal heads, one awash at 700 yards southward of the rocks.

A wreck is charted about 1⅓ miles south-southeastward of the rocks and another wreck is charted almost 1½ miles southward of the same rocks.

10–95 Anchorage.—The anchorage off the City of Panama, although shallow and an open roadstead, which on the seaward side is entirely unprotected, may be considered secure. The bottom, being mud, holds well, and with good ground tackle and with common precautions a vessel might lie here with one anchor down during any part of the year.

The inner anchorage is in 2 fathoms about 1 mile eastward of the Northeast Bastion. The outer anchorage is in 3½ to 4 fathoms about 2 miles southeastward of the city, or in 5 to 6 fathoms northeastward of Perico Island.

10–96 Tidal currents.— The flood current sets to the northwestward and the ebb current to the southward, the strength varying from ½ to 1½ knots, the ebb being stronger than the flood. The long swell which occasionally sets into the road ceases with the flowing tide.

10–97 Directions. — Steamers should have no difficulty in making the outer anchorage.

10-98 Panama City (8°57′ N., 79°32′ W., H.O. Charts 5000 and 5006), the capital of the Republic of Panama, with a population of about 369,000 (1964), stands on a rocky peninsula at the head of Panama Bay, and was formerly a strongly fortified city. It has an imposing appearance from the sea; the churches, towers, and houses, showing above the line of fortifications, stand out in contrast with the dark hills inland. It is plainly visible and easily recognized, and at night the glow of the lights of the city can sometimes be seen for 10 or 15 miles at sea and will serve as a general guide in approaching.

The houses and stores, once typically Spanish, with overhanging balconies, are now a hybrid Spanish-American. The main streets are lined with stores and Chinese or East Indian shops; there are banks, a modern market, churches, a cathedral, clubs, and a college. The city is having a rapid growth and has modern conveniences. Sanitation and municipal water supply are under the control of the Panama Canal.

A modern residential section, called **Bella Vista,** is situated northeastward of the city proper.

The old city of Panama, built in 1518, stood at the mouth of a creek, about 4 miles northeastward of the present city.

The United States has a legation and a consulate general here.

Piers.—There are several piers, all small and dry at low water, and only available for small vessels and lighters. The general landing place at high water is near the market place, known as "The Playa." Great care is required when landing at Panama in steam cutters or other heavy boats, which can be effected only at nearly high water.

For supplies, communication, etc., see sec. 10-75.

Quarantine.—Quarantine and sanitation are controlled by the Panama Canal. The quarantine flag should be hoisted upon entering the port. All vessels are visited by the canal quarantine officer and a bill of health is required by him. Bills of health are issued by the shipping commissioner of either Balboa or Cristobal.

Hospitals.—There are two excellent hospitals in Panama. For hospitals operated by the Panama Canal, see sec. 10-86.

10–99 Coast.—From Panama Harbor the coast trends eastward for about 25 miles to Rio Chepo. The 5-fathom curve is 3½ to 5 miles offshore.

10–100 Isla Chepillo, lying off the mouth of the Rio Chepo and 2½ miles from the nearest coast, is 1 mile long but narrow and irregular. It is low on the northern side and rises by a gentle ascent toward the middle part. The southern end may be approached within 1 mile. Northeastward of the island is Bajo de Carta-

gena, a bank of hard sand, forming the western side of Canal Boquituerta, which leads to Rio Chepo.

A light is shown from a steel tower, 20 feet high, on the summit of Isla Chepillo.

10–101 Rio Chepo (*9°00′ N., 79°07′ W., H. O. Chart 5584*) is shallow. The entrance channel, Canal Boquituerta, is to the eastward of Isla Chepillo and has a least depth of 1 fathom. Villages lie near the river banks at the entrance. It has been stated that 10 feet could be carried to Anna Luz, 8 miles up the river, and 5 feet to El Capitan, 12 miles up the river, both of which are very small villages.

On account of the considerable flood water in October and November, the entrance is occasionally dangerous; floating trees make snags and resultant bars and new channels are cut.

10–102 Tides.—The mean high water interval at Rio Chepo is 3h. 5m.; spring range 16.2 feet, mean range 12.5 feet.

10–103 Coast.—The coast from Isla Chepillo to Rio Chiman, a distance of 32 miles, is low and covered with mangroves. There are several shallow streams. The land northward of these rivers is of some elevation; Column Peak, about 12 miles northward of Rio Chiman, and Thumb Peak, at the western extremity of the range, are conspicuous. Extensive mud flats, dry at low water, extend from 1 to 3 miles from the coast, and outside of the flats is a shoal bank with less than 3 fathoms; the outer edge of this bank is about 8 miles from the shore.

Islote el Pelado, 5 miles southwestward of the mouth of the Rio Chiman, is flat, of small extent, about 72 feet high and treeless, but is covered with a coarse shrub; it is steep-to on all sides and forms a useful mark for vessels bound to Panama. A light is shown on the eastern side of the islet.

Rio Chiman is wide at the mouth, but shallow, being nearly dry at low water, with small channels for canoes. The entrance is well marked by the wooded bluffs on each side, Isla Maje to the southward, and Islote el Pelado in the offing. On the eastern side, under a hill, is the small village of Chiman.

A rock, with less than 6 feet of water over it, was reported (1958) to lie about 2 miles south-southwestward of the center of Isla Maje.

Rio Trinidad (*8°35′ N., 78°32′ W., H. O. Chart 5584*), about 9 miles southeastward of Rio Chiman, has a low, rocky projection forming its southern entrance point. Shag Rock, a barren islet frequented by birds, lies 2½ miles northwestward of the entrance.

Las Islas Pajaros, both of which are small and rocky, lie between 2½ and 3½ miles south of Punta de Brujas, the southern entrance point of the Rio Trinidad, and about 1½ miles offshore. Between these islets and the shore the depths are shallow.

Punta Gorda, 7½ miles south-southeastward of Punta de Brujas, is bold and wooded. There is more swell to the southward of this point than to the northward.

Rio Buenaventura, 3½ miles southeastward of Punta Gorda, is shallow. Near the edge of the shoal off the mouth of this river is Farallon Ingles, a small islet, 85 feet in height.

Punta Brava, 5 miles southeast of Farallon Ingles, is the northern entrance point of Bahia San Miguel. There are a number of rocks within ¼ mile of the shore to the northwestward of it, and the sea breaks heavily over them.

10–104 BAHIA SAN MIGUEL (*H.O. Chart 1410*) is 14½ miles wide between Punta Brava and Punta Garachiné (sec. 10–128) and recedes about 20 miles to the eastward. Between Punta San Lorenzo, 1¼ miles east-southeastward of Punta Brava, and Punta Patiño, to the southeastward, the bay narrows to a width of 6½ miles but expands again to about 10 miles and again narrows to 4½ miles between Morro Buena Vista and Punta Momosenega. From here a gradually narrowing channel extends for 7 miles to the northeastward to the Boca Grande, where it turns sharply and extends 4 miles to the south-southeastward to the junction of the Rios Sabana and Tuira.

A flat with 5 fathoms and less extends across the entrance to the bay and for about 8 miles to the seaward; two shallow spots of 3½ and 4½ fathoms lie 4½ miles northwestward of Punta Garachine. Inside the bay the depths gradually increase and through the Boca Grande the depths are 11 to 24 fathoms.

The waters in the bay are in general a yellow mud color and have numerous heavy swirls due to river currents and tides. These are not indicative of the depth. During the rainy season the bay is filled with large floating trees which are a menace to navigation.

10–105 Ensenada de Garachine, within the point of the same name, is 10½ miles wide, north-northeast and south-southwest, and recedes 6¾ miles to the southeastward but is mostly shallow. Mud flats, which dry at low water, extend 3 miles offshore These flats are fronted by a bank, with 2 to 3 fathoms, which occupies much of the remainder of the bay. A shoal, 4 miles long and ½ mile wide, with a least depth of 1 fathom, lies 3 to 7 miles northeastward of Punta Garachiné; it breaks at half tide.

Vessels may anchor close off either Punta Garachiné or Punta Patiño, the depth of water being convenient. The anchorage off the former point is particularly calm and well protected during the summer season.

10–106 Punta Patino (*8°16′ N., 78°19′ W., H. O. Chart 1410*), is sharp and projecting with Patiñito Islet close off it. There is deep water off the islet. Punta Barro Colorado, about 2½ miles northeastward of Punta Patiño, is bold, rocky, and has a conspicuous patch of reddish clay on its face. Between the points there is a shallow bay.

A light is shown from the roof of a square concrete structure, 10 feet high, on Patiñito Islet.

A 5-fathom patch lies about 1¾ miles north-northwestward of Patiñito Islet.

Ensenada Mogui is 4½ miles wide between Punta Alegre, which is 1½ miles northeastward of Punta Barro Colorado, and Punta Momosenaga. This bay is generally shallow. Punta Barro Colorado has a conspicuous red cliff.

A reef, which dries, extends about ¾ mile northward from Punta Alegre.

There are several depths of 5½ to 6 fathoms charted 2½ to 3 miles northward of Punta Alegre.

Isla Cedro, which is densely wooded, lies about 1⅓ miles off Punta Momosenega. Several islets and rocks extend southward of it. The depths to the northeastward and southwestward of the islet are shallow.

Barry Rock lies about 1⅓ miles offshore at about 2½ miles northward of Punta Momosenega and 2¾ miles southward of Boca Chica.

Banco del Buey, about 1 mile south of Punta Brava, is extensive and it breaks heavily at high tide.

All vessels are advised to avoid the vicinity of the bank and Punta Brava.

10–107 Punta San Lorenzo, located 2 miles eastward of Punta Brava, is the western entrance point of Ensenada Pena Hueca. At a little over 1 mile southeastward of the point is Islita Batatilla and between 1½ and 2½ miles eastward of this islet there is a shoal with a least depth of 1½ fathoms.

A 4-fathom patch lies about 4 miles southward, and a 4¼-fathom patch lies about 3 miles southeastward, respectively, of Punta San Lorenzo.

Ensenada Peña Hueca is 8 miles wide, east and west, between Punta San Lorenzo and Punta Buena Vista, and recedes about 6 miles to the northward. The greater part of the bay is shallow.

Islas Iguana, Iguanita, and Josefa and Lost Rock lie in the western part of the bay.

A rocky reef was reported (1942) to extend about 1½ miles off a point on the eastern side of Ensenada Peña Hueca, about 2 miles north-northwestward of Punta Buena Vista.

Punta Isla Maria, 4 miles east-northeastward of Punta Buena Vista, marks a sharp turn of the shore line to the northward at the beginning of the Boca Grande.

Sombrereta, a conspicuous little rock, about 20 feet high and covered with grass, lies 1¾ miles south-southeastward of Punta Buena Vista. Between this rock and Isla Cedro, 1⅓ miles to the south-southeastward, is the best channel up the bay.

A group of islets, including Los Bongales, Tallo, Corasal, and Conejo, lies between 1¾ and 3½ miles to the northeastward of Sombrereta. The depths in the vicinity of the islets are shallow and between the islets and the shore to

the northward there are several shoal patches.

10–108 Anchorage.— The space between Isla Cedro, Sombrereta, and the above-mentioned group of islets appears to afford the most favorable anchorage for vessels waiting for slack tide before going farther up.

Isla San Carlos (Stanley Island), low and wooded, 1½ miles long and 1 mile wide, divides the channel into two passages. Boca Grande, the principal passage, forms a continuation of Bahia San Miguel to the northward along the western and northern sides of the island, while Boca Chica is between the southern side of the island and Punta Virago.

A radio mast is located on the southeastern point of Isla San Carlos.

10–109 Boca Chica (*8°25′ N., 78°10′ W., H. O. Chart 1410*) is about 1 mile long and 300 yards wide between the shores at its narrowest part, abreast Bona Vista Point, the southeastern point of Isla San Carlos. The channel has a least depth of 5 fathoms, which is found abreast Bona Vista Point. Here the channel lies nearer the southern shore, being narrowed by a shoal which extends southeastward and eastward from the point; there are rock heads near the point and 4½ fathoms on the part near the channel. A shoal with about the same depth but of less extent borders the southern shore of the narrows.

On the northern side of the western entrance to the channel, and about 300 yards west of the southern point of Isla San Carlos, lie Foley Rocks, awash at half-tide. A pinnacle rock with a depth of 1 fathom lies about 250 yards northward of Punta Bagochiquito.

A half-tide rock lies about 100 yards westward of Punta Bagochiquito.

The currents in the narrows abreast Bona Vista Point have a velocity of 3½ knots at ebb and at flood.

10-110 Punta Bagochiquito Light is shown from a tower with a red latern, located on the southern side of the western entrance to Boca Chica.

10–111 Boca Grande is about 1 mile wide at the entrance between the rocks outside Boca Chica and Milne Island, near the western shore, and continues for 1½ miles at about the same width between Isla San Carlos and the shore. A dangerous rock, only showing at about three-quarters ebb and connected by a ledge with the island, lies off its northwestern point. This channel now bends to the eastward and continues with the same width between Sebollita and Jeannette Islands, on the north, and a large flat rock, nearly always uncovered, and a small wooded island, about 200 yards off Isla San Carlos, on the south. Then bending southeastward it continues between Cartagena and Cartagenita Islands on the west and the main shore on the east, gradually broadening after passing the former island and attaining a width of nearly 2 miles abreast of Boca Chica. The depths to the eastward of Boca Chica are about 6 to 10 fathoms.

La Palma, a village with about 100 thatched or tin-roofed huts, is about 1 mile southward of the eastern entrance to Boca Chica.

Rios Sabana and Tuira. —At about 2 miles eastward of La Palma is Punta Sabana at the junction of the Rios Sabana and Tuira. The Sabana flows southward to its mouth eastward of the point. The Tuira flows to the northwestward and is navigable, during the rainy season, for boats of 10-foot draft as far as El Real, about 35 miles southeastward of La Palma.

Vaguila Rock, showing at about half tide, lies a little over ½ mile southward of Punta Sabana. There is a good channel, 750 yards wide, with 9 to 14 fathoms, between the rock and the islet off the point.

10–112 Dairen Harbor is the water area at the junction of Boca Grande and the Rios Sabana and Tuira.

Banco San Jose, a dangerous shoal, lies in the fairway of vessels bound to Panama from the southward. It is about 1 1/4 miles long, northwest and southeast, and a little over 1/2 mile wide within the 5-fathom curve but within the 20-fathom curve it is 4 1/2 miles long and 2 miles wide. In the center of this shoal, lying 14 1/2 miles 272° from Punta Garachine (sec. 10-128) is Trollope Rock which has only 9 feet of water over it.

10–113 Light buoy. — A cylindrical light buoy, painted red and black in horizontal bands and showing a flashing white light, is moored about 1/3 mile southward of Trollope Rock.

10-114 ARCHIPIELAGO DE LAS PERLAS (PERLAS ISLANDS) (*H. O. Chart 5580*) consists of a number of islands and numerous rocks, which cover an area of about 450 square miles in the northeastern part of the Gulf of Panama. The length of the group, north and south, is about 30 miles and the width is about 20 miles. The islands are high and wooded and their shores are steep. There are many islets, reefs, and sunken rocks around the group and between the larger islands.

There is no occasion for any other than small coastwise steamers to go close to the islands, but should a vessel be out of her reckoning and sight them when bound to Balboa or Panama she should leave the group to the eastward and give Isla de San José a berth of about 2 miles, and then lay a course for Taboguilla Island. Fortunately the southwest shores of Isla de San José are free from offshore dangers, and there is deep water fairly close-to.

The channel to the eastward between the islands and the mainland is not used by steamers, except in rare instances, or by other than small coastwise vessels with local knowledge. Banco San José and Trollope Rock lie in the middle of its southern entrance, and should a vessel get too close inshore on either side there are hidden dangers.

There are four towns on the islands—San Miguel, with a population of about 1,500; Saboga, Casapeta, and Mafafa, with a population of about 200 each. In general, the water supply is good and there is an abundance of game, fish, and some fruit. Mosquitoes are numerous and as a result there is a great deal of malaria among the native population.

There are two seasons — the rainy season from April to Octoher, and the dry season from October to April. During the rainy season visibility is exceptional. Few days find a totally clouded sky, and in general the heaviest rainfalls are so scattered that good visibility will prevail in most directions. In the midst of a downfall visibility reduces to zero, however. During this season southerly winds prevail and the sea is invariably calm. During the dry season visibility is not as good on account of the haze. Northerly winds prevail at this time and frequently kick up a choppy sea.

The inhabitants of the islands are a mixture of the native Indians, Panamanians, and Negro races, and in general are friendly and peaceloving. There are many schools in the larger villages, but the people are very poor and generally speaking, are undernourished. The principal industry is pearl fishing. Some of the smaller islands are owned by the natives, and in a few cases, by residents of Panama City, but most of them are owned by the Republic of Panama, which Government controls the group.

CAUTION.—Firing and bombing practice may take place in the warning areas in the vicinity of Archipielago De Las Perlas. Notice will be given by radio stating the area concerned, time and type of firing to be conducted.

10-115 Isla Pacheca (*8°40′ N., 79°03′ W., H. O. Chart* 5581), at the northern end of the group, is about ¾ mile long, northwest and southeast, ½ mile broad and about 200 feet high. Isla Pachequilla, a small island, about 80 feet high, lies about 400 yards off the northwestern end with a rock, about 36 feet high, close southward of its western point.

A light is shown from a square concrete column on a tank house, 34 feet in height, on the northeast point of Isla Pacheca.

Isla Bartolomé lies about 1 mile southeast of Isla Pacheca and about midway between them there is a ¼-fathom patch. The channel between the islands should not be used by any craft other than small boats owing to shifting sands. A 1-fathom bank extends ¼ mile northeast of the island and a reef extends about 400 yards southwestward from the southwestern end of the island.

Isla Contadora, about 1¼ miles long, northeast and southwest, and about 150 feet in height, lies nearly 1 mile southward of Isla Bartolomé. On its northwestern side the 5-fathom curve is about 400 yards offshore but off its southern and southeastern sides there are numerous shallow patches, some of which dry.

Isla Saboga, about ⅓ mile west of Isla Contadora, is about 1¾ miles long, north and south, about 1 mile wide, and 216 feet in height. A

reef and a detached shoal, with a depth of nearly 2 fathoms over it, extend 1½ miles northward of the island and on the reef there are several islets, as well as several rocks, which cover at half or three-fourths tide. Shallow depths extend 1¼ miles south-southwestward of the island. Isla Chitre, 254 feet high, lies about ¼ mile southward of Saboga; and El Campano, a reef which breaks heavily, extends about 700 yards southwestward of it. A shoal, which breaks at low tide, lies ½ mile off the southeast point of Isla Chitre between the bearings 097° and 127° from that point.

There is no channel for craft of any size between Islas Saboga and Contadora because of numerous shallow patches and sunken rocks.

10–116 Saboga Anchorage, formed by the islands of Contadora and Saboga and the islets to the north of them, is a good and spacious harbor, about 1½ miles long, north and south, and nearly ¾ mile wide. The general depths are 5½ to 11 fathoms. The usual anchorage is in 8 to 10 fathoms ½ mile northward of the village on Isla Saboga. The bottom is green mud and is good holding ground. The anchorage is well protected against strong north and south winds by numerous small islands. There is considerable current here, varying with changing conditions of wind and tide. The tide is practically the same as at Balboa. The shores are generally rocky, although there is a good beach on which small boats or planes can land.

Two channels lead into the harbor. The channel from the northwestward, named Canal Pacheca, passes southward of the island of the same name, between it and the reef extending northward of Isla Saboga. It is 400 yards wide at its narrowest part and has a least depth of 5½ fathoms on the recommended course. Canal Contadora, from the eastward, passes northward of the island of the same name and has a least depth of 9 fathoms.

Bajo la Almirante, which covers at one quarter flood, is a large reef lying about ¾ mile southeastward of the southwestern point of Isla Contadora.

10–117 Directions.–Vessels using Canal Pacheca should pass within ½ mile of Isla Pachequilla and stand to the southward until the center of Isla Bartolomé bears 116°; keep it on this bearing until the eastern extremity of Isla Saboga bears 180°, which will lead to the anchorage.

When entering by Canal Pacheca upon the northwest-going tide, attention must be paid not to bring the eastern extremity of Isla Saboga to bear eastward of 180°, to avoid being set upon the northeastern rocks of the ledge extending north from Isla Saboga.

If entering by Canal Contadora, pass ¾ mile to the eastward of Isla Bartolomé and stand to the southward until the church cupola in the village of Isla Saboga bears 244°; this bearing leads to the anchorage. The tidal currents are strong and variable.

Tides.—The mean high water interval at Saboga Anchorage is 3h. 03m., springs rise 16 feet, neaps rise 11 feet.

Isla Chapera and Isla Pajaros (*8°34′ N., 79° 02′ W., H. O. Chart 5581*), the next islands south of Isla Contadora, have a narrow channel between them that is available only to small craft. The area between Islas Pajaros and Gibraleon is dotted with shoals, having narrow channels which can be used by small boats. Isla Catalina, about 2 miles westward of Isla Pajaros, is small and awash at extreme high tide. There is a 5-fathom channel south of Isla Catalina extending from southwest to northeast between Islas Contadora and Chapera. It is not recommended because of strong tidal currents and shallow water on both sides.

Casaya, Bayoneta, and Viveros are the largest of a cluster of islands on what may be termed an extensive reef, about 7 miles long by 5 miles broad, stretching off the northwestern point of Isla del Rey; there are also numerous islets and rocks rising from the reef, and the

passages between them all are foul, with occasional strong tides. A shoal 1¼ miles long by ½ mile wide, with only 12 feet of water on its shoalest part, lies about 3 miles eastward of the northern point of Casaya; and the Islas Caracoles, with foul ground around them, lie about 1½ miles northeastward of the northeastern point of Viveros.

10–118 Anchorage for all types of vessels the year around, with good holding ground in 6 to 10 fathoms, is available in the vicinity of Isla Caracoles. This islet is small, rocky, and covered with coconut palms. Shallow patches of 3 or 4 fathoms lie between Isla Caracoles and the extensive shoal north-northwestward of it.

10–119 Directions.—The entire group of islands stretching northwestward from the northwestern point of Isla del Rey should be avoided by vessels bound up Panama Bay by approaching the islands on their western side no nearer than just to open the eastern point of Isla San José eastward of Isla Pedro Gonzales, bearing 175° astern; and on their eastern side should not open San Pablo, an islet off the northeastern side of Isla del Rey, or bring it to bear eastward of 151° astern.

Isla del Rey, the largest of the Archipielago de las Perlas, is about 15 miles long, north and south, by 7½ miles wide, with several peaks, the highest being 680 feet high. Numerous islets and shoal patches, with deep water between them, lie as much as 4 miles off the western coast, but should not be approached by strangers within the depth of 10 fathoms. Punta de Cocos, the southern extremity, is the end of a remarkable promontory, 4 miles long by about 1 mile wide, jutting southward into the sea. Off its southern extremity there is a detached island which is not noticeable until close aboard. The island has steep, rocky sides.

Off the eastern side of Isla del Rey there are a number of islands but they are steep-to and can be approached within ½ mile. A rock with a depth of only 8 feet over it lies 2¼ miles northeastward of Isla Santelmo, about midway between Camoté and Monte islands.

10–120 San Miguel (*8°27′ N., 78°57′ W., H. O. Charts 5581 and 5582*), the principal town of the islands, is on the north side of Isla del Rey. It is of considerable size, with a conspicuous church, but is badly situated, landing at low water being difficult. Cerro Congo and Cerro Carabali rise southward of the town, the former being 500 feet high and the latter 450 feet.

A light is shown from San Miguel, about one mile northeastward of Cerro Congo.

10–121 Bahia Santelmo (*H. O. Chart* 5585), on the east side of Punta de Cocos, is 4⅔ miles wide north-northeast and south-southwest and recedes about 3 miles to the northwestward. Isla Santelmo, about 1 mile in diameter and 360 feet in height, lies about 1 mile southward of Punta Chiquero, the northern entrance point of the bay. The beach along the bay is mostly rocky, but there are many partially exposed beaches where small boats may land. There is a small well-protected inlet in the northwest section, where small boats or planes may be beached.

There are depths of 6 to 12 fathoms in the bay.

A 1½-fathom patch lies 1 mile east of the southeastern extremity of Punta de Cocos.

A rock, awash, lies near the head of the bay at about 1¾ miles west-northwestward of the northwestern extremity of Isla Santelmo.

There is anchorage in all parts of the bay. Large vessels may anchor outside the 10-fathom curve with safety. Southerly winds cause a swell to roll in but the sandy bottom provides a good holding ground. The current is strong along the line between Punta de Cocos and Isla Santelmo, diminishing to the northward of Santelmo.

Isla Galera, lying 8 miles 100° from Punta de Cocos, is small and has a long sloping side; it is about 130 feet high. A cliff forms its eastern side, sloping down to the west, and to the southward a reef runs off for nearly 1 mile. A coral rock with a least depth of 3 feet over it lies about ½ mile westward of the island. The rock breaks occasionally. The island is generally the first land made by vessels bound to Pan-

ama; it should not be approached within the depth of 10 fathoms, but between it and Punta de Cocos there is a good passage by using which the vessel will be clear of Banco San Jose, 9 miles to the southeastward.

It was reported (1963) that 4 air obstruction lights are exhibited on the summit of Isla Galera.

10–122 Isla Pedro Gonzales (*8°23′ N., 79° 06′ W., H. O. Chart 5582*), separated from the islets off the western side of Isla del Rey by a broad, deep channel, is of irregular shape, with a length, northwest and southeast, of 3⅔ miles, and has on its northern side a wide and deep indentation forming two bays, the eastern of which is named Ensenada Honda, partially protected on the north by the small islands, Islas Señora and Señorita. Isleta Trapiche, 60 feet high, which is connected by a sandy neck with Pedro Gonzales at low-water spring, forms the division between the two bays; off the eastern point of Trapiche extends a rocky ledge, and from this extends a shoal with 12 feet of water at the end, about 600 yards from the point. Ensenada Honda, which lies within this shoal and Punta Zancadilla on the opposite side, is 1 mile wide and recedes nearly 1¼ miles affording anchorage in 5 to 7 fathoms, with good protection from wind and sea. The southern half of this bay has less than 5 fathoms. The bay, on the western side of Isleta Trapiche, is small and shallow.

10–123 Tidal currents are not felt at the anchorage, but off the island there is considerable set, the flood setting northward and the ebb southward, the latter being generally the stronger.

10–124 Directions.—Vessels may pass on either side of Islas Señora and Señorita, taking care to avoid the shoal eastward of them; if entering Ensenada Honda, the shoal off Isleta Trapiche may be avoided by not passing westward of midway between this island and Punta Zancadilla.

Isla Señora, wooded and about 80 feet high, lies about 1,800 yards north of Isleta Trapiche; it is about 900 yards long, north and south. At 300 yards eastward of its southern part is Isleta Señorita, 40 feet high, with a depth of 1½ fathoms between them; and shoals, with a depth of 2 fathoms, extend ½ mile eastward from Señorita. The channel between them and Isla Trapiche, has a depth of 7 fathoms.

10–125 Measured distance.—Two pairs of steel framework towers, on the northwestern side of Isla Pedro Gonzales, mark a measured distance of 1 mile on a course of 0°–180°.

It was reported (1944) that the south range beacons have become obscured by undergrowth, and that the north range is partially obscured.

10–126 Bajo del Medio (*8°22′ N., 79°07′ W., H. O. Chart 5582*).—This dangerous rock, awash at low water, with 8 to 12 fathoms close around it, lies northward of the middle of the channel, between Islas Pedro Gonzales and San José; the channel south of Bajo del Medio is deep and clear. Niagara Rock, a 9-foot shoal, lies 2 miles 264° from Bajo del Medio.

The passage north of Bajo del Medio should be avoided.

Buoys.—The southwestern side of Bajo del Medio Rock and the southeastern side of Niagara Rock are each marked by a red can buoy.

10–127 Isla de San José, lying 3¾ miles southward of Pedro Gonzales, is about 6½ miles long by 3 miles wide. A deep bay indents the southeastern side of the island, but the swell sets in there with great violence. A 2-fathom shoal, with 10 fathoms around it, lies in this bay. Eastward and southward of the southern end are a number of high rocks of singular and fantastic shapes, lashed by a heavy surf; this part of the island should be avoided. The western shore is bold and cliffy, with a small bay near the middle, open to the northwestward.

A light is shown near the southwestern extremity of the island.

10–128 Bahia del Rey.—This large expanse of water, bounded by Rey, Viveros, Bayoneta, Pedro Gonzales, and San José islands, affords a good anchorage for all types of vessels, with good holding ground of green mud. The three channels leading to it from the northwest, west, and south

are wide, deep, and without obstruction except Bajo del Medio in the western channel. The bay has very little protection from the south, however, and it is very choppy with winds from that direction.

Vessels should remain outside the 10-fathom curve in the area between Isla de Cocos and Punta de Cocos because of numerous shoals and a general rocky, uneven bottom.

Punta Garachiné (Santa Barbara), the southern entrance point of Bahia San Miguel, is the outer extremity of a peninsula, about 2 miles wide, which projects in a northerly direction. The point is steep-to on its northern side but shallow depths extend westward from the peninsula. A light is shown about 1 mile southward of the point.

10–129 Coast.— From Punta Garachiné a high, bold, wooded coast trends south-southeastward for about 36 miles to Bahia Piñas.

Punta Escarpado is located about 2 miles southwestward of Punta Garachiné. A reef extends about ¾ mile offshore southward of the point. Near the outer edge of the reef there is a rock, 3 feet high, named Islita Gajuala.

Cerro Sapo, 8 miles southward of Punta Garachiné and 3 miles inland, is a sharp conical peak, 3,900 feet in height.

Punta Caracoles, 25½ miles south-southeastward of Punta Escarpado, is a bold rocky point. On the northern side of the point there is a small bay which affords excellent anchorage for boats. The anchorage is protected except from the west. The bottom is mud and sand.

10–130 Bahia Piñas (*7°33′ N., 78°12′ W., H. O. Chart* 1019), the best anchorage between Punta Garachiné and Octavia Bay, is formed by a small peninsula and the mainland. It is 1½ miles wide at the entrance between Punta Pinas, the southern extremity of the peninsula, and the mainland to the southeastward, and extends 2 1/3 miles to the northward. There is a depth of 20 fathoms in the entrance, and the bay gradually shoals within to 5 fathoms at 1/3 mile from the head, where there is a white sand beach with a few native huts on it. A light is shown on Punta Pinas. It was reported (1961) that the light was obscured due to overgrowth of trees.

Off Punta Piñas are two small islands, Morro de Piñas, nearly 1 mile to the southwestward, and Morro Centinela, 1⅓ miles to the northwestward. Close off Punta Jarque, southward of the entrance, are Los Morros de Jarque, several small islands. There is deep water all around the two islands off Punta Piñas, and outside Los Morros le Jarque. When entering Bahia Piñas steer a midchannel course and anchor in the depth of water desired.

The bay affords good anchorage, sand bottom, with good shelter except from the southwestward. There is practically no current, although the average range of the tide is about 10 feet.

10–131 Caution.—South of Punta Jarque is a large bay, Bahia Jarque, which should not be mistaken for Bahia Piñas, as it is very shallow, having about 2 feet of water in it.

10–132 Tides.—The mean high-water interval at Bahia Piñas is 3h.10m.; spring range 13.7 feet, mean range 10.5 feet. The tidal currents are slight.

10–133 Coast.—From Punta Piñas to Ardita Bay, a distance of 32 miles, the coast is high, rugged, and thickly wooded, having deep water close to the shore, with the exception of two small bays about 12 miles southward of Punta Piñas. The northern bay has convenient anchorage.

APPENDIX I

List of principal ports, showing particulars of depths, etc.

Port	Depth at L. W. O. S.		Spring range	Remarks
	In channel of approach	In Anchorage		
		Fathoms	*Feet*	
Ensenada	Deep	3—10	5	
Magdalena Bay (Man of War Anchorage)	10—19 fathoms	9—13	[1]5.5	
San Lucas Bay	Deep	6—12	[1]2.8	
San Jose del Cabo	Deep	6—10	4.5	Open roadstead.
La Paz	16 feet	3½	5.4	
Port Santa Rosalia	25 feet	.....	.....	Artificial harbor.
(Outer anchorage)	Deep	7—13	.....	Open roadstead.
Colorado River	2½ fathoms	3½	31.5	
Guaymas Harbor	6 fathoms	2½—6	5	
Topolobampo Harbor	[2]17 feet	7—8	5	Subject to sudden change.
Mazatlan Harbor	30 feet	9—14	3.8	
Port San Blas	Deep	4½—6	3.2	Open roadstead.
Manzanillo Harbor	do	6—10	2	
Acapulco Harbor	do	14—18	1.8	
Puerto Salina Cruz	35 feet	3—8	4	Inner harbor dredged to 30 feet. Material changes in depth, due to silting and dredging. Considered difficult harbor to enter.
Champerico	Deep	6½	6.1	Open roadstead.
San Jose	do	8—9	6.1	do
Acajutla	do	7—8	6.4	do
La Libertad	do	9	6.7	do
Jiquilisco Bay (El Triunfo)	14 feet	5—10	7.2	
Port La Union	23 feet	6—7	10	
(Outer anchorage)	Deep	6—7	.....	
Amapala Harbor	3½—7 fathoms	6—9	9.8	
Corinto Harbor	26 feet	4½—6½	[1]6.8	
San Juan del Sur	Deep	4—7	7.6	Open to west and southwest.
Puntarenas	do	5	9.2	
Puerto Armuller	do	.....	.....	Vessels secure alongside wharves. Depths of 33 to 46 feet are available.
Balboa Harbor	40 feet	.....	16.4	Little anchorage space; vessels secure alongside wharves. Harbor depths are from 31 to 46 feet.

[1]Mean.
[2]High Water.

METEOROLOGICAL TABLES

[U. S. Weather Bureau, Department of Agriculture]

TABLE 1

MEXICO.——STATION, GUAYMAS.—*Position, 27°55'N., 110°53' W., altitude 26 feet*

Month	Air temperature °F.			Mean relative humidity (percent)	Rain			Wind		Number of days with—						Sunshine (percent of possible)	Mean cloud amount (0-10)
	Mean	Mean maximum	Mean minimum		Average fall (inches)	Number of rainy days	Maximum fall in 24 hours (inches)	Mean velocity (knots)	Maximum velocity (knots)	Strong winds	Thunder storms	Fog	Hail	Clear skies	Cloudy skies		
January	64	73	55	52	0.20	2	-------	9.3	56.4	4.2	0.2	6.4	0	18.9	3.1	59	2.5
February	66	75	57	53	(trace)	1	-------	8.2	46.3	2.0	0	5.4	0	16.8	2.0	65	2.6
March	70	79	60	50	.32	2	-------	10.3	42.8	6.7	.6	6.4	0	18.2	3.6	63	3.0
April	74	84	64	48	.16	1	-------	9.9	49.6	3.7	0	7.3	0	23.1	1.2	72	1.8
May	78	88	69	50	.20	1	-------	8.9	40.5	3.2	0	8.5	0	24.5	.8	66	1.6
June	84	93	76	57	.08	1	-------	8.4	40.8	1.8	.4	2.5	0	23.0	.5	70	1.8
July	87	94	80	63	1.69	7	-------	8.8	50.6	2.8	2.7	4.3	0	11.6	2.7	55	3.8
August	87	95	80	64	3.58	8	-------	7.0	59.7	3.2	.7	2.1	0	12.1	5.1	57	4.0
September	86	95	78	66	2.40	6	-------	8.5	99.2	1.3	1.0	4.6	0	19.5	1.3	67	3.2
October	81	90	72	67	.35	2	-------	9.5	50.6	2.9	1.5	4.0	0	23.3	.9	74	1.7
November	71	82	64	70	.53	3	-------	8.9	53.5	5.8	0	5.3	.1	19.3	3.9	65	2.9
December	65	74	56	72	1.50	5	-------	9.5	54.3	5.2	.4	5.2	0	17.3	4.3	61	3.0
Means	76	85	68	59	-------	-------	-------	8.8	-------	-------	-------	-------	-------	-------	-------	64	2.7
Totals	-------	-------	-------	-------	11.11	39	-------	-------	-------	42.8	7.3	62.0	.1	227.6	29.4	-------	-------
Extremes	-------	-------	-------	-------	-------	-------	-------	-------	99.2	-------	-------	-------	-------	-------	-------	-------	-------
Number of years' observations	6			14	5	5	------	6	6	7	14	10	9	12	12	13	14

TABLE 2

MEXICO.—STATION, MAZATLAN. —*Position, 23°11′ N., 106°25′ W., altitude, 256 feet*

Month	Air temperature, °F.			Relative humidity (per cent)	Rain			Wind											Number of days with—							Percentage of possible sunshine	Mean cloud amount (0-10)
	Mean	Mean maximum	Mean minimum		Average fall (inches)	Number of rainy days	Maximum fall in 24 hours (inches)	Mean velocity (knots)	Maximum velocity (knots)	Percentage of observations from—									Strong winds	Gales	Thunderstorms	Hail	Fog	Clear skies	Cloudy skies ●		
										North	Northeast	East	Southeast	South	Southwest	West	Northwest	Calm									
January	67	71	63	76	0.79	3	2.3	11.8	47.4	12	6	9	4	2	4	16	42	5	2.8	0	0.2	0	2.8	15.4	6.4	59	3.7
February	67	71	62	77	.51	2	2.1	11.5	37.3	10	5	9	5	2	5	20	38	6	2.6	1	.2	0.1	2.9	17.5	5.6	63	3.2
March	67	71	62	77	.24	2	.5	10.7	44.9	6	4	8	5	2	5	23	39	8	3.5	1	.1	0	3.7	16.7	6.1	65	3.3
April	70	74	65	78	.08	1	.1	9.7	36.7	5	3	9	8	2	7	27	30	9	2.4	0	.1	0	5.1	17.6	3.8	67	3.2
May	75	78	70	77	.12	1	.1	9.3	64.7	3	3	12	9	4	11	30	18	10	.7	0	.1	0	1.8	20.5	2.6	70	2.7
June	79	82	76	76	1.46	7	1.5	8.9	72.3	2	3	9	8	5	16	41	10	6	1.0	1	2.2	0	.3	15.0	5.5	67	3.8
July	81	85	77	78	5.94	17	5.0	8.4	51.9	5	9	13	6	4	13	33	12	5	3.8	3	8.0	0	.04	5.0	11.0	53	5.9
August	82	85	77	79	8.27	18	4.5	9.5	65.9	6	13	15	7	3	10	27	15	4	3.8	3	9.5	0	.07	6.0	11.5	53	6.0
September	81	85	77	80	7.99	15	6.1	9.7	66.0	6	10	19	8	4	9	24	14	6	4.3	4	6.4	0	.02	8.6	9.7	55	5.3
October	80	83	75	78	2.60	6	4.4	9.9	52.9	11	11	15	6	3	7	21	19	7	1.9	1	1.4	0	.3	20.2	4.0	67	3.0
November	74	78	69	75	.87	3	1.9	8.0	34.0	15	11	12	5	2	5	16	28	6	1.1	1	.3	0	1.0	18.8	5.0	65	3.0
December	69	73	65	75	1.26	4	3.6	10.7	46.5	14	9	10	5	2	4	13	38	5	2.9	1	.3	0	1.5	15.1	7.3	54	3.7
Means	74	78	70	77	----	----	----	9.8	----	8	7	12	6	3	8	24	25	7								62	3.9
Totals	----	----	----	----	30.13	79	----	----	----	----	----	----	----	----	----	----	----	----	30.8	16	28.8	.1	19.5	176.4	78.5	----	----
Extremes	----	----	----	----	----	----	6.1	----	86.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Number of years' observations	10			45	47	46	10	9	9	10									23	10	43	38	43	33	33	16	44

TABLE 3

MEXICO.—**STATION, MANZANILLO.**.—*Position, 19°04′ N., 104°20′ W.; altitude 10 feet*

Month	Air temperature, °F.			Mean relative humidity (percent)	Rain			Wind											Number of days with—				Mean cloud amount (0-10)
										Percentage of observations from—													
	Mean	Mean maximum	Mean minimum		Average fall (inches)	Number of rainy days	Maximum fall in 24 hours (inches)	Mean velocity (knots)	Maximum velocity (knots)	North	Northeast	East	Southeast	South	Southwest	West	Northwest	Calm	Strong winds	Gales	Thunder storms	Fog	
January	75	84	68	78	0.04	1	0.6	7.0	38.9	17	12	4	4	10	11	18	10	14	0.4	1	0.1	1.5	5.3
February	74	83	66	76	.24	1	.5	8.0	30.5	10	14	6	5	7	12	22	12	12	0	0	.1	3.5	4.7
March	74	84	65	76	0	0	0	8.5	33.0	8	14	7	7	9	12	23	8	12	1.3	1	.4	2.9	5.2
April	76	85	68	75	0	0	0	8.9	40.2	6	14	7	6	6	15	28	6	12	2.5	1	0	1.6	6.0
May	79	88	71	74	0	1	0	8.7	50.6	6	10	5	4	5	19	32	7	12	2.0	1	.2	3.2	6.2
June	82	89	76	77	4.02	8	3.6	10.3	68.0	7	9	6	7	4	16	31	8	12	6.0	4	2.4	.7	7.9
July	83	91	76	77	5.12	9	4.8	6.6	64.2	15	13	7	9	5	10	16	9	16	4.0	2	5.0	.1	7.7
August	83	91	76	78	5.75	10	5.3	5.8	60.1	20	15	6	8	6	8	15	9	13	3.3	1	6.1	.1	8.1
September	81	89	76	82	13.11	13	13.1	11.3	77.8	13	18	9	12	5	8	14	8	13	5.5	3	4.0	.8	8.3
October	81	89	76	79	4.53	6	9.0	5.4	38.3	18	14	4	7	8	11	15	10	13	1.2	1	2.3	2.0	7.0
November	79	87	72	80	.51	1	2.4	4.7	38.7	16	19	3	6	8	12	15	11	10	.2	0	.2	2.9	6.0
December	77	85	70	78	2.95	2	4.8	6.1	27.0	17	18	4	6	8	12	16	11	8	2.4	1	.6	.9	6.4
Means	79	87	72	77	------	------	------	7.5	------	13	14	6	7	7	12	20	9	12	------	------	------	------	6.6
Totals	------	------	------	------	36.27	52	------	------	------	------	------	------	------	------	------	------	------	------	28.8	16	21.4	20.2	------
Extremes	------	------	------	------	------	------	13.1	------	77.8	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Number of years' observations	10			9	10	10	10	4	4	10									7	10	10	7	9

TABLE 4

MEXICO.—**STATION, ACAPULCO.** —*Position, 16°50′ N., 99°56′ W.; altitude, 10 feet*

Month	Air temperature °F.			Mean relative humidity (percent)	Rain			Wind		Number of days with—					Mean cloud amount (0-10)
	Mean	Mean maximum	Mean minimum		Average fall (inches)	Number of rainy days	Maximum fall in 24 hours (inches)	Mean velocity (knots)	Maximum velocity (knots)	Strong winds	Thunder storms	Fog	Clear skies	Cloudy skies	
January	79	85	70	79	0.63	(1)		10.1	39.9	0	0	0	20.7	1.3	2.0
February	79	87	70	78	0	(1)		10.7	37.1	0	0	0	21.1	1.8	1.7
March	79	87	70	77	0	(1)		11.3	41.4	0	0	0	22.0	2.4	1.6
April	80	87	71	77	0	1		10.3	38.9	0	0.2	0	20.1	2.0	2.0
May	82	89	74	75	1.65	4		11.3	49.6	0.3	.7	0	14.2	3.2	3.7
June	83	89	76	79	16.50	15		13.2	97.2	.5	3.3	0	3.3	16.2	6.4
July	83	89	75	79	6.02	11		10.5	51.9	0	1.7	0	4.5	9.9	5.7
August	83	89	75	79	6.34	14		11.8	62.6	.2	1.8	0	5.9	10.4	6.0
September	82	88	75	82	14.72	18		11.5	62.2	0	1.3	0.1	2.0	14.2	6.8
October	81	88	74	80	5.87	12		11.8	89.5	.2	1.3	0	9.8	7.0	5.0
November	81	88	72	80	1.89	4		10.3	38.5	.2	.1	0	18.3	2.7	2.8
December	79	87	70	80	.71	1		8.9	36.7	.7	.3	0	17.2	3.8	3.0
Means	81	88	73	79				11.0							3.9
Totals					54.33	80				2.1	10.7	0.1	159.1	74.9	
Extremes									97.2						
Number of years' observations	8			8	8	6		8	8	4	7	6	6	6	8

[1] Less than 0.5 day.

TABLE 5

MEXICO.—**STATION, SALINA CRUZ.**—*Position, 16°12′ N., 95°12′ W., altitude, 184 feet*

Month	Air temperature °F			Mean relative humidity (percent)	Rain			Wind										Number of days with—							Mean cloud amount (0-10)
										Percentage of observations from—															
	Mean	Mean maximum	Mean minimum		Average fall (inches)	Number of rainy days	Maximum fall in 24 hours (inches)	Mean velocity (knots)	Maximum velocity (knots)	North	Northeast	East	Southeast	South	Southwest	West	Northwest	Calm	Strong winds	Gales	Thunderstorms	Hail	Fog	Clear skies	Cloudy skies	
January	76	83	70	60	.04	1	0.9	19.0	68.8	54	29	1	2	4	5	1	1	4	21.4	20	0.1	0	0.1	24.0	0.6	1.5
February	77	84	71	63	.39	1	.4	17.9	65.5	44	25	1	3	10	9	1	1	6	15.5	14	.3	0	.3	22.9	.6	2.0
March	79	85	73	64	.63	1	.1	17.3	70.4	34	20	1	5	16	15	1	1	7	17.2	12	.2	0.04	.4	22.9	1.0	1.9
April	81	87	76	67	.47	2	1.3	17.3	65.9	27	18	1	4	20	20	1	1	8	13.0	9	1.0	0	.8	22.0	.6	2.8
May	83	88	77	70	3.27	6	5.4	13.0	54.6	25	18	2	6	19	19	1	1	9	11.2	7	3.5	0	.2	12.8	3.1	4.7
June	80	85	74	76	11.89	18	5.6	9.5	49.8	31	19	3	5	10	11	3	3	15	8.4	4	8.0	0	1.2	4.4	12.7	6.8
July	82	88	75	71	4.49	11	2.0	11.5	49.6	52	29	1	1	3	4	1	3	6	13.2	10	7.8	0	.3	3.9	11.7	6.0
August	82	89	75	71	5.51	12	3.4	11.5	47.8	49	32	2	3	2	4	1	2	6	12.5	10	7.7	0	.4	4.6	10.4	6.2
September	80	86	74	73	7.05	11	8.7	8.5	46.7	40	26	2	2	5	8	2	2	13	8.2	4	5.3	0	.8	2.6	12.2	6.4
October	80	85	74	66	4.02	6	4.5	12.2	68.0	50	25	1	2	5	7	1	2	7	12.8	10	1.7	0	.2	10.9	9.4	4.7
November	79	85	72	59	.94	2	.7	16.3	64.7	59	28	1	1	3	2	(1)	2	4	21.2	21	.3	0	.2	20.6	1.7	2.8
December	77	84	70	61	.12	1	.3	17.1	62.6	56	26	1	2	4	4	(1)	2	5	18.1	19	0	0	0	26.4	.3	2.1
Means	80	86	73	67				14.3		43	25	1	3	8	9	1	2	8								3.8
Totals					38.82	72													172.7	140	35.9	0.04	4.9	177.0	64.3	
Extremes							8.7		70.4																	
Number of years' observations	10			22	24	21	12	9	9	10									19	10	24	24	21	9	9	22

[1] Less than 0.5 percent.

TABLE 6

EL SALVADOR.——**STATION, SAN SALVADOR.**—*Position, 13°40′ N., 89°13′ W.; altitude, 2,238 feet*

Month	Air temperature °F.			Mean (7A, 2P, 9P) relative humidity (percent)	Rain			Wind										Number of days with—			Mean cloud amount (0-10)
										Percentage of observations from—											
	Mean	Mean maximum	Mean minimum		Average fall (inches)	Number of rainy days	Maximum fall in 24 hours (inches)	Mean velocity (knots)	Maximum velocity (knots)	North	Northeast	East	Southeast	South	Southwest	West	Northwest	Calm	Wind of 22 knots or greater	Dense fog	Thunderstorms	
January	72	92	58	69	0.21	1	0.69	5.8	38.8	60	8	8	7	9	3	(1)	5				0.3	2.4
February	73	93	59	68	.28	1	.96	6.2	48.5	38	5	15	13	21	3	2	3					3.1
March	75	95	61	69	.40	1	1.28	6.4	21.5	29	7	8	12	36	5	1	2				2.2	4.1
April	76	94	64	70	2.04	4	3.39	4.9	32.5	19	3	7	17	41	9	2	2			0.7	7.2	5.6
May	76	92	66	79	7.76	13	2.95	4.4	29.2	13	2	6	22	43	8	5	1			.3	14.9	7.0
June	74	88	65	82	13.78	20	7.62	3.5	38.8	21	6	10	21	24	12	4	2	(1)	0.3		16.5	7.5
July	74	90	64	80	12.17	19	2.77	3.5	48.5	46	11	10	9	9	6	5	4			.7	16.1	7.3
August	74	90	65	81	12.06	19	4.72	3.5	48.5	39	13	10	11	9	8	3	7				15.2	7.3
September	74	89	64	84	11.90	19	3.67	3.5	38.8	17	9	11	19	23	8	6	7		.3	1.3	15.3	7.6
October	73	89	65	82	10.18	16	5.45	4.9	38.8	30	9	6	14	19	9	6	7	(1)	.7		9.3	6.4
November	73	90	62	72	1.52	4	1.69	6.2	48.5	60	5	5	4	7	2	1	7		.3		4.8	4.6
December	72	91	60	72	.54	2	.71	6.6	38.8	65	6	6	4	6	2	3	8				2.5	2.4
Means	74	91	63	75				5.0		37	7	8	13	21	6	3	5	(1)				5.4
Totals					72.84	119													1.6	3.0	104.3	
Extremes							7.62		48.5													
Number of years' observations	23			23	23	23	14	4	10	14									3	3	5	14

[1] Less than 0.5 day.

TABLE 7

NICARAGUA.—STATION, RIVAS. —*Position, 11°27′ N., 85°51′ W.; altitude, 150 feet*

Month	Air temperature °F.			Mean relative humidity (percent)	Rain			Wind									
									Percentage of observations from—								
	Mean	Mean maximum	Mean minimum		Average fall (inches)	Number of rainy days	Maximum fall in 24 hours (inches)	Mean velocity (knots)	North	Northeast	East	Southeast	South	Southwest	West	Northwest	Calm
January	76	78	75	86	0.46	4	0.62		0	87	13	0	0	0	0	0	0
February	77	79	73	81	.20	3	.12		0	71	29	0	0	0	0	0	0
March	78	82	74	79	.15	(1)	.06		0	71	26	0	3	0	0	0	0
April	81	83	79	81	.26	1	(trace)		0	63	20	10	3	0	0	4	0
May	80	84	77	85	8.19	8	3.15		7	45	19	10	3	7	3	6	0
June	79	81	75	90	11.83	17	4.72		3	63	10	10	7	3	0	4	0
July	78	80	75	89	7.20	13	3.86		3	78	10	6	0	3	0	0	0
August	79	81	76	86	8.07	15	3.15		0	74	10	7	0	6	3	0	0
September	78	80	76	90	10.17	19	2.16		3	37	10	17	3	10	3	10	7
October	77	79	74	91	17.38	22	2.56		6	29	10	13	3	10	6	13	10
November	77	80	73	89	4.58	12	2.76		0	63	17	3	0	3	0	7	7
December	78	79	72	63	1.27	6	2.15		0	90	7	3	0	0	0	0	0
Means	78	80	75	86					2	64	15	7	2	4	1	3	2
Totals					69.76	120											
Extremes							4.72										
Number of years' observations	1			1	21	21	1		6								

[1] Less than 0.5 day.

TABLE 8

THE CANAL ZONE.—STATION, BALBOA HEIGHTS. —*Position, 8°58′ N., 79°33′ W.; altitude, 118 feet*

Month	Air temperature, °F.			Mean relative humidity (percent)	Rain			Wind										Number of days with—						Percentage of possible sunshine	Mean cloud amount (0-10)
										Percentage of observations from[1]—															
	Mean	Mean maximum	Mean minimum		Average fall (inches)	Number of rainy days	Maximum fall in 24 hours (inches)	Mean velocity (knots)	Maximum velocity (knots)	North	Northeast	East	Southeast	South	Southwest	West	Northwest	Calm	Wind 22 knots or more	Thunderstorms	Dense fog[2]	Light fog	Clear skies	Cloudy skies		
January	80	88	72	78	0.89	5	1.55	7.8	27.8	45	6	4	3	3	----	13	26	----	------	0.6	0.1	0.2	8	2	77	4.8
February	80	89	71	76	.88	3	2.22	9.4	29.5	43	7	4	4	----	----	3	39	----	------	.1	.1	.1	7	2	76	4.7
March	81	90	72	74	.88	2	2.17	9.1	31.3	36	10	3	6	3	----	3	39	----	5.7	.6	(3)	(3)	6	2	70	5.0
April	81	89	74	78	3.02	8	3.15	7.7	33.9	30	7	3	7	3	----	3	40	7	------	3.7	------	.1	2	8	53	6.4
May	80	87	74	85	7.90	18	4.70	5.4	40.8	23	6	6	10	3	3	4	39	6	.7	9.0	------	.1	------	18	42	7.5
June	80	86	74	87	8.23	20	4.52	4.7	33.0	27	7	7	10	6	3	13	27	----	------	10.2	.1	.4	------	21	35	8.0
July	80	86	74	87	7.33	18	2.80	5.3	29.5	26	7	3	3	6	----	29	26	----	.7	10.8	.3	.2	------	20	38	7.8
August	80	86	74	87	7.88	20	3.34	5.2	32.1	32	7	4	3	6	3	19	26	----	------	11.5	.1	.3	------	18	38	7.8
September	80	86	74	87	8.08	20	4.24	5.0	33.0	30	7	7	7	8	3	19	19	----	2.7	10.6	.2	.5	------	19	38	7.8
October	79	85	74	88	10.10	21	4.51	5.6	33.0	26	6	6	13	16	7	10	16	----	.3	9.8	.4	.3	------	20	40	7.9
November	79	85	73	88	10.63	22	5.33	5.1	29.7	23	3	7	7	13	7	17	23	----	------	5.8	.4	.6	------	19	42	7.8
December	80	87	73	84	4.30	15	1.90	5.6	31.3	29	6	4	3	3	----	23	32	----	------	2.8	.1	.3	2	9	60	6.3
Means	80	87	73	83	------	------	------	6.3	------	31	7	5	6	6	2	13	29	1	------	------	------	------	------	------	51	6.8
Totals	----	----	----	------	69.72	172	------	------	------	----	----	----	----	----	----	----	----	----	10.1	75.2	1.7	3.0	25	158	------	------
Extremes	----	----	----	------	------	------	5.33	------	[4] 51.2	----	----	----	----	----	----	----	----	----	------	------	------	------	------	------	------	2
Number of years' observations	28	22	22	29	38	22	22	22	22	4									3	22	22	22	22	22	22	22

[1] Observations taken on Naos Island.
[2] Objects not visible at 1,000 feet.
[3] Less than 0.5 day.
[4] Recorded July 10, 1909. Monthly maximum velocity data for 1914-36.

GLOSSARY

Words occasionally found on the charts and in the Sailing Directions

Spanish	English	Spanish	English
Aduana	Customhouse.	Gran, grande	Great.
Agua	Water.	Gris	Gray.
Amarillo	Yellow.	Hondo, hondura	Deep.
Amarra	Anchorage, mooring.	Isla	Island.
Arrecife	Reef.	Isleta	Islet.
Arroyo	Brook, rivulet.	Laja	Lake.
Atalaya	Lookout station, signal staff.	Lago	Flat rock.
Bahia	Bay.	Largo	Long.
Baixo, baxo	Shoal, bank.	Loma	Hilltop.
Baja, bajo	Low, shoal.	Medano	Sand bank.
Baliza	Beacon.	Meridional	Southern.
Banco	Bank.	Mesa	Tableland.
Barlovento	Windward.	Monte	Mountain.
Barra	Bar.	Muelle	Mole, landing wharf.
Barranca	Ravine, precipice.	Negro	Black.
Blanco	White.	Norte	North.
Boca	Mouth, entrance.	Oeste	West.
Caheza	Shoal head.	Pardo	Gray.
Cabezo	Summit of hill.	Paso, passa	Pass.
Cabo	Cape.	Peñón	Rocky mountain.
Cala	Creek, small bay.	Pico	Peak.
Caleta	Small bay, cove.	Piedra	Stone, rock.
Canal	Channel.	Playa, praia	Beach.
Casa	House.	Pueblo	Town, village.
Castillo	Castle.	Puente	Wharf, dock.
Cayo	Cay.	Puerto	Port, harbor.
Cerro	Hill.	Punta	Point.
Chico	Small.	Quebrado	Pass.
Cienaga	Marsh.	Quebradero	Breaker.
Colina	Hill.	Rada	Road, roadstead.
Cuenca	River hed.	Rama	Branch.
Dársena	Dock, harbor basin.	Restinga	Reef.
Desembarcadero	Landing.	Ribera	Bank.
Dique	Dock.	Rio	River.
Dique de Carena	Drydock.	Roca	Rock.
Dique seco	Drydock, basin.	Rojo	Red.
Embocadero	Mouth, opening.	Saco	Bay.
Ensenada	Bay, cove.	Salina	Salt works.
Escollo	Rock.	Salto	Cliff.
Estancia	Ranch, farm.	Seno	Bay.
Este	East.	Septentrional	Northern.
Estero	Lagoon, creek.	Sierra	Mountain chain.
Estrecho	Strait, narrow passage.	Silla	Saddle.
Estuaria	Wide river mouth.	Sotavento	Leeward.
Fanal	Light tower.	Sur	South.
Faro	Lighthouse.	Tetas	Paps.
Fondeadero	Anchorage.	Torre	Tower.
Fortaleza, fuerte	Fort.	Verde	Green.
Freo	Strait.	Vigia	Lookout.
Golfo	Gulf.		