

Kuala Johore in the passage between Pulo Sajahat and Singapore Island. Two light buoys mark the opening in the obstructions. The light buoy on the east side of the opening is a black conical buoy showing a flashing white light, and the light buoy on the west side of the opening is a red can buoy showing a flashing red light.

6-100 SUNGI JOHORE, entered between Pulo Tekong Kechil and Tanjong Kopok, about 1 1/2 miles northwestward, is navigable for vessels with local knowledge, drawing up to 20 feet, as far as Pulo Layang, about 10 miles above Tanjong Kopok. Above Pulo Layang the channel is barred by an extensive shoal with a maximum depth of 7 feet. Small craft drawing 5 feet, at any state of the tide, can proceed as far as Kota Tinggi, about 24 miles from the entrance, where there is a tanker berth with adequate depths for small vessels at all stages of the tide. In 1953 a least depth of 8 feet was reported in this stretch of the river. A draft of 6 feet can be carried about 11 miles farther upstream.

6-101 COAST.—Tanjong Johore (Pengelih) (1° 22' N., 104° 06' E.) is the bluff promontory located on the east side of Kuala Johore about 5 1/4 miles east-by-south of Tanjong Changhi.

TIDES.—Tidal heights at Tanjong Johore above datum of soundings are: MHWS 9.4 feet, MHWN 7.4 feet, MLWS 2.4 feet, MLWN 4.4 feet.

6-102 MALANG BERDAUN, a rocky islet 10 feet high to the tops of the bushes, lies about 1,500 yards southeastward of Tanjong Johore, within the edge of the drying bank, which here extends 1,500 yards from the coast. Shallow water extends a distance of 400 yards outside it. Between Malang Berdaun and Tanjong Langkah Baik, 2 4/5 miles southeastward, the bank dries off about 800 yards and the depths decrease suddenly from 7 to 4 fathoms toward the bank.

DIRECTIONS FOR CLEARING.—Bukit Belungkor bearing 356°, will lead westward of Malang Berdaun, and Tanjong Ayam open of Tanjong Langkah Baik bearing 095°, will lead southward.

6-103 PULO TEKONG BESAR and Pulo Tekong Kechil are two islands lying northwestward of Tanjong Johore, at the entrance of Johor River, dividing that stream into two branches. Pulo Tekong Besar is 3 1/2 miles

in length in an east and west direction and 2 1/3 miles in breadth north and south.

Pulo Tekong Kechil, lying close to the west side of the larger island, is nearly round, its diameter being about 1,350 yards. A reef, on which there is a coral patch which dries from one foot to 3 feet, lies close westward of the northern extremity of Pulo Tekong Kechil. A 3-fathom patch lies about 1,200 yards westward of the same point. There is an islet named Sijonkan (Pulau Sanyongkong) lying close to the southeastward of Pulo Tekong Besar, and another, named Pulo Sajahat, consisting of three rocks covered with vegetation at 1,500 yards to the southward of Pulo Tekong Kechil.

A rock drying 6 feet and having 6 fathoms close-to lies 400 yards northwestward of Pulo Sajahat, on the channel edge of the bank which surrounds both Tekong Islands. This bank is steep-to in places and extends 1 1/2 miles southward of Pulo Tekong Besar and 2 1/2 miles northward of Pulo Tekong Kechil.

6-104 MALANG TIGA appear to be three rocky heads awash, the outer one lying 163° distant 1 1/3 miles from the south point of Pulo Tekong Kechil; the shoal, with depths under 3 fathoms extends 1,200 yards southeastward of that rock. The easternmost rock of Malang Tiga is marked by the ruins of a masonry beacon.

CAUTION.—An 18-foot patch and a 33-foot patch lie about 3/4 mile south-southeast and 1 mile west-northwest, respectively, of the beacon in ruins.

6-105 DIRECTIONS.—In approaching Kwala Johore from the eastward, Tanjong Changhi should be steered for, bearing 302°, which leads in the fairway eastward of Johore Shoal and Red Bank in not less than 7 fathoms. When abeam of Angler Bank lighted buoy, distant about 1/4 mile, the light structure on Tanjong Chek Jawa should be brought into range 312° with the beacon located about 200 yards southeastward of it, and this bearing held until within the lighted buoys which mark the opening between the obstructions described in section 6-99. Thence course may be altered for Serangoon Harbor or Sungi Johore.

PILOTAGE.—Pilots are required for all except local vessels; the pilot vessel will be met in the vicinity of the Johore Shoal Buoy. Previous notice should be given to the association in Singapore.

Calder Harbor is the space between Pulo Tekong Besar and the mainland eastward of it, northward of Tanjong Johore. The breadth of the harbor, between the banks on either side, is 1,500 yards, with anchorage in 5 to 8 fathoms. Sungei Santi enters the harbor on its east side, with a depth of about 1 fathom, deepening within; it takes its rise near Barbukit Hill.

Merlin Rock, with a least depth of 16 feet, lies about 1,500 yards northward of Tanjong Johore about midway between the banks extending off that point and Pulo Tekong Besar.

6-106 COAST.—Tanjong Langkah Baik lying 3.3 miles east-southeastward from Tanjong Johore, is a somewhat prominent point. The 3-fathom edge of the shore bank is 1,000 yards distant from Tanjong Langkah Baik and from the shore eastward to Tanjong Ayam and should not be approached under depth of 7 fathoms.

A light is shown from Tanjong Langkah Baik.

Tanjong Ayam (South Point) ($1^{\circ}20'N.$, $104^{\circ}12'E.$), the most southern point of this part of the Malay Peninsula, lies nearly 4 miles eastward of Tanjong Langkah Baik with Tanjong Sungi Kapal between; the 6-fathom curve is about 1,000 yards off Tanjong Ayam.

A wreck is reported to lie about $3\frac{3}{4}$ miles east-southeastward of Tanjong Ayam. It is marked by a green conical lighted buoy.

Tanjong Bulat lies nearly 2 miles eastward of Tanjong Ayam; Sungi Ringgit a small stream, is immediately westward of it. The 3-fathom edge of the shore bank is rather more than 1,000 yards off Tanjong Bulat but from the head of the bight between it and Tanjong Penyusuh, it extends $1\frac{1}{3}$ miles off.

ROCKS.—There are two rocks, with less than 6 feet of water over them, lying just inside the 3-fathom curve, at 700 and 900 yards southward of Tanjong Bulat.

FISHING STAKES.—There are several villages between Tanjong Johore and Tanjong Bulat, the inhabitants of which are chiefly engaged in fishing. The whole area between

the shore and the 6-fathom curve is so crowded with fishing stakes and traps as to render navigation impossible.

6-107 Pulo Che Kamat about 1,000 yards northeastward of Tanjong Bulat, is a round island, 106 feet high and about 500 yards in extent, with an islet 50 feet high off its southwest part connected to it by a reef, both standing on the shore bank.

DIANA COVE.—Close westward of the southwest extremity of Tanjong Penyusuh is Diana Cove, with a depth of about 1 fathom.

ANCHORAGE.—There is good anchorage off Diana Cove in 9 fathoms, stiff mud and excellent holding ground, with Pulo Mungging bearing 057° and South Point 272° with Tanjong Langkah Baik just shut in.

6-108 WATER.—There is a stream of fresh water in Diana Cove, and water may be procured in the sandy bays on either side of it. Within Pulo Che Kamat to the westward here is a good stream upon the mainland, where fresh water may be obtained with facility in either monsoon; but in the northeast monsoon the eastern streams are more convenient.

Good water can also be procured from the stream close around the rocky point about 1,200 yards northward of Tanjong Penyusuh.

6-109 Tanjong Penyusuh (Datok), the southeast extremity of the Malay Peninsula, and the north side of the east entrance to Singapore Strait, is level land covered with trees, with some small hills behind. Coral reefs extend off from 200 to 600 yards, with Lima Islands in the offing.

The highest coast hill in this vicinity, 329 feet high, is located within Diana Cove, at $1\frac{1}{5}$ miles westward from this point.

Tanjong Punge lies about 4 miles northward of Tanjong Penyusuh; its summit is conspicuous, being wooded, and 199 feet high to the tops of the trees. The bay between has depths under 3 fathoms to beyond a line joining the points with a 4-foot patch at $1\frac{4}{5}$ miles southward of Tanjong Punge.

Pulo Punge is wooded and located 250 yards southward of the point and is 73 feet high to the tops of the trees.

Sungl Pungei lies with the bight and is approached by a boat channel, navigable except at low water.

Tanjong Stijam lies about 4.5 miles northward of Tanjong Punge, and False Barbukit Hill, previously mentioned, is 2 miles west-southwestward of Tanjong Stijam.

Foul ground extends 1,500 yards off the point, and the bay between the point and Tanjong Pungei has depths of less than 3 fathoms out to beyond the line joining them.

A WRECK, with mast showing, lies sunk about 3 miles eastward of Tanjong Stijam.

There is a considerable coast and riverside population and frequent clearings, but the greater portion of the coast is covered with thick forest.

Horsburgh Light. The light structure is difficult to distinguish, and, on most northerly bearings, is obscured by trees.

CAUTION.—As no advantage is to be gained by venturing among the Lima Islands, it is best to consider the whole of the space occupied by them as impracticable for ordinary navigation and to avoid the locality, passing at least 2 miles outside Pulo Mungging.

DIRECTIONS FOR CLEARING.—Tanjong Langkah Baik in range with Tanjong Ayam, bearing 274°, leads southward of all the dangers southward of the Lima Islands.

6-112 PULO LIMA, 110 feet high, is the westernmost and largest of the group; it lies 1,500 yards off Tanjong Penyusuh, is



Barbukit 234°, 20 miles

Barbukit Hills

Rakit Sitajam

6-110 SINGAPORE STRAIT—EASTERN ENTRANCE.—The eastern entrance to the strait lies between Tanjong Penyusuh, off which are the Lima Islands, and the Remunia (Romenia) Shoals extending about 13 miles northeastward of the point on the north, and Tanjong Berakit 19 miles southeastward of Penyusuh on the south. Near the fairway between these points is Pedra Branca (sec. 6-118) with a deep channel on either side. There are several shoal patches southwestward of the lighthouse, described with the fairway dangers later.



6-111 COAST.—For the coast northward of Tanjong Stijam, see Pub. No. 93, Sailing Directions for the Western Shores of the China Sea.

LIMA ISLANDS, together with many dangers around and among them, front Tanjong Penyusuh; they extend nearly 3 miles in a north-northeast and south-southwest direction.

LIGHT.—A light is shown from Pulo Mungging (South Lima Islet) 6.8 miles 286° from

barely 200 yards in extent, and is conspicuously covered with trees. Pulo Besar northeastward of Pulo Lima is wooded and 88 feet high, with the summit cleared, except for a single tree; it is about 150 yards in extent and situated 100 yards from Pulo Lima with which it is connected by a ridge of rocks, drying at low water.

PULO MUNGGING 600 yards southeastward from Pulo Lima is 79 feet high, wooded, and, being the southernmost of the group, is easily recognized.

A rock 12 feet high lies near its southern point, with a reef of straggling rocks extending to the eastward.

A rock 2 feet high lies about 600 yards southwestward of Pulo Mungging and a patch of 3 fathoms at 1,000 yards southeastward of the rock.

SHOALS.—The southernmost danger is a rock with a depth of 2 1/4 fathoms situated 1.5 miles 206° from the summit of Pulo Lima; a patch of 4 3/4 fathoms lies 1,000 yards in a southeasterly direction from this rock.

6-113 LIMA CHANNEL.—This channel, between Tanjong Penyusuh and the Lima Islands, is used by coasting steamers; but

as it is narrow and encumbered by shoals, it should not be used without local knowledge.

PEAK ROCK, 37 feet high, a barren rock of reddish color, easily recognized, lies 1,200 yards eastward of Pulo Lima. A patch of 1 1/2 fathoms lies eastward of it and patches with depths of 4 and 5 fathoms between Peak Rock and Whale Rock.

STORK REEF is about 600 yards in extent, dries 3 feet, and lies about 1,200 yards southeastward of Peak Rock.

FALLODEN HALL SHOAL (1° 21' N., 104° 19' E.) is about 400 yards in extent, with a depth of 2 1/2 fathoms; it is situated 1,100 yards south of Stork Reef and on the northwestern part of a bank about 1.5 miles in extent, on which are depths from 7 to 9 fathoms.

CONGALTON SKAR, a rocky patch with a depth of 5 feet, and steep-to, lies about 3/4 mile eastward of Peak Rock. An unexamined shoal with a reported depth of 5 1/2 fathoms, lies about 1 1/4 miles east-northeastward of Congalton Skar.

6-114 WHALE ROCK, at 1,400 yards north-eastward of Peak Rock, dries 7 feet; it is a small ledge on which the sea generally breaks, and which is steep-to; the depths around are irregular.

JONES REEF, having a depth of 1 fathom, and 8 to 9 fathoms close-to, lies 500 yards northeastward of Whale Rock, with Peak Rock bearing 232°, nearly 1 mile.

Between Jones Reef and North Rock are situated two shoals of 3 1/4 and 3 3/4 fathoms, respectively; these are steep-to with depths of from 7 to 9 fathoms of water around.

NORTH ISLAND, 104 feet high, and very

small, covered with trees, lies 1,200 yards northwestward from Peak Rock and about 1 mile offshore; shallow water extends 600 yards northward of it.

6-115 NORTH ROCK, small, 32 feet high, and with a few bushes on it, is situated 1,600 yards northward of North Island.

A small barren rock 1 foot high is situated 600 yards southward of North Rock with a patch of sunken rocks between them.

A REEF, about 1,000 yards in extent, and with rocks which dry, lies between North Island and North Rock. There are several patches between it and North Island.

REMUNIA (Romenia) Shoals are a number of detached patches of coarse sand and gravel, extending northeastward and thence northward from Lima Islands toward North Patch. They are steep-to on their east and south sides, there being depths of from 12 to 20 fathoms at a short distance. Between the patches there are depths of over 6 fathoms.

The shoalest spot, over which there is a depth of 15 feet, lies about 5 miles north-northwest of Horsburoh Lighthouse. The north extremity of the shoal lies about 11 miles north-northeast of Horsburgh Lighthouse.

6-116 DIRECTIONS FOR CLEARING.—The southern extremity of Pulo Mungging, bearing 256°, leads southward of Remunia (Romenia) Shoals, and Horsburgh Lighthouse, in range with the center of the western slope of Great Bintang Hill, bearing 169°, leads eastward of them in a depth of about 6 fathoms, but a patch of 5 fathoms is situated about 200 yards on each side on this range line.

Eddies bringing up sand and mud from the bottom make the whole shoal very visible and rather alarms a stranger using this range line, or the one for North Channel, giving the impression that there is less water than there really is.

This track is only recommended for vessels of light drafts.

RIDGE.—Remunia Shoals are connected with North Patch by a ridge on which the depths are from 5 to 9 fathoms, with many isolated patches of 3 1/2 to 4 and 5 fathoms; also between Remunia Shoals and the Lima Group are similar patches; large vessels therefore should pass eastward of this ridge and of North Patch.

6-117 **NORTH PATCH**, lying between 6.5 and 7.5 miles northeastward from the most shoaled part of the Remunia Shoals, is 11.2 miles in length, in a north and south direction, with depths of from 3 1/2 to 4 3/4 fathoms. Its northern end lies 11.8 miles 88° from False Barbukit and about 10 3/4 miles, 013°, from Horsburgh Lighthouse.

A lighted buoy, marking North Patch, is moored about 10 1/2 miles north-northeastward of Horsburgh Lighthouse. (The buoy was reported missing (1965).

The western summit of Great Bintan Hill, in range with the foot of the eastern slope of Little Bintan Hill, bearing 182°, leads eastward of North Patch and the shoals to the southward, and between Eastern Bank and North Patch.

CAUTION.—Mariners are warned that the North Channel should not be used for navigation, as no advantage is gained by passing through it, and it is possible that more dangers exist there than are shown on the chart.

Mariners are warned that firing and bombing practices take place in the following areas: (1) Singapore (China Sea) North Range comprises all that area of the high seas within 5 miles of positions 1° 35' N., 104° 25' E., and 1° 50' N., 104° 25' E., and within 5 miles of a line joining these positions; (2) Singapore (China Sea) South Range, is all that area within 4 miles of Tanjong Punge.

EASTERN BANK, the outermost of the known banks of Tanjong Penyusuh in the approach to Singapore Strait, is nearly 2 miles in extent, with depths of 10 fathoms at the extremities. Depths of 4 and 8 fathoms lie within the bank.

A vessel grounded (1964) about 1 mile northward of the south extremity of the bank.

The bank itself lies about 6 miles within the range of Horsburgh Light, which, from its northern edge bears about 205°, distance about 14 miles.

6-118 **PEDRA BRANCA (White Rock)** lying in the middle of the eastern entrance of Singapore Strait, 8 miles from either shore, is 150 feet in length, 100 feet in breadth, and 24 feet high. It is situated on the western edge of a bank with depths of 6 to 10 fathoms, which extends 1.2 miles eastward of it.

HORSBURGH LIGHT (1°20'N., 104°24'E.), located on Pedra Branca, is shown from a cylindrical granite structure fitted with a radar reflector. A radio beacon transmits at the lighthouse.

It was reported (1963) that Pedra Branca is a good radar target up to 15 miles distant.

ANCHORAGE.—During the southwest monsoon small vessels can anchor in a depth of 10 fathoms hard bottom, but good holding ground, with Horsburgh Lighthouse bearing 206°, distant 400 yards.

At this anchorage, during the east-going current, slack water continues, and during the west-going current the overfalls are not experienced until the lighthouse bears about 192°.

FAIRWAY—SHOALS.—A rock which dries 2 feet, lies 600 yards 75° from the lighthouse.

A **PATCH**, with a depth of 4 1/2 fathoms, and steep-to lies 800 yards northward of the lighthouse.

6-119 **MIDDLE ROCKS**, southward of Pedra Branca, are of a whitish color, from 2 to 4 feet high, and stand on the southern edge of the surrounding bank at 1,200 yards from the lighthouse.

SOUTH LEDGE consists of three rocks, the northern of which dries 8 feet, the others do not uncover. They are steep-to, depths of from 16 to 20 fathoms being obtained within a short distance, and are almost always marked by heavy tide rips or the sea breaking over them; the northern rock lies 2.1 miles 201° from Horsburgh Lighthouse.

Rocky heads, having depths of 10 fathoms, lie between the lighthouse and South Ledge.

6-120 CARTER SHOAL is a pinnacle rock with a depth of 1 3/4 fathoms; it is steep-to on its eastern side and has depths of less than 10 fathoms extending from its western side for a distance of 100 yards. It is marked by heavy overfalls. This rock lies 4.4 miles 211° from Horsburgh Lighthouse.

To the southward of Carter Shoal, at a distance of nearly 1 mile, are several coral patches covering an area of over 1,000 yards; the least water is 5 fathoms, which depth is found at 1,600 yards 160° from Carter Shoal.

Several rocky patches, with from 8 to 10 fathoms, are situated about 4.5 miles southward and eastward of Horsburgh Lighthouse, as charted.

OVERFALLS.—A bank with depths of 9 to 10 fathoms, about 1,500 yards in extent, lies 248°, distant 5.5 miles from Horsburgh Lighthouse. It is marked by heavy overfalls and eddies, the depth, at a short distance from it, being from 11 to 24 fathoms. There are overfalls and eddies between this bank and Carter Shoal.

6-121 TIDES.—Tidal heights at Horsburgh Light (1°20'N., 104°24'E.) above datum of soundings are: M.H.H.W 7.3 feet, M.L.H.W 6.7 feet, M.L.L.W 2.2 feet, M.H.L.W 4.4 feet.

CURRENT.—In making Singapore Strait from the northward, vessels should always be prepared to meet with a current running to the southward in the northeast monsoon, and the northward in the opposite season, the strength of which is governed by the strength of the monsoon. In fine weather

its rate is usually from 1 1/2 to 2 knots, but the rapidity of the current is also accelerated or retarded by the tidal currents near the coast. Between Horsburgh Lighthouse and a position 40 miles to the eastward it has been known to set at the rate of from 3 to 4 knots.

In the neighborhood of Horsburgh Lighthouse the main directions of the current are northeast and southwest, the current being of similar type to that found in the western approaches to Singapore and running at about the same velocity; the northeast-going current near Horsburgh Lighthouse corresponds to the east-going current in the western approaches, but commences about half an hour later. No exact information regarding the duration of the northeast-going current, or the commencement and duration of the southwest-going current, can be given.

The direction of the current is, for some hours before and after slack water, considerably influenced by a cross current running in a northwest or southeast direction; this current is of similar type to the main current and commences to run to the northwestward about 5 1/2 hours before the commencement of the northeast-going main current, but its velocity is only about 1/3 that of the main current. It will be seen that, as the currents are of diurnal type and as the times of commencement of the northeast-going and northwest-going currents differ by about 5 1/2 hours, the cross current will be running at its greatest velocity when the main current is slack, and vice versa.

The table in section 6-46 may be used for the Horsburgh main current by converting the time on the first line of 11 1/2 hours before higher high water at Singapore, and the other times to correspond, directions being northeasterly, and directions southwesterly; it may also be used for the cross current by converting time on the first line to 8 hours after higher high water at Singapore and other times to correspond, and di-

viding the tabulated velocities by 3, + directions being northwesterly, and — directions southeasterly.

The current near Horsburgh Lighthouse runs in the direction toward which the prevailing wind is blowing; the velocity may reach 2 knots during gales or strong and long-continued monsoon winds, but during calms there may be no current. A weak current setting northwestward was found during a period of southeasterly winds in September, 1924.

From the above remarks it will be seen that near the summer solstice, if strong southwesterly winds occur at about the time when the new moon is in maximum declination, a set of as much as 4 knots to the northeastward may be found during the period of the northeast-going current, with no corresponding southwesterly set; whereas near the winter solstice, if strong northeasterly winds occur at about the time when the full moon is in maximum declination, a set to the southwestward of about 4 knots may be experienced during the period of the southwest-going current, with no corresponding northeasterly set.

It should be particularly remarked that, in Singapore Main Strait generally, as in all places where the currents are of diurnal type, the strongest currents in each month occur a day or two after the moon reaches maximum declination, not after new or full moon, and the strongest currents of the year occur near the solstices, when the moon is in maximum declination near new and full moon, and the sun is also in maximum declination, not near the equinoxes.

6-122 Directions—Singapore Road to the eastward.—Having cleared the road, course may be shaped about 085°, and by keeping the flagstaff on Fort Canning bearing northward of 270°, as long as it remains in sight (or Fullerton Light at night), will

lead southward of Johore Shoal. Pulo Mungging, just open of South Point, bearing 075°, also leads southward of Johore Shoal. When Johore Hill bears 000°, the vessel will be eastward of Johore Shoal, and may steer for Horsburgh Lighthouse, bearing about 079°, until within about 5 miles of it, when course should be altered to pass about 1 mile to the northward of it, thence into the China Sea, eastward of North Patch, and as convenient.

In thick weather the land is seldom obscured for any length of time, so that a vessel is generally able to fix her position; but if not able to do so the soundings will show whether she is within the 20-fathom curve, which should be avoided, and course altered as necessary to keep in the deep channel, passing in preference over the 9-fathom bank westward of Horsburgh Lighthouse, and avoiding the area within the 20-fathom curve off Lima Islands. If in any doubt, the vessel should haul toward the north shore, by sounding, and anchor. This shore may be approached to depths off from 11 to 12 fathoms.

6-123 From the China Sea.—Middle Channel, the passage generally used by vessels passing through the straits, has an average width of 4 miles between Horsburgh Lighthouse and the 10-fathom curve off Remunia Shoals. There are no dangers within this area, but a vessel should, when approaching from the eastward, steer so as to pass about 1.2 miles northward of the lighthouse, and then alter course so as to proceed through the center of the channel.

The entrance may be easily recognized, if the weather is clear, by Great Bintan Hill, a remarkable Saddle Hill on Pulo Bintan and Barbukit, the sharp-peaked hill on the opposite side of the strait. Bearings of these objects will serve to determine the vessel's position when shaping a course to sight Horsburgh Lighthouse.

Departing from Pulo Aor (H. O. Pub. No. 93), steer to bring it to bear about 000°

when disappearing; if the weather be clear, Bintan Hill and Pulo Aor may be seen together, but this seldom happens. The western summit of Great Bintan Hill in range with the foot of the east slope of Little Bintan Hill, bearing 182° leads nearly 1 mile eastward of North Patch, of $3\frac{1}{2}$ fathoms.

6-124 In slightly hazy weather, having Pulo Aor disappearing bearing about 000° , a course between 192° and 204° may be requisite if the northeastern current is running out of the strait. The depths will decrease regularly in steering southward, and the low land will probably be seen to the westward when in depths in 18 or 20 fathoms; if so, coast it along at about 13 miles distance, until False Barbukit, a low sloping hill, is discerned, appearing like a clump of trees more elevated than the others. When this hill bears 248° , a depth of 15 fathoms is the fair track; with it bearing 265° , overfalls in 16 to 13 fathoms may be experienced, or probably less water, the vessel being then on about the parallel of the North Patch and Eastern Bank.

If there is any doubt about the position of the vessel she should either haul off into deep water or anchor.

The following directions must only be followed at the discretion of the master of the vessel.

With False Barbukit bearing 265° , if depths of 10, 9, or 8 fathoms be obtained, and being uncertain whether these soundings are near the North Patch, or on the shallow part of Eastern Bank, haul to the southeastward until in 14 or 15 fathoms. Then steer 180° until the hill bears 270° , when the vessel will be to the southward of Eastern Bank, and may haul in 248° , when a depth of 10 or 11 fathoms will show that these soundings are on the outer edge of Remunia Shoals.

If less than 10 fathoms be obtained, haul out directly eastward into depths of 15 or 16 fathoms, and then steer along the south-east edge of the shoals in depths of 16 to 17

fathoms. A course should be steered to make Horsburgh Lighthouse, bearing about 215° , passing northward of it at the distance of 1 to 2 miles. Tanjong Sitapa in range with South Point, Pulo Mungging kept just open of that point, bearing 075° , astern, will lead southward of Johore Shoal, from whence course may be shaped for Singapore Road. The vessels in the road will be a guide in approaching the anchorage, and as Tanjong Katong is neared, the flagstaff on Fort Canning Hill should be brought to bear about 287° , which leads in.

6-125 At night it is necessary to keep a good outlook for Horsburgh Light, which should be in sight before a vessel can get near the dangers at the entrance of the strait. It is sufficient guide for navigating Middle Channel.

The light bearing about 215° will lead well eastward of the ridge between Remunia Shoals and North Patch; when about 2 miles distant from the light a course may be shaped to pass about 2 miles northward of it, and bringing it astern bearing about 080° , until the light on the Fullerton building at Singapore comes in sight.

Both lights will be visible at the same time in clear weather, when about midway between them. Fullerton Light should be brought on about the bearing 280° , which leads in between the shoals of Tanjong Katong and Outer Shoal.

In the event of Fullerton Light not being distinctly made out by the time Johore Hill bears 012° , care is necessary not to shoal the water under depths of 16 fathoms toward Johore Shoal; and if a depth of 10 fathoms be obtained the course should be altered quickly to the southward, for this shoal is steep-to and cannot be approached with safety under that depth.

If bound into Malacca Strait from abreast Johore Shoal, with Fullerton Light in

★ (1666) **MALAY PENINSULA—Singapore Strait—Wreck information.**
The dangerous wreck of a 7,000 ton vessel lies sunk in 01°18'54'' N., 104°15' E. (approx.). The wreck is marked by a green conical buoy marked "*Wre*" and shows a *flashing white* light every 5 seconds. Depths of water over the wreck have not been determined.

(N.M. 11/66)

(RS 6631/66.)

H.O. Charts 3749, 1205, 5501, 1170, 5591.

H.O. Pub. 70, 1951, page 216.

(2106) **MALAY PENINSULA—Singapore Strait—Wreck information.**
dangerous wreck in 01°18'54'' N., 104°15'42'' E. (approx.) is now marked by a green conical wreck buoy showing a *Fl. G. 5 sec.* light.

(See N.M. 11(1666) 1966.)

(N.M. 14/66)

(N.M. 9, Port Swettenham, 1966.)

H.O. Charts 3749, 1205, 5501, 1170, 5591.

H.O. Pub. 70, 1951, page 216.

sight, course may be altered for St. John Islands, observing that Raffles Light is visible from a distance of about 5 miles eastward of those islands, when clear of them, and leads clear of all dangers northward of it. A vessel should steer to pass within a short distance of St. John Islands, avoiding the south side of the strait, thence passing southward of Raffles Light at a prudent distance, and shaping course for Malacca Strait.

6-126 SOUTH CHANNEL is not recommended for vessels of heavy draft, as there is no advantage gained by using it, and the bottom is generally rocky and uneven, with numerous shoals. The principal dangers are South Ledge and Carter Shoal, as before described.

Should, however, a vessel find herself in the South Channel, she should steer to the northwest along the line Barbukit open westward of the highest coast hill, bearing 303°, which leads between Carter Shoal and South Ledge in not less than 10 fathoms; and as soon as Horsburgh Lighthouse bears 056° a vessel may shape course through the fairway of the strait for Singapore Road. At low water, when both South Ledge and Middle Rocks are plainly visible, it is often preferable to pass between them instead of getting on to the range line just mentioned, especially when, as frequently happens, rain clouds obscure Barbukit.

6-127 NORTH CHANNEL, lying between Remunia Shoals and the dangers outlying the Lima Islands, is about 3.5 miles wide, with banks of from 3 to 5 fathoms in the fairway, and it is possible that other dangers may exist than shown on the chart. As no advantage is gained by passing through, it should not be used by strangers. It is used by coasting craft.

JOHORE STRAIT (Selat Terbrau) (Old Strait Of Singapore)

6-128 GENERAL REMARKS.—Johore Strait (H.O. Chart 1205) the channel between Singapore Island and the Malay Peninsula

was formerly the passage by which all vessels proceeded between India and China when the main strait at present in use was not known to be navigable. There is no passage through except for small craft on account of the railway causeway eastward of Johore Bahru.

PILOTS can be obtained at Singapore, but their knowledge of the western portion of the strait is limited.

6-129 ITS WESTERN APPROACH (H.O. Chart 3748) is barred by a sandbank which stretches across from Tanjong Bulus to Tanjong Gul, with depths under 3 fathoms; a narrow channel with a least depth of about 20 feet is shown on the chart southward and eastward of Pulo Merambong.

The depths in the western portion of the strait are irregular, the least depth in West Reach is about 19 feet about 1/2 mile above Kolek Rocks. In Putri Narrows there is a depth of 19 feet on the range in North Channel and 24 feet on the range line in Middle Channel.

Vessels drawing more than 18 feet or exceeding 350 feet in length should not use the western entrance. From Tanjong Bulus to Tanjong Kupang, 7 miles northeastward, the coast on the western side of the entrance is low with no conspicuous features.

6-130 SUNGEI PULAI, a moderately large river, which rises eastward of Gunong Pulai, a conspicuous mountain located about 20 miles northward of Tanjong Bulus, flows out between Tanjong Bin, 4 3/4 miles north-northeastward of Tanjong Bulus and Tanjong Kupang. The northern shore of the entrance to the river westward of Tanjong Kupang, is composed of mud and sand backed by mangroves.

TANJONG KUPANG (Poh) can be identified by a red-roofed building located about 50 yards west of the point. Kampong Tanjong Pelepas, about 1 1/4 miles north of Tanjong Bin, has a wooden jetty with a depth of 15 feet alongside.

There is a depth of 9 fathoms in the narrows at the entrance to the river, but there

(6448) MALAY PENINSULA—Singapore Approaches—Chart amendment.—

1. The following will be expunged :

- (a) The yellow buoy in $1^{\circ}14.6'$ N., $103^{\circ}35.9'$ E. (approx.).
- (b) The stranded wreck in $1^{\circ}15.7'$ N., $103^{\circ}30.3'$ E. (approx.).
- (c) Small circle "Radio Sta" in $1^{\circ}20.3'$ N., $103^{\circ}42.1'$ E. (approx.).
- (d) The mooring buoy in $1^{\circ}09.7'$ N., $103^{\circ}53.3'$ E. (approx.).

2. The lights in the following approximate positions will be changed as indicated :

(a) Lighted Beacon No. 45 ($1^{\circ}11.9'$ N., $103^{\circ}48.3'$ E.), now shows *Gp. Fl.* (2) 5 sec.

(b) The light ($1^{\circ}10.2'$ N., $103^{\circ}52.8'$ E.) is visible 4 M.

(c) Pulo Nipa Light ($1^{\circ}09.2'$ N., $103^{\circ}39.4'$ E.) is visible 8 M.

3. A yellow spherical buoy showing a *Qk. Fl. Or.* light exists about 3.74 miles 261° from Sultan Shoal Light ($1^{\circ}14.3'$ N., $103^{\circ}38.9'$ E. approx.).

Note.—A mooring buoy is located about 0.28 mile $052^{\circ}30'$ from the buoy in (3).

4. A fishing light, *Qk. Fl. R. 11 ft. 2 M.*, exists about 0.79 mile $348^{\circ}30'$ from Tanjung Teritip Light ($1^{\circ}18.2'$ N., $103^{\circ}39.3'$ E. approx.).

5. The symbol for a dangerous wreck will be substituted for the stranded wreck charted in $1^{\circ}10.7'$ N., $103^{\circ}53.1'$ E. (approx.).

6. A mooring buoy exists about 1.9 miles $130^{\circ}30'$ from the light ($1^{\circ}10.2'$ N., $103^{\circ}52.9'$ E. approx.).

7. A submarine cable will be charted, extending from the western limit of the Prohibited Anchorage Area, as follows :

(a) Extending from a point 2.7 miles 202° from Sultan Shoal Light in (3), in a $273^{\circ}45'$ direction for 3.56 miles.

(b) Thence 0.84 mile $255^{\circ}45'$,

(c) Thence 0.29 mile 285° ,

(d) Thence 1.0 mile 258° ,

(e) Thence 0.35 mile 223° ,

(f) Thence 0.65 mile 256° ,

(g) Thence 2.12 miles 279° ,

(h) Thence 4.10 miles 272° ,

(i) Thence $297^{\circ}30'$ to the border of the chart.

8. A submarine cable will be charted, extending from the western limit of the Prohibited Anchorage Area, as follows :

(a) Extending from a point 1.6 miles 131° from Sultan Shoal Light in (3), thence in a 252° direction for 0.26 mile,

(b) Thence 1.2 miles 269° ,

(c) Thence 0.1 mile 234° ,

(d) Thence 5.18 miles 269° ,

(e) Thence 2.05 miles 268° ,

(f) Thence 5.19 miles 272° ,

(g) Thence 3.17 miles 332° ,

(h) Thence in a 296° direction to the border of the chart.

Note.—On H.O. Chart 1205, the legend "CABLES" will be charted in $1^{\circ}11'N.$, $103^{\circ}40.8' E.$

(See N.M. 18 (2843) 1966.)

(N.M. 41/66.)

(B.A. Chart 3833.)

H.O. Charts 3748, 3749 (1d, 2b, 5, 6), 3746 (2c), 3747 (2c), 1205 (1a, b, 2b, c, 3, 5, 7, 8), 3745 (1b, 2c), 3131 (1b, 2b, c).

H.O. Pub. 112, Nos. 24870, 24890, 24902.

H.O. Pub. 70, 1951, pages 104, 181, 183, 185, 187, 190, 222.

is a bar across it to the southward and entrance should not be attempted without local knowledge.

ALERT SHOAL, with a depth of 16 feet, lies 5 1/2 miles eastward of Tanjong Bulus and on a line joining that point and Tanjong Gul.

TANJONG TERITIP, a low point with coconut palms on it, is located about 1,200 yards north-westward of Tanjong Gul. A LIGHT is shown from Tanjong Teritip.

TANJONG TUAS is located about 1 mile northwestward of Tanjong Teritip.

TEREMBU PAYA, a coral patch, drying from 2 to 5 feet, lies 3/4 mile west-southwestward of Tanjong Tuas. It is marked by beacon "25", painted black, with a black spherical topmark.

A bank, with depths of 4 to 6 feet over it, lies with its north edge 1/2 mile west of beacon No. 25, and extends in a southwesterly direction for 1,200 yards. Another bank, with depths of 5 to 6 feet over it, lies 400 yards northwestward of the same beacon.

A coral patch, drying 2 feet, lies about 1/2 mile northward of the beacon.

6-131 PULO MERAMBONG is an islet 75 feet high to the tops of the trees, with a ridge nearly dry in places extending 2 miles northward of it, parallel to the channel. At about 500 yards eastward of the islet is the 3-fathom edge of the bank which extends southwestward of Tanjong Kampong, a mangrove point, the east point of the entrance; on this ridge there are many patches, some dry at low water.

LIGHT.—A light is exhibited from a white lattice-work tower on Pulau Merambong.

A RADAR REFLECTOR stands close westward of the light structure.

KOLEK ROCKS, drying 2 feet, are a group of boulders lying about 400 yards northeastward of Pulau Merambong and 350 yards westward of the range line.

Tanjong Merawang is the southern point of Pulau Kampong (Pulau Merawang) which is located on the coastal reef about one mile northward of Terembu Paya. The west

edge of the coastal reef is marked by a beacon, located about 400 yards westward of Pulau Kampong, numbered "28", and painted in black and white checkers, with a black spherical topmark. A rocky patch, which dries 1 foot, lies off the entrance to Sungai Blukang and 1,400 yards north-northeastward of beacon "28".

6-132 WEST REACH extends from Pulau Merambong to the entrance to Sungai Perfat, on the western side of the strait, about 8 1/2 miles north-northeastward. In places the channel is narrow and intricate, and great care is necessary, since the current is strong and the shoals numerous.

Northward of Tanjong Kupang is the Kupang range of hills, the highest of which is Woody Hill, the tops of the trees on its summit having an elevation of 392 feet. Bukit Kupang, 263 feet high, is surmounted by a black and white iron beacon with a diamond top mark, and lies 800 yards northward of Woody Hill. Sentinel Hill, which is well-wooded, lies 3/4 mile south-southwestward of Woody Hill. On the eastern side of the entrance to the strait there are similar but lower hills; many of those inland are cleared, but those near the coast are densely wooded.

The western shore between Tanjong Kupang and the entrance to Sungai Pendas, 2 3/4 miles northeastward, is composed of mud and sand, backed by mangroves.

Observing Johore Strait from close eastward of Pulo Merambong, the most conspicuous landmarks on the Johore side are Woody Hill and the 94-foot hill on the north side of the entrance of Sungai Pendas.

Sungai Pendas rises northward of Bukit Kupang and has a wooden jetty close westward of the native village on the northern side of the entrance.

6-133 TANJONG KARANG, the northern entrance point of Sungai Blukang, is a narrow promontory, with a red cliff, 25 feet high, on its western face. Sungai Blukang and

Sungei Blukang Kechil, which flows into its southern side, is navigable by canoes. Mud flats, with patches of rock and coral, extend offshore in this vicinity and dry in patches. A rocky patch, which dries 3 feet, lies $\frac{1}{4}$ mile northward of Tanjong Karang.

About 1,400 yards north-northeastward of Tanjong Karang is Tanjong Pasir Laba, with Sungei Tengeh between. The headland is bare and rises to an elevation of 55 feet.

Between Tanjong Pasir Laba and Tanjong Bajau, about a mile northeastward, there is a bay, on the shore of which there are some low red cliffs. Tanjong Bajau is a red cliff 23 feet high.

Foul ground, with depths of less than 18 feet, extends about 400 yards from the shore at a point about 700 yards northeastward of Tanjong Pasir Laba, and 700 yards northward of Tanjong Bajau is a 13-foot patch. This patch nearly joins a long sand spit, with depths of from 2 to 18 feet, fronting the eastern shore between Sungei Berih Estuary and Pulau Pergam, about $1\frac{3}{4}$ miles northward of Tanjong Bajau.

Sungei Berih consists of two moderately large rivers and numerous creeks, flowing into West Reach between Tanjong Batau and Tanjong Berih, 1,600 yards northeastward.

6-134 Coast.—The hills in the southwestern part of Singapore Island are generally conspicuous. Bukit Chao Chu Kang, a cleared hill, 286 feet high, situated about $2\frac{1}{2}$ miles eastward of Tanjong Pasir Laba, has a white beacon with a black diamond top mark on its summit.

On the northern side of the entrance to Sungei Pendas is a prominent isolated hill, 94 feet high and densely wooded. With this exception the coast between this river and Tanjong Bunga, about 1,400 yards north-northeastward, is low and backed by mangroves and coconut palms.

Between Tanjong Bunga and the entrance to Sungei Bahan, about a mile northward,

there is a rubber plantation, and a few houses and coconut palms. The coast here is backed by undulated cultivated country 80 to 140 feet high. A pier extends from the coast about 600 yards east-northeastward of the north entrance point of Sungei Bahan. A large white bungalow with a red roof stands close to the pier.

From Tanjong Berih, the eastern shore continues of the same character for $1\frac{1}{2}$ miles to Tanjong Murai. Patches of rock and coral, which dry, lie $\frac{1}{4}$ mile offshore in places.

6-135 Pulau Bergam, 66 feet high, lies on the mud bank on the eastern side of the strait about 1 mile northward of Tanjong Berih.

Lucy Rock, with a depth of 18 feet over it, lies close eastward of the center of the fairway, 750 yards west-southwestward of Pulau Pergam.

Between Tanjong Murai and Tanjong Gedong, about $1\frac{1}{4}$ miles northeastward, the coast is steep-to. Bukit Pergam, 280 feet high, is a fairly conspicuous bare hill lying about 1,300 yards eastward of Tanjong Murai.

For about a mile northeastward of Sungei Bahan the western shore is of the same character as southward of it, thence it becomes steep-to, and at Tanah Runtuh there are cliffs 90 feet high. There are depths of at least 35 feet close off these cliffs. A conspicuous village with a jetty lies about 500 yards northward of Tanah Runtuh. A red-roofed building, with a jetty near by, stands about $\frac{1}{2}$ mile north-northeastward of the same point.

Shores—Putri Narrows.—From Tanah Runtuh, $1\frac{3}{4}$ miles northeastward, to a point about 600 yards beyond Tanjong Setajam, on the northern side of the strait, the bottom is very foul and great caution is necessary.

About a mile northward of Tanah Runtuh, the Sungei Perpat, a shallow sluggish stream, flows into Putri Narrows. The western shore, northward of Tanah Runtuh, changes, the hills being nearly all cleared and cultivated. Bukit Setajam, 146 feet high and cultivated,

situated 1,300 yards northeastward of the eastern entrance point of Sungei Perpat, is a prominent landmark.

On the eastern shore, close northward of Tanjong Gedong, is the entrance to Sungei Karang, the coast being backed by densely wooded hills, from about 70 to 160 feet high, with several creeks. About $\frac{1}{2}$ mile northeastward of Sungei Karang is the entrance to Sungei Sarimbun, the Sungei Hantu flowing out between. At the eastern side of the entrance of Sungei Sarimbun there are cliffs 37 feet high.

6-136 Pulau Sarimbun, 128 feet high to the tops of the trees and densely wooded, lies on the southern side of the strait, close off the mouth of Sungei Sarimbun. Foul ground extends about 300 feet from the southeastern side, and 450 feet eastward from the northeastern side. Batu Addis, with a depth of 4 feet, lies close to the outer end of this foul ground, but elsewhere the island is steep-to.

May Rock, with a depth of 18 feet, lies 600 yards westward of Pulau Sarimbun.

Sarimbun Rocks are two patches, which dry 7 feet, lying on an extensive area of foul ground northeastward of Pulau Sarimbun. The western rock is marked by a black beacon with a black topmark situated about 500 yards north-northeastward of Pulau Sarimbun. An isolated rocky patch, with a depth of 12 feet, lies 250 yards northeastward of the beacon.

Buoy—Spoil ground.—A spherical buoy, marking an ammunition spoil ground, is moored about 600 yards 055° from Sarimbun Beacon. The spoil ground area is within a 375-foot radius of this buoy.

Herald Rock, with a depth of 18 feet, lies about 600 yards eastward of Pulau Sarimbun, and 175 yards from the south shore of the strait.

Horseshoe Reef, over which there are depths of from 12 to 18 feet, is a narrow ridge of rocks extending across the middle of the strait near the northeastern end of Sarimbun Rocks. Between the northern end of the reef and the northern end of the strait there are several patches, with depths of from 14 to 18 feet.

6-137 **Sungei Malayu** flows into the northwestern side of the strait. On the southwestern entrance point, $\frac{3}{4}$ mile northeastward of Tanjong Setajam, there is a cliff 20 feet high, and a village. The coast is steep-to. About $\frac{1}{2}$ mile from the entrance, on the west bank of the river, is a village and a pier. The land in the vicinity is extensively cultivated.

On the southeastern side of the strait, Sungei Perempan, an unimportant stream, flows out, and $1\frac{1}{4}$ miles farther northeastward is Sungei Buloh, and the islet of the same name at the mouth.

Between Tanjong Setajam and Pulo Sarimbun confused eddies exist, and a $3\frac{1}{2}$ knot current should be expected at full ebb and much less at full flood.

Town Reach extends from Putri Narrows to the causeway. About $1\frac{1}{4}$ miles northeastward of Sungei Malayu is Tanjong Danga, on which there is a bungalow belonging to the Sultan of Johore. A small pier, which dries, is located here. Tanjong Danga is the southern and western entrance point, respectively, of Sungei Danga and Sungei Skudai.

An extensive bank, with depths of less than 18 feet, on which there is a patch that dries, extends across the mouth of Sungei Danga so that the channel into Sungei Skudai is well over on the eastern shore.

The land on the northern side of Town Reach, eastward of Sungei Skudai, is from 120 to 200 feet high, consisting of two ranges of hills, on which are the houses and bungalows of the residents of Johore Bahru. The most conspicuous object in Johore Strait is the tower of the government offices, 289 feet high, located about 800 yards west-northwestward of the northern end of the causeway. This tower can be seen from a great distance. Other conspicuous objects on the northern shore are the two white water towers; the Mosque with four domes about $\frac{1}{2}$ mile westward of the government office tower; and the tower of the Sultan's Palace. A hotel lies about 1,600 yards west-northwestward of the Mosque, and close westward of the hotel is the wharf of the Marine Department depot, with a depth alongside of 10 feet.

On the southern side of the strait, between Tanjong Buloh and Sungei Kranji, about $\frac{3}{4}$ mile southeastward, the shore is bordered by dense mangroves and swamps.

Kampung Kranji stands about $\frac{3}{4}$ mile eastward of the eastern entrance point of Sungei Kranji.

6-138 Woodlands, about $1\frac{1}{4}$ miles north-eastward of Kampung Kranji, is situated at the southern end of the causeway. The land in the vicinity has been partly cleared. The railway station is situated close to the causeway. There is a village close southwestward of the railway station (see sec. 6-159).

Shoals, with depth of 35 and 36 feet, are located about 1,300 and 1,100 yards, respectively, west-southwestward of the Marine Department Depot. Causeway Shoal, with a least depth of 16 feet, lies in midchannel southward of the Istana. The eastern end is connected to the northern shore close westward of the causeway by a spit, with depths of 15 to 26 feet. A 16-foot patch lies about 500 yards westward of the northern end of the causeway, and a rocky patch with a depth of 23 feet, lies about 600 feet west of the south part of the causeway.

Causeway.—The causeway, which extends across the strait close eastward of Johore Bahru, carries the railway and highway.

A lock at the northern end of the causeway is closed to navigation.

6-139 Johore Bahru, situated 14 miles above Pulau Merambong, is the capital of the State of Johore. It is a flourishing town with a 1964 population of 83,500. It is the residence of the Sultan, and presents a most picturesque appearance from the opposite

side of the strait. Close westward of the town and near the shore, is the Istana, the principal residence of the Sultan.

There is railway communication with Singapore, the principal ports in the Malay peninsula, and Bangkok.

The town is connected to the general telephone with Singapore.

There is a general hospital.

6-140 Tidal current.—In Johore Strait, before the construction of the causeway, the tidal currents were mainly diurnal, as in the approach to Singapore, but they are now mainly semi-diurnal. Slack water generally occurs four times in each lunar day and the greatest variations in rate follow the moon's phases.

Owing to the number of sizable rivers flowing into the strait, the rate of the ebb current is increased, and that of the flood current decreased, during and after heavy rains.

(A) Western part of strait (observations obtained in midchannel off Tanjong Kampong and in midchannel in the narrows at Tanah Runtuh).

The ebb current runs from about 1 hour after high water at Singapore until about 5 hours before the following high water at an average maximum rate of 1.6 knots at springs and 0.8 at neaps. The flood current runs from about 5 hours before high water at Singapore until about 1 hour after high water at an average maximum rate of 1.4 at springs and 0.7 knots at neaps. No appreciable differences were found in the rates of the current at the two positions where observations were obtained. In Town Reach the rate of the cur-

rent, especially if the flood, decreases as the causeway is approached.

(B) Eastern part of the strait, Calder Harbor and Sungai Johore.

(a) Calder Harbor, in midchannel off Tanjong Johore:

The ebb current runs from about the time of high water at Singapore until about 6 1/4 hours after high water, at an average maximum rate of about 1.2 knots. The flood current runs from about 6 1/4 hours after high water until the time of the following high water at an average maximum rate of about 1 knot.

(b) Sungai Johore, in midchannel between Tanjong Surat and the shoal westward of it:

The ebb current runs from about half an hour after high water at Singapore until about 5 1/2 hours before the following high water at an average maximum rate of about 1.2 knots. The flood current runs from about 5 1/2 hours before high water until half an hour after high water at an average maximum rate of 1 knot.

(c) In Kuala Johore, in a position about 1 3/4 miles west-southwestward of Tanjong Johore, the tidal current is chiefly rectilinear. The ebb current runs southeasterly from about a half hour after until about 5 hours before high water at Dockyard Reach. Its maximum rate of about 1.2 knots at springs and 0.7 knots at neaps is reached about 4 hours after high water at Dockyard Reach. The flood current runs northwesterly from about 5 hours before until about a half hour after high water at Dockyard Reach. Its maximum rate of about 1.3 knots at springs and 0.7 knots at neaps is reached about 2 hours before high water at Dockyard Reach.

(d) Off Loyang, in a position about 700 yards westward of Fairy Beacon, the tidal current is chiefly rectilinear. The ebb current runs east-northeasterly from about a half hour after until about 6 hours after high water at Dockyard Reach. Its maximum rate of 1.2 knots at springs and 0.6 knots at neaps is reached about 3 hours after high water at Dockyard Reach. The flood current runs west-southwesterly from about 5 1/2 hours before until a half hour before high water at

Dockyard Reach. Its maximum rate of about 1.4 knots at springs and 0.7 knots at neaps is reached about 2 hours before high water at Dockyard Reach.

(e) Off Punggol, in a position about 800 yards northward of Punggol Light Beacon, the tidal current is chiefly rectilinear. The ebb current runs easterly from about a half hour after until about 6 hours after high water at Dockyard Reach. Its maximum rate of about 1.6 knots at springs and 0.9 knots at neaps is reached about 3 1/2 hours after high water at Dockyard Reach. The flood current runs westerly from about 5 1/2 hours before until the time of high water at Dockyard Reach. Its maximum rate of about 1.6 knots at spring and 0.9 knots at neaps is reached about 2 hours before high water at Dockyard Reach.

(f) Off Singapore Naval Base, in a position about 1/2 mile southwestward of Kanan Light Beacon, the tidal current is chiefly rectilinear. The ebb current runs east-southeasterly from about a half hour after until about 6 hours after high water at Dockyard Reach. It reaches a maximum rate of about 0.4 knots at springs about 3 1/2 hours after high water at Dockyard Reach. The flood current runs west-northwesterly from about 6 hours before until about the time of high water at Dockyard Reach. It reaches a maximum rate of about 0.3 knots at springs about 2 1/2 hours before high water at Dockyard Reach.

TIDES.—Tidal heights at Tanjong Punggol (1°25'N., 103°55'E.) above datum of soundings are: MHWS 9.9 feet, MHWN 7.7 feet, MLWS 1.8 feet, MLWN 4.0 feet.

Tidal heights at Naval Dockyard (1°28'N., 103°50'E.) above datum of soundings are: MHWS 10.7 feet, MHWN 8.2 feet, MLWS 2.4 feet, MLWN 4.7 feet.

6-141 ANCHORAGES.—Anchorage may be obtained anywhere in Johore Strait southward of Tanah Runtuh, except that near Pulau Merambong there is at times a heavy sea. If obliged to anchor in this vicinity the best berth is in about 24 feet, about 600 yards west-southwestward of Beacon 28.

The holding ground is generally good, consisting of stiff mud and sand. Anchorage between Tanah Runtuh and Horseshoe Reef is not recommended, but farther eastward it can be obtained anywhere in stiff mud.

A convenient anchorage to Johore Bahru is in 7 1/2 fathoms, about 250 yards southward of the Istana. Anchorage should not be made eastward of this point, because of eddies and tide rips made by the causeway.

Landing is easy everywhere, except between Tanjong Gul and Tanjong Kampong, where it is very exposed.

CAUTION.—The directions described below should be used with caution. It was reported (1960) that the range marks are no longer visible.

6-142 DIRECTIONS.—After passing Sultan Shoal Lighthouse, keep the highest tree on Pulau Merambong in line with Woody Hill, bearing 359°, passing eastward of Alert Shoal, until Beacon No. 25 bears about 046°. A conspicuous clump of casuarina trees will be in line, bearing 010°, with a small tree on a nearly bare hill. This will lead eastward of Pulau Merambong and Kolek Rocks in a depth of not less than 21 feet. After passing Kolek Rocks, haul to the eastward a little to clear Merambong Spit, and then bring the red cliff on Tanjong Bajau, in line with a dip in the hills, bearing 033°, just westward of Bukit Pergam. Keep on this course until in the middle of the strait, when course may be altered to proceed in mid-channel. When Tanjong Bunga is abeam, haul over to the west side of the channel to avoid Lucy Rock and the foul ground off Pulau Pergam, after which the midchannel course may be resumed, until after passing Tanah Runtuh.

Eastward of Tanah Runtuh there are three channels. North Channel is the most direct and easiest, but should not be attempted by a vessel of more than 14 feet draft. Middle Channel is narrow and tortuous, but has the greatest depth and is well marked. South Channel is southward of Pulau Sarimbun and has a depth of 22 feet, but is not recommended.

6-143 MIDDLE CHANNEL.—After passing Tanah Runtuh keep slightly over to the

northwest side of the strait, and bring Sarimbun Rocks Beacon in line with Johore water tower bearing 058°. Steer on this line until abreast Pulau Sarimbun, then alter course to 093° for a wooden hut on a pier on Singapore Island. When the south point of Pulau Sarimbun is just open of the land on the Singapore Island side, southwestward of it, alter course to 060° to clear Horseshoe Reef.

After passing Horseshoe Reef, alter course to the northward and steer for the water tower, bearing 060°, until the Sultan's bungalow on Tanjong Danga bears 348°, then haul gradually to the eastward and steer 103° for the south part of the causeway, anchoring off the Istana.

NORTH CHANNEL.—Follow directions for Middle Channel until clear of May Rock, when haul to the northward, and pass midway between Sarimbun Rocks Beacon and Tanjong Setajam, with the water tower bearing 059°. Caution is necessary to guard against a set toward the foul ground to the southward.

6-144 EAST ENTRANCE OF JOHORE STRAIT (H. O. Chart 3750).—This entrance between Tanjong Changi and Tanjong Kopok, 3 miles northward, is divided into two channels by Pulau Ubin. Serangoon Harbor, the south channel, is deeper and better. Nanas Channel is the north one. That part of Johore Strait between Tanjong Punggol (sec. 6-151) and the mouth of Sungai Tebrau is known as Tebrau (Dockyard) Reach; thence, to the causeway, it is known as Ordnance Reach.

The general harbor area between the east entrance point of Johore Strait north and westward to the Causeway, which includes Naval Dockyard, Nanas Channel, Serangoon Harbor, Tebrau Reach and Ordnance Reach, is known as Port of Singapore North.

SPEED RESTRICTIONS.—The following speed restrictions are in force in the east part of Johore Strait, within the limits of the naval port:

(1) Vessels in the channel should not normally exceed a speed of 14 knots.

(2) Speed is to be restricted to 8 knots between Changi Buoy and a line drawn in a 220° direction from the southeast extremity of Pulo Ketam.

(3) Speed restricted to 8 knots westward of Beaulieu Shoal Light Buoy.

(4) Vessels elsewhere reduce speed as necessary to avoid damage to boat moorings, ferry terminals, etc.

FISHING STAKES.—The northern shore of the strait from Biru Light Beacon to within one mile of the causeway, and the southern shore from Sungai Seletar to the Naval Dockyard is heavily encumbered with large bamboo fish traps which extend as much as 800 yards offshore—in places, as far as the 6-fathom line. A number of these fish traps cover at high water.

Pulau Ubin, the island that divides the east entrance to Johore Strait into two channels, has a length of 4 miles in an east and west direction and a maximum width of 1 mile. The island consists of hills, most of which are thickly wooded, fronted and intersected by extensive mangrove swamps. The soil on the high parts of the island has a red color, and several granite quarries are worked.

6-145 SERANGOON (Selarang) HARBOR.—There are depths of over 6 3/4 fathoms in the fairway which in no part is less than 400 yards wide, and off the south part of Pulau Ubin the harbor is as much as 900 yards wide between the 6-fathom curves on either side. Several streams discharge into the harbor, the principal of which, Sungai Serangoon, is navigable by launches for a distance of nearly 2 miles to the village of the same name, where there is a Catholic church and mission.

Fairy Point is located on the southern shore, about 1 1/2 miles southwestward of Tanjong Chek Jawa. A conspicuous water tower, painted in red and white checkers, 125 feet high, stands about 3/4 mile southwestward of Fairy Point. A smaller water tower, obscured by buildings and trees when close inshore, stands 131° 1/2 mile from the conspicuous water tower. The smaller water tower, with Loyang Light Beacon, is used as a range for the northwestern reach of Serangoon Harbor.

The smaller water tower has a painted orange stripe visible from the northwestward.

Lights for the use of aircraft are shown from the top of the tower.

A light is shown on Tanjong Chek Jawa, the southeast extremity of Pulau Ubin.

A beacon stands about 200 yards south-eastward of the light structure. In range, they bear 312°.

SHOAL—BUOY.—There is considerable shoal water on the north side of the east entrance of Serangoon Harbor, formed by a bank extending eastward from the east end of Pulau Ubin. Depths of 6 feet and less extend 1/2 mile eastward from Tanjong Chek Jawa. A small patch with a depth of 5 feet, and a patch with a depth of 33 feet, lie, respectively, about 1,200 and 1,500 yards southeastward of the same point.

Off the southeast extremity of the above-mentioned bank is moored a black conical buoy with a globe top mark. This buoy is named "Ubin."

A conical light buoy painted in black and white stripes is located about 1 mile eastward of Tanjong Chek Jawa light structure.

6-146 PULAU SEKUDU, an 18-foot rocky islet with some bushes on it, is located on a drying reef about 500 yards southwestward of Tanjong Chek Jawa. About 350 yards southward of Pulau Sekudu is Malang Papan, a rock that dries 8 feet.

A light is shown on Malang Papan, Changi Light Buoy, a can buoy painted red and showing a flashing red light, is moored on the south side of the fairway in Serangoon Harbor in a position about 800 yards southward of Malang Papan.

Batu Puteh, a group of gray granite rocks, 8 feet high, lies 250 yards northwestward of Fairy Point. The rocks have deep water around and between them. The tidal currents, especially the east-going one, are strong in the vicinity of these rocks.

LIGHTS.—A light is shown on Batu Puteh.

A light is shown on Loyang Beacon, located 1,400 yards southwestward of Batu Puteh. This beacon is a white concrete pile beacon with a triangular topmark on the edge of the drying flat at Kampong Loyang.

Two rocks, about 50 yards apart, each of which dries 7 feet, lie about 300 yards south-southeastward of the light on Batu Petah.

Each of these rocks is marked by a beacon surmounted by a white diamond.

Loyang Pier, a Royal Navy installation, extends 1,340 feet north-northwestward from a position on shore about 400 yards south-eastward of Loyang Light Beacon. In 1961, the depth at the head of the pier was 32 feet; alongside depths measured 350, 500 and 740 feet from the pierhead were 15 feet, 10 feet and 0 feet, respectively.

Four mooring buoys are moored within 400 yards of the western side of the jetty.

6-147 Pulau Ketam, a mangrove island about 60 feet high to the top of the trees, is separated from the southwest side of Pulau Ubin by Ketam Channel. Jones Reef, is located on the southwest side of the fairway in Ketam Channel. Jones Reef, a rocky patch drying 2 feet, is marked by a red and white vertically striped pole beacon on the north side, and by a white pole beacon on the south side.

Three mooring buoys are anchored close northeastward of Jones Reef. Two small jetties extend from the shore of Pulau Ubin about $\frac{1}{2}$ mile northwestward of Jones Reef. There are depths of over 5 fathoms in the channel from the east entrance of Ketam Channel to the westernmost jetty.

Off the northwest end of Pulau Ketam, there is a patch of rock which dries 4 feet and forms the southeast edge of the north entrance of the channel. Drying rocks, that extend nearly 400 yards offshore, lie on the northwest side of the channel.

Squance Bank, on which the least depth is 10 feet, extends first southward and then eastward from the south extremity of Pulau Ubin. A rock that dries 2 feet lies on the bank in a position 200 yards southeastward of the southeast extremity of Pulau Ketam.

Squance Light Buoy, a black conical buoy showing a flashing white light, is moored southeastward of Squance Bank.

Serangoon light buoy, painted red and showing a flashing red light, is moored $\frac{1}{2}$ mile southwestward of the northwest extremity of Pulau Ketam.

6-148 Pulau Serangoon, a mangrove island about 40 feet high, is on the extensive bank that extends off the southwest shore of the west part of Serangoon Harbor. The bank dries southeastward and northwestward from the island.

Anchorage.—Serangoon Harbor affords excellent anchorage in any convenient depth, the holding ground being stiff mud.

Prohibited anchorage.—See sec. 6-99 for the prohibited anchorage area in Kuala Johore.

Anchorage is prohibited in an area bounded by lines extending 357° across the strait from positions about 350 and 300 yards eastward and westward, respectively, of Punggol Beacon.

6-149 Nanas Channel (*H. O. Chart 3750*), located on the north side of Pulau Ubin, has in The Narrows, the west end, a least navigable width of 350 yards and a least depth of 16 feet. A vessel with local knowledge can draw 24 feet.

Henderson Shoal, a middle ground at the east entrance of Nanas Channel, has a least depth of 28 feet, mud bottom.

Fishing stakes exist in the fairway northward of the shoal, causing a danger to navigation during poor visibility.

6-150 Pulau Nanas, on the north side of the channel, $1\frac{1}{4}$ miles westward of Tanjong Kopok, is intersected with granite quarries and becomes conspicuous from the southeastward when it opens clear of the

northeast point of Pulau Ubin, because of the red soil covering the quarry. A bank, which dries in places, extends 450 yards eastward from Pulau Nanas, and at its outer end is a rock 3 feet high. Some rocks, which dry 7 feet, lie close off the southwest side of the island.

Dawes Rock, which dries 3 feet, is located on a sunken coral reef about 1 1/2 miles westward of Pulau Nanas and 300 yards off the north shore. A beacon marks the edge of the reef close southward of Dawes Rock.

Tanjong Gemok, located about 2 1/4 miles westward of Pulau Nanas, rises steeply to a round-topped hill, 60 feet high to the tree tops.

A shoal with a least depth of 16 feet is located about 1/4 mile southeastward of Tanjong Gemok.

Fan Shoal extends from the northwest side of Pulau Ubin across the west end of Nanas Channel. There are depths of less than 3 fathoms for a distance of 500 yards northwestward from Tanjong Tajam; thence the general depths over the shoal are from 24 to 30 feet, with the exception of a patch of from 21 to 22 feet lying in midchannel on the east end of the shoal.

Tajam Light is shown from a white iron beacon close off Tanjong Tajam, the west extremity of Pulau Ubin.

BEACONS.—The Narrows are marked by two beacons, one on the edge of the shoal extending from Tanjong Gemok and the other on the edge of the shoal extending from the north extremity of Pulau Ubin.

TEBRAU (DOCKYARD) REACH.—A least depth of 37 feet can be carried from abreast Tanjong Punggol to the causeway. The west part of this reach, westward of the entrance to Sungai Tebrau, is known as Ordnance Reach.

From the fairway of the strait the general appearance of the land is that of a densely wooded, undulating country fronted generally

by mangroves and sometimes by palm trees. A few isolated tall trees stand out conspicuously. Several streams flow into this reach.

6-151 PULAU TUKANG, an island about 70 feet high to the tops of the trees, is located 1 1/4 miles westward of Tanjong Gemok.

Biru Light, located 800 yards westward of Pulau Tukang, is shown from a white concrete pile beacon with a triangular topmark.

Buloh Light Buoy, a black conical buoy showing a flashing white light, is moored about 1/2 mile west-southwestward of Biru Light. It marks a 23-foot patch.

Tanjong Punggol is located about 1 mile westward of the west end of Pulau Ubin. A light is shown from a concrete pile located close off Tanjong Punggol.

A black conical light buoy, marking the southern side of a 27-foot patch, is moored about 1/2 mile northwestward of Punggol Light.

PULAU SELETAR.—For about 4 miles northwestward from Tanjong Punggol the south shore of Tebrau Reach forms a bay into which several streams flow, and at the northwest end of the bay is Pulau Seletar, a mangrove island, about 80 feet high to the tops of the trees. From the northeast side of this island a narrow shoal of sand and mud, which dries in places, named Alang Perimbi, extends southeastward to within a mile of Tanjong Punggol and fronts the bay. A black buoy is moored off the eastern end of Alang Perimbi.

6-152 PIERS.—On the south shore about 2 miles west-southwestward of Tanjong Punggol is a pier with depths of 7 feet alongside and a least depth of 9 feet in the approach. Two small jetties that dry at low water are located 1,000 and 1,400 yards northwestward of this pier.

6-153 PERIMBI LIGHT BUOY, a yellow conical buoy showing a flashing red light, is moored on the northeast side of Alang Perimbi in a position 1 1/2 miles west-northwestward of Tanjong Punggol.

Two BUOYS, painted in black and white checkers, are moored about 1 1/4 miles westward of Tanjong Punggol, and mark the seaward end of a submarine cable.

PROHIBITED ANCHORAGE.—Anchorage is prohibited in the area between southeastward through west-southwestward from Perimbi Light Buoy.

SHOAL.—A 32-foot patch lies close to midchannel in a position about 3/4 mile east-northeastward of Seletar Light Beacon.

GUDONG LIGHT BUOY, conical and black and white striped, marks the shoal.

SELETAR LIGHT is located on Alang Perimbi in a position 500 yards northeastward of the southeast end of Pulau Seletar.

FLARES.—When required for night-flying, a flare path is laid between Seletar light beacon and Buloh light buoy. It is marked by six equally spaced **GREEN FIXED LIGHTS** and **RED FIXED LIGHTS**. They are attached to the above-mentioned navigational aids.

HUTAN LIGHTED BEACON is located about 3/4 mile northeastward of Seletar Light.

PASANG LIGHTED BEACON is located 1 1/3 miles eastward of Seletar Light.

6-154 **FELKIN SPIT**, with depths of 17 to 30 feet, is an extension of the shore bank northeastward of Pulau Seletar. Its southeast end lies about 1,200 yards northeastward of the southeast end of the island.

FELKIN LIGHT BUOY, a red can buoy showing a flashing red light, is moored on the northeast side of Felkin Spit, about 1,200 yards northeastward of the northwest end of Pulau Seletar.

MASAI BUOY NO. 8, painted black, is moored on the north side of the fairway, about 400 yards northward of Felkin Buoy.

ROCKS.—Off the north shore of the strait, east-northeastward of the north extremity of Pulau Seletar, is a rocky patch with depths of from 10 to 17 feet over it, extending about 400 yards offshore. About 1,400 yards further northwestward is a narrow shoal bank, fronting Sungai Masai, with

depths of 24 to 30 feet over it, about 800 yards from coast.

LAVIS SHOAL, with depths of 4 to 18 feet over it, extends about 400 yards from the south shore between a position about 3/4 mile northwestward of Pulau Seletar and the West Stores Basin.

LAVIS Beacon, surmounted by a basket topmark, is located on the edge of the drying coastal bank about 1/2 mile northwestward of the northwest end of Pulau Seletar.

6-155 **SINIOP LIGHT** is shown on the edge of the shoal extending from the north shore in a position northward of the east end of Lavis Shoal.

BEAULIEU LIGHT BUOY, painted red and showing a flashing red light, is moored 1,800 yards west-southwestward of Siniop Light. It is moored off Beaulieu Shoal, which fringes the shore immediately eastward of the entrance of the Naval Stores Basin.

6-156 **NAVAL DOCKYARD.**—The Naval Dockyard is located on the south shore of Tebrau Reach in a position 1 3/4 miles northwestward of Pulau Seletar.

Several drydocks are located at the Naval Dockyard. The dimension of the largest, a graving dock, are:—length on the bottom, 995 feet; breadth at entrance at M.H.W.S 130 feet; depth on sill at chart datum, 34.1 feet. (This dock can be lengthened approximately 52 1/3 feet by placing the caisson in the outer stop)

KANAN BEACON LIGHT is located on the north shore opposite the Naval Dockyard.

6-157 **BUOYS—LIGHTS.**—A conical buoy, painted in black and yellow checkers with a ball topmark, is located about 1/4 mile northwestward of the floating drydock. Several mooring buoys are located in the channel northward of the floating drydocks.

COAST.—Between Lavis Beacon and a conspicuous house, located on the south shore close southeastward of the Naval Dockyard, the approach to the drying coastal bank is foul and encumbered by numerous stranded wrecks, fish traps and piles. There is an obstruction with a depth of 1 foot that lies about 100 yards northeastward of a pier

located close by the conspicuous house. Two more obstructions with depths of 9 feet and 5 feet, lie within a distance of about 300 yards southeastward of this pier.

RUMAH MERAH, a house with a red roof—known locally as the Red House—stands on piles close off the south shore in a position 1/2 mile westward of the Naval Dockyard. A shoal with a depth of 2 feet lies about 1/4 mile westward of Rumah Merah and about 150 yards offshore. It is marked on its northeast side by a can BUOY, painted in red and white checkers and topmarked by a ball.

RADIO TOWERS.—A group of six radio towers, each 200 feet high, is located about 1 mile south-southwestward of Rumah Merah. A light is shown from each of these towers. Several other radio towers, each 130 feet high, are located northward and southward of the main towers.

On the north shore opposite Rumah Merah is a conspicuous red bluff, 35 feet high, known as Red Cliff. It is covered with grass and scrub. A bank, with depths of from 28 to 36 feet, extends southward from Red Cliff for about 400 yards. Another bank, with a depth of 28 feet, extends west-southwestward from Red Cliff almost into midchannel. A spoil ground, on which are numerous wrecks, lie on this bank. It can best be seen on the chart. A LIGHT BUOY, conical, painted green, is moored about 600 yards west-southwestward of Red Cliff. It marks the south end of the spoil ground referred to above.

DENMAN SHOALS, with a swept depth of 7 feet, is a rocky area westward of Rumah Merah. It extends as far as 700 yards off the south shore.

DENMAN LIGHT BUOY, painted red and showing a flashing red light, is moored on the northwest side of Denman Shoals.

MOORING BUOYS are located eastward and southwestward of Denman Light Buoy.

6-158 SUNGEI TEBRAU flows into the north side of Johore Strait about 1 1/2 miles westward of Red Cliff. Inside the entrance the fairway is about 150 yards wide, and the east bank is steep-to. This river is not navigable very far above its entrance.

TEBRAU RANGE LIGHTS.—The front light is shown from a white concrete pile beacon surmounted by a triangle, located on the

eastern side of the entrance to Sungei Tebrau.

The rear light is shown from a white concrete pile beacon surmounted by a triangle, located on the west side of the entrance to Sungei Tebrau about 2/3 mile 289° from the front light.

RANGE BEACONS.—Two range beacons stand about 1,150 yards westward of Red Cliff. The front beacon, known as Senibong Beacon, is located 200 yards offshore, and the rear beacon is 300 yards 053 1/2° from the front beacon. When in range, these beacons lead through the fairway in Ordnance Reach.

6-159 ORDNANCE REACH.—There is a prominent building on the north side of this part of the strait, the Estana Pasir Plangi, a chocolate-colored house with a small water tower near it, located 1 1/2 mile northeastward of the north end of the causeway (sec. 6-138).

Armament Jetty is located on the southeastern side of Ordnance Reach in a position 1 1/2 miles east by north of the north end of the causeway. This T-head jetty has depths of 24 feet alongside. A light is shown from each end of the T-head. A 27-foot patch lies in mid-channel about 1/2 mile westward of the southwest end of Armament Jetty. A LIGHT BUOY marks the south extremity of the patch.

A T-head jetty extends from the shore in a southeasterly direction for about 260 yards from a position about 1/2 mile northeastward of the north end of the causeway. A LIGHT is shown from each end of the T-head.

A red cliff is conspicuous about 1/2 mile northeastward of Armament Jetty. A white concrete pile beacon stands at low water mark about 200 yards westward of the red cliff.

Woodlands Jetty, about 800 yards north-eastward of the south end of the causeway, is a T-headed oil jetty with a dolphin on each side of the head. The jetty has a length of 575 feet and a depth alongside of 29 feet. Pilotage is not compulsory, but is advisable for berthing.

Ruthenia Pier is located about 1/4 mile northeastward of the south end of the causeway. Two MOORING BUOYS lie off the head of the pier.

Between Woodlands Jetty and Ruthenia Pier, the coastal bank, with depths of 12 feet and less, extends northward from the shore for about 300 yards. Two obstructions with depths of 8 feet lie on the bank.

6-160 Anchorage can be obtained in any part of Tebrau Reach where the depth is convenient except in the vicinity of submarine cables.

A quarantine anchorage, the limits of which are shown on the chart, is located in a mile long area north-northwestward of Palau Seletar.

Explosive anchorages are located eastward and southward of the entrance of Sungi Tebrau.

A number of mooring buoys are moored in Tebrau and Ordnance Reaches.

6-161 DIRECTIONS.—If proceeding through Serangoon Harbor, keep the summit of Bukit Mandai, on Singapore Island, bearing 272° and open just southward of the south extremity of Pulau Ketam. When the pavilion on the pier about 1 1/2 miles west-southwestward of Fairy Point bears 247°, alter course toward it to bring Malang Papan Light Beacon to bear 065°, astern, and pass southward of Squance light buoy. When Loyang Light Beacon comes in range astern with the smaller water tower southward of Fairy Point (sec. 6-145),

steer with these two marks astern and Biru Light Beacon bearing about 311°, ahead. When Seletar Light comes in range 291° with the new water tower at the naval base, steer on this range, passing southward of Buloh Light Buoy and northward of Perimbi Light Buoy. When Siniop Light bears 317° steer for it on that bearing. Having passed northeastward of Felkin Light Buoy, when Hutan beacon bears about 122° course should be altered to 302 to bring this beacon astern bearing 122° until Tebrau Range Lights come in range about 288 1/2°. This range leads in midchannel abreast the Naval Dockyard.

If proceeding to an anchorage off the causeway and having reached a position abeam of Rumah Merah, steer to pass northward of Denman Light Buoy. Then steer with the range beacons located about 1/2 mile westward of Red Cliff bearing about 053° astern. This course leads through the fairway of Ordnance Reach.

If entering Johore Strait through Nanas Channel, steer 340° for Tanjong Kopok, which course leads to the entrance of Nanas Channel. Pass northward of Henderson shoal and thence keep in midchannel, passing southward of the beacons close off Dawes Rock and Tanjong Gemok. The north side of Pulau Ubin is marked by four beacons, the positions of which can best be seen on the chart.

Between Woodlands Jetty and Ruthenia Pier, the coastal bank, with depths of 12 feet and less, extends northward from the shore for about 300 yards. Two obstructions with depths of 8 feet lie on the bank.

6-160 Anchorage can be obtained in any part of Tebrau Reach where the depth is convenient.

A quarantine anchorage, the limits of which are shown on the chart, is located in a mile long area north-northwestward of Palau Seletar.

Explosive anchorages are located eastward and southward of the entrance of Sungai Tebrau.

A number of mooring buoys are moored in Tebrau and Ordnance Reaches.

6-161 Directions.—If proceeding through Serangoon Harbor, keep the summit of Bukit Mandai, on Singapore Island, bearing 272° and open just southward of the south extremity of Pulau Ketam. When the pavilion on the pier about 1½ miles west-southwestward of Fairy Point bears 247°, alter course toward it to bring Malang Papan Light Beacon to bear 065°, astern, and pass southward of Squance light buoy. When Loyang Light Beacon comes in range astern with the smaller water tower southward of Fairy Point (sec. 6-145), steer with these two

marks astern and Biru Light Beacon bearing about 311°, ahead. When Seletar Light comes in range 291° with the new water tower at the naval base, steer on this range, passing southward of Buloh Light Buoy and northward of Perimbi Light Buoy. When Siniop Light bears 317° steer for it on that bearing. Having passed northeastward of Felkin Light Buoy, steer about 302° until Tebrau Range Lights come in range about 288½°. This range leads in midchannel abreast the Naval Dockyard.

If proceeding to an anchorage off the causeway and having reached a position abeam of Rumah Merah, steer to pass northward of Denman Light Buoy. Then steer with the range beacons located about ½ mile westward of Red Cliff bearing about 053° astern. This course leads through the fairway of Ordnance Reach.

If entering Johore Strait through Nanas Channel, steer 340° for Tanjong Kopok, which course leads to the entrance of Nanas Channel. Pass northward of Henderson shoal and thence keep in midchannel, passing southward of the beacons close off Dawes Rock and Tanjong Gemok. The north side of Pulau Ubin is marked by four beacons, the positions of which can best be seen on the chart.

CHAPTER 7

BANGKA (BANKA) STRAIT TO SINGAPORE STRAIT BY THE OUTER ROUTE AND BY RHIO (RIOUW) STRAIT

7-1 Outer route—General remarks.—Vessels bound from Bangka Strait to Singapore now seldom adopt the outer route to the eastward of the islands of Linga and Bintan, most vessels preferring to proceed by Rhio or Berhala Straits; it, however, forms part of the main route into the China Sea and is therefore of importance.

Tidal currents.—Between Tanjong Kalian, northern end of Bangka Strait, the Rhio and Linga Archipelagoes and Singapore, the average rate of the tidal currents, in the southerly monsoon is greater than in the northerly monsoon on account of the prevalent winds from that direction; nevertheless, in the latter monsoon greater rates have been observed than in the former.

The greatest rate observed in the northerly monsoon was 2 knots and in the southerly

monsoon $1\frac{1}{4}$ knots, whereas the average rates, on the contrary, were only $\frac{1}{2}$ and $\frac{3}{4}$ knot, respectively.

7-2 COAST (*H. O. Chart 3747*).—The coast of Sumatra from Batakarang Point, western side of northern entrance to Bangka Strait, trends north-northwestward for about 75 miles, to Tandjung Djabung. The entire coast is very low, covered with wood, and fronted by a mud bank that, within a depth of 5 fathoms, in places, extends about 13 miles offshore. It may be approached to a depth of 5 fathoms, except off Tanjung Djabung, where the 5-fathom curve is barely a mile offshore, with less than 2 fathoms close to its edge. Vessels bound to Berhala Strait, when approaching Tanjung Djabung, should keep about 8 miles offshore until it bears 270° .

The description of the coast northward from Tanjung Djabung continues in section 8-2.

A dangerous wreck, the position of which is approximate, lies sunk about 19 miles off the coast in position about 40 miles northward of Batakarang Point.

7-3 Off-lying islands and dangers.—Toedjoeh Eilanden ($1^{\circ}10'S.$, $105^{\circ}18'E.$) lie in the northeastern approach to Bangka Strait, in a position about 20 miles from the northern coast of Bangka Island. Bangka Strait and the Toedjoeh Eilanden are described in H.O. Pub. No. 71, "Sailing Directions for Soenda Strait & the Western & Northeast Coasts of Borneo & Off-lying Islands".

7-4 to 7-7 These sections have been deleted.

7-8 Saja Island ($0^{\circ}47'S.$, $104^{\circ}56'E.$), situated about 30 miles northwestward of the Toedjoeh Eilanden, is steep-to, of granite formation, covered with wood, and its summit is a double peak 689 feet high; the northern peak is about 60 feet less in elevation than the southern one, and both peaks are in range on a 180° and opposite bearing. On the northwest side is a small village off which one may anchor in 16 fathoms with the edges of Saja Island bearing 095° and 187° . The anchorage ground is poor. Njamuk (Njamook) Islets, formed of granite, steep, wooded, and uninhabited, lie at 1,000 and 1,600 yards northward of Saja. The rock between the Njamuk Islets is submerged at low water.

A wreck with mast above water lies $15\frac{1}{2}$ miles southward of Saja Island.

Saja Island is a good radar target at 19 miles distant.

7-9 Castor Bank is a ridge with a hard sandy bottom, with a least depth of 6 fathoms, and from 11 to 15 fathoms around; it is 9.5 miles in length in a northeast and southwest direction, and about 500 to 1,000 yards in breadth within a depth of 10 fathoms, except at the southern end, where it widens to about 3 miles.

The bank is famous for a species of red fish, named Ikan Merah, from their color.

Cowmans Bank.—At 6 miles westward of Castor Bank, and parallel to it, is a narrow bank of hard sand and shells, with here and there mud, known as Cowmans Bank. It is 8 miles long and has a breadth of from 500 to 1,500 yards within the 10-fathom curve and is steep-to; the least depth is 6 fathoms near its center.

Ilchester Bank (Alang Kalem) ($0^{\circ}27'S.$, $104^{\circ}58'E.$) is 2.5 miles in length in a northeast and southwest direction, within a depth of 3 fathoms and 6 miles in length within a depth of 10 fathoms, beyond which it is steep-to. The shoalest spot, $1\frac{1}{4}$ fathoms near its center, lies nearly 9 miles 193° , from Tanjung Djang Lighthouse.

A narrow bank, 4 miles in length, lies southward of Ilchester Bank; its shoalest spot of 29 feet lies $12\frac{3}{4}$ miles, 197° , from Tanjung Djang Lighthouse. Tanjung Djang Light is obscured over this bank and over the western portion of Ilchester Bank.

7-10 Singkep Island—General Remarks (*H.O. Chart 3747*).—Singkep is situated about 20 miles northward of Tanjung Jabung on the Sumatra coast, between which is Berhala Strait with the island of the same name about midway. Northward of Singkep is Lingga Island, with Selayar Island in the channel between. Off the western extremity of Singkep are the Rusuk Buaya Islands, separated from Singkep by Sebayur Strait.

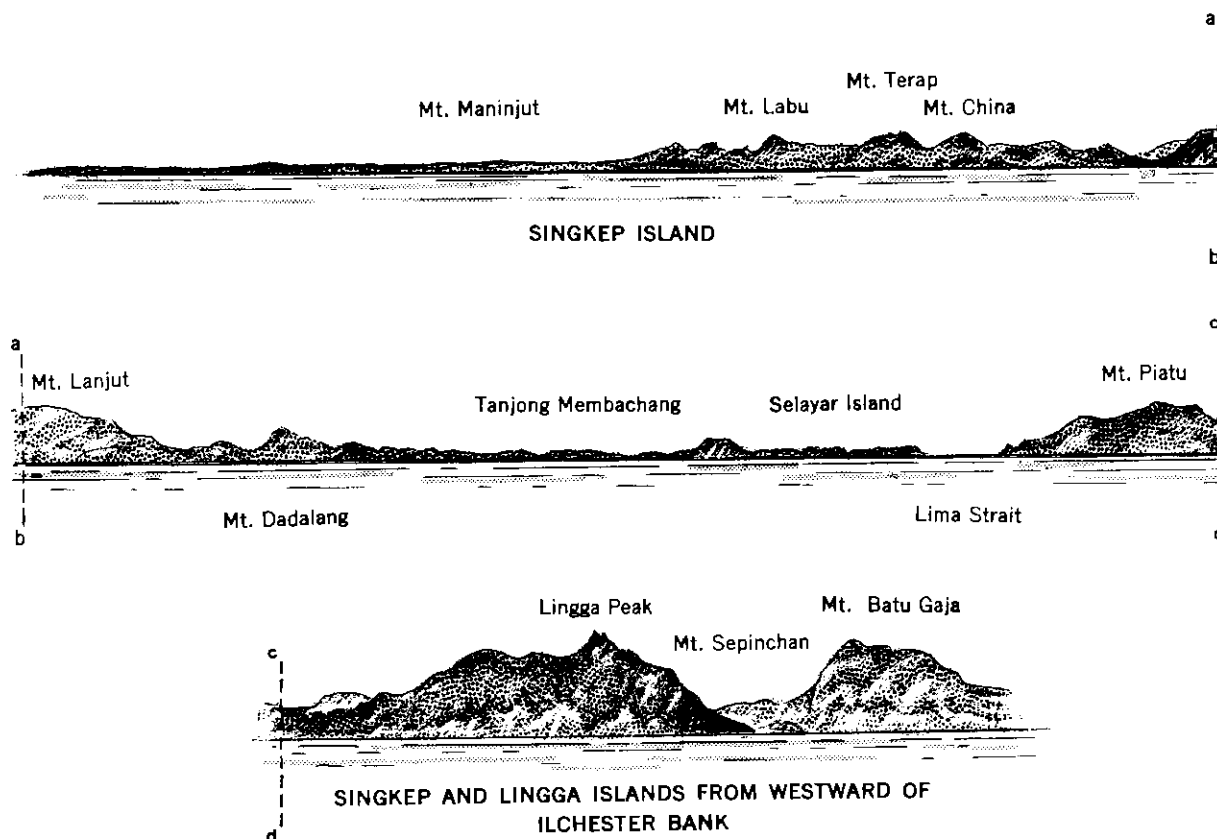
Singkep Island is about 20 miles in length and the same in breadth, much indented on its northern and southern sides. It is of considerable elevation, having on its northeastern side a range of hills, the summit of which, Mount Landjut (Landjoet), is 1,688 feet high. Mount Labu, the southern extremity of the range, is 1,432 feet high. Farther southward is Mount Manindjut (Maninjoet), 556 feet high. On the western side is Mount Bidei, 684 feet high. The remaining portion is low, with here and there an isolated hill.

It is only the eastern and northeastern coast of Singkep and the dangers off them which will be noticed here; the other portions of the group belong to the Inner Route, by Berhala and Durian Straits, and are described with those straits.

7-11 Eastern coast.—From Tanjung Malang, the southeastern point of the island, the coast has a northeasterly direction for 10 miles to Tanjung Pa Singkep, with Tanjung Tidja 2 miles beyond. The part between Malang and Pa Singkep is fairly thickly populated. The most important village is Dabo (Dabok).

Beacon.—A beacon with a white cylindrical top mark, marks a wreck which lies off the pier at Dabo.

Buoys.—A white conical buoy marks a $1\frac{1}{2}$ -fathom shoal northeastward of the wreck.



7-12 Pier.—The pier at Dabo is about 1,100 yards long with facilities for loading and unloading cargo. There are two tanks situated near the root of the pier, painted red and green respectively. An iron framework radio mast, 22 feet high, stands about ½ mile north-northwestward of the root of the pier.

7-13 Shoals.—From the Singkep Laut Islands (sec. 8-6) southward of Tanjung Malang, a shoal extends northeastward within the 5-fathom curve to a position 10 miles northeastward of Tanjung Malang. The central portion with depths of 1 fathom to 3 fathoms, is 8 miles in length, and its northern extremity lies 5.5 miles 164° from Tanjung Pa Singkep.

Buku, the southwestern point of Singkep Island, in range with the northern extremity of Keling Island, bearing 270°, leads southward of these shoals.

At Tanjung Tidja, the east point of the island, the 5-fathom curve is distant about 1½ miles, but eastward of the point a drying bank extends from the coast, and the 5-fathom curve is distant 5 miles in a northeast direction from Tanjung Tidja. About 5 miles northward of that point lies a bank nearly 4 miles in length, in an east and west direction, with depths of from 1½ to 3 fathoms; its eastern edge is about 5 miles from the coast.

The patch on its western edge dries at low water.

7-14 Lingga, an island, lying about 4 miles northward of Singkep, is about 35 miles in length, in a northwest and southeast direction; it largely consists of alluvial flats. The northern portion of the island is hilly, the peaks attaining heights of 664 and 742 feet; and at its southwestern part is Piek

van Lingga, a remarkable mountain attaining an elevation of 3,957 feet and split in two, which Horsburgh describes as "two peaks rising like spires from the summit of the mountain"; it is visible from a considerable distance in clear weather.

A 3 miles northeastward of Piek van Lingga is Mount Sepintjan, with a flat top, 3,371 feet high, and on its eastern slope is Batu Gadjah, the eastern side of which has a gray Y-shaped patch.

Daik (0°14' S., 104°38' E.), the principal village, is situated by the stream of the same name, on the western side of the shallow bay on the southern coast. At the mouth of the stream is a white stone pillar which is not visible in the offing. A little southward of it is a post from which a fixed white light (unofficial) is exhibited.

The channel to Sungai Daik over the coast bank is marked by three white pole beacons (unofficial) which should be left to the starboard on entering. In the channel along the pole beacons there is a low-water depth of 3 feet; elsewhere it is practically dry. There are no villages of any importance in Lingga.

There are no streams of any importance on the east coast.

7-15 South coast—Islets and dangers.—Between Tanjungs Bliung and Buar, the coast forms a shallow indentation, known as Lingga Bay, about 20 miles wide, the 3-fathom curve running almost straight across between the above points. From Tanjung Bliung to about 8 miles eastward there are various islets and reefs for which the chart should be consulted. Mepar and Kelombok are inhabited. The northwest point of the

coast reef of the latter is marked by a white ball beacon. Mepar is highest on the east side; on the north side is a village. It is fringed by a reef and lies within the 3-fathom curve, southwest of Tanjung Butun.

The islands of Badas, Kelombok, and Hantu, largely fringed by reefs which dry at low water, lie on a ridge with a depth of less than 3 fathoms which ends southward of Tanjung Bliung in a dry reef which consists of two parts. Between this reef and Tanjung Bliung is a channel with more than 5 fathoms of water, extending easterly between Mepar and Badas and northward of Kelombok. In the channel southward of Mepar is a small ridge with less than 3 fathoms of water on which there is a rock with 3 feet. Between Mepar and Kelombok are a few rocks, steep-to, on which the low-water depths range from 1 to 2 feet; the easternmost, however, uncovers at very low water. The east side of it is marked by a black beacon with a truncated cone top mark, as is also the drying reef west-southwest of Kelombok.

Mengalang Island is overgrown. Southward of this island are a few rocky patches, among them the Titi Mengalang, Ular, Sebanga, and Sebanga Laut. There are no dangers eastward of Mengalang within the 5-fathom curve, and it shoals regularly toward shore. Beyond the 5-fathom curve are some patches with less than 5 fathoms.

7-16 Tides.—The tides at Tanjung Butun, within the islets, are diurnal and subject to irregularities.

It is high water at about 9 hours in the forenoon on January 1, and about 2 hours earlier in each of the following months; springs occur about 3 days after the moon's greatest declination, with a rise of 7 feet and neaps, at a similar period after moon has no declination, with a rise of 1 foot.

About the second half of June and December springs rise $8\frac{1}{2}$ feet and neaps $2\frac{1}{2}$ feet and about the same time in March and September springs rise $5\frac{1}{2}$ feet with no perceptible rise at neaps.

During the semidiurnal tides springs occur $3\frac{1}{2}$ days after full and change, with high water at about 4h. 0m., and a rise of 2 feet; neaps happen at a similar period after the moon's quadratures, with high water at 10h., the rise amounting to 1 foot in the second half of June and of December, and being imperceptible in the second half of March and of September.

Tidal currents.—The flood runs to the westward at the rate of 2 knots.

7-17 Krandin Anchorage.—There is an anchorage in the cove between Tanjungs Asak and Pekaka in 13 feet of water off Krandin Village on the following bearings: Tanjung Asak 353° and Busing Island 120° .

In leaving the anchorage, head toward the west, passing northward of Kelombok, and anchor in the vicinity of the white ball beacon. This channel is clear with depths not less than 14 feet but should be navigated by day only on account of the many fishing inclosures which it is necessary to pass between.

Burning and Busing Islets lie on the eastern side of the bay, close to the shore southward of Tanjung Pekaka.

7-18 Directions for Daik.—Coming from Penuba Strait, pass between Tengah and Serang Islands. Bring Mount Pisang to bear 235° astern and steer 55° for the beacon with black truncated cone (on east side of drying reef west-southwest of Kelombok Island) until Badas Island, easily recognized by the high peak on the south side, bears north, when steer 65° for the south point of Kelombok Island. When the above-mentioned beacon bears north or the northwest point of

Kelombok bears 45° , steer 30° between this beacon and the beacon with white ball top mark (on the coast reef northwest of Kelombok) until the north and northeast points of Kelombok are in range, bearing 117° , when the course should be changed to east. When the northeast point of Kelombok bears 171° , bring this point astern and steer 351° to the mouth of the Sungai Daik which can not be distinguished from the sea.

One may anchor in 10 feet at low water springs.

In the channel from Badas are various fishing stakes, practically all of which have top marks. These stakes should not be confused with the official beacons.

7-19 TOWN.—Daik ($00^{\circ}13' S.$, $104^{\circ}38' E.$), the principal town, population 6,000, is prettily situated on the western shore of the bay, at a little within the entrance of the fresh-water stream of the same name. At the mouth of the river is a small house.

The stream is not more than 100 feet wide, and will only admit small craft, as its bar dries at low water spring tides; the channel through the mud, in the approach, is marked by three white beacons. Both sides near the entrance are densely wooded, and alligators are numerous. There is a well near the town.

7-20 Batu Kapal (De Hes Rock), a reef on which the depth is 1 fathom, lies 2 miles offshore and 3 miles westward of Tanjung Goro; it is marked by tide rips. Tanjung Djang Light is obscured over it.

Tanjung Goro, the southeastern point of the island, may be known by a saddle hill, 630 feet high, over it.

Between Tanjungs Goro and Djang is a shallow bight named Tolo Bay, on the western side of entrance to which is Kokau, a small hilly islet; 600 yards to the southward of the islet is Batu Maresoh, a rock just above high water.

Sunsa Island, about 1,000 yards southward of Tanjung Djang, has a hill, 325 feet high; a small wooded rock lies close westward, and 1,400 yards west-southwest of the islet there is a rock almost awash at low water.

A $1\frac{1}{2}$ -fathom patch lies almost 1 mile southeastward of Sunsa.

The outer extremity of the coastal reef on the west side of Sunsa Island is located 2,730 yards from Tanjung Djang Light.

Tanjung Djang, the eastern extremity of Lingga, from its prominent position, and the pyramidal peak, 556 feet high on its northern extremity, is conspicuous, and visible in clear weather from a distance of about 30 miles.

On the north side of the point are two small and shallow bays with sandy beaches. The eastern bay affords good anchorage during the south-southeast monsoon to vessels drawing up to 2 fathoms of water.

Light.—A light is exhibited from an iron framework near a stone dwelling 65 feet high on Tanjung Djang.

Islets—Rocks.—Merati Island, lying 1.5 miles eastward of the lighthouse on Tanjung Djang, is surrounded by a reef; nearly midway between it and the point there is a rock above water.

7-21 Coast.—The northeastern coast of Lingga is formed of numerous hillocks, from 200 to 300 feet high, which gives it a uniform appearance, but neither it nor the adjacent islets are safe to approach at night. The hills near the northern end of the island are 664 and 742 feet high, as before observed. Sandy beaches are met with in places along the coast.

A reef, with rocks awash on it, extends 1,000 yards offshore, under Mount Piatu, about 4 miles northwestward of Tanjung Djang; thence to Tanjung Takih, at the entrance of Limbung Bay, the shore is free from dangers. At the mouth of Liang River, there is a small pier of bamboo poles, from the head of which small native craft can take in or discharge cargo.

7-22 Outlying islands and dangers.—Selentang (East Domino Island), called Pulo Semat by the natives, is a sandy islet covered with trees, which are about 80 feet high. Selentang lies about 11 miles north of Tanjung Djang. It is surrounded by a reef which extends as much as $\frac{3}{4}$ mile from its north side. Two rocks, with depths of $\frac{3}{4}$ fathom and $1\frac{1}{2}$ fathoms, lie respectively about 600

yards and 1 mile southward of Selentang.

Temporary anchorage may be had on the western side of the island, in about 11 or 12 fathoms.

Budjang (Boedjang) Island ($0^{\circ}08'S.$, $104^{\circ}55'E.$), about 5 miles westward of Selentang, is hilly and wooded, with a peaked hill, 365 feet high, near its center; it is steep-to on the northeastern side but elsewhere is surrounded by a reef which dries on which, on the southeastern side, are two wooded rocks. Bulu village is situated on a bight on the southeastern side. Between the island and the coast the depths are from $5\frac{1}{2}$ to 7 fathoms.

7-23 Godjong Island, situated between Budjang and Tanjung Liang, is low and wooded; except on its southwestern side it is surrounded by a reef that dries and extends for a distance of 800 yards.

Malang Bilang, a rock 14 feet high, fringed by reef, lies 112° , distant 1,600 yards from Godjong Island, and **Pasir Pandjang**, a sandbank which dries and is 600 yards in length, is situated about 1 mile 051° from Godjong.

Terumbu Tjawan is about 1,600 yards in length, and dries; between it and the northern point of Budjang there is a narrow channel with a depth of 6 fathoms.

Maras Rocks (Meradinai), two wooded rocks, connected by a reef, lie about a mile southeastward of Kongka Besar Island, with a narrow channel between, in which there is a depth of 7 fathoms.

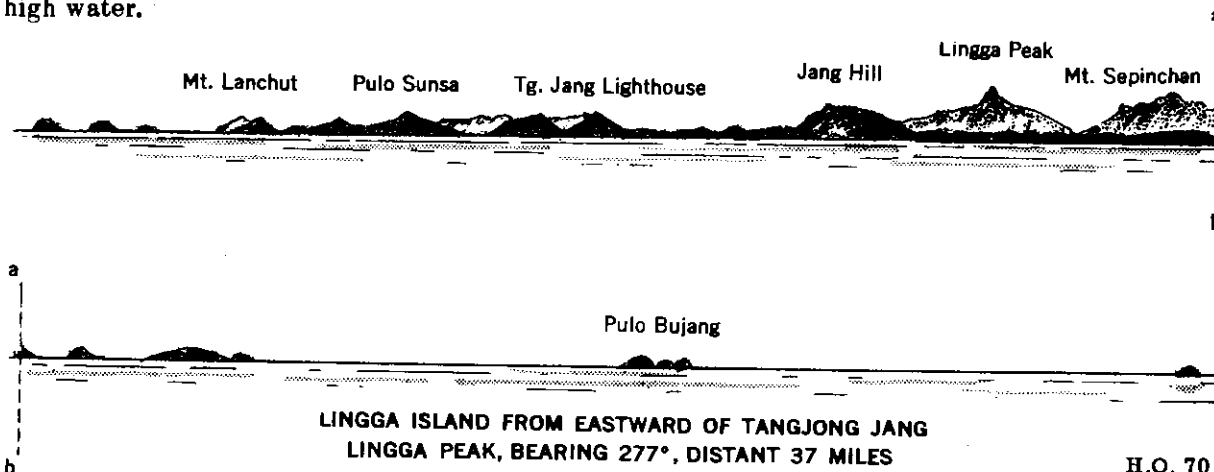
Midway between these rocks and Terumbu Tjawan there is a reef with two rocks above high water.

Kongka Besar (Great Domino Island) lies about 3.5 miles northwestward of Budjang and is hilly throughout its whole length, with some remarkable peaks; the eastern coast of the island is rocky and steep-to. A drying rock lies about 2 miles westward of the northwest point of Kongka Besar.

7-24 Kongka Kechil Island, 379 feet high, close westward of Kongka Besar, is separated from it by a narrow channel, with depths of $2\frac{1}{2}$ fathoms, which is used by small vessels; on its eastern side there is a Chinese village of charcoal burners. Two detached reefs lie southeastward of Kongka Kechil; on the northern one is **Penoh Island**, and on the southern there are rocks above water; they lie within the 5-fathom curve around the larger islands. At 1 mile 200° from Kongka Kechil is **Penoh Laut** on the southern end of a drying reef; southward of it is **Seranggang**, a small wooded islet.

Blading (Belading) Island is the largest of a group of islets and rocks lying about 1.5 miles northward of Kongka Besar. Reefs with rocks above water extend about 1 mile northwestward of it. A drying rock and a rock awash, close eastward of it, lies about $2\frac{1}{4}$ miles southwestward of the island.

7-25 Tidal currents.—The flood current runs in a north-northwest direction, parallel to Lingga, Sebangka, and the other islands, entering the channels between those islands and continuing to the northward. Off Rhio Strait it meets the flood current which comes southward along the eastern coast of Bintan and enters that strait.



This flood current passes through Temiang, Merodong, Dempo, and Abang Straits. Westward of these straits the flood current takes a general south-southeasterly direction, or in the opposite direction to the flood currents eastward of Lingga, passing southward through Chempa Strait and along the western coast of Lingga. About 10 miles westward of these islands there is not much current.

The flood currents through Temiang, Merodong, and Pangelap Straits meet off Kebat, at the northwestern end of Temiang, and cause heavy tide rips and eddies in that locality at certain times which it is dangerous to pass through. The flood current also passes northward between Mesana and Duyung, joining that coming westward through Merodong Strait. The flood current sets north-northwestward between Sebangka and Bakong, and also passes westward through Dasi Strait, and at times attains a velocity of 4 knots in that strait.

The ebb current through all the channels of straits referred to runs in the opposite direction to that given above, except where two or more currents meet or divide, when the general direction may differ.

In the very narrow channels, which are of no consequence to navigation, the currents often attain a rate of 3 to 4 knots, but in the wider channels they do not exceed from 2 to $2\frac{1}{2}$ knots.

Pulau Krokodil, about 15 feet high, lies 69° , distant 3.5 miles from Blading Island, with a reef at 600 yards westward of it. Patches of $3\frac{3}{4}$ to $4\frac{3}{4}$ fathoms lie between it and Kentar to the westward, as charted.

7-26 Kentar Island, situated 1.5 miles eastward of Tanjung Gantong, the southeastern point of Sebangka, is hilly, the highest part near its southeastern point being 394 feet high; when coming from the northward, and before the adjacent islands to the southward are visible, much resembles the hill on the southeastern extremity of Lingga.

From the southern side of the island, a bank, with less than 3 fathoms of water, extends about 1 mile. Nearly a mile beyond a narrow reef stretches 2.5 miles in an east and west direction, with $1\frac{3}{4}$ fathoms of water over it, and westward of this there is a sandbank nearly always dry. Between the east end of the narrow bank and the bank extending from Kentar there is a small reef with a rock above water named Anak Langu.

Light.—A light is exhibited from an iron frame structure 108 feet high on a hill at the southeast point of Kentar Island.

Kentar Island is a good radar target at 20 miles distant.

7-27 Bakau Island ($0^\circ 05' N.$, $104^\circ 45' E.$), lying about a mile northward of Kentar, is surrounded by a reef, and Tjandur (Tjandoer) and Beringin, two small islets, are situated on the reef about a mile northward of Bakau.

A reef which dries lies about 1 mile 275° from Beringin.

Kapas, a rock 2 feet high at the northern end of a reef lies nearly 4 miles 316° from Bakau.

A shoal, with a depth of $4\frac{1}{2}$ fathoms lies nearly 1 mile 150° from Kapas. Karang Busung, a reef about 1 mile in length in a north-eastward and opposite direction, lies about 1 mile 305° from Kapas.

A $4\frac{3}{4}$ -fathom patch lies about $2\frac{1}{2}$ miles westward of Karang Busung.

A shoal, with a least depth of $2\frac{1}{4}$ fathoms, lies about $2\frac{3}{4}$ miles eastward of Bakau Island.

Pollux Rock, with a depth of 2 feet and 10 and 11 fathoms close-to, is situated 025° , distant 6 miles from the summit of Bakau, on the southern side of the eastern approach to Temiang Strait.

7-28 Sebangka is an island between Linga and Temiang Islands. It is 19 miles in length between Tanjung Gantong, its southeastern extremity, and Utanbesar, its northwestern

extremity, with a maximum breadth of about 3 miles. Its summit near its center, southward of Kelombang village, is 512 feet in height, and the hill northeastward of Tanjung Gantong is 438 feet.

Reefs, dry at low water, front the northern side of Tanjung Gantong, western side of the channel between Bakau and Kentar and that point; they are rendered visible from the discoloration of the water.

Kelombang Rocks ($0^{\circ}09' N.$, $104^{\circ}36' E.$), are situated on the reef fronting the shoal off the village of the same name, with Rangus Rocks northward of them.

A patch of $2\frac{1}{4}$ fathoms lies 1,500 yards offshore, at 5.5 miles northwestward of Kelombang Rocks. Limas, is an island at the northern extremity of Sebangka, is connected with it by a reef. A patch of 3 fathoms lies about 1 mile northward of the northern point of Limas, and there are rocks above and below water extending about 1 mile westward of the northern point.

Anchorage.—At some distance off the northeastern coast of Sebangka good anchorage may be obtained in depths of from 7 to 8 fathoms, over sand.

7-29 COAST.—Limbung Bay lies on the east coast of Lingga westward of Tanjung Taki and within the islands and reefs just described. It is shallow, with depths of about 2 fathoms, and has several rocks and reefs dry at low water. It is only available for small craft.

The shores of the bay are low, with a sandy beach, and covered with vegetation. The bottom, over the greatest portion of the bay, is mud. There are several Chinese settlements, and on the west side is Limbung, the principal village.

Hantu, a small islet, low and sandy, lies on the southwestern end of a reef dry at low water, and situated 1,000 yards off Tanjung Taki, the eastern point of the entrance. Three rocks, dry at low water, lie about 1 mile 233° from Hantu.

Empoh, a small islet, low and wooded, lies at the extremity of the 3-fathom curve, at 2.7 miles 326° from Hantu. There are sunken rocks around it.

The bay contains several islets and rocks. In the southern portion are Telcm, Seranggas, Barok, and Kekek, low, wooded islets. At 1,000 yards 340° from Kekek is a drying reef, and on the western side of Kekek there are other islets and reefs.

Udjung Beting Island, nearly 4 miles in length, and the largest in the bay, has tolerably steep hills on its eastern side, which slope toward the west. On its southern end, there is a reef which extends 1,000 yards.

Hitam is an islet which lies eastward of Udjung Beting Island and is connected with its southern end by a reef. On the northeastern side of the latter island is a reef extending 1,200 yards and a rock which dries at low water. Pongo Island lies between the southern end of Udjung Beting Island and the coast, with Basing Island on the reef extending from its northwestern end. Tikus and Malang Tikus are overgrown rocks above water, each surrounded by a reef and lying southward of Pongo.

7-30 Directions.—Being within the outlying islands and dangers steer to pass in the fairway between Hantu and Hitam Islets, keeping toward the latter, to avoid the three rocks west-southwestward of Hantu, then steer to the southwestward between the drying reef northward of Kekek and the rocks or islets off the western shore, anchoring westward of Kekek in about 2 fathoms over mud.

Coast.—From Limbung Bay the coast trends in a northwesterly direction for 5 miles to Duara River, which flows out of an inlet named Semarong Bay, in which are Senanyai, Panju, and Seningka, three tolerably large villages, and into which the Resun and Semarong Rivulets discharge. Further northward on this coast is Sekana village, between Tanjungs Lundang and Vwa.

7-31 Alut Island, 512 feet high, and 3.5 miles in length, lies northwestward of Udjung Beting Island, near the middle of a chain of islands 12 miles in length, including the latter island, and parallel to the shore. Ileuh lies 2 miles northwestward of Alut, with Lutong and Mutus between and Berang, 242 feet high northwestward of it. Between these and the shore are reefs, dry at low water, with Beraï Island on the largest, and at 1 mile eastward of Ileuh is Anak Ileuh, with foul ground extending about 2 miles southeastward of it.

Inshore of Alut and the islets northwestward of it is a channel with depths of not less than 3 fathoms in the fairway. An isolated patch with a depth of $1\frac{1}{2}$ fathoms is located on the northeastern side of this channel about 1 mile westward of Lutong.

A $2\frac{1}{2}$ -fathom patch lies about 1,400 yards westward of Anak Ileuh.

Burung Island, 142 feet high, lies in the fairway, within Sebangka Island, at 3.2 miles northwestward of Berang, with reefs extending 1 mile southeastward of it. A 4 miles westward of Burung is the eastern entrance of Dasi Strait. A small drying coral reef lies about 1 mile westward of Burung Island. A $4\frac{3}{4}$ -fathom patch lies about $\frac{3}{4}$ mile westward of the same island.

Anchorage.—Eastward of Alut, between it and the Kongka Islands, there is a wide space in which there is good anchorage in depths of 4 to 5 fathoms, mud and sand bottom.

7-32 Islands and channels between Sebangka and Bakong.—Burung Island, which lies in the fairway of the southern approach to these channels, has been described above.

The following islands separate the channel on the Sebangka side from that on the Bakong side: Ujung Kaju Island, the southernmost; Mamut, 389 feet high, the central and largest; and Tapeuh, the northernmost; besides smaller islands and islets with narrow passages between. Lokong, 85 feet high, in the fairway of the eastern passage, lies abreast Mamut, and Monong lies abreast it close over to Sebangka.

This eastern channel has depths of 10 fathoms and more as far northward as Setmu Island, thence the fairway is through Selat Ayer Raja, a narrow passage between that island and Pasir Gagah, in which the tidal currents are strong at times; thence apparently eastward of Liang, and of Selih Islet or reef into Temiang Strait, avoiding charted reefs. The latter portion is not charted on a sufficiently large scale for it to be used by other than those locally acquainted with it. Both the east and west channels are used by Chinese trading vessels visiting Lingga.

The western channel lies between the central islands, above mentioned, and Buli, Rekas, Tapai, and Tigi, and some unnamed islets and rocks northwestward of Tigi. The southern entrance is narrow abreast Buli and the island next northwestward, off which there is a shoal with $\frac{1}{4}$ fathom of water, but the channel is deep, about 12 fathoms. The northeastern side of the channel at the southern entrance is formed by a small islet and rocks above and below water extending nearly 2 miles southeastward of it. The northern entrance is obstructed by a shoal with a least depth of $1\frac{1}{2}$ fathoms, leaving only narrow passages on each side of it. A rock with less than 1 fathom lies in the western of these two passages, and a $3\frac{1}{2}$ -fathom patch lies in the eastern one. Local knowledge is essential for the navigation of this channel.

7-33 SETTLEMENTS.—There are small villages on the islands. The principal settlement is on Monong, on the Sebangka side.

7-34 Islands and dangers between the approaches to Temiang and Merodong Straits:

Mesana (Mesanak) Island, located 7 miles northward of the north extremity of Sebangka, has the form of an elbow, of which the long arm extends $4\frac{1}{2}$ miles in a north and south direction and the short arm 3 miles east and west.

Ridges of hills extend the whole length of both arms, the highest point, 351 feet high, being where the arms meet.

On the eastern side of Mesana the coast reef extends for a distance of 1,400 yards, and close to the rocky east point, and connected to it by a reef, is Kuju Island, small but moderately high. About 2 miles north-eastward of the eastern extremity of Mesana are some patches with $2\frac{1}{2}$ to $3\frac{3}{4}$ fathoms, called Madgeburg Shoal. A depth of $5\frac{1}{2}$ fathoms lies about $4\frac{1}{4}$ miles east-north-eastward of the same point. Two rocks which cover at high water lie nearly $\frac{1}{2}$ mile off the north side of the island and about 1 mile eastward of Observation Point, the northwest extremity of the island. Patches of $3\frac{3}{4}$ fathoms lie about 300 yards north-westward of the rocks mentioned above and about 400 yards northward of Observation Point.

Westward of the island foul ground extends westward to Merodong and other islands.

Mesana Island is a good radar target at 10 miles distant.

ANCHORAGE.—Good anchorage may be obtained, in 6 to 8 fathoms, mud, and sand, from 2 to 5 miles eastward of the east point of Mesana.

7-35 NJAMUK ISLAND ($0^{\circ} 20' N.$, $104^{\circ} 33' E.$), 183 feet high, and located about $1\frac{1}{2}$ miles southeastward of the south point of Mesana, is surrounded by a reef which extends a mile northeastward of it, with several drying rocks, and it is generally breaking. In the channel between Njamuk and Mesana there is a sandy islet with some trees; the channel is apparently choked with rocks.

It was reported (1963) that Njamuk Island was a good **RADAR TARGET** at 12 miles distant.

An extensive shoal about $\frac{1}{2}$ mile in length with a depth of 5 fathoms, lies with its outer edge about $1\frac{1}{2}$ miles eastward of the east extremity of Njamuk.

7-36 MERODONG GROUP lies to the westward of Mesana, between it and the Temiang group. It comprises six islands, separated by channels unsuitable for navigation unless buoyed, and there is no object in venturing among them. Merodong, the northern island, is 610 feet high, and its conical peak is one of the principal landmarks for making Rhio Strait.

Madang (Medang) Island, southwestward of Merodong, comprises two low islands

covered with mangroves; a reef, which dries, surrounds the greater part of the northern island, extending on the northern side for a distance of 600 yards. Reefs, dry at low water, lie between the northern island and Merodong, and a patch of $4\frac{3}{4}$ fathoms, steep-to, lies about $\frac{3}{4}$ mile northwestward of the west extremity of the island.

Between the southern Madang and Doejoeng (Dujung) Island, southeastward of it, are several reefs, and one off the southern extremity of Madang, as charted.

Doejoeng Island, the southernmost of the group, is hilly and is surrounded by reef. There is a village with coconut trees on its southern coast.

Desie and Salamanang Islands lie northward of Doejoeng, and apparently are all on the same reef; both islands are hilly, and the rocks overgrown with vegetation.

Rocks, dry at low water, extend 1,600 yards, 018° , from the northwest extremity of Merodong, south side of Merodong Strait; and a rock, awash at low water, lies 081° ; distant $1\frac{2}{5}$ miles, from the same extremity, with a rock with less than 6 feet of water between. Banks, with $2\frac{1}{2}$ fathoms or less water, encumber the channel between these dangers, and Mesana, and in its south part, eastward of Salamanang and Doejoeng, are the wooded Botjong Rock and other rocks. This channel is not navigable unless buoyed.

7-37 FREDERICK (Admiral Stellingwerf) REEF ($0^{\circ} 37' N.$, $105^{\circ} 09' E.$) is the outermost of the reefs lying off the southeastern coast of Pulo Bintan. It is a rock, covered with coral, nearly 600 yards in length, and with a least depth of $1\frac{1}{2}$ feet and is steep-to, there being depths of 19 to 20 fathoms fairly close, except at the northeastern side, where irregular depths of from 10 to 11 fathoms extend 2 miles off.

CAUTION.—In light winds the reef may be distinguished by the discoloration of the water, but with a fresh breeze it is difficult to distinguish breakers from the swell except when the tidal current is setting against the wind with a comparatively smooth sea.

DIRECTIONS FOR CLEARING.—As this dangerous reef lies in the direct track of vessels, the utmost care is necessary to avoid it. A vessel will keep eastward of it by not going into less than 25 fathoms and to the westward of it by keeping Gunung Kuas on Bintan and Buruan Island, 295 feet high,

well in sight, until the latter bears 290°, which leads well northward of the reef.

7-38 TIDAL CURRENTS.—Off Pulo Bintan at the change of the monsoon in April, the flood current runs southward for 18 hours, and the ebb northward for 6 hours. In June the periods are reversed, consequently a current against the southwest monsoon will only take place a few hours each day.

SANDBANK.—At about 9 miles 306° from Frederick Reef is the northern termination of a narrow sand ridge, with depths of from 6 1/2 to 10 fathoms, and steep to on its eastern side. From this extremity the bank trends in a southwest and westerly direction for about 33 miles to Mesana Island, at the entrance to Merodong and Rhio Straits. In the northeast monsoon, when rain and thick weather are experienced, obtaining soundings on this bank will afford a good guide to clear Frederick Reef and Geldria Banks, and avoid anchoring in deep water.

7-39 EAST COAST OF PULO BINTAN—DANGERS.—Numerous islands and dangers extend for a distance of 20 miles off the east coast of Pulo Bintan. Vessels making the passage between Banka and Singapore Straits should generally pass outside, or to the eastward, of the whole of these islands and dangers. The whole coast and the islands off it are as a rule fringed with coral.

7-40 ASPECT.—Kijang, a number of variously shaped hills, are located on the southeastern side of Pulo Bintan; the southernmost is 784 feet high; Gunung Kuas (Koeas) (0°52' N., 104°35' E.), a blunt cone, 795 feet high at 4 miles southwestward of them, has a summit in the form of a truncated cone. Sharp Rock (Temborah), 462 feet high, is located on the east side of Kelong Island, eastward of Kijang Strait.

7-41 KIJANG (Kidjang) STRAIT (0°50' N., 104°37' E. H.O. Chart 5877) is a narrow passage between the southeast coast of Pulau Bintan and several small islands immediately off that coast. Tanjong Tili the south extremity of Pulau Bintan, marks the west side of the south entrance of Kijang Strait. The distance from Tanjong Tili to the north entrance of Kijang Strait is about 8 miles. The north part of the strait is unmarked and used only by small vessels with local knowledge. The

south part is suitable for use by vessels inbound for Sungei Kolar, a port located on the west side of the strait about 2 1/2 miles north-northeastward of Tanjong Tili. A BAR restricting the south entrance extends from Tanjong Tili for about a mile in an east-northeastward direction to the southwest extremity of an adjacent island. Two range BEACONS, located about 1 1/2 miles north-eastward of Tanjong Tili, lead across the bar in a least depth of 16 feet. The entrance channel is marked by buoys. An overhead cable, with a clearance of 148 feet, crosses the channel about 400 yards south of the berth at Sungei Kolar.

Vessels leaving Sungei Kolar pass north of Pulau Mana, a small island in the middle of Kijang Strait about 1/2 mile north-northeastward of Sungei Kolar, thence east and southward through Selat Dendang, and south and southwestward through Selat Kelong. These channels are marked by buoys and beacons. Navigational orientation in this area can best be had by reference to the chart. It is reported that ships drawing 28 1/2 feet have cleared Sungei Kolar via these channels.

A CHANNEL, which is marked by beacons, leads into Kijang Strait from southeastward of Pulo Kelong. It passes northward of two drying reefs lying a little less than 1/2 mile northward and northwestward of Pulo Kambat, an islet located about 1 mile southeastward of Pulo Kelong. A BEACON marks the northwest drying reef. From thence, it passes northward of Pulo Rusa Besar. A 4 2/3-fathom shoal lies in midchannel about 700 yards west-southwestward of the southwest point of Pulo Kelong. CAUTION is advised in the navigation of this channel, as it has not been thoroughly examined in recent years.

A red can buoy, surmounted by a cylinder, is moored about 650 yards north-northeastward of Pulo Rusa Kechil.

A SWEPT CHANNEL from Kijang Strait, dragged to a least depth of 7 fathoms (1955), leads eastward and then northward to a position northeastward of Mapor Island.

From a position about 1/2 mile northwestward of Kambat Island, proceed east-northeastward for 4 miles until Boroës Island bears 150°. Thence, steer eastward for 7 miles until Marapas Island bears 038°. Then, steer north-northeastward until Marapas Island bears 112°. From thence the

swept channel leads northward for about 8 miles to its seaward end.

7-42 TIDAL SIGNALS.—The following tidal signals are shown from the wharf at Sungei Kolar:

A cylinder below a cone, point up, indicates that the tidal current is flowing in.

A cylinder above a cone, point down, indicates that the tidal current is flowing out.

A cylinder above a cone, point down, and below a cone, point up indicates slack water.

PILOTAGE AND PRATIQUE.—A vessel bound for Sungei Kolar from an infected port should call at Pulo Sambo for pratique. If she has a clean bill of health, she may proceed directly to Rhio for a pilot. (See section 7-99.) Vessels should arrive before 1430 hours local time if they expect pilotage to Sungei Kolar the same day. A pilot for Sungei Kolar may also be boarded 1/2 mile southward of Tanjong Tili; in this case, the vessel should arrive before 1700 hours for pilotage the same day. Pilotage is compulsory for a vessel whose gross capacity exceeds 750 cubic meters.

Permission must be obtained to enter Kijang Strait.

7-43 SUNGEI KOLAR (Sungei Kolak) (Kijang), a bauxite port, is located about 3 miles northward of the south entrance of

BERTHAGE.—There is no concrete quay the ship is moored alongside dolphins and two jetties. The maximum-sized vessel that can be berthed is 525 feet. The maximum

draft that can be taken depends on the depth over the bar, but a draft of 27 1/2 feet is always acceptable. Bauxite is loaded at 100 to 250 tons per hour by means of two booms and conveyor belts. The height of the loading vessel from the waterline to bulwark or hatch top must not exceed 32 feet.

Vessels must moor with four manila lines forward and four aft, and on spring tides wires must also be used. A special watch over the moorings must be kept during the ebb tide which runs from south to north.

SUPPLIES.—Fresh provisions, potatoes and cigarettes are usually obtainable when ordered in advance. A limited quantity of lubricants in barrels can be supplied in an emergency. There is a ship chandler. Fresh water and bunkers are obtainable at Tanjung Uban (sec. 7-111).

REPAIRS.—Minor repairs can be made at the bauxite plant.

MEDICAL.—A doctor is in the port.

7-44 OFF-LYING ISLANDS AND REEFS.—GIN BESAR, Gin Kechil, and Numbing, close eastward of Gin Kechil, are three islands, which are together about 5 miles in extent, lying from 8 to 13 miles southeastward of Kuas Hill, and separated from each other by narrow channels; that along the southern side of Gin Besar has depths of 3 3/4 to 8 2/3-fathoms, but its entrances are more or less foul. Several hills on the islands are from 200 to 254 feet high, and one, rising about the center of Gin Besar, is 254 feet high and has a solitary tree on it. It is a prominent mark when making Rhio Strait.

7-45 SENDARA STRAIT is the channel between the Gin Islands and Pulo Telang. In it are some banks with less than 3 fathoms, and off the coast reef of Telang are some drying patches. At its northern end off Gin Besar is Rinti, with a small islet northward of it, both surrounded by reef. These obstructions combine to make the passage unsafe except to those acquainted with it.

The dangers southeastward of Pulo Telang that lie in the approach to Sendara Strait are described with Pulo Telang in section 7-78.

7-46 PULO TEROTI, the southernmost of a cluster of islets, lying to the southeastward of Numbing, is 112 feet high and 2 1/4 miles southeastward of that island. Rusah (Roesah), composed of two rocks on a small drying reef, lies between Teroti and Numbing, and there are several rocks above and below water between these islets and Numbing.

Pulo Buruan (Beruan) lies 5 1/2 miles north-northeastward of Teroti, and being 295 feet high, and saddle shaped, it is conspicuous and easily recognized.

Geldria Banks are the outermost dangers, lying 13 or 14 miles eastward of Gin Islands well out toward the fairway of vessels proceeding between Bangka and Singapore Straits, especially such as pass westward of Frederick Reef. Their northeast extremity lies distant 13 1/2 miles from the east extremity of Numbing, whence the banks extend in a southwest direction for about 3 miles, having rocky heads with depths of 3 to 5 fathoms over them, and from 15 to 20 fathoms close to the east or seaward side.

RALEIGH SHOAL lies 3 miles westward from the southwest extremity of Geldria Banks, and has a depth of 3 1/4 fathoms over coral bottom, 5 miles 107° from Pulo Buruan. Several shoal patches lie northward and southward of it.

A PATCH, of coral and sand, nearly 1 mile in length, with 3 3/4 fathoms of water, lies 3 miles southwestward of Raleigh Shoal, 4 1/2 miles 143° from Pulo Buruan.

7-47 BOAT ROCKS (Kaju Ara) 0°49'N., 104° 57' E.), lying about 2 1/2 miles northward from the north end of Geldria Banks, are three low rocks, the highest 13 feet above high water. A rocky patch, with 5 1/2 fathoms of water over it, lies about midway between. There are eddies or tide rips near these dangers.

PULO MERAPAS is the outer and eastern island off the eastern coast of Bintan. It is 264 feet high, covered with trees, and is steep-to at 600 yards off.

Pulo Merapas is a good radar target at 18 miles distant.

From a position 4 1/2 miles west-by-southward of the western extremity of Pulo Merapas, a sandy shoal with depths of 4 1/2 to 6 fathoms extends about 5 miles south-southwestward.

7-48 DIRECTIONS FOR CLEARING.—Pulo Teroti, bearing 270°, leads southward of Geldria and other shoals; Boat Rocks in range with Pulo Buruan leads northward, and Merapas Island, bearing 333°, leads eastward of them.

PULO MAPOR an irregular-shaped hilly island, from 3 to 4 miles in extent, lies about 8 miles off the eastern coast of Pulo Bintan; its northwestern point is 354 feet high, and has on it a conspicuous tree. Rocks extend about 1 mile off its northeastern point; and there are others, some above water, off its southeastern point, the outer one of which, named Bare Rocks, are 55 feet high. Melibon, a pyramidal-shaped islet, 88 feet high, lies 1,200 yards from the northwestern point.

Pulo Mapor is a good radar target at 17 miles distant.

7-49 Anchorage.—On the eastern side of Pulo Mapor the coral reef, which as a rule fringe all the islands off the eastern coast of Bintan, as well as that coast itself—is absent, leaving a small sandy bay, where vessels may anchor in 5 to 6 fathoms, about 1,500 yards offshore. As the bottom in parts of this bay is foul, care must be taken to keep Bare Rocks open eastward of Tree Islet, 58 feet high, off the southern extremity of the bay.

Passage Rock, 26 feet high, lies about 1,500 yards northward of the northeastern point of Pulo Mapor; there is a rock about 1,500 yards northeastward of the point.

7-50 Pulo Sentoet, 144 feet high, and of sugar-loaf form, lies about $2\frac{1}{2}$ miles northwestward of the northeast extremity of Pulo Mapor. It is steep-to on the northern side, but a reef extends 1,000 yards from its southern extremity.

Pulo Sentoet, with Middle Rock, Black Rock, and Pulo Berlangkap lying north and northwestward of Pulo Mapor, form a sort of chain stretching from outside the dangers off the north coast of that island to the shore of Pulo Bintan. Though there is a wide channel within Pulo Mapor, no vessel without local knowledge should attempt it.

There are several islets off and near the coast of Bintan. The most conspicuous of these is Pulo Nekoa (Nikoi), 200 feet high, and on which is a conspicuous tree. It forms the western side of the northern entrance to the channel within Pulo Mapor.

Middle Rock is a pinnacle, awash at low water, and depths of 11 fathoms close to, lying 287°, distant 3.8 miles, from Pulo Sentoet.

Black Rock, 22 feet high, with a smaller rock close to its southern side and depths of 13 to 17 fathoms around, lies 6 miles 295° off Pulo Sentoet.

Pulo Berlangkap is an islet 90 feet high, lying 5 miles northwestward from Black Rock and nearly 2 miles off Tanjung Berlangkap.

A dangerous sunken rock with less than 16 feet of water over it lies about 2 miles northeastward of Pulo Berlangkap. A wreck is stranded on this rock.

7-51 COAST—Landmarks.—From Tanjung Berlangkap to Tanjong Berakit (sect. 6-94), 8 miles northward, the northeastern coast of Pulo Bintan forms a bay indented with several bights or coves. Over the point, at about 1 mile northwestward of Tanjung Berlangkap, is a conspicuous tree the top of which is about 288 feet high, and at 2 miles within is a hill 359 feet high.

Three-quarters of a mile northward of this hill, close to the coast, is another, named Double Tree Hill, 334 feet high.

The coast of this part of Pulo Bintan is for the most part fronted by a reef which projects in some places to the distance of 1,000 yards, and just to the northward of the point upon which stands the conspicuous tree is a ledge of rocks, between which and the point northwestward of it is Boat Cove, apparently a convenient place for landing.

Tides.—It is high water, full and change, approximately, at Pulo Sentoet at 3 hours 40 minutes; at Pulo Buruan at about 6 hours 0 minutes; the spring rise is about 9 feet.

Tidal currents.—During the shifting months of the monsoons the tidal currents are

regular, but during their strength the surface current will be always more or less governed by the wind.

The flood tidal wave comes from the northward, and runs nearly parallel to the eastern coast of Pulo Bintan, along its southern side toward Abang Strait, and to the northward in Rhio Strait, meeting another flood current from Singapore Strait, near the town of Rhio.

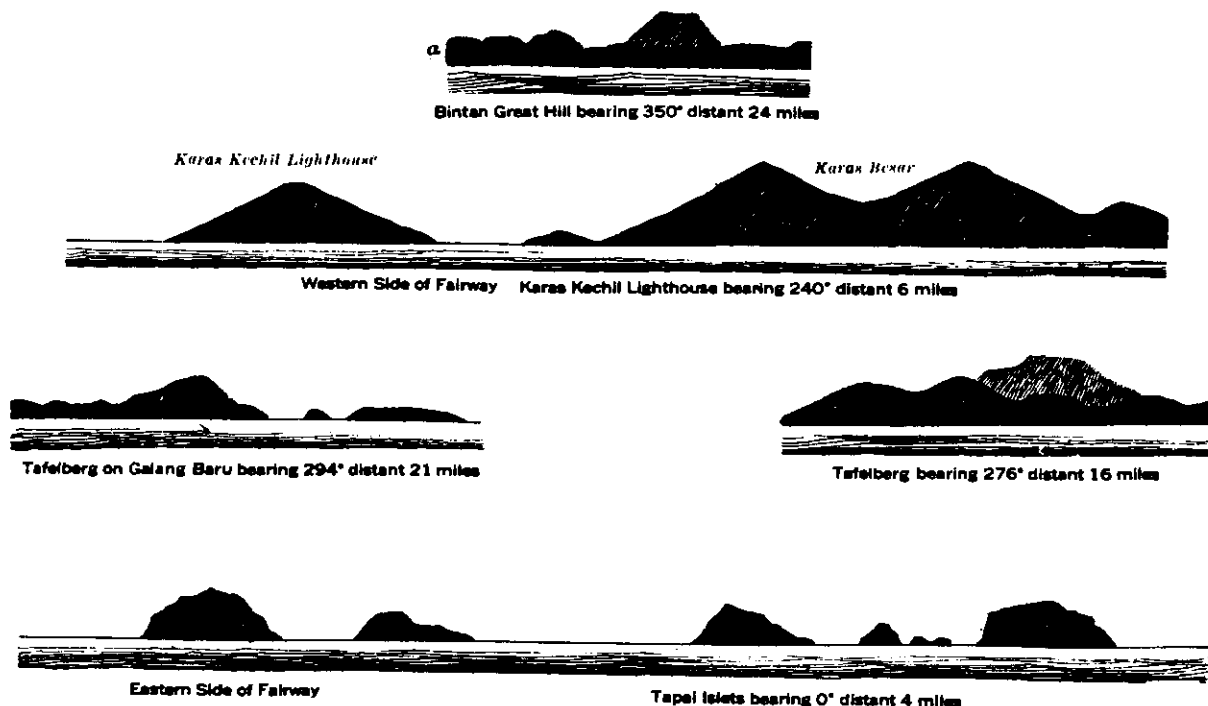
The flood sets to the southward along the eastern coast of Linga, and close to Tanjung Jang, its southeastern extremity, thence it runs westward to Penuba Strait and obliquely across Linga Bay to Berhala Strait. From Tanjung Jang to Saya Island and onward to Bangka Strait its direction is nearly south; another current from about 2 miles southward of Saya Island sets toward Berhala Strait.

The ebb current sets in the opposite or northerly direction, and the meeting of this current from Bangka and Berhala Strait was observed to take place between Saya and Tuju Islands.

7-52 SUPPLIES.—Water can be obtained in cove on Pulo Bintan as charted.

7-53 Rhio (Riouw) Strait (*H. O. Charts 1205, 3747*)—General description.—The route from Bangka Strait to Singapore, eastward of Linga and through Rhio Strait, was the one commonly adopted by vessels proceeding either way between Sunda Strait and Singapore, as being safe, sheltered, and easily navigable, the Netherlands Government having placed lights and beacons on many of the dangers; whereas the route eastward of Pulo Bintan is exposed in both monsoons, and the fairway is encumbered with many dangers, which render it necessary for vessels to keep at a considerable distance from the land. Rhio Strait is available for all classes of vessels, both by day and by night.

SOUTHERN APPROACH TO RHIO STRAIT



Rhio Strait, the southern limit of which is between Mesana and Telang, is bounded on the east by Pulo Bintan, and on the west by the chain of islands of which Galang, Rempang, and Batam are the chief; numerous smaller islands and shoals front the main shores on each side of the strait, and much contract the width of its main navigable channel. The strait is about 50 miles in length, in a northwest and southeast direction, having depths ranging from 6 to 20 fathoms in the fairway, the least depths being in the southern portion of the strait. Better water than 6 fathoms could be carried, for which see the chart.

The southern entrance of the strait is about 17 miles wide, for a distance of 11 or 12 miles, contracting to 3.5 miles between Little Karas Island and the shoals southward of Tapai Islands. About the middle of the strait, and 3.5 miles northward of Great Karas Island, is Pulo Pangkil, with dangers extending 5 miles southeastward from it; between these and the dangers northward of

Great Karas Island is the principal channel, about 2 miles wide, with fairway depths of 10 to 20 fathoms, bounded on the west by Mubut Laut Island, and the islets and dangers within it, off the northeastern end of Pulo Galang. The principal dangers are buoyed or beacons. The shores of the strait are, for the most part, sparsely populated, the greater portion of the population consisting of Malays, and the remainder Chinese.

At Pulo Lobam, about 10 miles northward of Pulo Pangkil, the strait is also about 2 miles in width between Johannes Shoal and Orion Rock, the narrowest part of the strait.

Northward of Tanjung Uban, the western extremity of Pulo Bintan, the strait rapidly widens to its northern entrance, where it is about 10 miles in breadth.

CAUTION.—The center of a submarine exercise area is located about 5 miles north of the north entrance to Rhio Strait. (See sec. 6-1.)

7-54 West side of the approach.—The islands and dangers bordering the approach to Rhio Strait only are described here. Mesana Island forms the southern side of the entrance of Merodong Strait, and west side of approach to Rhio Strait.

Landmarks.—Mesana and the dangers outlying it have been described with the outer route, and Merodong Peak has also been referred to as being a useful mark from the offing, and is here again mentioned, as it is a prominent mark in making Rhio Strait.

Gin Islands, on the opposite side of the approach to Rhio Strait, are also a good mark.

The shores of the strait are heavily wooded and at various places small villages are located.

Merodong Peak, see section 7-36, seen from the southward, presents a conical appearance, and, being the only hill of this feature in the vicinity, is conspicuous. It is one of the principal objects which will enable a stranger to identify the entrance to Rhio Strait, for it can nearly at all times be seen over Mesana as the strait is approached. The hill, from the peak, forms a shoulder to the northwestward and gradually slopes in that direction, so that after Mesana is passed the conical shape disappears.

7-55 Binan (Benan) Island ($0^{\circ}28' N.$, $104^{\circ}28' E.$), $3\frac{1}{2}$ miles northwestward from Mesana, is the easternmost island of the Tiampan Group, which separates Merodong and Pangelap Straits. It is 2 miles in length, tapering to both ends, and is $\frac{3}{4}$ mile wide near the middle. The island is easily recognized by a conspicuous hill, 221 feet high, at its southeastern end. A reef fronts the greater part of Binan, extending from 500 to 1,000 yards off the northern and northeastern sides.

Rifleman Shoal, located about 1 mile east-

ward of Binan, is a patch of hard sand 600 yards in extent with a depth of 2 fathoms lying about $1\frac{1}{3}$ miles 048° from Binan Hill. On the bank extending $4\frac{1}{2}$ miles eastward of it there are depths of from $5\frac{1}{2}$ to 10 fathoms, where good anchorage may be obtained.

7-56 Katang Linga Island, $1\frac{1}{2}$ miles northwestward from Binan, is a bold, bluff-looking island 1 mile in length and 239 feet high at the north end; the southern end is low. A reef fronts the greater part of it, extending in some places a distance of about 400 yards. A shoal of sand, coral, and stones, which dries in places at low water, lies between the northern point of Katang Linga and Tokong (Nopong) Island, but quite out of track of vessels navigating Rhio Strait.

Binan and Katang Linga form the eastern limit of a number of islands named the Tiampan Group.

With onshore winds a heavy sea runs up on the eastern side of these islands.

The islands to the westward will be described in connection with Pangelap Strait.

Pulo Galang (*H. O. Chart 1205*).—Pulo Galang and Galang Baru southward of it, both hilly and thickly wooded, are separated by Penyabung Strait. On the east side of these islands are numerous islands and reefs terminating eastward in Little Karas Island or Karas Kechil, on which there is a lighthouse. Tanjung Maralagan, the southeastern extremity of Pulo Galang, is high and thickly wooded. Dempo Point is the eastern extremity of Korek Rapat Island, which lies nearly 3 miles southeastward of Tanjung Maralagan, and is the easternmost islet of those lying in and fronting the bay formed between the two Galang Islands.

7-57 Penyabung (Penjaboeng) Strait, from 300 to 400 yards in breadth, except at its western end, where the breadth is less

than 100 yards, has depths of from $2\frac{1}{2}$ to 5 fathoms; its shores are overgrown with mangroves. Its best entrance is between Tanjung Maralagan and Tanjung Dahan (Tarong) Island, southward of it, but it is only available by small craft locally acquainted.

7-58 Pulo Dempo (Rondo) ($0^{\circ}36' N.$, $104^{\circ}18' E.$), 114 feet high lies $11\frac{1}{3}$ miles 125° from the south extremity of Galang Baru, and on the north side of the east entrance to Dempo Strait; it is a conspicuous, thickly wooded islet, showing round and bold against the adjacent land, and is one of the most useful objects for recognizing the entrance to both Rhio and Dempo Straits when coming from the southward.

Haai Reef, a patch with a least depth of $1\frac{1}{4}$ fathoms, lies 155° , distant 500 yards from Pulo Dempo, and there is a rock above water about 600 yards inshore of the islet. It is well westward of the track to Rhio Strait.

The east end of Little Karas Island open of Dempo Point bearing 020° , leads eastward of Haai Reef.

7-59 Galang Islands, west coast.—**Penyabung (Nguwal) Island** lies close off the west side of Galang Baru, and is a narrow island $1\frac{1}{2}$ miles in length, fringed by reef. A patch of 4 fathoms lies between the south extremity of its reef and Tanjung Koko, southeastward of it; and a rock, with less than 6 feet is reported between the patch and the point. A patch of 1 fathom lies within the 5-fathom curve, fronting the bight, between Tanjung Koko and the southern extremity of Galang Baru. A rock with a depth of 4 feet lies about $\frac{3}{5}$ mile southwestward of the north extremity of Penyabung. The channel between Penyabung and Galang Baru is encumbered by several islets and reefs and should not be attempted without local knowledge.

Semut (Labun) Island, fringed by reef, lies 1,000 yards northwestward of Penyabung Island, and about the same distance offshore. Penyabung Islets lie in the western entrance to Penyabung Strait, with a rock dry at low water at 1,200 yards westward of them, and

with a sunken rock about 200 yards northward and a 3-foot shoal about 400 yards southwestward, respectively, of the drying rock. There are no other dangers outside the 5-fathom curve. Table Hill (Tafelberg), on the west coast of Galang Baru, is 649 feet high.

Melor Islets ($0^{\circ}44' N.$, $104^{\circ}11' E.$), two in number, lie near the coast of Pulo Galang, about 2 miles northwestward of Penyabung Islets.

The west entrance of Tiung Strait is located about $2\frac{1}{2}$ miles farther north-northwestward.

Pulo Panjang, 2 miles in length, north and south, lies with its southern extremity 1 mile to the westward of Tiung Strait.

A rock, awash at low water, lies $\frac{1}{2}$ mile southward of it. A $2\frac{1}{4}$ -fathom patch lies about 1 mile southeastward of the rock. About $\frac{2}{3}$ mile southward of the rock is the extremity of a shoal with depths under 5 fathoms extending southwestward from the south point of the western entrance to Tiung Strait.

Wreck.—A dangerous wreck lies nearly 1 mile southward of the rock.

7-60 The coast of Pulo Rempang, northward of Pulo Panjang, forms the eastern side of the approach to Bulan Strait, and is fronted by shallow flats to a distance of about 4 miles. Hangop Rock lies on the northern end of the outer flat at 4 miles westward of Tanjung Klingking.

7-61 Rhio Strait, west shore.—**Great Bank** is located off the east side of Galang Baru, between Pulo Dempo and Batu Belobang Island, within the edge of the 5-fathom curve fronting the bight. The bank or shoal is $1\frac{1}{2}$ miles in length, with a least depth of $1\frac{1}{4}$ fathoms, and affords temporary anchorage on and within it for vessels of light draft.

Islands.—Korek Rapat, Korek Busung, Tanjung Dahan, Batu Belobang, and Sembur, with some smaller islands, fill the bight westward of Dempo Point, the eastern extremity of Korek Rapat Island; there are narrow passages between them, but useless for navigation.

Shoals.—A shoal with a least depth of $4\frac{1}{4}$ fathoms lies a little less than 4 miles south-eastward of Little Karas Island, and its southwest side is marked by a lighted conical buoy painted red. About 1 mile northeastward of this shoal, with an intervening depth of at least $5\frac{1}{2}$ fathoms, lies the south tip of another shoal which extends about $3\frac{3}{4}$ miles south-southwestward from the Tapai Islands. A shoal with a least depth of $4\frac{3}{4}$ fathoms lies about 3 miles south-southeastward of Little Karas Island Light.

7-62 Great Karas Island, located 4 miles northward of Dempo Point, is $3\frac{1}{2}$ miles in length by 1,500 yards in breadth; it is hilly, with a flat summit, wooded, and has a reef encircling it extending in places for the distance of 500 yards. The island is inhabited.

A reef, 400 yards in length, which dries, lies 006° , distant 1,000 yards from the western extremity of the island, with a similar reef close eastward of it. From abreast the latter reef, and extending nearly halfway along the northern coast of the island is a flat with depths of from $2\frac{1}{4}$ to 3 fathoms, projecting 1 mile from the island, and for 1,000 yards farther in the same direction the depths are under 5 fathoms; vessels when abreast it should keep the whole of Little Karas well open of Great Karas.

7-63 Chassens (Tjassens) Bank is triangular shaped, with its base, about $3\frac{1}{2}$ miles in length, on the southern side of Great Karas, its extremity with depths under 5 fathoms, being located about 2 miles from the eastern and 4 miles from the western points of the island; it has depths of from 3 feet to 3 fathoms, and a reef which uncovers at half ebb is located on its southeast extremity, 192° , distant $1\frac{1}{2}$ miles, from the southeast point of the island.

There is a channel on each side of Chassens Bank, but the north one, crossing the neck of the shoal, has a depth of $2\frac{1}{4}$ fathoms, and is only available for small vessels; the southern channel, between Chassens Bank and Tanjung Dahan Island, is nowhere less than 1,500 yards wide, with depths of from

6 to 8 fathoms. Care is necessary, however, when avoiding Chassens Bank, to give a safe berth to a small reef which lies 650 yards off the northeastern part of Tanjung Dahan Island, and when the western end of Great Karas bears about 045° steer to pass midway between the western extremity of that island and Penika (Steen) Islet to avoid reefs southward of the latter, on the bank fronting Pulo Galang.

WRECK.—A dangerous wreck lies about $1\frac{1}{2}$ mile eastward of Little Karas Island.

7-64 Little Karas is an island marking the southwestern end of the narrow part of Rhio Strait, is 154 feet high and about $1\frac{1}{3}$ mile in length in an east and west direction, formed of two small hills, and fringed by a reef. On its southwestern side is a sandy beach with a good landing place.

A spit with a least depth of 5 feet extends about $1\frac{1}{3}$ mile northward from the island. A depth of $3\frac{3}{4}$ fathoms lies about 300 yards southward of the east end of the island.

Light.—A light is shown on the southeast summit of the island.

The light structure is difficult to distinguish until within 5 miles of it. A palm tree close to the structure is a better mark and is seen at a much greater distance than the structure itself.

Shoals.—A shoal, with a least depth of $5\frac{1}{2}$ fathoms, lies $\frac{3}{4}$ mile north-northeastward from Little Karas Light.

Two $5\frac{1}{2}$ -fathom patches and a $4\frac{3}{4}$ -fathom patch lie, respectively, about 2 miles eastward, $1\frac{3}{4}$ miles east-northeastward and 2 miles northeastward of Little Karas. Fish stakes are located in the vicinity of the $4\frac{3}{4}$ -fathom patch. The main channel (sec. 7-53) is deep and about $1\frac{1}{4}$ miles wide between these patches and the islet. Depths of $4\frac{1}{4}$ to 6 fathoms are found between these patches and Rotterdam Reef (sec. 7-89).

Seguchi (Segutji) Reef lies 171° , distant about 1,800 yards from Little Karas Light, and uncovers. Shoals of $2\frac{2}{3}$ and $2\frac{1}{2}$ fathoms, steep-to on their east sides, extend about 500 yards southwestward and north-northwestward, respectively, from Seguchi Reef.

7-65 Tanjung Semandur (Semandoer) the northeast extremity of Pulo Galang, lies $2\frac{1}{2}$ miles northwestward from the west end of Great Karas, and has on its north side a high in which there is a village. A reef fronts the point to a distance of 500 yards.

Penika (Steen) Islet, consisting of some wooded rocks, is surrounded by a reef, and lies inside the edge of the 5-fathom curve, which passes about $1\frac{1}{2}$ miles eastward of the eastern coast of Pulo Galang, and nearly midway between the west end of Great Karas and Tanjung Semandur. There are patches which dry on the shore bank southwestward of it. Fishing stakes are located in the shoal water between Penika Islet and Tanjung Semandur.

Shoal.—There is a shoal with a least depth of $\frac{3}{4}$ foot 1,875 yards, 100° from Steen Islet..

7-66 Mubut Islands.—At $6\frac{1}{2}$ miles, northwestward of Little Karas Light, and in the eastern approach to Tiung Strait, is Mubut Laut Island (Moeboet Laoet) 183 feet high, and inhabited; it is the larger and higher of the two Mubut Islands, and easily distinguished by its prominent position off the deep inlets to the westward. It rises to a round peak, with the greatest declivity on the eastern side, while the smaller island, Mubut Durat Island, is considerably lower toward its center, and thickly wooded.

A reef, with depths of less than 2 fathoms, on which there are some rocks drying at low water, extends 2 miles southward of Mubut Laut Island, which will be avoided by keeping the west extremity of Great Karas bearing westward of 192° . A shoal with depths of 3 feet to $4\frac{3}{4}$ fathoms extends nearly 2 miles northward from both islands. Fishing stakes encumber the area between the two islands.

A depth of $1\frac{1}{2}$ feet (P.A.) was reported in 1957 about $1\frac{1}{3}$ miles southward of the west end of Mubut Laut Island. The north extremity of Tanjung Sembulang, open of its east extremity, leads eastward of it, but

the west extremity of Great Karas well open of Mubut Laut, bearing 185° , is a better mark according to the chart, and it also leads eastward of the $3\frac{3}{4}$ -fathom patch off Tanjung Sembulang (sec. 7-69).

7-67 Tiung Strait, the opening between Tanjung Galang and Rempang is almost blocked by a sandbank at about $\frac{1}{2}$ mile westward of Mubut Durat, having a least depth of 7 feet (1956); reefs also extend northeastward from Tanjung Semandur, nearly to Mubut Durat.

Buoys.—A can buoy, painted red, is moored about $\frac{1}{2}$ mile west-southwestward of Mubut Darat. A can buoy, painted in red and white checkers is moored about 2 miles west-southwestward of the same islet. It marks the south side of the channel.

Directions.—It is advisable for vessels transiting this passage to pass westward of the red can buoy, then steer 221° until the northeast extremity of Tanjung Semandur is abeam, then change course to 261° , keeping the red and white checkered buoy close on the port bow. On this course vessels should pass about 100 yards northward of this buoy. From this position vessels with local knowledge can be guided by the chart.

7-68 Jetty.—At the mouth of the Senyantun River south side of the west entrance of the strait, is a jetty for the use of small steam craft. The river is navigable by those vessels for some distance.

7-69 Tanjung Sembulang (Semboelang) ($0^\circ 52' N.$, $104^\circ 16' E.$), the eastern extremity of Pulo Rempang, is a rather precipitous point overgrown with trees on the western side of the main channel of Rhio Strait; the hill within it is 252 feet high. The point is fronted by a reef to the distance of about 300 yards, close to which are depths of 6 to 8 fathoms.

Sembulang River, a small stream, with its entrance dry at low water, lies nearly 2 miles westward of Tanjung Sembulang, and here there are two small villages. Pakaul, a small island on the shore reef, 1,000 yards north-

ward of the entrance, shows up well against it on account of the darker color of the trees on it.

A patch with a least depth of $3\frac{1}{4}$ -fathoms lies about 2- $\frac{1}{3}$ miles eastward of Tanjung Sembulang. Its eastern side is marked by a light buoy painted in black and white checkers.

A patch, with a depth of $4\frac{1}{2}$ fathoms and from 6 to 7 fathoms around, lies about 1.6 miles 074° from Tanjung Sembulang.

7-70 Chemara (Tjemara) Bank, lying about 3.5 miles northwestward of Tanjung Sembulang, and about 1.5 miles eastward of Pulo Chemara, is 1.3 miles in length in a north-west and southeast direction, with a least depth of $1\frac{1}{2}$ fathoms. The eastern point of Mubut Durat open of Tanjung Sembulang leads well eastward of it.

Beacon.—A beacon with a black conical topmark marks Chemara Bank.

Anchorage.—During the southeast monsoon good anchorage, in 5 fathoms, may be obtained southward of Chemara Bank, with the eastern point of Mubut Laut just open of Tanjung Sembulang, bearing 135° , and Pakaul Island, 180° .

7-71 Pulo Chemara (Tjemara) the southernmost of the chain of islands which front Bulang Channel between Pulo Batam and Rempang is hilly, and partially covered with trees. It is 256 feet high, about 1.8 miles in length, 1,500 yards in breadth, and fringed by a reef; there is a village on the southeastern side. A flat, with less than 3 fathoms of water over it, extends for a distance of nearly a mile from the southeastern side, and between it and Chemara Bank the depths are from $3\frac{1}{4}$ to 5 fathoms.

Pulo Tungjuk (Tandjuk) (Tundjuk) (Toendjoek) lying nearly 1.3 miles northward of Pulo Chemara, is flatter than that island

and entirely covered with vegetation; it is 660 yards in extent and surrounded by a reef, which on the eastern side projects 500 yards. A ridge, with rocky patches, some drying, connects these islands.

Range Lights.—The front light is exhibited from an iron framework with a white triangular top mark, apex up on the west side of Pulo Tunjuk.

The rear light is exhibited from an iron framework with a white triangular top mark, apex down 423 yards 180° from the front light.

These lights in line lead through the north entrance to Rhio Straits.

The keeper's dwelling is painted white, with a red roof, and stands near the rear light, where is also the acetylene house, a small building painted white, with a gray roof. Near the front light is a small watchtower, painted white, with a red roof. The beacons on which the lights are exhibited are difficult to recognize.

7-72 Pulo Subang (Soebang) Mas and Ajer Radja.—Pulo Subang Mas or Kanchil lies close westward of Pulo Tunjuk; Ajer Radja close northward of it, separated by a narrow channel, which dries at low water, is the northernmost of four islands lying between Chemara and Bulang Channel; both these islands are hilly and covered with tall trees. Pulo Pentjaras is a small, round islet lying on the shore reef close to the northeastern point of Ajer Radja; a rock above water, of a reddish color, and having on it a conspicuous tree, lies on the shore reef off its northeastern point.

Johannes Shoal.—On the eastern edge of the 3-fathom curve, fronting the bay between the eastern extremity of Subang Mas and Pulo Pentjaras, lies Johannes Shoal, a patch of 2 fathoms, with 7 fathoms close outside it. Tanjung Sembulang, kept open eastward of