



Fremantle Harbor

H. O. 74

FREMANTLE

CHANGE
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308a

North Quay has 9 berths numbered 1 thru 7, 9 and 10. Berth No. 10A, located adjacent to North Quay at the northwestern corner of the inner harbor, has 680 feet of berthing space for small vessels and has a depth of 14 feet alongside (1962).

On Victoria Quay there are eight cargo sheds and on North Quay are ten sheds, two of which are used for grain and flour shipping. There is a 20-ton derrick located on North Quay and another on Victoria Quay. One 15-ton and one 80-ton floating crane is provided by the port. About 7 or 8 vessels can be accommodated at Victoria Quay and 9 vessels at North Quay. Telephones are available at all berths except No. 1 berth, North Quay.

Boom Defense Jetty, located between the 2,000-ton slipway and South Mole, is 315 feet long with depths of 4 to 10 feet alongside. Railroad connections are available on the jetty.

Pile Yard Jetty, an old wooden structure, is located westward of "A" berth on Victoria Quay.

Fish Market Jetty, a concrete structure with a T-end located in south Fremantle, is 253 feet long with depths of 5 feet alongside.

All sheds and quays are lighted by electricity and are equipped with modern cargo handling apparatus.

A vessel can carry out all cargo work and take on all supplies at one berth as all berths and sheds are connected by roads and railroad lines which are linked up to the main railroad system.

REPAIRS.—General repairs can be carried out to the hull and machinery of all classes of vessels. There is a floating crane of 80 ton capacity, and 2 electric cranes of 3 and 7 ton capacity.

The approximate dimensions of the largest marine railway in the port are: length of cradle, 273 feet; depth over blocks at H.W.O.S.T.: forward 14 feet, aft 23 feet; breadth of entrance, 48 feet; lifting power, 2,750 tons.

Surveyors representing the following, Lloyds Register (united with British Corporation Registry), Marine Underwriters Association, Bureau Veritas and the American Bureau of Shipping, are available in Fremantle.

TUGS.—Several powerful tugs and a sea-going tug are available; the signal for tug is the flags "YP" of the International Code as given in the signals.

SUPPLIES.—Provisions and general ship stores can be obtained at Fremantle.

Water is brought to all the quays by pipeline.

COAL.—Limited supplies of coal are available.

FUEL AND DIESEL OIL.—Large stocks of fuel and Diesel oil are maintained. Fuel oil can be delivered by pipeline on the quay at a rate of 1,650 bbls. per hour and Diesel oil at a rate of 2,160 bbls. per hour.

COMMUNICATION.—Fremantle and Perth are directly connected with the main railroad lines.

Mail steamers of several lines call outward and homeward (alternate fortnight). There are also frequent services coastwise and to Singapore. There is monthly steamer communication with London via Durban and Capetown.

Fremantle is connected with the interstate telegraph system. A submarine CABLE is laid to Cocos Islands, thence by Mauritius to Natal and Europe.

Telephone services are available at all berths.

An airmail service operates twice weekly.

There is a radio station at Applecross, on the southern bank of Swan River, 4.5 miles east-northeast of Fremantle.

WEATHER FORECASTS.—Telegraphic weather reports from the principal Australian stations, are received daily with a forecast of probable weather. These are exhibited at the post offices of Fremantle and Perth, and copies can be obtained on application. The

latest available information as regards marine weather conditions and forecasts can be obtained by telephoning or other inquiry at the Perth Weather Bureau.

HOSPITAL.—Fremantle Public Hospital, which has a capacity of 200 beds, will accept seamen.

8-39 SWAN RIVER (H.O. Chart 1907) entrance is between North and South Moles, projecting seaward from Rous and Arthur Heads, as described before; the space from the heads to the railroad bridge; a distance of 1,700 yards above, is now Fremantle Harbor, known also as the inner harbor.

At 400 yards eastward of the railroad bridge the river is spanned by Fremantle Bridge. Small vessels pass under the bridges. Vessels of 6 feet draft can ascend to the wharves at Perth. High tension cables span the river westward of and alongside the railway bridge.

Between Fremantle and Perth the river winds considerably in its course, and carries depths of 1 1/4 to 10 fathoms. The channel is marked by lights and pile beacons. At Rocky Bay, the first considerable bend, 1 mile above bridge, a flat, dry in places at low water springs, extends to within about 50 yards of the western shore, its edges being marked by pile beacons.

Freshwater Bay, a deep loop bight on the northern shore, is about 1,500 yards in extent, the center of which is filled by Karakatta Bank; at its head is the town of Claremont and railroad station. Above this the river trends eastward and northeast toward Perth, opening out into a large expanse known as Melville Water, 4 miles long and 1 to 2 miles broad, the channel through which carries a depth of 7 to 3 fathoms nearly to its northern end.

Canning River, spanned by a bridge, emptying into the eastern side of Melville Water, is navigable by boats for 8 or 9 miles.

At 3 miles northward of Canning River, Swan River narrows to less than 400 yards, with a depth of 13 feet in the fairway at the entrance to Perth Water, a shallow basin 2 miles long, which separates North and South Perth, and washes the shores upon which the city is built. From its entrance a channel with a least depth of 7 feet has been dredged across to the city wharves, continued parallel to the wharves eastward to Fraser Point. Channels have been dredged from the city wharves across the water, with depths of 4 to 6 feet.

BEACONS.—The prominent points of the shoals bordering the track to Perth are marked by red-pole beacons surmounted by white disks on the starboard hand and by black-pole beacons with triangles on the port hand. The 1-fathom edge of Karakatta Bank, in Freshwater Bay, is marked by five beacons.

ABOVE PERTH, Swan River is more confined between its banks and very tortuous, but can be ascended by boats, for 10 miles, to the picturesque town of Guildford.

8-40 PERTH (31° 57'S., 115° 52'E.), the capital of Western Australia, is on both banks of Swan River, about 12 miles by water above Fremantle; there is an excellent road between the two towns, and good services by railway and river. The principal portion of the city is on the northern side of the river. Among the public buildings are government house, town hall, library, hospital, and observatory, with ample parks and gardens. In 1961, the population was about 420,100 including the suburbs.

CLIMATE.—The weather during the winter months (May to the end of October) is delightful, there usually being a succession of fine bright days, occasionally varied by a severe but brief storm. The nights are frequently cold and the temperature in July often is below 40°,

but frosts are not known. January and February are the hottest months, with a mean maximum temperature of 85°, but the heat is not generally felt oppressively and the nights are cool and pleasant.

WINDS.—A land breeze from the east-northeast sets in, in the morning and shifts to a sea breeze from the west-southwest in the afternoon.

8-41 OWEN ANCHORAGE (32°07'S., 115°44'E., H.O. Chart 1907).—From Fremantle Harbor the shore to Owen Anchorage is low and sandy, with a continuous ridge of scrubby limestone hillocks 100 to 150 feet high within, trending southward for 4.5 miles to Woodman Point, which is only a few feet above the level of the sea.

A fishing boat harbor is located close southward of the South Mole at Arthur Head. It is enclosed by 2 breakwaters. A light is shown on the head of the northern breakwater.

Owen Anchorage, between Success Bank and Parmelia Bank, southward of Gage Roads, is entered from Gage Roads by passing through the dredged channel across Success Bank. This anchorage has lost its value since Fremantle Harbor has been opened to commerce.

Beagle Anchorage, the northern part of Owen Anchorage, affords good shelter in comparatively smooth water even during the winter months; the southeastern part under Woodman Point is preferable during summer, when strong breezes prevail from southward and westward; described below.

In the center of Owen Anchorage there are depths of 6 to 8 fathoms; the eastern part is comparatively even, but has several rocky heads. A shoal with a depth of 4 3/4 fathoms lies about 1 1/2 miles northwestward of the

western extremity of Woodman Point. The shoal lies within the 6-fathom curve close northward of the Parmelia Bank.

Two lights in range 181 1/2° are located about 2 1/2 miles westward from Woodman Point Light.

8-42 CHANNEL.—A channel 1 3/4 miles long, 500 feet wide, and 38 feet deep (1966) has been dredged across Success Bank. The eastern side of the channel is marked by light beacons, painted red, and lettered "B" to "F" from northward. The western side is marked by light beacons, painted black, and numbered "2" to "6" from northward. A light buoy is moored on either side of the fairway at the outer and inner ends of this channel. The buoys on the eastern side are red with a red square topmark and lettered "A" and "G", respectively. The western side buoys are black with a black triangular topmark and numbered "1" and "7", respectively. Lighted range beacons located about 2 miles west-southwestward of Woodman Point, in line 169 1/4°, lead through the middle of the channel. The use of anchors is prohibited within an area 100 feet eastward and westward of this lead.

See section 8-33 regarding traffic signals for navigating this channel.

JETTIES.—Robbs Jetty, located about 2 miles south-southeastward of the root of the South Mole, has two 400-foot berths with depths of 14 to 21 feet alongside. There is a short jetty about 1,000 yards northward of the smelting works. The explosives jetty, with depths of 17 to 26 feet alongside, is about 2 miles southward of Robbs Jetty. There is a prohibited area which extends about 1/4 mile offshore for about 1/2 mile on each side of the

explosives jetty. Only authorized vessels are permitted to enter this area. A vessel berthed at the explosives jetty should, on the approach of gales, proceed to Beagle Anchorage, or to Sulphur Bay on the eastern side of Garden Island. There is also a jetty at Woodman Point which is 820 feet long and has depths of 6 to 14 feet alongside.

8-43 **Woodman Point—Quarantine Station.**—At Woodman Point, the southern extremity of Owen Anchorage, is the quarantine station, the buildings of which are conspicuous.

Woodman Point Light has been described in section 8-27.

Dangers.—The following dangers lie in Owen Anchorage and its approaches.

8-44 **Success Bank**, with depths of $1\frac{1}{4}$ to 3 fathoms extends from the shore between Arthur Head, located at the root of the South Mole, and Catherine Point located about $1\frac{1}{4}$ miles south-southeastward, in a westerly direction for $5\frac{1}{4}$ miles, and is over 1 mile in breadth; thence in a northwesterly direction it is 1,000 yards broad to within a short distance of Straggler Rocks. This bank is composed of sand and weed, with rocky patches. The depths on Success Bank were reported (1927) to have decreased.

Fish Rocks, which dry 1 foot, are located about 1 mile westward of Catherine Point on a spit, with depths of 2 to 6 feet, which extends about $1\frac{1}{2}$ miles westward of Catherine Point.

Landmarks.—The following landmarks are located on the eastern side of Owen Anchorage. Distances and bearings are from Catherine Point:

Four chimneys, each 170 feet high, about $\frac{3}{4}$ mile south-southeastward. An obstruction light is shown from the top of each chimney.

A pile beacon, about one-half of a mile southward.

Meatworks chimney, about $1\frac{1}{2}$ miles south-southeastward.

8-45 **Mewstone** ($32^{\circ}05' S.$, $115^{\circ}39' E.$, H. O. Chart 1907) is a round bare rock 54 feet high, with smaller rocks extending 200 yards from its western and 300 yards from its northwestern side.

A 15-foot patch and a 14-foot patch lie about 1,100 yards westward and northwestward, respectively, of Mewstone.

Rowboat and Seal Rocks are the central and southeasternmost of three rocks above water, situated 800 yards eastward from the Mewstone; Rowboat is 15 feet, and Seal 3 feet high. From Seal Rock a ledge, with depths under 3 fathoms, extends 600 yards southward, parts of it being nearly dry at low water.

At 400 and 600 yards northward and northwestward respectively from Rowboat Rock are small sunken rocks, with 1 fathom of water. For others, see the chart.

8-46 **Parmelia Bank** is a similar projection to Success Bank; it separates Owen Anchorage from Cockburn Sound, has depths of from 1 to $2\frac{3}{4}$ fathoms of water over it, and extends from Woodman Point to beyond Carnac Island, a distance of about 5 miles. A very shoal spot, on which the sea breaks heavily in a westerly swell, is situated on Parmelia Bank at about 1.8 miles westward of Woodman Point.

Channel.—A channel about $1\frac{1}{2}$ miles in length and 500 feet in width has been dredged across Parmelia Bank; depth in 1963 was 38 feet. The eastern and western sides of the channel are marked by light beacons and light buoys. Lighted range beacons, located west-southwestward of Woodman Point, in line $169\frac{1}{4}^{\circ}$ lead through in midchannel. Auxiliary lights to assist small craft, are shown at a height of 12 feet from the above range beacons. Additional lights are shown, at heights of 42 and 25 feet, from the front and rear range beacons, respectively, for the use of vessels approaching from the southward.

See section 8-33 regarding traffic signals in use for navigating this channel.

8-47 **Woodman Spit**, the eastern or inner part of Parmelia Bank, extends over 1 mile from the point, and its inner part dries.

A line of **dolphins**, each about 100 yards apart, extends in a westerly direction from a position $1\frac{1}{2}$ miles 265° from Woodman Point Light to the eastern side of Parmelia Bank Channel. Thence, from the western side of the channel, the line of dolphins ex-

tends in a southwesterly direction to a position 1.3 miles 126° from the southeastern extremity of Carnac Island.

Patches.—Nearly 1 mile northward of Woodman Point is a patch of rocky ground 1,000 yards in extent, with a depth of $1\frac{1}{3}$ fathoms at its southeastern extremity. At 1,000 to 1,500 yards westward from this patch are three rocky patches extending in a north and south direction, and covering a space of 1,000 yards; the northern and southern rocks having depths of $2\frac{1}{2}$ fathoms, and the middle rock 2 fathoms. A 16-foot rocky patch lies about $1\frac{3}{4}$ miles north-northwestward of Woodman Point.

8-48 Beagle Anchorage.—The deepest water and best holding ground in Owen Anchorage is in its northeastern part, known as Beagle Anchorage. It is about 400 yards northward of Middle Ground, in $6\frac{1}{4}$ fathoms, sandy bottom; a fair berth may also be found in $4\frac{1}{4}$ fathoms northeast of Middle Ground on a sandy bottom.

Middle Ground, in the southern approach to Beagle Anchorage, composed of sand and rock, is about one-half of a mile in extent, with depths of 2 to 3 fathoms.

A rock, with a depth of $3\frac{1}{2}$ fathoms of water over it, lies about 1,000 yards westward of the center of Middle Ground, and Elbow Shoal with a depth of 14 feet lies 200 yards northward of the rock.

Beacon.—Middle Ground Beacon, a 15-foot steel tower with a black conical topmark, marks the northwestern edge of Middle Ground.

Beacon.—Elbow Beacon, a steel tower, 15 feet high with a red square topmark, is moored on the southern extremity of Elbow Shoal.

Rock.—About 1,000 yards westward of Empress Rock is a small rocky ledge with a depth of $2\frac{1}{2}$ fathoms of water over it and 4 fathoms close around.

Beacons.—Nook Beacon, a steel tower 15 feet high, painted black with conical topmark, marks the northern side of the above-mentioned rock.

Success Spit Beacon, a 15-foot steel tower, painted red with a can-shaped topmark,

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marks the southern edge of Success Bank, about 1,000 yards westward of the outer end of Robbs jetty.

8-49 Empress Rock, with $2\frac{1}{3}$ fathoms, lies 600 yards offshore, on the edge of 3-fathom bank, extending from the shore about midway between Catherine Point and James Rocks, eastern side of Beagle Anchorage.

A pile structure stands on the bank, about 200 yards northward of Empress Rock.

Beacons.—S.E. Limit Beacon, a 20-foot steel tower painted black, with conical topmark, marks the edge of the shore bank about 300 yards northward of Empress Rock.

N.E. Limit Beacon, a 20-foot steel tower, painted red with a can-shaped topmark, marks the edge of the shore bank, about 800 yards northward of Empress Rock.

8-50 Directions.—Vessels from Gage Road to Robbs Jetty should approach Success Bank Channel with the range beacons in Cockburn Sound (Sec. 8-42), bearing about 169° , and pass between the light buoys marking the northern channel entrance. Steer on the 169° range through the channel, passing between the light buoys marking the southern entrance of the channel. When Rottnest Island Light is in range 301° with Mewstone Rock, steer eastward for about $1\frac{1}{2}$ miles, passing about 100 yards southward of Elbow Shoal Beacon. Then steer northeastward for about 700 yards passing about 100 yards northwestward of Middle Ground Beacon. Steer east-northeastward for about $\frac{1}{2}$ mile to a position about 100 yards northward of Nook Beacon, and then as requisite for the pier.

Vessels proceeding to Woodman Point explosives jetty, after clearing Nook Beacon, steer south-southeastward with Woodman Point Light ahead, bearing 150° . When the head of the explosives jetty bears 180° , steer for it.

An alternate route to the explosives jetty is southward of Middle Ground. Vessels on leaving the southern entrance of Success Bank Channel steer eastward with Meatworks Chimney ahead, bearing 091° , until the head of the explosives jetty bears 180° , and then steer for it.

8-51 **Straggler Channel** ($32^{\circ}04' S.$, $115^{\circ}40' E.$., H.O. Chart 1907), lies between the southeastern end of Straggler Reefs and the western end of Success Bank. There are no aids to navigation and the channel should only be used by vessels with local knowledge.

8-52 **Carnac Island** ($32^{\circ}07' S.$, $115^{\circ}40' E.$.), on the western extremity of Parmelia Bank, is 58 feet high, with a bare white top, its northern and western sides having a cliff face, and its eastern side sloping gradually to a sandy beach. A large bare sand patch extends across the southeastern end. From the southeastern extremity of the island a sand spit extends in an east-northeasterly direction for about 200 yards.

Westward of Carnac Island sunken reefs project about 1,600 yards, almost connecting with the rocky ridge westward of it.

8-53 **Flat Rock**, about 20 feet high, with perpendicular sides and a level grassy top, lies 200 yards southward of Carnac Island, with small dry rocks and ledges between; ledges also extend 200 yards southward and about 450 yards southwestward of Flat Rock.

Shag Rock, 30 feet high, lies a little over 200 yards northward from Carnac Island, with several sunken rocks between.

Pointer Rock, northward of Shag Rock, awash at low water, lies 600 yards north of Carnac Island, and is surrounded by sunken rocks to the distance of 100 yards.

8-54 COCKBURN SOUND APPROACH-

ES (*H. O. Chart 1907*)—General remarks.— Cockburn Sound can be entered only through Success and Parmelia Bank Channels from Gage Roads.

8-55 **Outlying dangers.**—**Five-fathom Bank** lies in the approach to Cockburn Sound from the westward. Its northern extremity is about 4 miles southward of the eastern end of Rottnest Island, whence it extends in a southerly direction for upwards of 16 miles, and is from 1,000 to 1,500 yards in breadth. Although named the Five-fathom Bank it is a rocky ridge with patches on it in places with depths of only a few feet. The northernmost shoal on the bank or ridge has a depth of $2\frac{1}{2}$ fathoms and lies 2.4 miles, 259° from the high Straggler Rock. Between it and Rottnest Island are patches of 4 to 5 fathoms as charted. Southward of the shoal between it and Seaward Reef are several rocks of $2\frac{1}{2}$ to $3\frac{1}{2}$ fathoms, with from 5 to 7 fathoms close around.

From the 10-fathom curve on the western side of Five-fathom Bank, the water deepens rapidly to 16 and 18 fathoms. The eastern side is steep-to, with a clear channel about 2 miles wide between it and the islets and reefs to the eastward.

Vessels over 12 feet draft should not cross Five-fathom Bank northward of Casuarina Shoal; vessels under 18 feet draft might cross it between 3 and 7 miles southward of that shoal, but it is not recommended.

Channel.—The best known passage is between Casuarina and Hawley Shoals. See

Directions for Challenger Pass, given in section 8-59.

8-56 Seaward Reef ($32^{\circ}07' S.$, $115^{\circ}36' E.$), with 1 fathom of water lies 8.7 miles, 281° from the white obelisk about 1 mile southeastward of Woodman Point in range with Flat Rock; isolated shoals, with depths of $2\frac{1}{2}$ to $3\frac{1}{4}$ fathoms continue in a southerly direction for 2 miles, to Casuarina Shoal.

Casuarina Shoal is a large patch of foul ground with $1\frac{3}{4}$ to $2\frac{1}{4}$ fathoms of water over it. Its shoalest spot lies 290° , 3 miles from Haycock hillock.

8-57 Hawley Shoal, on which the vessel of that name struck in 1883, lies 1.2 miles southward of Casuarina Shoal with a depth of $2\frac{3}{4}$ fathoms of water over it, and from $4\frac{1}{2}$ to 5 fathoms close around.

Rocks with depths of 3 fathoms and 4 to 5 fathoms around lie 400 yards eastward and 500 yards southeastward from Hawley Shoal.

Range mark.—The obelisk over Jervoise Bay in range with Entrance Rocks, northwestern extremity of Garden Island, bearing 083° , leads across Five-fathom Bank, between Casuarina and Hawley Shoals, in a charted depth of not less than $4\frac{3}{4}$ fathoms.

Southward from Hawley Shoal the patches on the bank or ridge are more scattered, and have depths varying from 3 to 4 fathoms, except at 3 miles northward of Coventry Reef, where there is a rock with $2\frac{1}{2}$ fathoms over it. A wreck with a depth of 1 fathom lies about $1\frac{1}{4}$ miles eastward of this rock. Other shallow heads may exist on this ridge and vessels should avoid crossing it.

8-58 Coventry Reef (*H. O. Chart 1907*), near the southern extremity of Five-fathom Bank, lies 4.8 miles, 215° from summit of Cape Peron; it consists of a small cluster of rocks awash at high water, over which the sea always breaks, and is surrounded with sunken rocks at a distance of 200 to 400 yards.

The extent of Five-fathom Bank or ridge southward of Coventry Reef has not been defined.

The bank, with charted depths of 18 fathoms, 12 miles westward of Coventry Reef, is said to have over it as little as 11 fathoms. (*H. O. Chart 3423.*)

8-59 Challenger Pass (*plan on H. O. Chart 1907*), now closed to traffic, was formerly the principal channel into Cockburn Sound, between Carnac and Garden Islands, is bounded on the northern side by Middle Ground, Flat Ledge, and Three-fathom Bank, and on the southern by the Challenger, Stag, and Travancore Rocks. The narrowest part of the pass is between Flat Ledge and Stag Rocks, where it is only about 100 yards wide; the depths in the pass vary from $3\frac{1}{4}$ to 6 fathoms.

Great care must be taken in approaching this pass, as there are no natural range marks to guide through the channel.

Middle Ground, on the northern side of Challenger Pass, is 1,000 yards in length and 200 yards in breadth, with several rocks having depths of from $1\frac{3}{4}$ to $2\frac{3}{4}$ fathoms over them and 3 to $3\frac{1}{2}$ fathoms close around. Several sunken rocks with from $\frac{1}{2}$ to 3 fathoms of water and 5 to $6\frac{1}{2}$ fathoms around them, extend from the northwestern part of Middle Ground. A rock, with 4 feet of water, lies 1,800 yards, 250° from Flat Rock, off the southeast of Carnac Island.

8-60 Flat Ledge consists of several patches, with a least depth of $1\frac{1}{2}$ fathoms of water and 5 fathoms close around. The eastern patch of $1\frac{1}{2}$ fathoms lies 1,900 yards, 215° from Flat Rock. Sunken Rocks, with 2 to 4 fathoms on them, extend in a north-easterly direction nearly 200 yards from Flat Ledge.

Patches of $3\frac{1}{4}$ and $3\frac{3}{4}$ fathoms lie in the channel southward of Flat Ledge.

Perriam Reef, with $1\frac{1}{2}$ fathoms on its shoalest part, lies 1,200 yards, 217° from Flat Rock; between this reef and Carnac Island are several rocky patches of 7 to 10 feet.

Three-fathom Bank, with two rocky patches only a few yards apart with depths of from $2\frac{1}{2}$ to $2\frac{3}{4}$ fathoms on them, lies 1,800 yards, 195° from Flat Rock.

8-61 Challenger Rock, on the southwestern side of entrance of Challenger Pass, is awash at low water and lies 1.4 miles, 315° from Beacon Head Hill.

Rocks.—There is a rock with less than 6 feet at 150 yards southwest of it. In the fairway, at 500 yards northwest of Challenger Rock, are patches of $3\frac{1}{4}$ fathoms. In the vicinity of this rock there are several sunken rocks, with depths of 5 to 20 feet of water over them.

Stag Rocks extend 100 yards in a north and south direction, with from 1 to 3 fathoms of water over them; the shoalest Stag Rock lies 110° 800 yards from Challenger Rock.

Travancore Rock, with $2\frac{1}{4}$ fathoms least water, lies 095° 300 yards from Stag Rock.

Inside Rock, nearly 1 mile within Challenger Pass, with $2\frac{3}{4}$ fathoms on its shoalest part and 4 fathoms around, lies 1,800 yards, north-northeastward of Beacon Head Hill. A depth of $6\frac{1}{4}$ fathoms lies about $\frac{1}{4}$ mile eastward of Inside Rock and within the 10-fathom curve nearly $1\frac{1}{4}$ miles inside of Challenger Pass.

8-62 Northeast Spit.—Northeast Spit extends, with depths under 3 fathoms, 070° 1,450 yards from the Brothers Rocks, 13 feet high, situated close to the eastern side of Beacon Head of Garden Island.

There are many other rocks, with names given to them, but they lie away from the track in a network of shoals and it would be useless to describe them.

Directions for clearing.—The low Stragler Rock well open eastward of Carnac Island, will lead eastward of the dangers just mentioned.

8-63 North Channel ($32^{\circ}09' S.$, $115^{\circ}40' E.$) is an unbuoyed passage encumbered with shoals, between Northwest Spit, which extends about 1,200 yards northwestward of Entrance Point, Garden Island, with many ledges on it awash at low water, and Sea Reef and other dangers eastward of it. Entrance Rocks, 20 feet high, lie about 150 yards off Entrance Point.

A resurvey in 1885 led to the discovery of several additional sunken dangers, with from $1\frac{1}{2}$ to 3 fathoms on them and deep water close around, and clearly shows that vessels should not attempt North Channel.

The rocks in North Channel are remarkable sandstone pinnacles, the sounding lead rolling off their summits suddenly into the deep water which surrounds them. Although the soundings give little or no indication of the approach to these dangers, the bright yellow pinnacle rocks can readily be discerned during smooth water and a clear sky.

8-64 COCKBURN SOUND (H. O. Chart 1907)—**General remarks.**—Cockburn Sound is a spacious sheet of water, formed between Garden Island and the mainland, and sheltered from northward by Woodman Spit and Parmelia Bank. It is 8 miles in length north and south, 5 miles in width, and affords secure anchorage nearly throughout, in 5 to 12 fathoms, well protected from all winds, especially on the western side near Garden Island. The holding ground consists of stiff blue clay.

It is entered only through Success Bank and Parmelia Bank Channels from Gage Roads. Both channels are marked by light beacons and light buoys. The lighted range beacons located about 2 miles westward of Woodman Point, in range $169\frac{1}{4}^{\circ}$ lead through both channels. These range lights are also a range for transit through Cockburn Sound. The Front light of Success and Parmelia Banks Channel Range is also the Rear light

of Cockburn Sound Range. Vessels proceeding southward into Cockburn Sound or northward into Parmelia Channel should leave the range beacons on their port hand.

Tides.—It is high water, full and change, in Cockburn Sound, at 9h. 0m; springs rise from 1 to 1½ feet.

8-65 Western shore.—Garden Island, which forms the western side of Cockburn Sound is 5.5 miles in length, north and south, and from 700 yards to a little over 1 mile in breadth; its western side is bordered with reefs, extending 400 to 800 yards from the shore. The hills on the western side of the island rise abruptly from the beach, varying from 110 to 195 feet in height, clothed with grass and bush; the summit is near its center, and is about 195 feet in height. The eastern side of the island is lower, with a small growth of trees in the valleys. The northern conspicuous hillock on its western side is 135 feet high, named the Haycocks. The northern extremities of the island are Entrance Point, and Beacon Head within it; these, with the surrounding reefs, have been mentioned with Challenger Pass.

8-66 Dance Head ($32^{\circ}10' S.$, $115^{\circ}40' E.$) is a low sandy projection, about 1 mile southeastward of Beacon Head; thence southward for 1 mile to Cliff Point the shore is only a few feet above the sea, behind which the flat extends 700 yards to the foot of the hills. Two miles southward of Cliff Point is a conspicuous sand-faced cliff, with Colpoys Point, low and sandy, 1 mile beyond, forming the northern point of Port Royal or Careening Cove.

Harding Rock, with a least depth of less than 6 feet, is the northern extremity of a detached bank, 400 yards in length, lying between Second and Dance Heads, and lies 800 yards, 120° from the former.

8-67 Sulphur Bay, between Dance Head

and Cliff Point, has in its southern part a rocky spit with depths of $4\frac{1}{4}$ to 5 fathoms extending 800 yards from the shore.

Sulphur Bay was formerly the winter anchorage for vessels resorting to Swan River, being sheltered from the prevalent winds.

The best anchorage in Sulphur Bay is northeast or southeast of Sulphur Rock, in 9 fathoms, clay bottom.

Water may be obtained from a well near Cliff Point; wood is not plentiful and of small description.

Sulphur Rock, of 13 feet, lies 200 yards southeastward of this spit, with Second Head just open of Dance Head.

Rocks.—At 800 yards southeastward from Cliff Point and 500 yards offshore, are some rocks with depths of less than 6 feet extending nearly 1,000 yards in a southerly direction nearly to the shore. Southward of these rocks the shore bank extends 400 to 600 yards off as far as Colpoys Point, with depths under 3 fathoms steep-to. A patch, with depths of less than 6 feet, lies about 1,700 yards north-northwestward of Colpoys Point and about 500 yards offshore.

8-68 Port Royal (Careening Cove) ($32^{\circ}14' S.$, $115^{\circ}42' E.$) is 1,000 yards wide between Colpoys and Perkin Points, with depths of 8 fathoms, over clay bottom, and is fringed by a sand bank extending from 100 to 200 yards from the shore. Two small rocks, a few yards apart, lie 300 yards from its western shore, with depths of 5 and 7 feet over them.

On the western shore about 1,400 yards southwest of Colpoys Point is a boat landing.

Two jetties are located in the vicinity of this boat landing. The northern jetty is 200 feet long and has a depth of 15 feet alongside its 50-foot head. A breast dolphin has been established about 50 feet northeastward of this jetty. The southern jetty is similar to the other but has a depth of only 6 feet alongside its head.

(1247) AUSTRALIA—West coast—Jervoise Bay—Jetties nonexistent.—

1. The two jetties in (approx.) $32^{\circ}08.6' S.$, $115^{\circ}45.5' E.$ will be expunged.
2. A rock groin exists between the two jetties in (1) extending 0.1 mile in a $194^{\circ}30'$ direction from the shore.
3. Foul ground exists inshore of a line from the head of the groin in (2) to the stranded wreck about 0.15 mile ESE.

(N.M. 8/66.)

(N.M. 2(35), (36), Sydney, 1966.)

H.O. Chart 1907.

H.O. Pub. 74, 1952, page 317.

8-69 Collie Head (*plan on H. O. Chart 1907*), the southern extremity of Garden Island, is 60 feet high, consists of rocky cliffs, separated by sandy bights, with foul ground extending about 600 yards to the southeastward from the outer cliff.

Southern Flats extend 1.8 miles southward and southeastward of it, patches on which are nearly awash. The flats are steep-to on their northern, eastern, and southeastern sides. With a heavy west or southwest swell the sea breaks heavily.

A light is shown from a black steel-framework beacon situated on the eastern edge of Southern Flats, at about $1\frac{1}{2}$ miles east-southeastward of Collie Head.

8-70 Eastern shore (*H. O. Chart 1907*).—From Woodman Point the shore trends southerly about 5 miles to James Point, forming a slight bay, the northern part of which is known as Jervoise Bay. A white obelisk is erected on the limestone ridge, 141 feet high, 1.3 miles southeastward from Woodman Point.

Nearly midway between Woodman and James Points, at about 1,000 yards inshore, is Mount Brown, 243 feet high (not charted), the highest point of the coast ridge, which continues in a southerly direction, varying from 120 to 200 feet in height and thickly wooded. Immediately within the ridge there are lakes and swamps, extending northward and southward for several miles.

Landmarks.—A steel cylindrical tower (refinery) 200 feet in elevation, is located about $\frac{1}{4}$ mile inshore on James Point. A chimney, 114 feet high, is located about 700 yards north-northeastward of the tower. A continuous flame burns from this chimney.

Jetties.—Refinery Jetty, of L-shaped form, with a length of more than 880 feet, is located at James Point; the face of the jetty is roughly parallel to the adjacent shoreline. There are three 250-foot berths with depths of 44 and 45 feet (1963) alongside. Vessels secure to dolphins. Tugs and line-tending craft are available.

A jetty, about 480 feet long, extends westward from the shore about $\frac{1}{4}$ mile southeastward of the head of Refinery Jetty.

Steelworks Jetty, about 1,400 feet long, extends northwestward from the shore about 1 mile northeastward of James Point. The jetty has one berth, 640 feet long with 30 feet alongside (1961).

A jetty, having a berth of about 1,070 feet with 39 feet alongside, extends about $\frac{1}{2}$ mile westward from a position about 2 miles north-northeastward of James Point.

Buoys moored about 400 yards and 700 yards north-northeastward of the jettyhead mark the eastern side of a turning basin off the jetty. The jetty is well fendered and has a 10-ton travelling crane. Two floodlight towers, 80 feet high, are located on the jetty, one at each end of the berth. Fresh water and provisions are available at the jetty.

Two small jetties extend from the shore in Jervoise Bay, one in the northeastern part and one in the southeastern part about $1\frac{1}{2}$ miles southward of Woodman Point.

A breakwater extends a short distance offshore from about $\frac{1}{4}$ mile eastward of Woodman Point. Two jetties, with depths of more than 20 feet alongside and suitable only for small craft, extend from the breakwater. Strong surges are felt at the jetties during the winter months.

8-71 Jervoise Bay ($32^{\circ}08' S.$, $115^{\circ}45' E.$).—Although protected from the northward, a heavy swell rolls into Jervoise Bay, through Challenger Pass and North Channel during westerly gales, and with southwesterly winds a short, heavy sea sets in. Landing is impracticable during these winds owing to the surf on the beach.

8-72 Shoals.—From Woodman Spit, a sunken ridge, with depths under 5 fathoms, and with many shallow isolated patches of 2 to 3 fathoms, extends to James Point, parallel to the shore, at a distance of about $1\frac{1}{2}$ miles. On the eastern side of this ridge, about $1\frac{3}{4}$ miles northward of James Point, there are two patches, close together, of $1\frac{1}{2}$ and $1\frac{3}{4}$ fathoms, respectively. Within this ridge are depths of 4 to 6 fathoms, sand and mud bottom, with several rocks having depths of from less than 6 feet to 3 fathoms of water over them. For the positions of these, see the chart.

There are several passages, with about 4 fathoms of water, over this ridge, but in the absence of any natural range marks, unless buoyed, vessels above 12 feet draft without local knowledge should only use Woodman Channel.

Between these shoals and Garden Island there is an almost uniform depth of 10 to 12 fathoms over a bottom of soft blue clay.

Channels to Jervoise Bay and Steelworks Jetty.—Woodman Channel, with a depth of 28 feet, trends about 1 mile northeastward into Jervoise Bay from a point about $1\frac{1}{4}$ miles southwestward of Woodman Point.

Jervoise Channel, with a depth of 28 feet (1961), extends from the northeastern end of Woodman Channel about $1\frac{1}{2}$ miles south-southeastward of Medina Channel.

Medina Channel, with a depth of 28 feet (1961), is an extension of Jervoise Channel that trends about 2 miles further south-southeastward to a point about $\frac{3}{4}$ mile northeastward of the Steelworks Jetty.

Each channel is 600 feet wide.

James Channel, about 450 feet wide with a depth of 24 feet (1961), leads about 2 miles southeastward from a point $2\frac{1}{2}$ miles north-northwestward of James Point to the southern end of Medina Channel.

Navigational aids.—Two lights in range $051\frac{1}{2}^{\circ}$ mark the center of Woodman Channel. The front light is shown from a steel tower surmounted by a spar daymark on the shore about $\frac{1}{2}$ mile southwestward of Woodman Point Light (sec. 8-27), which forms the rear light.

Two beacons in range 344° mark the center of Jervoise Channel. The front beacon, 39 feet high, is a steel tower on a wooden dolphin surmounted by a spar daymark about 1 mile west-southwestward of Woodman Point Light. The rear beacon is a similar structure 49 feet high, without the daymark, located about $\frac{1}{2}$ mile north-northwestward of the front beacon.

Two lights in range 164° mark the center of Medina Channel. The front light is shown from a white steel framework tower located on the shore about $1\frac{1}{4}$ miles north-northeastward of James Point. The rear light is shown from a steel tower about $\frac{1}{2}$ mile south-southeastward.

Two lights in range 125° mark the center of James Channel. The front light is the Medina Channel front range light. The rear light is shown from a steel tripod, surmounted by a white striped daymark, and is located about $\frac{1}{4}$ mile southeastward of the front light.

Two light beacons mark the entrance of Woodman Channel about $2\frac{1}{4}$ miles southwestward of Woodman Point Light. Two similar light beacons mark the entrance of Medina Channel about 2 miles south-southwestward of Woodman Point Light. A similar light beacon stands close southward of the junction of Woodman and Jervoise Channels.

Two lights in range 133° mark the approach to the Refinery Jetty. The front light is shown

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(7210) AUSTRALIA—West coast—Fremantle Outer Harbor—Cockburn Sound—**Prohibited area changed.**—A dashed line will be charted from a position about 0.27 mile $178^{\circ}30'$ from the FR light (32°14.0' S., 115°45.3' E. approx.) in a 284° direction for about 0.80 mile to the existing boundary of the prohibited area.

Note.—The curved dashed line south of the above will be expunged.

(N.M. 46/66.)

(N.M. 40(393), Sydney, 1966.)

H.O. Chart 1907.

H.O. Pub. 74, 1952, page 318a.

from a column with a triangular topmark, point up, painted in red and yellow horizontal bands, located on the elbow of the jetty. The rear light is shown from a gray steel framework tower with a triangular topmark point down, similarly painted and located on the shore about 1/3 mile southeastward.

Two sets of lights, vertically disposed, are shown from the northern and southern corners of a cooling water intake close northward of Refinery Jetty.

A light is shown from a tower at the head of Steelworks Jetty. Another tower is located on the jetty about 200 yards from the latter.

A light is shown on the southeastern corner of the Refinery Jetty.

A light is shown on the seaward end of the jetty, located about 2 miles north-northeastward of James Point.

Elbow Light Buoy, painted black, is moored about 1½ miles northward of Steelworks Jetty on the western side of Medina Channel.

Medina Light Buoy, painted black, is moored about ¾ mile north-northeastward of Steelworks Jetty on the western side of Medina Channel.

Light buoys mark the entrance of James Channel, about 2½ miles north-northwestward of James Point. Pinnacle Rock, a 2½-fathom shoal located on the southern side of the channel, is marked by a buoy. A light buoy lies on the same side of James Channel, about 1,200 yards southeastward of Pinnacle Rock.

Two light buoys are moored near the western edge of the bank westward and north-westward of James Point. A pile beacon with a triangular topmark, point up, stands about 800 yards westward of James Point and marks the western edge of shoal water.

Directions for Woodman, Jervoise, James, and Medina Channels.—After clearing the rear range light structure southward of Parmelia Bank Channel, vessels proceeding to the Steelworks Jetty should steer a south-easterly course until Woodman Channel Range Lights are in range 051½°. This course leads between the two light beacons marking the rocks on the edge of the 5-fathom curve and the entrance of Woodman Channel.

After passing the light beacon marking the junction of Woodman and Jervoise Channels on the starboard hand, course should be altered to enter Jervoise Channel with the range lights in range 164°. This range also marks Medina Channel.

Pass Elbow Light Buoy and Medina Light Buoy to starboard and alter course for the Steelworks Jetty on the desired approach for berthing.

Vessels proceeding to Steelworks Jetty via James Channel should clear the rear range light structure of Parmelia Bank Channel as mentioned above. Then resume a course of 169°, with Parmelia Bank Channel range in line astern, until James Channel Range Lights are in range 125°. Steer 125° until past the light buoy located about 1 mile northwestward of Steelworks Jetty, and alter course to the southeastward for the jetty.

Except in case of easterly winds during the summer months, vessels are advised to berth bow out using the starboard anchor for swinging.

Anchorages.—There is a good summer anchorage in the bight northward of James Point in 4½ to 5½ fathoms, mud bottom, sheltered by the shallow ridge extending northward from that point.

Anchorage principally for tankers awaiting berth can be taken in a larger area about 1½ miles westward of James Point in about 10½ fathoms.

Prohibited area.—An area, prohibited to all unauthorized vessels and boats, lies close southward of James Point, between the shore and a pecked line arc, indicated on the chart.

Mooring buoys principally for tugs, are placed near the shore southward of the jetty.

8-73 Mangles Bay, the southern part of Cockburn Sound, is between James Point and John Point, within Cape Peron, and is protected from the westward and northward by Cape Peron and the reefs extending across South Channel to Garden Island.

A light is shown on the shore about 2½ miles south-southwestward of James Point.

Anchorage.—The best anchorage in Mangles Bay is in about 9 fathoms, mud bottom, with John Point bearing 280° , and the head of the L-shaped jetty at Rockingham bearing 200° , distant 750 yards. Two mooring buoys lie in about the center of the anchorage.

8-74 Rockingham—Jetties (32° 16' S., 115° 43' E.).—An L-shaped jetty extends from the shore at Rockingham about 2 miles east-southeastward of John Point. The head of this jetty is 350 feet long and has a least depth of 31 feet alongside, except at the extreme western end, where the depth is 28 feet. Another jetty extends from the shore about 800 yards eastward of the jetty just described.

The shore of the bay is steep for 1,000 yards on either side of the eastern jetty, there being 7 or 8 fathoms close alongside the edge of the bank, which is less than 200 yards from the high-water line.

Rockingham was (1923) closed to shipping and has not been used as a port for some years past.

8-75 SOUTH CHANNEL (*plan on H. O. Chart 1907*), leading to Cockburn Sound from seaward, lies between Garden Island and John Point, the northern extremity of Cape Peron, and is rather more than 1 mile wide. It is barred by the Southern Flats, which extend 1.8 miles southeastward of Garden Island, and thence across to the cape. There is a depth of about 9 feet over the bar, about 1,800 yards across, which may be taken by those thoroughly acquainted with it in small vessels. There are many shallow patches extending from the shore on both sides of the fairway, and to the distance of 1 mile westward of John Ledge. A beacon marks the southeastern side of

Collie Ledge, which lies about $\frac{1}{2}$ mile southward of Collie Head. The ledge has a least depth of 9 feet and extends about 260 yards westward from the beacon.

Ledges.—Ledges awash at low water extend 600 yards southward from Southwest Head, the southwestern point of Garden Island, with patches of 2 fathoms 200 yards beyond and others of $2\frac{1}{2}$ to $2\frac{3}{4}$ fathoms in the fairway and seaward of it.

8-76 John Ledge is a small black rock awash, at low water, at the northern extremity of the ledges extending about 1,200 yards from John Point, many of which are also awash.

8-77 Directions (H. O. Chart 1907).—South Channel can only be used during fine weather and with local knowledge, as in southwesterly gales the sea breaks throughout. It is stated that vessels from the southward bound into Cockburn Sound by South Channel should cross Five-fathom Bank from 1 to 2 miles northward of Coventry Reef (until the waters southward of that reef have been surveyed) and thence steer for the highest part of Garden Island; and when John Point bears 086° , to bring Collie Head, 60 feet high, to bear 040° and steer for it on that bearing until John Ledge bears 176° , thence a southeasterly course to the desired anchorage in Mangles Bay.

The clear passage 2 miles wide between Coventry Reef and the reefs fronting Warnbro Sound seems preferable to crossing Five-fathom Bank northward of that reef; the dangers, if any, southward of Coventry Reef have not been surveyed, therefore that reef should be given a wide berth by keeping to the eastern side of the passage.

The current, in summer and with southwest winds, sets across South Channel in a northeast direction until northward of John Ledge, thence it turns to the eastward. In winter it sets from Mangles Bay northwestward to John Ledge and thence southwestward.

8-78 THE COAST.—Cape Peron ($32^{\circ}16' S.$, $115^{\circ}41' E.$), the southwestern extremity of a conspicuous headland, with a conical summit 88 feet high, forms the southern point of entrance of South Channel, leading into Cockburn Sound. It is joined to the mainland by a low, narrow, sandy neck, which separates Mangles Bay from Shoalwater Bay, giving the cape the appearance of an island when seen from a distance.

Mushroom Rock, about 12 feet high, lies 100 yards off the northwestern extremity of Cape Peron. Ledges awash at low water extend 400 to 600 yards from the cape, and several sunken rocks, with 1 to 3 fathoms extend about 1,200 yards to the westward and southwestward. These dangers should not be approached in less depths than 8 fathoms.

8-79 Shoalwater Bay lies between Cape Peron and Mersey Point, 2 miles to the southward, and, as its name implies, is useless as an anchorage, sunken dangers extending nearly out to the 5-fathom curve, and with patches under 5 fathoms beyond.

Bird Islet, 32 feet high, is situated 1,000 yards southward of Cape Peron summit, with Gull Rock, 12 feet high, within it. Seal Islet, 30 feet high, lies 1.5 miles southward of the cape; a sunken ledge extends from the shore nearly out to the islet.

There are several passages between the islets and ledges, with $2\frac{1}{2}$ to 3 fathoms, but too intricate for navigation. The passage generally used by boats is between the ledges extending from Seal Islet and Penguin Isle,

keeping close to the ledges on the northern side to avoid a 6-foot rock 500 yards north of Penguin Isle.

8-80 Penguin Isle, connected with Mersey Point by a sunken ledge which dries in places, is 800 yards in length north and south, and about 200 yards in breadth; near its southern end is a conical hill 60 feet high, scantily covered with vegetation.

Sunken rocks and ledges, with depths of $2\frac{3}{4}$ and $4\frac{1}{4}$ fathoms, extend to the distance of about 1,000 yards westward of this island, and patches of 3 and $3\frac{1}{4}$ fathoms are situated about 1,300 yards westward of Second Rock, 8 feet high, southward of Penguin Isle.

The western extremity of Garden Island bearing 356° leads westward of all ledges southward of Cape Peron. (H. O. Chart 1907.)

8-81 WARNBRO SOUND—General remarks.—Warnbro Sound lies between Mersey Point and Becher Point and is 4 miles wide. It is protected from the westward by a chain of islets, rocks, and reefs, with narrow passages between, extending right across.

The principal entrance is southward of Passage Rock, which is situated nearly midway between Penguin Isle and Sisters Rocks; it has depths of 5 to 6 fathoms, but is tortuous. There is a clear channel 2 miles wide between Coventry Reef and the islets and reefs in front of Warnbro Sound, with regular depths of 8 to 12 fathoms sand bottom.

Aspect.—The northern shore of the sound is very low, and behind it are some extensive swamps, dry in summer; the eastern shore is backed by sand hillocks, about 80 feet high, scantily covered with scrub and brush; the southern shore is low. Eastward of the sand hillocks the lowlands extend over 1 mile to a ridge of grassy hillocks; within them are

two extensive lakes, named Gulugup and Walyungup; on the eastern sides of these lakes is a wooden range, the highest point, named Tamworth Hill, being 300 feet high. The junction of the roads between Rockingham, Mandurah, and Pinjarra is situated about 1 mile from the northeastern corner of the bay.

8-82 **North Sands**, parts of which dry at low tides, extend from the northern shore of the sound and Penguin Isle to Passage Rock. The outer edge is skirted by rocks from 8 to 27 feet high.

Passage Rock, 20 feet high, at the southern extremity of the sands, rises abruptly from the middle of a dry ledge; this rock forms the northeastern side of the main entrance to Warnbro Sound.

South Sands are banks of sand and weed, in some places dry at low water, extending from Becher Point northward nearly 2 miles to Tongue Sand, its extremity forming the southern side of Coasters Channel.

8-83 The **Sisters**, on the northwestern edge of South Sands, are a cluster of six bare rocks, the highest 23 feet above the sea, whence sunken ledges extend northward to a rock 2 feet high, at the western extremity of Tongue Sand.

Murray Reefs (*H. O. Chart 3423*) are the continuation southward of the Sisters, on the western edge of South Sands, for a distance of about 6 miles. The southernmost rock, on which the sea breaks occasionally, lies 331° , 4.5 miles from Robert Point and 4.5 miles from the nearest shore; Horseshoe Reef, the shoalest (name not charted), on which the sea breaks in fine weather, is 4 miles from the Sisters. Coasters avail themselves of the smooth water inshore of these reefs to work up against adverse winds. Several vessels have been wrecked on the seaward side of these dangers, as there is a

strong set toward them, especially during westerly gales.

8-84 **Ledges**.—Between and seaward of Passage Rock and the northern end of Tongue Sand are several sunken ledges about 1,200 yards in length in a north and south direction, the southernmost of which are awash in places at low water, and form the northern side of Coasters Channel. The northernmost are named Austin, Clifton, and Harding ledges, with depths of $1\frac{1}{2}$ to 3 fathoms, northward of which is the Bar Channel, into the sound. Austin Ledge lies 650 yards, 266° from Passage Rock.

Copeland Ledge, with $1\frac{1}{4}$ fathoms least water, lies 350 yards northward of Austin Ledge, and a detached ridge, with a depth of $1\frac{3}{4}$ fathoms lies 670 yards northwestward of Austin Ledge; a patch of 3 fathoms lies 450 yards northward of the $1\frac{3}{4}$ -fathom patch. All of the above lie within the 5-fathom curve.

At about 600 yards westward of Harding Ledge is the northern extremity of two ridges about 600 yards in length, with depths under 5 fathoms; from heads of $3\frac{1}{2}$ fathoms lie 1,300 yards, 254° and 1,500 yards, 243° respectively from Passage Rock.

Channel Reef, awash at low water, and about 200 yards in length, lies 900 yards, 179° from Passage Rock, and on the northern side of Coasters Passage.

A patch of $1\frac{3}{4}$ fathoms lies directly in the fairway of Coasters Passage, between the rock 2 feet high, on the northwestern extremity of Tongue Sand, and the end of the reefs southward of Harding Ledge.

8-85 **Entrances—The bar**.—At either end of the ledges just described are the northern and southern entrances to the sound, but they are not available except to those thoroughly acquainted with them.

The best and widest channel of these is that over the bar, northward of Austin and

Clifton Ledges, and between the latter and Passage Rock in depths of 5 fathoms, but the channel is tortuous except for steam vessels, and even for those, in the absence of natural marks and buoys, is not available to strangers. There is a straight passage 100 yards wide between Austin and Harding Ledges, but being so narrow it can not be recommended.

Coasters Channel, the southern entrance, is between the ledges extending southward from Harding Ledge, and the $1\frac{3}{4}$ -fathom rock before mentioned as lying in the fairway. The channel is only 200 yards in width, and has about $3\frac{1}{2}$ fathoms of water in it. There are no natural range marks, and in absence of any buoys this channel is not available to a stranger.

8-86 **Port Kennedy**, the southern part of Warnbro's Sound, affords secure anchorage in 7 to 9 fathoms sand and mud bottom, about 1 mile northeastward of Becher Point.

Water may be obtained by digging in the swampy ground about 200 yards inshore of Becher Point, but no firewood is obtainable. The nearest settlement is Rockingham, in Mangles Bay, 8 miles northward from Port Kennedy.

Tides.—It is high water, full and change, in Warnbro's Sound, at 9h.; springs rise 2 feet, and neaps 1 foot 6 inches; they are, however, very irregular, being greatly influenced by the prevailing wind. During winter gales from the northward and westward, the water rises considerably above its normal level, and the land winds, prevalent mostly in November, December, and January, cause very low tides, especially between the hours of 4 and 11 a. m.

8-87 **COAST—Murray River and Peels Inlet** ($32^{\circ}31' S.$, $115^{\circ}48' E.$, *H. O. Chart 3423*).—The coast from Becher Point trends southeastward about 3 miles to a high sandy hillock, thence southward 6.8 miles to Robert Point, western side of entrance to Murray River. The point is low and sandy, with a high and wooded hill within it.

Ledges which dry extend 300 yards off the point.

The mouth of Murray River is nearly 1,000 yards wide, with sand spits extending nearly across it. The bar is only a few yards across, and has seldom more than 4 to 6 feet of water; the depth varies according to the weather, and at times the mouth is closed altogether. From its mouth the river trends in a southerly direction 2 miles, where it opens into a sheet of water named Peels Inlet, which extends 5 miles to the southward, and is about 5 miles wide; at its southwestern corner its width is reduced to about 2 miles, whence it extends southward 10 or 11 miles, under the name of Harvey Estuary.

Murray River resumes its course from the eastern corner of Peels Inlet in a general easterly direction for about 5 miles, thence to the southward to Pinjarra, etc.

8-88 **Mandurah and Pinjarra**.—Half a mile within the mouth of Murray River on the eastern shore, is the small town of Mandurah, with post and telegraph offices. Sea mullet, which are caught in the Murray River at certain periods of the year, are canned; there are also large fruit-preserving companies.

Pinjarra, on the River Murray about 10 miles above Mandurah, is the chief township of the district, and a station of the southwestern railroad.

8-89 **Cape Bouvard** ($32^{\circ}41' S.$, $115^{\circ}37' E.$, *H. O. Charts 3423 or 3424*).—From Robert Point, at the mouth of the Murray, a rocky shore, with occasional small sandy beaches, extends southwestward for 10 miles to Cape Bouvard.

Bouvard Reefs lie between 5 and 15 miles southward of Cape Bouvard, at distances varying from 2 to 3 miles offshore; the southern reef is 3.3 miles offshore, about 22.5 miles, 275° from Mount William. The sea only breaks on these reefs during a heavy swell. There are depths of 12 to 16 fathoms westward of Bouvard Reefs.

(6030) AUSTRALIA—West coast—Bunbury—Landmark.—Tanks (~~conspic~~)
exist about 200 feet 293° from Bunbury Light (33°19.1' S., 115°37.9' E. ~~approx.~~).

(N.M. ~~32/33~~)

(N.M. 32(317), Sydney, 1966.)

H.O. Chart 3501 (Plan A).

H.O. Pub. 74, 1952, page 322.

(7211) AUSTRALIA—West coast—Bunbury—Range lights established.—

1. Range lights have been established as indicated:

(a) Front, *F. Bu.*, about 397 yards 292° from power station chimney ($38^{\circ}18'$
 $55.5''$ S., $115^{\circ}39'35.5''$ E. approx.).

(b) Rear, *F.Bu.*, about 417 yards 160° from (a).

2. A range line will be charted in a 340° direction from (1b) as a dashed line for 0.5 mile, thence as a solid line for 1.0 mile.

Note.—The legend "*Lts in line 160°* " will be charted near the northern **end of** the line.

(N.M. 46/66.)

(N.M. 40 (394), Sydney, 1966.)

H.O. Chart 3501 (Plan A).

H.O. Pub. 111B, Nos. 15812, 15812.1.

H.O. Pub. 74, 1952, page 322.

8-90 The coast from Cape Bouvard trends southward for a distance of 37 miles to Koombanah Bay; a narrow grassy topped ridge with an average height of 180 feet, extends 25 miles southward of the cape, thence for 3 or 4 miles the hills are about 70 feet high, rising gradually southward toward the bay. At 6 and 16 miles, respectively, south of the cape are two conspicuous sand patches extending from the beach to the summit of the ridge. Within the coast ridge the hills rise to heights of 247 and 355 feet.

Rocks.—At from 11 miles northward of Koombanah Bay, the beach is fringed for 2 miles in a southerly direction by several ledges and sunken rocks, dry in places at low water, extending 400 to 600 yards from the shore; at about 3.8 miles northward of the bay are two sunken rocks 1,200 yards offshore.

Mount William ($32^{\circ}56' S.$, $116^{\circ}02' E.$), 1,588 feet high, is a conspicuous peak, $18\frac{1}{2}$ miles inland, rising from the apparent level surface of the Darling Range.

8-91 Koombanah Bay (Koombana Bay) ($33^{\circ}18' S.$, $115^{\circ}39' E.$, *plan on H. O. Chart 3501*) is 1.3 miles wide between Casuarina Point and its eastern shore, and is open to the northward. At its head, within Casuarina Point, is the harbor and the town of Bunbury.

Casuarina Point, its western extremity, is composed of sand hills covered with low scrubby vegetation, gradually rising to the height of 130 feet.

8-92 Harbor.—The western side of the harbor is formed by a breakwater, about 5,500 feet long, which extends northeastward from Casuarina Point, following the line of the reef. The eastern side is formed by a jetty about 4,800 feet in length, which

extends north-northeastward from a position about $\frac{1}{4}$ mile northeastward of Casuarina Point.

In 1963 there were three berths on the southeastern side of the jetty with depths of $24\frac{1}{2}$, 28 and 30 feet; and three 600-foot berths on the northwestern side with depths of 18, $27\frac{1}{2}$ and 30 feet alongside. There was a depth of 30 feet in the approach channel (1963). The greater part of the harbor has depths of 6 to 18 feet.

No. 1 groin, about 800 yards long, is located about 1 mile eastward of the foot of the jetty. No. 2 groin is located about 1 mile northeastward of No. 1 groin.

Vessels load in turn alongside the jetty according to draft; 28 feet (1963) is the maximum safe loading draft.

A conspicuous silo stands 350 yards southward of the root of the jetty. A power station with five conspicuous chimneys stands close southeastward of the root of No. 1 groin.

The town of Bunbury has been reported to give good radar returns up to 10 miles.

Lights.—A light is shown from a tower on a pile, about 600 yards southward of Casuarina Point.

A light is shown on the northern end of the breakwater.

8-93 Anchorage.—Vessels moor under direction of the harbor master. The mole or breakwater affords good shelter during northwest gales, which are prevalent from May to October, but in high northwesterly winds vessels approaching the berths are advised to stand off until weather moderates. The usual anchorage is in about $4\frac{1}{2}$ fathoms, sand and mud bottom, eastward and southeastward of the end of the jetty and the holding ground is good.

CAUTION.—A strong set toward the breakwater is generally experienced, especially during winter; vessels should therefore keep about 1 mile off the end of the breakwater when approaching Bunbury.

SIGNALS.—Vessels communicate with the signal and telegraph station at Bunbury by the International Code.

8-94 TIDES.—It is high water, full and change, in Koombanah Bay, about 9h.; springs rise 2 1/2 feet and neaps 1 1/2 feet.

Fogs are practically unknown here, but from February to April, haze from bushfires is dense at times.

Pilots board all vessels, pilotage being compulsory. Pilots will not take vessels in at night. The pilot will board from a white motorboat and meets vessels about 2 miles outside the harbor. The "H" flag is displayed by the pilot boat. Masters should report their estimated time of arrival well in advance through the harbor office at Bunbury by radio, or by telephone from Fremantle.

8-95 DIRECTIONS (H.O. Charts 3423 or 3424 and plan on H.O. Chart 3501).—Approaching Koombanah Bay from the westward, Mount Lennard, the highest hill on Roe Range, 15 miles inland, in range 103° with a saddle-shaped hill near the coast, will lead to it. This track passes about 1 1/2 miles northward of Naturaliste Reefs (sec. 8-107). When Casuarina Point Mole Lighthouse is in sight steer to round it at the distance of 500 yards or more, and haul down for the anchorage eastward of the jetty.

Vessels entering Bunbury Harbor should keep the groyne in line bearing 150° until the southeastern side of the outer berth of the jetty is open, and then alter course to proceed to berth allotted keeping within 200 feet of the jetty.

At night, if from southwestward, a vessel should not come under 8 fathoms until well north of Casuarina Point Mole Light. In working into the bay, the depths off the eastern shore gradually shoal, there being 3 fathoms at 700 yards from the beach; a heavy swell, however, frequently rolls in on this shore, and in bad weather the patch of rocks, with 3 3/4 fathoms of water and nearly 1,200 yards offshore, breaks heavily.

8-96 LESCHENAULT INLET (H.O. Charts 3501 and 3424) empties into the southwestern

corner of Koombanah Bay, abreast the town, having a shallow sand bar with depths, in 1948 of 2 feet. Above Waller Point, where Preston River discharges its waters, at 1.5 miles from the entrance, the inlet opens into a lagoon, from 1,500 yards to 1.3 miles wide; this lagoon extends over 7 miles to the northward nearly parallel with the seacoast, from which it is separated by a peninsula ridge of scantily covered sand hills, varying from 200 to 1,000 yards in breadth, the drift from which is gradually shoaling the water in the lagoon.

At 1.5 miles above Waller Point on its eastern shore, Collie River discharges, which, together with Preston River and their numerous tributaries, the Ferguson, Brunswick, and Wellesley, drain large tracts of country.

The eastern shore is backed by a ridge of hills from 100 to 200 feet high and fronted by extensive flats; between these and the western shore of the inlet is a depth of from 2 to 5 feet. Fish, black swans, and other waterfowl abound in the inlet.

8-97 BUNBURY (33°19'S., 115°39'E., plan on H.O. Chart 3501), in the southwestern corner of Koombanah Bay, is the principal port of the southern district, and 112 miles from Perth. The population is about 13,500 (1963). Bunbury is a first port of entry (sec. 1-18). A radio quarantine report is required at least 24 hours in advance.

BERTHS.—Berth Nos. 1, 2, and 3 East have depths alongside of 30, 28, and 24 1/2 feet, respectively, (1966). Berth Nos. 1, 2, and 3 West have depths of 30, 27 1/2, and 23 feet, respectively, (1966). Berths are about 600 feet in length and vessels up to 530 feet can dock and undock without difficulty. Special arrangements are necessary for vessels of greater length up to 570 feet.

The jetty is connected with the general railway system and is equipped with five 3-ton cranes. There are steam and electric winches. The jetty is lighted.

REPAIRS.—Repair facilities are limited, and only urgent, minor deck and engine room repairs can be made. It is preferable to have repairs effected at Fremantle. Divers are available in an emergency.

SUPPLIES.—Deck and engine room supplies are available. Dairy products, fish, fruits, and meats are available. Water of fair quality is

piped to the jetty. Fuel oil is available at Berths 1 East and 1 West via pipeline. The pumping rate is about 513 bbls. per hour, a 48 hour advance notice is required.

COMMUNICATION.—Bunbury is connected by railroad with the main lines of the State, also with the coal fields on Collie River. Coastal steamers call frequently. There are excellent telephone and telegraph services available. Radio service is obtained through Perth Radio.

HOSPITAL.—There is a government hospital, with beds for 30 patients, and several private hospitals.

CLIMATE.—Bunbury and Busselton, owing to their genial climate, are summer resorts. Mean annual height of barometer 30.01 inches; maximum 30.54, minimum 29.46. Mean temperature 61°; maximum 96°, minimum 35°. Mean annual rainfall 36.20 inches.

Weather forecasts may be obtained at the post office, daily except Sundays.

8-98 GEOGRAPHÉ BAY (plan on H.O. Chart 3424), between Casuarina Point and Cape Naturaliste, 34 miles apart, has depths of about 10 fathoms at a distance of 5 miles offshore and 20 fathoms 15 miles off; it is open to northerly and northwesterly winds.

The shore of Geographé Bay from Casuarina Point trends southwestward 20 miles to Wonnerup Inlet; for the first few miles a grassy ridge rises from the beach, having at nearly 3 miles southward of Casuarina Point a remarkable double-peaked grassy hillock named the Paps, 273 feet high; thence toward the inlet the shore is very low. From about 8 miles southward of Casuarina Point a continuous swamp extends in a southerly direction immediately behind the coast ridge, which varies from 200 to 1,000 yards in breadth. At 13 miles southwestward of Casuarina Point is Minninup, a high bare sand patch, forming one of the conspicuous features in this locality. Mount Lennard, 1,100 feet high, about 12 miles eastward of Casuarina Point, is conspicuous.

SHOALS.—For 3 to 4 miles northward of Minninup sand patch the beach is fringed with ledges extending from 200 to 600 yards from the shore, and about 2 miles northward of the sand patch and 1,000 yards offshore is a sunken reef on which the sea breaks

during a heavy swell. The whole shore of Geographé Bay southward of the sand patch is fronted with sand and rocky banks, with depths of 1 to 3 fathoms extending from 1,000 yards to 1.5 miles.

A 3-fathom shoal lies 600 yards 055° from the head of the jetty at Busselton.

8-99 WONNERUP INLET AND VASSE ESTUARY (33°36'S., 115°26'E.) have a common mouth a few yards wide, with only sufficient water for boats, and which is often barred completely. The inlet extends in an easterly direction above 1,000 yards, opening into a sheet of water 1,000 yards wide and 3.5 miles in length in a northeasterly direction.

Ludlow River empties into the inlet about 1.3 miles from the northeastern extremity.

Vasse Estuary from its entrance trends southwestward through a narrow channel for 1.5 miles, the land between it and the sea being about 200 yards across; thence to the eastward for 1,000 yards into a sheet of water extending westward for about 4 miles, varying from 1,000 yards wide at its eastern end to 200 yards at its western end, and passing through the town site of Busselton. The Abba and Sabina Rivers discharge into the estuary near the eastern end, and Vasse River into the western end.

During the winter, New River, 3 miles in length, connects the western end of the estuary with a small lake named Broadwater, which is about 1,500 yards from the coast.

QUARANTINE.—The quarantine area is limited by a circle with 1/4-mile radius and centered on the outer end of the jetty.

8-100 BUSSELTON (Vasse) (33°39'S., 115°20'E., plan on H.O. Chart 3424), a small town, and seaport in the southern part of Geographé Bay, with railroad connection to main lines via Boyanup Junction.

The export of timber and dairy produce are the chief industries of the place; population in 1964 was 2,500.

BUSSELTON JETTY is about 5,900 feet in length, narrow for the greater portion, but for about 600 feet from its extremity, and also in three other places, over a less distance, is about 39 feet wide as charted. The depth is 24 1/2 feet at its head, and there is no better water for nearly 600 yards distance off it. The berth on the eastern side of

the outer end is 504 feet in length, with a depth of 23 feet; that on the western side is 480 feet in length, also with a depth of 23 feet. The two inner berths have depths of 21 feet alongside at low water. The summer season, October to April, is the most convenient for vessels loading.

A light is exhibited from a 15-foot wooden gallows, at the end of the jetty.

Supplies of provisions may be obtained in limited quantities. Water is laid on to the jetty.

Fuel.—Collie coal can be put on board, from trucks at the jetty, at the rate of 50 tons per hour.

Communications.—There is a railroad connection to main lines via Boyanup Junction which is connected to Flinders Bay by a light railroad line, via Busselton; there is fortnightly steamship service to Bunbury.

Hospital.—Busselton Public Hospital, a government hospital, will receive seamen.

8-101 Anchorage (plan on H. O. Chart 3424).—Vessels can find good anchorage, in a depth of about 4 fathoms, about 600 yards north-northwestward of the outer end of the jetty.

Although Geographe Bay is open to the northwest, remarkably smooth water is experienced in comparison with the strength of the wind during gales from that quarter. The westerly swell was observed to diminish quickly eastward of a line joining Capes Naturaliste and Bouvard, especially southward of a line joining Cape Naturaliste and Minninup sand patch. A thick coating of seaweed was seen growing upon the bottom in depths of 15 fathoms and less water which probably helps to break up the swell.

8-102 Shoals.—Detached gravel banks, with from $2\frac{3}{4}$ to 3 fathoms on them, and 4 to 5 fathoms close around, lie from $1\frac{3}{4}$ to 3 miles westward of Busselton Jetty.

Tides.—It is high water, full and change, at Busselton Jetty at 9h. 29m.; springs rise 2 feet 3 inches.

Toby Inlet.—At 8.5 miles westward of Busselton Lighthouse is the entrance to Toby Inlet (generally closed), which extends westward for a considerable distance nearly parallel to the beach, and separated from it by a narrow strip of land.

8-103 The coast from a position about $1\frac{1}{4}$ miles westward of the entrance to Toby Inlet, where there is a mouth of a small stream, trends northwestward for 2.8 miles to Dalling Point, with numerous sandbanks, dry at low water, extending nearly 1,000 yards from the shore. At 1 mile northward of Dalling Point is Castle Rock, 110 feet high, nearly detached from the shore; and 1 mile beyond in the same direction lies Gannet Rock, 10 feet high. Between Dalling Point and Eagle Bay the coast rises almost abruptly from the beach to a height of 350 to 450 feet.

Water.—In the small bay southward of Gannet Rock, and in Eagle Bay, 3.3 miles northwestward from Dalling Point, there are streams of fresh water.

8-104 Eagle Bay.—Fair anchorage may be obtained in Eagle Bay during southerly and southwesterly winds, at about 1,500 yards from the beach.

Bunker Bay, about 1 mile northwestward of Eagle Bay, and 1.5 miles eastward of Cape Naturaliste, has several sunken rocks close to the beach. Bunker Point, the western entrance point of the bay and the eastern extremity of Cape Naturaliste, is a dark cliffy point over 200 feet high, the cliffs continuing nearly straight to the cape; ledges which dry extend 300 yards off the point, and about 400 yards northeastward of the point is a sunken rock.

Rocks.—At 1,200 yards 006° from Bunker Point is a rock with less than 6 feet of water over it, which does not always break; nearly midway between the point and Cape Naturaliste, and 600 yards offshore, is another rock with about 6 feet of water.

8-105 CAPE NATURALISTE ($33^{\circ}32' S.$, $115^{\circ}01' E.$), 400 feet high, is the western headland of Geographe Bay; its extremity is formed of low sandy hillocks. At 2 miles

within the cape is a round-topped grassy hill, 688 feet high, and at 4.5 miles in the same direction is a narrow ridge 752 feet high, falling abruptly on the eastern and western sides. Between this ridge and the shore of Geographe Bay there is a densely wooded ridge of hills, varying from 300 to 550 feet high, extending in a southerly direction for a few miles.

By night the sand hills forming the pitch of Cape Naturaliste are sometimes conspicuous against the dark background of the downs over them, and serve to distinguish the cape. Radar returns from Cape Naturaliste have been reported up to 26 miles in range.

About 400 yards from the extremity of the cape are several small rocks, visible at low water.

Light.—A light is exhibited from a 62-foot gray stone tower, 1 mile, 108° from the extremity of the cape.

Communication—A signal station is established at the lighthouse. It is connected by telephone with the telegraph system.

Vessels can communicate at night by Morse Code.

Fogs occur here between October and March, lasting from 2 to 8 hours at times.

8-106 **Wright Bank**, on which the sea breaks in a heavy swell, is from 1.5 to 2 miles northward of Cape Naturaliste, and consists of two patches 1,000 yards apart, northwestward and southeastward; the northern patch lies 346° , 2.3 miles from the lighthouse. In strong gales the rollers commence 1,000 yards westward of these shoal spots, being doubtless the edge of the shallow water.

There is a depth of 23 fathoms, gravel and shells bottom, at 100 yards northward of Wright Bank.

Rollers were observed on a spot midway between Cape Naturaliste and Wright Bank; it would probably break with an onshore

gale. Vessels should not pass inshore of Wright Bank.

Directions for clearing.—Castle Rock in range with Gannet Rock Point, bearing 145° , leads eastward of the dangers of Cape Naturaliste; and Sugar-loaf Rock, 138 feet high, well open westward of the pitch of the cape, bearing 172° , leads westward of them.

Current.—After northwest gales, or a continuance of northwesterly winds, there is a strong outset from Geographe Bay to the northwestward, which, meeting the ocean swell off Cape Naturaliste, produces at times an appearance of broken water extending 3 or 4 miles from the cape.

8-107 **Naturaliste Reefs** ($33^{\circ}18' S.$, $115^{\circ}05' E.$), on which the sea does not always break, lie 002° about 18.5 miles from Cape Naturaliste Lighthouse, and consist of two patches, nearly awash, lying northeast and southwest, 1,400 yards apart. The northern patch is steep-to on its western side, against which the sea, striking in bad weather, is thrown to a considerable height.

The soundings give no warning in approaching these reefs, as there are depths of from 20 to 23 fathoms 200 yards distant.

The 20-fathom curve skirts the dangers extending 2 miles northward from Cape Naturaliste, and thence trends to the northeastward, following the curve of Geographe Bay until reaching the parallel of Casuarina Point, where it turns abruptly to the westward in the shape of a prong, with Naturaliste Reefs at its extremity. There are depths of 23 to 27 fathoms, over sand and shell bottom, between Cape Naturaliste and Naturaliste Reefs.

8-108 **THE COAST** from Cape Naturaliste trends southward for about 10 miles to Cape Clairault; at 1.5 miles southward of the former there is a remarkable rock named the Sugar-loaf, 138 feet high and

about 200 yards from the shore. Southward of this rock for a distance of 4.5 miles is an unbroken cliffy coast, and at 1.5 miles beyond is a small deep bight with a sandy beach, having several rocks awash at low water lying off it. At 800 yards north-northwestward from the western end of this bight lies a rock 12 feet high.

Through a break in the coast ridge a small stream named Cunyulgup Brook discharges into the bight.

At 1,500 yards southward of the bight there is a cliffy point, with a rock, 47 feet high, 400 yards from it.

8-109 **Cape Clairault** ($33^{\circ}42' S.$, $114^{\circ}59' E.$, *H. O. Chart 3424*), about 100 feet high, is formed of sandy hillocks scantily covered with low scrub and bush, behind which the coast ridge rises abruptly to 500 and 600 feet.

The coast from Cape Clairault, a cliffy and rugged coast, trends southward 10 miles to Cowaramup Point, having several sunken rocks at a distance of 200 to 700 yards off.

There are several breaks in the cliffs through which the Cuninup, Wilyabrup, and Bilgedup Brooks empty into the sea, at respective distances of 3, 6, and 7 miles from the cape (not charted); Cuninup and Wilyabrup Brooks have high bare sand patches on the southern side of their mouths.

8-110 **Cowaramup Point** is a bare sandy projection with rocky ledges extending 700 yards northwest of it; there is a deep rocky bight on its northern side, with numerous sunken rocks.

Reef.—At 2.3 miles 333° from Cowaramup Point, is Cowaramup Reef, of considerable extent, over which the sea breaks in a heavy swell; between it and the shore the ground is foul.

A partially wooded hill, 645 feet high, lies 2.5 miles southeastward from Cowaramup Point.

8-111 **Cape Mentelle** (*H. O. Chart 3499*), 6 miles southward from Cowaramup Point, is a dark green head, 140 feet high, faced with a steep cliff to the westward, and rising to a height of 227 feet within it; rocky ledges front the cape to a distance of 600 yards, dry at low water. At 1,200 yards west-northwestward from the cape is Cow Rock, 10 feet high, with a small sunken rock 200 yards northward of it.

Margaret River lies close southward of the cape, and its mouth is generally barred with sand. A high wooded hill rises abruptly from the southern side of the entrance.

The coast from Cape Mentelle trends southward 8 miles, to Freycinet Point, with several off-lying sunken rocks between, extending from 500 yards to 1 mile from the shore. At about midway between the Bujdup and Calgadup Brooks, at the distance of about 1,000 yards inland, is a conspicuous sand peak.

Black Rock, 18 feet high, lies about 200 yards off the mouth of Calgadup Brook.

About 2 miles northward of Freycinet Point is a low sandy point with several rocks 2 and 3 feet high 1,000 yards from the shore; northwestward of these rocks are some sunken rocks 1 mile from the shore.

8-112 **Freycinet Point** ($34^{\circ}05' S.$, $115^{\circ}00' E.$) is a low, dark, rocky point, 60 feet high, with a flat-topped granite hill, 180 feet high, a short distance eastward. About 400 yards southwest of the point is a rock awash, on which the sea always breaks.

Coast.—About 4 miles south of Freycinet Point is North Point, with a dark rock, 40 feet high, on the rocky foreshore. At 1.5 miles northeast of the point is Boranup Hill, 642 feet high.

The coast between Freycinet Point and North Point has not been surveyed.

8-113 HAMELIN BAY (*plan on H. O. Chart 3501*), between North Point and White Cliff Point, nearly 4 miles apart, is protected in its southern portion by Hamelin Island and the reefs extending westward from it, and affords good shelter during the summer months, or with winds southward of west, but it is perfectly open between north and west, from which quarters severe gales blow, particularly during the winter months. The inner harbor affords protection for small craft off the jetty, but it is closed as a port.

Aspect.—The eastern shore of the bay, from North Point, is a long sandy beach, which for the first 1.5 miles is backed with limestone cliffs about 100 feet in height; these gradually decrease to about 40 feet at the southern end and are fringed with several rocky ledges, many dry at low water. Quoin Rock, 36 feet high, lies about 700 yards southward of North Point at 500 yards offshore.

8-114 Boranup Sand Patch, about the middle of the bay, is a sandy tableland extending inshore about 200 yards, rising thence to a white sandstone ridge from 470 to 630 feet high at 1.5 miles from the beach.

The sand drift is gradually moving eastward, maintaining apparently a height of 150 feet on its eastern side, as the decayed tops of the karri trees which just show through the sand are about the same height as those not yet inclosed. These trees attain a height frequently beyond 150 feet. Boranup Sand Patch is a conspicuous landmark, and is visible in clear weather from a distance of 22 miles.

8-115 **Dangers.**—Grace Rock, awash at high water, and over which the sea breaks, is of small extent, and lies 1.4 miles, 195° from North Point. Shallow heads extend from 400 to 600 yards southeastward of the rock and 300 yards northwest of it.

A shallow head lies 325° , 600 yards from Grace Rock. The ground is foul beyond this head, and also inshore of Grace Rock, and in bad weather the water breaks the whole distance between it and North Point, and as far southward to near Middle Rock.

Middle Rock, nearly midway between Grace Rock and Hamelin Island, has a depth of $4\frac{1}{2}$ fathoms, with 6 to 7 fathoms, around it, and lies 1.6 miles, 153° from Grace Rock.

South Rock, with $2\frac{1}{4}$ fathoms of water, lies 1,000 yards southward of Middle Rock, 1,600 yards, 347° from the end of the jetty.

Southeast Ledge, with a least depth of $3\frac{1}{4}$ fathoms, lies between South Rock and the eastern shore.

Inside Rock, with a depth of $2\frac{1}{4}$ fathoms, lies 550 yards 045° from the end of the jetty, and at 500 yards offshore.

8-116 **Hamelin Island** ($34^{\circ}13' S.$, $115^{\circ}01' E.$), 105 feet high, and nearly 500 yards in diameter, has steep cliffy shores, and the top is covered with a scrubby vegetation. From its northwestern extremity a rocky ledge extends over 200 yards, having on it several pinnacle rocks from 25 to 40 feet high; this island is surrounded with ledges, but has a small sandy beach near its northeastern end on which landing may be effected.

The island is situated on the reef, which extends nearly 1 mile westward of White Cliff Point, and with the adjacent reefs protects the inner harbor, and also the bay to a certain extent, from southerly winds.

Light.—A light is exhibited from a white square concrete tower, 29 feet high, on the summit of Hamelin Island.

8-117 **Western dangers.**—Southwest Rock, 7 feet high, lies 225° 1.5 miles from the summit of Hamelin Island; between it and the island is Black Rock, 21 feet high, Whalesback, 18 feet high, and other rocks

above and below water, within the edge of the 10-fathom curve off Foul Bay.

Edith Rock.—Northward and westward of Hamelin Island there are several rocks and ledges dry in places at low water; the outer named Edith Rock, is 14 feet in height, and lies 1.2 miles, 326° from the northwestern extremity of Hamelin Island. At the distance of 150 yards northwestward of Edith Rock is a patch of $2\frac{1}{2}$ fathoms.

Two ledges, covered at high water, lie about 400 yards 215° from Edith Rock; and two sunken rocks, on which the sea generally breaks, with $1\frac{1}{2}$ to $2\frac{3}{4}$ fathoms, lie 200° from 800 to 1,000 yards from Edith Rock.

Old Man Rock.—About midway between the sunken rocks and Hamelin Island is Old Man Rock, 6 feet high, situated on the western edge of the shallow ledges which dry in places, and fill the space between it and Hamelin Island. The ledge extends 600 yards northward and nearly 1,000 yards southward of Old Man Rock.

8-118 Lisle Channel. westward of Old Man Rock, is about 600 yards wide, with depths of $5\frac{1}{2}$ to 7 fathoms; it is usually taken by vessels entering the bay from the southward with a favorable wind or under steam.

Tides.—It is high water, full and change, in Hamelin Bay, at 9h. 49m.; springs rise 2 feet 9 inches, neaps 2 feet. The tides are irregular, and greatly influenced by the prevailing winds, those from westward and northward causing the highest, and offshore winds the lowest tides.

8-119 Directions (H. O. Charts 3499 and 3501).—Vessels from northward should give Freycinet Point a berth of about 2 miles, and when the middle of Boranup Sand Patch bears about 085° , steer to pass about 400 yards northward of Edith Rock, 14 feet high, thence to the anchorage.

Vessels from the southward should give Cape Hamelin a berth of at least 3 miles, keeping outside the 20-fathom curve. When Hamelin Island bears eastward of 050° , Old Man Rock, 6 feet high, and Edith Rock, 14 feet high, will be visible, and course may be shaped to pass through Lisle Channel.

If passing outside Edith Rock, from abreast Hamelin Island, steer to give it a berth of 1,000 yards, and haul into the bay at about 400 or 500 yards distance northward of Edith Rock, with Boranup Sand Patches bearing about 085° , whence haul southeastward to the anchorage.

If working into the bay, Grace Rock should not be approached on its northwestern side nearer than 1,000 yards, and in standing toward Edith Rock, when within it, avoid opening North Point westward of Grace Rock; Mushroom Rock well open northward of Peak Islet clears all danger on the southwestern side of the bay. On the northeastern side do not shut in the high land of Cape Hamelin with White Cliff Point, until Edith Rock bears westward of 254° (to clear the rocks extending southward and eastward of Grace Rock). Thence, a vessel may close the beach to 600 yards, remembering, as the southern portion of the bay is approached, to avoid South Rock, of $2\frac{1}{4}$ fathoms, and Southeast Ledge, of $3\frac{1}{4}$ fathoms.

8-120 Anchorage.—Hamelin Bay is exposed to the northwest, from which quarter gales are experienced at all seasons, and a heavy swell is thrown in. Vessels should moor with open hawse to northwestward or ride at single anchor with a long scope of cable. From the beginning of May until the beginning of November, upon the usual indications of a northwest gale (barometer about 29.80 inches and falling, with strong land winds between east and northeast), vessels of too deep draft unable to find pro-

tection in inner harbor are advised to put to sea and seek shelter in Flinders Bay until the gale is over. Having regard to the severity of gales at that season and the possibility of accident from the nature of the holding ground, the delay and inconvenience occasioned would be compensated by the assured safety of the vessel.

The surveying schooner *Meda* (in November, 1882) found considerable swell with southerly winds in the outer anchorage south-southeastward of South Rock in $6\frac{1}{2}$ to 7 fathoms, but obtained smoother water by shifting berth 500 yards southeastward, in 5 fathoms, with the eastern extremity of Peak Islet bearing 236° and Mushroom Rock 183° .

8-121 **Inner Harbor** ($34^{\circ}12' S.$, $115^{\circ}01' E.$, *H. O. Chart 3501, plan of Hamelin Inner Harbor*) lies between Peak Islet and Mushroom Reef on the northward and Hamelin Island and adjacent reefs on the southward; it is about 600 yards in length by 200 yards in breadth, with depths of 19 to 30 feet, but its entrance has only 17 feet.

Although of small extent, it is a secure haven for vessels shipping timber when the outer anchorage would be hazardous (May to November). The services of a local pilot are necessary.

By a proclamation in Commonwealth Gazette this harbor is closed to shipping from October 1, 1905.

8-122 **Islets and dangers.**—Mushroom Rock, 24 feet high, lies at the distance of 250 yards east-northeastward of the end of the jetty.

Mushroom Reef extends over 200 yards distance from the rock and has several patches which are awash at low water springs and one which dries 1 foot. The northernmost patch, with 4 feet of water, and steep-to, lies about 200 yards, 023° , from

the end of the jetty, and forming the south-eastern side of the entrance channel.

Peak Islet, 43 feet high, is about 120 yards in length, east and west, and situated nearly 600 yards northwestward of Mushroom Rock.

A reef extends nearly 400 yards eastward of it, within the 3-fathom curve and overlapping Mushroom Reef. It is shallow for a distance of 250 yards from the island, where there is a depth of 10 feet a little westward of the entrance channel.

Tides.—It is high water, full and change, in Inner Harbor, at 9h. 49m.; springs rise 2 feet 9 inches, neaps rise 2 feet. The rise of tide is much affected by the prevailing winds; westerly winds are accompanied by sustained high water, while easterly winds, particularly from south to east, invariably cause a continuance of low water. During northwest gales the water remains from 3 to 4 feet above the ordinary level.

Supplies.—Wood, water, provisions, and dairy produce can be obtained from Karridale, a timber station about 3 miles inland, in small quantities.

Communication (*H. O. Chart 3499*).—From Karridale there is a railroad southward to Augusta, another timber station. Northward it runs to Busselton and beyond, as charted.

There is telegraphic communication with Karridale, Perth, etc.

8-123 **THE COAST** from White Cliff Point, Hamelin Bay, trends 1.8 miles southward to Knobby Head, with several small rocky projections and sandy bights between, the whole being fringed with ledges and sunken rocks, forming the eastern side of Foul Bay. Knobby Head is smooth and grassy, 133 feet high, with a high reddish cliff to seaward. A short distance within the head are some dark bushy-topped sand

hills, from which a large bare sandpatch extends to the southwestward, and not visible from the northwestward.

Off the northern point of Knobby Head, 100 yards distant, is a rock 40 feet high, eastward of which, about 600 yards distant, is a small bight with a sandy beach; from the head of this bight a valley extends in an easterly direction for upward of 1 mile, to a swampy plain, the coast hills rising on the northern and southern sides of the valley to a height of 350 feet. Seaward of Knobby Head are several ledges awash at low water, the outer ledge lying 270° , 1,200 yards from it, with several sunken rocks beyond; the outer of these, on which the sea only breaks with a heavy swell, lies 275° , 1.5 miles from the head.

Foul Bay is so encumbered with sunken reefs that it is useless as an anchorage or place of shelter.

8-124 Cape Hamelin ($34^{\circ}15' S.$, $115^{\circ}02' E.$) is a low cliff-faced point, fronted with numerous dry ledges and sunken rocks extending to the westward $1\frac{1}{4}$ miles, and in a southwesterly and southerly direction 2 miles.

Coast.—Nearly 1 mile southeast from Cape Hamelin, Turners Brook empties itself; at 500 yards above its mouth and on its southern side a high perpendicular cliff rises, which is conspicuous when seen from southwest.

Caution.—From Cape Hamelin the coast trends southeastward 8 miles to Cape Leeuwin, and is fronted by numerous sunken reefs and rocky islets, the most important of which are here mentioned. It has not been thoroughly surveyed, and vessels should keep seaward of the 20-fathom curve.

Landmark.—A high and conspicuous sand patch is situated $2\frac{1}{4}$ miles southeastward of Cape Hamelin, which, in hazy weather, may

possibly be mistaken for Boranup Sand Patch over Hamelin Bay.

8-125 Cumberland Rock, 33 feet high, and of a dark color, lies south-southeast 4 miles from Cape Hamelin and about 2 miles offshore. At about 1.8 miles southwestward from Cumberland Rock lies a reef, on which the sea breaks only during a heavy swell. Within Cumberland Rock lie Jacks Ledge, 6 feet high, and other rocks.

Between Cumberland Rock and Cape Hamelin is Minn's Ledge, 6 feet high, with many rocks between it and that cape.

Between Cumberland Rock and Cape Leeuwin are many sunken rocks, which break in bad weather, some 2 miles offshore, as charted.

8-126 Geographe Reef, two rocks about 200 yards apart, with deep water close-to, and on which the sea breaks only at uncertain intervals in moderate weather, lies 3.8 miles, 220° from Cape Hamelin, and 295° from Cape Leeuwin Lighthouse.

Directions for clearing.—St. Alouarn Island well open southward of Cape Leeuwin, bearing 114° , leads southward of Geographe Reef, and Boranup Sand Patch over Hamelin Bay, bearing 035° , leads northwestward of this danger.

8-127 CAPE LEEUWIN (THE LION-ESS) ($34^{\circ}22' S.$, $115^{\circ}08' E.$, H. O. Chart 3499), called after the Dutch vessel of that name, is a small round head about 60 feet in height and fronted with reefs, which extend to the distance of 5 miles in a southeasterly direction. It is joined to the mainland by a low, swampy neck whence, 700 yards from the cape, the land rises abruptly to 487 feet and continues, at about that height, with a few breaks, to beyond Cape Hamelin. A hill, 730 feet high, is situated $3\frac{1}{2}$ miles north-northwestward of Cape Leeuwin. Cape Leeuwin has been reported to give good radar returns up to 17 miles.

Light.—A light is exhibited from a gray, cylindrical stone tower, 128 feet high, on the south summit of the cape.

Signals.—The lighthouse is connected by telephone with the telegraphic system of Australia. A radiobeacon transmits from the lighthouse.

Fogs of from 2 to 6 hours duration are at times experienced at the lighthouse, chiefly in the early morning between November and March. A smoky haze often occurs in the early morning.

8-128 Offlying dangers.—St. Alouarn Islets consist of a chain of rocky islets and reefs, extending 5 miles southeastward from Cape Leeuwin.

Seal Islet, the inner of the St. Alouarn Islets, 1 mile from the cape, is 29 feet high, and 400 yards in length.

St. Alouarn Islet ($34^{\circ}24' S.$, $115^{\circ}12' E.$), 86 feet high, and the principal islet of the group, is situated 3.5 miles southeastward from the cape. It is 400 yards in length, northwest and southeast, and nearly 200 yards in breadth.

Southeast Rocks.—At 1,500 yards southeastward of St. Alouarn Islet is Flinders Islet, a bare rock about 20 feet high; and 1,000 yards beyond, at the extremity of the reef in this direction, are the two Southeast Rocks, 15 feet high, and close together. A sunken rock lies about 200 yards eastward of them.

8-129 Southwest Breaker, on which the sea seldom breaks, is the southern extremity of the reef; it has a depth of 6 feet, with 13 fathoms close seaward. The rock lies 4.8 miles, 150° from Cape Leeuwin Lighthouse, and 1.9 miles, 226° from Southeast Rocks.

The westernmost rock, which only breaks in bad weather, has a depth of $1\frac{3}{4}$ fathoms, and lies 1.1 miles west of Spout Rock, 4 feet high, and 2.4 miles, 156° from Cape Leeuwin

Lighthouse.

Directions for clearing.—Cape Leeuwin Lighthouse, bearing 353° , or northward of that bearing, leads westward of these dangers; and Southeast Rocks, 15 feet high, bearing 025° , leads southeastward of Southwest Breaker; they should be given a much wider berth.

Bank.—Irregular bottom, with depths of 12 to 20 fathoms, and deeper water between, lies about 3.5 miles westward of Alouarn Islet Reefs and of Cape Leeuwin, causing the sea to break over it in bad weather.

8-130 Current (*H. O. Chart 3424*).—Between Cape Leeuwin and Cape Naturaliste (in November) the surveying schooner *Meda* experienced a set to the northward at the rate of 1 mile per hour. A confused sea was experienced just outside the 100-fathom curve of coast soundings, with smoother water both seaward and inshore. In the months of January and February a strong current to the eastward or setting toward the land is reported as having been experienced in the offing between Cape Leeuwin and Swan River; moreover, a current of considerable velocity has been experienced at all seasons of the year setting toward the land in the vicinity of Cape Leeuwin.

Gales.—The severity of the gales off Cape Leeuwin is well known to seamen, and the rapidity with which they succeed one another during the winter months. A falling barometer gives good warning of the approach of northwesterly gales along the whole line of coast between Northwest Cape and Cape Leeuwin.

8-131 Magnetic disturbance.—Abnormal variation was reported by the *Chindwara* between Fremantle and Cape Naturaliste, in February, 1921. The compass needle was deflected 20° to the westward and normal variation was not regained until the ship passed Cape Leeuwin.

8-132 General directions—Rounding Cape Leeuwin.—The distance to which sunken dangers extend off a long stretch of coast about Cape Leeuwin, and the frequent thick weather that prevails with strong on-shore winds and an inset in the same direction, makes it very desirable to give a good berth to this dangerous point in all but settled weather. From 15 to 20 miles is a good margin to leave, and if a spot between these distances to the southwestward of the cape is taken as a point for which to steer when coming from the northwestward, which is just within the range of Cape Leeuwin Light, very little time will be lost in making King George Sound. When approaching the coast between Cape Naturaliste and Cape Leeuwin by day, in clear weather, vessels may stand into 30 fathoms, the bottom being coarse sand mixed with shells and small stones.

At night.—The greatest caution should be used in running in to make Cape Leeuwin Light; with the weather at all thick, the

light, powerful as it is, will often not be visible as far as Geographe Reef, 8 miles to the northwestward; and as mist may hang about the land when it is clear at sea, the lead should never be neglected, and vessels should not stand into less depths than 70 fathoms.

8-133 Approaching the coast northward.—Between Cape Naturaliste and Rottnest Island, by night, or in thick weather, a vessel should not stand into less than 30 fathoms until northward of Naturaliste Reefs. Thence northward, she may stand into 20 fathoms, coarse brown sand mixed with shells, and occasionally gravel and small stones. The depth of 20 fathoms however, will be found within 1,000 yards of the dangers off Cape Vlaming, Rottnest Island; vessels, therefore, bound to the northward of Rottnest Island, should not go into less than 30 fathoms, as the island is approached.

Coast.—For the coast eastward, see H. O. Pub. No. 167, South Coast of Australia.

APPENDIX I

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

Port	Depth at M. L. W. S.		Rise of tide		Remarks
	In channel of approach	In anchorage	Springs	Neaps	
Ashburton Road	24 feet	23 to 27 feet	7.0	4.8	Not recommended during the cyclone season.
Beagle Bay	6½ fathoms	3 to 5 fathoms	20.5	13.5	Open to northwestward.
Bunbury, Koombanah Bay	30 feet	24 to 27 feet	3.5	-----	A depth of 30 feet at outer end of jetty.
Fremantle:					
Gage Roads	6 fathoms	7 to 9 fathoms	2.8	-----	
Inner harbor	36 feet	34 feet	2.8	-----	Within breakwaters, dredged to 36 feet throughout.
Gascoyne Roads, Shark Bay.	Deep	3½ to 5 fathoms	5.0	-----	1½ to 4 miles off-shore.
Geraldton, Champion Bay	31 feet	5 to 6 fathoms	3.0	-----	Open from north-west to north.
Port Hedland	1 foot	2½ to 6 fathoms	19.0	12.0	Bar harbor. Depth alongside jetty 20 feet.
Port Darwin	32 feet	6 to 12 fathoms	22.8	16.5	
Roebuck Bay	Deep	7 to 9 fathoms	28.0	18.0	
Inner harbor (off Broome)	14 feet	4 to 10 fathoms	28.0	18.0	Bar harbor.
Wyndham, Cambridge Gulf	22 feet	4 fathoms	28.0	15.5	30 feet at Meat Works Jetty.

Note.—The depths shown at wharves and in channels do not necessarily mean that a vessel may be loaded to this draft; the local port authorities should be consulted for these particulars.

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APPENDIX II

Place—Burketown, Albert River. Latitude $17^{\circ} 45' S.$, longitude $139^{\circ} 33' E.$ Height above mean sea level, 87 feet
[Meteorological table compiled from 13 years' observations from British Admiralty Sailing Directions]

Month	Air temperature										Cloud amount, scale 0 to 10	Rain	Wind	Percentage of observations, from—	Force	Percentage of observations of strong winds	Number of days, fog									
	Mean		Mean daily		Mean monthly		Extreme								North	Northeast	East	Southeast	South	Southwest	West	Northwest				
	For month	Daily am- plitude	For month	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Mean force Beaufort scale					North	Northeast	East	Southeast	South	Southwest	West	Northwest				
January	In.	In.	°F.	°F.	°F.	°F.	°F.	°F.	%	In.	In.	In.	In.	2.2	27	32	7	6	2	6	2	11	6	Force 5		
February	29.71	0.10	85	93	77	102	71	108	68	59	5.6	8.23	11	7.17	1.9	16	31	8	15	5	6	26	0			
March	29.74	.09	84	92	76	100	70	110	62	60	5.1	6.19	10	4.33	2.0	11	22	12	20	14	7	7	0			
April	29.77	.10	83	93	74	99	66	105	60	51	3.9	5.16	7	14.54	2.0	7	20	17	41	9	1	21	.2			
May	29.80	.10	81	92	69	97	61	103	55	40	2.8	1.10	2	8.27	2.3	5	16	16	42	16	2	21	.2			
June	29.85	.11	74	86	63	92	51	97	46	39	2.6	.16	1	1.10	2.4	5	16	16	47	12	3	11	.3			
July	29.88	.11	70	82	57	86	47	92	42	39	2.5	.24	1	.63	2.3	8	18	8	18	8	1	23	.3			
August	29.90	.11	69	82	53	82	46	92	43	37	1.7	.04	1	.04	2.2	7	15	7	16	3	0	1	1.5			
September	29.90	.12	71	85	58	88	52	85	43	34	1.5	.04	1	.04	2.3	6	27	11	35	13	2	24	1.6			
October	29.95	.13	76	89	62	70	54	101	48	37	1.7	.04	1	.24	2.5	16	34	9	28	9	3	16	1.6			
November	29.89	.13	81	83	70	102	58	108	53	39	2.5	.39	1	2.01	2.6	16	36	6	6	3	0	1	2.5			
December	29.83	.13	84	94	74	76	103	98	107	61	45	3.3	1.61	4	3.98	2.4	28	34	6	5	6	1	13	.9		
Means	29.87	.11	79	90	68	106	45	106	52	45	3.2	2.3	14	27	10	27	9	4	1	6	4	21	9.0			
Totals												27.81	47	48.86												
Extreme values												110	42	14.84												
Number of years' ob- servations																							11			

Hours of observation, 9h, 15h.

¹ Range between 9h and 15h.

² Day with 0.01 in. (0.3 mm) rain or more.

Maximum fall during the 24 hours from 1 morning observation to the next.

³ Mean of highest each year and lowest each year.

APPENDIX II

Place—Port Darwin. Latitude 18° 28' S., longitude 130° 51' E. Height above mean sea level, 97 feet

[Meteorological table compiled from 52 years' observations. From British Admiralty Sailing Directions]

Month	Pressure at mean sea level, reduced to 32° F. and lat. 45°		Air temperature						Relative humidity	Rain		Wind								Percentage of observations of strong winds					
	Mean		For month		Mean daily		Mean monthly			Cloud amount, scale 0 to 10		Total fall		Percentage of observations, from—											
	For month	Daily amplitude ¹	For month	Maximum	Minimum	Maximum	Minimum	Maximum		For month	Maximum	Number of days ²	Maximum fall in 24 hours ³	Mean force Beaufort scale	North	Northeast	East	Southeast	South	Southwest	West	Northwest	Calm		
January	29.71	0.08	84	90	77	77	95	72	72	100	100	12	7.8	1.6	3	4	5	2	24	43	7	5	0		
February	29.71	0.09	83	90	77	77	95	72	72	101	101	12	7.4	1.6	3	4	6	18	21	25	11	8	0		
March	29.74	0.09	84	91	77	77	95	72	72	102	102	12	7.0	1.6	3	4	6	18	20	39	12	8	2		
April	29.76	0.10	84	92	78	78	95	72	72	104	104	12	6.6	1.6	3	4	6	19	59	44	4	6	2		
May	29.88	0.10	84	92	78	78	95	72	72	105	105	12	6.2	1.6	3	4	6	19	59	44	4	6	2		
June	29.89	0.11	79	88	88	88	95	72	72	106	106	12	5.8	1.6	3	4	6	19	59	44	4	6	2		
July	29.92	0.12	77	88	88	88	95	72	72	108	108	12	5.4	1.6	3	4	6	19	59	44	4	6	2		
August	29.89	0.12	78	88	88	88	95	72	72	108	108	12	5.0	1.6	3	4	6	19	59	44	4	6	2		
September	29.86	0.13	83	92	74	74	94	72	72	108	108	12	4.6	1.6	3	4	6	19	59	44	4	6	2		
October	29.80	0.11	86	94	78	78	98	72	72	109	109	12	4.2	1.6	3	4	6	19	59	44	4	6	2		
November	29.74	0.12	85	94	78	78	98	72	72	109	109	12	3.8	1.6	3	4	6	19	59	44	4	6	2		
December	29.74	0.09	85	94	78	78	97	72	72	109	109	12	3.4	1.6	3	4	6	19	59	44	4	6	2		
Means	29.81	0.10	83	91	74	74	99	60	60	100	100	12	6.5	1.5	6	8	10	26	3	6	11	23	7	4	
Totals								105	56				61.80	99										4.0	
Extreme values													11.68												
Number of years' observations													40												35

Hours of observation, 9h. and 15h.

¹ Range between 9h. and 15h.² Day with 0.01 in. (0.3 mm) rain or more.³ Maximum fall during the 24 hours from 1 morning observation to the next.

* Mean of highest each year and lowest each year.

Month	Pressure at mean sea level, reduced to 32° F. and lat. 45°		Air temperature						Relative humidity	Rain		Wind								Percentage of observations of gales				
	Mean		For month		Mean daily		Mean monthly			Cloud amount, scale 0 to 10		Total fall		Percentage of observations, from—										
	For month	Daily amplitude ¹	For month	Maximum	Minimum	Maximum	Minimum	Maximum		For month	Maximum	Number of days ²	Maximum fall in 24 hours ³	Mean force Beaufort scale	North	Northeast	East	Southeast	South	Southwest	West	Northwest	Calm	
January	29.74	0.08	84	92	79	79	95	72	72	106	106	12	4.7	1.6	3	4	5	2	24	43	7	5	0	
February	29.74	0.09	85	92	79	79	95	72	72	106	106	12	5.0	1.6	3	4	6	18	21	25	11	8	0	
March	29.77	0.09	85	93	77	100	95	72	72	104	104	12	5.5	1.6	3	4	6	18	21	25	11	8	2	
April	29.88	0.10	83	93	72	100	93	72	72	107	107	12	5.2	1.6	3	4	6	18	21	25	11	8	2	
May	29.92	0.10	76	88	68	88	94	45	45	109	109	12	1.9	1.6	3	4	6	18	21	25	11	8	2	
June	29.95	0.10	71	83	60	91	95	40	40	109	109	12	1.3	1.6	3	4	6	18	21	25	11	8	2	
July	29.98	0.11	73	85	60	93	95	51	51	109	109	12	1.0	1.6	3	4	6	18	21	25	11	8	2	
August	29.92	0.11	77	89	65	98	103	57	57	109	109	12	0.8	1.6	3	4	6	18	21	25	11	8	2	
September	29.92	0.11	81	91	71	103	95	57	57	109	109	12	0.5	1.6	3	4	6	18	21	25	11	8	2	
October	29.88	0.10	85	93	76	103	98	57	57	109	109	12	0.3	1.6	3	4	6	18	21	25	11	8	2	
November	29.88	0.10	88	93	79	103	98	57	57	109	109	12	0.1	1.6	3	4	6	18	21	25	11	8	2	
December	29.70	0.09	88	93	79	103	98	57	57	109	109	12	0.0	1.6	3	4	6	18	21	25	11	8	2	
Means	29.85	0.10	80	89	70	106	97	47	47	109	109	12	5.8	2.5	3	4	6	14	16	29	11	3	2	
Totals								111	40				24.16	42										10.0
Extreme values													14.03											
Number of years' observations													23											

Hours of observation, 9h. 15h.

¹ Range between 9h. and 15h.² Day with 0.01 in. (0.3 mm) rain or more.³ Maximum fall during the 24 hours from 1 morning observation to the next.

* Mean of highest each year and lowest each year.

Place—Carnarvon. Latitude $24^{\circ} 54' S.$, longitude $113^{\circ} 39' E.$ Height above mean sea level, 15 feet

[Meteorological table compiled from 30 years' observations. From British Admiralty Sailing Directions]

Month	Pressure at mean sea level, reduced to $32^{\circ} F.$ and lat. 45°		Air temperature						Relative humidity	Rain		Wind						Percentage of observations of gales							
	Mean		Mean daily		Mean monthly		Extreme			Cloud amount, scale 0 to 10		Total fall		Percentage of observations, from—											
	For month	Daily amplitude ¹	For month	Maximum	Minimum	For month	Maximum	Minimum		For month	Maximum	Number of days ²	Maximum fall in 24 hours ³	Mean force Beaufort scale	North	Northeast	East	Southeast	South	Southwest	West	Northwest	Calm		
January	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	1.9	1.95	2.5	0	0	0	0	0	0	0	0	0	Force 7	
February	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	1.9	1.95	2.5	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0	0.3	
March	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	1.9	1.95	2.5	0	0	0	0	0	0	0	0	0	0.3	
April	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	1.9	1.95	2.5	0	0	0	0	0	0	0	0	0	0.3	
May	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	1.9	1.95	2.5	0	0	0	0	0	0	0	0	0	0.3	
June	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	1.9	1.95	2.5	0	0	0	0	0	0	0	0	0	0.3	
July	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	1.9	1.95	2.5	0	0	0	0	0	0	0	0	0	0.3	
August	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	1.9	1.95	2.5	0	0	0	0	0	0	0	0	0	0.3	
September	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	1.9	1.95	2.5	0	0	0	0	0	0	0	0	0	0.3	
October	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	1.9	1.95	2.5	0	0	0	0	0	0	0	0	0	0.3	
November	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	1.9	1.95	2.5	0	0	0	0	0	0	0	0	0	0.3	
December	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	1.9	1.95	2.5	0	0	0	0	0	0	0	0	0	0.3	
Mean	29.35	0.07	71	80	62	110	61	—	—	89	2.8	—	—	—	2.9	2	6	9	13	29	31	6	2	2	—
Total	—	—	—	—	—	—	—	—	—	9.51	33	—	—	—	2.9	2	6	9	13	29	31	6	2	2	—
Extreme values	—	—	—	—	—	—	—	—	—	116	37	—	—	—	4.77	—	—	—	—	—	—	—	—	—	—
Number of years' observations	—	—	—	—	—	24	—	—	—	—	—	25	39	38	39	—	—	—	—	—	—	—	—	—	10

Hours of observation, 9h. and 15h.

¹ Range between 9h. and 15h.² Day with 0.01 in. (0.8 mm) rain or more.³ Maximum fall during the 24 hours from 1 morning observation to the next.⁴ Mean of highest each year and lowest each year.Place—Perth. Latitude $31^{\circ} 57' S.$, longitude $116^{\circ} 50' E.$ Height above mean sea level, 187 feet

[Meteorological table compiled from 46 years' observations. From British Admiralty Sailing Directions]

Month	Pressure at mean sea level, reduced to $32^{\circ} F.$ and lat. 45°		Air temperature						Relative humidity	Rain		Wind						Percentage of observations of gales							
	Mean		Mean daily		Mean monthly		Extreme			Cloud amount, scale 0 to 10		Total fall		Percentage of observations, from—											
	For month	Daily amplitude ¹	For month	Maximum	Minimum	For month	Maximum	Minimum		For month	Maximum	Number of days ²	Maximum fall in 24 hours ³	Mean velocity	North	Northeast	East	Southeast	South	Southwest	West	Northwest	Calm		
January	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	2.9	0.31	3	1.73	17	3	11	13	27	6	1	22	2.5	
February	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	2.9	0.31	3	1.61	17	3	12	15	22	6	1	2.1	2.5	
March	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	2.9	0.75	4	1.64	18	4	12	14	21	6	1	2.8	2.5	
April	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	2.9	1.57	7	2.64	13	5	18	20	11	14	1	2.2	2.5	
May	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	2.9	4.89	14	2.60	12	13	19	14	10	10	12	4	1.6	2.5
June	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	2.9	6.88	17	2.60	12	13	19	14	8	6	11	4	1.8	2.5
July	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	2.9	6.88	17	2.60	12	13	19	14	8	6	11	4	1.8	2.5
August	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	2.9	6.88	17	2.60	12	13	19	14	8	6	11	4	1.8	2.5
September	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	2.9	6.88	17	2.60	12	13	19	14	8	6	11	4	1.8	2.5
October	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	2.9	6.88	17	2.60	12	13	19	14	8	6	11	4	1.8	2.5
November	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	2.9	6.88	17	2.60	12	13	19	14	8	6	11	4	1.8	2.5
December	29.32	0.30	29.32	71	53	29.32	108	54	116	29.32	82	2.9	6.88	17	2.60	12	13	19	14	8	6	11	4	1.8	2.5
Mean	29.32	0.08	64	73	56	105	38	—	—	59	4.0	—	—	16	8	13	13	10	15	20	11	7	2	—	
Total	—	—	—	—	—	—	—	—	—	53.92	119	—	—	—	—	—	—	—	—	—	—	—	1.6		
Extreme values	—	—	—	—	—	—	—	—	—	108	34	—	—	—	—	—	—	—	—	—	—	—	0.0		
Number of years' observations	—	—	—	—	—	25	—	—	—	—	—	66	—	—	—	—	—	—	—	—	—	—	39		

Hours of observation, 9h. and 15h.

¹ Range between 9h. and 15h.² Day with 0.01 in. (0.8 mm) rain or more.³ Maximum fall during the 24 hours from 1 morning observation to the next.⁴ Mean of highest each year and lowest each year.

APPENDIX II

Place—Cape Leeuwin. Latitude $34^{\circ} 22' S.$, longitude $115^{\circ} 08' E.$ Height above mean sea level, 163 feet

[Meteorological table compiled from 25 years' observations. From British Admiralty Sailing Directions]

Month	Air temperature										Relative humidity	Cloud amount, scale 0 to 10	Rain		Wind										Percentage of observations of fogs Number of days of fogs	
	Mean		Mean daily		Mean monthly		Extreme		Total fall				Maximum fall in 24 hours ¹	Number of days ²	Percentage of observations, from—											
	For month	Daily amplitude ³	For month	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	ml/hr	14	North	Northeast	East	Southeast	South	Southwest	West	Northwest	Cloud	52 mild Ar	1.0	1.5			
January.....	59.05	0.03	68	74	63	83	74	55	101	51	56	0.67	8	1.54	14	1	4	18	19	11	4	1	1.0	1.5		
February.....	59.98	.04	69	74	63	83	75	55	104	55	75	5.7	.01	7	4.02	13	2	13	20	10	9	0	1.1	1.4		
March.....	60.00	.03	67	73	62	80	75	55	97	51	73	5.9	1.30	11	2.20	13	7	14	12	10	9	1	1.2	1.6		
April.....	59.98	.03	65	70	60	76	61	55	95	48	48	7.9	6.3	2.01	12	2.72	13	7	13	12	10	9	1	1.3	1.5	
May.....	59.00	.03	61	66	57	75	69	45	81	55	45	7.1	5.67	21	4.85	15	15	15	12	18	11	16	15	1.1	1.5	
June.....	59.98	.02	56	68	54	74	62	47	73	44	51	7.3	6.90	24	1.81	17	14	15	4	14	12	16	15	0	5.0	
July.....	59.00	.02	57	61	53	73	67	47	71	41	51	7.2	6.24	24	2.98	18	18	18	14	14	12	16	15	0	7.0	
August.....	59.00	.02	57	61	53	73	68	45	72	45	51	7.1	5.24	24	1.98	18	10	9	3	16	16	22	18	1	7.0	
September.....	59.00	.02	58	63	53	73	71	47	79	32	51	7.1	5.38	22	1.18	18	5	6	3	8	15	21	1	6.0		
October.....	59.98	.02	58	65	52	75	75	48	87	45	47	6.9	2.63	10	1.97	16	17	17	14	14	12	16	15	1	4.0	
November.....	59.00	.03	58	63	57	75	75	51	84	42	42	6.5	1.29	12	0.91	14	3	5	5	12	10	13	15	1	1.2	
December.....	59.98	.03	60	73	50	82	54	55	95	51	75	6.1	.95	10	2.56	14	1	2	11	30	19	15	14	1	1.3	
Means.....	59.00	.03	62	68	57	83	74	44	—	—	75	6.6	—	—	15	7	8	9	17	13	14	13	13	1	3.6	5.3
Total.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	104	36	—	—	—	—	—	—	—	—	—	
Extreme values.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Number of years' observations.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

Hours of observation, 8h. and 16h.

¹ Range between 8h. and 16h.² Day with 0.01 in. (0.8 mm) rain or more.³ Maximum fall during the 24 hours from 1 morning observation to the next.⁴ Mean of highest each year and lowest each year.

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