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Captain David Hancox is an Australian with degrees in science and engineering. He became involved in the salvage industry and in 25 years he has worked in most facets of casualty salvage and wreck removal and acquired a high level of technical proficiency. Employed by a leading salvage company in the Far East his skills were recognised by promotion to Senior Salvage Master and Salvage Manager. Currently he lives with his family on the Bellarine Peninsula, near the entrance to Port Philip Bay, with a good view of Melbourne. He is a member of an international salvage consultancy based in Singapore, which gives regular opportunities to continue his association with the South China Sea.

Professor Victor Prescott holds a personal chair in geography at the University of Melbourne. International boundaries on land and sea have been the main focus of his research in the past thirty years. He has written books on those subjects and political geography in general and some have been translated into Arabic, German and Italian.

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1. Introduction

Several scholars have described and analysed political and legal aspects of the Spratly Islands dispute. They include Djalal (1990), Chang (1991), Coquia (1990), Dzurek (1985), Hamzah (1993), Park (1981), Samuels (1982), Thomas (1989) and Weatherbee (1987). There is no corresponding collection of papers and books describing and analysing the physical characteristics of the Spratly Islands region. Useful studies of sedimentary basins by Emery and Ben-Avraham (1972), of oil and gas potential by Valencia (1985) and of the status of fisheries by Mansor Mat Isa and Raja Mohammad Noordin (1993) are notable exceptions to this generalisation.

This study seeks to make two contributions to the physical description of the Spratly Islands. First it provides a description of the islands and rocks that stand above high water, the reefs that uncover at low water and the shoals that are always submerged. These descriptions are based on sailing directions published by American, British and French authorities, on charts published by those countries and China, Japan and Taiwan, and by personal observations by David Hancox.

Second, because few people who write about the Spratly Islands have been able to visit them and because therefore they have to rely on charts of the region, this paper provides an account of hydrographic surveys throughout this region and a list of all known published charts.

It is hoped that the geographical description and the record of surveys and charts will provide a useful research tool for scholars interested in the physical, legal and political aspects of the Spratly Islands.

2. Geographical Description of the Islands, Rocks, Reefs and Shoals of the Spratly Islands Region

These descriptions are based on three complementary sources. First the sailing directions produced by Findlay (1869) in the 19th century and by American, British and French authorities since 1901 (US Naval Oceanographic Office, 1967 and US Defense Mapping Agency 1988 and 1994; Hydrographer of the Navy, 1975 and 1982; Service Hydrographie et Oceanographique de la Marine, 1982). It is salutary to realise that many of the current statements in sailing directions about the Spratly Islands are taken, sometimes without change, from Findlay's publications. Second, the largest scale reliable charts, listed in Appendix II, have been used to augment the descriptions in the sailing directions and to calculate areas.

Third, David Hancox has visited parts of the Spratly Islands since 1966 to salvage stranded vessels and has observed some of the features and made sketches and taken photographs.

The descriptions are organised in two sequences. The first deals with features west of 115° 18'E; the second with features east of that meridian. This meridian was selected to represent a corridor that is not less than 30nm wide that trends north–south and divides the features into eastern and western sections. Livock Reef in the north of the eastern section straddles this meridian, as does Commodore Reef in the south of the western section. In each sequence the features have been described from north to south in such a way that each one is related by direction and bearing to the preceding feature. Each entry is numbered consecutively through the text and deals with either a single feature, such as Mariveles Reef, or a collection of features such as North Danger Reef. Appendix III provides an index to place-names and shows the number of the entry where they are described.

Coordinates for features represent their estimated geographical centre but distances between features are measured from their nearest limits. At the end of each entry a list of available Chinese, Malaysian, Filipino and Vietnamese names are given. The Pinyin and Wade-Giles versions are given for Chinese names; the Wade-Giles version appears second in parentheses. Thus the entry for Amboyna Cay shows:

Feature	Chinese	Malaysian	Filipino	Vietnamese
Amboyna Cay	Anbo Shahzou (An-po Sha-Chou)	Pulau Kecil Amboyna	Kalantiyaw	dao An Bang'

These names have been prepared from various charts and lists of names published by Haller-Trost (1990) and an American map (United States National Technical Information Service, 1992). Li Shu, a doctoral student in the Geography Department at the University of Melbourne, provided invaluable assistance with the transliteration and translation of Chinese names and notes on charts.

Various writers have defined the Spratly Islands in different ways. In some ways it would be more accurate to produce a different name for the features in the South China Sea on which those writers focus, but that is now impossible. Since we are not writing only about islands we have referred, when necessary, to the Spratly Islands region. For us that region, with one exception, lies south of 12°N and seawards of the 200 metres isobath off the continental and insular coasts that define the South China Sea. The exception is the Luconia Shoals that lie just landwards of that isobath, 60 nautical miles (nm) from the coast of Malaysia and well within the claim published on Chinese maps. However we have not included the Elizabeth Shoals and associated features that lie within 30nm of the Malaysian coast and which fall just within the published Chinese claim.

Some modern charts of the Spratly Islands region continue to show some features which do not appear to exist. In this account there will be no reference to those features which appear on some charts but which are not recorded in either the latest British or American sailing directions. Proceeding from west to east these features are Duvalle, Owen and Stag Shoals, various Ganges Reefs, Cay Marino, Northeast Shea, Nanle Ansha, Glasgow Bank, North Viper and Viper Shoal, and Puning and Suilang Ansha. Nor is there reference to Jubilee and Coronation Banks that have a least depth of 280 metres.

The islands in the Spratly Islands region are usually described as cays. The International Hydrographic Organisation (1990: 37) describes a cay, kay or key as *"A low flat island of sand, coral etc. awash or drying at low water, a term originally applied to the coral islets around the coast and islands of Caribbean Sea*." This definition indicates that cays might submerge at some stages of the tidal cycle. Bird (1994) a distinguished coastal geomorphologist has commented that the term cay is sometimes used for features better described as inter-tidal sand banks. He is of the opinion that such features tend to develop into sand islands or are the remains of a former sand island. This view conveys the impression of evolution and decay which is set out in some detail by Nunn (1994: 243-9).

He begins by describing cays as impermanent accumulations of sand and shingle on broad reef flats, usually devoid of vegetation and often overtopped by swash. He then continues to show how cays can achieve a level of permanence as they are converted to motus. The motu has a higher level of permanence than a cay and that is achieved by the development of beach rock along the ocean-facing swell, by the incorporation of shingle ridges into the fabric of the cays and colonisation by vegetation. Motu in monsoon regions tend to develop beachrock on both sides because of the change in direction of the principal swells. The following descriptions will refer only to islands and cays, but wherever possible it is indicated when they are vegetated, or when they are bare or when it is reported that they cover at high water. It is probably reasonable to assume that when islands or cays are reported to be occupied that measures will be taken by the residents to reduce any threat of erosion.

Finally it must be stressed that these descriptions are not intended to be sailing directions. They are designed for scholars interested in the physical, political and legal aspects of this region or in this region as a laboratory where rules for the definition of national maritime zones can be tested.

2.1 The Spratly Islands west of meridian 115° 18' East

(i) North Danger Reef

North Danger Reef is located at 11°25'N, 114°21'E and is the most northerly feature in the Spratly Group. It lies 18nm north of Thitu Island and Reef. This oval coral reef measures 8nm along its main axis, which is aligned northeast–southwest, and its greatest breadth is 3.7nm. The perimeter of North Danger Reef measures 19nm and there is a sharp contrast between its northwest and southeast segments. The northwest segment joins North and South Reef, which uncover, and is marked by Northeast and Southwest Cays situated on drying reefs and Jenkins Patches. Jenkins Patches lies between Southwest Cay and South Reef; it has a least depth of 4.3 metres. The southeast segment between North and South Reefs does not dry at any point. It is defined by Day Shoal and Farquharson and Sabine Patches arranged from north to south, and they have least depths of 3, 7.1 and 5.1 metres respectively.

Northeast Cay is situated at the centre of an oval reef aligned in the same direction as North Danger Reef. The reef measures 1.2nm along its main axis and measures 0.5nm at its widest. It dries to 1 metre and there is a feature that stands 2 metres above high water. This feature is called Shira Islet and lies 320 metres south of Northeast Cay. It is a pronounced hummock with a circumference of about 90 metres and the reef between Northeast Cay and Shira Islet dries at low water. Northeast Cay is also aligned northeast–southwest and has a linear shape;

its area is about 7 hectares. The Chinese name for North Danger Reef translates to Twin Islands. Northeast Cay is the North Son Island while Southwest Cay is South Son Island. Both cays have a height of 3 metres and are reported to be occupied.

Southwest Cay with a length of 650 metres and a width of 280 metres has a more oval shape than Northeast Cay; it has an area of 12 hectares. Southwest Cay lies close to the eastern edge of an oval reef which has a long northeast–southwest axis of 1.3km and a maximum width of 680 metres. In 1889 (Findlay, 1889: 593) the vegetation on both cays was described as coarse grass, and specific mention was made of a solitary stunted tree on Northeast Cay. It was also noted that the cays were frequented by fishermen from Hainan who harvested bêche-de-mer and turtle shell and supplied themselves with water from a well near the centre of Northeast Cay. In 1937 the British sailing directions (Hydrographic Department, 1937: 119) noted that Northeast Cay was covered with coarse grass with low bushes around the perimeter with large bushes and a 10 metre coconut tree near the centre. Southwest Cay was still reported to be covered with coarse grass but additional information was provided about the cay being a breeding ground for seabirds and about a guano industry which had provided exports on a considerable scale. In the early 1980s both cays were heavily wooded with trees to 9.1 metres.

North and South Reefs have similar areas. North Reef has an area of 3km² and is shaped like the head of a mushroom with the dome facing outwards. It uncovers 0.5 metres in the south and 0.8 metres in the north and the east and north outward facing sections bear rocks and stones. South Reef is shaped like an axe-head; it has an area of 2.7km² and apart from the northeast section it bears rocks and stones along its edge.

Apart from the shoal patches already noted the remainder of the surrounding reef has depths of at least 10 metres except between North Reef and Northeast Cay.

The lagoon consists of two parts separated by Iroquois Ridge which extends from Northeast Cay to within 0.3nm of Day Shoal. The ridge has a least depth of 8.2 metres. South of the ridge lies the main part of the lagoon with a flat, mainly sandy bed at depths of 30 to 42 metres with only a few coral heads reaching to within 15 metres of the surface. Between Iroquois Ridge and North Reef lies the small remainder of the lagoon with depths of 21-31 metres. The bed of this northern section is more coral than sand.

The whole reef is steep-to and except off the southwest tip of South Reef the depths within 1nm of the reef are 700 to 1,000 metres. At that range the depths off the southwest tip are 250 metres.

Feature	Chinese	Filipino	Vietnamese
North Danger Reef	Shuangzi Qunjiao (Shuang-tzu Ch'un-chiao)		
Northeast Cay	Beizi Dao (Pei-tzu Tao)	Parola	Dao Song Ta Dong
Southwest Cay	Nanzi Dao (Nan-tzu Tao)	Pugad	Dao Song Tu Tay
North Reef	Dongbei Jiao (Tung-pei Chiao)		
South Reef	Nailuo Jiao (Nai-lo Chiao) or Xinan Jiao (Hsi-nan Chiao)		Da Nam

(ii) Trident and Lys Shoals

Although separated by a channel 2nm wide these two shoals can be considered together. They lie 23nm east of North Danger Reef at 11°28'N, 114°40'E and 11°19'N, 114°35'E respectively. Both reefs are submerged atolls. Trident Shoal is shaped like a keyhole and the long axis, tending north–south has a length of 9.5nm. Lys Shoal is circular with a diameter of 5nm. The shoals are steep-to and several patches on the outer reefs rise to within 18 metres of the surface. One patch in the northwest of Trident Shoal is awash at low water; the least recorded depth on Lys Shoal is 4.9 metres. No indication could be found of the depths of the lagoons.

Feature	Chinese	Vietnamese
Trident Shoal	Yongdeng Ansha (Yung-teng An-sha)	Bai Dinh Ba
Lys Shoal	Lesi Ansha (Le-ssu An-sha)	Da Men Di

(iii) Thitu Island and Reefs

This feature is composed of two steep-to coral reefs centred on 11°3'N, 114°16'E lying 18nm south of North Danger Island. Both reefs are aligned west–east. The narrow channel that separates them is 0.75nm wide, and no bottom could be found at 182 metres. The western reef measures 7.3nm along its west–east axis and has a maximum width of 3nm; the eastern reef measures 4.7nm west–east and has a maximum width of 1.8nm.

The western reef is marked by six drying patches along its north side and by reefs along its south side at depths of 5.5 to 12.8 metres. The northern edge of the western reef measures about 9nm, while the southern edge which does not dry measures 6nm. They surround an elongated lagoon 3.5nm long with a maximum width of 1.1nm. The depths in the lagoon vary from 20 to 32 metres and there are few coral heads. The eastern edge of the western reef is marked by an almost circular drying reef with a diameter of 0.9nm. Thitu Island is located on the southern edge of this reef; it has an area of about 32 hectares and is reported to be occupied. This island, with an elevation of 3.6 metres, was originally covered with low bushes, coconut palms and plantain trees. A circular drying reef with a diameter of 0.5nm lies 1.5nm northwest from Thitu Island. A further 1.4nm westwards, along the northern edge of the western reef, lies a more extensive linear drying patch with a length of 1.4nm and a width of 0.5nm. Located at the centre of this patch is a tiny sand cay with a length less than 200 metres. Two small drying reefs lie in the channel 1.1nm wide that separates the linear patch from the large drying reef than defines the western edge of the western reef. Shaped like a thick letter C this reef has a maximum width of 0.6nm.

The eastern reef consists of a confused platform of coral with three drying patches but without any lagoon. Two main patches that uncover mark the western and eastern edges of this roughly oval platform. The western patch is shaped like an arrow head pointing westwards with twin barbs. The barbs measure 1.4nm each. The small triangular drying patch close to this western patch has a longest side of 550 metres. A large compact reef shaped like an equilateral triangle with sides measuring 1.1nm marks the eastern edge of the eastern reef.

Feature	Chinese	Filipino	Vietnamese
Thitu Reefs	Zhongye Qunjiao (Chung-yeh Ch'un-chiao)		Dao Thi Tu
Thitu Island	Zhongye Dao (Chung-yeh Tao)	Pagasa	Dao Thi Tu
Eastern Reef	Tiezhi Jiao (Tieh-chih Chiao)		

(iv) Subi Reef

Subi Reef lies 7.5nm southwest from Thitu Reefs at 10°54'N, 114° 6'E. This reef is shaped roughly like a diamond with the long axis, aligned east–northeast, measuring 3.7nm and the shorter axis 2.7nm. The coral reef is continuous and surrounds a lagoon which has a maximum width of 1.9nm. The reef which dries is usually marked by breakers; it has a maximum width of 370 metres in the southeast and a maximum width of 1,800 metres in the southwest. The reef is steep-to and the maximum recorded depth between Subi Reef and Thitu Reefs is 1,018 metres. Subi Reef is reported to be occupied.

Feature	Chinese	Vietnamese
Subi Reef	Zhubi Jiao (Chu-pi Chiao)	Da Su Bi

(v) Loaita Bank and Reefs

Loaita Bank lies 25nm east of Subi Reef at 10°47'N, 114°27'E. The bank's long axis is aligned southwest–northeast and its shape viewed on the charts resembles a turtle on its back. The fairly straight long axis of 20nm along the northern edge marks the base of the shell. The southeast shore provides the shell's dome and the head is marked by the largest drying reef that marks the southwest tip of the Bank. The maximum width of the bank is 7nm. Loaita Bank has a lagoon with its northern half surrounded by shoals with a least depth of 9.1 metres and its southern half surrounded by shoals and seven drying reefs. The perimeter of the bank measures about 48nm.

Five of the seven drying patches lie along 12nm of the bank's southern shore. Proceeding from the northeast to the southwest the first drying reef is rectangular in shape and has an area of about 50 hectares. A further 1nm to the south lies a triangular reef that occupies 27 hectares. The triangular reef bearing Lankiam Cay is located a further 2.5nm southwest; it has an area of about 60 hectares. Lankiam Cay is situated close to the centre of the reef; it is sandy, has an area of only a few hectares and is reported to be occupied. There is a small linear patch 4.4nm southwest from Lankiam Cay with an area of about 25 hectares. The last drying patch along this southern sector lies a further 1.9nm west. This circular reef has an area of about 50 hectares of which Loaita Island occupies 6 hectares. The island is located in the southeast quadrant of the reef and originally it stood 1.5 metres above high water and was covered with mangroves and coconut palms. It is reported to be occupied.

The other two drying patches in the southern section of the bank lie 4.8nm northwest from Loaita Island. The largest of the two reefs marks the western tip of the bank. It has an area of about 2.3km² in the shape of an isosceles triangle with the base facing the lagoon. A smaller

reef, with an area of 1.5km², lies 0.8nm to the northeast across a channel 7 metres deep. There is a sand cay located just south of the centre of this reef. Until 1951 sailing directions usually noted that *"...there was a sand cay in 1868..."*. Recent editions are unequivocal that there is a cay. The seven drying patches and intervening channels define 22nm of the lagoon's rim; the remaining 22nm of that rim are defined by reefs that vary in depth from 9 to 64 metres.

The sand and coral floor of the lagoon is flat with depths mainly in the range 53 to 63 metres and a few coral heads close to the reef.

Feature	Chinese	Filipino	Vietnamese
Loaita Reefs	Daoming Qunjiao (Tao-ming Chun-Chiao)		
Loaita Island	Nanyue Dao (Nan-yueh Tao)	Kota	Dao Loai Ta
Lankiam Cay	Yangxin Shazhou (Yang-hsin Sha-chou)	Panata	Bo Loai Ta

Menzies Reef, which is awash at low tide is located at 11°9'N, 114°48'E, 18nm from the northern tip of Loaita Bank. A ridge of foul ground extends most of that distance between the two reefs, with depths ranging from 3.7 to 48 metres. The narrow channel of 1nm between Loaita Bank and the ridge has a least depth of 32 metres. This reef is shaped like a barbed arrowhead pointing northeast; both barbs measure 4 to 5nm and the area of the reef is 15km².

Feature	Chinese	Vietnamese
Menzies Reef	Mengzi Jiao (Meng-tsu Chiao)	Da Mon Di

(vi) West York Island

This island lies 14nm southwest from Menzies Reef at 11°5'N, 115°E. It is bordered by a reef 2nm wide to the north; elsewhere the reef does not exceed 0.8nm. The measurements of the island have been recorded as about 500 metres long and 320 metres wide, giving an area of about 15 hectares. It was originally covered with trees and bushes and is reported to be occupied.

Feature	Chinese	Filipino	Vietnamese
West York	Xiyue Dao (Hsi-yueh Tao)	Likas	Dao Ben Loc

(vii) Irving Reef

This reef lies 11nm southwest from West York Island at 10° 52'N, 114°55'E. It has an oblong shape with the long axis aligned southwest–northeast measuring 2nm. It dries in patches when a central lagoon is revealed. There is a very small sand cay at the northern end of this reef.

Feature	Chinese	Filipino	Vietnamese
Irving Reef	Huo'ai Jiao (Huo-ai Chiao)	Balagtas	Dao Ca Nham

(viii) Tizard Bank and Reefs

This large coral bank is located at 10°28'N, 114°27'E and lies 30nm southwest from Irving Reef. Its principal axis measures 32nm and is aligned east-northeast–west-southwest; the maximum width is 11nm. The perimeter of the bank measures about 80nm and it is outlined by reefs that dry in eight patches. The reefs enclose a lagoon with a bottom mainly of coral with small patches of sand and shell. The drying reefs occupy only 16 % of the perimeter and the greatest distance between any two adjacent drying reefs is 20nm. Except in the vicinity of the drying reefs, the reef that does not dry generally has a least depth of 10 metres. Most of the lagoon has depths of 50 to 80 metres, although there are some coral heads in the central section reaching to within 7 metres of the surface.

Three of the eight drying reefs are surmounted by islands. Itu Aba is the largest island in the whole of the Spratly Islands with an area of 50 hectares; it has a length of 1,400 metres, a width of 370 metres and is occupied. The island, with a height of 2.4 metres, is situated near the centre of the northern edge of Tizard Bank and centred with the same alignment as the bank on an elliptical reef that has a length of 1.4nm and a width of 0.5nm. The surrounding reef uncovers 1.5 metres and there is a rock south of the island standing 0.9 metres above high water. Situated 6.5nm east of Itu Aba Island is an un-named sand cay with an area of 7 hectares; it is reported to be occupied. The cay, 3 metres high, is located near the centre of a circular reef with an area of 132 hectares, that uncovers to 1.3 metres. There are some small rocks on the reef that stand above high water. Namyit Island lies 11.8nm due south of Itu Aba Island towards the western end of the southern reef that defines Tizard Bank. It has an area of about 9 hectares, stands 18.6 metres high, and lies on the eastern half of an elliptical reef aligned east–west; it is occupied. This reef with a length of 2nm and a width of 0.5nm uncovers to 1.4 metres. There are some small rocks that stand above high water on this reef and one large rock that stands 1.1 metres above high water at its eastern end.

The remaining five reefs that uncover are located at the eastern and western termini of Tizard Bank and on its northeast perimeter. At 10°21'N, 114°41'48"E the eastern terminus is marked by Eldad Reef which is the largest of the reefs that uncover on Tizard Bank. Viewed from the west the shape of the reef resembles a giraffe. The back and neck mark the eastern edge of the reef for 3.5nm. The neck, chest and forelegs mark the northeast edge of the reef for 3.5nm and the rump and hind-legs mark the southeast perimeter of the bank for 1.6nm. This reef dries from 0.4 metres at the south end to 1.4 metres at the northern end. There are some large rocks on the reef that stand up to 1.3 metres above high water. The low-water mark around Eldad Reef lies 12nm east of the low-water mark around the un-named sand cay. Lying 5.7nm northeast of the un-named sand cay is Petley Reef at 10°25'36" N and 114°34'50" E. This reef is almost circular with an area of about 172 hectares. It uncovers 1 metre and is surmounted by some small rocks that might stand above high water. Petley Reef marks the northern terminus of a tongue of submarine reef that projects northeasterly from the northern perimeter of the bank. This reef is reported to be occupied. Located between Itu Aba Island and the un-named sand cay is a small reef of 24 hectares that uncovers to 0.5 metres. It lies 2.1nm east of the low-water mark surrounding the reef on which Itu Aba stands.

The two remaining features are called Gaven Reefs and they mark the western edge of Tizard Bank. The larger northern reef, roughly diamond-shaped with an area of 86 hectares, is located at 10°12'48"N, 114°13'9"E. It dries in parts to 1.2 metres and has one large rock that stands 1.9 metres above high water. This rock is not mentioned by any British or American

sailing directions that have been inspected. However, while both sets of sailing directions remark that this reef covers at high water, the American sailing directions (Defense Mapping Agency Hydrographic/Topographic Center, 1994: 13) includes the information that this reef is marked by a white sand dune 1.8 metres high. An earlier American pilot (US Naval Oceanographic Office, 1967: 88d) refers to a *"small white dune"*. The north Gaven Reef is reported to be occupied. The smaller southern reef has an area of 67 hectares and dries to 1 metre. Both the Gaven Reefs lie more than 12nm from the low-water mark around Itu Aba and the un-named sand cay, and less than 12nm from the low-water mark around Namyit.

Examination of the depths around Tizard Bank reveal that within 1nm of most of the edge of the reef the depth of water is 700 to 800 metres. The exceptions to this generalisation are found off northeast Petley Reef and between Itu Aba and the northernmost Gaven Reef. At 1nm from the reefs in these areas the depths are 500 to 600 metres.

When this description is compared with that contained in the directory compiled by Findlay (1889: 589-90) it appears that the islands have not changed in size or their location on the reefs. There is only one notable difference. The difference arises from the statement by Findlay that the reef between the unnamed cay and Itu Aba was the same size as the reef on which the cay is located. On modern charts and from observation this intermediate reef is only one-fifth of the extent of the reef bearing the un-named sand cay.

Feature	Chinese	Filipino	Vietnamese
Tizard Reef	Zheng He Qunjiao (Cheng-Ho Chun-chiao)		
Itu Aba	Taiping Dao (T'ai-p'ing Tao)	Ligaw	Dao Ba Binh
Namyit Island	Hongxiu Dao (Hung-hsiu Tao)	Binago	Dao Nam Yet
Sand Cay	Dunqian Shazhou (Tun-ch'ien Sha-chou)		Dao Son Ca
Petley Reef	Bolan Jiao (Po-lan Chiao)		Da Nui Thi
Eldad Reef	Anda Jiao (An-ta Chiao)		
Gaven Reef (N)	Nanxun Jiao (Nan-hsun Chiao)		Da Gaven
Gaven Reef (S)	Xinan Jiao (Hsi-nan Chiao)		Da Gaven

(ix) Flora Temple or Western Reef

This circular steep-to reef lies 37nm west from Tizard Bank at 10°15'N, 113°36'E. It has an area of about 40 hectares. There is no report that this reef uncovers although some rocks reach within 1.8 metres of the surface.

Feature	Chinese	Vietnamese
Flora Temple	Fulusi Jiao (Fu-lu-ssu Chiao)	Da Ben Cay Co

(x) Discovery Great and Small Reefs

Discovery Great Reef lies 18nm southwest from Flora Reef at 10°5'N, 113°51'E. It is a narrow steep-to reef that is aligned north–south. None of the recent sailing directions consulted give the size but Findlay (1889: 588) gives the length as 10nm and the width up to 1nm. The lagoon has no entrance; it appears to be shallow and constrictions of the reef and coral heads effectively divide it into three reaches of equal length. This information is derived from a sketch map, lacking any scale, in the American sailing directions (Defense Mapping Agency, 1994: 15). The reef dries and some large rocks stand above high water. It is reported to be occupied. Discovery Small Reef is circular and lies 10nm east of the southern tip of Discovery Great Reef at 10°1'N, 114°1'E. It dries exposing an area of about 1km².

Feature	Chinese	Filipino	Vietnamese
Discovery Great Reef	Daxian Jiao (Ta-hsien Chiao)	Paredes	da Lon
Discovery Small Reef	Xiaoxian Jiao (Hsiao-hsien Chiao)		Da Nho

(xi) Union Bank and Reefs[1]

This large bank lies 17nm southeast from Discovery Small Reef at 9°57'N, 114°25'E. It rises steeply on all sides and the summit is defined by at least 31 charted drying coral patches. The maximum distance between any two adjacent shoals is 5nm. These patches enclose a linear area where vessels can anchor although there would be little shelter in bad weather. This elongated shoal measures 29nm along the main axis which is aligned southwest–northeast. The maximum width of 7.5nm is found in the southwest, the northeast section has a width of about 4nm. The total area of reefs and enclosed bank amounts to 470km². The largest patches are found in the northeast and southwest extremities. Johnson Reef marks the southwest extremity; it has an area of 7km². This reef is U-shaped with the entrance to a shallow lagoon from the north. The American sailing directions report that the edge of the lagoon is defined by white coral while the outer edge of the reef is composed of brown volcanic rocks. It is not known whether this identification was made from collected specimens. If it was simply observed then there is the greater likelihood that the outer reef consists of coral that has been darkened by accumulations of coralline algae *(sp. Lithothomnian)*. A number of large rocks show above high water in the southeast of the reef; the largest stands 1.2 metres. This reef is reported to be occupied. A rectangular reef called Collins lies 1nm northwest of Johnson Reef across a navigable channel. It is reported in the American sailing directions that a coral dune is located at the southeast corner of Collins Reef. It is not clear whether this is a dune formed from coral debris or a coral ridge in the shape of a dune. According to Bird (1994) the former explanation is more likely. Collins Reef is reported to be occupied.

A further 5nm north of Collins Reef is a small drying patch called Loveless Reef. The small coral patch that bears Sin Cowe Island is located 3.5nm northeast from Loveless Reef and 9nm northeast from Johnson Reef. The small island near the middle of the reef stands 3.6 metres

[1] Union Bank and Reefs were surveyed by HM surveying ship *Herald* in April and May 1931 and all names of features are dervived from names of surveying officers aboard *Herald* (Cmdr. N.A.C.Hardy) or the church calendar. The *Herald* survey of Union Bank and Reefs has never been published by the Hydrographer of the Navy.

high. There are thirteen coral patches between Sin Cowe Island and Whitsun Reef which marks the eastern tip of Union Bank. Only two of these reefs are named in sailing directions. McKennan Reef lies 9.5nm east of Sin Cowe Island at 9°54'N, 114°28'E. It has an area of about 2.5km² and is reported to be occupied. There is some confusion whether McKennan Reef is the occupied reef. Haller-Trost (1990), Shephard (1993) and the United States National Technical Information Service (1992) report that McKennan Reef is occupied. Only the United States National Technical Information Service (1992) gives the Chinese name for McKennan Reef and it is recorded as Dongmen Jiao. Chinese sources use the name Dongmen Jiao for Hugh or Hughes Reef with the coordinates of 9°55'N, 114°30'E. The Chinese and British report that the adjacent reef to the west is called McKennan Reef. The next feature to be named is Holiday Reef that lies 14nm northeast from Sin Cowe Island. There is no evidence from the charts or the sailing directions that either McKennan Reef or Holiday Reef are in any way distinguished from the other patches on Union Bank.

The northeast limit of the bank's summit is defined by Whitsun Reef. Shaped like the number seven, with an area of 10km², this is the largest coral reef on the bank. In 1957 American sailing directions reported the presence of a small cay that Japanese and Taiwanese charts indicate is situated 2.5nm from the northeast tip of Whitsun Reef. In the 1988 and 1994 American sailing directions there is no reference to any cay on Whitsun Reef. Lying 3nm west from the southern tip of Whitsun Reef is Grierson Reef that supports a small sandy cay and some large black boulders. Lansdowne Reef lies 13nm southwest from Grierson Reef and 8nm northeast from Johnson Reef at 9°46'N, 114°22'E. A white sand dune is recorded on this reef which is reported to be occupied. There is confusion about the Chinese name for Lansdowne Reef. Chinese sources call the reef Qiong Jiao; that is the name Shepard uses while Haller-Trost is silent on this name. The United States National Technical Information Service (1992) gives the Chinese name of Lansdowne Reef as Quyuan Jiao. The Chinese identify Quyuan Jiao as Higgens Reef at 9°48'N, 114°24'E. Some Chinese and British maps name another seven of the reefs surrounding Union Bank. Whitsun, Grierson and Lansdowne Reefs are reported to be occupied.

Feature	Chinese	Vietnamese
Union Bank and Reefs	Jiuzhang Qunjiao (Chiu-chang Chun-chiao)	Sinh Ton Dong
Johnson Reef	Chigua Jiao (Ch'ih-kua Chiao)	Da Gac Ma.
Collins Reef	Guihan Jiao (Kuei-han Chiao)	Bai Vung May
Loveless Reef	Hua Jiao (Hua Chiao)	
Sin Cowe Island	Jinghong Dao (Ching-hung Tao)	Dao Sinh Ton
McKennan Reef	Ximen Jiao (Hsi-men Chiao)	
Hugh or Hughes Reef	Dongmen Jiao (Tung-men Chiao)	
Holiday Reef	Changxian Jiao (Ch'ang-hsien Chiao)	
Whitsun Reef	Niu'e Jio (Niu-o Chiao)	da Ba Dau
Grierson Reef	Ranqing Shazhou (Jan-ch'ing Chiao)	Sinh Ton Bong

Higgens Reef Lansdowne Reef	Quyuan Jiao (Chu-yuanm Chiao). Qiong Jiao (Ch'iung Chiao)	 Da Len Dao

(xii) Tennent or Pigeon Reef

This is a steep-to triangular drying reef 55nm south of Union Bank at 8°51'N, 114°E; it has an area of about 3.4km². There are some rocks that stand above high water, the largest being in the southeast sector. The lagoon appears to be deep with only one coral head but there is no entrance. The American sailing directions refer to white coral lining the edge of the lagoon on the inner side of the reef while the outer edge is brown suggesting volcanic rock. As noted earlier, unless the rock was identified as being volcanic from samples, the outer edge of the reef is likely to be darkened coral. This reef is reported to be occupied. Tennent Reef is used by British sources and Pigeon Reef by American sources.

Feature	Chinese	Vietnamese
Tennent Reef	Wumie Jiao (Wu-mieh Chiao)	Da Tien Nu

(xiii) Cornwallis South Reef

This reef lies 24nm southwest from Tennent/Pigeon Reef at 8° 42'N, 114°11'E. It is almost oblong in shape, aligned north–south, with an area of about 35km². The reef dries exposing a lagoon with depths down to 9 metres; it is reported that it can be entered from the south through a channel 360 metres wide with some coral heads and a depth of 9 metres. Cornwallis South Reef is reported to be occupied.

Feature	Chinese	Vietnamese
Cornwallis South Reef	Nanhua Jiao (Nan-hua Chiao)	Da Nui Le

(xiv) Alison Reef

This reef lies 6nm northwest from Cornwallis South Reef at 8°48'N and 114°E. It is oval in shape aligned southeast–northwest; its long axis measures about 10nm and its area is about 75km². This submerged atoll dries in patches defining a shallow and foul lagoon. The northern reef is about 1nm wide and is pierced by one entrance 640 metres wide with a depth of 9 metres. The southern reef is about 0.5nm wide and has many narrow entrances with depths about 9 metres. The Chinese name is translated as Six Entrances Reef. This reef is reported to be occupied.

Feature	Chinese	Vietnamese
Alison Reef	Limen Jiao (Liu-men Chiao)	Bai Toc Tan

(xv) Pearson Reef

This steep-to coral reef lies 14nm northwest from Alison Reef in 8°57'N, 113°40"E. The reef consists of a central rectangular section aligned east–west from which project a southwestern promontory and a narrow northeastern peninsula, the whole length being about 5nm. The lagoon, for which no soundings have been found, contains many coral heads and lacks any entrance; it lies in the central rectangular section. The northwest and southwest extensions provide the widest sections of reef and on each there is a sand cay dotted with small rocks. The cay in the northeast stands two metres high while that in the southwest has an elevation of one metre. The southwest cay is reported in the American sailing directions but not in the British version of 1982. Pearson Reef is reported to be occupied.

Feature	Chinese	Filipino	Vietnamese
Pearson Reef	Bisheng Jiao (Pi-sheng Chiao)	Hizon	Dao Vanh Vinh

(xvi) Maralie Reef or Bittern Reef

This steep-to circular reef lies 14nm north of Pearson Reef at 9°12'N, 113°40'E. It is regarded as a very dangerous feature because it is small with a diameter of 0.3nm. Estimations of the least depth over it vary from 12.8 metres in the British sailing directions to 0.9 metres in the American sailing directions, which also reports that the reef does not generate breakers, and appears to be formed of brown volcanic rock only covered with coral in the southwest sector.

Feature	Chinese	Vietnamese
Maralie Reef	Shipan Zai (Shih-pan-tsai)	Da Nui Mon

(xvii) Fiery Cross or Northwest Investigator Reef

This steep-to reef lies 46nm northwest from Maralie Reef at 9°57'N, 112°58'E. It has a linear shape aligned southwest–north east and its long axis measures 14nm while the maximum width is 4nm, giving a total area about 110km². Reefs 1nm wide surround a lagoon. Several patches of coral uncover and between them there are channels with depths from 15 to 40 metres. However none of the sailing directions refers to any specific entrance or mentions possible anchorages in the lagoon. Soundings in the lagoon give depths of 1.4 to 39 metres. The American and British sailing directions agree that at high water the reef is covered except for a prominent rock 1 metre high on the the southwest section. In calm weather the sea does not cover the reef. It is reported that the reef is occupied.

Feature	Chinese	Filipino	Vietnamese
Fiery Cross Reef	Yongshu Jiao (Yung-shu Chiao)	Kalingan	da Chu-Thap

(xviii) London Reefs

The four reefs that make up this feature are arranged over 40nm between parallels 8°50' and 8° 57'N from 112°11'E in the west to 112°52'E in the east. The reefs are called West, Central, East and Cuarteron; this latter reef lies 39nm south from Fiery Cross Reef. All the London Reefs are reported to be occupied.

West Reef is an oval coral atoll with its long axis of 5.5nm aligned southwest–northeast; its maximum width is 3nm. and the total area about 40km². The reef dries at its east and west extremities and on the eastern section there is a long narrow cay which stands 0.6 metres above high water. The lagoon is cluttered with coral heads but there are depths of 14.6 metres.
The circular Central Reef is the smallest of the four with an area about 1km²; it lies 5nm northeast from West Reef. When it uncovers a shallow lagoon is exposed. The British sailing directions follow Findlay (1889) and refer to a sandy cay in the southwest that might cover at highwater spring tides. The American directions refer to two cays in the southwest and east but makes no mention of possible submergence.

East Reef lies 13nm southeast from Central Reef; it has an area of about 40km². This linear reef has a long axis aligned west–east of 7nm and a maximum width of 2.5nm. The unbroken reef surrounds a lagoon containing many coral heads with a recorded depth of 14 metres. Near the western edge there are rocks that seldom cover; one stands 1 metre high.

Cuarteron Reef lies 10nm east from East Reef. This feature is shaped like a bean with a length of 3nm aligned east–west; it has an area of 8km². There is no entrance to the small shallow lagoon and on the north side of the reef there are some rocks standing 1.6 metres high that do not cover.

Feature	Chinese	Filipino	Vietnamese
London Reefs	Yinqing Qunjiao (Yin-ch'ing Ch'un-chiao)		Con Tay
West Reef	Xi Jiao (Hsi Chiao)		da Tay
Central Reef	Zhong Jiao (Chung Chiao)		Dao Sa Truong Dong
East Reef	Dong Jiao (Tung Chiao)	Silangan	da Dong
Cauteron Reef	Huayang Jiao (Hua-yang Chiao)		bai Chau Vien

(xix) Spratly Island and Ladd Reef

The island, which by custom provides the collective name to the islands, reefs and shoals of the South China Sea, is located 21nm southwest of West Reef in the London Group. Its position is 8°38'30"N, 11°54'50"E. The island has the shape of an isosceles triangle with a base aligned northeast–southwest measuring 750 metres and the apex 350 metres distant; the area is 13 hectares. At the three corners there are reefs that uncover; they have widths up to 200 metres. This low island stands 2.4 metres above high water and lies at the southeastern edge of a coral bank which has an area of 1.8km² out to the 18 metre isobath. This island is occupied.

Captain Doyle of Australia and Captain Campbell of the Hydrographic Office provided information about the naming of this island. It can be pinpointed to 9 am on 29 March 1843. At that time Richard Spratly, master of the whaler *Cyrus* was sailing southeast from the direction of Ladd Reef which he had sighted the previous day. The story continues in a letter Spratly wrote to the Hydrographic Office on 1 April 1843:

> *"...at 9 h. A.M. a low sandy island was discovered from the masthead, bearing S.E.bE. four leagues. On nearing the beach was visible to the water's edge, the top appearing to be covered with small bushes, and about the height of a Ship's hull, with a black patch dividing the sandy beach in nearly two equal parts to the water's edge...One [of these two dangers] I call Ladd Reef, after Captain Ladd of the Ship Austen, who appears first to have seen it; the other Spratly's Sandy Island."* (Nautical Magazine, 1843: 697).

Findlay noted that Spratly Island was Horsburgh's Storm Island. In view of their present status Storm Islands might have been a more appropriate name for the whole group! Commander Ward reported that there was not even a blade of grass on Spratly Island and that Spratly had been deceived by the mirage effect associated with seabirds standing erect (Findlay, 1889: 586).

Ladd Reef lies 15nm west from Spratly Island at 8°39'N, 111°40'E. This oval reef has a length of 3nm and a maximum width of 1nm. The drying reef is covered with boulders and defines a lagoon, with a bottom of white sand, which does not seem to have any entrance. The reef is reported to be occupied.

Feature	Chinese	Filipino	Vietnamese
Spratly Island	Nanwei Dao (Nan-wei Tao)	Lagos	Dao Truong Sa
Ladd Reef	Riji Jiao (Jih-chi Chiao)		da Lat

(xx) The Southwest Banks

There are six shoals of varying size lying between Ladd Reef and the continental margins of Vietnam, Indonesia and Malaysia. Prince of Wales, Prince Consort, Alexandra, Grainger, and Vanguard Banks lie in a cluster about a point at 7°50'N, 110°10'E. Rifleman Bank, larger than the others, lies 80nm to the east. There are reports that structures have been erected on Prince of Wales Bank, Grainger Bank, Prince Consort Bank and Vanguard Bank.

Prince of Wales Bank

This coral bank lies 70nm southwest from Ladd Reef at 8°10'N, 110°32'E. It has an irregular shape with a length of 10nm aligned southwest–northeast and a maximum width of 6nm. Depths over the bank vary in an irregular manner with the least depth recorded being 7.3 metres on the western margin.

Alexandra Bank

This bank lies 2nm southeast from Prince of Wales Bank at 8°N, 110°37'E. This oval bank is aligned north–south with the long axis measuring 5nm within the 18 metre isobath and a width of 3nm. The coral bottom is visible and the least recorded depth is 5.5 metres.

Grainger Bank

Grainger Bank lies 11nm southwest from Alexandra Bank at 7°49'N, 110°29'E. This almost circular coral bank has a diameter of about 4nm and a least recorded depth of 11 metres.

Prince Consort Bank

This Bank lies 28nm west of Grainger Bank at 7°55'N, 109° 58'E. With a bottom of sand and coral the least depth recorded is 18.3 metres in the northwest.

Vanguard Bank

Vanguard Bank lies 22nm southwest from Prince Consort Bank at 7°32'N, 109°45'E. The linear crest of this bank is aligned west–east and within the 18.3 metres isobath measures 16nm long and 3nm wide. The least recorded depth is 16.5 metres.

Feature	Chinese	Vietnamese
Prince of Wales Bank	Guangya Tan (Kuang-ya T'an)	bai Phuc Tan
Alexandra Bank	Renjun Tan (Jen-chun T'an)	bai Huyen Tran
Grainger Bank	Lizhun Tan (Li-chun T'an)	bai Que Duong
Prince Consort Bank	Xiwei Tan (Hsi-wei T'an)	bai Phuc Nguyen
Vanguard Bank	Wan'an Tan (Won-an T'an)	bai Tu Chinh

Rifleman Bank

This bank lies 94nm east from Vanguard Bank and 41nm south from Ladd Reef at 7°45'N, 111°35'E. The Chinese name translates as Golden Shield Bank and aptly describes its shape as a large oval. The crest of the bank is marked by more than a dozen shoal patches with least depths from 3 to 11 metres. The shield is defined by Bombay Castle, Kingston Shoal, Orleana Shoal and Johnson Patch at the north, south, east and west extremities of the shield. They have least depths of 3, 11, 8.2 and 7.3 metres respectively. It is reported that Bombay Castle is occupied.

Feature	Chinese
Rifleman Bank	Nanwei Tan (Nan-wei T'an)
Kingston Shoal	Jidun Ansha (Chin-tun An-sha)
Bombay Castle	Pengbo Bao (P'eng-po-pao)
Orleana Shoal	Aonan Ansha (Ao-nan An-sha)
Johnson Patch	Chang Jun Ansha (Ch'ang-jun An'sha)

(xxi) Amboyna Cay

Amboyna Cay lies 71nm east from Rifleman Bank at 7°53'30"N, 112°55'E. Modern sailing directions do not give the size of the cay but Shepherd (1993) gives the area as 1.58 hectares. If the island was roughly rectangular the area indicated by Findlay (1889: 622) was 1.55 hectares. The height of the cay above high water is about 2.4 metres. In 1864 there was one metre of guano at the western edge of the reef. More than a century later the British sailing directions of 1988 still describe the western half of the cay as being covered with a bed of guano. This must be unpleasant for the present occupants of this small island. The cay is encompassed by an irregular coral platform up to 360 metres wide that dries in parts. Coral banks extend 800 metres and 550 metres respectively from the northwest and northeast edges of the reef surrounding the cay.

Feature	Chinese	Malaysian	Filipino	Vietnamese
Amboyna Cay	Anbo Shazhou (An-po Sha-chou)	Pulau Kecil Amboyna	Kalantiyaw	dao An Bang

(xxii) Barque Canada Reef

This reef lies 21nm northeast from Amboyna Cay at 8°10'N, 113°18'E. It is shaped like a seal with the head represented by the northeast reef , the tail by the southwest reef and the body by the lagoon. Barque Canada Reef is 15.5nm long and 2nm at its widest. The reef dries defining a narrow, apparently deep, lagoon to which there is no entrance. A large rock at the southwest extremity stands 4.5 metres and another group of rocks to 2 metres occupies the centre of the reef extending north from the lagoon. Barque Canada Reef is reported to be occupied.

Feature	Chinese	Malaysian	Vietnamese
Barque Canada Reef	Bai Jiao (Pai Chiao)	Terumbu Perahu	bai Thuyen Choi
North rocks	Niao-yu Dingshi (Niao-yu-ting Shih)		
South rock	Danzhu Shi (Tan-chu Shih)		

(xxiii) Mariveles Reef

This drying reef lies 35nm southeast from Barque Canada Reef at 7°59'N, 113°55'E. Its shape resembles a tea-spoon with the handle pointing southeast. The total area of reef and lagoons is 17km². This steep-to reef completely encloses a lagoon at each end although the southeastern lagoon is only one-third the size of the northwest lagoon. There is a sand cay 1.5 metres high between the two lagoons. This cay with some rocks stands above high water and is reported to be occupied.

Feature	Chinese	Malaysian	Vietnamese
Mariveles Reef	Nanhai Jiao (Nan-hai Chiao)	Terumbu Mantanani	da Ky Van

(xxiv) Erica Reef

This small oval reef lies 14nm northeast from Mariveles Reef at 8°7'N, 114°8'E. The reef, which is unbroken, dries to enclose a shallow lagoon. Some isolated rocks on the eastern edge might stand above high water.

Feature	Chinese	Malaysian
Erica Reef	Boqi Jiao (Po-chi Chiao)	Terumbu Siput

(xxv) Investigator Shoal

This shoal lies 20nm east from Erica Reef at 8°8'N, 114° 40'E. It is a large submerged atoll with the shape of a club with the narrow handle pointing westwards; its total area is about 205km². Except for the narrow western portion the reef surrounds a lagoon which has depths of at least 45 metres. Less than half the reef dries in patches; the remaining sections lie at depths of 5 to 18 metres. The drying reefs are found along the north side of the atoll.

No names are given for these patches in the American or British sailing directions but there are Chinese names. The largest drying reef marking the western tip and northwestern edge for about 12nm is called Langkou Jiao (Lang-k'ou Chiao) which translates as Wave Frontier Reef. The third largest section of drying reef lies in the middle of the northern edge and is called Erjiao Jiao (Erh-chiao Chiao) which translates as Two Horn Reef. The second largest drying reef marks the eastern tip and is called Xiantou Jiao (Hsien-t'ou Chiao) which translates to Head of the Reef. There are reports that large fishing vessels enter the lagoon, through a southeast entrance 365 metres wide and 37 metres deep, and find good anchorage but no shelter, and that some large rocks at the western end might be visible at high water.

Feature	Chinese	Malaysian	Vietnamese
Investigator Shoal	Yuya Ansha (Yu-ya An-sha)	Terumbu Peninjau	bai Tham Hiem
Western reef	Langkou Jiao (Lang-k'ou Chiao)		
Central reef	Erjiao Jiao (Erh-chiao Chiao)		
Eastern reef	Xiantou Jiao (Hsien-t'ou Chiao)		

(xxvi) Commodore Reef

This reef lies 28nm northeast of Investigator Shoal in 8°2'N, 115°13'E. It is a linear reef aligned west–east and has the appearance of two circular atolls with diameters of 1.7nm joined by a reef 2.5nm long and 0.75nm wide. The whole feature has an area of 20km². The western end of the reef dries 1.5 metres and many other patches uncover. The western lagoon is accessible and depths are down to 14 metres. The eastern lagoon is reported to be shallow and foul. There is a sand cay that stands 0.3 metres at high water on the central connecting reef, and Flat Rock has the same elevation on the eastern tip of this feature. The cay is reported to be occupied.

Feature	Chinese	Malaysian	Filipino	Vietnamese
Commodore Reef	Siling Jiao (Ssu-ling Chiao)	Terumbu Laksamane	Rizal	da Cong Do

(xxvii) Ardasier Bank

This extensive bank lies 10nm southwest from Investigator Shoal at 7°43'N, 114°15'E. It has a linear shape with the long axis of 38nm aligned southwest–northeast and the maximum width of 10nm. The summit of the bank is edged by more than 30 coral patches only one of which dries; the total area enclosed by these patches is 850km². The depths over the patches that do not dry vary from 3.7 to 18.3 metres. Depths within the coral ring vary from 41 to 65 metres but sailing directions say the bank has not been closely examined. The translation of the Chinese name is Safe Crossing Shoal. The drying coral patch is appropriately called Ardasier Reef. It is shaped like an isosceles triangle with the base facing seawards. It encloses a small shallow lagoon for which the 1994 Malaysian chart shows two entrances. The total area of this feature is about 8km²; it is reported to be occupied.

Dallas Reef can be considered with Ardasier Bank for two reasons. First it lies only 5nm west from Ardasier Reef at 7° 37'30"N, 113°48'E; second its Chinese name translates as Bright Star Reef, while Ardasier Reef is Little Bright Star Reef. Dallas Reef has a linear shape aligned west–east and measures 5nm by 1nm; its total area is about 17km². It dries completely exposing a narrow lagoon to which there is no entrance.

Feature	Chinese	Malaysian	Vietnamese
Ardasier Bank	Andu Tan (An-tu T'an)	Permatang Ubi	bai Ngua
Ardasier Reef	Guangxingzai Jiao (Kuang-hsing-tsai Chiao)	Terumbu Ubi	
Dallas Reef	Guangxing Jiao (Kuang-hsing Chiao)	Terumbu Laya	

(xxviii) Swallow Reef

This reef is located 14nm south from Dallas Reef at 7°23'N, 113°48'E. The narrow belt of coral 3.5nm in length encloses a shallow basin and there are some rocks which stand above water on the east and southeast sections of the reef. There is a small apparently rocky island standing 2 metres high on the south rim of this reef. It is noteworthy that when the latest Malaysian chart is compared with maps produced in 1979 the name for Swallow Reef has been changed from Terumbu [Reef] Layang Layang to Pulau [Island] Layang Layang.

Feature	Chinese	Malaysian	Vietnamese
Swallow Reef	Danwan Jiao (Tan-wan Chiao)	Pulau Layang Layang	da Hoa Lau

(xxix) Royal Charlotte Reef

This reef lies 30nm southwest from Swallow Reef at 6°56'N, 113°36'E. It has a rectangular shape with sides about 1nm long. Boulders up to 1.2 metres high show above high water on the northeast and southeast edges, and the reef dries enclosing a small basin.

Feature	Chinese	Malaysian	Vietnamese
Royal Charlotte Reef	Huanglu Jiao (Huang-lu Chiao)	Terumbu Semarang Barat Besar	da Sac Lot

(xxx) Louisa Reef

Louisa Reef lies 41nm southwest from Royal Charlotte Reef at 6°19'N, 113°14'E. This quadrilateral reef has sides about 1.2nm in length and has a number of rocks on its surface. Two clusters in the northeast and southwest do not cover and stand one metre above water level. The tiny central basin is shallow.

Feature	Chinese	Malaysian
Louisa Reef	Nantong Jiao (Nan-tung Chiao)	Terumbu Samarang Barat Kecil

(xxxi) North and South Luconia Shoals

North Luconia Shoal lies 49nm southwest from Louisa Reef at 5°40'N, 112°30'E. This is a dangerous area of shoal reefs and no safe passage through is recorded. As Findlay (1889: 611) noted, *"These dangers were examined by HMS Rifleman, and were found to consist of a mass of coral reefs and shoals, among which no vessel should venture."* These dangers occupy an area shaped like an isosceles triangle with a base of 40nm facing east. The whole area comprises about 1,400km², with Hayes Reef, Moody Reef and Friendship Shoal marking the south, west and north points respectively. There are eight named features. From north to south they are Friendship Shoal, Hardie, Aitken, Buck, and Moody Reefs, Seahorse Breakers and Tripp and Hayes Reefs. Only Hayes Reef and Seahorse Breakers dry; the other reefs have least depths varying from 3.7 to 9.6 metres.

South Luconia Shoals lie 12nm south from North Luconia Shoals at 5°5'N, 112°38'E. This area of shoals is shaped like an egg aligned east–west about 30nm long by 15nm wide. It has an area of about 900km². There are six named coral reefs which from west to east are Stigant, Connell and Herald Reefs, Luconia Breakers, Richmond Reef and Comus Shoal. Only Luconia Breakers dry; the least depths over the other reefs vary from 4.6 to 8.2 metres.

Feature	Chinese	Malaysian
North Luconia Shoals	Beikang Ansha (Pei-k'ang An-sha)	Gugusan Beting Raja Jarum
Friendship shoal	Mangyi Ansha (Meng-i An-sha)	Beting Rentap
Hardie Reef	Haikang Ansha (Hai-k'ang An-sha)	Terumbu Asun
Aitken Reef	Jijing Jiao (I-ching Chiao)	Terumbu Datak Landih
Buck Reef	Faxian Ansha (Fa-hsien An-sha)	Terumbu Linggir
Moody Reef	Kangxi Ansha (K'ang-hsi An-sha)	Terumbu Permaisuri
Seahorse Breakers	Nan'an Jiao (Nan-an Chiao)	Hampasang Dang Ajar
Tripp Reef	Bei'an Jiao (Pei-an Chiao)	Terumbu Litong
Hayes Reef	Nanping Jiao (Nan-p'ing Chiao)	Terumbu Lang Ngindang
South Luconia Shoals	Nankang Ansha (Nan-k'ang An-sha)	Gugusan Beting Patinggi Ali
Stigant Reef	Hai'an Jiao (Hai-an Chiao)	Terumbu Sahap
Connell Reef	Yinbo Ansha (Yin-po An-sha)	Terumbu Dato Talip
Herald Reef	Haining Jiao (Hai-ning Chiao)	Terumbu Saji
Comus Shoal	Huanle Ansha (Huan-le An-sha)	Beting Merpati
Richmond Reef	Tanmen Jiao (T'an-men Chiao)	Terumbu Balingian
Luconia Breakers	Qiongtai Jiao (Ch'iung-t'ai Chiao)	Hampasan Bentin

Figure 1: The Spratly Islands west of meridian 115° 18' East

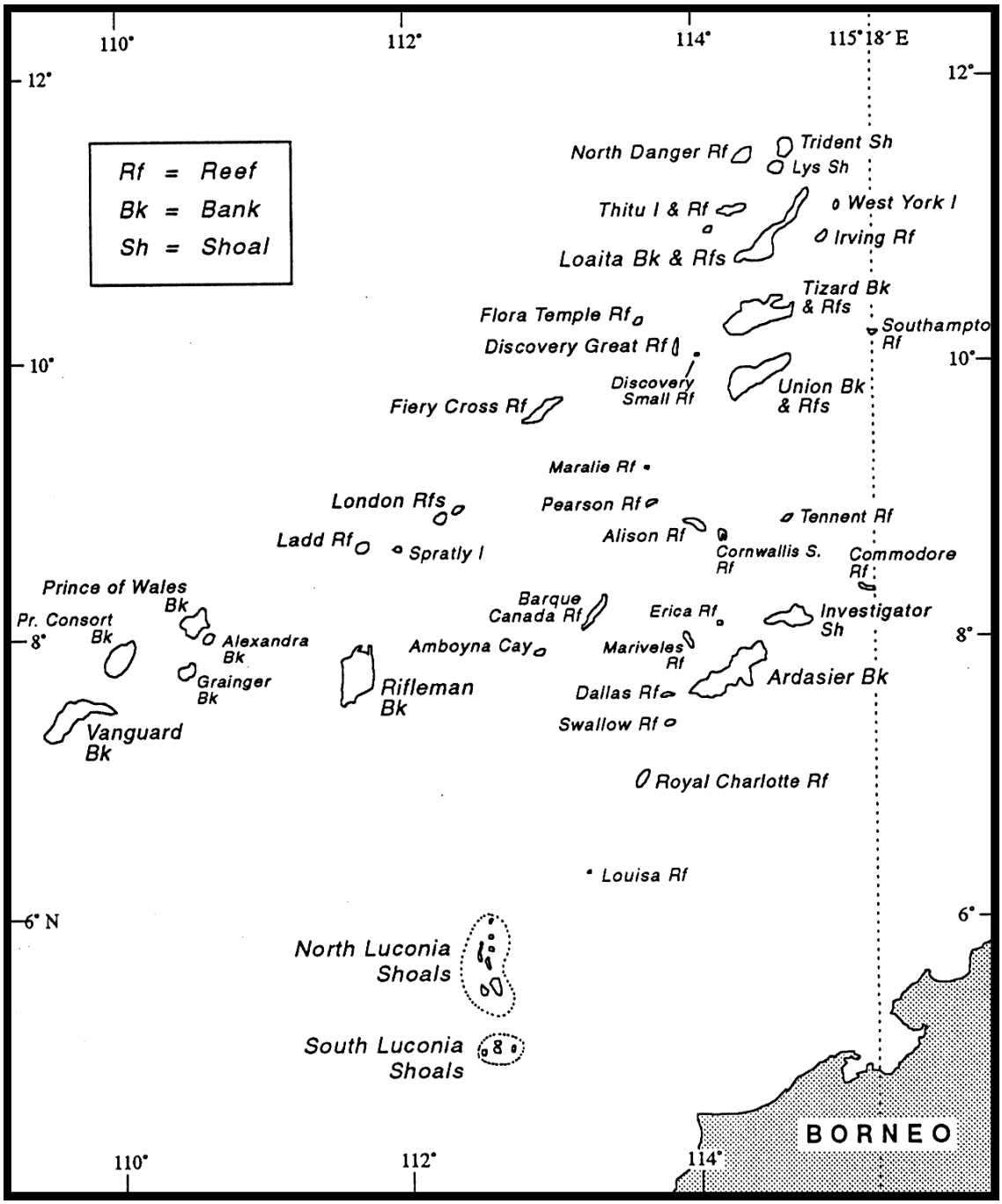
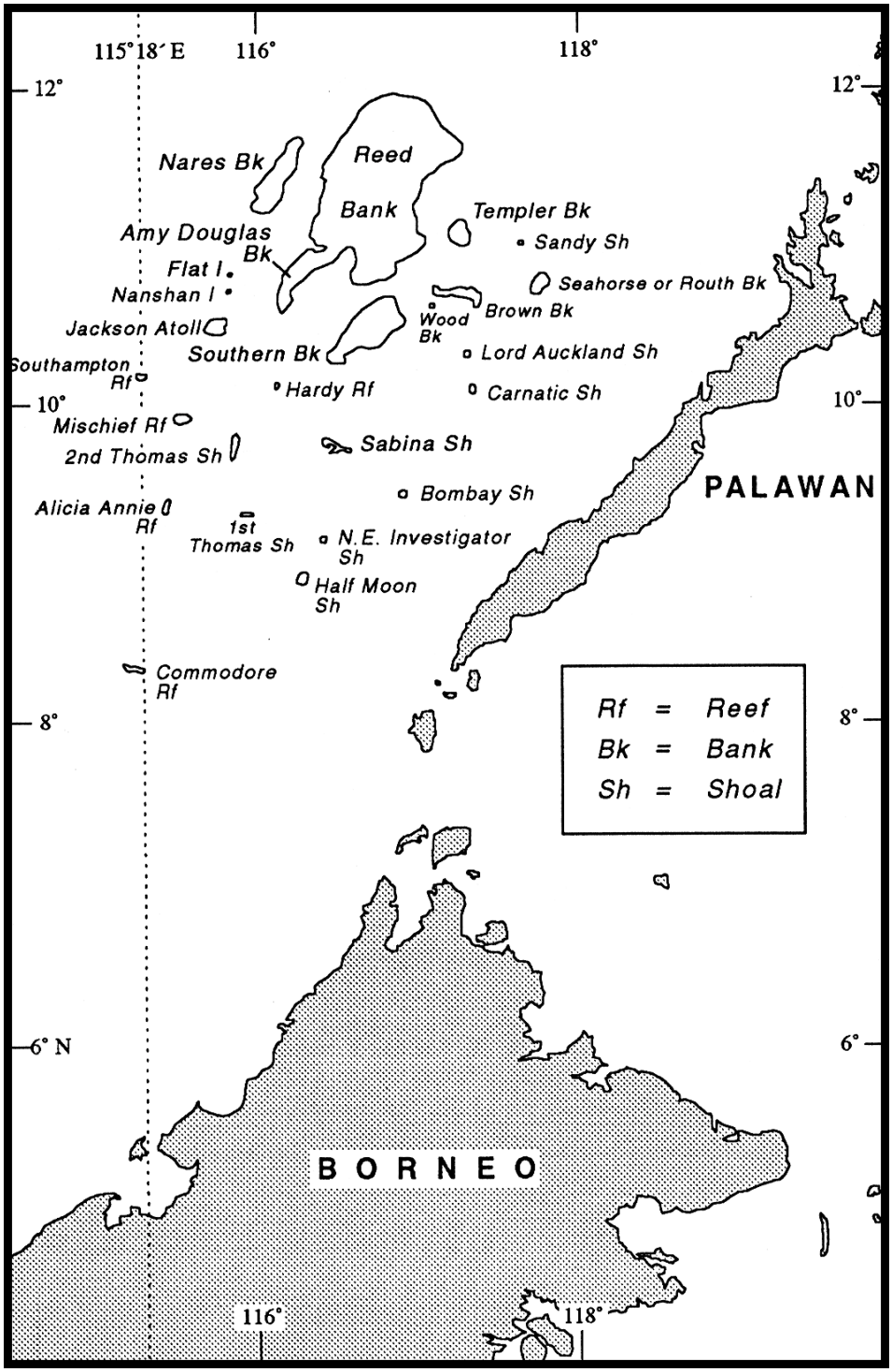


Figure 2: The Spratly Islands east of meridian 115° 18' East



2.2 The Spratly Islands east of meridian 115° 18' East

(i) The Northwest Banks

The northwest area of the Spratly Islands region is bounded by 12°N and 10°20'N and meridians 116° and 118°E and is characterised by some very large shoals and a lack of any islands. The principal feature is Reed Bank, named after Lieutenant Reed who carried out extensive surveys in the 1860s. Reed Bank is bounded on the southwest and west by Amy Douglas Bank and Nares Bank respectively. To the south of Reed Bank lies the detached large Southern Bank and to the southeast is located a cluster of seven much smaller shoals. Most of the banks have not been carefully surveyed as the following quotations indicate:

> *"Caution. It is strongly emphasised that this portion of the area is for practical purposes unsurveyed although the positions and approximate limits of numerous shoals have been determined."* (Hydrographer of the Navy, 1975: 134).

> *"Caution. Nothing can be added to the information shown on the charts covering Dangerous Ground east [from Nashan Island] to Lord Auckland Shoal and N to Sandy Shoal. The area is relatively unexamined [and] subject to conflicting reports; hence considered dangerous to navigation."* (Defense Mapping Agency, 1988: 14).

Reed Bank is the largest single feature in the Spratly Islands region; it is centred on 11°20'N, 116°40'E. This bean-shaped shoal extends about 70nm from Pennsylvania North Reef in the south to Mary Louise Bank in the north; these features have least depths of 16.5 and 27 metres respectively. The maximum width is about 30nm and the total area about 7,000km². Charts show depths over the bank varying from 16 metres (11°22'N, 116°27'E) to 90 metres (11°1'N, 116°54'E).

Amy Douglas Bank abuts the southwest edge of Reed Bank in the vicinity of 11°N, 116°30'E about 10nm north of Hiranie Shoal. This shoal is on the northeastern edge of the Amy Douglas Bank and has a least depth of 1.8 metres. Amy Douglas Bank is centred about 10° 50'N, 116°18'E. Its north–south axis measures about 37nm and its maximum width is about 12nm; the shoal has an area of about 1,070km². In addition to Hiranie shoal there are two named drying reefs that mark the southwestern edge of Amy Douglas Bank. Iroquois Reef marks the southern tip. It is shaped like the letter 'V' with an approximate area of 8km². Baker Reef lies 5nm north of Iroquois Reef; it is circular with an approximate area of 20 hectares. Depths shown for the bank as a whole vary from 11 to 75 metres.

There are depths of 1,200 metres in the waters, 12nm wide, that separate northwest Reed Bank from Nares Bank. This detached bank has the shape of a tear drop measuring about 40nm north–south and 10nm at its widest point; its area is about 780km². Very few soundings are recorded for Nares Bank; they vary from 18.3 to 75 metres.

Southern Bank lies 6.5nm south of Pennsylvania North Reef. It is located about 10°30'N, 11° 40'E, with its southwest–northeast axis measuring about 30nm and its maximum width 16nm. The shoal has an area of about 1,030km². It has an irregular shape with the widest patches of reef up to 3nm in the southwest and north. Depths over the bank vary from 13 to 84 metres.

The seven small banks that lie in the zone bounded by 10°36' and 11°8'N and 117°8' and 117° 50'E vary in size and the detail with which they have been charted. Proceeding from north to south there are three features, Templer Bank, Leslie Bank and Sandy Shoal arranged from west to east along parallel 11°2'N. Templer Bank lies 13nm east of Reed Bank; it is shaped like an egg measuring 9nm north–south and 5nm in width. The area of Templer Bank is about 115km² and the least depth recorded on it is 18.3 metres. Leslie Bank stands 6nm east of Templer Bank; it is circular with an area about 40km². The least recorded depth on Leslie Bank is 16.5 metres. Sandy Shoal is reported to lie 9nm east of Leslie Bank. It is steep-to and very small and it is regarded as being *"doubtful"*.

Next there is a line of four reefs between 10°35' and 10°51'N; they are Wood Bank, Brown Bank, Fairie Queen Shoal and Seahorse or Routh Shoal arranged from west to east. Wood Bank is an oval shoal aligned northwest–southeast; it is located at 10°37'N, 117°10'E. Its length is about 4nm and its width 2nm, giving an area of about 15km². The least reported depth is 18.3 metres. Brown Bank lies 8nm north of Wood Bank. It appears to have a complex pattern of reefs occupying an area of about 60km². It measures 8nm along the main north–south axis with a width of 3.7nm. The least depth shown is 14.6 metres. Fairie Queen is a small shoal with a least depth of 16.5 metres lying 14nm west of Brown Bank. Finally Seahorse or Routh Shoal lies 9nm northeast from Fairie Queen Shoal at 10°47'N, 117°47'E. It has the form of a submerged atoll with depths over the fringing reef of 8 metres and depths near the centre of 31 metres. This shoal has an area of about 80km².

Feature	Chinese	Vietnamese
Reed Bank	Liyue Tan (Li-yueh T'an)	Bai Co Rong
Pennsylvania North Reef	Yangming Jiao (Yang-ming Chiao)	
Hirane Shoal	Antang Jiao (An-t'ang Chiao)	
Iroquois Reef	Houteng Jiao (Hou-t'eng Chiao)	
Baker Reef	Gongzhen Jiao (Kung-chen Chiao)	
Mary Louise	Xiongnan Jiao (Hsiung-nan Chiao)	
Amy Douglas Bank	Antang Tan (An-t'ang T'an)	
Nares Bank	Dayuan Tan (Ta-yuan T'an)	
Southern Bank	Nanfang Qiantan (Nan-fang Ch'ien-t'an)	
Templer Bank	Zhongxiao Tan (Chung-hsiao T'an)	
Sandy Shoal	Shenxian Ansha (Shen-hsien An-sha)	
Brown Bank	Zong Tan (Tsung T'an)	
Wood Bank	Zi Tan (Tzu T'an)	
Seahorse or Routh Shoal	Haima Tan (Hai-ma T'an)	
Fairie Queen Shoal	Xianhou Tan (Hsien-hou T'an)	

(ii) Flat and Nanshan Islands and Hopkins Reef

Flat and Nanshan Islands are located on a steep-to bank of about 120km² that has not been closely examined. It is shaped like a parallelogram with a long axis lying north–south. It is centred at 10°43'N, 115°50'E, 15nm west from Amy Douglas Bank. Flat and Nanshan Islands mark the northern and western points of this unnamed bank respectively. The southern point of the bank lies about 7nm south from Nanshan Island while the eastern point is 5.5nm southeast from the same island. Depths over the bank are reported to be 45 to 48 metres. The two islands lie at the centre of circular reefs that have areas of about 2km². They are both sandy islets and are reported to be occupied. Nanshan is reported to be 575 metres long standing 2.4 metres above the reef; originally it was covered with coarse grass. Flat Island is smaller with estimates of its length ranging from 90 to 210 metres. The variations might be explained by reports that the cay lacks vegetation and is subject to erosion. There is a shallow shoal reef reaching from Flat Island to within 1nm of Nanshan Island.

Hopkins Reef, which is sometimes awash, lies 16nm east of Flat Island. It is steep-to and is usually marked by breakers. At the centre of the reef there is only 0.9 metres of water but the submarine slopes have a gradient of 60° so that 91 metres from the shallowest point there is 150 metres of water.

Feature	Chinese	Filipino	Vietnamese
Flat Island	Feixin Dao (Fei-hsin Tao)	Patag	Dao Binh Nguyen
Nanshan Island	Ma Huan Dao (Ma-huan Tao)	Lawak	Dao Vinh Vien
Hopkins Reef	Huoxing Jiao (Huo-hsing Chiao)		

(iii) Jackson Atoll

Jackson Atoll lies 12nm south of Nanshan Island in 10°30'N, 115°45'E. It has a roughly rectangular shape and the diagonals measure 6.3nm and 5.9nm. The Chinese name for this atoll means that reefs can be found in five directions. Five drying coral patches outline the lagoon. Proceeding clockwise from the northeast they are called Dickinson, Petch, Hampson, Deane and Hoare Reefs. Their respective areas are 110, 120, 7, 190 and 140 hectares. Petch and Hoare Reefs uncover one metre, Dickinson and Deane Reef uncover 0.6 metres and Hampson Reef is awash at low water.

The lagoon has depths varying from 25 to 46 metres with a few coral heads in Fly Patches between Hoare and Dickinson Reefs, on the northern perimeter. There are four entrances to the lagoon. Two lie on either side of Hoare Reef and the other two lie between Dickinson and Petch Reef and they are separated by Middle Shoal with a least depth of 7 metres. While the bottom of coral and sand provides good holding ground the lagoon provides no shelter from rough weather.

Feature	Chinese
Jackson Atoll	Wufang Jiao (Wu-fang Chiao)
Dickinson Reef	Wufang Tou (Wu-fang-t'ou Chiao)
Petch Reef	Wufang Nan Jiao (Wu-fang-nan Chiao)
Hampson Reef	Wufang Wei (Wu-fang-wei Chiao)
Deane Reef	Wufang Xi (Wu-fang-hsi Chiao)
Hoare Reef	Wufang Bei (Wu-fang-pei Chiao)

(iv) Southampton Reefs

This system consists of two drying coral reefs. Livock Reef is located at 10°11'N, 115°19'E, 28nm southwest from Jackson Atoll. The Chinese name appropriately translates as Triangular Reef, for that is its shape. It surrounds a lagoon and has a total area of 10km². When it uncovers some large rocks appear and there are reports that a few are still visible at high water. Hopps Reef lies 3nm northeast from Livock Reef. It is circular with an area of 85 hectares and unlike Livock Reef there is no lagoon and no large rocks.

Feature	Chinese	Vietnamese
Hopps Reef	Lusha Jiao (Lu-sha Chiao)	da Hop
Livock Reef	Sanjiao Jiao (San-chiao Chiao)	

(v) Hardy Reef

This reef is located 48nm east from Livock Reef at 10°8'N, 116°8'E. The reef uncovers and a strip of sand is reported to lie at its centre. The Chinese translation of the name means Half-way Reef. Hardy Reef is 27nm from Jackson Reef and 26nm from Sabina Shoal and these three features are on a straight line on a Mercator projection.

Feature	Chinese
Hardy Reef	Banlu Jiao (Pan-lu Chiao)

(vi) Lord Auckland Shoal

This shoal lies 70nm east of Hardy Reef at 10°19'N, 117° 18'E. It has an area of about 70 km² and a least depth of 14.6 metres.

Feature	Chinese
Lord Auckland Shoal	Elan Ansha (O-lan An-sha)

(vii) Carnatic Shoal

This shoal lies 11nm south from Lord Auckland Shoal at 10°6'N, 117°20'E. It is a small circular reef with a least depth of 6.4 metres.

Feature	Chinese
Carnatic Shoal	Hongshi Ansha (Hung-shih An'sha)

(viii) Sabina Shoal

Sabina Shoal lies 56nm southwest from Carnatic Shoal at 9° 45'N, 116°27'E. It consists of two main parts that occupy an area of 115km². The larger western part is rectangular aligned northwest–southeast; from the southeastern corner there is a narrow eastern extension. This shoal is inclined from east to northwest so that the reefs in the eastern section are awash while the western margin records a least depth of 3.7 metres.

The western section encloses a lagoon with depths to 29 metres.

Feature	Chinese
Sabina Shoal	Xianbin Jiao (Hsien-pin Chiao)

(ix) Boxall Reef

This reef lies 18nm southwest from Sabina Shoal at 9°36'N, 116°10'E. The Chinese name translates to Oxcart Wheel Reef and this drying circular coral reef covers an area of 2.7km². There is no lagoon on Boxall Reef nor any rocks visible at high water.

Feature	Chinese
Boxall Reef	Niuchelun Jiao (Nieu-ch'e-lun Chiao)

(x) Second Thomas Shoal

This shoal is shaped like a carrot aligned north–south with an area of 60km². It lies 19nm west from Boxall Reef at 9°43'N, 115°50'E. The shoal measures 9nm along its main axis and has a maximum width near the northern tip of 3nm. A reef 1,300 metres wide dries in patches and encloses a lagoon with depths to 27 metres. While the eastern side of the reef is broken no entrances are reported into the lagoon which has many coral heads. At low-water large rocks are visible at the southern end of the reef.

Feature	Chinese	Vietnamese
Second Thomas Shoal	Ren'ai Ansha (Jen-ai An-sha)	bai Co May

(xi) Mischief Reef

Mischief Reef lies 50nm east of Union Banks and Reefs at 9° 55'N, 115°32'E. The reef is roughly circular measuring 3nm from north to south and 4.2nm from east to west. The reef is awash and dries in patches to 0.6 metres; along the north and northeast segments it is about 0.4nm wide whereas elsewhere the width is not more than 0.2nm. There are three entrances into the lagoon in 1.6nm of the southwest section of the reef. They are all narrow and the most westerly and easterly passages, with least depths of 26 and 9.1 metres respectively, are only suitable for boats. The westernmost passage is the deepest of the three but its inner end is almost closed by a coral ridge; the eastern entrance is only 18.3 metres wide. The central passage has a least depth of 18 metres and a navigable width of 37 metres. It leads to a lagoon with depths varying from 18.3 to 29.2 metres. The bottom is sand and coral and the southwest half of the lagoon lacks the coral heads that encumber the northeast half, some of which uncover to 0.3 metres.

Feature	Chinese	Vietnamese
Mischief Reef	Meiji Jiao (Mei-chi Chiao)	da Vanh Khan

(xii) Alicia Annie Reef

Shaped like an axehead aligned north–south this reef lies 29nm south from Mischief Reef at 9° 22'N, 115°27'E. The unbroken reef and lagoon have an area of 14km². There are conflicting reports on whether the lagoon is deep or shallow. All the reef dries to at least 0.3 metres but the north and south ends stand well above that level. There is a sand or coral cay at the north end that stands 1.2 metres above high water. At the southeast corner some large rocks are just visible at high water.

Feature	Chinese	Filipino	Vietnamese
Alicia Annie Reef	Xian'e Jiao (Hsien-o Chiao)	Arellano	da Suoi Ngoc

(xiii) First Thomas Shoal

This shoal lies 27nm east from Alicia Annie Reef at 9°20'N, 115°51E. This steep-to narrow shoal is aligned west–east and occupies an area of 11km². When the reef dries rocks standing one metre high help delineate a shallow linear lagoon.

Feature	Chinese	Vietnamese
First Thomas Shoal	Xinyi Jiao (Hsin-i Chiao)	bai Soui Nga

(xiv) Bombay Shoal

This circular steep-to shoal lies 57nm northeast from First Thomas Shoal at 9°27'N, 116°56'E. It has an area of 2.5km². Rocks on the reef dry to 0.6 metres defining a lagoon with a sandy bottom where depths reach 33 metres. The tidal amplitude is 1.2 metres.

Feature	Chinese
Bombay Shoal	Pengbo Ansha (P'eng-po An-sha)

(xv) Northeast Investigator Shoal

This submerged coral atoll lies 32nm southwest from Bombay Shoal at 9°10'N, 116°28'E. The feature has a surface area of 2km² and the reef dries to expose a lagoon that might be accessible to boats at high water. Some rocks might be visible at high water at the western end of the reef.

Feature	Chinese
Northeast Investigator Shoal	Haikou Jiao (Hai-k'ou Chiao)

(xvi) Royal Captain Shoal

This shoal lies 16nm southeast from Northeast Investigator Shoal at 9°2'N, 116°40'E. This feature is steep-to and rocks on the reef dry to 1.2 metres defining a lagoon with depths to 31 metres; it contains several coral heads. The total area of this feature is 8km².

Feature	Chinese
Royal Captain Shoal	Jianzhang Jiao (Chien-chang Chiao)

(xvii) Half Moon Shoal

This shoal, called Crescent Reef by Chinese cartographers, lies 25nm southwest from Royal Captain Shoal at 8°52'N, 116°16'E. Rectangular in shape the shoal measures 5.5nm along its main north–south axis and 4nm along the northern edge and 2nm along the southern limit. A steep-to reef varies in width from nearly 1nm in the northeast to 0.4nm around most of the perimeter. The reef is awash and one inclined rock on the east side stands one metre above high water. Parts of the reef dry exposing a lagoon with depths down to 27 metres. There is one break in the reef; a narrow channel in the northeast has a width of 182 metres and a depth of 12 metres. The tidal amplitude is 1.2 metres.

Feature	Chinese	Vietnamese
Half Moon Shoal	Banyue Jiao (Ban-yueh Chiao)	bai Trang Khuyet

3. Chronology of Hydrographic Surveys in the Spratly Islands 1815 to 1992

This chronology restricts itself to the principal survey work done by cartographers trained in what might be termed European surveying methods from the beginning of the 19th century.[2] It is known of course that maps were produced as a result of the voyages of Cheng Ho, but these interesting depictions were not really useful to the early European seaman bent on a safe passage to China.

Similarly many 17th and 18th century maps and charts delineated with comparative accuracy the coasts of Malaya, Cochin China, Hainan and China to the west and the Philippines east of the South China Sea. However these maps and charts tended to falter as they progressed into the central regions of the South China Sea.

For example, Herbert's *"Correct Chart of the China Sea - etc"* (Herbert, c.1758) published in about 1758 shows the Paracel Islands as a long group of islands and reefs extending from 13 to 17 degrees North. On the same chart Macclesfield Bank is somewhat incorrectly positioned, but clearly named as Macclesfield Bank. The present day Spratly Islands, or 'Dangerous Ground' appears as 'white space' an immediate warning to later generations of seaman that perhaps no surveys had been made in that area. On Herbert's chart two areas on the western edge of the Dangerous Ground are marked as shoals and one, with the notation *"Low Island and Reefs"*, appears to be on the same latitude as Thitu Island and Reefs.

In general terms the 18th century European navigator was not particularly well served for charts and accurate navigational information in most parts of the world. This problem applied more or less equally to naval or mercantile seamen. As a result several nations took positive action to form an official naval hydrographic establishment, beginning with France in 1720. The Lords Commissioners of the Admiralty in London decided in 1795 to appoint an official to be known as the 'Hydrographer of the Navy' who would take charge of most aspects of compiling and supplying charts and other hydrographic information to the Royal Navy.

The first Hydrographer of the Navy was Alexander Dalrymple FRS who occupied the Hydrographer's post between August 1795 and May 1808. Dalrymple had begun his career as a writer in the East India Company (EIC), and had subsequently become interested in finding safer, quicker routes to and from India to China. In 1759 Dalrymple made his first exploratory voyage into the South China Sea aboard *Cuddalore* which was intended, in part, to prove that ships bound for Canton could avoid the worst dangers of the South China Sea by proceeding through the Sulu and Celebes Seas. In some respects Dalrymple's first surveying voyage was less than a resounding success when the *Griffin* (one of several ships being guided into the Sulu Sea by *Cuddalore*) struck a reef and sank off Jolo on 20 January 1761.

Undeterred by this set-back Dalrymple made a survey of Palawan's west coast before returning to Madras in January 1762. Dalrymple's cartographic interests were recognised in 1779 with his appointment as the first official Hydrographer of EIC, an appointment he held until 1795 when, as mentioned above, he became Hydrographer of the Navy. During Alexander Dalrymple's period as Admiralty Hydrographer, few if any charts of the South China Sea were

[2] A summary of significant dates in the hydrography of the Spratly Islands is provided in Appendix I.

published by the Admiralty although Dalrymple's own charts of the area, compiled before 1795, were available to navigators of all nationalities.

Captain James Horsburgh succeeded Dalrymple as Hydrographer of EIC in 1795. Like Dalrymple, Horsburgh was deeply interested in publishing charts, sailing directions and making efforts to ensure that commanders of EIC ships were aware of all possible dangers that might be encountered during their voyages. The expansion and increasing importance of the China trade, combined with the losses of ships on EIC voyages prompted Horsburgh to assign Captain Daniel Ross, assisted by Lieutenant P. Maugham to survey duty in the South China Sea on the coast of China (1807) the Paracel Islands (1808) Cochin China (1809) and the produced coast of Palawan (1810). Although there were many charts published as a result of February Ross's surveys one, which concerns the present subject, was entitled, *"(South) China Sea - Sheet 1 and 2"* (Horsburgh, 1821), published by Horsburgh in 1821 and 1823. Sheet 1 of this chart (1821) was the first reasonably accurate delineation of the area already known to seamen as The Dangerous Ground. On the 1859 edition of this chart Spratly Island was referred to as Storm Island, although whether this name is one ascribed by Ross himself or by Horsburgh is not known.

When the October 1821 *"South China Sea"* chart was published, Captain Horsburgh had already produced in 1811 his two volumes of sailing directions entitled *"The India Directory or Directions for Sailing to and from the East Indies, China Australia and the Interadjacent ports of Africa and South America."* This book, which rapidly became known as *"Horsburgh's Directory"* or *"The India Directory"*, was produced in a total of eight editions between 1811 and 1864 before being effectively superseded by Findlay's *"Directory for the Navigation of the Indian Archipelago and the coast of China from the Straits of Malacca and Sunda, and the passages east of Java, to Canton, Shanghai, the Yellow Sea and Korea."*

The foundation of a hydrographic establishment at the Admiralty did not reduce the EIC's surveying operations which were, if anything, increased by Horsburgh, who as EIC Hydrographer despatched both cruisers and survey vessels of the EIC's Bombay Marine on surveys into various parts of Asia, including the South China Sea as related above. Charts derived from these surveys were published *"according to Act of Parliament by J. Horsburgh."* However that Act of Parliament did not appear to provide any form of copyright protection to the EIC whose surveys were reproduced by a number of European cartographic publishers.

Amongst these chart publishers a number of English firms predominate, changing their name and style as individual and/or family interests were sold or merged together. In addition to William Herbert mentioned above, the lineal progression of these private London chart publishers was:

- Thomas Jeffery
- Robert Sayer and Bennett c. 1770
- David Steele
- Robert Laurie c. 1790
- Laurie and Whittle c. 1797-98

Steele, for example, was quick to produce *"Steele's new Chart of the coast of China from St. John's Island to Pedra Branca, showing the entrances and course of the River Tigris (sic) to Canton"* on 1 October 1810, a chart based in part on work ordered by Horsburgh. Similarly

by 1815 the *"New Seaman's Calendar"* was advertising five charts of the (South) China Sea, including a version of the Horsburgh/Ross two sheet chart (South) China Sea, that was sold under the title *"Chinese Seas after Horsburgh."* As there was some degree of embellishment or improvement in many of these privately produced charts their accuracy was questionable.

By the time Horsburgh's chart China Sea was produced in 1821-23 the Royal Navy's second Hydrographer, Captain Thomas Hurd, had completed a review of his establishment, and its progress in improving navigational information. Writing in his official Hydrographer's Report of 7 May 1814, he stated:

> *"The return of Peace to this Country makes me consider it as an official duty to represent to the Lords Commissioners of the Admiralty the great deficiency of our Nautical knowledge in almost every part of the World...Nearly the whole of China and Eastern Seas included between Kamchatka and Van Diemen's Lands, together with the Philippines and Islands on the western coast of Sumatra are unknown to us..."*
>
> (Hydrographer's Report, 1814 quoted by Day, 1967: 27).

Dalrymple's period as Hydrographer had been characterised by great industry, with a minuscule staff, in obtaining vast amounts of information. However distribution of that information in the form of charts was not a hall-mark of Dalrymple's Admiralty hydrographic stewardship, hampered as he was by lengthy periods of warfare, and his own management of the Hydrographic Office. In addition to the miserly spending authorised by the Lords Commissioner of the Admiralty, Dalrymple was to some extent competing with the private chart publishers, work produced by French hydrographers and charts being privately published for Royal Navy officers.

Captain Hurd's comments that the *"whole of China and the Eastern Seas...are unknown to us"* should be interpreted within the context of his position as Hydrographer of the Navy. With the exception of work being undertaken at the direction of EIC there were few charts of the South China Sea that even remotely complied to standards that the Royal Navy's own small corps of surveying officers had shown they were capable of producing. An Admiralty publication *"Sea Surveys"* stated:

> *"During Dalrymple's tenure of office there was no organised surveying as it is now understood, and it will perhaps have been noted that the Board Minute of August 12, 1795, contained no instructions regarding the prosecution of surveys, whether at home or abroad. But Captain Cook had already shown the way, and by his accuracy and attention to detail had for all time set an ideal which it has been the ambition of later generations to live up to. Cook was a remarkable man in every way, and his example inspired others, among them Captain Matthew Flinders, in the Reliance, who may be said to have been the first naval surveyor employed abroad under the auspices of the Hydrographic Office. This does not imply that there was no hydrographic surveying done at all during this time; on the contrary, a great deal of work was being carried out by navigators the world over, La Pérouse, Malaspina, D'Entrecasteaux, Beautemps Beaupré, Baron Humboldt and Lisiansky being perhaps the best known and most able. The importance of the surveys in the Far East executed by Captain James Horsburgh in 1796-1812 cannot be exaggerated, nor should the work of Commander W.R. Broughton on the coasts of China and Japan be overlooked"*
>
> (Edgell, 1965: 4-5).

Planning for surveys allocating ships and commencing examinations of the South China Sea's central regions was instigated towards the end of Captain (later Rear Admiral Sir) Francis Beaufort's tenure as Hydrographer of the Navy, which spanned 1829 to 1855. From 1843 HMS *Samarang* under command of Captain (later Admiral Sir) Edward Belcher made numerous surveys on the Borneo and Philippine coasts, delineating much of the southern and eastern area of the Dangerous Ground until *Samarang* returned to England in 1847. Belcher was followed by Commander Bate in HMS *Royalist*, which worked principally in the Palawan Passage area between 1848 and 1853. Bate's chart of Palawan published on 3 November 1856 was one of the oldest charts still being produced by the Admiralty in 1975.

When the post of Hydrographer was held by Captain (later Rear Admiral) John Washington between 1855 and 1863 surveys in the South China Sea and the Dangerous Ground continued, with the ships *Royalist* and *Saracen*. After surveying Pratas Reef, with the intention of locating a suitable position for building a lighthouse, *Saracen* was sent south to Bangka Strait. In 1862, Staff Commander Reed, HMS *Rifleman*, commenced a detailed survey of the Dangerous Ground, an operation that the Royal Navy's first hydrographic historian described as *"...clearing the highways to the north from Singapore of the China Sea"* (Dawson, 1885: 140). During 1863 Commander J. Ward succeeded Reed in command of *Rifleman*, surveyed Vanguard, Prince of Wales, Alexander and Granger Banks, and disproved the existence of several previously reported dangers. Commander Reed returned to *Rifleman* in 1866, to continue examinations of the north-western regions of Palawan Passage.

Commander Reed's 1867-68 survey took him into the Spanish waters off Palawan, where he cooperated with Captain Claudio Montero of the Spanish Navy who was engaged in similar survey work. Captain Montero made a practice of exchanging copies of his surveys with Reed, and in due course Montero's work found its way into additions and corrections to British Admiralty charts. In 1869, after completing a large survey of Balabac Strait the *Rifleman* was condemned as unfit for further service and sold. The name of this ship is perpetuated in the naming of Rifleman Bank, and that of her commander in Reed Bank. Reed's second-in-command of *Rifleman*, Lieutenant Thomas Tizard (who also commanded HMS *Saracen* between 1864 and 1867) is recognised in the naming of Tizard Bank. Commander Reed also compiled the first volume of the Admiralty Sailing Directions for the passage from Singapore to Hong Kong.

Commenting in 1869 upon the of charting of the South China Sea a geographer (Findlay, 1869: v) wrote:

> *"Palawan, and some of the islands North of Borneo, were elaborately surveyed and profusely described by Captain Bate. The western coasts of the Philippine Islands have been generally laid down from the surveys of various Spanish officers.*
>
> *The China Sea is perhaps the locality where hydrography has made the greatest changes of late years. Up to 1862 the charts of this great highway exhibited a labyrinth of detached shoals, scattered about without order or connection, laid down from the isolated observations of zealous officers of the East India service, many of which are now difficult of recognition, from the vague manner of their announcement. The increasing importance of the China commerce, and the advance in the sailing powers of the ships employed in it, caused this great sea to be much more frequented*

> *than in former years. Since the year above named, Commander Reed, with a moderate staff, in HMS Rifleman, examined the outer line of dangerous shoals limiting the two great channels, which are separated by a vast range of dangerous coral reefs and shoals, the 'Archipelago of Reefs', leaving the clear Main Channel to the NW, and the Palawan Channel to the SE of them, perfectly free from danger for vessels beating up or down the China Sea by either passage in the opposite monsoons".*

Findlay himself, as geographer to Richard Holmes Laurie, had compiled a series of twelve charts under the general title *"The Indian and Pacific Oceans"* covering the area from Cape of Good Hope to Cape Horn, several sheets including all or portions of the South China Sea. That private cartographers were apparently able to compete with the Admiralty Hydrographer's products indicates that the Admiralty had not pursued its commercial sales particularly vigorously and that many merchant seamen still preferred the commercial charts. The 1869 Admiralty Catalogue of Charts Plans, Views and Sailing Directions in Section XIII (Indian Archipelago, China Sea and Japan) lists over thirty six coastal charts around the circumference of South China Sea. The four sheet series China Sea that are still in use today had only recently been published as:

2660 a China Sea, Southern Portion, Singapore to Calamian
2660 b 1868, and;
2661 a China Sea, Northern Portion, Cam-ranh Bay to Formosa Strait
2661 b 1867.

Admiralty surveys in the South China Sea moved away from the Dangerous Ground for several years after 1868 concentrating more on the coasts of China. Between 1881 and 1883 HMS *Magpie,* under the command of Foley Vereker was engaged in surveying southern areas in the course of a general re-examination of Borneo's offshore northern coasts.

It was not until October 1888 that the Admiralty published the first detailed chart of some principal reefs in the Dangerous Ground. That chart's title was:

BA 1201 - *"Reefs in the China Sea"*

and it contained plans of:

- Loai Tu Island and Reefs
- North Danger
- Thi Tu Island and Reefs and Subi Reef
- Tizard Bank and Reefs.

BA 1201 was derived from the 1867-68 surveys by Reed, Tizard, Lys and others in HMS *Rifleman* referred to earlier in this chronology. *"Reefs in the China Sea"* was to remain substantially unaltered for many years and today, 1995, it is still a current chart in the Admiralty catalogue with a plan of Spratly Island added as a result of surveys in 1951. Basically BA chart 1201 represents the *"beginning and the end"* of the Admiralty's publicly available detail charts of features in the Dangerous Ground. As will be explained survey ships of the Royal Navy worked in the Dangerous Ground after 1867-68, but most of their more detailed surveys were not made available to the general public.

Although not specifically relevant to the Dangerous Ground as such the German naval ships SMS *Freya* and *Iltis* made a survey of the Paracel Islands between 1881 and 1883, from which the Admiralitat in Berlin produced a two sheet chart entitled "*Die Paracel Inseln*". This chart was much more detailed than the 1808 surveys made by Captain Ross of the Bombay Marine, and was quickly reproduced by the British Admiralty in June 1885 as chart BA 94 "*Paracel Islands*".

The French hydrographic authorities were equally quick to use this survey, reproducing the German work as their chart 4101 "*Les Paracels*". This exchange and reproduction of surveys and charts originated by one country has characterised some aspects of charting and hydrography in the South China Sea. It may also be a possible reason why some inconsistencies appear to perpetuate themselves from chart to chart produced by different countries.

The British surveying ships *Rambler* and *Flying Fish* operated on the fringes of the Dangerous Ground from 1885 to 1890 with *Rambler* making a detailed resurvey of Pratas Reef in 1889.

The first decade of the 20th century did not see any particularly special British Admiralty efforts to make new surveys in the Dangerous Ground, although survey work continued on the Borneo and China coasts. One survey ship, HMS *Merlin* under the command of Commander Walter, was engaged on Gordon Patch off Labuan and recovered hydrocarbon gas samples from a depth of 62 fathoms. This discovery prompted further surveys and laid the foundation for the subsequent large scale petroleum-related hydrographic and seismic work off Brunei, Sabah and Sarawak. Between 1909 and 1914 the *Merlin* was employed surveying the offshore banks and shoals that lie north of Borneo, approaching the southern boundary of the Dangerous Ground. Many of the areas examined have subsequently become major oil and gas producing areas of considerable economic and political importance. Large scale surveys of the South China Sea were effectively terminated by the outbreak of the First World War, and in 1914 HMS *Merlin* proceeded to Hong Kong to be paid-off, releasing her surveying staff for more urgent hydrographic work in the North Sea.

This thumbnail sketch of the first century of modern hydrographic surveys in the Dangerous Ground since February Hurd's 1814 report may give the impression that survey work in the South China Sea was largely performed by the British Admiralty. In fact there were other nations involved in various survey activities, particularly by the French Marine's *Service Hydrographique et Oceanographique de la Marine* (SHOM) on the coast of Indo-China and by Spanish and US hydrographers on the western coast of the Philippines. However these countries did not actively venture into the area now referred to as the Spratly Islands. Thus it happened that the Royal Navy's hydrographic surveyors, with somewhat wider ranging instructions than many of their contemporaries made the first detailed examinations of The Dangerous Ground.

After the First World War Admiralty survey ships returned to the South China Sea in 1921 for both general and special surveying duties, some of the latter being concerned with the Dangerous Ground. In the 1923 survey season HMS *Iroquois* began work off Miri, Sarawak, as part of oil export activity developing in that area. *Iroquois* was to remain in the South China Sea some years, and during 1925, under Commander A.L. Jackson, the vessel was engaged in secret surveys of North Danger Reef, where Commanders Fryer and Day were making an examination of the atoll for fleet anchorage purposes. (Day, 1972: 62 and 68). During 1927

when HMS *Herald* was engaged in surveys of South Luconia Shoal the *Iroquois* made further surveys around the Dangerous Ground, and in 1928 she was working in the Paracel Islands.

In 1931 *Herald* and *Iroquois*, assisted by HMS *Bridgewater* and the Royal Air Force, made an extensive survey of the north-eastern area of the Dangerous Ground, under secret orders including the only modern survey of Union Bank and Reefs. These surveys were made to investigate probable areas for seaplane operations in time of war. The 1931 program was continued in 1932 by *Herald* which made surveys at Scarborough Reef, Royal Captain Shoal and Half Moon Reef. Clandestine surveys continued in 1933 when Jackson Reef, Mischief Reef and areas on the north-western side of Palawan Passage were surveyed. Despite the survey activity described above the Admiralty did not release any new charts of the area, and it was the US Hydrographic Office which published the *Herald's* surveys of Jackson Atoll and Mischief Reef in HO 5658 in October 1950, as a Confidential or Green chart. USHO chart 5658 was republished in a 2nd Edition on 16 March 1980 under the same title, as DMA chart 93042 without any restriction on its availability. In February and March 1935 the US Navy ships *Pigeon*, *Heron* and *Bittern* surveyed Pigeon Passage.

During 1936 and 1937 there was a considerable increase in hydrographic investigations in the Dangerous Ground, as an Admiralty survey ship, a US Navy salvage vessel, USS *Pigeon*, and Imperial Japanese Navy (IJN) survey teams carried out a variety of investigations in the region. The Japanese Navy's Hydrographer had published a number of general charts that included the Dangerous Ground, but Japan's 1936-37 operations were intended to survey North Danger Reef (1936) and Tizard Bank (1936-37) for fleet anchorage and military purposes. In 1936 the IJN's Hydrographer issued substantially revised versions of IJN-HO 810 *"South China Sea"* and IJN-HO 1675 *"Northern Approaches to Philippine Islands"*, following these general charts with four completely new charts:

- IJN-HO 521-3 Hakuken Syo (North Danger) on a scale of 1:30,000
- IJN-HO 522 Nakashima Fukin (Itu Aba) on a scale of 1:30,000
- IJN-HO 523-2 Tizato Tai (Tizard Bank) on a scale of 1:75,000
- IJN-HO 524 Shinnan Gunto on a scale of 1:750,000.

These Japanese charts were published in 1938, but did not become available to non-Japanese military users until after the Second World War. The US Navy's Hydrographic Office republished IJN HO 521 and 523 in October 1950 under HO numbers 5658 North Danger and 5657 Tizard Bank. The ROC-Taiwan Naval Hydrographer also republished IJN-HO 523-2 under ROC No. 478 *"T'ai-Ping Tao and Cheng-Ho Chun-Chiao"* in 1953.

Japanese hydrographers made 'sketch' surveys during 1936 - 1937 of various reefs in Shinnan Gunto, published as IJN-HO 525, that included:

- Irving Reef
- Jackson Atoll
- Loai Ta and Menzies Reef
- Mischief Reef
- Nanshan Island
- Investigator Shoal
- Southampton Reefs

- Trident and Lys Shoals
- Union Bank, including Sin Cowe Island.

Like the charts of North Danger and Tizard Bank these sketch surveys were not readily available until July 1951 when the US Hydrographic Office published them as Chart HO 5657 *"Plans in the Dangerous Ground - South China Sea"*. These same plans, less the plan of Spratly Island were re-published in December 1956 by ROC-Taiwan in chart 477-A *"Plans in Nan-Sha Chun-Tao"*.

Also in 1937 the US Navy salvage ship *Pigeon* (ASR-6) conducted a further hydrographic survey in the Dangerous Ground. *Pigeon* verified a 10-mile wide channel clear of dangers, originally surveyed in 1935, and made both southeast to northwest and northwest to southeast transits of the Dangerous Ground direct from Fiery Cross Reef to Half Moon Shoal. Generally referred to as *"Pigeon Passage"* this track enabled a prudent navigator to make night passages through the Dangerous Ground with some degree of safety prior to the advent of satellite navigation systems. For salvage and naval purposes Pigeon Passage provided a convenient east to west short cut through the middle of the Dangerous Ground. For reasons that are not entirely clear Tennent Reef is generally referred to as Pigeon Reef in US Sailing Directions. Presumably, based on navigational experience in Pigeon Passage, USS *Pigeon* used Tennent Reef as a navigational check on the southern boundary of Pigeon Passage.

HO Publication 93 *"Sailing Directions for the Western Shores of the South China Sea"* included directions for Pigeon Passage in its 4th, 5th and 6th Editions. The current American sailing directions eschews any mention of Pigeon Passage stating:

> *"Little advantage can be had in deviating from the recommended routes in the South China Sea to cross this [Dangerous Ground] area in view of the extensive dangers to be encountered. Due to conflicting data and accuracy of the various partial surveys of Dangerous Ground, certain shoals and reefs may appear on one chart but not on another regardless of the scales involved. Charted depths and their locations may present considerable error in the lesser known regions of this area. Avoidance of Dangerous Ground is the mariner's only guarantee of safety."*
>
> (US Defense Mapping Agency PUB 161, 1994: 11-12).

On balance this is probably sound advice for those who have no pressing commercial or military reason for making transits through the Dangerous Ground.

Whilst IJN hydrographers made their surveys on the major and lesser reefs in 1936-1937, and USS *Pigeon* went her way through the Dangerous Ground, making a number of sketch surveys, HMS *Herald* resumed her 1934 survey program. British surveyors connected their work with US Coast and Geodetic surveyors of Palawan and frameworks for several new small scale charts of the area were established. *Herald* returned to survey work at Mischief Reef again in 1938, and continued with examinations and recharting reefs off the Borneo coast close to the Dangerous Ground.

Royal Navy survey work in the South China Sea ceased on the outbreak of war in Europe in 1939, with surveying officers attached to *Herald* and *Bridgewater* being dispersed or assigned to local operational duties. Apart from whatever the Japanese Navy may have done to improve

their own charts of the Dangerous Ground, no further British or US Navy hydrographic operations were conducted in the area until the Pacific War finished in 1945.

As no major military campaigns were conducted in the Dangerous Ground itself there was no requirement for new surveys, particularly as the Royal Navy had not been idle in the area in years preceding 1939. The Admiralty's Hydrographer issued three confidential or 'F-series' charts which included some data obtained during various survey operations in the Dangerous Ground, in addition to information already published on BA chart 1201. It was, in part, information from BA chart F.6064 that was incorporated in USHO chart 5658 *"Plans in the South China Sea"* when that chart was published in October 1950, to include the Admiralty surveys of Jackson Atoll and Mischief Reef.

The first new general chart of an area of the South China Sea published after the Second World War was the French SHOM 5691 *"Annam et Cochin*", released in September 1945. Produced on a 1:909,000 scale SHOM 5691 covered an area from Latitude 7-30 to 15-30 North, and extended slightly eastward of Longitude 112-15 East, thus incorporating Spratly Island, and its adjacent reefs and banks on a medium scale chart. Although providing only slightly more detail of reefs than was available on BA 2660A (Scale 1:1,550,000), the new SHOM chart gave navigators sailing from any port between Qui Nhon and Saigon a single sheet chart on which to plot a course to or from Spratly Island. It is not known whether this was a reason for the choice of scale and layout that governed production of SHOM 5691, but it is a noticeable feature of that chart.

By 1946 fair copies of IJN's Dangerous Ground plans had passed into US and Chinese hands, although, as related above, it was not until October 1950 that the US Hydrographic Office finally published this Japanese material. The Admiralty published no Japanese material concerning the reefs and shoals in Dangerous Ground, leaving BA 1201 *"Reefs in the China Sea"* as its only publicly available chart of features in the region. The first Royal Navy survey vessel assigned to routine hydrographic duties in South China Sea, HMS *Sharpshooter* had arrived off Borneo in 1946, where that ship conducted hydrographic operations in the approaches to Brunei, related to general charting improvements in Northwest Borneo.

In 1948 a newly commissioned Admiralty survey ship, HMS *Dampier*, arrived in the South China Sea, to commence hydrographic work off Bintulu in Northwest Borneo. *Dampier* remained in the South China Sea for several years, improving or making new surveys off Borneo, and running extensive lines of soundings in the area. In 1951 *Dampier*, under Commander R.H. Connell, examined Spratly Island, which was surveyed by Lieutenants D.W.S. Collins and D.N. Price, to produce a small plan of the island. That plan, the first published Admiralty survey of Spratly Island, appeared on a 1:25,000 scale incorporated on a new version of chart BA 1201 *"Reefs in the China Sea"*. Thus, over 100 years after its discovery, Spratly Island actually appeared as a small plan on a publicly available chart. Despite the importance that now attaches to Spratly Island the Admiralty, in their wisdom, did not see fit to designate the modified BA 1201, published on 30 January 1953, as a new edition. Instead the addition of Spratly Island to this chart was merely accorded a notation *"Large Corrections"*. Spratly Island had been accurately surveyed in 1864 by *Rifleman* under Commander John Ward, but the 4 inch to 1 mile 'fair chart' was not published by the Hydrographer.

Similarly the US Navy in their postwar chart HO 5657, *"Plans in the Dangerous Ground - South China Sea*", published in July 1951, included a plan of Spratly Island on a scale of 1:15,000. Many of the plans published in HO 5657 were derived directly from Japanese surveys of 1937. Subsequently most of these plans (excluding Spratly Island) were reproduced on ROC-Taiwan chart 477A, *"Plans in Nan-Sha Ch'un-Tao"*, published in December 1956. ROC-Taiwan chart 477A contains a total of nine plans, and the only readily apparent difference between USHO 5657 which has ten plans and ROC-T 477A is that the US chart has a plan of Spratly Island. Although US Hydrographic Office published a plan of Spratly Island on chart HO 5657 this chart was superseded in 1974 and at present the US Navy does not publish a detailed chart or plan of Spratly Island. The Royal Navy published no further detailed plans or charts of areas within the Dangerous Ground after revising BA 1201 in January 1953.

Following the re-establishment of ROC-Taiwan's Navy Hydrographic Service at Kaohsiung, their Hydrographer produced the first publicly available medium scale, single sheet chart of the Dangerous Ground. That chart, ROC-T No. 476, entitled *"Nan-Sha Chun-Tao"* was published in October 1953 and used a number of Japanese and Taiwanese surveys as sources. The 1:750,000 scale of ROC-T No. 476 made it useful for navigation inside the Dangerous Ground, provided due care was taken not to place absolute reliance on the veracity of any positions of banks and reefs in the middle of Dangerous Ground. As this caveat applied to all BA, Japanese and US charts then available, this did not constitute a particular hardship when using the better scale ROC chart.

In April 1954 the ROC-Taiwan Navy Hydrographer printed chart ROC-T 477 entitled *"Islets of the Nan-Sha Ch'un-Tao"* which incorporated data drawn from various sources to 1938 to reproduce plans of:

- Chung-Yeh Ch'un-Chiao (Thitu Island)
- Shuang-Tzu Chiao (North Danger)
- Tao-Ming Ch'un Chiao (Loaita Island)

The arrangement of plans and appearance of the chart is very similar, if not identical to the 4th (1944) edition of USHO chart 2786 *"Reefs in the South China Sea"*. However scales used on ROC plans, being 1:111,600 are different to USHO scales of 1:117,840. Similarly ROC-Taiwan 477's scale of 1:111,600 for North Danger differs from BA 1201's Loaita and North Danger at 1:111,400 although the plan of Thitu Island is at exactly the same scale (1:111,600) as the plan appearing on BA 1201.
The ROC-Taiwan hydrographic authorities followed-up ROC-T 477 in 1956 with their chart No. 477A incorporating nine plans previously referred to and in addition to acknowledging that data is drawn *"... from a Japanese survey in 1938..."* contains the notice:

"CAUTION. Be prudent to use this abbreviated survey chart."

Reference has been made to the 1944 edition of USHO chart 5658 (1 October 1950) that reproduced the British surveys of Jackson Atoll and Mischief Reef. However some difficulty arises when attempting to reconcile the US Navy's post war charts of Tizard Bank. It appears that the US Navy had two charts of Tizard Bank in circulation for some time, one being the plan at a scale of 1:117,840 printed on USHO 2786, *"Reefs in the China Sea"*, and the other, USHO 5659 being solely a plan of *"Tizard Bank and Reefs"* at a scale of 1:75,000, published in its first edition in October 1950. The derivation information printed on HO 5659 states:

"*From a Japanese survey of 1936 and 1937, Authority-Japanese chart S-523.*"

Whilst it may be possible that the IJN fair chart obtained by US Navy in the aftermath of World War II was numbered S-523, JMSA's Tokyo archive copy of that chart bears the number 523-2.

The USHO chart catalogue for 1967 shows that HO 5659 is a plan of Tizard Bank, but HO 2786 relates to various other reefs, excluding Tizard Bank. However an examination of chart HO 2786 obtained in 1968 shows the chart to be little altered in content from its original 1911 form, although the plans have been re-arranged in rectangular blocks as they indeed were on the 4th (August 1944) edition of the chart. USHO 5659 is not even indicated as being available in the US 1970 catalogue, when chart distribution authority moved from US Naval Oceanographic Office to the Defense Mapping Agency (DMA). However USHO 5659 re-appears in later mid-1970 DMA chart catalogues as DMA No. 93043, with a first edition date given as October 1950, exactly as that chart is printed today.

As part of the changes that occurred to US Navy's chart distribution and numbering system in 1970, the previous USHO 4-digit series numbers were cancelled and replaced by a DMA 5-digit code. Thus US HO 2786 re-emerged from this exercise in a revised edition dated 21 September 1970 bearing number (DMA) 93061 *"Reefs in the South China Sea"*, with a catalogue notation of *"4th Edn/Aug 1944"*, still containing a plan of Tizard Bank and Reefs. The situation appears to be clarified in the 1994 edition of DMA's (Public Sale) Nautical Charts and Publications catalog which lists the two charts as:

- 93043 Tizard Bank
- 93061 Reefs in the South China Sea
  Plans (B) Thitu Island and Reefs and Subi Reef
  (C) Loaita Island and Reefs.

However purchasers of DMA 93061 should be aware that the chart, as sold over the counter, also contains plans of North Danger and Tizard Bank and Reefs both slightly defaced with a *"Cancelled"* stamp.

In August 1953 the Philippines Coast and Geodetic Survey published their chart (Phil) 4716 *"Palawan"* on a scale of 1:402,000 which contains some useful data concerning banks and reefs of the Dangerous Ground that adjoin Palawan Passage. This Philippines chart is also reproduced by US as DMA chart 92033 which is presently in a 5th Edn, dated 16 August 1986.

The (Japanese) Maritime Safety Board (now Japanese Maritime Safety Agency JMSA) published its chart (JMSA) 1801 *"South China Sea, Southern Portion, Eastern Sheet"* on 24 October 1959. This chart on a scale of 1:1,200,000 provides a better representation of the entire Dangerous Ground on a more convenient scale than the 1:1,550,000 used on BA 2660B, its near equivalent British chart. The next large scale general chart published was the Philippines PC and GS 4200 *"Philippines"*, 19 December 1960, on a scale of 1:1,575,000 which only shows some of the eastern area of the Dangerous Ground. PC and GS 4200 both in its December 1960 and December 1968 editions does not show any Philippine claims into the Dangerous Ground, although this matter is rectified on both the latest (February 1984) edition of PC and GS 4200 and the PC and GS Chart Catalogue of 1991. The JMSA chart 752

"Palawan", published 5 August 1968 on a scale of 1:750,000 provides a better coverage of the Dangerous Ground's eastern edges than its DMA counterpart, DMA 92033.

The US Hydrographic Office improved its general chart coverage of the Dangerous Ground with the publication of a second edition of HO 5501 *"South China Sea - South Western Portion"* in May 1966 on a scale of 1:971,600, and the first edition of a new chart HO 5498 *"Mui Bai Bung to Mui Da Nang"* on a scale of 1:1,071,000 in July 1967.

Both these charts are available as DMA 71027 and DMA 93030 respectively in 1994, somewhat defaced with Omega navigation graticules. As both charts are bathymetric they provide a very good representation of bottom contours in the Dangerous Ground.

ROC-Taiwan produced a new chart ROC-0474 *"South China Sea -Southern Portion, Eastern Sheet"* on 31 October 1974, based upon JMSA chart 1801, using the same scale of 1:1,200,000. This ascribes Chinese (Wade Giles) names to all features in the Dangerous Ground (Nan-Sha Chun-Tao) and is a very useful chart for this reason, apart from its navigational value.

The People's Republic of China published its chart No. 9203 *"Southern Portion of Nanhai"* on 1 August 1976, adopting a scale of 1:2,000,000 which takes in the entire Nansha Qundao region as the chart covers the area between the equator and 14° North.

On 10 June 1980 the Russian Hydrographic Office, GONIO, published chart No. 66480 *"Tizard Bank and Reefs"* on a scale of 1:75,000. This chart is very similar in appearance to the IJN-HO chart 523-2, and represents another example of borrowing hydrographic information from earlier sources.

In June 1982 the US DMA published a series of four charts, on a scale of 1:250,000 covering almost the entire Dangerous Ground area under the following numbers and titles:

- 93044 Yongshu Jiao to Yongdeng Ansha
- 93045 Heng Jiao to Haima Tan (Routh Shoal)
- 93046 Mantangule Island to Eran Bay
- 93047 Yongshu Jiao to Po-Lang Chiao.

An adjoining chart, DMA 93048 *"Duhu Ansha (North Viper Shoal) to Kimanis Bay"*, published in November 1982, connects chart 93046 to the northern Borneo coastline.

One unusual feature of chart DMA 93047, the south-western sheet of the four, is that its western boundary is established at Longitude 111° 55' East, thus **excluding** Spratly Island, Ladd Reef and Rifleman Bank from the coverage provided by these four charts.

The five DMA charts are derived from various acknowledged sources, including ROC-Taiwan charts 474, 476, 477, 477A, 478 Philippine charts 4716 and 4720 together with *"Miscellaneous Data"*, and each contains a notice unusual for US charts that states:

> *"This chart is based in whole or in part on information from other than official US Government sources as indicated. Copyright restrictions of the country of origin continue to exist."*

When BA 967 *"Palawan"* was re-issued on 15 November 1985 as a much-improved version of previous 25 August 1924 edition it contained a number of interesting remarks under the heading *"Source Data"* including:

> *"g. DANGEROUS GROUND.*
> *Admiralty, United States and Japanese reconnaissance surveys prior to 1940. See Caution."*

The caution notice, printed in large magenta letters in the title block of BA 967 states:

> *"DANGEROUS GROUND*
> *The large area north-westward of the recommended track [through Palawan Passage] is known to abound with dangers. No systematic surveys have been carried out and the existence of uncharted patches of coral and shoals is likely; the positions of the charted banks and shoals cannot be relied upon. Vessels are warned not to attempt to pass through this area; see Admiralty Sailing Directions."* (BA 967, November 1985).

ROC-Taiwan's chart No. 0476 *"Nan-Sha Ch'un-Tao"* was re-issued as a revised, colour-tinted 2nd edition on 30 April 1988, retaining its previous 1:750,000 scale. This new, and current, edition of ROC-Taiwan No. 0476 is a considerable improvement on its predecessor, and lists a number of sources of hydrographic data including:

- 1st (1953) Edn of chart 0476.
- Various surveys prior to 1971.
- JMSA chart No. 752 (Palawan) 1968 edition.
- JMSA chart No. 567 (Labuan to Sampanmangio Point) 1981 edition.
- JMSA chart No. 1502 (South China Sea, Southern Portion -Western Sheet) 1975 edition.

Also, on 30 April 1988, the 2nd edition of ROC chart 0478 *"T'ai-Ping Tao and Cheng-Ho Chun Chiao"* was issued as a coloured chart. Originally published in October 1953 as an almost direct reproduction of IJN-HO chart No. 523-2 *"Tizato Tai"*, the new ROC-Taiwan 0478 maintained the original scale of 1:75,000 in exactly the same way as US DMA chart 93043 retains the original Japanese scale and metric soundings.

Malaysian chart MAL 781 *"Terumbu Semarang Barat Kechil to Terumbu Peninjau"* [Semarang Bank to Investigator Reef] was published 30 October 1988 on a scale of 1:300,000. This chart, includes:

- Ardasier Reef and Bank (Terumbu/Permatang Ubi)
- Barque Canada Reef (Terumbu Perahu)
- Dallas Reef (Terumbu Laya)
- Erica Reef (Terumbu Siput)
- Investigator Reef (Terumbu Peninjau)
- Louisa Reef (Terumbu Semarang Barat Kechil)
- Mariveles Reef (Terumbu Mantanani)
- Royal Charlotte Reef (Terumbu Semarang Barat Besar)
- Swallow Reef (Pulau Layang Layang)

Previously Swallow Reef was a 'reef', but the Malaysian chart adopts the term 'Pulau' (island) in describing Layang Layang. Chart MAL 781 is derived from a variety of survey data, including hydrographic work around Mariveles, Dallas and Swallow Reefs by the Royal Malaysian Navy's large oceanographic and hydrographic survey ship KD *Mutiara* (A152) during 1987. Chart MAL 781 also includes a warning that reads:

> *"CAUTION*
> *Certain areas within this chart as indicated by the scarcity of sounding have not been systematically surveyed especially around Permatang Ubi (Ardasier Bank) Terumbu Laya (Dallas Reef) Terumbu Perahu (Barque Canada Reef) and Terumbu Peninjau (Investigator Reef). Existence of uncharted rocks and corals very likely. Vessels are warned not to attempt to enter inside any lagoons."*

Malaysia published chart MAL-6 *"Sabah-Sarawak"* on 1 October 1991 to a scale 1:1,250,000. This chart has relatively good coverage of southern areas of Dangerous Ground (Kawasan Bahaya) extending from Vanguard Bank in the west to Commodore Reef (Terumbu Laksamana) in the east. The chart's northern boundary of Latitude 8° 50' North is sufficient to enable Spratly Island (Pulau Spratly) and Ladd Reef to be shown on the chart. Chart MAL-6 also contains a cautionary note about the dangers of navigating in the Dangerous Ground.

In concluding this brief chronology of hydrographic surveying in the Dangerous Ground it must be remembered that most, if not all of the original surveys were based on astronomical observations, made from comparatively small vessels or from atolls and cays themselves. For this reason it is not surprising that numerous marine casualties have occurred around the Dangerous Ground. Mariners, navigating from sextant observations obtained in leaden overcast northeast monsoon conditions, can easily make small mistakes in latitude and longitude that are sufficient to misplace their position up to 10 miles. Such errors, combined with probable small errors in the charted positions of many reefs in the area are sufficient to result in a marine casualty. Even use of modern satellite navigation/Global Positioning Systems aboard ships cannot make up for errors in positions of reefs that were originally laid down on charts without the benefit of satellite navigational devices.

Most charts of the Dangerous Ground which present day seamen and geographers refer to were laid down under conditions described below:

> *"In 1888 Commander W.U.Moore was instructed by Wharton [Admiralty Hydrographer] to take his ship Rambler to examine Tizard Bank.*
>
> *Tizard Bank has a few sand cays above water around its perimeter, whilst the encircling rim of Macclesfield bank, 300 miles to the north, has no depths less than ten fathoms. Both have lagoons within the reefs and their outer walls fall steeply away to great depths.*
>
> *The ship being anchored at various points on the shallow perimeter formed a base for the steam cutter, Using masthead angles, she ran sounding profiles from the deep water in over the ridge past the ship to the lagoon; meanwhile the second steam cutter made dredgings along this profile. The surgeon, P.W. Basset-Smith, who had an amateur interest in coral, was in the dredging boat collecting and preserving the*

specimens caught in the dredge and found enmeshed in swabs hauled along the seabed. On Tizard Bank decreasing quantities of live coral was found down to thirty-two fathoms on the outside slopes, which were thereafter composed of coral debris. In the lagoon sand was mostly to be found with occasional outcrops of coral down to forty-five fathoms where, surprisingly, live reef-building coral was discovered."

(Ritchie, 1967 364 - 365).[3]

[3] In October 1994, during a research visit to the Admiralty Hydrographic Agancy's archives at Taunton, David Hancox uncovered a wealth of survey material that has not reached the public domain including the 1860s and 1930s surveys, many of the latter marked *"Secret"* or *"Most Secret"*. This material also included surveys of some islands and reefs in the Spratlys made by Cmdr. Ward and Staff Cmdr. Reed in HMS *Rifleman*. This material will be described in some detail when further research by Hancox has been completed.

Appendix I: Significant Dates in the Hydrography of the Spratly Islands

1821-1823 Horsburgh's chart *"South China Sea"* published in two sheets. The southern sheet which covers the Dangerous Ground can also be found in later 1859 versions as *"South China Sea - Southern Part"*, and *"China Sea Sheet 1"*.

1840 Admiralty published chart BA 1270 *"The China Sea from Singapore to Canton to Manila"*, 20 May 1840.

1851 Surveys of Palawan Passage by Bate in *Royalist* commenced, and continued until 1855.

1856 Admiralty published chart BA 967 *"Palawan Island"*, 3 November 1856.

1862 Staff Commander Reed in *Rifleman* commences examination of Dangerous Ground, a task that continued until 1869, and defined the extent of the area. Reed's work on eastern boundary coordinated with Spanish Navy's hydrographers.

1867 Admiralty published charts BA 2660a and b *"China Sea - Southern portion, Singapore to Calamian"*.

1881 Charts BA 2660a and b re-issued as *"China Sea - Southern Portion"* on 1 November 1881.

1887 Admiralty publishes general chart BA 1263 *"South China Sea"* on 30 May 1887.

1888 Admiralty publishes chart BA 1201 *"Reefs in the China Sea"* on 23 October 1888, with plans North Danger, Loai Ta Island, Tizard Bank and Thi Tu Island and Reefs and Subi Reef.

1900 Hydrographic Department, IJN, publishes chart IJN 451 *"Reefs in the China Sea"* as a direct reproduction of BA 1201, on 29 May 1900.

1911 Hydrographic Office, US Navy, publishes chart No. 2786 *"Reefs in the China Sea"* reproduction of BA 1201 on November 1911.

1925 HMS *Iroquois* surveys North Danger Reef area. Hydrographic Department, IJN, publishes chart (IJN) 529A *"China Sea, Southern Portion, Eastern Sheet"* as a direct reproduction of the May 1925 New Edition of BA 2660A. This Japanese chart was published on 21 December 1925.

1931 HMS *Herald* surveying in Dangerous Ground. This work continued in 1932 with examinations of Jackson Reef, Mischief Reef and Royal Captain Shoal.

1935 US Navy surveys Pigeon Passage. Confidential Chart HO 5649 published December 1935.

1936 Japanese Navy survey parties commence work at North Danger and Tizard Banks. This work continued into 1937 with surveys of other areas in Dangerous Ground.

1937 USS *Pigeon* surveying Dangerous Ground to verify east-west transit passage. HMS *Herald* working at Mischief Reef and on western boundary of Dangerous Ground.

1938 Japanese Navy publishes confidential charts of North Danger, Tizard Bank and sketch plans of ten reefs/islets in the area.

1942 US Naval Hydrographic Office publishes chart HO 5501 *"South China Sea - Southwestern Part"* in April 1942.

1944 US Navy publishes revised version of chart HO 2786 *"Reefs in the China Sea"* during August 1944 with all plans reset on rectangular blocks. Admiralty chart F.6064 *"Plans in the South China Sea"* available for military use. (See USHO 5658 under 1950 entry).

1950 US Navy publishes confidential chart HO 5658 *"Plans in the South China Sea"* in October 1950, incorporating Japanese chart of North Danger and Admiralty plans of Jackson Atoll and Mischief Reef.

1951 HMS *Dampier* surveys Spratly Island.
US Navy publishes chart 5657 *"Plans in the Dangerous Ground - South China Sea"* that includes Spratly (Storm) Island, July 1951.

1953 Admiralty published revised chart BA 1201 *"Reefs in the China Sea"* including a plan of Spratly Island, on 30 January 1953.
Philippine C and GS publishes first edition of chart PC and GS No. 4716 *"Palawan"* in August 1953, showing eastern edge of Dangerous Ground.
ROC-Taiwan Navy publishes chart 476 *"Nan-Sha Chun-Tao"* in October 1953, based on ROC-Taiwan and Japanese surveys.

1954 ROC-Taiwan Navy publishes charts 477 *"Islets of the Nan-Sha Ch'un Tao"* on 20 April 1954.

1956 ROC-Taiwan Navy publishes chart 477A *"Plans in Nan-Sha Chun-Tao"* in December 1956.

1959 Japanese Maritime Safety Board publishes chart JMSA 1801 *"South China Sea - Southern Portion, Eastern Sheet"*, 24 October 1959.

1966 US Naval Oceanographic Office publishes 2nd edition of HO 5501, *"South China Sea, Southwestern Part."*

1967 US Naval Oceanographic Office publishes 1st edition of HO/BC 5498 *"Mui Bai Bung to Mui Da Nang"* which includes a large portion of the Dangerous Ground on scale 1:1,071,000 with detailed bathymetric information.

1974 ROC-Taiwan Navy publishes chart 0474 *"South China Sea - Southern Portion, Eastern Sheet"*, 31 October 1974.

1976 PRC-China published chart 9203 *"Southern Portion of Nanhai"*, 1 August 1976.

1977 Japanese Maritime Safety Agency publishes chart JMSA 2006 *"South China Sea"* scale 1:3,500,000 on 14 February 1977, that becomes basis for International chart INT 508 *"South China Sea"*. Chart INT 508 is then published by numerous countries including Germany, Malaysia, South Korea, Soviet Union, United Kingdom (BA 4508 of 25 September 1985) and United States.

1982 US DMA publishes four charts, 93044, 93045, 93046 and 93047 on 1:250,000 scale in November 1982. Chart 93047 excludes Spratly Island, which remains on chart 93030 on a scale of 1:1,071,000.

1987 Royal Malaysian Navy survey ship KD *Mutiara* operating around Ardasier, Dallas, Mariveles and Swallow Reefs.

1988 ROC-Taiwan issues new editions of charts 0476 *"Nan-Sha Ch'un Tao"* and 0478 *"T'ai-Ping Tao and Cheng-Ho Chun Chiao"* on 30 April 1988.
Malaysia publishes new chart MAL 781 *"Terumbu Semarang Barat Kechil to Terumbu Peninjau"* on 30 October 1988.

1991 Malaysia publishes new chart MAL 6 *"Sabah-Sarawak"* on 1 October 1991 on scale 1:1,250,000 that includes all southern areas of Dangerous Ground.

Appendix II: List of Navigational Charts and Plans of the Spratly Islands

Introductory Notes

This list is based on an original compilation by Du Plessis and Hancox during the period 1966 to 1981, with additions and amendments to August 1994.

In this Appendix countries and their respective hydrographic authorities are listed alphabetically, commencing with British Admiralty [Great Britain] and closing with Vietnam. Charts published by China are subdivided into two groups, namely charts produced by Republic of China - Taiwan, and Peoples' Republic of China.

Charts are listed numerically, in accordance with normal marine chart storage practices. Many hydrographic authorities follow a system of grouping charts with the first numeral (group) designating a particular area of the world.

It should be noted that the British Admiralty chart numbering system did not generally group charts whereby the first numeral indicates a particular area of the world, although a geographical *"folio"* system is followed, dividing the world into distinct areas.

Where several editions or variations of a particular chart have been published by a hydrographic authority the earliest or *"First Edition"* of that chart is listed first in this Appendix.

Chart Descriptions:

- *Chart names* and/or titles given in this list are the titles or names printed on the *"thumb label"* or title block of the chart concerned.

- Dates given are date of publication printed on the chart, and in the cases of newer editions, the dates of subsequent *"Large Corrections"* or *"New Editions"* are listed chronologically.

- Where a national hydrographic authority utilises by agreement, or otherwise, the surveys carried out by another country this fact, if noted on the particular chart concerned, is mentioned in this list.

- Chart scales are those given on the chart concerned.

British Admiralty Charts

Between 1840 and 1909 British charts were listed in an (un-numbered) small format publication entitled:

"Admiralty Catalogue of Charts, Plans, Views and Sailing Directions"

From 1910 to 1956 the format of British chart catalogue changed to include Index Charts or drawings, and the publication was re-titled:

"Catalogue of Admiralty Charts, Plans and Sailing Directions"

That publication was given the numerical designator Hydrographic Department (HD) publication *"HD 374"* in 1920. The title was again amended post-Second World War to:

HD 374 *"Catalogue of Admiralty Charts and other Hydrographic Publications"*

The Admiralty chart catalogue was renumbered to a Nautical Publication (NP) number some twenty years ago under the title:

NP-131 *"Catalogue of Admiralty Charts and Other Hydrographic* Publications" [4]

British Adm. No.	Title	Publication Data
(No number)	**South China Sea** - Sheet 1 February Daniel Ross (Bombay Marine) Published by J. Horsburgh, London.[5]	21 October 1821
967	**Palawan Island** 1:725,000 From surveys by Commander W. Bate, assisted by Lieutenants C. Pasco and C. Bullock and Mr W. Calver. This chart went through eight new editions and one large correction before being superseded by a new BA 967 in 1985.	3 November 1856
967	**Palawan** 1:725,000 Coloured - with views deleted	3 November 1856 New Edn 15 November 1985 Current Edn

[4] The current version of NP-131 is the 1994 edition.

[5] This chart was originally published by J. Horsburgh, Hydrographer of the East India Company. It is only included because it represents the result of an early 19th century survey to delineate the extent of the Dangerous Ground. This chart was not taken into the Admiralty series when the Hydrographical Office took over publishing East India Company charts in the early 1860s.

British Adm. No.	Title		Publication Data
1201	**Reefs in the South China Sea**[6]		23 October 1888
	- Loaita Island and Reefs	1:111,400	
	- Thi Tu Island and Reefs, and Subi	1:111,600	
	- North Danger	1:114,400	
	- Tizard Bank and Reefs	1:136,500	
1201	**Reefs in the China Sea**[7]		23 October 1888
	- Loaita Island and Reefs	1:111,400	New Edn 30 January 1953
	- North Danger Reef	1:111,400	
	- Spratly Island[8] 1951 survey	1: 25,000	Current Edn
	- Thi Tu Island and Reef, and Subi Reef	1:111,600	
	- Tizard Bank and Reefs	1:136,500	
1263	**South China Sea**	1:4,840,000	30 May 1887
	Various New Editions.		New Edn June 1897
	2 October 1912		
	12 January 1917		
	20 September 1918		
	11 September 1922		
	South China Sea	1:4,840,000	New Edn 4 February 1977
	South China Sea	1:4,840,000[9]	New Edn 14 January 1983
2112	**Ambong Bay to Sampanmangio Point**[10]	1:145,000	29 January 1913 New Edn 13 June 1958
	Kota Kinabalu to Pu. Mantanani	1:150,000	November 1990
2660 A[11]	**China Sea** - Southern Portion - Western Sheet	1:1,550,000	18 November 1881 New Edn 30 June 1972
2660 B	**China Sea** - Southern Portion - Eastern Sheet	1:1,550,000	1 November 1881 New Edn 27 August 1971

6 *Rifleman* surveys 1867-1868, Commander. J.W.Reed; but not published until October 1888. Superseded January 1953 by New Edn BA 1201.

7 "With additions and corrections from Japanese and US Navy charts to 1944".

8 Spratly Island appeared for the first time as a detailed plan on a BA chart following surveys by Lieutenants D. Collins and D. Prince, of HMS *Dampier* 1951.

9 Superseded by new International version of *"South China Sea"* chart known as Int 508 or BA 4508. See Japan.

10 Emerald and Big Bonanza Shoals, general details of southern shoals - from surveys by HMS *Merlin* 1909-1919 (Captain F.C. Learmouth) with additions from *HMS Herald* (Commander Jenks) 1938 and HMS *Dampier* (Commander N.D. Royds) 1956. Superseded in November 1990 by new chart.

11 BA chart 2660A (see below) first published in 1881 has always used, and continues to use, the conventional spelling of (Captain) Spratly's name as *Spratly*. Early, privately printed charts also use words *"Storm Island"* and some US charts use *"Storm Island"* in parentheses.

British Adm. No.	Title		Publication Data
2661 A	**China Sea** - Northern Portion - Western Sheet	1:1,500,000	7 August 1964
2661 B	**China Sea** - Northern Portion - Eastern Sheet[12]	1:1,500,000	18 September 1882 New Edn 24 March 1967
4508	**South China Sea**[13]	1:3,500,000	25 September 1987

Notes

1. Symbols and abbreviations used on BA charts have been changed considerably over the period covered by this list.

   (i) Between 1910 and 1970 all BA chart symbols and abbreviations were found on a single sheet chart No.5011 entitled:

   "Explanation of Signs and Abbreviations as shown on the charts issued by the Hydrographic Department, Admiralty."

   (ii) From 1972 these symbols etc are found in a new book edition of BA 5011:

   "Symbols and Abbreviations used on Admiralty Charts"

   Book Edition 1 - June 1972

   (iii) Since 1972 this booklet has been through five editions, up to 1987, when it was superseded by a revised and reset Chart 5011:

   "Symbols and Abbreviations used on Admiralty Charts"

   Edition 1 - 1991 - Sub-titled "INT-1"

[12] Charts BA 2660A, 2660B, 2661A and 2661B have been through numerous *"New Editions"* and *"Large Corrections"*. As an example the printing history of BA 2660A, China Sea-Southern Portion-Western Sheet is listed below:

Published:	18 November 1881
New Edn:	May 1886
" :	November 1894
" :	August 1896
" :	July 1909
" :	16 July 1912
" :	23 May 1923
Large Corr'ns:	10 September 1954
" :	10 September 1954
" :	11 January 1969
" :	30 June 1972

[13] Int. 508 - modified repro - of Japanese (JMSA) chart No.2006

This version of BA 5011 is based on the IHO publication:

"Chart Specifications of International Hydrographic Office"

adopted in 1982, with colour presentations.

The use of modern book versions of BA 5011 to interpret pre-1972 Admiralty charts is not advisable without specialist knowledge.

2. The Admiralty has published various editions of its sailing directions *"China Sea Directory"* (pre-1912) and *China Sea Pilot* since 1868. The current relevant editions of this publication are:

   (i) *"China Sea Pilot"* - Volume I [NP. 30]
   4th Edition, 1978; revised and re-issued 1987

   (ii) *"China Sea Pilot"* - Volume II [NP. 31]
   4th Edition, 1975; revised and re-issued 1982

NP. 30 covers the west side of the China Sea from Tg. Lompat in peninsular Malaysia to Zhelang Yan, PRC and includes Kep Anambas, Hainan and the (western) islands and banks bordering the main route from Singapore Strait to Hong Kong, including Paracel Islands and Macclesfield Bank.

NP. 31 covers the western and north-western coasts of Borneo, the Philippines (from Balabac to Cape Bojeador) and the outlying islands and dangers in the southern and eastern parts of the China Sea. The Dangerous Ground is described in Chapter 8, with a brief description of Scarborough Reef, Truro Shoal and Stewart Bank at the end of Chapter II.

3. Other publications by the (Admiralty) Hydrographer of the Navy relevant to the Dangerous Ground include:

   (i) *"Co-Tidal Atlas, South East Asia"* - NP. 215
   Hydrographic Dept., Taunton, Edition 1 - 1979.

   (ii) *"Underwater Handbook for South China and Java Seas"* - NP. 623
   Hydrographer of the Navy, London, 1967

NP. 215 is valuable, in conjunction with charted tidal data, for calculating approximate tidal ranges and checking predictions made with HD 289 data. It is also useful for general tidal movements in the region, if used with a comparable US-DMA Co-Tidal Range Line drawing.

NP. 623 is a comprehensive bathymetric and oceanographic handbook that was no longer on sale in 1972.

4. Considerable information can still be obtained from:

"Indian Archipelago and China Directory"
by A.G. Findlay, R.H. Laurie, London.
3rd Edn. 1889

Earlier or later editions are equally useful.

5. Although not specifically affiliated with the Admiralty, the International Hydrographic Bureau (of Monaco) published the useful document:

"General List Arranged by Oceans of Original Reports of Shoals of Doubtful Existence, and of Shoals the Positions of which are doubtful or approximate. Part D - NORTH PACIFIC OCEAN"
(Special Publication No 20, 2nd Edn. January. 1932, I.H.B., Monaco.)

This publication has been used to cross-check some ED/PD and other reefs that certain parties claim to occupy and some of which are still shown on certain charts.

The IHB, now known as International Hydrographic Organization IHO, also publishes:

"Chart Specifications of the IHO, and Regulations of the IHO for International (INT) Charts"
MP-004

Originally published 1972; republished as a modified document in 1989-1990. Printed in six parts, and gives IHO's specifications for compiling nautical charts, together with agreed symbols and abbreviations adopted for general use by IHO member states. Another IHO publication further codifies chart production:

"Chart INT 1
Symbols, Abbreviations, Terms used on Charts"

Republic of China - Taiwan
Chinese Navy Charts

Published by the Chinese Naval Hydrographic and Oceanographic Office, Kaohsiung, Taiwan.

No.	Title	Publication Data
0471	**South China Sea** - Northern portion 1:1,200,000 - Eastern Sheet Based on Japanese chart JMSA No.1500 of 1967	31 December 1980
0474	**South China Sea** - Southern Portion 1:1,200,000 - Eastern Sheet (General coverage of Nan-Sha Chun'Tao). Based on Japanese chart JMSA No.1801 of 1959[14]	31 October 1974
0476	**Nan-Sha Ch'un Tao** 1:750,000 (From various surveys to 1974, with additions to 1986; originally published in 1st Edn, Oct 1953 as No. 476). The best single sheet chart on this scale covering main areas of The Dangerous Ground.	30 April 1988
0477	**Islets of the Nan-Sha Ch'un Tao** - Chung-Yeh Ch'un Chiao 1:111,660 (Loia Ta Island and Reefs). - Shuang-Tzu Chiao 1:111,660 (North Danger Island and Reefs; part IJN-chart 521-2 q.v). - Tao-Ming Ch'un-Chial 1:111,660 (Lam Kiam Cay and reefs). Compiled from various sources to 1938 and minor corrections to 1962.	20 April 1954
0477A	**Plans in Nan-Sha Ch'un Tao** Total of 9 plans - as listed below: (English names in brackets) - Chiang-Lai Chaio 1:100,000 (Loai-Ta - N.E. area, inc. Menzies Reef) - Chin-Lun T'an 1:100,000 (Union Bank area inc. Sin Cowe Island) - Apps to Fie-Hsin Tao and Ma-Huan Tao 1:60,000 (Nanshan Island) - Hai-K'ou An-Sha 1:100,000 (N.E. Investigator Shoal) - Heng Chiao 1:100,000 (Southampton Reefs, Livock Is.) - Hsing-sheng Chiao 1:100,000 (Irving Reef)	25 December 1956

[14] Charts which follow, viz ROC Taiwan numbers 0476, 0477, 0477A and 0478 are published under the sub heading: "*China - Fourth Coast Area - Kwang Tung Province*"

No.	Title	Publication Data
0477A (cont.)	- Pei-Heng Chiao 1:120,000 (Jackson Atoll) - Sao-Men Chiao 1:100,000 (Mischief Reef) - Yung-Teng An-Sha 1:100,000 (Trident Shoal and Lys Shoal) Derived from a Japanese Survey of 1937 with a cautionary note: *"Be prudent to use this abbreviated survey chart"*.	25 December 1956
0478	**T'ai-Ping Tao and Cheng-Ho Chun-Chiao** 1:75,000 (Tizard Bank and Reefs) Based on Japanese surveys of 1936/37 and very similar cartography to IJN confidential chart Nr.532-2. Virtually a revised, acknowledged copy of Nr.532-2. (2nd Edn, superseding 1st Edn of Oct 1953)	30 April 1988

Notes

1. The Republic of China established the : "*Bureau of Navigation Charts*" as a special division of the (Chinese) Department of the Navy in 1922.
   See also Note 2, China-PRC charts.

2. In general terms the most detailed charts of larger islets and atolls in the Dangerous Ground are those published by ROC-Taiwan, namely:

   BA Number 0474; General chart
   BA Numbers 0476, 0477, 0477A and 0478; plans

3. Generally the symbols and abbreviations used on ROC-Taiwan charts follow present international custom, but in case of doubt ROC-Taiwan (Hydrographic) Publication No.1:

   "*Symbols and Abbreviations used on Chinese Charts*"
   Edn No.4, 1987
   Edn No.5, June 1992

   should be consulted.

People's Republic of China - PRC
China Navigation Press

PRC No.	Title		Publication Data
9203	**Southern Portion of Nan Hai**	1:2,000,000	August 1976 (1st Edn) June 1984 (2nd Edn)

Notes

1. PRC 5-digit series are not readily available, but from observations of these charts on salvage operations it appears that PRC 5-digit detail charts of Dangerous Ground are a mixture of Japanese, ROC-Taiwan, PRC-China Navigation Press and US charting.

2. The China Navigation Press is a lineal successor to the (Kuomintang) Republic of China, Department of the Navy's special Bureau for Navigation Charts, originally established in 1922 at Canton. ROC-Taiwan and PRC-China both use (archival) material originally surveyed and/or collected by the Bureau for Navigation Charts.

French Charts
Service Hydrographique de la Marine (SHOM)

SHOM No.	Title		Publication Data
2001	**Île de Palawan** From British chart BA 0967 Superseded in 1986 and replaced by BA 0967	1:1,000,000	February 1901
3106	**Detroit de Balabac et cheneaux entre Borneo et Palawan** From British surveys of 1868-69 Superseded		February 1892
5691	**Annam et Cochin** (Current chart)	1:909,000	1945
6837	**Mer de Chine meridionale** (Int. No.0508) Derived from Japanese chart JMSA No.2006	1:3,500,000	1981 NE 1990

Notes

SHOM does not appear to have taken any great interest in Storm (Spratly) Island until 1927 when Taiwan based Japanese interests began large-scale guano exploitation on Spratly Island. In 1927 a French Marine vessel carried out some hydrographic survey work around Spratly Island. However enquiries to SHOM indicate that no publicly available chart or plan of Spratly Island was published.

France declared formal possession of Spratly Island in April 1930; and the island was occupied by Japanese troops during March 1939.

In general terms French SHOM chart coverage of the South China Sea coastal areas has declined from a high point of 12 pages as shown in SHOM Publication No.824, dated January 1901:

> "*Catalogue par ordre Geographique des Cartes, Plans, Vues de Cotes, Instructions Nautiques, Memoires, etc. qui composent L'Hydrographie Francais.*"

to a two page entry in the 1994 SHOM Publication No.0004-ZKA:

> "*Catalogue des Cartes Marines et des Ouvrages Nautiques.*"

This is of course a reflection of the generally shrinking chart coverage offered by SHOM, whose (commercial) catalogues have reduced from a four volume (fascicule) publication, numbers 4-A, 4-B, 4-C and 4-O in 1971 to the 1994 single large volume SHOM Publication No.0004-ZKA.

The cartography and layout of more recent SHOM charts follows internationally agreed conventions in this matter, but earlier charts contain a variety of symbols. For older charts it will be necessary to consult:

"*Symboles et Abreviations figurant sur les cartes Marines Francais*"
(SHOM Publication No. 1-D - for example - 31 January 1978).

France has published numerous editions of Sailing Directions relating to Asia under the general heading of "*Mers de Chine et du Japon et Grand Archipel d'Asie*". In the year 1900 the following volumes were relevant to the South China Sea:

SHOM No.	**Title**	**Publication Data**
661	***"Instructions nautiques sur les Mers de Chine"*** (Introduction - Navigation generale).	8th Imprint 1883
807	***"Mers de Chine, tome I er"*** (Entrees occidentales de la mer de Chine - Sumatra et canaux avoisinants).	8th Imprint 1900
747	***"Mers de Chine, tome II"*** (Du detroit de Singapore aux approches Sud de Canton et de Hong-Kong).	8th Imprint 1894

In 1990 the SHOM Sailing Directions applicable to the South China Sea's Dangerous Ground are:

SHOM No.	**Title**	**Publication Data**
Serie K	***"Asie du Sud-Est"***	
Vol. 4	***"Detroits de Malacca et de Singapour, Cote est de Malaisie, Golfe de Thailande, Cotes est de la Peninsule Indochinoise"***	1982
Vol. 7	***"Grand Archipel D'Asie"*** (Cotes ouest et Nord-Est de Borneo Iles Philippines).	1978

German Charts

Number	Title	Publication Data
298	***"Sub Chinesisches meer"*** 1:3,500,000 (Int. 508 - Deutsches Hydrographisches Institut, Hamburg - reproduced from Japanese chart JMSA No.2006).	August 1978

The Deutsches Hydrographisches Institut and its successor Bundesamt fur Seeschiffahrt und Hydrographie do not issue any detailed charts of the Dangerous Ground area.

Indonesian Charts

Jawatan Hidro-Oseanografi

Number	Title	Publication data
02	**Kepulaun Indonesia dan Sekitarnya** 1:4,000,000 (inc. 'Daerah Berbahaja' or Dangerous Ground)	November 1961 New Edn September 1988
38	**Laut China Selatan - Bagian Selatan** 1:1,000,000	November 1926 New Edn October 1978
147	**Laut China Selatan - Pu Pu Anambas dan Pu Pu Natuna** 1:500,000	January 1909 New Edn April 1982
501	**Laut China Selatan dan Laut Natuna Ningga Laut Sulu dan Laut Sulawesi** 1:2,000,000	August 1986

Notes

1. Charts 38 and 147 were originally published by Royal Netherlands Navy(Hydrografic Dept), and have been improved by Indonesian Navy.

2. Indonesian charts and navigational publications are indexed in:

   "Katalog Peta laut dan Buku Nautika - Indonesia"
   TNI - Angkatan Laut, Jawatan Hidro - Oseanografi, Jakarta,
   (BPI) No.30 - July 1990.

3. No Dutch charts have been listed in this Appendix as very few were relevant to area considered or during the dates covered by this Appendix.

Japanese Charts

1. Japanese Hydrographic Office (JHO) of Imperial Japanese Navy (IJN)

JHO-IJN No.	Title	Publication Data
451	**Reefs in the China Sea** 1:111,400 Direct reproduction of BA chart 1201, with identical plans. Remained in the general chart catalogue until 1945/46 but was superseded for military purposes by IJN confidential charts 521, 522 and 523 below.	29 May 1900
521-2	**Hokuken Syo (North Danger Reef)** 1:30,000 Military confidential chart, on considerably larger scale than previously available on BA 1201 of 1888 which included a plan of North Danger Reef on a scale of 1:112,000.	14 March 1938
522	**Nagashim Fukin (Itu Aba)** 1:30,000	
523-2	**Tizato Tai (Tizard Bank)** 1:75,000 Military confidential chart. On larger scale than previously available BA 1201 of 1888 where Tizard Bank is depicted on scale 1:136,500. This chart (523-2) reflects considerable sounding work and accurate definition within lagoon, compared to BA 1201.	29 November 1938
524	**Shinnan Gunto** 1:750,000	
525	**Islets and Reefs in Shinnan Gunto** A series of ten sketch plans of reefs and ilsets in the Dangerous Ground, from surveys in 1936-37. These sketch plans were subsequently reproduced on US HO 5657, dated July 1951 and ROC-Taiwan 477A of 25 December 1956 with acknowledgement to Japanese surveys. Plans on various scales.	1938
529A and 529B	**China Sea - Southern Portion, Eastern Sheet** 1:1,550,000 Direct reproduction of BA chart 2660A. Superseded by JMSA 1801 in October 1959.	21 December 1925

2. Japanese Maritime Safety Agency (JMSA)

JMSA No.	Title	Publication Data
752	**Palawan** 1:750,000	August 1968
810	**South China Sea** 1:4,000,000 Superseded by JMSA 2006	November 1937
1502	**South China Sea** - Southern Portion 1:1,200,000 - Western Sheet From British, US, Indonesian and Japanese Surveys; includes eastern part of Dangerous Ground and south to Kuching (Long. 105E to 114-30E). Current Edn.	December 1975
1801	**South China Sea** - Southern portion 1:1,200,000 - Eastern Sheet From British, US, Indonesian and Japanese charts to 1958. Current Edn.	24 October 1959
2006	**South China Sea** 1:3,500,000 Current Edn. This chart is used as basis for International 1:3,500,000 series chart Int 508.	14 February 1977 New Edn 15 October 1985

Notes

1. Archive numbers quoted for JHO-IJN charts are archive numbers assigned by Hydrographic Library of Maritime Safety Agency of Japan, Tokyo.

2. A complete list of Japanese charts is found in:

   "Catalogue of Charts and Publications"
   Maritime Safety Agency - Japan
   Publication No.900

   which is generally issued at two year intervals.

3. Although both IJN and JMSA charts follow British Admiralty charts in topographic style, it is advisable to consult JMSA Publication No.6011:

   "*Chart Symbols and Abbreviations"*

   to avoid mistaken interpretation of charted information.

4. The relevant JMSA Sailing Directions for the Dangerous Ground are:

   JMSA *"South China Sea Sailing Directions"* Publication 204

   published in January 1988.

Prior to this date the JMSA sailing directions split the South China Sea more or less equally into two areas such that:

Publication 211 *"South China Sea - Western Area"*

covered area from Singapore Strait to Hong Kong, including Gulf of Thailand, Vietnam to Haiphong and the Paracel Islands, and

Publication 213 *"South China Sea - Eastern Area"*

covered area from Singapore Strait to Pratas Reef, including the northern coast of Borneo and the main Dangerous Ground areas.

(Publications 211 and 213 were superseded in 1988 by Publication 204).

5. JMSA also publishes a series of charts for the northern coast of Borneo which are not included in this Appendix.

South Korea
Republic of Korea Hydrographic Office

No.	Title	Publication Data
2508	**South China Sea** 1:3,500,000 (Int 508 - modified reproduction of JMSA 2006 of 14 February 1977).	August 1984

Malaysia
Directorate of Hydrography, Department of Navy

MAL No.	Title	Publication Data
6	**Sabah - Sarawak** 1:1,250,000	1 October 1991
781	**Terumbu Semarang Barat** 1:300,000 **Kechil (to) Terumbu Peninjau**	30 October 1988
4508	**Laut China Selatan** 1:3,500,000 (Int 508 - modified reproduction of JMSA 2006 of 14 February 1977).	31 December 1991

Notes

The Malaysian Chart Catalogue (Katalog Carta Malaysia) 1994 Edition indicates that Malaysia plans to publish the following charts that include substantial coverage of the southern areas of the Dangerous Ground:

MAL 78 *"Sarawak - Laut China Selatan"*
Scale 1:750,000
This chart will also carry the International chart series designator INT 5060.

MAL 89 *"Sabah - Laut China Selatan"*
Scale 1:750,000
This chart will carry International chart series designator INT 5061

Malaysian charts are published to conform with IHO specifications, and the Malaysian publication *"Malaysian Symbols and Abbreviations, MAL-1"*.

An examination of details around Ardasier bank and Reef on chart MAL 781 shows colouring/shading used to indicate depths should be interpreted from the colour shades used in *"MAL 1"*, not BA 5011.

Philippines

Coast and Geodetic Survey Department of National Mapping & Resource Information Authority (NAMRIA)

NAMRIA No.	Title	Publication Data
4200	**Philippines** 1:1,575,000 Published by Philippines Coast and Geodetic Survey, Department of National Defense (Numbered as 'PC & GS 4200')[15]	19 December 1960 (1st Edn) 2 December 1968 (2nd Edn)
4200	**Philippines** 1;1,575,000 Published by C & GS Dept, NAMRIA This chart includes boundary claim into the dangerous Ground or "Kalayaan Islands" Current Edn	New Edn. 13 February 1984
4203	**Philippines** - Western Part 1:1,575,000	1 January 1989
4707	**Philippines** - South Western Part 1:808,000	5 November 1984
4716	**Palawan** 1:402,000	10 November 1975
4720	**Balabac Strait and approaches** 1:405,200	16 July 1979

Notes

The NAMRIA C & GS Chart Index ascribes both English and Tagalog (Philippine) names to various reefs/islands in Dangerous Ground/Kalayaan Islands, as far west as London (Quezon) Reef, approx Long. 112-15 East.

The Philippines Chart Catalogue does not list any published detail or island/reef charts for the Philippines-claimed area of the Dangerous Ground.

Philippines publishes two volumes of Sailing directions, viz:

Philippine Coast Pilot - Part I
Philippine Coast Pilot - Part II

[15] This chart, as published in its 1st Edn. and its 2nd Edn. **only** shows (Philippine) International Treaty Limits and makes no boundary claims into the Dangerous Ground.

Russian - USSR Charts
Glavnoe Oupravlenie Navigatsii I Okeanografi

GONIO NR.	Title	Publication Data
66480	**Tizard Bank and Reefs** 1:75,000 Although not stated on chart this publication is very similar to ROC-Taiwan chart 0478, or earlier IJN chart 523-2. Current Edn	10 June 1980

Notes

1. All civilian-use charts produced by Russia/CIS are listed in:

   *"Catalogue of Charts and Publications of Glavnoe Oupravlenie Navigatsii I Okeanografi***".**
   Publication Nr. 7007.2, issued/dated 1992
   GONIO, St Petersburg

   All (civilian-use) charts relevant to South China sea are listed in Region 8 Index of Publication 7007.2, which includes charts for Macclesfield Bank and the Paracel Islands.

   (Russia's GONIO also produces a restricted (military) chart catalogue, Publication No. 7022, latest Edn. 1992, which contains some restricted charts of Vietnam ports and port approaches)

2. In many respects Russian chart symbols and abbreviations are similar to German charts, but use of Cyrillic symbols can cause confusion. If the official Russian Publication No. 7008.1 is not available the US (DMA) publication:

   "USSR Chart Symbols and Abbreviations"
   WOBZ-C4 Edn No.3 of November 1962

   is an acceptable substitute. Alternatively the Deutsches Hydrographisches Institut Publication INT 1 can be used, provided due care is taken.

Spanish Charts

Notes

1. No Spanish Charts of area have been listed in this section, since most surveys pre-date 1880, and are generally on the Palawn Passage edge of the Dangerous Ground.

2. Spanish charts of the Philippines coastal area adjacent to the Dangerous Ground circa 1900 are listed in:

   "Catalogo de las Cartas, Planos Y Libros de Venta en la Direccion de Hidrografia"
   (1902 Edition)

   published by Direccion of Hydrografia, Madrid, and first produced in 1857. The Catalogo is arranged geographically and printed on an A-4 type format. South China Sea charts are listed at Section 6.

United States of America

Introductory Notes

1. Prior to the Second World War there were three principal navigational chart producing organisations in the United States. These agencies and their areas of charting responsibility were:

- US Army Corps of Engineers (ACoE)
  US mainland intra-coastal waterways, upper reaches of main navigational rivers and some port area charts and plans.

- US Coast & Geodetic Survey (C & GS)
  Coastal and river charts, harbour approach, port plans and coastal sailing directions of US mainland and US overseas possessions and/or areas where the US government had interests, such as the Philippines.

- US Navy Hydrographic Office (USN-HO or USHO)
  Ocean and coastal navigational charts, plans and sailing directions of ocean areas which included approaches to the continental US and Alaska.

The agencies producing charts covering the South China Sea area prior to the Second World War were C & GS for Philippines coastal waters and USHO for the ocean and non-Philippine coastal waters. Only USHO charts are listed in Section 1 of US chart list.

USHO was also responsible for production of navigational publications and sailing directions. The USHO publications concerning South China Sea immediately post-Second World War were:

HO Pub 124 *"Coast of China - Yalu River to Hong Kong/Canton"*
(Including Yangtze River, the coasts of Taiwan and Pescadores Islands.)

HO Pub 125 *"Western Shores of the China Sea"*
(Singapore to Hong Kong)

HO Pub 126 *"Soenda Strait and Western Coast of Borneo and Off-Lying Islands"*

These publications were subsequently re-numbered after 1951 such that the following numbers were allocated to Sailing Directions:

HO Pub 71 *"Soenda Strait and West Coast of Borneo and Off-Lying Islands"*

HO Pub 92 *"Philippines"*

HO Pub 93 *"Western Shores of South China Sea"*
(Singapore Strait to Hong Kong)

Chapter 2 of HO Pub 93 entitled *"Outlying Islands, Banks and Dangers of the South China Sea"* contained the best modern descriptions and sketches then (1957) available of the Dangerous Ground.

2. Following a reorganisation of US charting responsibilities in 1970, there were three navigational chart producers, as listed below:

- US Army Corps of Engineers (ACoE)
  Retaining its US mainland charting responsibilities as described above.

- US Defense Mapping Agency (DMA)
  Subsumed the responsibilities of all charting areas and sailing directions previously serviced by either USHO or its successor in functions US Naval Oceanographic Office (NOO) with some additional charting regions added. The DMA is more correctly described by its parent, US Department of Defense, as:

  'Defence Mapping Agency Hydrographic/Topographic Centre'

  Until late 1992 US charts and sailing directions of the South China Sea were produced by DMA, as listed in Section 4 of US charts in the following list.

  Under the DMA's world-wide 'regional' geographical system, charts of the South China Sea are listed under Region 9.

- National Oceanic and Atmospheric Administration (NOAA)
  In effect the US Department of Commerce, which previously controlled the US Coast and Geodetic Survey, transferred all C & GS charting responsibilities to NOAA.Apart from some general oceanographic charts NOAA did not produce any charts or plans relevant to South China Sea.

3. The public sale distribution of Defense Mapping Agency (DMA) nautical charts and publications was transferred to National Oceanographic and Atmospheric Administration (NOAA) with effect from autumn 1992. As a result NOAA re-vamped previous DMA catalogues starting with DMA Catalog Part 2, Vol. I - Nautical Charts and Publications (DMA-NC). The new DMA-NC is still subdivided into nine sections, and East Asia (inc. South China Sea) is contained in

"DMA-NC 9 Region 9 - East Asia"
Nautical Charts and Publications
NOAA's National Ocean Service
1st Edn 1992-93

4. The South China Sea area is described in two DMA principal publications:

Pub 160 *"Sailing Directions (planning Guide) for South East Asia"*

Pub 161 *"Sailing Directions (en-Route) for the South China Sea and Gulf of Thailand"*

Pub 160 is currently (1994) in its 3rd Edn (1991) and the present edition of Pub 161 is the 6th Edn of 1994. Pub 161 contains a useful Index-Gazeteer in which navigational features and place-names are listed alphabetically, together with an approximate position. Geographical names in DMA charts and publications are generally those used by the nation having sovereignty. Alternate names, given in parentheses, appear on some charts and publications.

The Dangerous Ground is described in Chapter 1 of Pub 161, but some of the sketch plans of atolls and reefs should be used with caution.

Pub 161 also contains a comprehensive Chinese Hydrographic Names directory, arranged in 'Wade-Giles to Pinyin' and 'Pinyin to Wade-Giles' format between pages 221 to 240.

The best medium scale general chart coverage of the Dangerous Ground available from any charting agency are the DMA's (NOAA) 1:250,000 series charts listed below:

93044 Yongshu Jiao to Yongdeng Ansha
93045 Heng Jiao to Haima Tan (Routh Shoal)
93046 Mantangule Island to Eran Bay
93047 Yongshu Jiao to P'o-Lang Chiao
93048 Duhu Ansha (North Viper Shoal) to Kimanis Shoal

Unfortunately the south western sector chart, 93047, does not extend far enough westwards to include Spratly Island, Ladd Reef, or Rifleman Bank.

United States of America
1. US Hydrographic Office

Post 1900

Number	Title	Publication Data
2786	**Reefs in the China Sea** - Loai Ta Island and Reef - North Danger - Thi Tu Island and Reefs and Subi Reef - Tizard Bank and Reef From British surveys of 1867 and 1868; basically a copy of BA 1201. Superseded by HO 2786 of 1944.	November 1911 (1st Edn)
2786	**Reefs in South China Sea** - Thitu Island and Subi Reefs 1:117,840 - Loaita Bank and Reefs 1:117,840 Both from Japanese and British surveys between 1867and 1938. Superseded by DMA chart No.93061, on 21 September 1970 which also included plans of 'Tizard bank and Reefs' and 'Loaita Island and Reefs', based on corrected Japanese surveys.	8 August 1944 (4th Edn)
5498	**Mui Bai Bung to Mui Da Nang** 1:1,071,000 Includes all Dangerous Ground north of Rifleman Bank, and extends north to Macclesfield Bank and Triton Shoal in Paracels. Superseded chart; replaced by DMA No.93030.	8 July 1967 (1st Edn)
5501	**South China Sea** - South Western Part 1:971,600 Includes southern area of Dangerous Ground, inc Rifleman Bank, Ardasier Reef, Spratly Island. Superseded chart; replaced by DMA No.71027.	10 May 1966 (2nd Edn)
5649	**Dangerous Ground, Palawan Passage to London Reefs** 1:300,000 US Naval reconnaissance survey in 1935 Both 1935 and 1937 editions of this chart were classified as *"Confidential"*.	December 1935 (1st Edn) and, 1937 (2nd Edn)

Number	Title	Publication Data
5657	**South China Sea - Plans in the Dangerous Ground** - Amboyna Cay 1:7,500 - Irving Reef 1:100,000 - Itu Aba and Tizard Bank 1:15,000 - Nanshan Island and Flat Island 1:60,000 - North East Investigator Shoal 1:100,000 - Southampton Reefs * 1:100,000 - Spratly Island * 1:15,000 - Trident Shoal * 1:100,000 - Union Bank and Reefs 1:150,000 - Menzies Reef 1:100,000 Derived from Japanese surveys between 1936 and 1937 on Japanese HO 525, with Itu Aba from BA 1201 and Japanese HO 523. Superseded chart; plans marked * were **not** reissued on DMA 93061.	8 July 1951 (1st Edn)
5658	**Plans in South China Sea** - Jackson Atoll 1:75,000 - Mischief Reef 1:50,000 - North Danger Reef 1:30,000 - South Entrance to Mischief Reef 1:12,500 Jackson Atoll and Mischief Reef from surveys by HMS *Herald* - 1933 North Danger Reef from Japanese survey in 1936 Originally issued as a "*Confidential"* chart, derived from BA Secret Chart F.6064 and Japanese chart S-521 (IJN chart No.521-2). Superseded chart; replaced by DMA 93042 of same title (new edition) 16 March 1985.	October 1950 (1st Edn)
5659	**Tizard Bank and Reefs** 1:75,000 From Japanese surveys in 1936 and 1937, resulting in IJN S-523 Superseded chart; renumbered and published 1974 as DMA 93043.	October 1950 (1st Edn)
14705	**South China Sea** 1:1,031,800 Northern Portion, including Luzon and Taiwan. Also listed as BC 14705 in 1965. Superseded by DMA 91010.	

If using older USHO or US Naval Oceanographic Office charts it is advisable to check all symbols/abbreviations used on those charts with:

USNOO/US C & GS Chart No 1
"Nautical Chart Symbols and Abbreviations"
(Edn of September 1963 is most suitable)

United States of America
2. Defense Mapping Agency (DMA)

DMA No.	Title	Publication Data
WOPGN 508	**South China Sea** 1:3,500,000 US version of Int 508 Current Edn	July 1983 (1st Edn)
WOPGN 550	**Gulf of Thailand to Taiwan**, 1:2,802,000 inc the Philippines Current Edn	1 May 1982 (6th Edn)
WOPGN 632	**Strait of Malacca to Banda Sea**, 1:2,802,000 inc South China Sea, Java Sea and Celebes Sea	August 1981 (6th Edn)
71027	**Paulu Bintan to Mui Ca Mau**, 1:1,091,700 inc North Coast of Borneo and adjacent islands. From various sources to 1969 (Omega overprinted) Lat 01° N to Lat 09° N / Long 103°-30' to 115°-30' E	21 May 1983 (7th Edn)
92006	**Philippines** - Southern Part 1:1,089,900 (Loran C overprint)	12 July 1975 (2nd Edn)
93030	**Mui Bai Bung to Mui Da Nang** 1:1,071,000 (Omega overprinted) From various sources to 1970	15 March 1980 (4th Edn)
93042	**Plans in South China Sea** 1:30,000 - North Danger Reef From Japanese survey of 1936; see IJN 521-2 Jackson Atoll and Mischief Reef surveys by HMS *Herald* 1936. Re-issued version of (US) HO No 5658, first published October 1950 - Jackson Atoll 1:75,000 - Mischief Reef 1:50,000 - South Entrance to Mischief Reef 1:12,500	16 March 1985 (2nd Edn)
93043	**Tizard Bank** 1:75,000 From Japanese survey HO chart 1936/1937 S.523, based on IJN surveys 1936-1937. Re-issued/renumbered version of HO 5659.	October 1950 (1st Edn)
93044	**Yongshu Jiao to Yongdeng Ansha** 1:250,000 inc details Chin-lun Tan (Union Tablemount) From ROC-Taiwan charts numbers: 0474, 0476, 0477, 0477A and 0478 and miscellaneous data.	January 1982 (1st Edn) 26 May 1984 (2nd Edn)

DMA No.	Title	Publication Data
93045	**Heng Jiao to Haima Tan (Routh Shoal)** 1:250,000 (Southern Banks area, Nansha Qundao) From Philippine chart C & GS No 4716 of 1959 and ROC-Taiwan No 0476, 1953 Edn, and miscellaneous data.	8 June 1982 (1st Edn) 9 June 1984 (2nd Edn)
93046	**Mantangule Island to Eran Bay** 1:250,000 (Principal reefs Ardasier west to Hsi Chiao) From ROC-Taiwan chart number 0476 of 1953 and Philippine C & GS chart numbers 4324 (1958), 4325 (1958), 4326 (1960) , 4716 (1953) and 4720 (1960).	5 June 1982 (1st Edn)
93047	**Yongshu Jiao to P'o-Lang Chiao** 1:250,000 (Principal reefs in vicinity of Ardasier and north-westwards) From ROC-Taiwan Nos 0474 (1974) and 0476 (1953) and miscellaneous data Contains a 'Glossary of Secondary Names' giving Pinyin as 'primary' and English name as 'secondary' title.	June 1982 (1st Edn) 14 April 1984 (2nd Edn)
93048	**Duhu Ansha (North Viper Shoal) to Kimanis Bay** 1:250,000 From US and British charts to 1975.[16]	10 November 1982 (1st Edn)
93061	**Reefs in the South China Sea** 1:117,840 - Loaita Island and Reefs (Fathom Chart) - North Danger Reef - Thitu Island and Reefs and Subi Reefs - Tizard Bank and Reefs From British and Japanese Surveys between 1867 and 1938. By October 1976 plans of 'North Danger Reef' and 'Tizard Bank and Reefs' were stamped '*Cancelled*' as 'North Danger Reef' was on DMA 93042 and 'Tizard Bank' was on DMA 93043.	August 1944 (4th Edn) (Revised 21 September 1970)

Notes

1. The majority of US-DMA chart coverage of South China Sea is contained in Portfolio No.93,*"South China Coast to East Coast of Malay Peninsula"*, although it may be necessary to draw some charts from Portfolio No.91 *"Philippines (Northern Part)"* and Portfolio No.92 *"Philippines (Southern Part)"* to complete coverage.

[16] Chart 93048 *"Duhu Ansha (North Viper Shoal) to Kimanis Bay"* is unusual in that it uses in its title (North Viper Shoal) a feature that is classified as 'Existence Doubtful' (ED) and also shows Glasgow Reef. Chart MAL 6 shows North Viper Shoal with the notation 'ED', and Glasgow Reef as an un-named feature. Glasgow Reef is also clearly shown, and named as such on chart 93046 *"Mantangule Island to Eran Bay"*.

2. US-DMA charts and publications for South China Sea area were previously listed in:

> "*Defense Mapping Agency Catalogue of Maps, Charts and Related Products, Volume IX, East Asia"*
> (Generally referred to as "*Region 9 Catalogue*")

but are now found in DMANC-9 (See Note 3 in Introductory Notes to US chart listing).

3. Certain charts, indicated by green margins and lettering in older/superseded DMA catalogues were only issued to authorised Dept of Defense users, or to others on the basis of validated need. There were no 'green charts' listed in CATP 2, Vol 9 relevant to the Dangerous Ground, from 1970 onwards. However some USHO and/or US naval Oceanographic Office charts, including HO 5658 "*Plans in South China Sea"* (Jackson Atoll, Mischief Reef, North Danger Reef etc) were "*Confidential"* charts unavailable to non-Dept of Defense users.

4. Another small scale, useful outline chart is WOXZP-6137 - "*Display Plotting Chart, for South China Sea"* - on a scale of 1:4,383,000 = 1 inch per degree of longitude; it is a useful general reference for some purposes.

See DMA CAT-PB 1NA (Pub 1-N-A).

Vietnam

No Vietnamese charts have been consulted as observations at and discussions with Director (General) Le Ming Cong of *VISAL* indicate Vietnam uses a mixture of US-DMA and French charts, with some copies of British charts also in use.

It is highly probable that Vietnam has some surveys and restricted circulation hydrographic data for some of the areas it claims or occupies in the Dangerous Ground. It is also possible that the original reason for obtaining the Russian vessel *Nevel'skoy* was for its designed oceanographic and hydrographic purpose. *Nevel'skoy* was the only naval oceanographic research ship (other than *Vladimir Kavrayskiy*) ever built in the Soviet Union, and appears to have been a prototype for the *Nicholay Zubov* class.

VISAL-6, ex-*Nevel'skoy*, has been laid-up for some time, and Le Ming Cong did not appear to place ocean or coastal hydrography very high on his priority list.

Sketch Surveys in Dangerous Ground

Notes

1. These sketch surveys are held by David Hancox and can be obtained by contacting him.

2. The majority of sketch surveys are done on a 1:50,000 scale, although some variations to scales occur on surveys, depending on locality.

3. Surveys and examinations were generally controlled using Barr & Stroud range finder, radar and combinations of vertical and horizontal sextant angles.

4. Owing to lack of ship-borne helicopters in later 1960s, and more latterly 'suspicious' residents there has not been much opportunity to take aerial photographs of reefs and atolls in the Dangerous Ground.

5. All names used are the accepted English charted titles of the island, atoll or shoal concerned.

6. Names in inverted commas under a particular atoll, cay or reef are the names of a ship or marine casualty on that feature from which sketch surveys are derived.

Name of Atoll, Cay or Reef:

Alicia Annie
- See also sketch in Pub-161, page 17.

Alison Reef
- General sketch and leads to cay.

Amboyna Cay
- Sketch survey

Amy Douglas Reef
- (Iroquois Reef area).

Ardasier Bank
- General survey 'Sea Spray' files.
- Surveys for moorings.
- Survey sketches confined to south-western area.

Ardasier Reef
- Sketch survey of anchorage and entrance.

Barque Canada Reef

- See also USHO sketch survey in HO Pub 93.

Bittern Reef
Also known as "*Maralie Reef*".

- Sketch survey of reef limits.
- Sketch survey, north east area.
- See also DMA Pub 161, page 21.

Bombay Castle - as part of *Rifleman Bank*

- 'Geronimo' casualty file.

Bombay Shoal

- *'Salvonia'* file sketches, and photographs.
- Sketch surveys around 'Pompadour'.

Central Reef

- Sketch surveys 1968, revised 1976.

Collins Reef, (in *Union Banks*)

- See *Johnson Reef*.

Commodore Shoals

- Two sets of sketch plans.
- Anchorage diagram for 'FPSO-I'

Cuarteron Reef

- Surveys *'Rendsburg'* casualty, and tidal observations.

Dallas Reef

- See also *Ardasier* sketches.
- Sketches/photos *'Cherry Vinter'* casualty.

Discovery - Great Reef

- See AX-47 surveys, reproduced Pub-161, page 15.

Eldad Reef - Eastern edge *Tizard Bank*

- Sketch surveys - passage entrance.

Erica Reef

- Sketches only.

Fiery Cross Reef
Also known as *North West Investigator Reef.*

- *'Thames Breeze'* surveys.
- Sketches from *'Golden Cape'* Bridge Book.
- Data from tidal observations *'Huntingdon'*.

First Thomas Shoal

Flat Island

- Sketches in *Nanshan Group* folio.

Flora Temple Reef

- See *Western Reef*

Gaven Reefs

- See *Tizard Bank* sketches.
-

Grainger Bank

- See *'Vesthval'* survey sketches.
- Also *'Alexandra'* Anchorage.

Half Moon Shoal

- Sketch survey, also reproduced in Pub-161, page 16.

Hardy Reef

- Rough sketches only.

Herald Reef

- See *South Luconia* surveys for SSP/BSP.
- *'Djatibrono'* bank examinations.
- *'Jiun Ting'* surveys.
- Pipelay route diagrams, surveys, calculations on pipe laying radius bends etc.

Holiday Reef

- See *Union Bank* surveys.

Hopkins Reef

- See *Amy Douglas* sketch surveys.

Hopps Reef

- See *Southampton Reefs* sketches.

Investigator North East Shoal

Investigator Shoal

- Based on US sketches.
- *'Anemasse'* survey sketches.

Iroquois Reef

- See *Amy Douglas Bank* sketches.

Itu Aba Island

- See both Japanese chart and BA 1201, plus ROC-Taiwan surveys. Anchorage sketches and approaches.
- Also revised sketch Pub-161, page 14.

Johnson Reef

- See *Union Banks* survey.
- See also page 86c-'HO 93' and sketch in Pub-161, page 19.

Ladd Reef

- '*Chiei Maru'* sketch surveys.
- *'Tuscany'* sketch survey.

Lan Kiam Cay

- *Loai Ta Reef* sketches.

Livock Reef

- See *Southampton Reef* sketches.

Loai Ta Bank

- Sketches of *South West Cay*
- BA and ROC chart plans.

Loai Ta Island

- BA 1201 and other charts, plus entrance sketches.
- *'Steel Vendor'* sketch surveys and aerial photos.

London Reefs

- Sketches *Central, East* and *West Reefs*

Loveless Reef

- See *Union Bank* sketches and chart.

Luciona Shoals

- See *Connell, Herald* and *Stigant* Reefs.
- SSP and BSP topographic and hydrographic drilling maps.

Lys Shoal

- See also *Trident Shoal*
- *'Safina-E-Najam'* surveys

Maralie Reef
(US name *Bittern Reef*)

- Sketch only, and not very good.

Mariveles Reef

- Sketch surveys
- See also Pub-161, page 21.

Menzies Reef
- Sketches only.

Mischief Reef = Mischief Shoal
- Sketches and chart copies US-DMA 93042.
- Sketch survey on BA and Japanese IJN survey.

Namyit Island
- Sketch, sketch plan in Pub-161, page 13.

Nanshan Island
- Sketch, plus Japanese and ROC plans.

North Danger
- Sketch of cay, entrance leads from *'Safina-E-Najam'* file.
- See also BA 1201; and USHO sketches from *'Iroquois'* surveys (1926).

North Luconia Shoal
(Consisting of *Aitken*, *Buck*, *Hardy*, *Moody* and *Seahorse* shoals.)
- Sketch and *Shell* (BSP) topographic maps.

North Reef
- See *North Danger* sketches.

North-East Cay
- See *North Danger* sketches

Orleana Shoal
- See *Rifleman Bank* sketch.

Pearson Reef
- *'Selatan Dua'* surveys.
- See also Pub-161, page 20.

Pennsylvania Reef
- Sketches only, circuit and 'running survey', inaccurate.

Petley Reef
- See *Tizard Bank* main sketches.

Pigeon Reef
BA name *Tennent Reef*
- Sketch of anchorage and boat passage.
- See page 88a, HO-93, also Pub-161, page 21.

Prince of Wales Bank
- Sketch of 4 fathom reef area.

Rifleman Bank

- See sketches for *Bombay castle* and *Orleana* shoals.

Royal Captain Shoal

- M/Salvtug *'Winson'* surveys.
- M/Salvtug *'Maria Rosello'*.
- *'Donada'* surveys.
- *'Shannon'* surveys.

Royal Charlotte Reef

- Sketch survey *'Cherry Vinter'*
- Construction Proposal SSP maps of area.

Sabina Shoal

- Enlarged detail from *'Frederich Engels'* surveys.
- *'Farallon Glory'* surveys.

Sand Cay

- See *Tizard Bank* sketches.

Seahorse Breakers

- Shell/BSP surveys and constructors surveys.

Seahorse Shoal

Also known as *'Routh Breakers'* on BA charts.

- Enlarged sketch survey from US and BA charts.

Second Thomas Shoal

- Sketch surveys based on US data, entrances to lagoon.
- Also Pub-161, page 17.

Sin Cowe Island

- Sketch of East Entrance, cay and general approaches.

South Luconia Shoals

- See *'Aeakos'* survey on *Richmond Reef*.

Southampton Reefs

- See *Hopps Reef* plan.
- See *Livock Reef* sketches.

Southern Bank

- See sketch survey *Foulerton Patch*.

Spratly Island

- Sketch survey 'Spratly Anchorage' - with leads and anchorage.
- See BA 1201 - (1951 *Dampier* surveys).
- See USHO 5657 - includes plan of Spratly island.

Stigant Reef

- See *South Luconia Shoal*

Subi Reef

- See BA 1201.
- Sketch survey of cay entrance.
- Charted on US ROC-Taiwan, and Japanese IJN charts.

Swallow Reef

- See sketch surveys
- Salvage file *'Cherry Vinter'*.

Third Thomas Shoal

- See sketch survey.
- Noted as *Hopkins Reef* on our sketches.

Thitu Island and Reefs

- See BA 1201.
- Also JMSA and USHO charts.
- Sketch survey of anchorage.

Tizard Bank

- Sketch survey of anchorage.
- See also BA 1201 and derivatives in JMSA/IJN charts, ROC surveys.

Trident Shoal

- See sketch survey *'Capetan Costis 1'* August 1966.
- *'Safina-E-Najam'* salvage files.
- Trident Shoal not to be confused with Triton Shoal/Island, otherwise known as 'Treasure' or 'Not Again' Island, lying south-west of Paracel Islands.

Union Banks and Reef

- See sketches in *Sin Cowe Island*.
- JMSA, ROC and USHO/US-DMA charts.

Vanguard bank

- *Anzuk* delineation sketches, and target moorings.

West London Reef
Also known as *'West Reef'*

- Sketch plans of cay entrances.

West York Island

- BEJ's notes/sketches.
- Sketch and views of cay in *Golden Cape's* Bridge Book.

Western Reef

Sketch surveys made from two passages.

Appendix III: Geographical Index

Features such as islands, rocks, reefs and shoals are listed alphabetically followed by the number of the entry in the descriptive section.

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[17] Curiously while he was up a tree with a mobile telephone!

[18] This book was never released by the Admiralty and few copies have survived outside the Hydrographic Office archives.

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[19] This is one sheet containing three maps of Spratly Islands (1:2 millions), Paracel Islands (1:800,000) and South China Sea (1:8.5 millions) with a list of place names in English, Chinese, Malaysian, Filipino, Vietnamese and French on the reverse.