

# The Method for Delimiting the Maritime Boundary in the Internal Waters Between Ba Ria-Vung Tau Province and the Coastal Provinces of Vietnam

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DOI: <https://doi.org/10.52939/ijg.v18i5.2371>

## Abstract

*The study is based on the legislative documents and the locality's management situation, which propose defining maritime boundaries in the internal waters of the Baria-Vung Tau coastal province of Vietnam. Defining the boundary is a legal document that serves as a foundation for local administrative management as well as a document that supports relevant policies, such as clearly defining the scope of objects operating in local waters. This is also a document for local governments to use as a foundation for marine resource management, determining the extent of marine space for planning purposes, and allocating a portion to organizations and individuals to use and exploit by Vietnamese government regulations. The national topographic map of the VN2000 system established by the Ministry of Natural Resources and Environment has been adjusted and supplemented with the latest data used to build the plan. The determination of maritime boundaries has been technicalized and applied in many countries. All methods are based on the fairness principle, which two sides can agree to and accept. The results provide technical solutions to define maritime boundaries based on coastal morphological characteristics, management situation, and legal documents of the State of Vietnam.*

**Keywords:** Administrative Boundaries, Maritime Boundaries, The Major Direction

## 1. Introduction

Ba Ria-Vung Tau province has 8 district administrative units. One of them is an island district (Con Dao) (Committee for Ethnic Affairs, 2022). The administrative boundaries include the mainland and the sea (Prime Minister, 2012). Administrative boundaries are a content element of a geographic database for regional, territorial planning, and other tasks. The administrative boundary of the mainland has been determined according to the 364-CT Directive of November 6, 1991 (Council of Ministers, 1991). Many problems need to be solved at sea, such as anti-smuggling investigations, handling of accidents at sea, investigating means of a violation of maritime regulations of Vietnam, or settling disputes regarding the exploitation of coastal resources in localities. Therefore, the determination of maritime boundaries is necessary to make legal documents on marine space management, which it can be assigned to organizations and individuals to use and exploit

under the regulations of the State of Vietnam (Vietnamese Government, 2021).

The extent of maritime space is regulated by the International Convention on the Law of the Sea (Treves, 2008), which is concerned with determining maritime boundaries' legal and technical issues. On November 12, 1982, the Government of the Socialist Republic of Vietnam announced the baseline used to calculate the width of Vietnam's territorial waters (Socialist Republic of Vietnam, 1982). Vietnam declared the sea area inside the baselines and bordering the coast as the internal waters of Vietnam (Socialist Republic of Vietnam, 1977; The National Assembly, 2012). The administrative land boundary documents use the national topographic map of the VN2000 system (Ministry of Natural Resources and Environment, 2014), so the maritime boundary is also shown on the topographic map of the VN2000 system.

On land, national and administrative boundaries can be described by geographical objects such as rivers, streams, and waterways and are marked on the ground by national border markers and administrative boundaries. For maritime boundaries, the survey and demarcation in the field are not feasible. The determination of sea boundaries is carried out at the office and shown on the map (or chart) will be the measure used (Lévesque et al., 2008 and Palikaris and Mavraeidopoulos, 2020).

Based on the equidistant line, maritime boundaries are defined for administrative units with opposite or adjacent coastlines to determine administrative boundaries at sea in internal waters for administrative units in the country. The method of using concentric circles is based on the theory that the center of the circle is evenly separated at any point on the circumference of that circle. Depending on the distance, the radius increases or decreases for areas where the boundary is opposite so that the circle is in contact with points on both coastlines of the administrative units to be determined. The boundary line is determined by connecting the distance points of the circles' centers (Antunes, 2002; International Hydrographic Organization (IHO), 2006, 2014; Macaspac, 2002; National Mapping and Resource Information Authority, 2001; Beazley, 1994).

This study considered the determination of maritime administrative boundaries in the internal waters of Ba Ria-Vung Tau province with relevant coastal provincial administrative units.

## 2. Materials and Methods

### 2.1 Study Areas and Materials

The research area is the Ba Ria-Vung Tau province of Vietnam, consisting of land borders, maritime boundaries, and island area boundaries. The province of Ba Ria-Vung Tau shares land borders with Binh Thuan province to the east, Ho Chi Minh City to the west along the Thi Vai River, Dong Nai province to the north, and the East Sea to the south. The Con Dao district is an island district. The data sources used include:

- (1) The national topographic map of the VN2000 coordinate system, which is used to show administrative boundaries at sea.
- (2) The map shows the administrative boundary line of the mainland.
- (3) Baseline of Vietnam.

The mainland is described as follows in administrative boundary records: The provincial administrative boundary of Ba Ria-Vung Tau and Binh Thuan (Figures 1, 2) begins at a position

known as (DN-BT-BRVT) and ends at a point known as (BT-BRVT). The starting location is at the summit of May Tao mountain, in the major south-southeast direction. This is where the provinces of Dong Nai (abbreviated to DN), Binh Thuan (abbreviated to BT), and Ba Ria-Vung Tau meet (abbreviated to BRVT). The boundary line mostly follows rivers, streams, and land-based topography. The overall length, including the 09 landmarks and 02 characteristic points, is 37,001.4 m. Ba Ria-Vung Tau and Dong Nai (Figures 3, 1) begin at a point known as (BRVT-TP.HCM-DN). The place where Ba Ria-Vung Tau (abbreviated to: BRVT), Ho Chi Minh City (abbreviated to: TP.HCM), and Dong Nai provinces intersect (abbreviated to: DN). The administrative border runs east-northeast from the starting point, mostly following waterways, decomposition, and land-based features, and finishes at the characteristic point (DN-BT-BRVT) at the top of May Tao Mountain. The total length is 117,148.1m, including 06 provincial border landmarks and 07 characteristic points.

The provincial administrative boundary of Ba Ria-Vung Tau and Ho Chi Minh City (Figures 3, 4) starts with a point named (BRVT-TP. HCM-DN), which is the boundary point in the middle of Ho Chi Minh City (abbreviated to: TP.HCM) and Dong Nai province (abbreviated to: DN) and Ba Ria-Vung Tau province (abbreviated to: BRVT). From the starting point at the intersection between Tac Ong Co and the Thi Vai River, the administrative boundaries follow the river in the south-southwest direction to the characteristic point named (BRVT-TP. HCM). This point is located at the mouth of the Cai Mep River. The total length is 16,389.7 m, including the two characteristic points. According to administrative history documents, the Con Dao district has repeatedly changed the name of the administrative management unit. Con Dao district has been a part of the Ba Ria-Vung Tau province since August 1991.

### 2.2 Research Need and Design

It has been more than 20 years since the set of administrative boundary documents for the mainland was established, the process of socio-economic development in the period of industrialization and modernization of the country has led to the speed of urbanization in rural areas and the establishment of new urban areas and economic zones, export processing zones, and the change of natural topography due to landslides, changes in flow have distorted and significantly changed the administrative boundaries.

### Legend for Figures 1-4

- The administrative boundary of the province (city)
- The administrative boundary of the district
- The administrative boundary of the commune (ward, town)
- 2T.1 The administrative boundary's pillar of the province (city)
- 2H.1 The administrative boundary's pillar of the district
- 3X.1 The administrative boundary's pillar of the commune (ward, town)
- ⊙ (BT-BRVT) Characteristic point on the administrative boundary

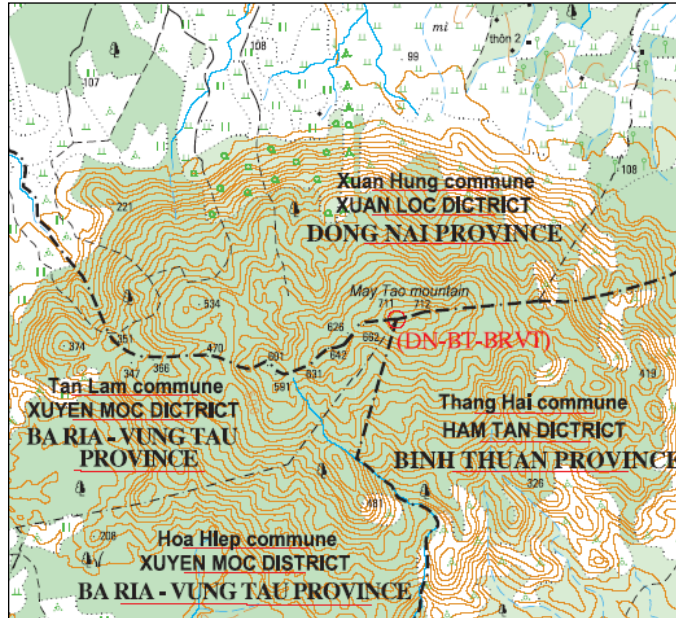


Figure 1: The Point (DN-BT-BRVT) shown on the topographic map is symbolized as C-48-36-A (6530 IV)

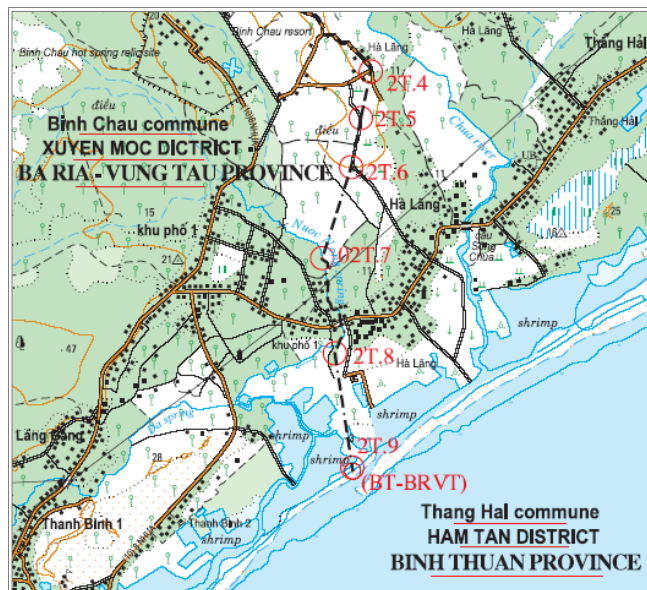


Figure 2: The Point (BT-BRVT) shown on the topographic map is symbolized as C-48-36-C (6530 III)

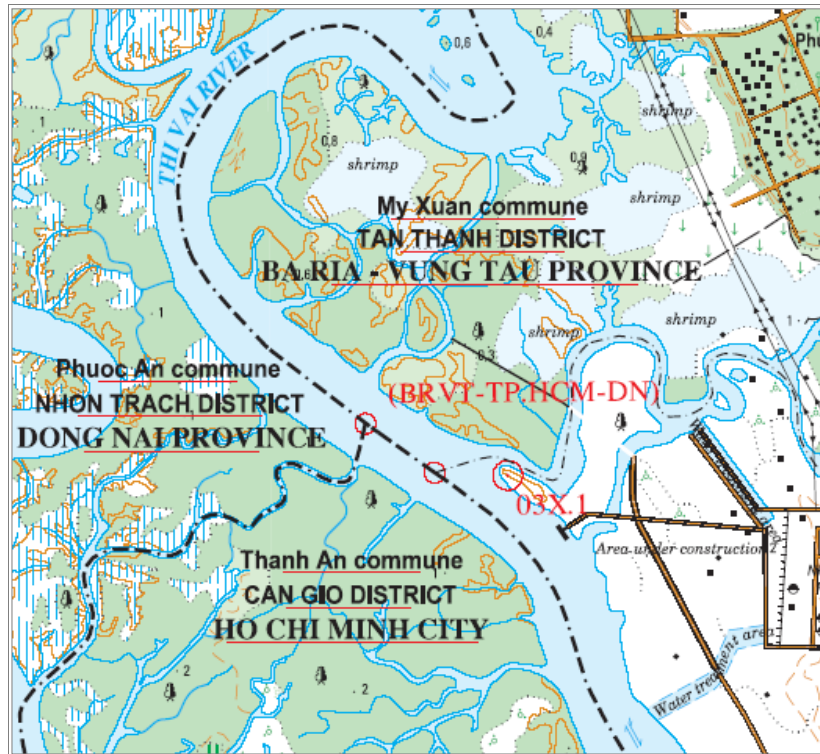


Figure 3: The Point (BRVT-TP.HCM-DN) shown on the topographic map is symbolized as C-48-35-C (6430 III)

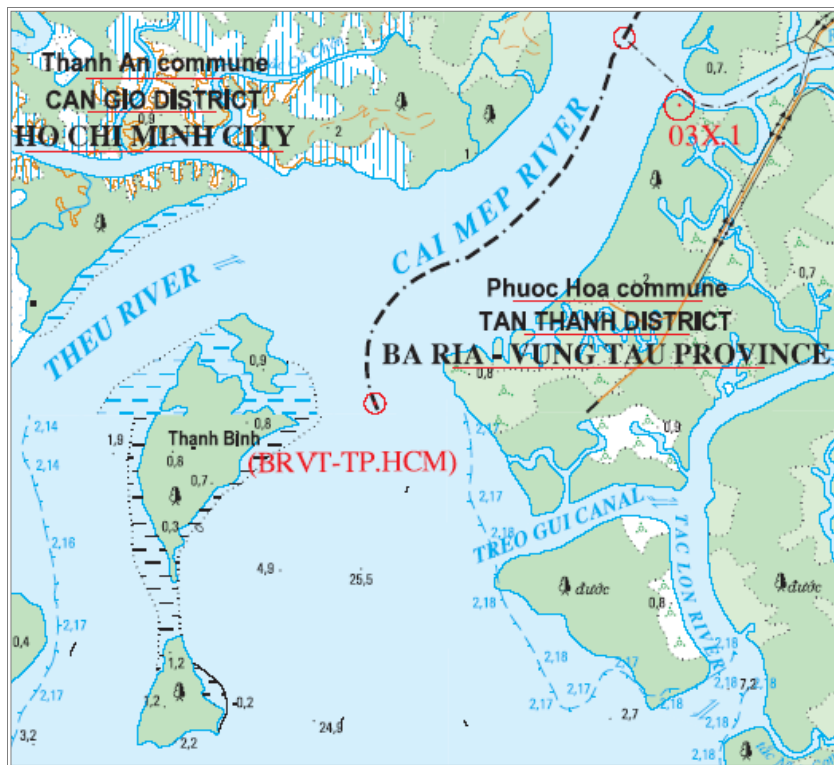


Figure 4: The Point (BRVT-TP.HCM) shown on the topographic map is symbolized as C-48-34-D (6330 II)



The National Assembly and the government have promulgated many documents to expand, upgrade, split, and merge administrative units. In the current period, the need for marine economic development, exploitation of resources from the sea, security issues at sea, maritime order, and safety is urgent. With the development of science and technology, updating, adjusting, and supplementing administrative boundaries to meet state management requirements must be timely to maintain completeness, accuracy, consistency, and a legal basis. administrative boundary map, including administrative boundaries on the mainland and administrative boundaries at sea (National Assembly, 2013).

In Vietnam, boundaries at all levels include administrative boundaries at provincial, district, and commune levels (Ministry of Natural Resources and Environment, 2014; National Assembly, 2013). The maritime border area extends from the national sea border to the entire administrative boundary of communes, wards, and townships bordering the sea, islands, and archipelagos (National Assembly, 2013; The National Assembly of the Socialist Republic of Vietnam, 2003). In this study, only the provincial boundary of Ba Ria-Vung Tau province is proposed in the internal waters. This study proposes the principle of naming and numbering points on the maritime administrative boundary line as follows: The administrative boundary line of the mainland ends at point zero. The point's name is an abbreviation for the administrative unit of the relevant province or city. The point (BT-BRVT), for example, is the final point on the mainland administrative boundary line of the provinces of Binh Thuan and Ba Ria-Vung Tau.

Point 1 is the intersection between the extended land boundary line and the lowest average sea level in many years, shown on the national topographic map of the VN2000 coordinate system. For estuaries and bays, point 1 will be the point on the straight line that closes the mouth of the river or bay. The point name is the abbreviation of the relevant province or city, plus the number 1. For example, point (BT-BRVT)1 is a point on the maritime administrative boundary line of the provinces of Binh Thuan and Ba Ria-Vung Tau. This is the point of intersection with the sea edge at the lowest average in many years.

Point 2 is the intersection between the maritime administrative boundary line and the baseline. The name of the point is the abbreviation of the relevant

province or city plus the number 2. For example, point (BT-BRVT)2 is the intersection point of the maritime administrative boundary of Binh Thuan province and Ba Ria-Vung Tau province with the baseline.

In addition, other characteristic points on the maritime administrative boundary line can be numbered according to Arabic numerals. For example, points 1, 2, and 3.

### 2.3 Methodology

Based on Vietnam's legal documents, respecting the local management status, the maritime boundary ensures fairness and simplicity by administrative management conditions; the administrative boundaries at sea continue and are close to the administrative boundaries on land. The process of determining the maritime boundary of Ba Ria-Vung Tau province is shown in Figure 7 (Sutherland et al., 2002).

The equidistance approach is the most fundamental way of defining maritime boundaries. When there is no agreement on boundaries, this strategy is utilized. Following this strategy frequently results in a large number of points that lead to complex borders. As a result, it can be altered by reducing the number of boundary segments while retaining the general direction. The other option is for stakeholders to swap equal-sized sections to get acceptable result (Carleton et al., 2002; Beazley, 1994). The method is related to the major direction of the coast used for adjacent administrative units. The major direction is set in the direction of the coast or perhaps a portion of the coastal area. The method was based on the usage of a common coast direction for nearby administrative divisions. The major direction is established by the coast or perhaps a portion of the coastal area (Fietta and Cleverly, 2016). However, there is frequent debate over which part of the shoreline should be used to identify the major direction (Carleton et al., 2002).

The administrative boundaries of the land section continue to stretch to form a right angle (90 degrees) to the major direction of the coast, the boundary at sea in the same direction towards the intersection with the baseline. This method is chosen and considered as a balanced and simplified line. The agreement method is a plan where two administrative units negotiate and reach an agreement. The results are recorded and submitted to the competent authorities for recognition.

### 3. Result and Discussion

#### 3.1 Result

According to the procedure shown in Figure 7:

(1) The morphological characteristics of the coastal the study area can determine the major direction of the coast is the line connecting the two points I-II. Determine the most protruding position at Point I is located at the tip of Sung Trau (also known as Ca Na cape), on the coast of Ninh Thuan province. Point II is located on the coast of Ca Mau province.

(2) Landmark 2T.9 is located on the provincial administrative boundaries of Ba Ria-Vung Tau and Binh Thuan. The land-based administrative boundary line pulls straight out to meet the shoreline at the point (BT-BRVT). This is the last point of the provincial administrative boundaries on the mainland of Binh Thuan and Ba Ria-Vung Tau. From the characteristic point (BT-BRVT) erect the right angle (90 degrees) with the major direction of the coast, intersecting with the average water level for many years at the location (BT-BRVT)1, intersecting with the baseline at the location (BT-BRVT)2.

(3) The Provincial administrative boundary of Ba Ria-Vung Tau and Ho Chi Minh City delimits the boundary on the Cai Mep River.

*Point 1* is located equidistant, a distance of  $a = 1052$  m from the farthest protruding point of Con Cho mound, Phu Lang Isle, and an unnamed mound.

*Point 2* is located equidistant at a distance of  $b = 3641.5$  m from the farthest protruding point of Phu Loi islet, Can Gio cape, and Mieu Ba islet.

*Point 3* is located at a distance of  $c = 4791$  m from the farthest protruding point of Ganh Rai cape, Can Gio cape, and the protruding point of the mainland in Ba Ria - Vung Tau province.

*Point 4* is located evenly from the farthest protrusion point of the Cai Da Trang Cape, on the tip of the Ganh Rai Cape in Ba Ria-Vung Tau province, and the most protruding part of Ho Chi Minh City by a distance of  $d = 4665.5$  m. The administrative boundary passes through point 4 and cuts the middle

point of the closing section of Ganh Rai Bay at the marker on the map is point (BRVT-TP.HCM)1. The straight section that connects Point A on the O Cap Cape (Ba Ria-Vung Tau) and Point B near Dong Tranh Cape (Ho Chi Minh City) closes the Ganh Rai Bay. From the location (BRVT-TP.HCM)1 erect the right angle (90 degrees) with the major direction of the coast and extend to the baseline at the location (BRVT-TP.HCM)2.

(4) Determining the maritime boundaries of the Con Dao district (Ba Ria-Vung Tau) - Figure 8.

*\*Case 1:* the islands of the island district are considered to be valid as the mainland; the furthest locations of the islands in the Con Dao district are connected to limit the scope of the district and find the equidistant line of the distance between the limit line and the multi-year average water level of the coastal provinces (Figure 9). Ba Ria-Vung Tau and Bac Lieu provincial maritime boundaries include points (BRVT-BL), 1, 2, and (ST-BRVT-BL). Ba Ria-Vung Tau and Soc Trang provincial maritime boundary include points (ST-BRVT-BL), 1, 2, and (BRVT-TV-ST). Ba Ria-Vung Tau and Tra Vinh provincial maritime boundary include points (BRVT-TV-ST), 1, 2, 3, and (BRVT-TV). Table 1 contains a list of coordinate points in the Con Dao district of Ba Ria-Vung Tau province, case 1.

*\*Case 2:* Con Son Island is assigned a validity of 6 nautical miles. Define the 6-nautical-mile limit of the island, reducing points to create limited sections (figure 10). Con Son Island's boundary range includes points (ST-BRVT)2-1, 1, 2, 3, 4, 5, 6, (ST-BRVT)2-2. Table 2 contains a list of coordinate points in the Con Dao district of Ba Ria-Vung Tau province, case 2. For the district Con Son island district area, Ba Ria - Vung Tau province was implemented, and it will need to have the exchange and unity of the relevant localities. After negotiating and agreeing on the expressed boundaries, a dossier shall be submitted to the competent authorities for approval as prescribed. In case of failure to reach an agreement, localities shall present their local views on the contents of the settlement as prescribed (Minister of Home Affairs, 2008).

Table 1: Case 1- Ba Ria-Vung Tau province, list of coordinate points of Con Dao district

No	Points	Latitude N	Longitude E
1	(BRVT-BL)	8°30'03.7498"	105°42'19.0427"
2	1	8°42'22.8033"	105°42'19.6121"
3	2	8°48'29.4184"	105°46'15.2174"
4	(ST-BRVT-BL)	8°55'31.8771"	106°03'22.2943"
5	1	8°57'12.5667"	106°07'27.4852"
6	2	9°00'07.0601"	106°19'19.4402"
7	(BRVT-TV-ST)	9°09'22.3699"	106°35'22.5908"
8	1	9°09'55.0224"	106°36'19.2935"
9	2	9°10'15.2588"	106°48'26.7746"
10	3	9°04'13.7634"	106°59'48.9429"
11	(BRVT-TV)	8°53'44.5328"	107°07'16.8710"

Table 1: Case 2- Ba Ria-Vung Tau province, list of coordinate points of Con Dao district

No	Points	Latitude N	Longitude E
1	(ST-BRVT)2-1	8°42'41.4734"	106°47'17.1488"
2	1	8°48'29.9936"	106°45'04.8837"
3	2	8°50'22.2114"	106°42'20.5639"
4	3	8°51'24.6946"	106°37'41.0545"
5	4	8°45'39.3911"	106°30'02.7018"
6	5	8°43'40.6028"	106°28'15.8641"
7	6	8°39'25.8993"	106°27'33.6966"
8	(ST-BRVT)2-2	8°36'45.5093"	106°28'51.8336"



Figure 1: Characteristic points on the provincial administrative demarcation line between Ba Ria Vung Tau and Ho Chi Minh City. The defined boundary is the blue boundary that resembles the simplified line from the red boundary line in Figure 6

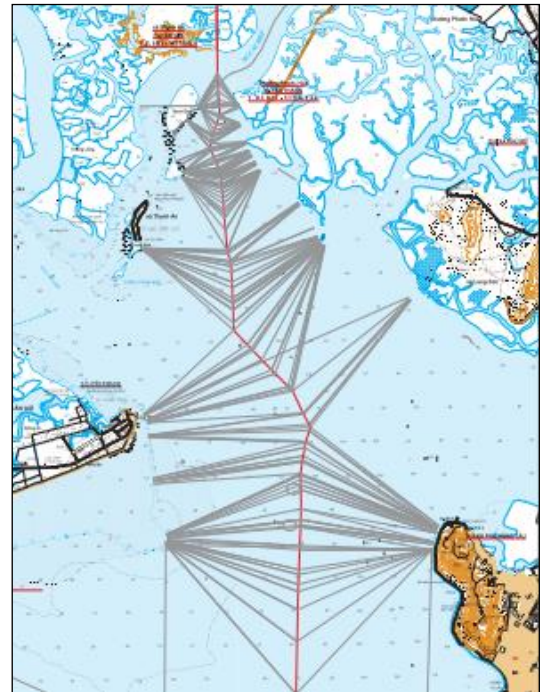


Figure 2: Use CARIS LOTs software for the identification of equidistance lines (red lines) (Lévesque et al., 2008 and Palikaris and Mavraeidopoulos, 2020).





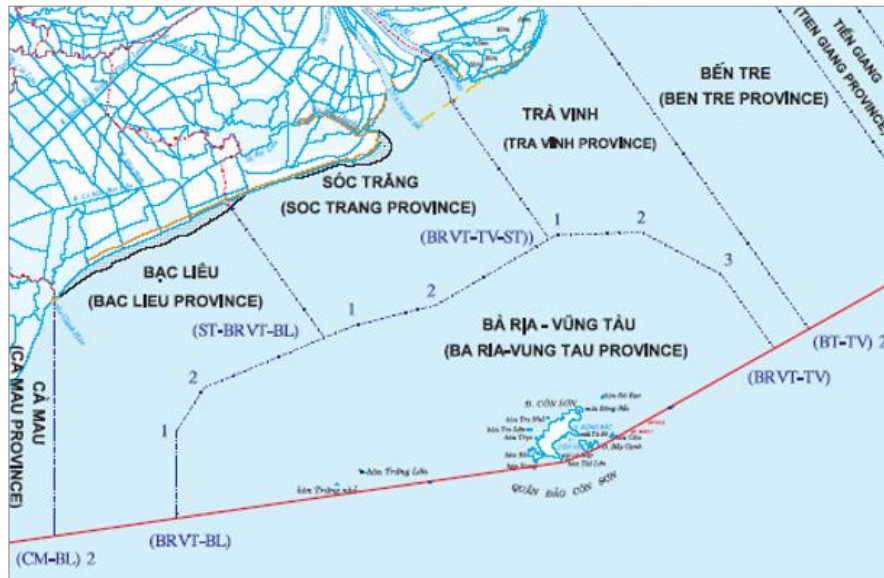


Figure 9: Boundary division by case 1

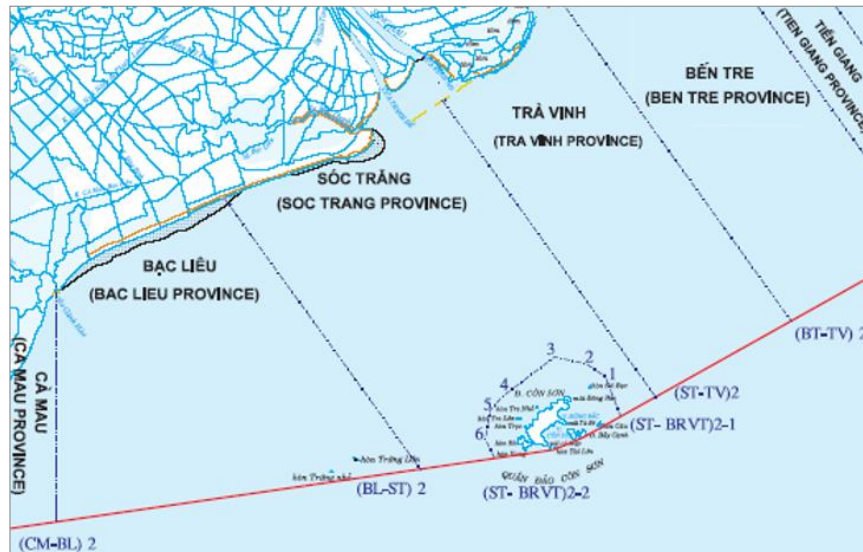


Figure 10: Boundary division by case 2

### 3.2 Discussions

The administrative boundaries of Ba Ria-Vung Tau province and Ho Chi Minh City demarcate the boundary on the Cai Mep River mentioned in section 3.1 (Figure 5) used by the equidistance line between the coasts.

Draw circles tangent to the coast. Connecting the centers of the circles is an equidistant line. The method of using concentric circles is based on the theory that the circumference of the circle is tangent to the shoreline of the administrative unit on the opposite coast. The size of the radius of the circle depends on the shape of the opposite shoreline. The boundary line is formed by connecting the points

corresponding to the centers of the circles. If the number of circle centers is numerous, the boundary line will have too many points, so it is common to use the solution to reduce the number of points to simplify the generated boundary segment and facilitate the line description. This study also practiced using a Computer-Aided Resource Information System-Law of the Sea (CARIS LOTS) to calculate (Figure 6). When comparing the boundary line created by the CARIS LOTS software (figure 6) with the boundary line created by the method of connecting the centers of the circles in Figure 5, the boundary lines are similar.

Simplifying the boundary line created by the support software will create a boundary line that is almost identical to the simplified boundary line in Figure 5. Thus, the boundary determination follows the method of connecting the centers of concentric circles and can be applied to define boundaries for other areas with opposite shorelines, for example at the district and commune levels. This method is simple and easy to apply to localities where they do not have the conditions to invest a lot of money for the purchase of supporting software.

#### 4. Conclusion

The determination of provincial boundaries in the internal waters of Ba Ria-Vung Tau province and coastal provinces and cities of Vietnam is carried out according to technical methods and ensures fairness. The provincial boundary line in the internal waters must ensure attachment between the sea boundary managed by the state and the maritime boundary of the province. The determination of maritime boundaries in the internal waters must also be ensured as a basis for the planning of marine space and integrated management of the sea area (Athanasidou et al., 2017; Djunarsjah et al., 2022). From the provincial boundary line, it is possible to determine the boundary lines for administrative units at the district level and then at the commune level. The results of the analysis of the status of administrative boundaries management and the current documents of the State of Vietnam serve as the basis for determining technical and technological solutions.

The selected boundary determination methods are plans of determining the major direction of the coast in combination with the distance method, evenly depending on the location of the administrative units involved. The technical solution is simple, easy to apply, ensures fairness, and is easy to convince stakeholders to accept. The proposed demarcation plans clearly define the scope of administrative boundaries management for provinces and cities in the research area by the management status, have legal grounds for the sections of boundaries approved by competent authorities; technical solutions for each area are feasible in practice.

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