DO SOLUTIONS TO INTERNATIONAL SECURITY ISSUES OF POORLY DEFINED MARITIME BOUNDARIES REQUIRE LEGAL, POLITICAL, AND TECHNICAL TOOLS

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Abstract

The Kingdom of Thailand (hereinafter “Thailand”) and the Kingdom of Cambodia (hereinafter “Cambodia”) claimed maritime zones independently, resulting in overlapping territorial claims area over the Gulf of Thailand. Starting to find the solution for overlapping claims area, 18 June 2001 Thailand and Cambodia had signed a Memorandum of Understanding between the Royal Government of Cambodia and the Royal Thai Government regarding the Area of their Overlapping Maritime Claims to the Continental Shelf. However, negotiations have made no progress under the framework of the MOU 2001. Different aspect on historic title and special circumstance makes negotiation freeze. The features unilaterally used by coastal States for delineating median line sometime are not appropriate to be the control points of median line such as rocks exceeding 12 nautical miles. Selection of features is the first step for drawing median line. Disagreement on selected features is the one of many reasons to obstruct the negotiation progress.

This paper aims at reducing the vagueness of immediate vicinity, which is not clear in the LOS Convention, by using mathematic calculation. The Equi-Area/Ratio is a method for maritime delimitation. Adjustment of the provisional median line of existing methods, such as partial effects, is one dimension adjustment by moving of the provisional median line. The Equi-Area/Ratio is two dimension adjustments because this method will be based on equal areas consideration. The Equi-Area/Ratio is proved by testing with maritime boundary judgements from the International Court of Justice, ICJ, especially case of Nicaragua and Colombia. The result shows that The Equi-Area/Ratio is applicable for maritime delimitation. The most potential of the method is that every feature can be inputted for calculation. As such it addresses the issue of disagreement on selecting features if the Equi-Area/Ratio is applied for maritime delimitation.

Significant difference of median lines between Cambodia and Thailand is from features which are unilaterally selected for median line delineation. For Thailand median line, the basepoints are from Thailand’s offshore features and Cambodia’s coastline and vice versa. Using all the most seaward features, the Equi-Area/Ratio is the optional method for coastal States, Cambodia and Thailand, to find the equitable solution.

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Acronyms

DOALOS	Division for Ocean Affairs and the Law of the Sea

LOS Convention	The United Nations Convention on the Law of the Sea 1982
ICJ	International Court of Justice
IHO	International Hydrographic Organization
ITLOS	International Tribunal for the Law of the Sea
TALOS	A manual on Technical Aspects of the United Nations Convention on the Law of the Sea 1982

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Part I Overlapping claim area in Gulf of Thailand

Geographically, the special publication Nº23 of International Hydrographic Organization (IHO) defined the closing line at the south of the Gulf of Thailand as "A line running from the Western extreme of Cambodia or Camau Point (8º36´N) to the Northern extreme of the point on the East side of the estuary of the Kelantan River (6º14´N, 102º15´E)".[1] The Camau Point is in Vietnam and the Kelantan River is in Malaysia. This line separates the Gulf of Thailand from the South China Sea. The Gulf of Thailand is surrounded by four countries: Cambodia, Malaysia, Thailand and Vietnam. By surrounding the Gulf of Thailand on the East, North and West, Thailand's coastline dominates the Gulf of Thailand with the longest coastline compared with the coastlines of Cambodia, Malaysia and Vietnam altogether. On the west side of the Gulf of Thailand are Thailand and Malaysia from the North to the South respectively. On the northern side of the Gulf of Thailand is Thailand's Historic Water. Cambodia, Vietnam and Thailand are countries on the eastern side of the Gulf of Thailand. The Gulf of Thailand has maximum depth 82 meters, the depth around the middle of the Gulf of Thailand about 50 – 70 meters and mean depth about 45 meters.[2] The area is about 300,858.76 square kilometers or 87,716.379 square nautical miles.[3] The maximum width parallel to latitude is about 659.122 kilometers or 355.897 nautical miles. Along Cambodia and Vietnam's coastlines are groups of islands, an isolated island, fringe islands, groups of rocks, and isolated rock. The most seaward feature is Hon Tho Chau about 88.474 nautical miles from the Vietnamese mainland. Moving a little to the north around the terminus point of the land boundary between Cambodia and Thailand, there are two big islands, one Koh[4] Kong which is the sovereignty of Cambodia and Koh Kut which is the sovereignty of Thailand. The shortest distance between them is about 24.49 nautical miles. The western side of the Gulf of Thailand has similar features as those in the east. The biggest island is Ko Samui one of the most popular islands for tourists. There are two more seaward isolated features on offshore Thailand, Ko Losin about 39.56 nautical miles and Ko Kra about 29.22 nautical miles from mainland. All of the most seaward features on both sides are used for straight baseline delineation. The geography of the Gulf of Thailand is concave, the normal shape for a gulf, because of which, and in the absence of agreements, it is difficult to avoid overlapping of maritime zones. The complexity of the overlapping claim areas in the Gulf of Thailand is various, but the unilateral submission for maritime zones by States. Two or more States have reached agreement these to have been criticized by States both inside and outside the region. There are several agreements in place within the Gulf of Thailand, such as the Historic Water between Cambodia and Vietnam, the maritime delimitation between Thailand and Vietnam and

[1] Limits of oceans and seas, IHO special publication No.23 3rd Ed.1953, para.47.
[2] Thai Nautical Charts No.045, 7th Edition, Sept., 2003.
[3] Hydrographic Department, Royal Thai Navy.
[4] Kaoh, Koh and Ko in Thai language mean island.

the joint developing area between Malaysia and Thailand. The maritime case the Gulf of Thailand is studied and documented by many researchers such as Clive Schofield (Maritime boundary delimitation in the Gulf of Thailand), J.R.V. Prescott (The maritime political boundaries of the World) or International Maritime Boundaries by Jonathan I. Charney and Lewis M. Alexander.

In the Gulf of Thailand, it seems that Cambodia and Thailand are the more fortunate States unlike Malaysia and Vietnam whose maritime zones are complicatedly by overlapping issues with neighboring coastal States in the South China Sea. Nevertheless, agreement between Vietnam and Malaysia would complete the issues within the Gulf of Thailand. With Cambodia Vietnam declared the joint historic water, with Thailand Vietnam delimited the maritime boundary. For Malaysia, there is a joint developing area with Thailand. Cambodia and Thailand are neighboring countries sharing land boundary staring in land and ending at the terminus point where the land meets the sea. Because of geography, Cambodia and Thailand are considered to be both adjacent coastal States at the terminus point and opposite coastal States. The overlapping claim area between Cambodia and Thailand will be the landward maritime zones, territorial zones and continuous zone, and seaward maritime zone continental shelf. The landward maritime zones, territorial sea and continuous zone, seem to be easier than continental shelf if they are delimited topologically. Because of special circumstance which can be considered to achieve an equitable solution for maritime delimitation, the starting point for delimitating maritime zones is vague because the position of the starting point, the terminus point of land boundary, is unilaterally coordinated. For opposite States, the most overlapping maritime zone which actually is the most seaward is continental shelf. Cambodia and Thailand prefer the equitable line. The lines unilaterally are drawn in different special circumstance causing maritime zone to overlap.

Chapter 1 Maritime claims in Gulf of Thailand

The unilateral claims, Vietnam in June 1971, Cambodia in July 1972 and Thailand in 1973, in the Gulf of Thailand were in 1970's decade. The time of independent claims was under the 1958 Geneva Conventions on the Law of the Sea. The details of the Conventions are about territorial

sea, contiguous zone, continental shelf and high sea. Because of geographic limitation, maximum continental shelf claims of coastal States will be overlapped. The median line of each coastal States is delineated and based on own opinion. The control points which are relevant to either adjacent or opposite States are chosen without opinion from relevant States. To meet the equitable solution median line is adjusted by special circumstance. The special circumstance is stated in both the 1958 Geneva Conventions on the Law of the Sea (the 1958 Geneva Convention) and the 1982 United Nations Convention on the Law of the Sea (LOS Convention) for equitable solution. The unilateral claims cause the problem for the negotiation in the overlapping claim areas. No coastal State can accept the claim of the other State. Nevertheless, irrespective of when a unilateral claim is made, this does not deny a later claim the same rights. Ideally, if the coastal States together negotiate to draw the median line before claiming the maritime zone, it seems to be easier than negotiating median line in the overlapping claim area. The negotiation after claims of maritime zone independently seems to be harder.

1.1 Section A. Treaty, bilateral and agreement

1.1.1 Colonization era

Historic the regimes of the sea can be divided into two categories the Mare Clausum (Closed sea) and Mare Liberum (Free sea). The historical of maritime boundary is described in the TALOS as that.

> The first known line drawn in the seas of the world was declared in 1493 by the Bull *Inter Caetera* by Pope Alexander VI. He declared that the islands and mainlands to the west of a meridian of longitude 100 leagues west of the Azores and Cape Verde, through Brazil were to be considered Spanish and those to the east of this meridian to be Portuguese, provided no Christian king was in actual possession of the territory.
>
> This meridian was adjusted in 1494 by the Treaty of Tordesillas between Spain and Portugal westwards to a line 370 leagues to the west of the Cape Verde Islands. The "Eastern Sea" was divided between Spain and Portugal by the Treaty of Zaragoza of 1529. Again a meridian of longitude was used running through the centre of Australia with the lands to the east being Spanish and to the west Portuguese. In the United Kingdom James I of England declared the "King's Chambers" in 1604. This Proclamation enclosed seas around England and Wales joining some 27 headlands with straight lines and declared that the water thus enclosed were under the sovereignty of the King. Diagrams of these claims can be found in "Lines in the Sea" edited by Francalanci and Scovazzi.[5]

[5] A manual on technical aspects of the United Nations Convention on the Law of the Sea, 4th Edition.

Mare Clausum was unfair for the powerless State at that time.

> In contrast to early claims to control the seas, in the early seventeenth century the right of the freedom of the seas was contained within a treatise by Grotius entitled *Mare Liberum*. This work purported to prove that there was a right to trade freely and was published as a direct challenge to the Portuguese claim to the "Eastern Seas". So already by the seventeenth century there were two camps – coastal State control and freedom of the seas - that remain to this day. However it was accepted by both camps that coastal States did have a right to control waters close to their land territory, by force if necessary. The "cannon shot" rule, as it became known therefore grew to mean control of inshore waters by the use of cannon on headlands and other promontories. This in turn developed into a general recognition that one marine league around the coast was under the control of the State that owned the coast.[6]

The colonization era in the area around the Gulf of Thailand was during 1970s. Cambodia and Vietnam were colonized by France whereas Malaysia was colonized by the Great Britain. Only, Siam (then Thailand) was the independent State. During the colonization Siam and France, on behalf of Cambodia, had signed treaties relating to land boundary. During 1904 – 1908 for land boundary treaties, sea is freedom according to customary law as Freedom of the Sea.[7] The coastal State can claim territorial sea 3 nautical miles from coastlines, beyond 3 nautical miles are high seas.[8] Every coastal State equally has right on natural resources and no coastal State can claim seabed, air or water on high seas.[9] This norm had accepted since the seventeenth century until 1958, it meant that during the colonization era there were no maritime boundaries[10] around the Gulf of Thailand In the colonial period, Britain occupied the area that in due course became Malaysia, while France eventually secured dominion over 'Indochina', and area comprising Cambodia, Laos and Vietnam.[11] The intervention of the colonial powers led to the conclusion of boundary treaties which in large part define the land boundaries and distribution of territory between the four Gulf of Thailand littoral states.[12] These treaties are therefore fundamental to the Gulf of Thailand States' maritime claims in that they determine what portion of the Gulf's coastline belongs to each State, and they additionally provide the starting point for maritime

[6] Ibid.
[7] Thanom Jareanlap, Admiral, Thai Maritime Boundary, 110th Journal of Security Studies, June 2012. Available at http://www.geozigzag.com/jurasan/ssp_index.php (Accessed: 11 August 2014)
[8] Ibid
[9] Ibid.
[10] Ibid.
[11] Schofield, Clive Howard (1999) Maritime boundary delimitation in the gulf of Thailand, Durham theses, Durham University. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/4351/
[12] Ibid.

boundaries between adjacent coasts by defining where the land boundaries intersect with the coast of the Gulf.[13]

During colonization era, Cambodia was under French protectorate for a period of approximately one century.[14] France (on behalf of Cambodia) and Siam (Thailand) had signed the treaty to detail the land boundary. The treaty was known as the Franco – Siam Treaty of 23 March 1907. The land boundary started in mainland with the 1st pillar and ended with the terminus point the 73rd pillar at the coastline where the land meets the sea. The terminus point was referenced to the highest summit of Koh Kut island which belongs to Siam. Also, during protectorate on Cambodia, in 1939 French Governor – General of Indo – China constructed the Brevie Line for an administrative and police jurisdiction line between what was to become Cambodia and Vietnam.[15] The Franco – Siam Treaty of 23 March 1907 and the Brevie Line were in the period of freedom at sea, and there did not concern about maritime boundary.

The terminus point had described in not only words but also a picture attached to the Franco – Siam Treaty 1907. The 1: 2,000,000 scale map was attached to the 1907 Treaty as following.

[13] Ibid.
[14] Mom Ravin, Law of the Sea, Maritime boundaries and dispute settlement mechanisms, page 29
[15] K.Kittichaisaree, The Law of the Sea and Maritime Boundary Delimitation in South-East Asia 180 – 181 (1987).

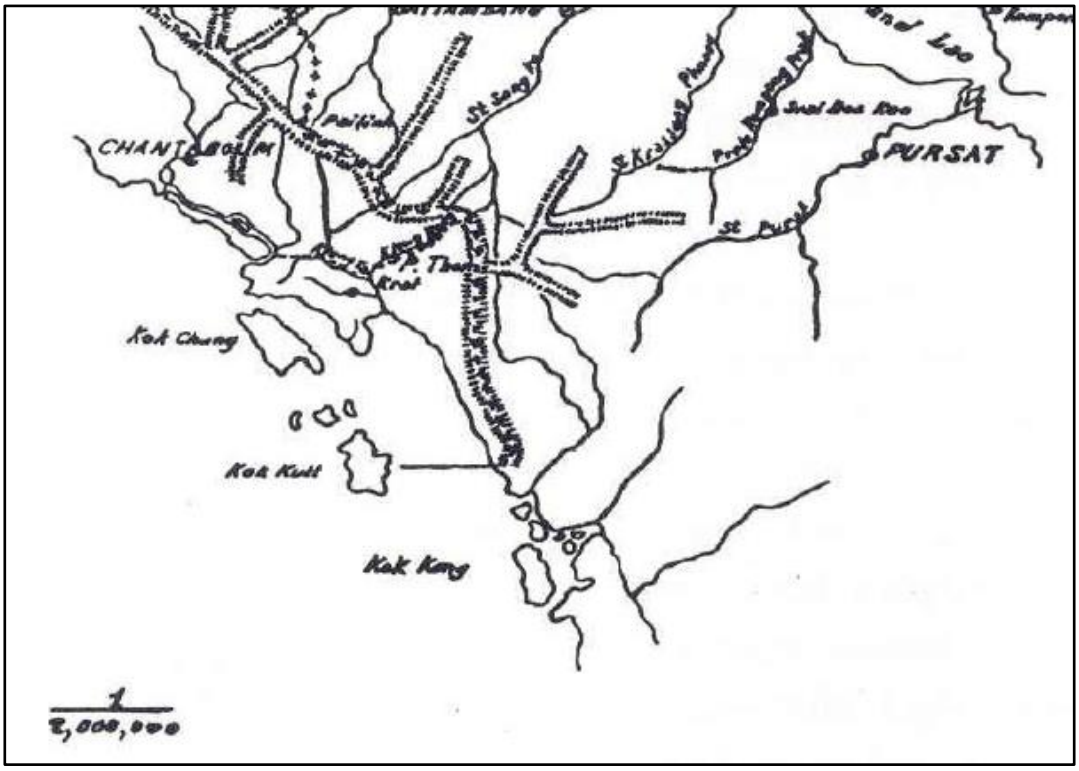

Figure 1: The attached 1: 2,000,000 scale map[16]
Source: Somjade Kongrawd

The terminus point of the land boundary was referenced by the highest point of Koh Kut. The explanation of the terminus point in French language is as that

> La frontier entre l'Indochine Française et le Siam part de la mer en un point situé en face du plus haut sommet de l'île de koh kut. Elle suit à partir de ce point une direction Nord-Est jusqu'à la crête de Phnom Kravanh. Il est formellement convenu que, dans tous les cas, les versants Est de ces montagnes, y compris la totalité du bassin Klong Kopo, doivent rester à l'Indochine Française.[17]

The translation to English is that

> The frontier between French Indochine and Siam starts from the sea on a point situated opposite of the highest summit of Koh Kut island. It follows from that point a North-East direction from the crest of Phnom Kravanh. It is formally agreed that, in all cases, the East slope of the mountains, including the totality of Klong Kopo bassin, have to stay to the French Indochine.[18]

[16] Somjade Kongrawd ,Captain, Thailand and Cambodia Maritime Disputes at: http://www.globalsecurity.org/military/library/report/2009/thailand-cambodia.pdf (Accessed: 14 July 2014).
[17] Mom Ravin, Law of the Sea, Maritime boundaries and dispute settlement mechanisms, page 118.
[18] During starting writing this paper at DOALOS, the author asked French Ph.D.Student doing internship at DOALOS to translate this statement from French to English. See appendix.

The purpose of the attached map was the descriptive picture of referenced point at highest summit of Koh Kut to terminus point on mainland. The word "…from the sea on a point situated opposite of the highest summit of Koh Kut Island" should mean that the highest summit of Koh Kut Island and the terminus point on mainland must be on the same parallel line or same latitude. The 1: 2,000,000 scale map has no significant for picking the terminus point on the coastline because the error can be 2,000 meters if 1 millimeter thickness of delineation is used. Regarding period of time, either erosion or deposition can cause either westerly or easterly changing in position of terminus point on mainland.

Cambodia and Vietnam shared a land boundary which was delineated by French during colonization era. In 1939 the French Governor – General of Indo – China constructed the Brevie Line for administrative and police jurisdiction line between what was to become Vietnam and Cambodia.[19] The Brevie Line was continuously drawn from land to the sea. The line surrounding on the northern of Phu Quoc Island pushes Phu Quoc Island under administrative and police jurisdiction as purpose. It should be noted, however, that the parties did not adopt the Brevie Line as maritime boundary delimitation between them although it is understood that Cambodia may, understandably, favour this option.[20] Governor-General Jules Brevie eventually issued a decision on the islands question on 31 January 1939 and his memorandum acknowledged that possession of certain islands was disputed between Cambodia and Vietnam but that those islands *"scattered along the Cambodian coast"* in particularly close vicinity to that coast *"logically and geographically requires that these islands be under the Administration of Cambodia.*" Concerning the other islands, the Governor-General divided the islands between the two administrations such that.[21]

> All the islands located north of the line perpendicular to the coast starting from the border between Cambodia and Cochin China and making an 140 grad angle with the north meridian, in accordance with the attached chart, will from now on be administered by Cambodia. All the islands south of this line, including the island of Phu Quoc, will continue to be administered by Cochin China ... the demarcation line thus made will make a line around the north of the island Phu Quae, passing three kilometres from the extreme ends of the north shore of this island.[22]

[19] Jonathan I. Charney and Lewis M. Alexander, International Maritime Boundaries; Vol. III, p.2358
[20] Schofield, Clive Howard (1999) Maritime boundary delimitation in the gulf of Thailand, Durham theses, Durham University. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/4351/
[21] Ibid.
[22] Ibid.

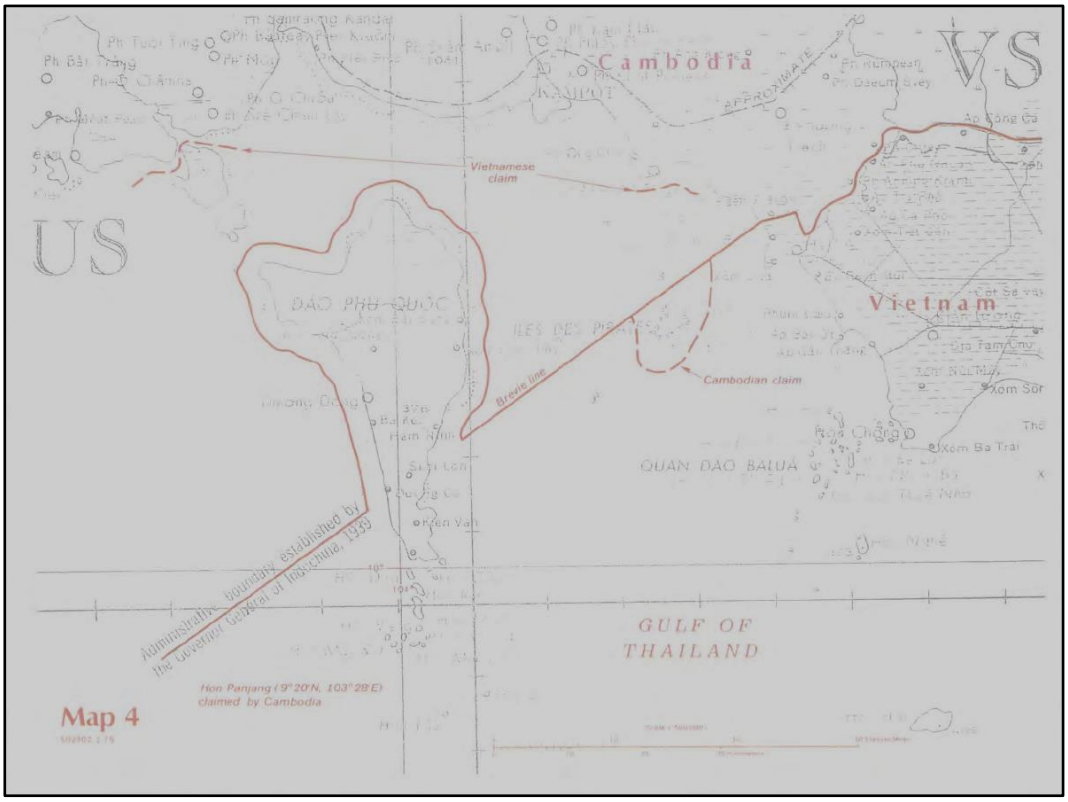

Figure 2: The Brevie Line
Source: Schofield, Clive Howard (1999)

The League of Nations sponsored a conference in The Hague in 1930, after the the Franco – Siam Treaty 1907 before the Brevie Line 1939, to discuss the codification of the law relating to coastal State controls within the territorial sea, and to freedoms of the high seas. No Treaty was produced from this conference, largely because of the politically sensitive issue of fisheries, but it was agreed that the conference should be reconvened at a later date. Following the Second World War and the establishment of the United Nations, an early task was to look again at the question of the codification of international maritime law. The International Law Commission was charged with the formulation of draft articles for a treaty or treaties on the law of the sea. The Commission began its work in 1950, submitting its results to the General Assembly in 1956.[23] The First Geneva Conference of the Law of the Sea was in 1958. What emerged were four Conventions rather than one, which was not originally intended. However it was the first time that the Law of the Sea had been codified. It can also be said that several parts of these Conventions were considered progressive and were intended to be enhanced by custom with advances in ocean development. The four Conventions were: The Convention on the Territorial Sea and the Contiguous Zone; The Convention on the High Seas; The Convention on Fishing and Conservation of the Living Resources of the High seas; and the Convention on the Continental Shelf. Each Convention had to be ratified separately and the take-up was not

[23] A manual on technical aspects of the United Nations Convention on the Law of the Sea, 4th Edition.

universal.[24] Cambodia and Thailand ratified on both territorial Sea and Contiguous Zone and Continental Shelf.[25] Under the 1958 Geneva Convention on the Law of the Sea, Cambodia claimed straight baselines in 1957, and claimed Continental Shelf in 1972 with new edition of straight baselines. Vietnam issued a Statement on the Territorial Sea, the Contiguous Zone, the Exclusive Economic Zone and the Continental Shelf on 12 May 1977 in which straight baselines were claimed from which the limits of all these maritime zones would be measured, but the first claim of Vietnam was from South Vietnam's Continental Shelf Claim on 6 June 1971.[26] Thailand made the declaration of the Bight of Thailand as a historic bay in 26 September 1959. Thailand claimed three straight baselines in 11 June 1970 and continental shelf in 18 May 1973. The fourth straight baseline, after the UNCLOS 1982, was claimed in 1992.

1.1.2 Pre – post the UNCLOS 1982 Vagueness and maritime zones in the Gulf of Thailand

After the 1958 Geneva Convention is the United Nations Convention on the Law of the Sea. The LOS Convention required 60 States to deposit articles of ratification or accession with the Secretary General of the United Nations to bring it into force one year after the date of the sixtieth ratification. For the LOS Convention, it became clear that by the early 1990s the sixtieth ratification was close, but that most States which had ratified up to that time were developing Nations. Cambodia gave the signature on 1 July 1983, but not ratify yet. Thailand gave the signature on 10 December 1982 and ratified on 15 May 2011. Vietnam gave the signature on10 December 1982 and ratified on 25 July 1994. The significant claims after the LOS Convention were from Cambodia and Thailand. Cambodia reclaims the straight baselines in 13 July 1982. Thailand claimed the fourth straight baseline in 17 August 1992. Whilst the LOS Convention is the overarching Convention when addressing marine and maritime sovereign rights, due to the dating of claims made in the Gulf of Thailand, consideration must be given to the 1958 Geneva Convention. The LOS Convention is one document also including the 1958 Geneva Convention details. During colonization era, the boundary treaties agreed by colonizing State and independent State focused on sovereignty on land including islands that was emphasized by the Brevie Line constructed for administrative and police jurisdiction line between what was to become Vietnam and Cambodia. For the sea, the customary law had been applied to the sea as "Freedom of the Sea" meaning coastal states can claim 3 nautical miles for territorial since 17th Century until 1958.[27] It has no ability, knowledge and equipment, of either colonized States or colonizing States during the colonization era to get natural resource under seabed.

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[24] Ibid.

[25] Schofield, Clive Howard (1999) Maritime boundary delimitation in the gulf of Thailand, Durham theses, Durham University. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/4351/

[26] Ibid.

[27] Thanom Jareanlap, Admiral, Thai Maritime Boundary, 110th Journal of Security Studies, June 2012. Available at http://www.geozigzag.com/jurasan/ssp_index.php (Accessed: 15 July 2014)

The 1958 Geneva Convention explains the methods and provides information for coastal States to claim maritime zones. The time the coastal States around the Gulf of Thailand claiming continental shelf independently was after the 1958 Geneva Convention. Without rectification, the States including landlocked States have the right on the sea automatically especially maritime zones claim. The flexibility in the LOS Convention is that maritime zones claims and maritime boundary can be adjusted by special circumstance. The coastal States around the Gulf of Thailand claimed maritime zones independently. The treaties and documents done during colonization era were used for taking advantage in the maritime zone claim.

Many agreements among the coastal States around the Gulf of Thailand have been signed for releasing the tension. Some disagreed area is related to more than two coastal States, but the result of the agreement done by the other two coastal States is the starting point for negotiating with the other relevant coastal State. Cambodia and Vietnam altogether claimed the Historic Water in 7th July 1982. The result of the Cambodia and Vietnam agreement is the starting point for Thailand and Cambodia to delimit maritime boundary in 9th August 1997.

Article 4 -1 Section II of the 1958 Geneva Convention and Article 7 – 1 Section II Part II of the LOS Convention explain the method for connecting straight baselines. Some unclear details are applied to take advantages from coastal States. The vaguest statements in these Articles are vicinity and general direction of the coast. For drawing the straight baselines, the statement for connecting straight baselines in the 1958 Geneva Convention and the LOS Convention is that.

> In localities where the coastline is deeply indented and cut into, or if there is a fringe of islands along the coast in its *immediate vicinity*, the method of straight baselines joining appropriate points may be employed in drawing the baseline from which the breadth of the territorial sea is measured.[28]

Prescott had said.

> Probably everyone would agree that a fringe of islands 3 nautical miles from the coast was in its immediate vicinity. Equally, everyone would probably concur that a fringe of islands 100 nautical miles from the coast was outside its immediate vicinity.

[28] United Nations Convention on the Law of the Sea 1982, page 22.

> Unfortunately, it would not be possible to predict with confidence what the majority thought of a fringe of islands 25, 40, or 65 nautical miles from the coast.[29]

The vagueness of the immediate vicinity is supported by Schofield that he has stated in his thesis that.

> The Geneva and UN Conventions failed to provide a specific distance offshore (or any other objective test) by which to measure whether a particular fringe of islands is close enough to the coast to be considered in its "immediate vicinity" or in order to assess whether the waters enclosed by the straight baselines are sufficiently closely linked to the land to be subject to the regime of internal waters.[30]

For reducing the vagueness of immediate vicinity and the general direction of the coast, the US Department of State Bureau of Oceans and International Environment and Scientific Affairs published the Limits in the Seas document number 106 Developing Standard Guidelines for Evaluating Straight Baselines. The document is to study for elaborating the circumstances and manner in which coastal states may use straight baselines.[31] The study is based on analysis with the long-accepted international law principles reflected in the 1951 Anglo-Norwegian Fisheries Case, the 1958 Geneva Convention on the Territorial Sea and the Contiguous Zone (Territorial Sea Convention), and the LOS Convention and the analysis draws on the work of recognized authorities in the field, as well as on textual examination and review of existing state practice.[32] The criteria for fringing islands is defined in the US Department of State's document as that.[33]

> (1) The directional trend of the outermost islands (i.e., the islands on which the straight baseline turning points will be situated) should not deviate more than 20° from the opposite mainland coastline (including any closing lines that may properly be drawn across bays, river mouths and harbors), or from the general direction of the opposite mainland coastline, whichever more nearly parallels the relevant islands;
>
> (2) There must be a consideration of distance between the outermost islands and the mainland coastline.
>
> (3) Islands considered part of the fringe should not be further apart from each other than 24 nautical miles;
>
> (4) Such islands should mask 50% of the opposite mainland coastline;

[29] Limits in the Sea No. 106. The US Department of State, Bureau of Oceans and International Environmental and Scientific Affairs. Available at http://www.state.gov/documents/organization/59584.pdf (Accessed on 6 August 2014).
[30] Schofield, Clive Howard (1999) Maritime boundary delimitation in the gulf of Thailand, Durham theses, Durham University. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/4351/
[31] Limits in the Sea No. 106. The US Department of State.
[32] Ibid.
[33] Ibid.

(5) No individual straight baseline segment should exceed 48 nautical miles in length.

For the third criterion, the reason why 24 nautical miles are given for maximum distance between islands is stated in the the US Department of State's document as that.

> The purpose of establishing a maximum distance between islands is, in large measure, to ensure that the islands form what can reasonably be considered a fringe, rather than an unconnected offshore aggregation. The rationale for the distance of 24 nautical miles is probably self-evident: 24 nautical miles is the maximum distance between islands that would permit an overlap of 12-nautical-mile territorial seas measured from low-water lines.[34]

The following illustration shows whether features offshore are considered as the fringe islands. The top features are fringe islands because the 12 nautical miles radius of each feature overlaps each other whereas the below it has no overlapping area between features.

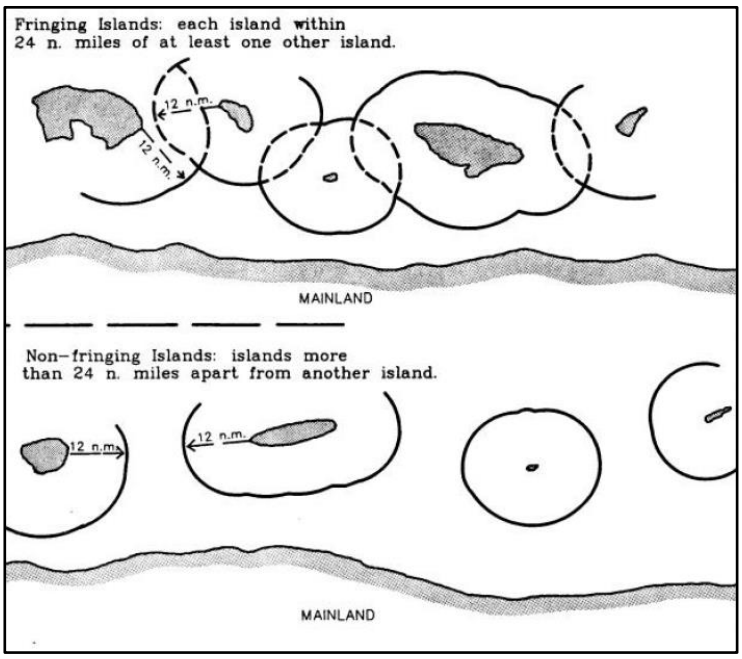

Figure 3: Fringing islands and non-fringing islands
Source: The US Department of State, Bureau of Oceans and International Environmental and Scientific Affairs

The fourth criterion, to require masking of the mainland coast is to help ensure that the establishment of the straight baseline system is premised on a significant relationship between the islands and the mainland coast.[35] This criterion is an essential aspect of justifying a straight baseline system which is mathematical description from the US Department of State. The explanation for the masking percentage test is stated that.

[34] Ibid.
[35] Ibid.

> Determining the masking percentage begins with constructing general direction lines for the mainland coast. This permits calculation of the masked and unmasked coastal areas without the tedious measurement of every coastal sinuosity. After these lines are established, perpendiculars are drawn from them seaward to the offshore islands. A point along the coastal general direction line is considered masked if the perpendicular that has been drawn from that point intersects an island. Once this is done, it is a matter of calculating the proportion between the length of the coastal direction line that is masked and the total length of that line. If the proportion equals or exceeds 50%, then the masking requirement is met.[36]

The example is given for illustrating the criterion as that.

> The mainland is characterized by three general direction lines - WX (36 nautical miles long), XY (32 nautical miles), and YZ (42 nautical miles). Eleven islands are situated off this part of the mainland. Perpendiculars have been drawn from the general direction line seaward to intersect the islands. In this example, the percentage of general direction lines WX and XY that is masked exceeds 50%, indicating that, if other straight baseline criteria are met, straight baselines would be proper. However, only 13% of the coastline defined by general direction line YZ is masked, thereby making straight baselines improper along this section of the coast.[37]

[36] Ibid.
[37] Ibid.

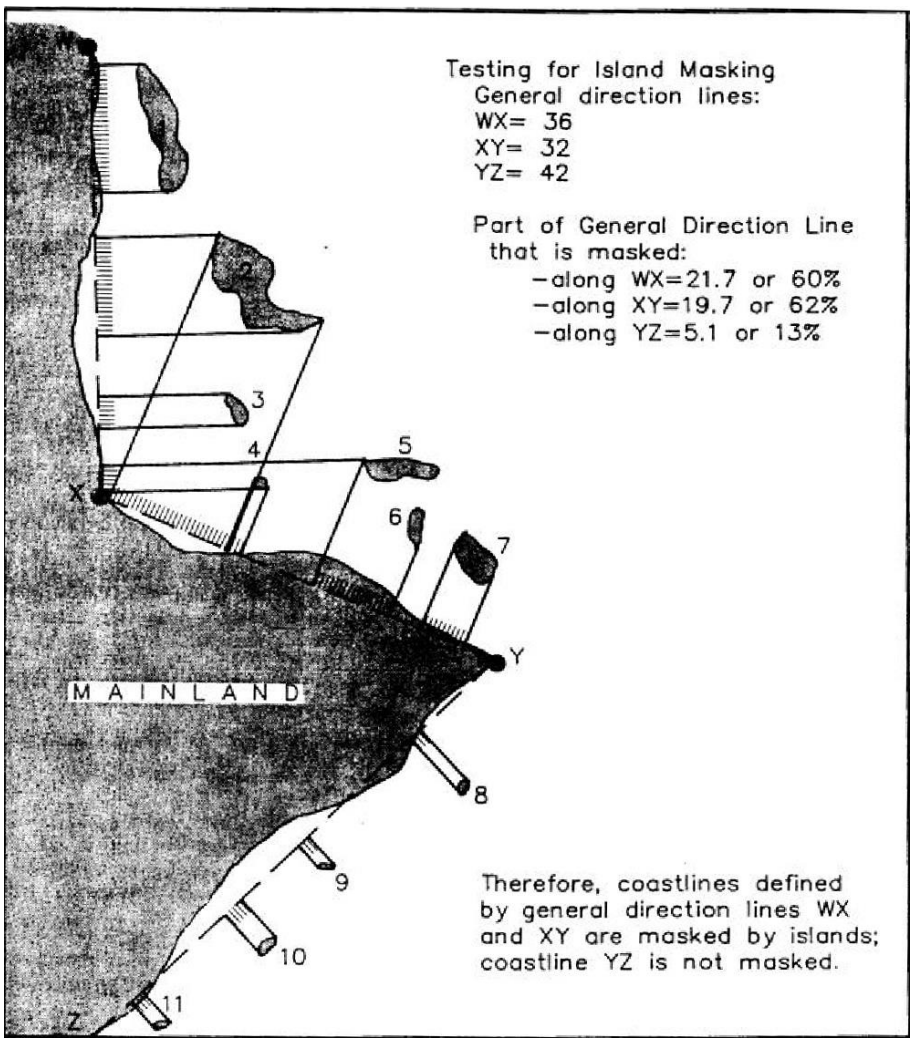

Figure 4: Testing for island masking, General direction lines
Source: The US Department of State, Bureau of Oceans and International Environmental and Scientific Affairs.

For the fifth criterion, the criteria on the maximum baseline length are the first both the 1958 Geneva Convention on Territorial Sea and the LOS Convention, the article on bays limits the length of a closing line to 24 nautical miles and the second neither convention contains any such limits for straight baselines.[38] Beazley suggests the use of a 45 nautical miles whereas Hodgson and Alexander urge the use of a 40 nautical miles.[39] 48 nautical miles is given by the US Department of State for individual segment baseline. The reason is that the length of 48 nautical miles is double the maximum length for a juridical by closing line, it preserves the significance of the differences between the bay articles and the straight baseline articles of the two conventions, without according coastal States unrestrained license in drawing baselines.[40]

[38] Ibid.
[39] Ibid. Analysis of the Angelo-Norwegian Fisheries Case.
[40] Ibid.

1.2 Section B. Straight Baselines in the Gulf of Thailand

1.2.1 Cambodia's straight baselines

Cambodia claimed straight baselines in the Gulf of Thailand three times 1957, 1972 and 1982.[41] The first two claims followed the guidance obtained from drafting the 1958 Geneva Convention, the third the last claim is after the UNCLOS 1982, within which the criteria for baseline determination remained the same. With regards to the Cambodia claims subsequent claims established more seaward limits. The points of origin and end of the first claim were as same as the second claim. The features further seaward make the two previous claims be in difference. The third claim has been originated at the same point as the first and the second claims. The distinguish differences are the first that Cambodia occupies the most seaward features for construction of straight baseline the second that the end point is floating

Date of Claim	Type of Claim
1957	Predominantly fringing islands but with mainland coastal points.
1972	Predominantly fringing islands but with mainland coastal points.
1982	Fringing islands.

Table 1: Date and type of Cambodia's claim
Source: Schofield, Clive Howard (1999)

[41] Schofield, Clive Howard (1999) Maritime boundary delimitation in the gulf of Thailand, Durham theses, Durham University. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/4351/

Figure 5: Three straight baselines claimed by Cambodia[42]
Source: Schofield, Clive Howard (1999)

[42] Ibid. Schofield had the list of coordinates from Prince Norodom Ranariddh's thesis (1976: 24-25). Using these coordinates, Schofield plotted straight baselines on British Admiralty Chart 3985 at a scale 1: 500,000. Because of lacking of technical information such as chart datum and datum transferring, Schofield plotted the straight baselines from the text descriptions of the locations of the base points.

Cambodia's 1957 straight baseline

The starting point for delineating straight baseline is the terminus points between Cambodia and Thailand, whereas the ending point is at terminus point between Cambodia and Vietnam. The direction from the starting point to the ending point is southeastern. The straight baselines connected the outermost point of the nearest features (rock, an isolated island, an isolated islet, and groups of either islands or islets) to the Cambodia's mainland. Cambodia's 1957 straight baselines consist of 12 segments linking a mixture of 13 defined island and mainland coastal points.[43] From measurement on British Admiralty Chart 3985, 1987 edition, at a scale 1: 500,000, the longest segment is 22.68 nautical miles, the shortest segment is 1.62 nautical miles and the average length is about 11.95 nautical miles. The total length of Cambodia's 1957 straight baseline is 143.36 nautical miles.[44]

Schofield gives an opinion on Cambodia's 1957 straight baseline claim that.

> Overall, Cambodia's 1957 straight baseline claim can be regarded as conservative rather than aggressive or expansionist in nature, hugging Cambodia's mainland coast. It can further be observed that the baselines claimed in 1957 broadly accord with Article 4 of the Geneva Convention on the Territorial Sea and Contiguous Zone and Article 7 of UNCLOS. This is, perhaps, particularly impressive bearing in mind the fact that the straight baseline system was formulated relatively soon after independence in 1949 and prior to the Geneva Conventions being opened for signature in 1958.

Specific Length for each segment of straight base line and specific distance of seaward features from land are none in both the 1958 Geneva Convention and the LOS Convention. The specific values in length and distance are from the US Department of State document. Comparing to the US Department of State document, Schofield comments that "Cambodia's 1957 straight baseline claim comfortably passes both the US's criteria".[45]

The US Department of State gives the determining the masking percentage for constructing the general direction lines for the mainland coast. If the general direction of the coast of Cambodia was drawn from the land terminus point between Cambodia and Thailand to the other terminus point between Cambodia and Vietnam, the length of the general direction of the coast would be about 119.989 nautical miles (solid black line) and the total length of width of features which are perpendicular to the general direction of the coast is about 26.876 nautical miles. The proportion

[43] Ibid.
[44] Ibid.
[45] Ibid.

will be (26.876 ÷119.989) x 100 = 22.398 %. The features taken for calculation are Koh Kong, Koh Samit[46], Koh Smach, Koh Rong, Koh Rong Samlem, Koh Ta Kiev, Koh Ses and small island near the land boundary between Cambodia and Vietnam.

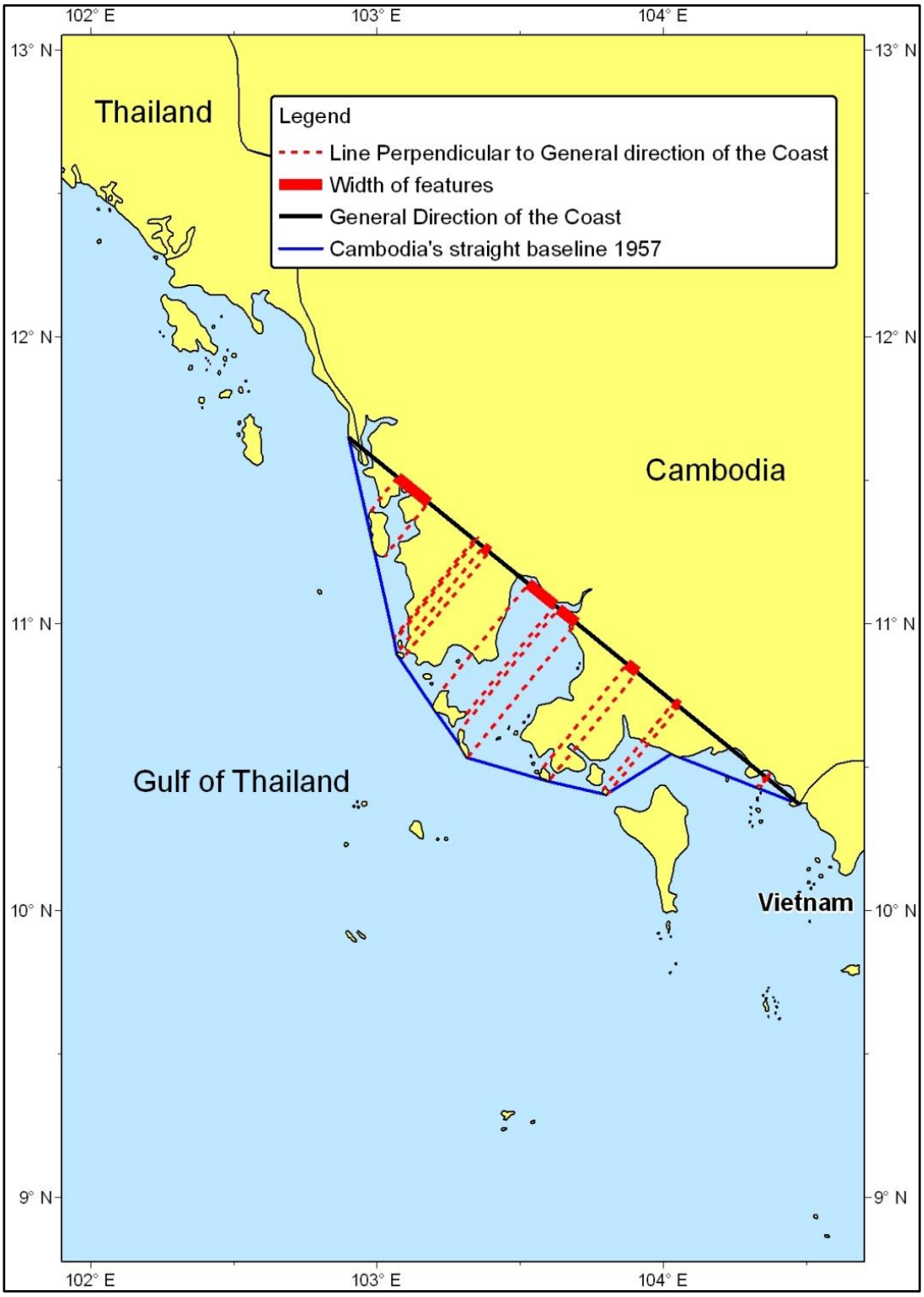

Figure 6: Island masking test Cambodia's 1957 straight baseline
Source: Author

Cambodia's 1972 straight baseline

[46] The name of this island is from Schofield, Clive Howard.

In 1972, Cambodia moved to revise its claimed system of straight baselines by Kret No.518/72/PRK dated 12 August[47] and claimed continental shelf by Cambodian *Kret* No. 439-72/PRK, 1 July 1972.[48] The reason for revising the straight baseline is that.

> The new system of straight baselines, composed of 20 segments connecting 21 points, was significantly more complex than Cambodia's earlier claim and, with the exception of the initial and terminal points on the coast, entirely superseded the straight baselines claimed in 1957. The 1972 claim therefore departed from the mainland coast at the intersection of the Cambodia Thailand land boundary with the littoral of the Gulf of Thailand and terminated at the Cambodia-Vietnam land boundary on the coast. The remainder of the 1972 system, however, extended seaward of that claimed in 1957. The revised baseline system therefore retained one of the prime features of the 1957 claim in that the entirety of the mainland coastline was fronted by straight baselines. The key differences between the 1972 and 1957 straight baseline systems lay in the fact that the islands used as basepoints were significantly further offshore than had previously been utilised, coupled with the inclusion of the major island of Koh Tral (Phu Quoc to Vietnam) and its associated islets within Cambodia's straight baseline system. The latter point is important in that the island concerned was at the time subject to a sovereignty dispute with Vietnam and it is likely that this was one of the main factors motivating the declaration of the revised straight baselines system.[49]

Schofield mentioned that it has no baseline segment claimed by Cambodia in 1972 exceeds the US suggested limit of 48 nautical miles, average length of such segments was considerably less. After tested with the masking percentage for constructing the general direction lines for the mainland coast, if the general direction of the coast of Cambodia was drawn from the land terminus point between Cambodia and Thailand to the other terminus point between Cambodia and Vietnam, the length of the general direction of the coast would be about 119.989 nautical miles (solid black line) and the total length of width of features which are perpendicular to the general direction of the coast is about 31.972 nautical miles. The proportion will be (31.972 ÷119.989) x 100 = 26.645 %. The features taken for calculation are Koh Kusrovie, Koh Veer, Koh Tang and the group of Dao Phu Quoc (Koh Tral)

[47] Schofield, Clive Howard (1999) Maritime boundary delimitation in the gulf of Thailand, Durham theses, Durham University. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/4351/

[48] Mom Ravin, Law of the Sea, Maritime boundaries and dispute settlement mechanisms.

[49] Schofield, Clive Howard (1999) Maritime boundary delimitation in the gulf of Thailand, Durham theses, Durham University. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/4351/

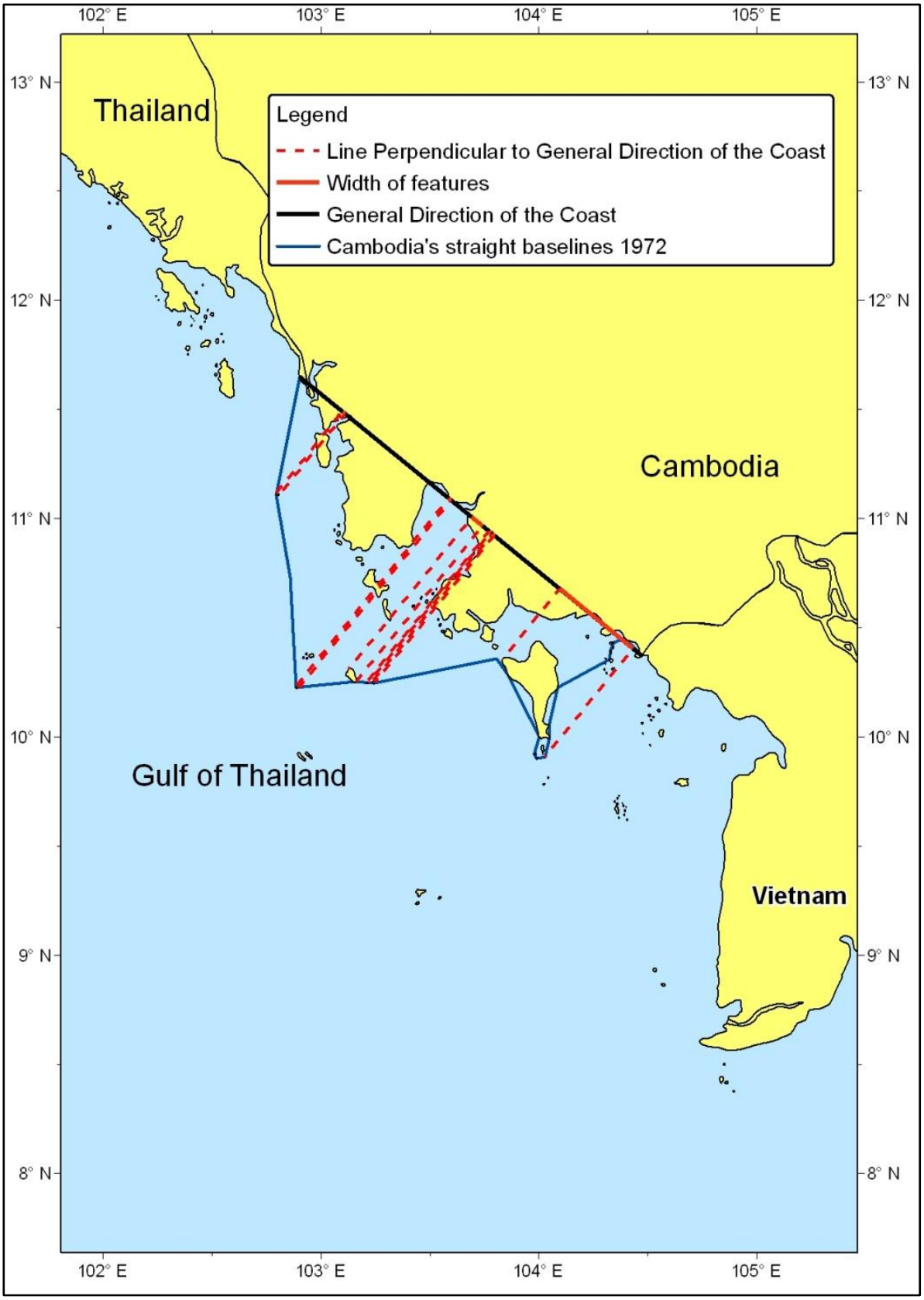

Figure 7: Island masking test Cambodia's 1972 straight baseline
Source: Author

It seems the second straight baseline of Cambodia better than Cambodia's straight baseline's 1957 because the masking percentage for constructing the general direction lines of the second

straight baselines (26.645%) is more than the first straight baseline (22.398%). Schofield commented about Cambodia's 1972 straight baseline as that.

> It has already been established how fallible the concept of the general direction of the coast is when attempts are made to apply it in practice. Thus, it could certainly be argued that the configuration of the 1972 straight baselines both does and does not reflect the general direction of the coast. Nevertheless, a subjective view is that the baselines do, broadly speaking at least, conform to the general direction of the coast.[50]

The significant comment is about Condor Reef which is picked for basepoints.

> Having made these generally positive observations, it cannot be maintained that Cambodia's 1972 straight baselines claim was above reproach. One aspect of the claim which is clearly at odds with the international law of the sea is the use of Condor Reef *(Recife Condor)* as a basepoint. According to the relevant British Admiralty *Pilot* this feature, lying just over 17nm (32km) offshore, *"dries to 0.3m (1ft)"* and does not host any navigational light or similar structure. It is therefore clearly a low-tide elevation rather than a rock or island. As such, it is an inappropriate point for use in the construction of straight baselines.[51]

The most affected areas seaward beyond the baseline will be turned to be the internal water. This sea area is about 6,463.524 square kilometers (excluding islands). The Condor Reef is symbolized on the British Admiralty Chart as following.

[50] Ibid. Schofield had put one disagrees for his analysis which is in his footnote no. 40th. The 40th footnote is as that "Kittichisaree (1987: 14) for one disagrees. In his analysis of Cambodia's 1972 straight baselines claim he notes that 'The sections which pass through Kusrovie islet/rock and Prins Island depart appreciably from the general direction of the coast, and the islets/islands in question are not in the immediate vicinity of the coast'."

[51] Ibid.

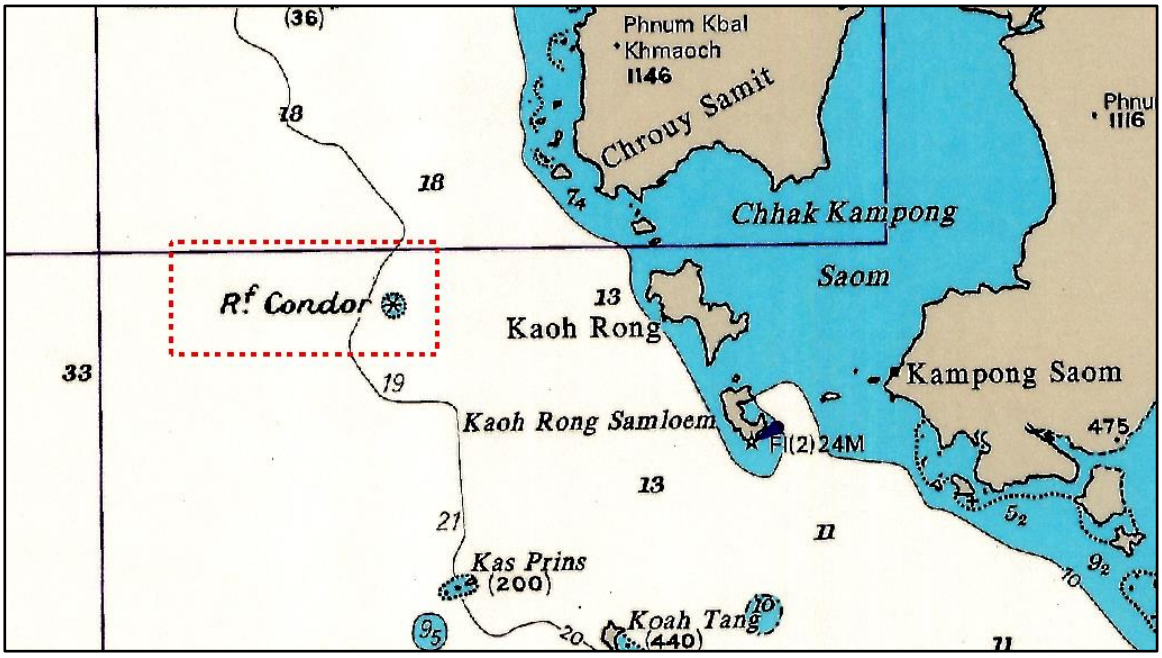

Figure 8: Condor Reef
Source: the British Admiralty Chart

Because of using the Condor Reef as straight as same as Cambodia's 1972 straight baseline, it is arguable that Cambodia's 1982 straight baseline is not countable for straight base line system. Article 4(3) of the 1958 Geneva Convention states that.

> Baselines shall not be drawn to and from low – tide elevation, unless lighthouses or similar installations which are permanently above sea level have been built on them" and Article 7(4) of the UNCLOS 1982 strengthening that by states that "Straight baselines shall not be drawn to and from low-tide elevations, unless lighthouses or similar installations which are permanently above sea level have been built on them or except in instances where the drawing of baselines to and from such elevations has received general international recognition.[52]

Cambodia's 1982 straight baseline

Cambodia revised straight baselines again in 13 July 1982 six days after the Cambodia -Vietnam jointly claimed the Historic Water in 7th July 1982. This claim, list of coordinated, is deposited to Division of Ocean Affair and Law of the Sea, United Nations.[53] The third straight baseline of Cambodia does not give any effect on continental shelf claimed by Cambodia in 1972 and it is the most seaward when comparing to the first and the second claims. Cambodia's 1972 Continental shelf was not adjusted by changing the straight baselines. Again, the most affected areas will be the areas that become internal water because of changing baseline seaward. Only

[52] LOS Convention 1982.
[53] Decree of the Council of State of 13 July 1982 Available at http://www.un.org/Depts/los/LEGISLATIONANDTREATIES/STATEFILES/KHM.htm (Accessed: 14 July 2014)

Cambodia's 1982 straight baseline was deposited to the United Nations. The obvious thing is that the endpoint of straight baseline system is neither on the mainland nor features in the sea. For the immediate vicinity, the length of segment of straight baseline exceeds 48 nautical miles and the distant between the mainland coast and the fringe of islands is greater than 24 nautical miles. In addition to pushing the straight baseline system offshore, this also had the effect of considerably simplifying Cambodia's claim, such that it comprised just five points linked by four segment lines. One, the last point in the claim, of them is floating point and effectively becomes a proxy point, this being a mid-point between Poulo Wei (Cambodia) and Poulo Panjang, some calls Hon Tho Chau, (Vietnam) for Thailand and Vietnam delimitating maritime boundary.

Schofield commented on Cambodia'1982 straight baseline as that.

> The motivation behind this change in the Cambodian claim may lie in the additional waters claimed, the perception that an enhanced negotiating position with regard to Thailand would be secured and in order to facilitate the conclusion of the Historic Waters Agreement with Vietnam.[54]

1.2.2 Thailand's straight baselines

Thailand made the declaration of the Bight of Thailand as a historic bay in 26 September 1959. Thailand claimed three straight baselines in 11 June 1970, after the 1958 Geneva Convention, and the fourth straight baseline, after the UNCLOS 1982, was claimed in 1992. All claims were with the list of coordinate. The third area of claim is in Andaman Sea. Only the Historic Water, Straight baseline I, II, and IV are in the Gulf of Thailand. There are no technical aspects such as chart datum explained in the claim. The starting point of the straight baseline area I is on the mainland, Leam Ling. Continuing southwestern, the first segment ends at Ko Chang Noi the distance about 3.23 nautical miles. The second segment connected by Ko Chang Noi and Hin Rap is about 6.69 nautical miles. The third segment connected by Hin Rap and Hin Luk Bat is about 7.07 nautical miles. The forth segment connected by Hin Luk Bat and the outmost seaward point of Ko Rang is about 11.8 nautical miles. The fifth segment connected by Ko Rang and Hin Bang Bao is about 13.78 nautical miles. The sixth segment connected by Hin Bang Bao and Laem Thian the outermost point of Ko Kut is about 4.26 nautical miles. The last segment is connected by Ko Kut and the Thailand – Cambodia Boundary Post is about 19.22 nautical miles.[55] The illustration for Thailand's straight baseline is as following.

[54] Schofield, Clive Howard (1999) Maritime boundary delimitation in the gulf of Thailand.

[55] Each segment is measured on Thailand Nautical Chart No.102 Ko Chuang to Koh Kong at 10°N, Indian 1975 datum, scale 1: 240,000.

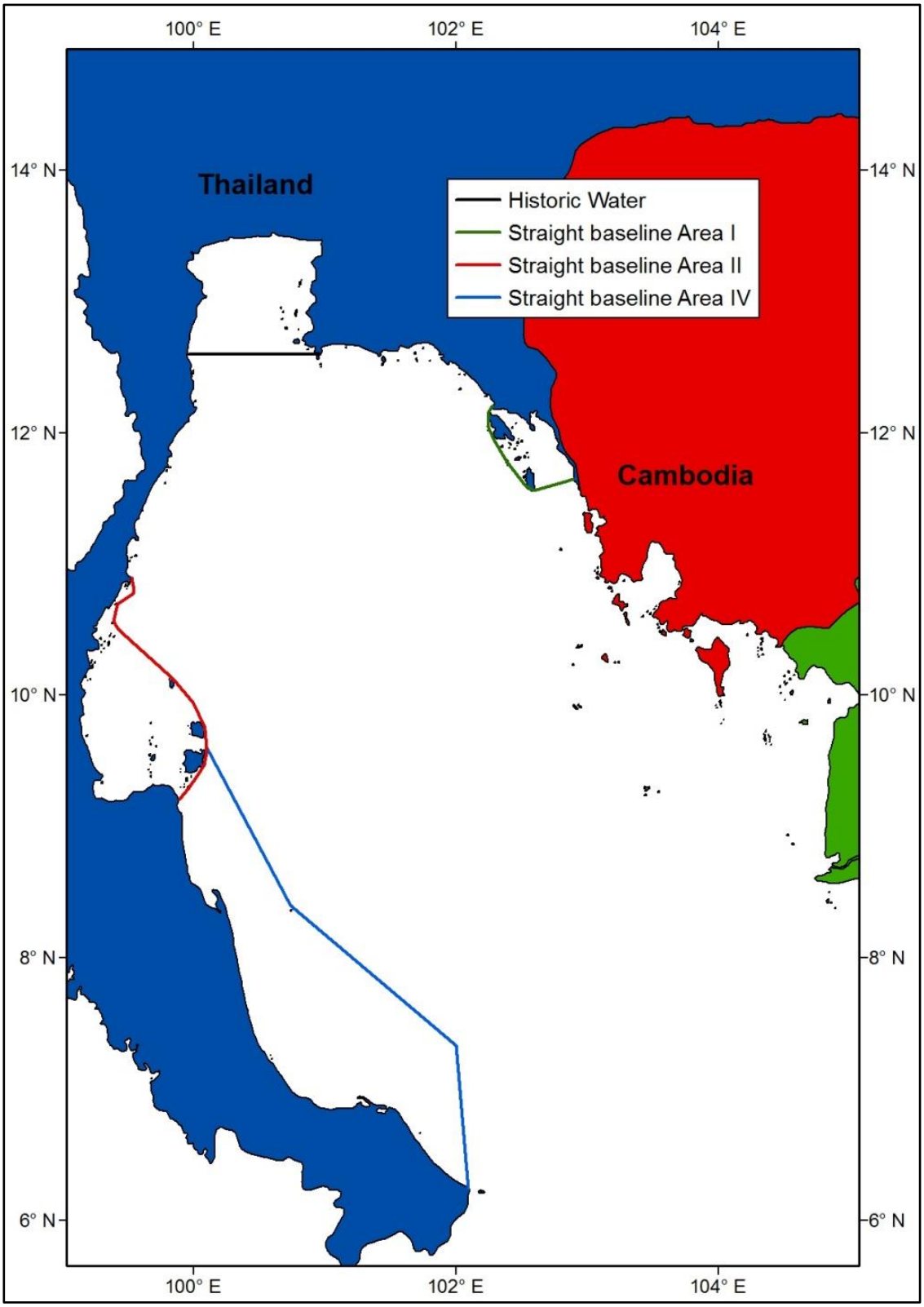

Figure 9: Thailand's straight baselines
Source: Author

The list of coordinates of Thailand's Area I straight baselines is as following table.

Reference No.	Geographical Name	Geographical Coordinate	
		Latitude N.	Longitude E.
1	Laem Ling	12° 12.3'	102° 16.7'

2	Ko Chang Noi	12° 09.6'	102° 14.9'
3	Hin Rap	12° 03.1'	102° 14.5'
4	Hin Luk Bat	11° 56.7'	102° 17.2'
5	Ko Rang	11° 46.6'	102° 23.2'
6	Hin Bang Bao	11° 35.8'	102° 32.0'
7	Ko Kut	11° 33.6'	102° 35.7'
8	Thai – Cambodia Boundary Post	--	--

Table 2: List of coordinates Thailand's straight baseline Area I
Source: Announcement of the Office of the Prime Minister, 12 June 1970 [56]

Thailand's Area I straight baselines system is above all two descriptive criteria of the US Department of State. The maximum length for one segment of straight baselines not exceed 48 nautical miles the longest segment about 19.22 nautical miles from Ko Kut to the terminus point between Cambodia and Thailand. The second descriptive criterion is 'immediate vicinity' the US Department of State suggested that a 24 nautical miles. The most seaward feature is Ko Rang distance from Ko Kut about 13.69 nautical miles and from Ko Chang about 13.09 nautical miles. The total length from Laem Ling to Cambodia – Thailand terminus point is about 49.74 nautical miles. The features used for calculating the mathematic test are Ko Chang, Ko Rang and Ko Kut. The total length which is projected perpendicularly to the previous line is about 27.73 nautical miles. The proportion will be (27.73 ÷ 49.74) x 100 = 57.74%. Therefore Thailand's Area I straight baseline is above all the US Department of State in both descriptive and mathematic criteria. The mathematic criterion test is illustrated as following figure.

[56] Available at http://www.un.org/Depts/los/LEGISLATIONANDTREATIES/PDFFILES/THA_1970_Announcement.pdf (Accessed on 13 August 2014)

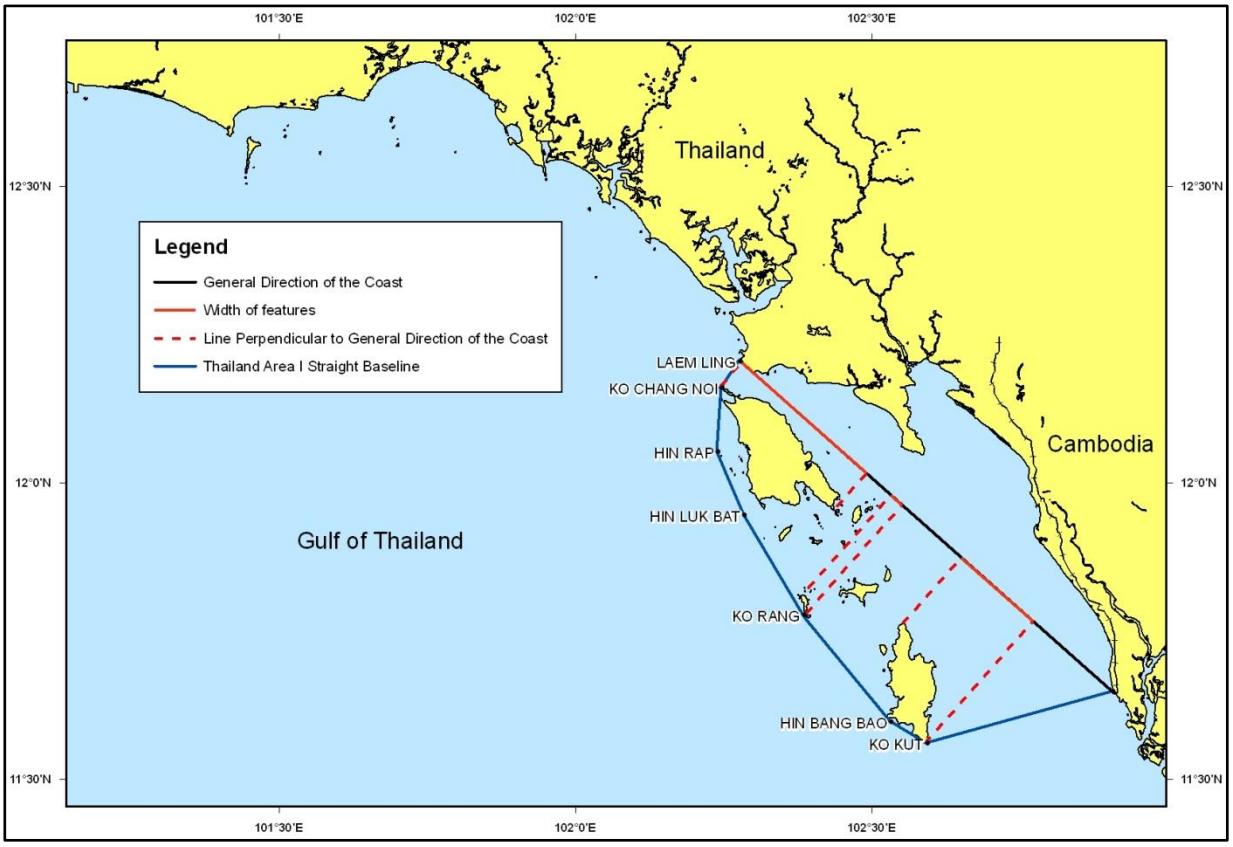

Figure 10: Island masking test Thailand's straight baseline Area I
Source: Author

Thailand's Area II straight baseline on the western side of the Gulf of Thailand is opposite to Area I straight baseline. The two big islands are Ko Phangan and Ko Samui. The straight baselines are composed of fifteen segments and almost parallel to mainland. The list of coordinates of Thailand's Area II straight baseline is as following:

Reference No.	Geographical Name	Geographic Coordinate	
		Latitude N.	Longitude E.
1	Laem Yai	10° 53.7'	99° 31.4'
2	Ko Ran Khai	10° 47.8'	99° 32.6'
3	Ko Ran Pet	10° 46.5'	99° 32.2'
4	Ko Khai	10 41.8'	99° 24.8'
5	Ko Chorakhe	10° 33.6'	99° 25.2'
6	Hin Lak Ngam	10° 30.0'	99° 25.6'
7	Ko Tao	10° 07.5'	99° 50.7'
8	Hin Bai	09° 56.6'	99° 59.7'
9	Ko Kong Thansadet	09° 45.8'	100° 04.7'
10	Ko Phangan	09° 49.0'	100° 05.2'
11	Ko Kong Ok	09° 36.1'	100° 05.8'

12	Ko Mat Lang	09° 32.0'	100° 05.3'
13	Ko Samui	09° 28.3'	100° 04.7'
14	Hin Ang Wang	09° 23.4'	100° 01.8'
15	Ko Rap	09° 17.9'	99° 57.8'
16	Laem Na Tham	09° 12.4'	99° 53.2'

Table 3: List of coordinates Thailand's straight baseline Area II
Source: Announcement of the Office of the Prime Minister, 12 June 1970 [57]

The length of each segment is as following table.[58]

From	To	Distance (nautical miles)
Laem Yai	Ko Ran Khai	5.98
Ko Ran Khai	Ko Ran Pet	1.35
Ko Ran Pet	Ko Khai	8.65
Ko Khai	Ko Chorakhe	8.30
Ko Chorakhe	Hin Lak Ngam	4.29
Hin Lak Ngam	Ko Tao	33.35
Ko Tao	Hin Bai	14.01
Hin Bai	Ko Kong Thansadet	11.82
Ko Kong Thansadet	Ko Phangan	1.85
Ko Phangan	Ko Kong Ok	7.88
Ko Kong Ok	Ko Mat Lang	4.10
Ko Mat Lang	Ko Samui	3.72
Ko Samui	Hin Ang Wang	5.56
Hin Ang Wang	Ko Rap	6.82
Ko Rap	Laem Na Tham	7.11

Table 4: Length of each segment Thailand's straight baseline Area II
Source: Author

Thailand's Area II straight baseline is one above the US Department of State criteria for the length of each segment because the longest distance is only 33.35 nautical miles from Hin Lak Ngam to Ko Tao. The only one fringe islet, from sixteen points, under the US Department of

[57] Available at http://www.un.org/Depts/los/LEGISLATIONANDTREATIES/PDFFILES/THA_1970_Announcement.pdf (Accessed on 13 August 2014)
[58] Each segment is measured on Thailand Nautical Chart No.203 and 204 at 10°N, Indian 1975 datum, scale 1: 240,000.

State criteria is Hin Bai which is far from mainland about 48.37 nautical miles. The mathematic criterion is by determining the proportion percentage between the width of the features projected perpendicularly to the general direction line and the total length of the general direction line. If the proportion equals or exceeds 50%, then it is proper for making straight baselines along the section of the coast. The total length from Laem Yai to Laem Na Tham is about 103.03 nautical miles. The all of features, exclude Laem Yai and Laem Na Tham, used for connecting point are counted for total length which is about 28.65 nautical miles. The proportion will be (28.65 ÷ 103.03) x 100 = 27.80%.

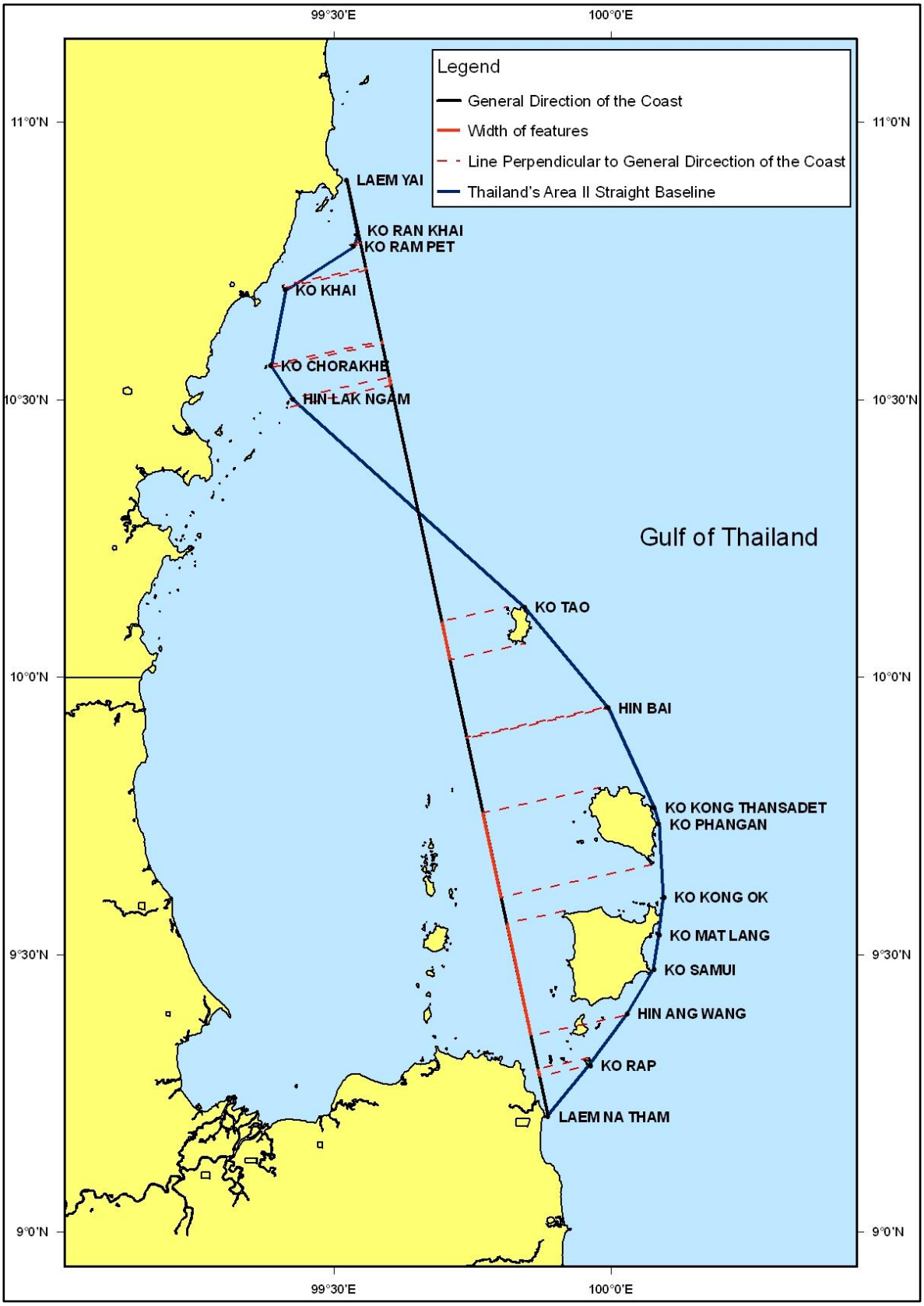

Figure 11: Island masking test Thailand's straight baseline Area II
Source: Author

Thailand's Area IV straight baseline is claimed in 17th August 1992 10 years after Cambodia's 1982 straight baseline claim. Thailand's Area IV straight baseline claim might be called *the equitable claim* by using the most seaward features as turning points for straight baseline construction. Thailand's Area IV straight baseline is extended from Area II straight baseline by connecting the line from Ko Kong Ok, the turning point in Thailand's Area II straight baseline, heading south – eastward to Ko Kra. The next segment connects Ko Kra and Ko Losin which is in the south of Ko Kra. The last segment is from Ko Losin to Thai – Malaysian Boundary. The list of coordinate is as following.

The list of coordinates of Thailand's Area II straight baseline is as following:[59]

Reference No.	Geographical Name	Geographical Coordinates	
		Latitude N.	Longitude E.
1	Ko Kong Ok	9° - 36'- 06"	100° - 05'- 48"
2	Ko Kra	8° - 23'- 49"	100° - 44'- 13"
3	Ko Losin	7° - 19'- 54"	101° - 59'- 54"
4	Thai-Malaysian Boundary	6° - 14'- 30"	102° - 05'- 36"

Table 5: List of coordinates Thailand's straight baseline Area IV

The length of each segment is as following table.[60]

From	To	Distance (nautical miles)
Ko Kong Ok	Ko Kra	83.22
Ko Kra	Ko Losin	98.36
Ko Losin	Thai-Malaysian Boundary	65.28

Table 6: Length of each segment Thailand's straight baseline Area IV
Source: Author

The most seaward feature is Ko Losin about 40.11 nautical miles. Thailand's Area IV straight baseline is inapplicable for the US Department of State's test in both descriptive tests, each segment greater than 48 nautical miles and the Ko Kra and Ko Losin situated more than 24 nautical miles, and mathematical test, the ratio between the width of the features perpendicular to the general direction of the coast less than 50%. Ko Kra and Ko Losin are above low – water line[61] as well as have the light for navigation aids installed on them, Ko Kra and Ko Losin. Article 7(4) in the LOS Convention is stated that "Straight baselines shall not be drawn to and

[59] Available at http://www.un.org/Depts/los/LEGISLATIONANDTREATIES/PDFFILES/THA_1992_Announcement.pdf (Accessed on 14 August 2014)
[60] Each segment is measured on Thailand Nautical Chart No.045 at 8°N, Indian 1975 datum, scale 1: 1,850,000.
[61] Ko Kra and Ko Losin are coloured yellow on the nautical chart that means they are always above sea water.

from low-tide elevations, unless lighthouses or similar installations which are permanently above sea level have been built on them or except in instances where the drawing of baselines to and from such elevations has received general international recognition". The navigation aids which are installed one that features makes Thailand's Area IV straight baseline lawful for extending the basepoints to Ko Kra and Ko Losin. The navigation aids were erected on Ko Losin in 4 May 1975 and on Ko Kra in 6 August 1975.[62] Geographically, the claim of Thailand is considered as equitable as the claim of Cambodia because Thailand uses the most seaward features as Cambodia for constructing the straight baselines.

[62] Hydrographic Department.

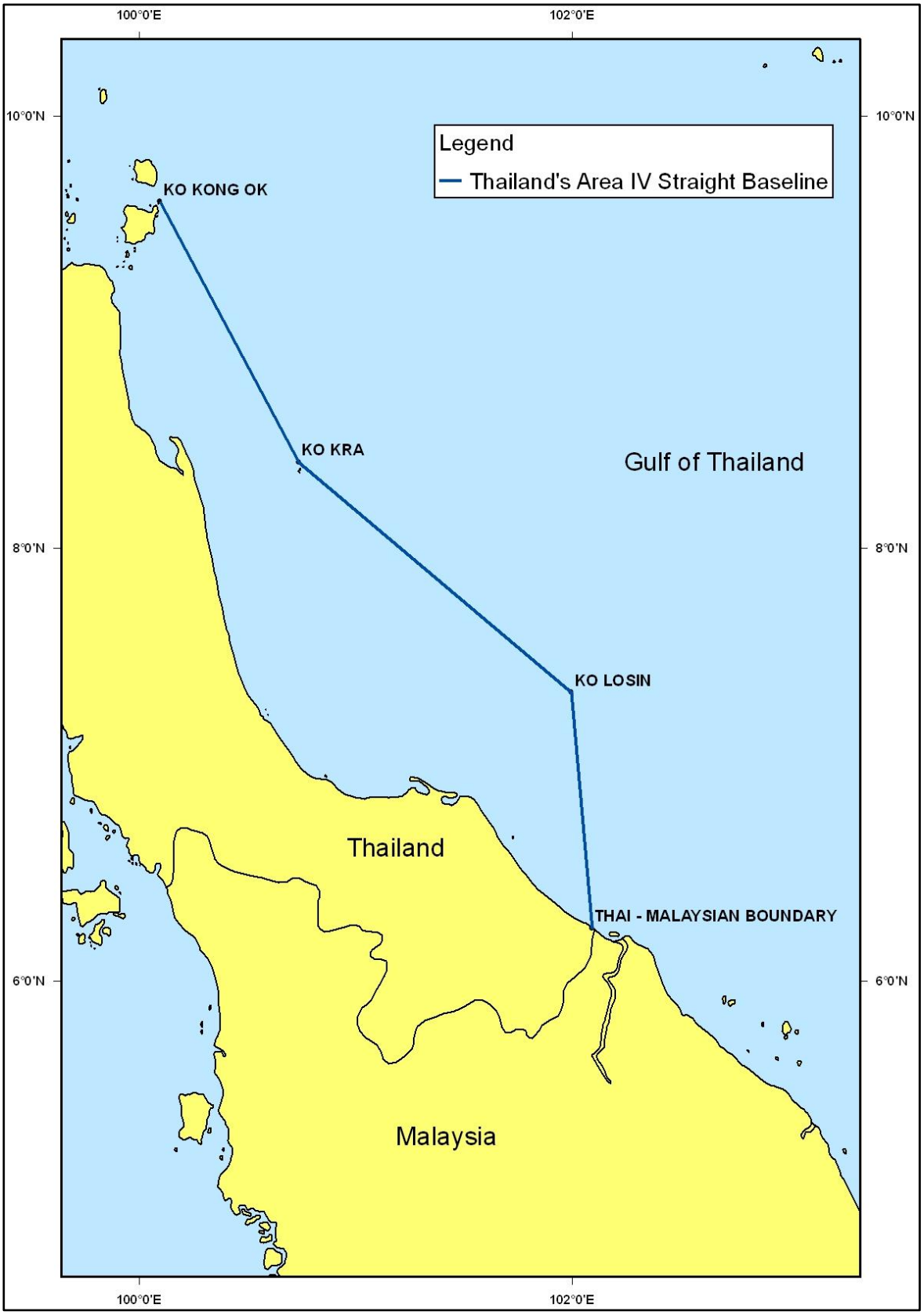

Figure 12: Thailand's Area IV straight baseline
Source: Author

Chapter 2 The 2001 Cambodia-Thailand MOU

2.1 Section A Continental Shelf Claims

2.1.1 Cambodia's continental shelf claimed

Four drafts of continental shelf delineations were proposed by a Committee of Experts formed by Cambodia in 1969 to study the Cambodia's continental shelf.[63] With respect to the delimitation with Thailand, the Committee was primarily concerned with two issues: the weight or effect to be given to the various Cambodian islands and rocks in the delimitation process; and the manner in which the Thai island of Koh Kut should be treated in the lateral section of the boundary.[64] The following picture is a working draft figure and not the definitive chart. This lacks technical information. Some technical information found on the draft of Cambodia's Continental Shelf Claims are scale, on the right top, which is 1 / 2192000 and a legend of lines explained at the bottom of the sketch chart. The critical information is none such as horizontal and vertical datum. The scale is too small to draw the low – water line. By following line explanation, line digitizing from the starting point is easier than the bottom.

Schofield explains the first three proposals as the following:

> The first proposal called for the lateral delimitation with Thailand to coincide with the bi-sector of the angle formed by the respective Thai and Cambodian baselines running from the terminal point on the land boundary.[65] Thailand adopted straight baselines in this area in 1970, the relevant segment of which stretched from the eastern tip of Koh Kut to the Thai-Cambodian land boundary's intersection with the coast. It must be recalled that at the time that these deliberations were taking place Cambodia was operating under its 1957 straight baseline system. Terming this the least favourable result, the Committee then proposed the construction of an equidistance line between Koh Prins and Poulo Wai on the Cambodian side and Koh Pennan, Koh Samuie, Ban Lem and Cap Patani on the Thai side to complete the delimitation. According to this option the Thai islets of Ko Kra and Ko Losin were therefore discounted. The second proposal was based on a line extending from the terminal point of the land boundary, described as a "perpendicular" line using the first segment of Cambodia's claimed straight baselines as its baseline and terminating at a point "PP" defined as being equidistant from the Cambodian and Thai baselines. This resulted in a slightly more favourable delimitation than the first alternative, which had essentially split the difference between the two parties' respective

[63] Schofield, Clive Howard (1999) Maritime boundary delimitation in the gulf of Thailand, Durham theses, Durham University. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/4351/

[64] Ibid.

[65] Schofield references to "Ranariddh, 1976: 367"

baselines. In both the first and second alternatives, the question of Cambodian sovereignty over Poulo Panjang (Tho Chu) and Koh Tral (Phu Quoc) islands was reserved.The third alternative was identical to the second except that it proceeded on the hypothesis that Poulo Panjang was under Cambodian sovereignty.[66]

[66] Schofield, Clive Howard (1999) Maritime boundary delimitation in the gulf of Thailand, Durham theses, Durham University. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/4351/

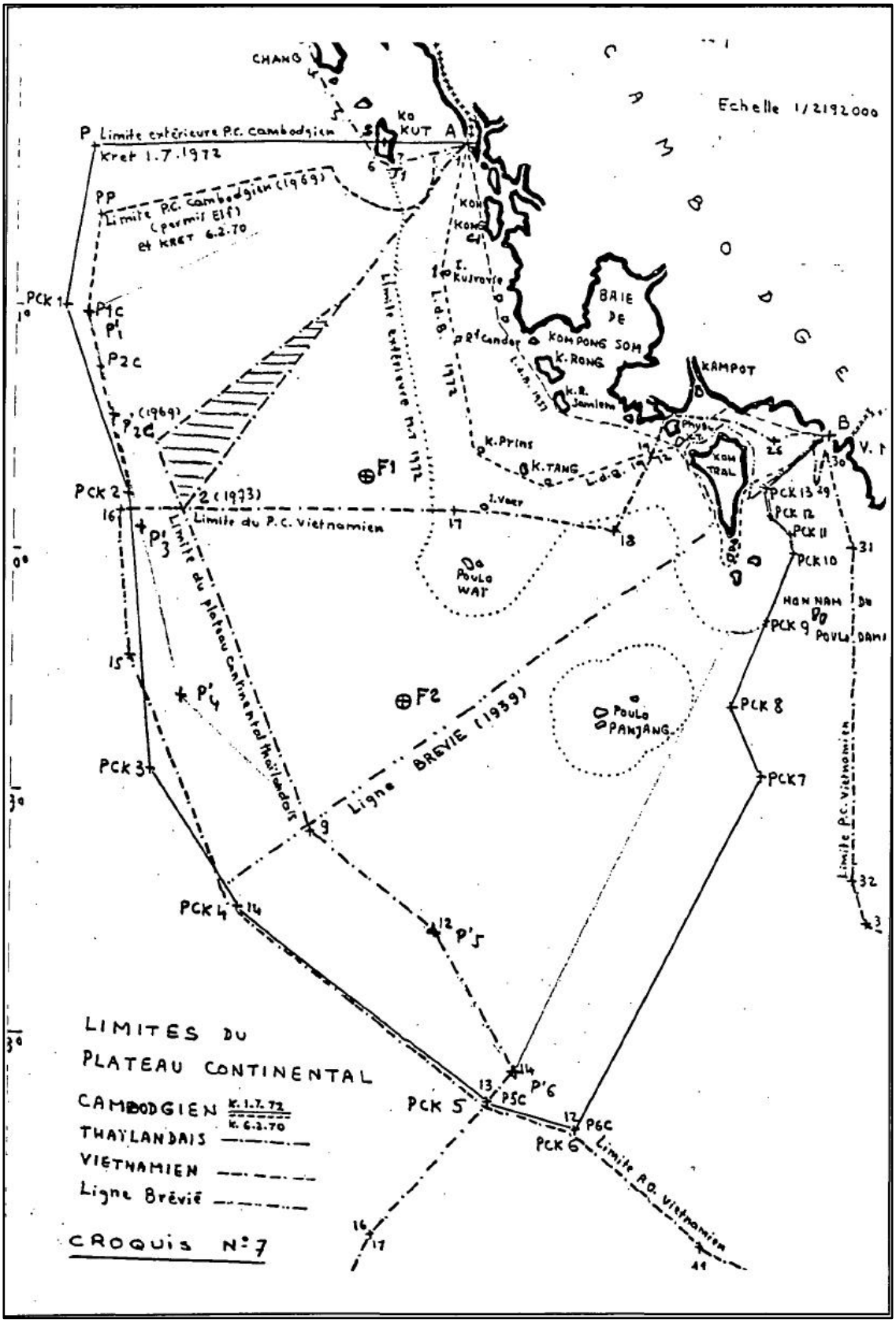

Figure 13: Draft of Cambodia's continental shelf claims
Source: Prince Norodom Ranariddh's thesis (1976)[67]

[67] Ibid.

The draft of Cambodia's continental shelf claims is rectified, geo-reference, to Thai nautical chart No.045 scale of chart 1: 1,850,000 at 8°N Indian 1975 Datum. Some technical aspects are not indicated on the draft such as horizontal and vertical datum, but the scale of draft is 1/2,192,000 as shown on the top right of the draft. The details, such as point A, point P and point Pck1 – Pck13, on the draft are used as control points to be rectified on Thai nautical chart. The list of Cambodia's continental shelf coordinates[68] is plotted as reference points to Thai nautical chart. The reference points, the red points, are for geo-referencing the draft of Cambodia's continental claims.[69] The result is as following.

[68] See Table 7.

[69] Cambodia's continental shelf coordinates are assumed on WGS 84 and plotted directly to Thai nautical chart.

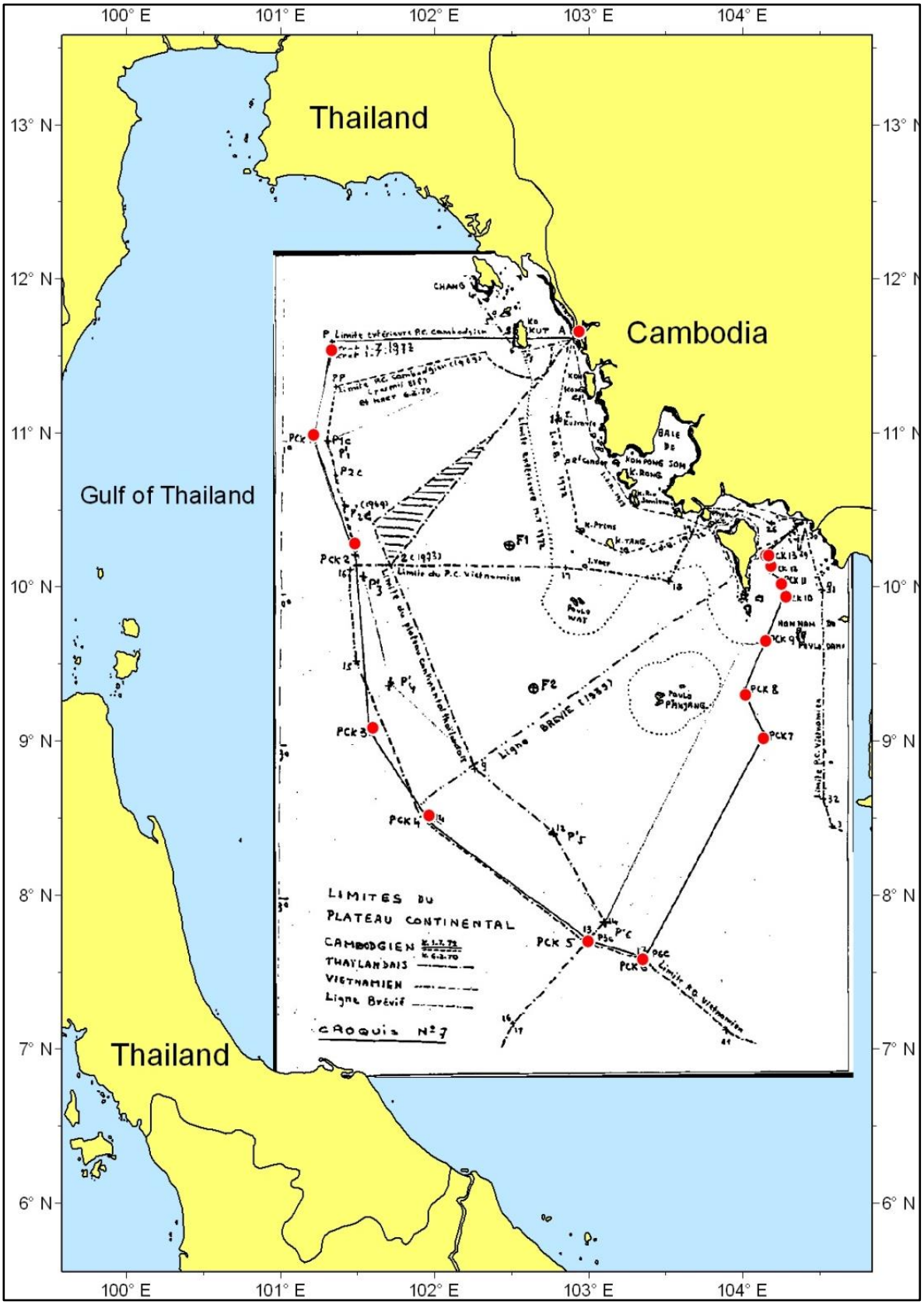

Figure 14: Rectified draft of propose Cambodia's continental shelf
Source: Proposed draft from Prince Norodom Ranariddh's thesis (1976)[70]
: Proposed draft registered and lines digitized by author

[70] Ibid

The author draws the four proposed continental shelf by following Clive Howard's explanation[71] and the geo-referenced draft of propose Cambodia's continental shelf. The first proposal called for the lateral delimitation with Thailand to coincide with the bi-sector of the angle formed by the respective Thai and Cambodian baselines running from the terminal point on the land boundary.[72] The result was not the most favorable. The Committee then continued with a the proposed construction of an equidistance line between Koh Prins and Poulo Wai on the Cambodian side and Koh Pennan,[73] Koh Samuie,[74] Ban Lem and Cap Patani on the Thai side to complete the delimitation.[75] It seems that the line was drawn by disregarding Thailand' straight baselines and that the Committee did not use only outermost points of the straight baselines, but also use features, Koh Prins and Poulo Wai, further seaward. The first continental shelf can be drawn from the terminus point, which is named on the chart as Point A, between Cambodia and Thailand to point P'1 at the first segment. The distance for the first segments is 103.690 nautical miles.[76] The second segment from point P′1 to point P′2 is 25.345 nautical miles, the third segment from point P′2 to point P′3 is 29.124 nautical miles, the forth segment from point P′3 to point P′4 is 42.588 nautical miles and the last segment from point P′4 to the Brevie Line is 44.972 nautical miles. The first proposal ends at the Brevie Line because it is on hypothesis that Poulo Panjang were not under Cambodian sovereignty.[77] It is vague for continuing to draw the line from the ending point where the segment from point P'4 intersected with the Brevie Line.

[71] Ibid.
[72] Ibid
[73] On Thai nautical chart spelled as Ko Pha-ngan on British Admiraltly chart spelled as Ko Phangan.
[74] On Thai nautical chart and British Admiraltly chart spelled as Ko Samui.
[75] Schofield, Clive Howard (1999) Maritime boundary delimitation in the gulf of Thailand, Durham theses, Durham University. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/4351/
[76] The distance in nautical miles is measured by three decimal place, 1 nautical mile = 1852 meters. If nautical mile unit is converted to centimetre unit, it has no decimal place.
[77] Schofield, Clive Howard (1999) Maritime boundary delimitation in the gulf of Thailand, Durham theses, Durham University. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/4351/

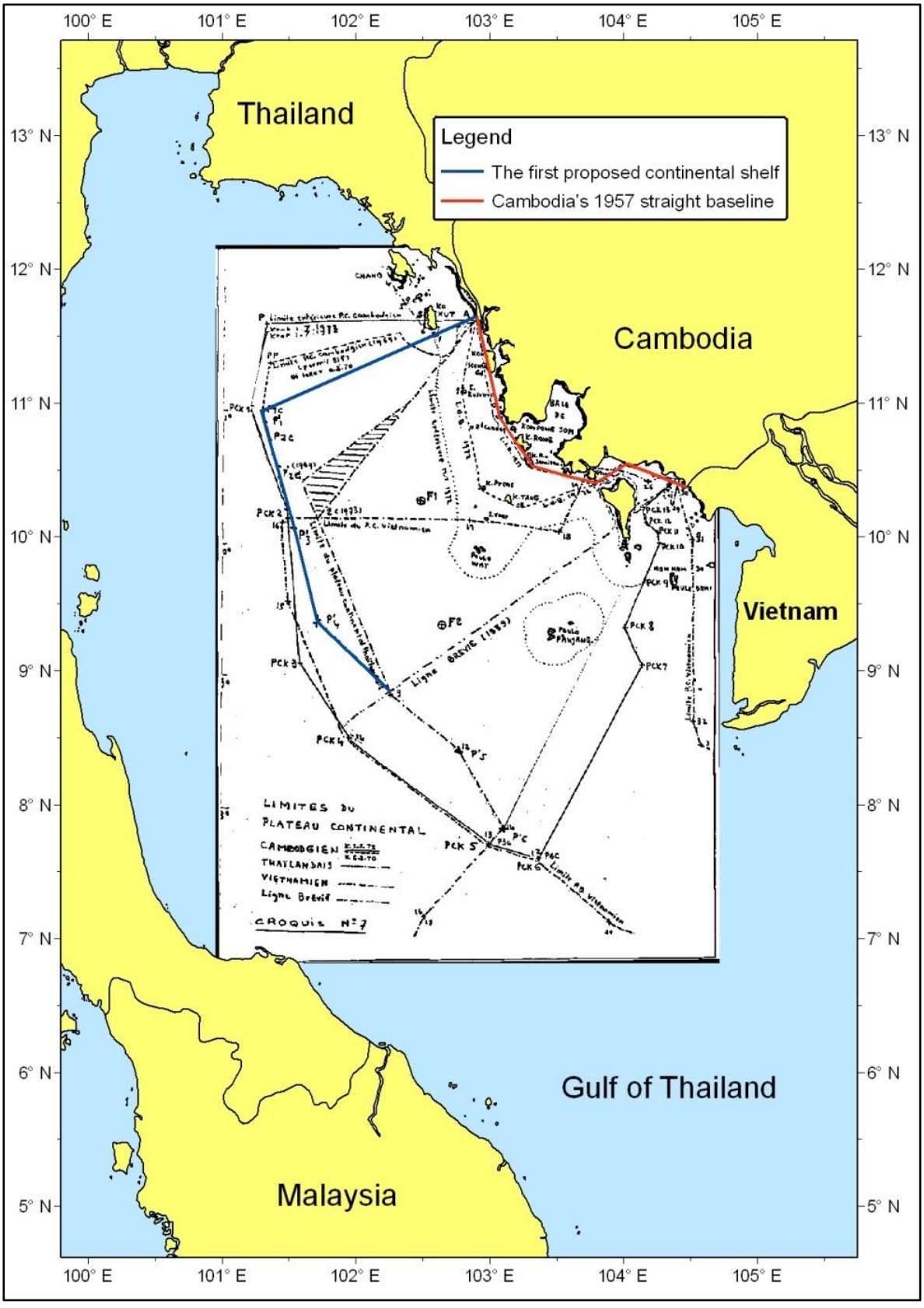

Figure 15: Digitizing of the first propose Cambodia's continental shelf
Source: Proposed draft from Prince Norodom Ranariddh's thesis (1976)[78]
: Proposed draft registered and lines digitized by author

[78] Ibid

The second proposal was based on a line extending from the terminal point of the land boundary, described as a "perpendicular" line using the first segment of Cambodia's claimed straight baselines as its baseline and terminating at a point "PP" defined as being equidistant from the Cambodian and Thai baselines.[79] Distance from starting point, same as the first proposal, to point PP is 93.128 nautical miles, from point PP to point P′1 is 21.887 nautical miles. The second proposal has area more than the first proposal. This resulted in a slightly more favorable delimitation than the first alternative, which had essentially split the difference between the two parties' respective baselines.[80] The first segment of the second continental shelf is perpendicular to Cambodia's 1957 straight baseline. The first segment is terminated at the turning point named point PP. From point PP, the line continues southward to point P'1, and then identically continues as same as the first proposed continental shelf. The second continental shelf line cuts off some land in the south of Ko Kut. It has no explanation why the line from terminus point is drawn perpendicularly to the first segment of Cambodia's 1957 straight baseline.

[79] Ibid.
[80] Ibid.

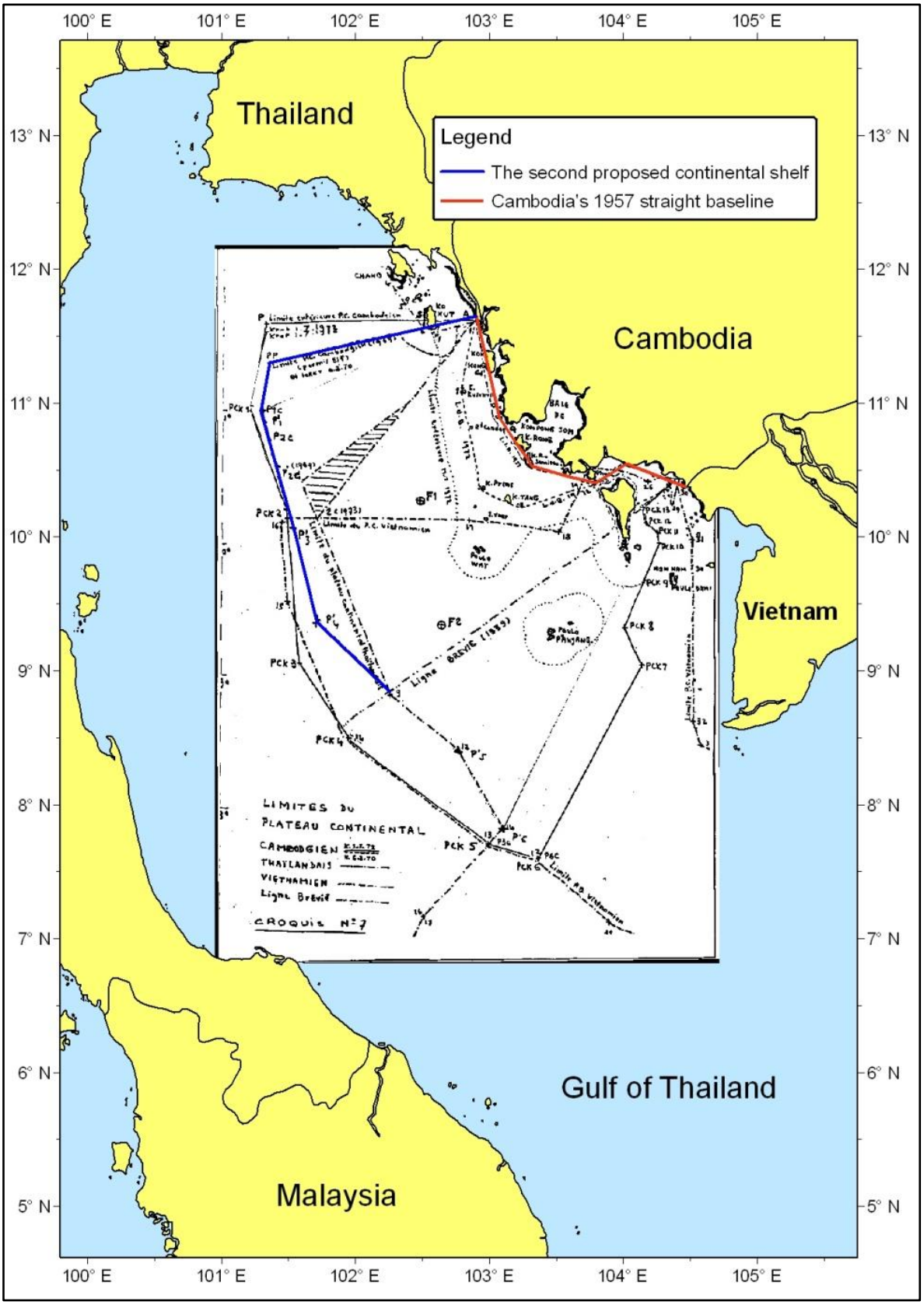

Figure 16: Digitizing of the second propose Cambodia's continental shelf
Source: Proposed draft from Prince Norodom Ranariddh's thesis (1976)[81]
: Proposed draft registered and lines digitized by author

[81] Ibid.

The third alternative was identical to the second except that it proceeded on the hypothesis that Poulo Panjang was under Cambodian sovereignty.[82] The continental shelf line continues from point P′4 across the Brevie Line to point P′5 which is about 86.016 nautical miles. The next segment form point P′5 to point P′6 is about 39.574 nautical miles. It has no point P′7 and further points on the registered and sketched chart for finishing the delineation. But, at point P′6 is dash line drawn north – eastern toward mainland.

[82] Ibid.

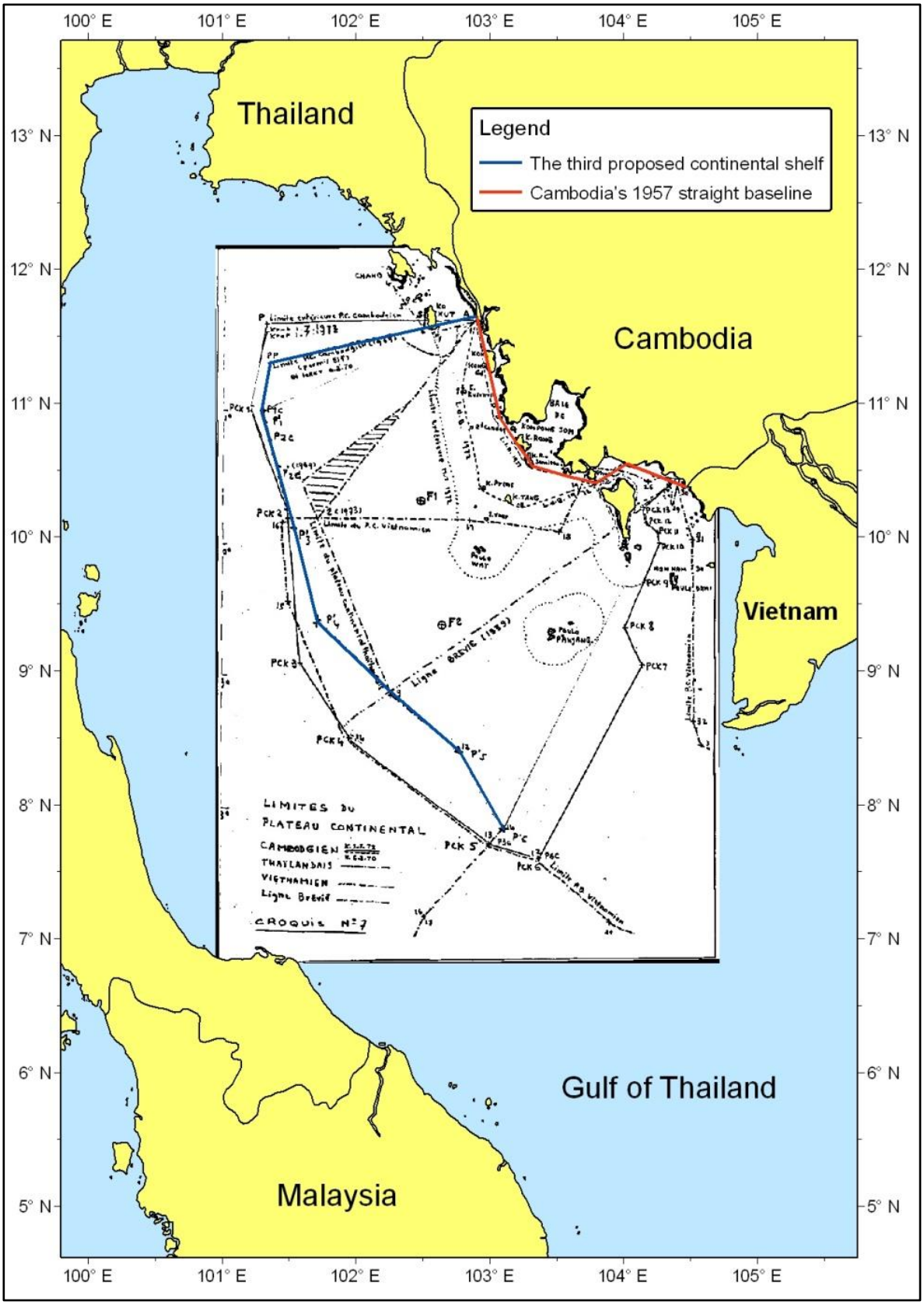

Figure 17: Digitizing of the third propose Cambodia's continental shelf
Source: Proposed draft from Prince Norodom Ranariddh's thesis (1976)[83]
: Proposed draft registered and lines digitized by author

[83] Ibid.

Schofield explains the fourth proposals the following:

> The fourth alternative was ultimately embodied in *Kret* No. 77 -70-CE of 6 February 1970. This recommendation was based on a line drawn on the basis of Cambodian 1957 straight baselines and thence equidistant between the two countries, using the islands of Poulo Wai and Panjang as base points on the Cambodian side (see Figure 5). In contrast to Cambodia's subsequent 1972 claim, that of 1970 describes an arc around the southern tip of Ko Kut island and, by terminating at Point PP, falls both south of the lateral claim and east of the interpretation of equidistance used to construct the opposite claim vis-a-vis Thailand constructed in 1972. This *Kret* formed the basis for Cambodia's first offshore concessions. On 21 February exploration rights to Cambodia's entire continental shelf, were formally awarded to the French Elf-ERAP Group.[84]

[84] Ibid.

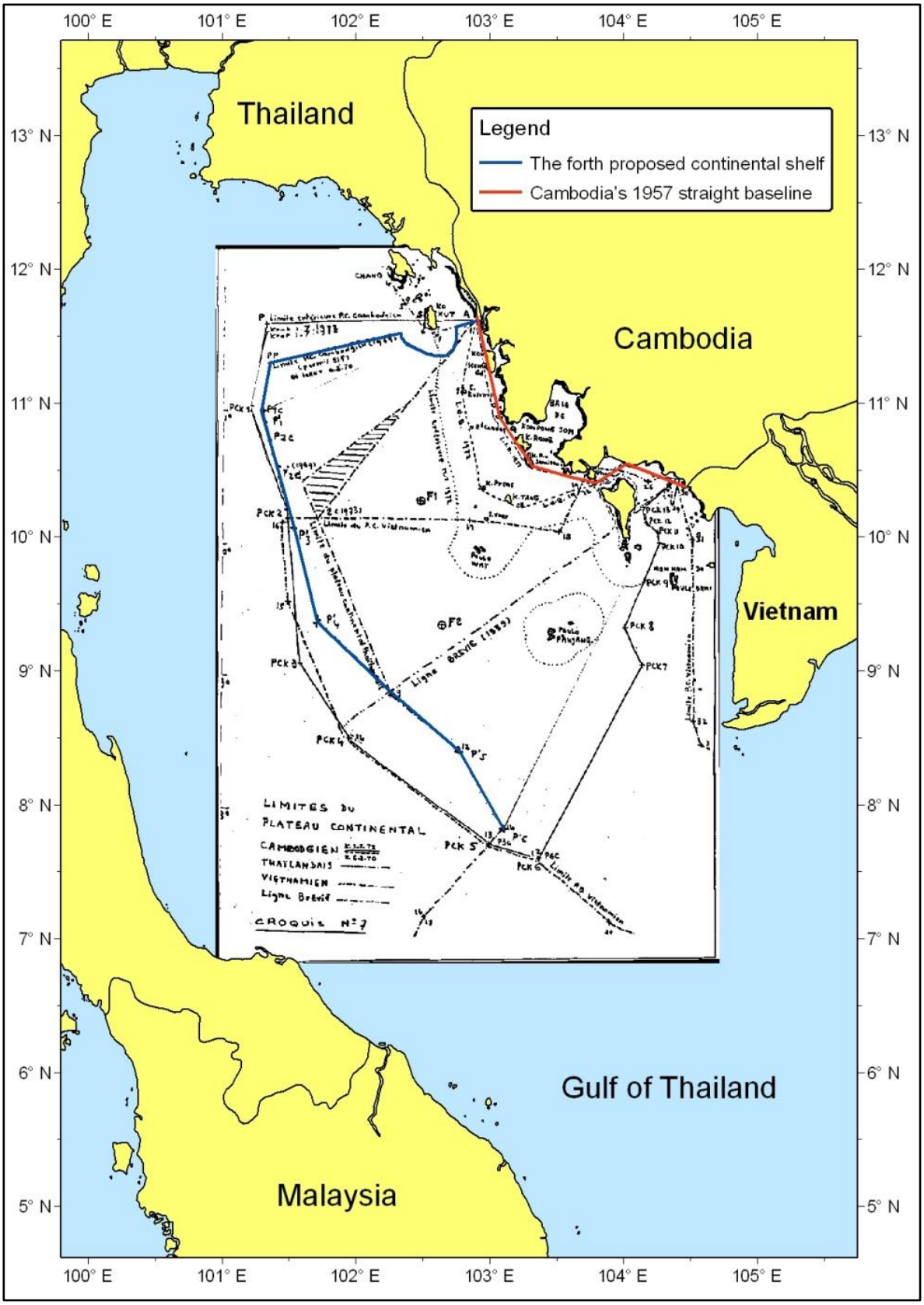

Figure 18: Digitizing of the forth propose Cambodia's continental shelf
Source: Proposed draft from Prince Norodom Ranariddh's thesis (1976)[85]
: Proposed draft registered and lines digitized by author

[85] Ibid.

Cambodia's 1970 claim was, however, swiftly superseded by *Kret* No.439172- PKR of 1 July 1972, which modified and extended the continental shelf limits claimed by Cambodia in 1970.[86] It seems that Cambodia took the most advantages for claiming the continental shelf in the Gulf of Thailand as Cambodia claimed continental shelf in 1 July 1972 by Degree of Khmer Republic. The coordinates from the map No.1972 of French Navy established in 1949, scale 1: 1,096,000 connected to boundary continental shelf of Cambodia as follows:[87]

- Point "A" is a border point on the sea line as stated in Treaty of Fraco-Siam, 23 March 1907 lying at longitude 102° 55´ 81´´ east and latitude 11° 38´ 88´´ north.

Remark on these coordinates is that the number of seconds cannot exceed 60´.

- Point "P" is the end point of straight line from point "A", the Koh Rosvie Island and baseline of Thailand are opposite lying longitude 101°20´00´´east and latitude 11°32´00´´north.

- The delimitation of equidistance line from north to south represents a line starting from point "P" and passing through point Pck1, Pck2, Pck3, Pck4, Pck5, Pck6, Pck7, Pck8, Pck9, Pck10, PcK11, Pck12, Pck13, and point "B" (a boundary point with North Vietnam), whose co-ordinates are as following table:

Point's name	Longitude East	Latitude North
Pck1	101°13´00´´	10°59´00´´
Pck2	101°29´00´´	10°16´50´´
Pck3	101°36´00´´	9°05´00´´
Pck4	101°57´50´´	8°31´00´´
Pck5	102°59´50´´	7°42´00´´
Pck6	103°21´00´´	7°35´00´´
Pck7	104°08´00´	9°01´00´´
Pck8	104°01´00´´	9°18´00´´
Pck9	104°08´50´´	9°38´50´´
Pck10	104°16´50´´	9°56´00´´
Pck11	104°15´00´´	10°01´00´´
Pck12	104°10´50´´	10°08´00´´
Pck13	104°09´00´´	10°12´00´´
Point B	104°09´63´´	10°12´00´´

Table 7: List of Cambodia's continental shelf coordinates
Soruce: Mom Ravin (2005)

[86] Ibid.
[87] Mom Ravin, Law of the Sea, Maritime boundaries and dispute settlement mechanisms, page 107 - 108.

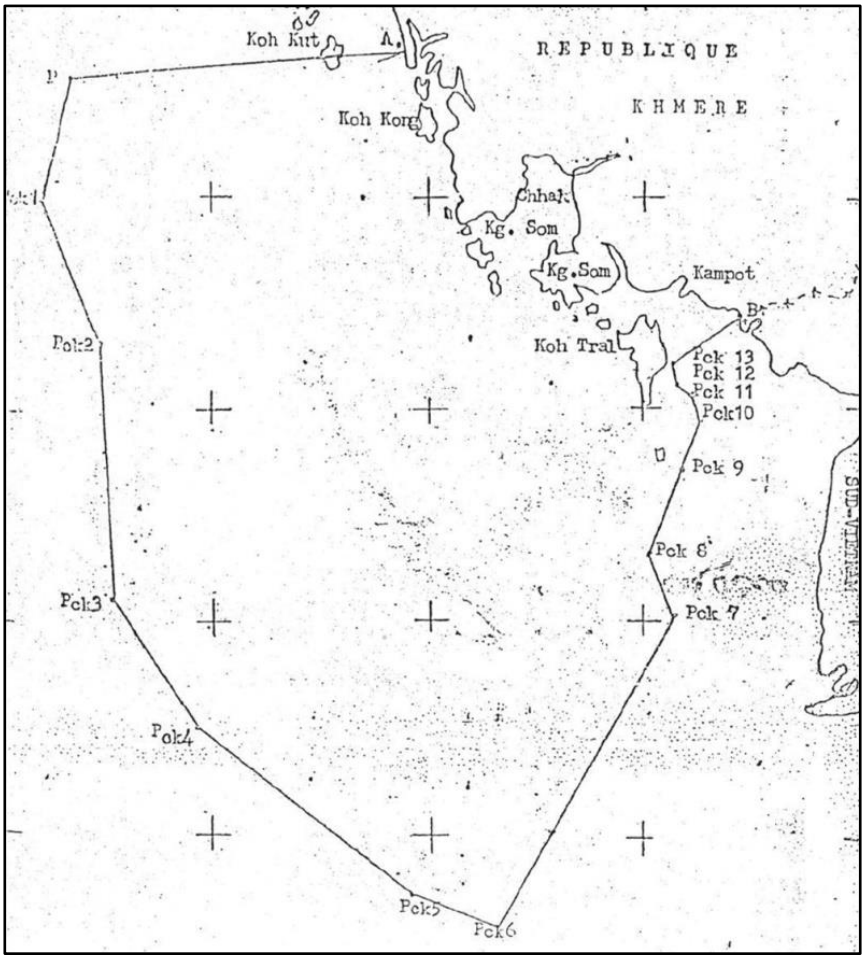

Figure 19: The attached map for Cambodia's continental shelf claim[88]
Source: Surakiart Sathirathai (2011)

After agreeing on the Historic Water with Vietnam, Cambodia reclaimed straight baseline again, the third time of claims, coordinates of baselines in Decree of the Council of State of 13 July 1982 of Cambodia as following.[89]

Number Geographical Place	Latitude(N)	Longitude(E)
1 Border point on low-water mark between Thailand and the People's Republic of Kampuchea according to Treaty of 23 March 1907	11° 38.8'	102° 54.3'
2 Kack Kusrovie	11° 06.8'	102° 47.3'
3 Kack Voar	10° 14.0'	102° 52.5'
4 Poulo Wai	09° 55.5'	102° 53.2'
5 Point O out at sea on the south-west limit of the historic waters According to the Agreement of 7 July 1982 of the People's Republic of Kampuchea		

Table 8: List of Cambodia's 1982 straight baseline coordinates
Source: DOALOS

[88] Surakiart Sathirathai,Thai – Cambodia Maritime Overlapping Area: Problem and Development, page 7. Available at http://www.geozigzag.com/jurasan/ssp_index.php (Accessed: 15 July 2014)
[89] Decree of the Council of State of 13 July 1982 Available at http://www.un.org/Depts/los/LEGISLATIONANDTREATIES/STATEFILES/KHM.htm (Accessed: 14 July 2014)

Remark I The 1st point, coordinate longitude 102° 55´ 81´´ East and latitude 11° 38´ 88´´ North, of Cambodia's claim in 1972 is different from the 1st point, coordinate 102°54.3´ East and 11°38.8´ North, from the Decree of the Council of State of 13 July 1982. If these points are same in horizon datum and projection, the coordinates must not be different.

Remark II Geographically, the 4th point should be as same as point stated in the agreement on the Historic Waters between Cambodia and Vietnam. The point in the agreement has coordinates as described "In the southwest, the straight line stretches from coordinate 09°55´0 latitude north and 102°53´5 longitude east of Poulo Wai Island"

Remark III There are no technical details, such as chart datum and chart scale, in both the Agreement and the Decree of the Council of State.

2.1.2 Thailand's continental shelf claimed

Thailand claimed continental shelf in on 18 May 1973. The coordinates of the points are as follows:[90]

Point's name	Longitude East	Latitude North
1	11°39.0´	102°55.0´
2	09°48.5´	101°46.5´
3	09°43.0´	101°48.5´
4	09°42.0´	101°49.0´
5	09°28.5´	101°53.5´
6	09°13.0´	101°58.5´
7	09°11.0´	101°59.0´
8	08°52.0´	102°13.0´
9	08°47.0´	102°16.5´
10	08°42.0´	102°26.5´
11	08°33.0´	102°38.0´
12	08°29.0´	102°43.0´
13	07°49.5´	103°05.5´
14	07°25.0´	103°24.8´
15	06°50.0´	102°21.2´
16	06°27.8´	102°09.6´
17	06°27.5´	102°10.0´
18	06°14.5´	102°05.6´

Table 9: List of Thailand's continental shelf coordinates
Source: Royal Proclamation establishing the Continental Shelf of the Kingdom of Thailand

[90] Royal Proclamation establishing the Continental Shelf of the Kingdom of Thailand in the Gulf of Thailand, 18 May 1973.

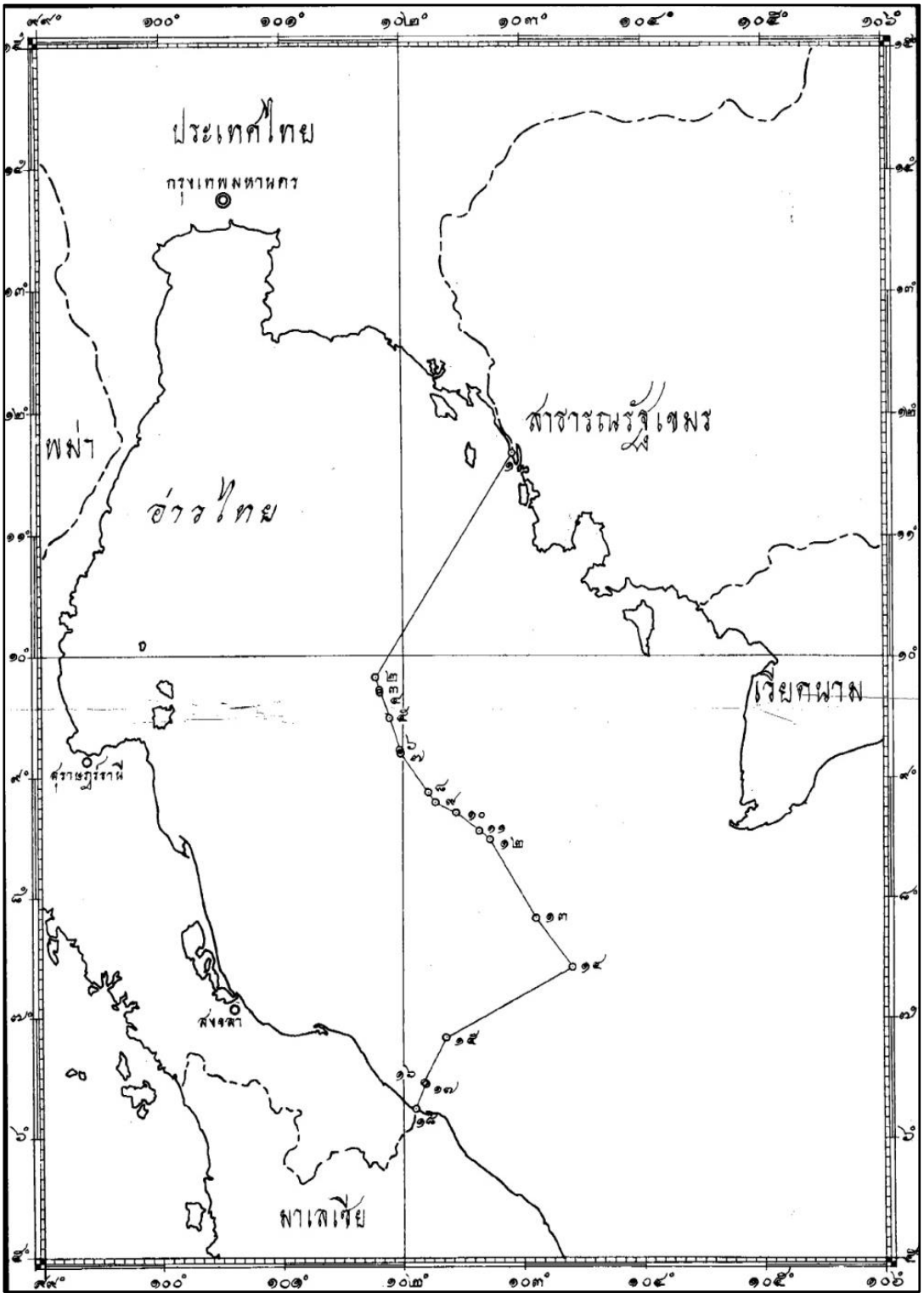

Figure 20: Thailand's continental shelf claim[91]
Source: Royal Proclamation establishing the Continental Shelf of the Kingdom of Thailand

[91] Royal Proclamation establishing the Continental Shelf of the Kingdom of Thailand in the Gulf of Thailand, 18 May 1973, Available at http://www.ratchakitcha.soc.go.th/RKJ/index/index.htm (Accessed: 15 July 2014).

The starting point for Thailand's continental shelf hypothesis coincides with the Cambodia's starting point. The starting point is the land terminus point as stated in the Franco – Siam Treaty 23 March 1907. Thailand unilaterally coordinated the starting point different from Cambodia's starting point. Cambodia's starting point is 11° 38.8'N and 102° 54.3' E whereas Thailand's starting point is 11°39.0′ N and 102°55.0′ E. The entire lateral or adjacent boundary between Cambodia and Thailand claimed by Thailand is made up of a straight line from the land boundary terminus to Point 2 in the central Gulf. Schofield explains the first segment of Thailand's continental shelf that.

> Point I of the Thai claim coincides with the terminus of the land boundary between Cambodia and Thailand. The entire lateral or adjacent boundary between Cambodia and Thailand claimed by the Thais is made up of a straight line from the land boundary terminus to Point 2 in the central Gulf. The long straight line adjacent boundary claimed by Thailand between Points 1 and 2 in relation to Cambodia in 1973 is consistent with a bisector of the angle between the straight baseline segments of the two states' respective straight baseline systems immediately offshore.[92]

The two straight baseline claims involved are Thailand's Area I declared by Bangkok in 1970 and the relatively conservative straight baselines declared by Cambodia in 1957.[93] The remainder of the 1973 Thailand claim, from point 2 to point 13 in the Central Gulf of Thailand relevant to Cambodia and Vietnam consists of a north-south median line equidistant, probably between the opposite mainland coasts of Cambodia and Thailand, but ignoring both its own Area 2 straight baseline claim, Cambodia's straight baseline claim and Cambodian islands.[94] From Point 14 the Thai claimed continental shelf boundary turns abruptly southwest to terminate at Point 18 at the intersection of the Thai-Malaysia land boundary on the coast.[95]

[92] Schofield, Clive Howard (1999) Maritime boundary delimitation in the gulf of Thailand, Durham theses, Durham University. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/4351/
[93] Ibid.
[94] Ibid.
[95] Ibid.

2.2 Section B Solutions for Overlapping claimed areas in the Gulf of Thailand

The unilateral claims, Vietnam in June 1971, Cambodia in July 1972 and Thailand in 1973, in the Gulf of Thailand were in early 1970's decade. The overlapping claimed among three countries in the Gulf of Thailand is as following picture.[96]

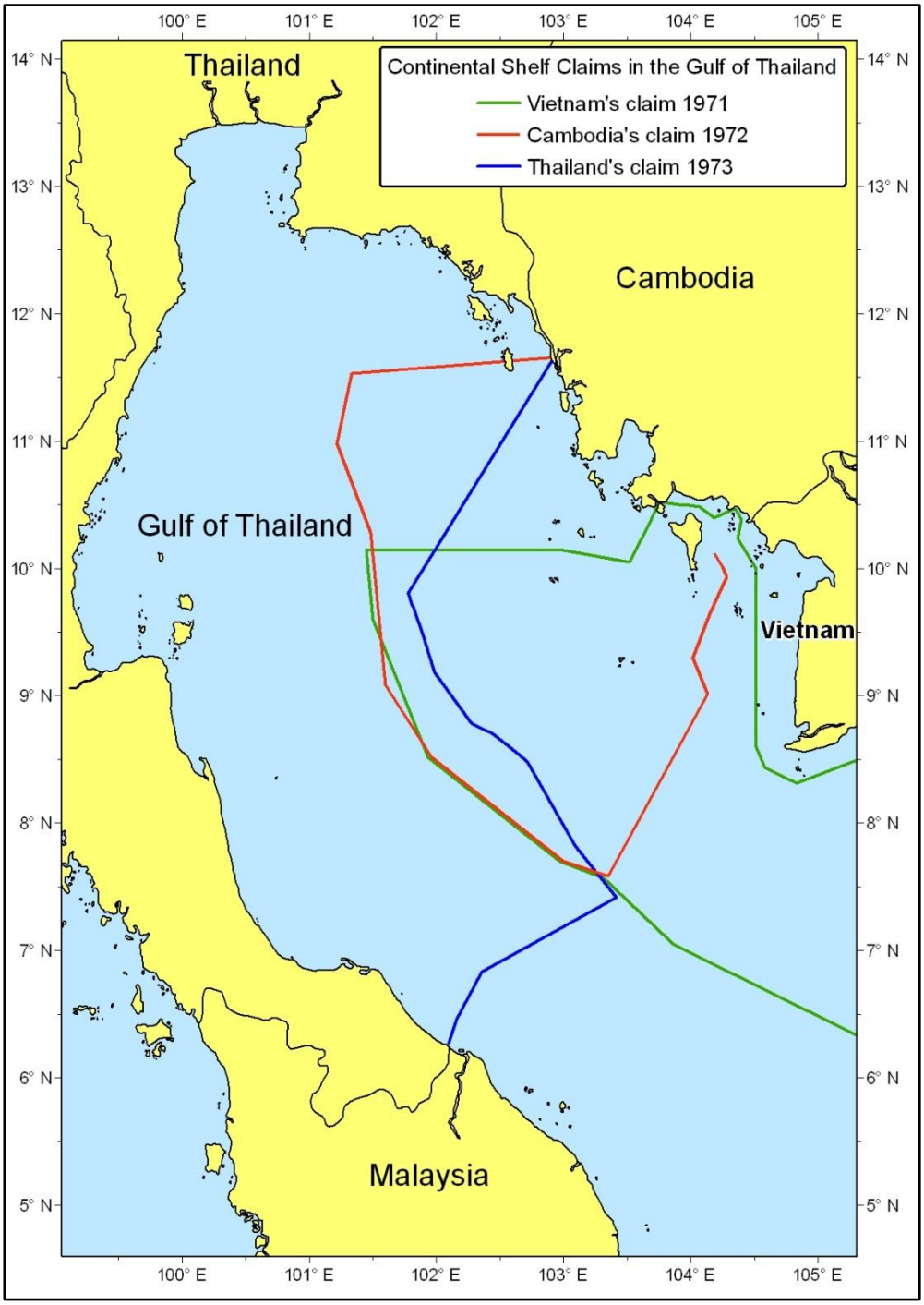

Figure 21: Continental shelf claim in the Gulf of Thailand
Source: Author

[96] Every coordinates are assumed to be on WGS84. The claimed coordinates will be plotted on chart scale 1:1,850,000. The parameters for datum transfer, from Royal Thai Survey Department, from WGS84 to Indian1975 are; dx : 204.5 meters, dy;837.9 meters, dz;294.8 meters. Available at http://www.rtsd.mi.th/. The maximum error for plotting the claimed coordinates would be 2,687.9 meters, if the thickness 1 mm. is used for delineation. The error is from 1,850 meters of chart scale and 837.9 meters of maximum parameters for datum transfer.

Cambodia and Vietnam had agreed to claim the Historic Water together in 7th July 1982. Charney and Alexander described this agreement that "Several countries have protested the historic waters designation in the agreement on the ground that the criteria for historic waters are well-accepted and that Cambodia and Vietnam have failed to demonstrate that they have openly asserted their claim, that jurisdiction has been effectively exercised for a significant time period, and that other states have acquiesced to the claim. For Thailand, the significant effect was the detail in the Article 3 of the Historic Water Agreement that "The meeting point O of the two baseline used for measuring the breadth of the territorial waters of each country situated in the sea on the line connecting from Tho Chu Island and Poulo Wai Island will be defined by an agreement between the two Parties". Point O is at the middle point on line connecting Tho Chu Island of Vietnam and Poulo Wai Island of Cambodia. The equitable median line from point O must be perpendicular to line connecting Tho Chu Island and Poulo Wai Island. A Vietnamese academic has referenced the existence of a 1991 "Working Arrangement" regarding a maritime boundary between Cambodia and Vietnam.[97]

[97] Nguyen Hong Thao, Vietnam's First Maritime Boundary Agreement, 5 Boundary & Sec. Bull. 74, 77 (1997).

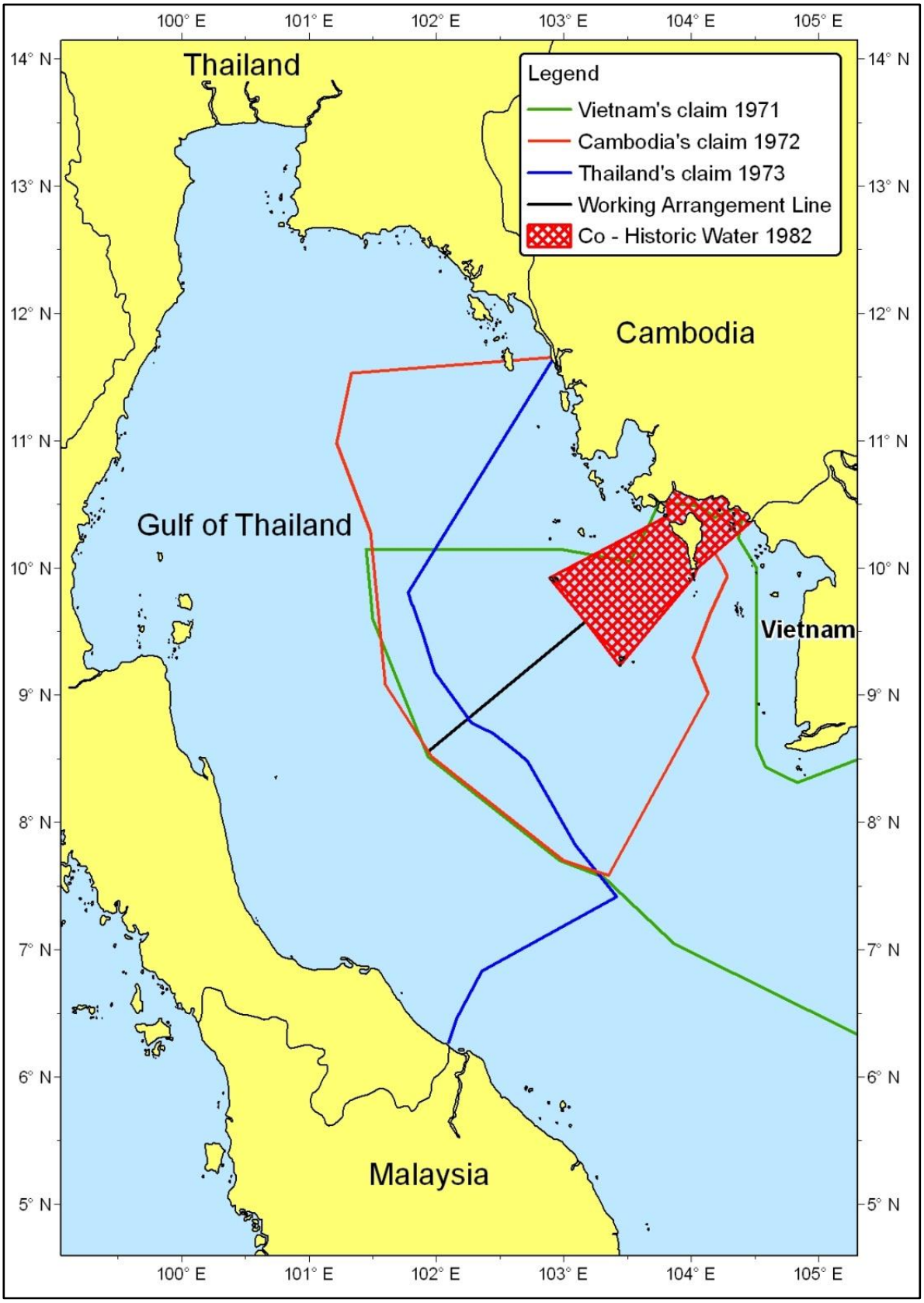

Figure 22: Cambodia and Vietnam Historic Water
Source: Author

After agreeing the Historic Water with Vietnam, Cambodia also deposited their new straight baseline coordinates. *Baseline retained for the limitation of the territorial waters of the People's Republic of Kampuchea Decree of the Council of State of 13 July 1982,*[98] *to Division of Ocean Affair and the Law of the Sea (DOALOS) United Nations*. Maritime zones of Cambodia after the Historic Water Agreement should be as following picture.

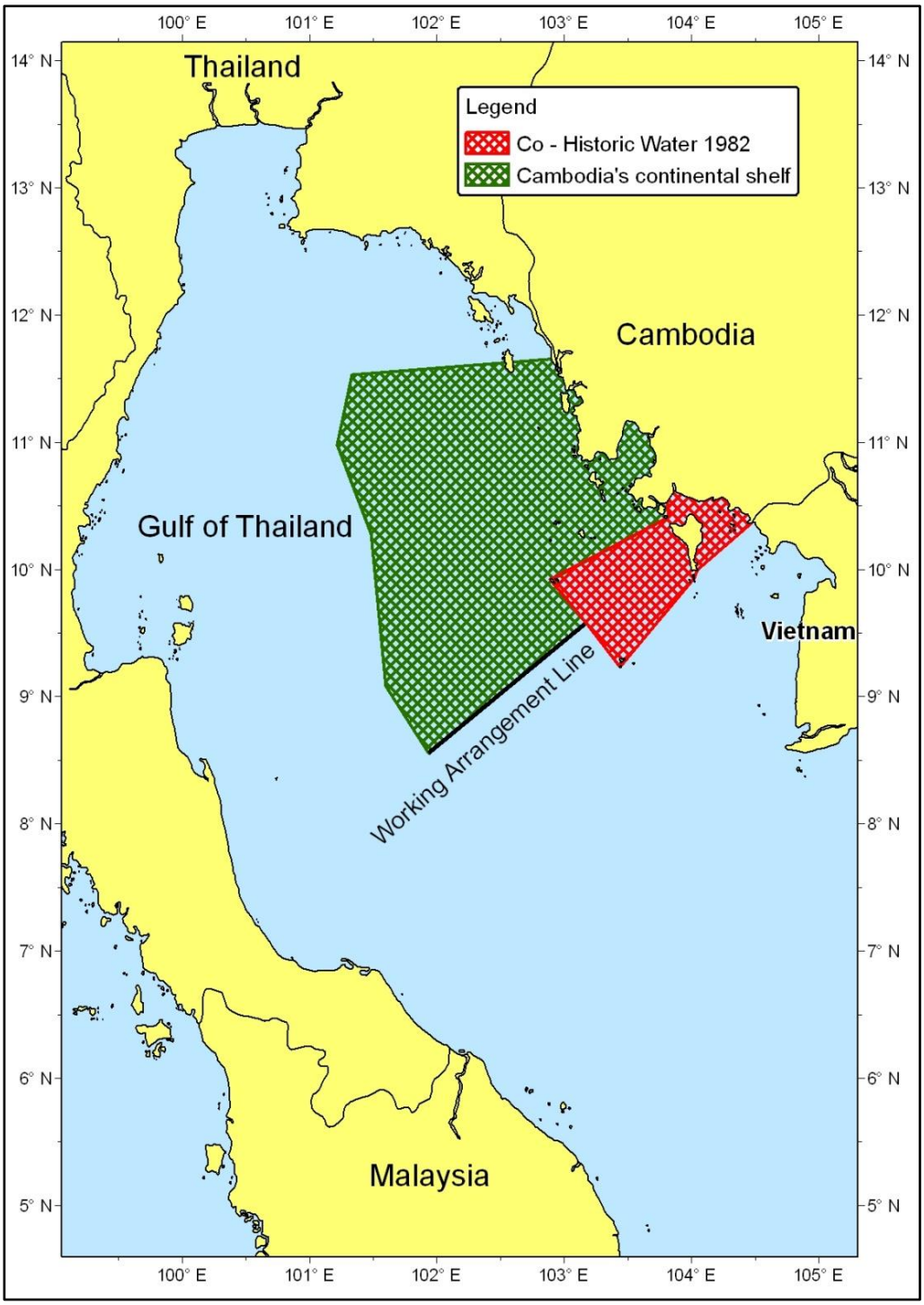

Figure 23: Cambodia's continental shelf above the Working Arrangement Line
Source: Author

[98]Available at http://www.un.org/Depts/los/LEGISLATIONANDTREATIES/STATEFILES/KHM.htm (Accessed: 14 July 2014)

The Working Arrangement Line is perpendicular to line closing the Historic Water. By implication, the area above the Working Arrangement Line will be under Cambodia sovereignty whereas area below the Working Arrangement Line will be under Vietnam sovereignty. This can be recognized by the Cambodia – Thailand MOU 2001 and the agreement between Thailand and Vietnam on maritime delimitation. The location of Point Int2 & Int3 which are stated in Cambodia – Thailand MOU 2001 will be verified. Point Int2 & Int3 are on the Working Arrangement Line. The Point K which is the starting point for maritime delimitation between Thailand and Vietnam also is on the Working Arrangement Line. Area above the Working Arrangement Line Cambodia's continental shelf will overlap with Thailand's continental shelf, and area below the Working Arrangement Line Vietnam's continental shelf will overlap with Thailand's continental shelf.

After Cambodia and Vietnam had agreed on the Historic Water Agreement, Thailand and Vietnam had agreed on the delimitation of the maritime boundary between the two countries in the Gulf of Thailand in 9th August 1997.[99] The detail of the agreement was stated that "The maritime boundary between the Kingdom of Thailand and the Socialist Republic of Viet Nam in the relevant part of their overlapping continental shelf claims in the Gulf of Thailand is a straight line drawn from Point C to Point K defined by latitude and longitude as follows: Point C: Latitude N 07° 48' 00.0000", Longitude E 103° 02' 30.0000" Point K: Latitude N 08° 46' 54.7754", Longitude E 102° 12' 11.6542"". Point C is the northernmost point of the Joint Development Area established by the Memorandum of Understanding between Thailand and Malaysia on the Establishment of a Joint Authority for the Exploitation of the Resources of the Seabed in a Defined Area of the Continental Shelf of the Two Countries in the Gulf of Thailand, done at Chiangmai on 21 February 1979, and which coincides with Point 43 of Malaysia's continental shelf claim advanced in 1979 whereas Point K is a point situated on the maritime boundary between Viet Nam and Cambodia, which is the straight line equidistant from Tho Chu Islands and Poulo Wai drawn from Point O Latitude N 09°35'00.4159" and Longitude E 103°10'15.9805".[100]

[99] Available at http://www.un.org/Depts/los/LEGISLATIONANDTREATIES/PDFFILES/TREATIES/THA-VNM1997MB.PDF (Accessed: 15 July 2014)
[100] Ibid.

The agreement respects to the neighboring coastal states both Cambodia and Malaysia that the Point C does not exceed the agreement between Malaysia and Thailand and Point K is on the median line between Cambodia and Vietnam.

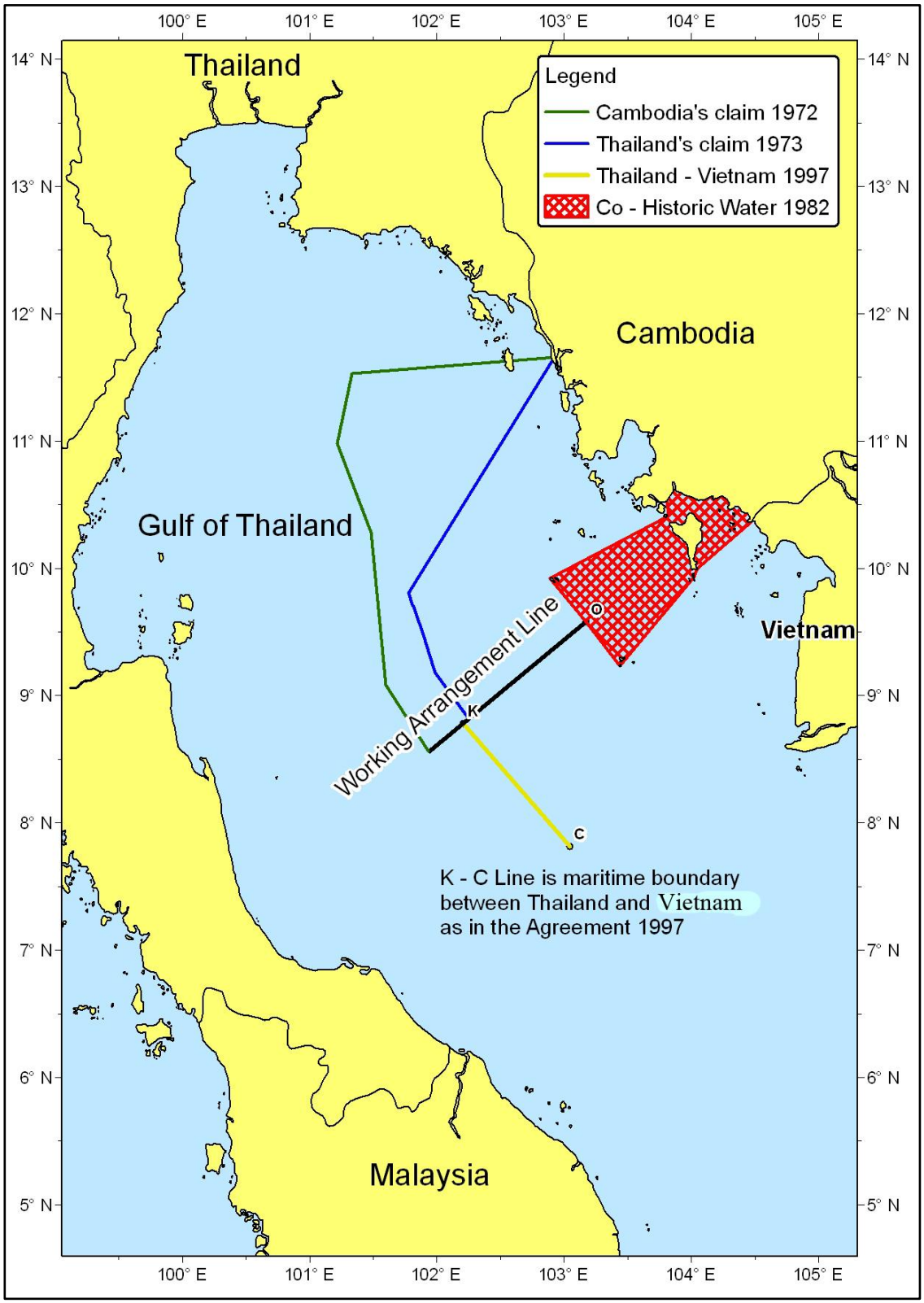

Figure 24: Maritime boundary between Thailand and Vietnam
Source: Author

The picture shows point K and C which are described in the Agreement between Thailand and Vietnam. The line connecting Point K and Point C is perpendicular to Working Arrangement Line (yellow colour).

The result of agreement on the Historic Water between Cambodia and Vietnam made maritime boundary between Thailand and Vietnam possible. The overlapping claimed area between Cambodia and Thailand is still unresolved.

2.2.1 Continental Shelf Delineation[101]

Cambodia and Thailand claimed continental shelf unilaterally. Each States has own hypothesis for median line construction. This section will scrutinize the continental shelf delineation of both Cambodia and Thailand.[102]

Cambodia continental shelf delineation

The continental shelf construction is explained in Degree of Khmer Republic.[103] In the Degree of Khmer Republic, the highest summit of Koh Kut is named as Point 'S' which has no coordinates specified. Point 'P' is the end point of straight line from point 'A', the Koh Rosvie Island and baseline of Thailand are opposite lying longitude 101°20´00´´ E and latitude 11°32´00´´ N.[104] The length from point P to point A is about 94.792 nautical miles. Dash black line from point P the same length from point P to point A intersecting Thailand's coastline might be the control point on Thailand's side. This control point is not the outermost point as seen on the figure the circle is in Thailand's mainland especially the land adjacent to the terminus point.

[101] The control points of turning points are from author's hypothesis.

[102] Every coordinates are assumed to be on WGS84. The claimed coordinates will be plotted on chart scale 1:1,850,000. The parameters for datum transfer, from Royal Thai Survey Department, from WGS84 to Indian1975 are ; dx : 204.5 meters, dy;837.9 meters, dz;294.8 meters. Available at http://www.rtsd.mi.th/. The maximum error for plotting the claimed coordinates would be 2,687.9 meters, if the thickness 1 mm. is used for delineation. The error is from 1,850 meters of chart scale and 837.9 meters of maximum parameters for datum transfer. Cambodia's straight baselines are plotted on the outer most point of features following Clive Howard's thesis.

[103] Mom Ravin, Law of the Sea, Maritime boundaries and dispute settlement mechanisms, page 107.

[104] Ibid.

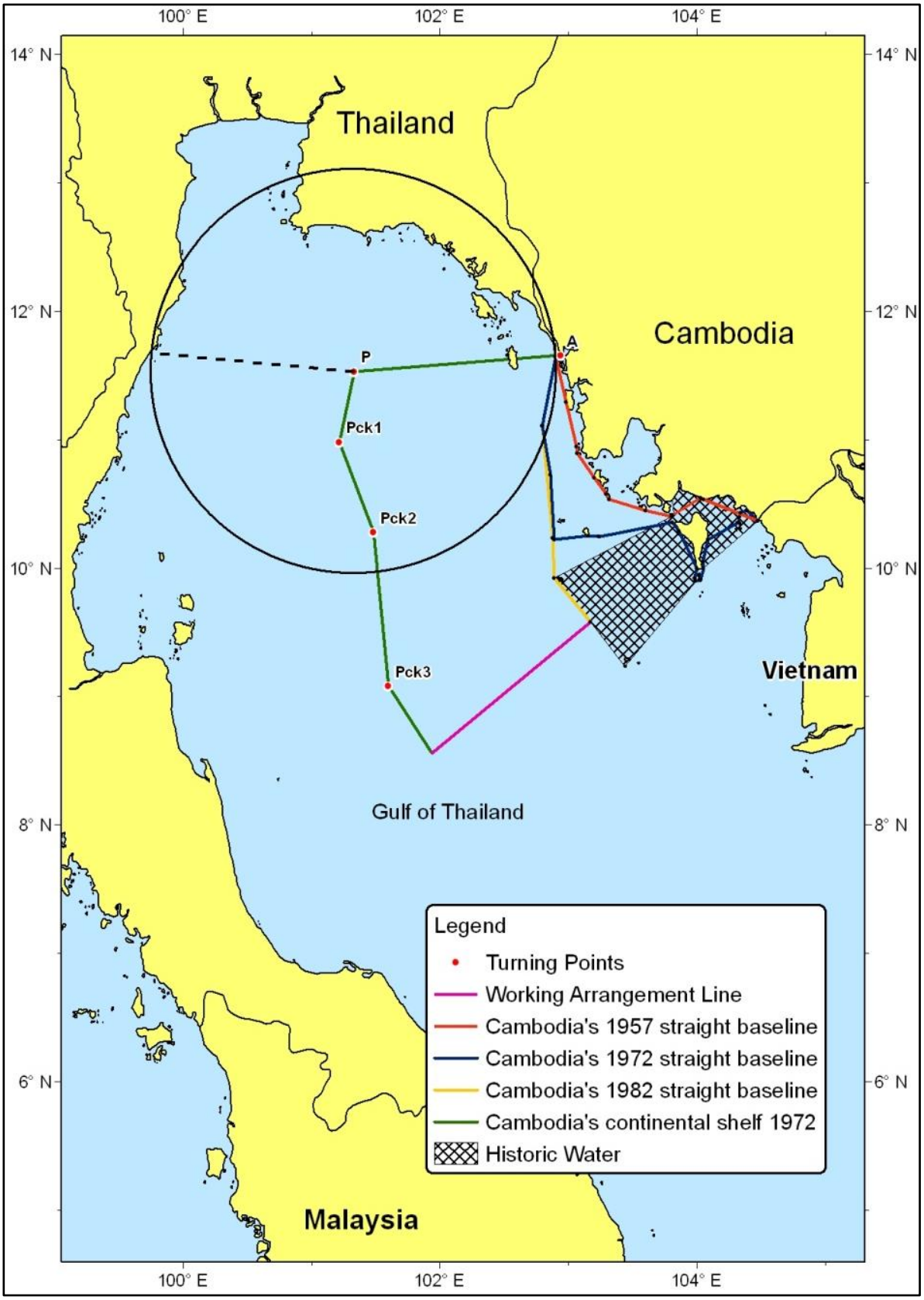

Figure 25: Control points of Point P
Source: Author

Point Pck1 may be referenced by Koh Kusrovie, control points No. 2 on Cambodia side, which is not on mainland, of Cambodia's straight baseline (black solid line) whereas the possible controls points on Thailand's coast are on mainland (black dash lines). Within the circle are Ko Chang and Ko Kut. It means that point Pck1 has improper control points on Thailand side. The length of the radius is about 93.283 nautical miles.

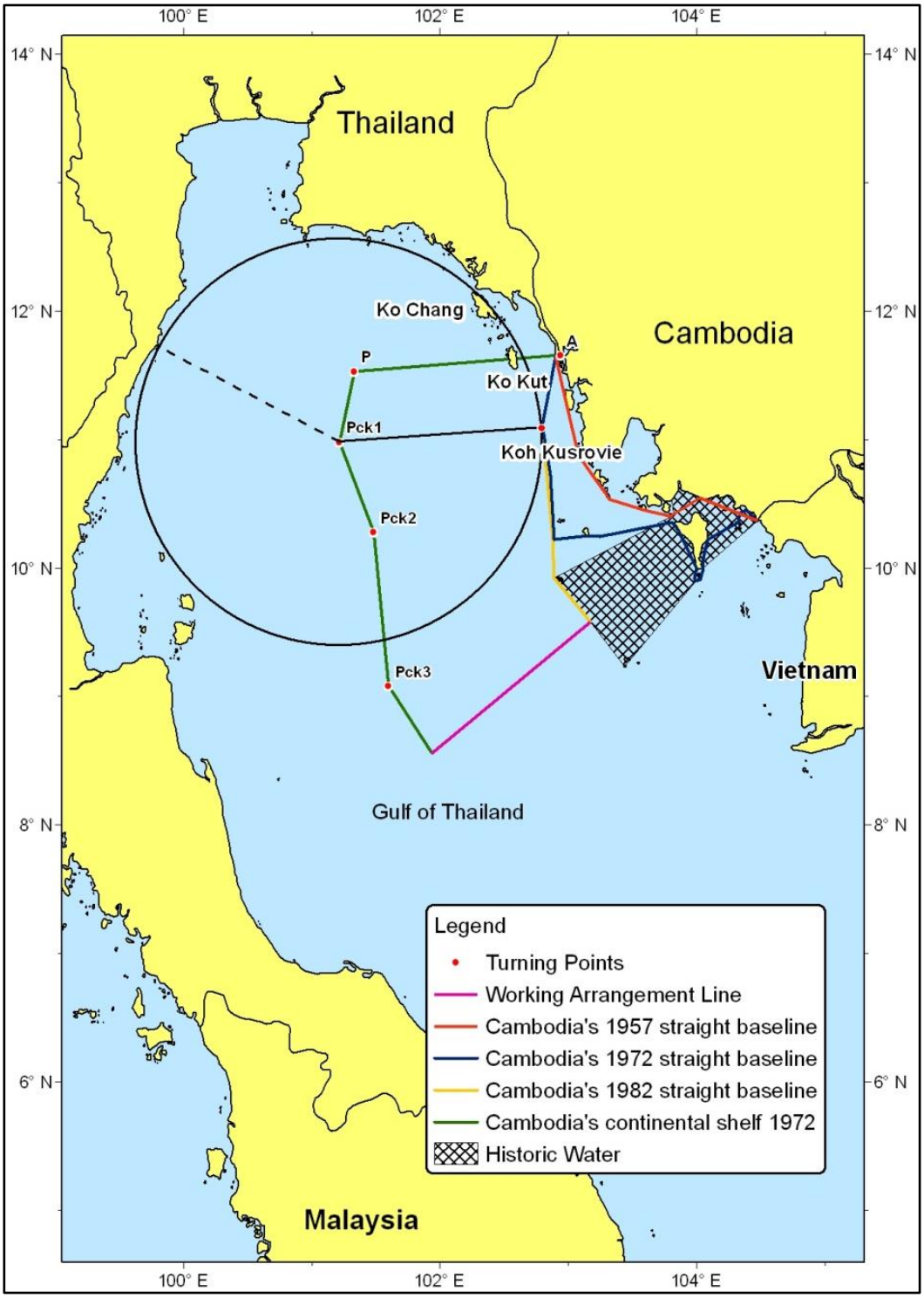

Figure 26: Control points of Point Pck1
Source: Author

Point Pck2 may be controlled by point 2 Koh Kusrovie of Cambodia's straight baseline (black solid line) whereas the possible controls points on Thailand' s side might be at the outermost point of Ko Samui (black dash lines). The control point on Thailand side is improper because the circle cut the Ko Phangan. Ko Phangan and Ko Samui not only are much larger than Koh Kusrovie but also can sustain both human habitation and economic life. Ko Samui is about 9.776 nautical miles from mainland, but Koh Kusrovie is about 17.465 nautical miles from mainland. The length of the radius is about 91.824 nautical miles.

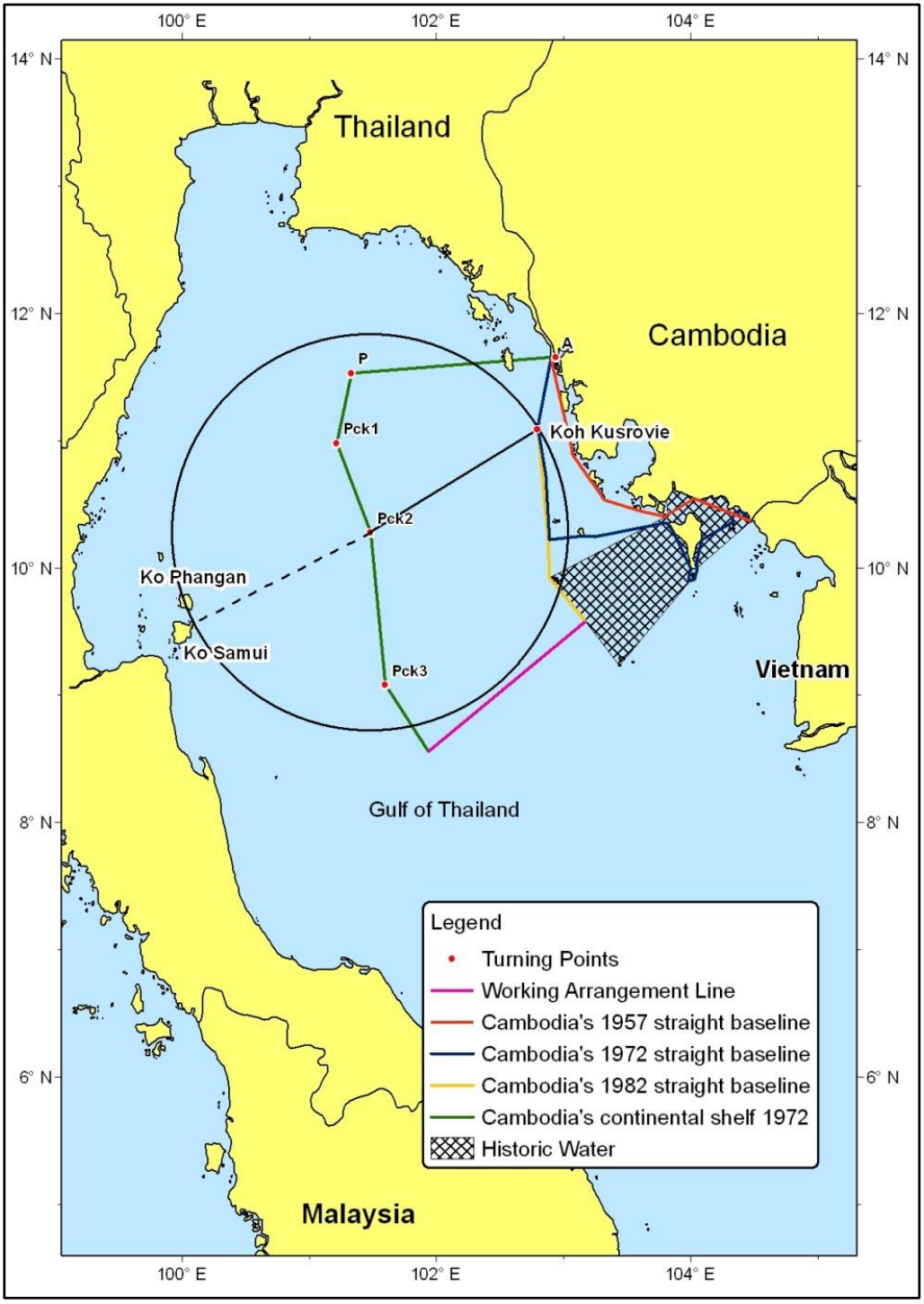

Figure 27: Control points of Point Pck2
Source: Author

Point Pck3 may have control points from point 4 Poulo Wai of Cambodia's straight baseline (black solid line) and outermost point on Ko Samui (black dash line). The position of Pck3 is improper because the circle cuts the Thailand's coastline below Ko Samui. The length of the radius is about 91.929 nautical miles and Poulo Wai is about 55.483 nautical miles.

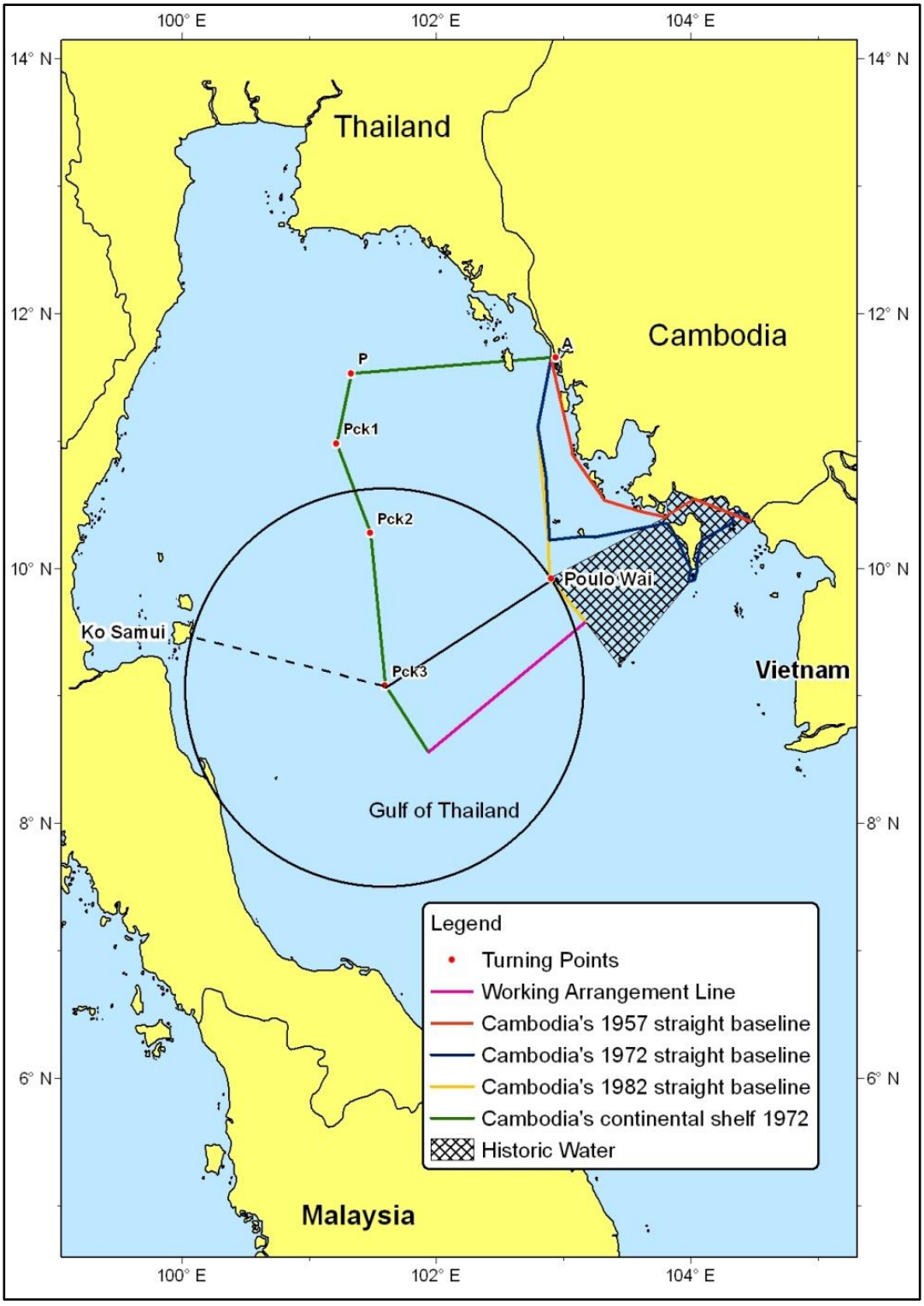

Figure 28: Control points of Point Pck3
Source: Author

Point Pck4 is below the Working Arrangement Line which hypothetically separates maritime boundary between Cambodia and Vietnam.

Cambodia delineated median line by giving full effect for the most seaward natural features in Cambodia water. Only Ko Samui, the famous island for tourists, of Thailand Cambodia counted for delineation. The natural feature closest to mainland is Point 2 Koh Kusrovie about 17.465 nautical miles and the furthermost natural feature is Point 4 Poulo Wai about 55.483 nautical miles.

Thailand's continental shelf delineation

Thailand claimed continental shelf in 18th May 1973, signed agreement with Vietnam for delimitating overlapping claimed area in the Gulf of Thailand in 9th August 1997. Point 1 was coordinated by Thailand and its coordinates was different from Cambodia's coordinate. Thailand's median line from point 1 to point 2 is bisector line. The length from Point 1 to Point 2 is about 128.929 nautical miles[105]. Point 2 may have control points from outermost point of Ko Samui of Thailand's straight baseline (black solid line) and outermost point on Koh Rong of Cambodia (black dash line). The length of the radius is about 102.17 nautical miles. Comparing area between Ko Samui and Koh Rong, Ko Samui is larger than Koh Rong 169.849 square kilometers or 3.38 times. Ko Samui has area about 241.100 square kilometers whereas Koh Rong has area about 71.251 square kilometers. The distance from mainland, Ko Samui is about 9.859 nautical miles, and Koh Rong is about 5.633 nautical miles. Ko Samui is located more seaward than Koh Rong 4.266 nautical miles, 1.750 times.

[105] The measurement is on Thai Nautical Chart No.045, Indian 1975 Datum, Scale 1: 1,850,000 at Latitude 8° N.

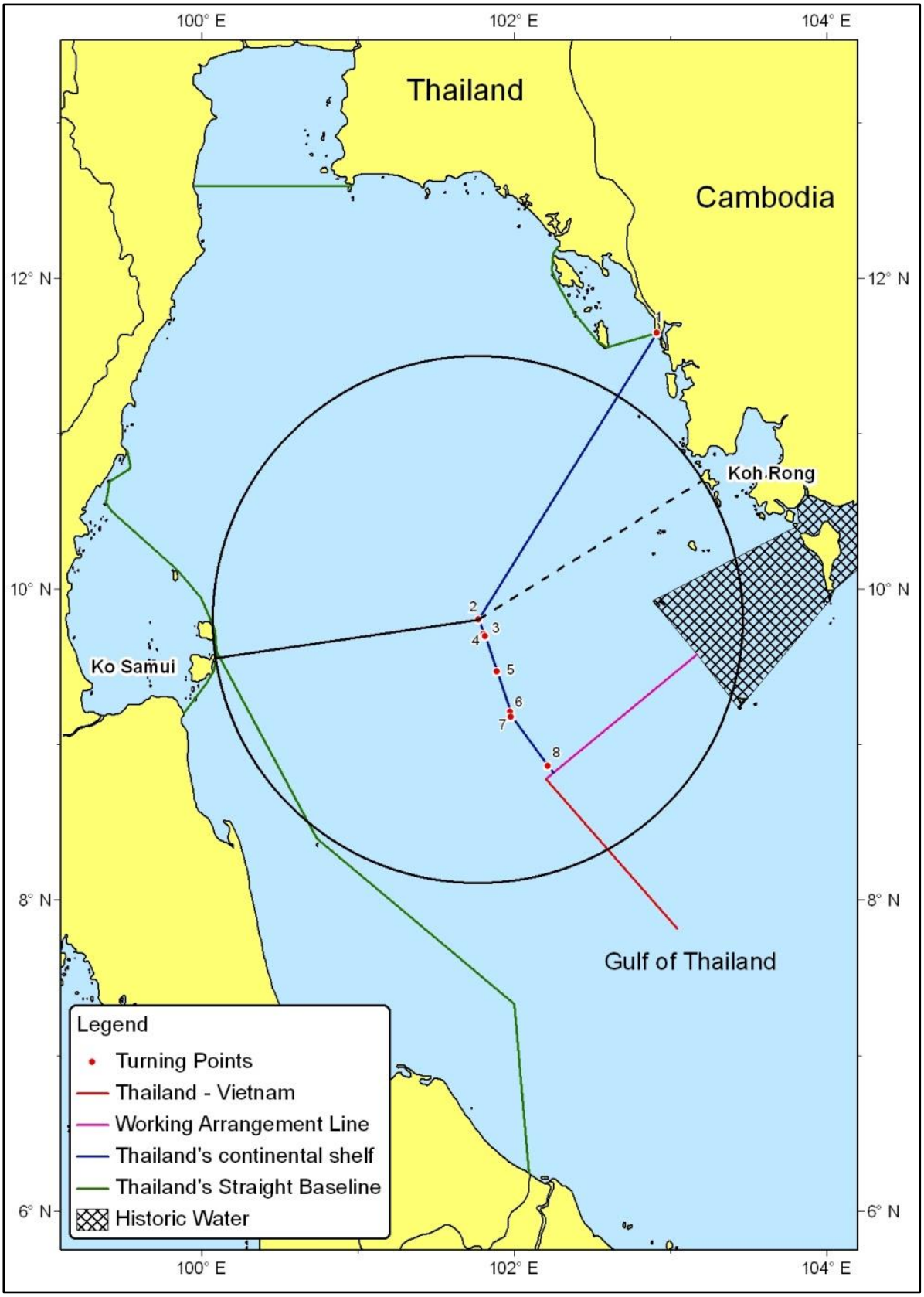

Figure 29: Control points of Point 2
Source: Author

Point 3 may have control points as same as Point 2 from outermost point of Ko Samui of Thailand's straight baseline (black solid line) and outermost point on Koh Rong of Cambodia (black dash line). The length of the radius is about 101.22 nautical miles. The segment from Point 2 to Point 3 is about 5.815 nautical miles.

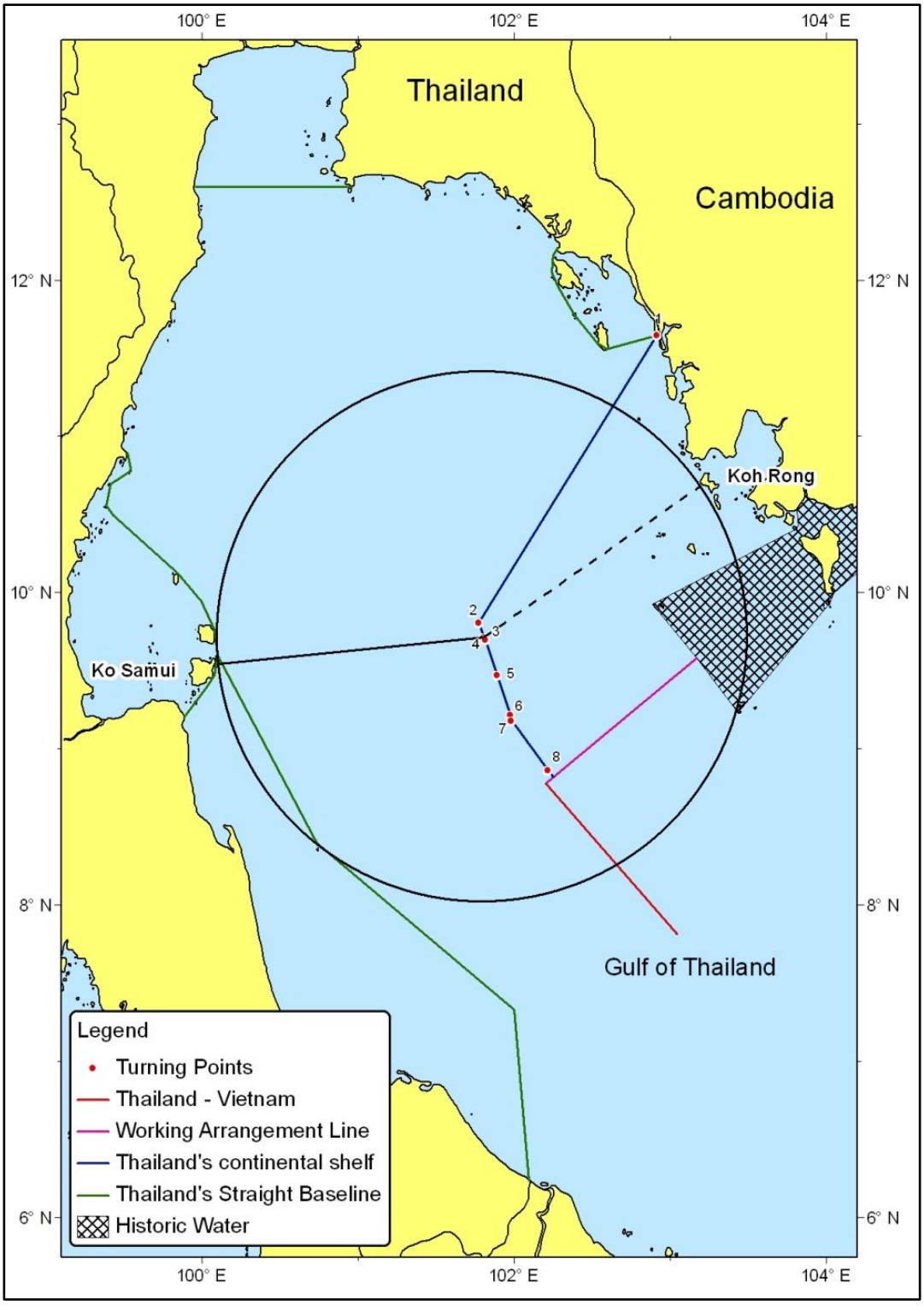

Figure 30: Control points of Point 3
Source: Author

Point 4 is very close to Point 3, distance about 1.11 nautical miles. Point 4 may have control points from outermost either point of Ko Kra of Thailand's straight baseline (black solid line) and outermost point on Tho Chu of Vietnam (black dash line). The length of the radius is about 101.22 nautical miles. This turning point, Point 4, is constructed by using control points on Vietnam side not on Cambodia side. Ko Kra has an area about 0.573 square kilometers whereas Tho Chu has about 9.904 square kilometers. Ko Kra is smaller than Tho Chu 9.331 square kilometers or 17.28 times. The distance from mainland, Ko Kra is about 28.020 nautical miles, and Tho Chu is about 71.258 nautical miles. Tho Chu is located more seaward than Ko Kra about 43.238 nautical miles, 2.54 times.

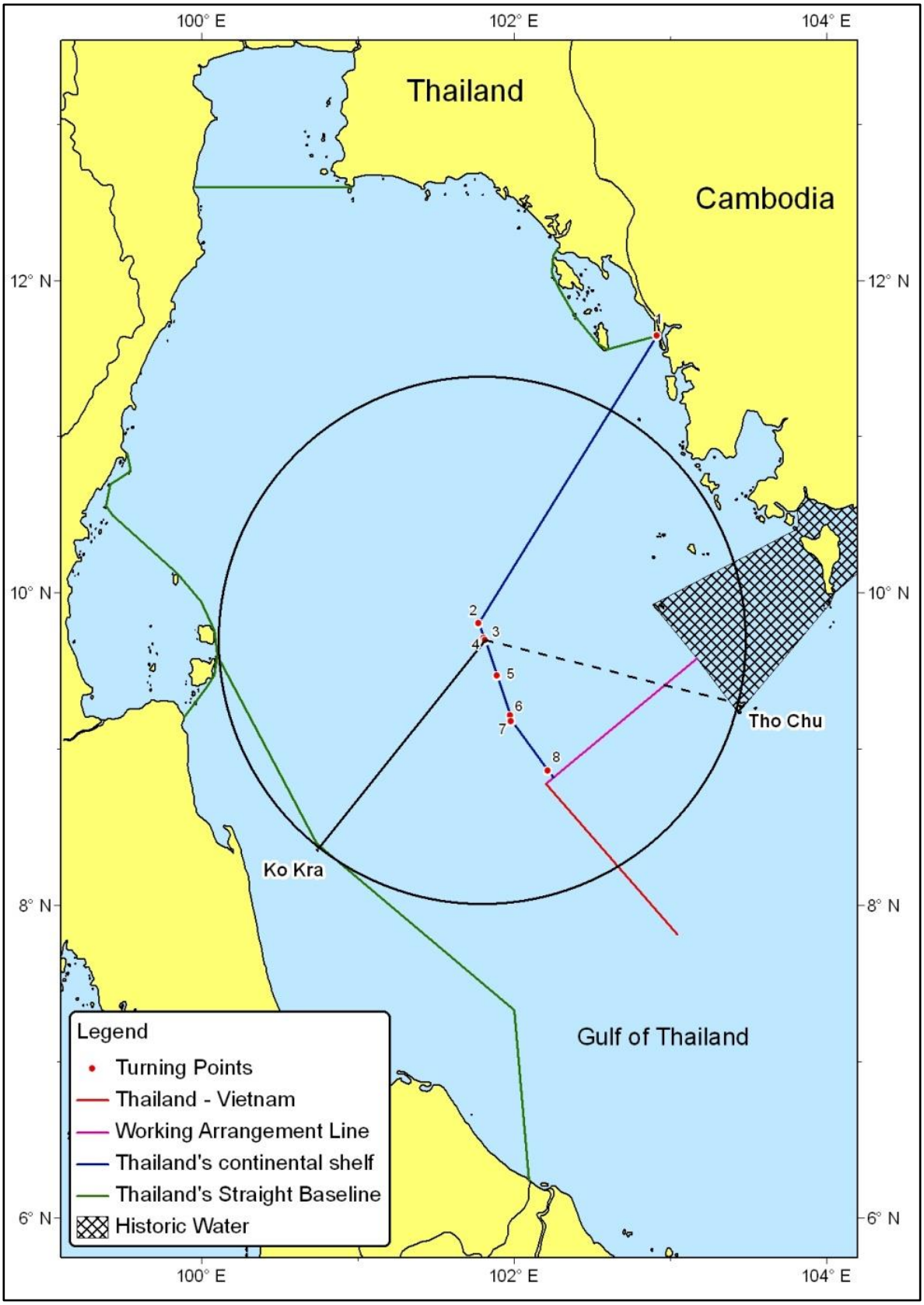

Figure 31: Control points of Point 4
Source: Author

There are two sets of control points for Point 5. The first set may have control points from outermost point of Ko Kra of Thailand's straight baseline (black dash line) and outermost point on Tho Chu of Vietnam (black dash line). The length of the radius is about 93.95 nautical miles. The second set may be the same control point with as Point 3. The control points for the second set may be Ko Samui or Koh Rong. The length of the radius is about 101.27 nautical miles.

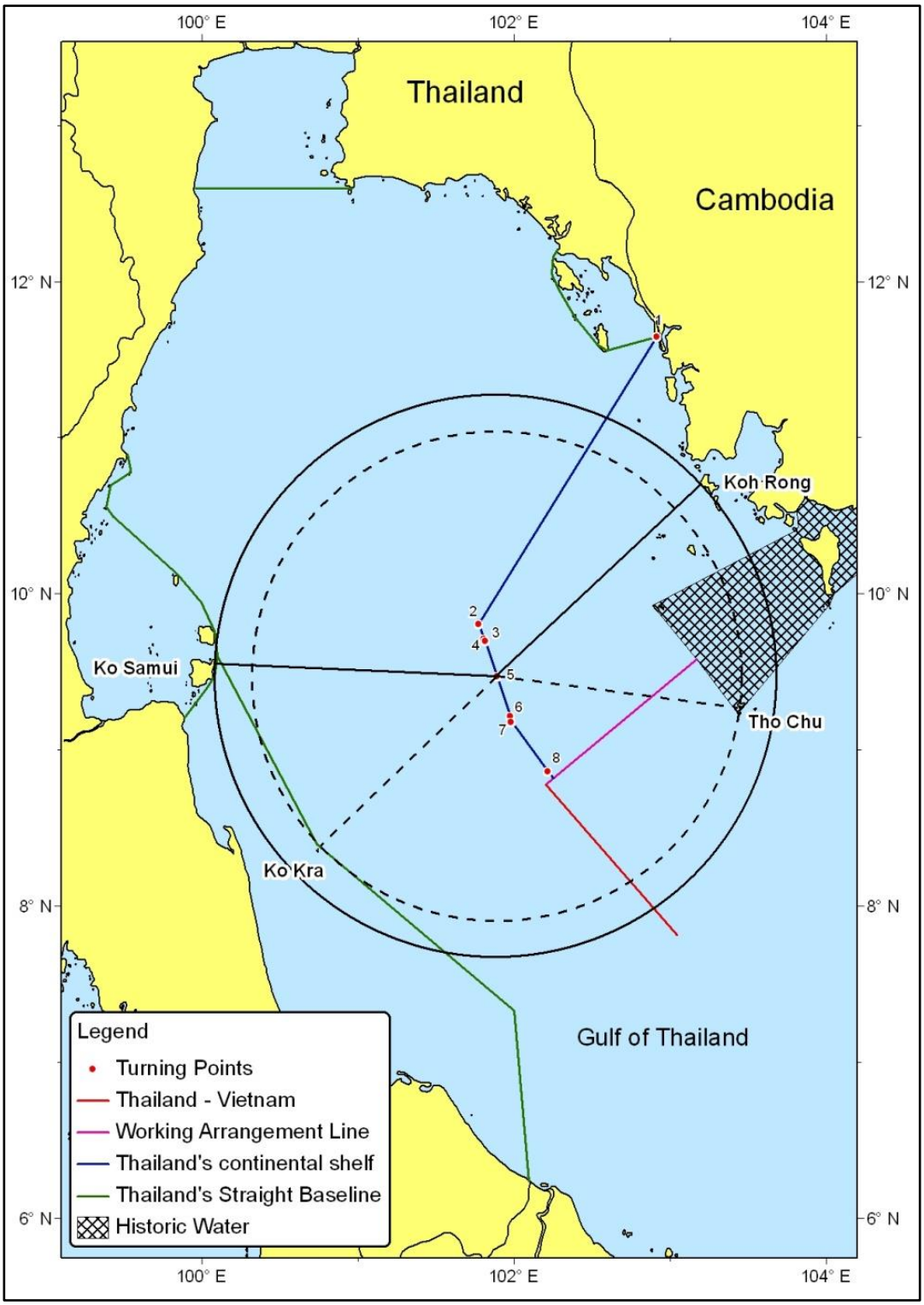

Figure 32: Control points of Point 5
Source: Author

There are two sets of control points of Point 6. The first set, black dash line a small circle, may have control points from outermost point of Ko Kra of Thailand's straight baseline and outermost point on Tho Chu of Vietnam. The length of the radius is about 93.95 nautical miles. The second set, black solid line a big circle, may have control points from Ko Samui and low – water line on Thailand side as well as Koh Rong from Cambodia side. The length of the radius is about 113.81 nautical miles.

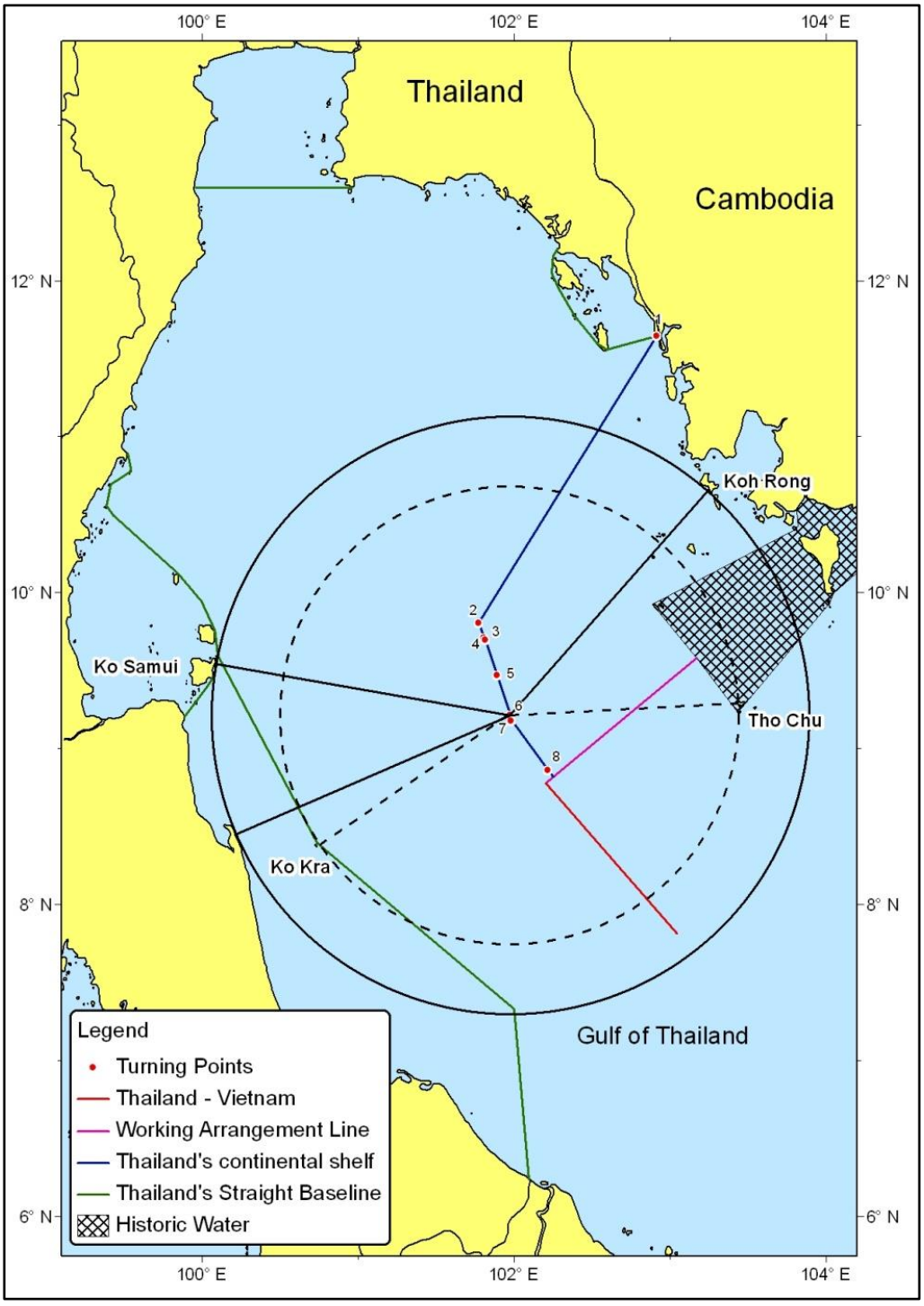

Figure 33: Control points of Point 6
Source: Author

Point 7 may have control points from outermost point of Ko Kra of Thailand's straight baseline (black solid line) and outermost point on Tho Chu of Vietnam (black dash line). The length of the radius is about 101.82 nautical miles.

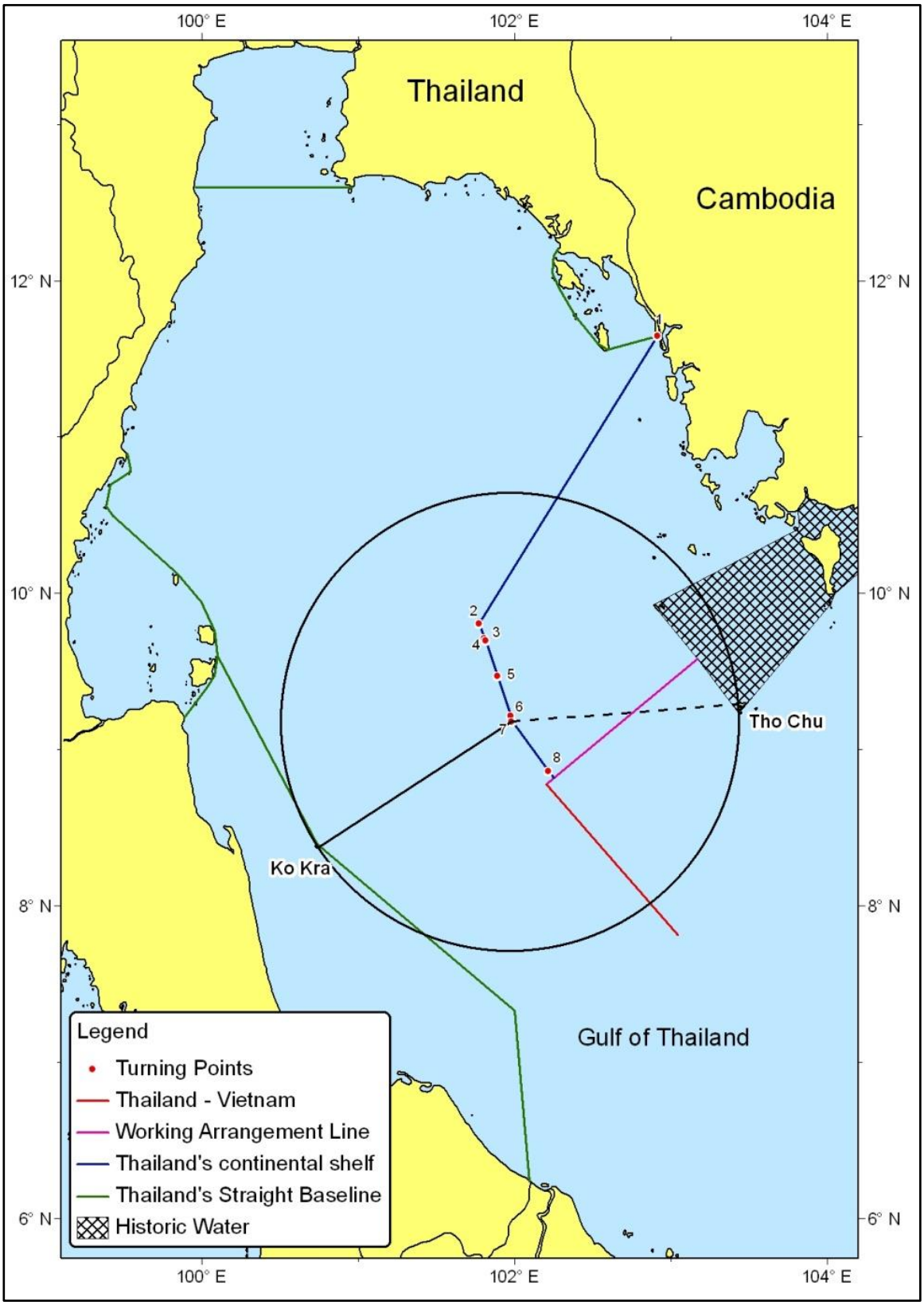

Figure 34: Control points of Point 7
Source: Author

Point 8, the last point overlapped with Cambodia, may have control points from outermost point on low water line of Thailand's coastline (black solid line) and outermost point on Phu Quoc, an island within the Agreed Historic Water. The length of the radius is about 127.09 nautical miles. Phu Quoc has area about 596.047 square kilometers and far 6.790 nautical miles from mainland.

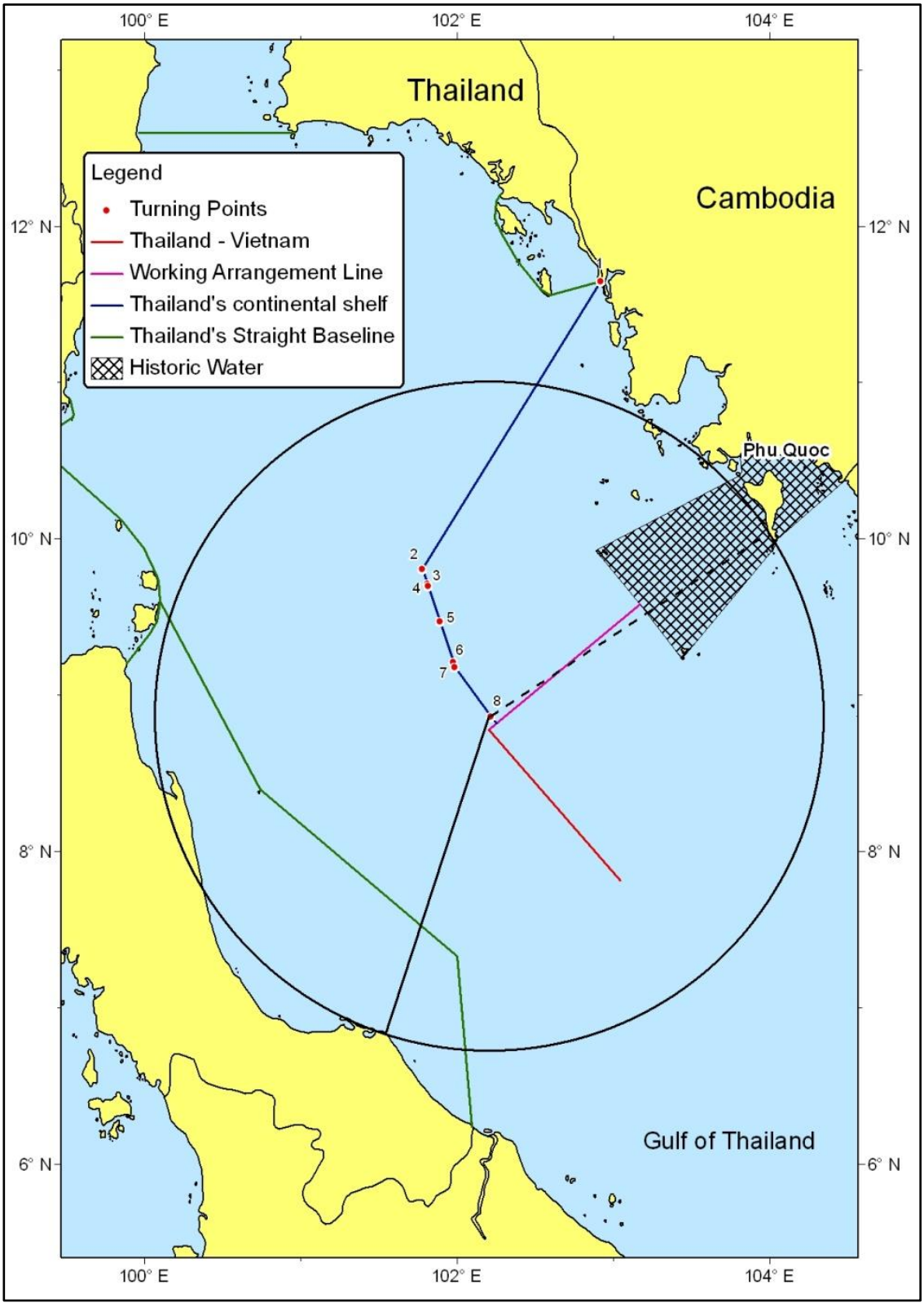

Figure 35: Control points of Point 8
Source: Author

2.2.2 Cambodia-Thailand MOU 2001

The last agreement between three coastal States, Cambodia, Thailand and Vietnam, is the "Memorandum of Understanding between the Royal Government of Cambodia and the Royal Thai Government regarding the Area of their Overlapping Maritime Claims to the Continental Shelf" which was signed on 18 June 2001. First meeting between Cambodia and Thailand about overlapping in continental shelf was held during 2-5 December 1970 in Cambodia, but resulted in no resolution.[106] The next meeting in 1994 – 1995, two countries agreed to have Provisional Arrangement under the LOS Convention.[107] The purpose of the agreement was for setting up the technical committee for solving the problem bilaterally.[108] The different aspects especially the overlapping claimed area had no progress during the meeting in Bangkok between 18-19 July 1995.[109] The significant progress between Cambodia and Thailand was in 2001. The two countries agreed on the MOU 2001. The other opinion is from David A. Colson and Robert W. Smith.

> The 2001 Cambodia-Thailand MOU is an agreement-to-agree respecting the overlapping maritime claims of the two States in the Gulf of Thailand. The MOU 2001 defined area of overlapping into two area separated by line parallel 11°N of latitude. The area above latitude 11°N is defined as the "Area to be Delimited" and the area below the same latitude is defined as the "Joint Development Area". The division of "the Overlapping Claims Area" into two areas is along latitude 11°N with the precise longitude points to be verified by the two States. The use of 11°N of latitude is clearly one of negotiation and unrelated to any geographic or other consideration. Given the dispute between Cambodia and Thailand over Ko Kut and its effect on claims, a division line between the "Joint Development Area" and the "Area to be Delimited" where Ko Kut was no longer a controlling feature (closer to 10°N of latitude) might have been expected.[110]

The "Joint Development Area" and the "Area to be Delimited" are set to hostage each other. The last sentence of Article 2 of the MOU indicates that both areas are "an indivisible package" that negotiating the maritime boundary and establishing the joint development area must be done simultaneously. It has no coordinates listed in the MOU. The names of points, above the *"Working Arrangement Line"* between Cambodia and Vietnam, as claimed by both Cambodia and Thailand are illustrated on the map attached to the MOU.

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[106] Surakiart Sathirathai,Thai – Cambodia Maritime Overlapping Area: Problem and Development. Available at http://www.geozigzag.com/jurasan/ssp_index.php (Accessed: 15 July 2014)
[107] Ibid.
[108] Ibid.
[109] Ibid.
[110]David A. Colson and Robert W. Smith, International Maritime Boundaries, Vol. V, Report Number 5-24.

The points of Thailand's claim shown on the attached map are T1-T8 whereas the points of Cambodia's claim are PtA, PtP, Pck1-Pck3. Additionally, the legend of the attached map details that "PtA & T1- location of land border with coastline at low water to be verified", "Int1 & Int4 – location of respective meridians of longitude to be verified" and "Int2 & Int3 – location of these points to be verified". This is detailed because the attached map of the MOU has none of critical technical information such as chart datum in both vertical and horizontal, scale. All of coordinates are needed to be mutual coordinated by two States. Ideally, PtA & T1 must be the terminus point as stated in the Franco-Siam Treaty 1907. Int1 & Int4 are stated only to be verified in meridian of longitude because the coordinates of latitude will technically be 11°N which is the separation line between the "Joint Development Area" and the "Area to be Delimited". Int1, at latitude 11°N, is far from point Pck1 coordinate 101°13′00″E and 10°59′00″N, a point in Cambodia's continental shelf claim, about 0°1′00″. The standard unit of distance and length measurement stipulated in the LOS Convention is the International nautical mile (M).[111] This nautical mile, approved by IHO at the International Hydrographic Conference of 1992, has a value of 1852 meters and is equivalent to the length of a minute of arc of geographical latitude at about 44 degrees of latitude.[112] Points Int2 & Int3 are need in verify of location both latitude and longitude. Point Int2 is the intersection between Cambodia's continental shelf line and the "Working Arrangement Line" as well as Thailand's continental shelf line intersects the "Working Arrangement Line" at point Int3.

The error of the Attachment of the MOU 2001 is coordinates of latitude.[113] For specifying the latitude, the letter of coordinate must be either "N" or "S". The coordinates defining the latitudes in the attached map are 09°E, 10°E and 11°E. Correctly, "E" must be replaced by "N", the overlapping claimed area in the north hemisphere, respectively as 09°N, 10°N and 11°N. For economic and environmental consideration, the principal motivation for the MOU is access by both States to the hydrocarbon resources that may exist in "the Overlapping Claims Area" which is evidenced by the large "Joint Development Area" created by the MOU.[114] Although both Cambodia and Thailand have proclaimed straight baselines, the "Overlapping Claims Area,"

[111] IHO Special Publication No.51, A manual on technical aspects of the United Nations Convention on the Law of the Sea-1982, 4th Edition-March 2006.
[112] Ibid.
[113] This error has been recognized by an officer from Royal Thai Marine Corp.
[114] The objective is that both areas must be done simultaneously.

which tracks the continental shelf claims of the two States, does not take baselines into account.[115]

The purpose of the MOU 2001 is to setup the technical committee authorized for drafting agreements on the "Joint Development Area" and the "Area to be Delimited". It is very clear that neither maritime boundary is delimited nor sharing in portion of natural resource is set in the MOU 2001.[116] Many technical aspects need to be agreed before the starting of delimitation such as scale of charts and special circumstances. Maritime boundaries between Cambodia and Thailand are both about territorial sea and continental shelf which are different in method for delimitation. Sharing in portion of natural resource is not stated on the MOU 2001, but many options of sharing are proposed such as 60:40, 70:30 or 90:10. The setting up of committee for considering both Areas is not binding for either proportion of sharing natural resource or maritime delimitation. The purpose of committee is to consider opinion from both sides and to draft agreement. If they agree, each country will continue for internal legalization.[117] Details in the MOU 2001 are about maritime delimitation, but the purpose of the MOU 2001 is to turn conflict into co-operation.[118]

[115] David A. Colson and Robert W. Smith, International Maritime Boundaries, Vol. V, Report Number 5-24. But, the features the most seaward are used as control points for constructing continental shelf and some these features are in baseline systems.
[116] Surakiart Sathirathai,Thai – Cambodia Maritime Overlapping Area: Problem and Development. Available at http://www.geozigzag.com/jurasan/ssp_index.php (Accessed: 15 July 2014)
[117] Ibid.
[118] Ibid.

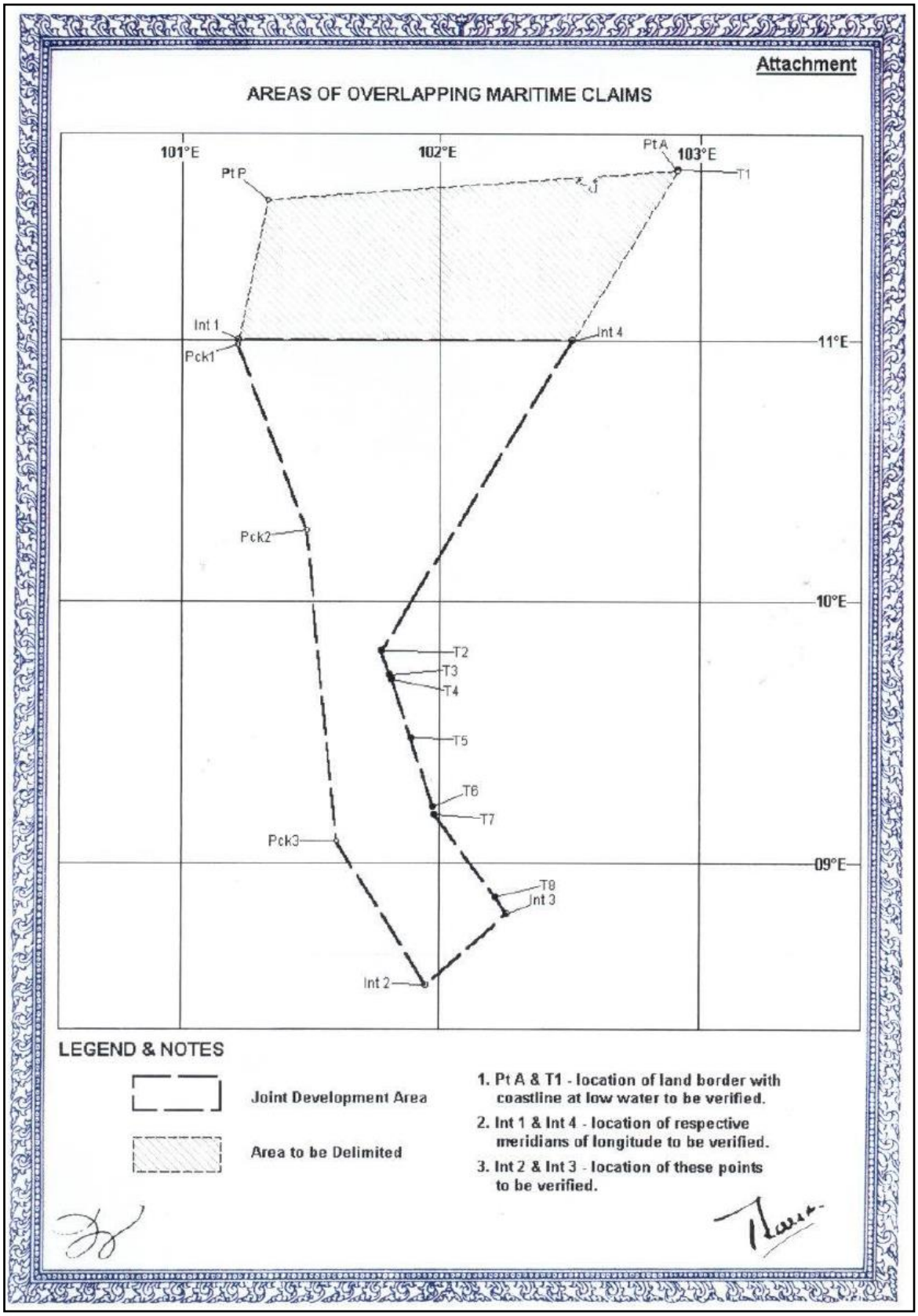

Figure 36: Attached map to MOU 2001
Source: Cambodian National Petroleum Authority[119]

[119] Available at http://cnrp-media.blogspot.co.uk/2009_11_01_archive.html (Access on 8 October 2014).

Unseen aspects for the MOU 2001

The first unseen aspects

Many opinions are given to the MOU 2001. The main opinions can be divided into two significant ideas. The first is that the MOU 2001 must be followed by Cambodia and Thailand because the processing on overlapping claimed area was already settled in the MOU 2001. The reason to support this idea is that the MOU 2001 is the agreement between two countries. The second idea does not agree with the first because the MOU 2001 is the starting point for talking. The details in the MOU 2001 can be adjusted because it is not the end state of negotiation. Delimitation for the whole area of overlapping is the reason supporting the second idea. Because the area above latitude 11°N will be delimited as stated in the MOU 2001, the delimitation lined ending on latitude 11°N must continue from somewhere around latitude 11°N to the area below latitude 11°N. For this reason, it should have none of the Joint Development Area.

The second unseen aspect

The sovereignty is clear for maritime boundary above latitude 11°N, but it is still ambiguous for the Joint Development Area. The Joint Development Area is for sharing the natural resource, gas and oil. The problem will be for other aspects such as fishery and custom in the area below latitude of 11°N if the Joint Development Area is really occurs.

Part II The Equi - Area / Ratio the new method for maritime delimitation

Chapter 3 The combination between technical and special circumstances

3.1 Section A Methods for maritime delimitation

3.1.1 Existing methods

The equidistance line is explained in the TALOS as that

> In maritime boundary delimitation an equidistance line is defined as a line every point of which is equidistant from the nearest points on the territorial sea baselines of two States. Article 15 refers to this line as a median line, but in the technical literature a distinction has often been made between a median line, defined as an equidistance line between two opposite States, and a lateral (equidistance) line, which is defined as an equidistance line between two adjacent States. In practice, however, the concept of adjacent and opposition are often difficult to define and apply, but the method used to determine an equidistance line is the same whatever the relationship of the coasts of the States. [120]

For constructing the median line, the selection of basepoints is very important. The agreement on the basepoints of coastal States originates the construction of median line. The selection of basepoints is explained in the TALOS as that

> Only portions of a State's baseline will affect an equidistance line. By definition, the equidistance line will be constructed by using only the salient (seaward-most) basepoints. The number actually chosen will depend on the interplay of the relevant segments of baseline of both States, on the configuration of the coastline, and on the distance of the median line from the nearest basepoints. The greater the distance, the fewer the basepoints that are likely to affect it, and the greater the distance that may be selected between points along a smooth coast. [121]

The median line which is stated in Article 15 of the LOS Convention relates to territorial sea only, and the median line can be adjusted by historic title and special circumstances. For delimiting maritime boundary between Cambodia and Thailand, Article 15 is applicable in case of historic title especially the starting point. The median line method for maritime delimitation is stated in Article 15 of the LOS Convention as that.

> Where the coasts of two States are opposite or adjacent to each other, neither of the two States is entitled, failing agreement between them to the contrary, to extend its

[120] A manual on technical aspects of the United Nations Convention on the Law of the Sea, 4th Edition.
[121] Ibid.

> territorial sea beyond the median line every point of which is equidistant from the nearest points on the baselines from which the breadth of the territorial seas of each of the two States is measured. The above provision does not apply, however, where it is necessary by reason of historic title or other special circumstances to delimit the territorial seas of the two States in a way which is at variance therewith.[122]

Because of historic title or other special circumstances, the median line can be adjusted by method derived from the equidistance principle such as Partial Effect, Coastal Length Comparison, the equi-ratio method or method related to the "General Direction" of the Coastline.[123] Many other methods of boundary delimitation may be imagined or have been used such as the Thalweg Concept, Prolongation of Land Boundaries, Arbitrary Lines or Enclaving.[124]

For drawing the median line more of less objective considerations are taken into account to achieve an equitable result.[125] Equidistance lines are two types described in the TALOS that.

> In particular it is possible to take into account only the most prominent base points, so that the resulting equidistant line is necessarily less complex than the strict line would be. Whilst these solutions undoubtedly produce a line that is simpler than a strict equidistance line, they are not derived directly from it; neither do they maintain the close relationship with it that is achieved with the "simplified equidistance line" already described. These other lines are sometimes referred to as "modified equidistance lines.[126]

The equi-ratio method method for adjusting a median line is also described in TALOS as that.

> In this method the boundary is defined as the loci of points having a constant ratio of distance between the baselines and base points of the two States. Any ratio of distances may be chosen to arrive at an equitable solution. The most straightforward application is the ratio 1:1 which results in the equidistant line. Any other ratio chosen will result in a series of conic segments, using the terms of plane geometry, a particularly interesting case being that of a small island State lying off the straight coast of a large State. A set of different ratios will provide a set of ellipses with the island State being located at one focal point of the ellipses.[127]

[122] The LOS Convention 1982.
[123] A manual on technical aspects of the United Nations Convention on the Law of the Sea, 4th Edition.
[124] Ibid.
[125] Ibid.
[126] Ibid.
[127] Ibid.

The equi-ratio method was formulated by Wijnand Langeraar.[128] Langeraar described his equi-eatio method as that.

> A boundary line between the offshore area under the jurisdiction of two coastal states, either adjacent or opposite, will be called an equiratio line when every point of it will be defined by a constant ratio of its distance from the nearest point of the baselines from which the breadth of the territorial sea of each state is measured.[129]

Langeraar improved his method by comparing lines generated by equi-ratio method with lines resulted from the North Sea continental shelf cases of 1969. With the ratio at 0.9, ratio 1 for normal median line, the line generated by the equi-ratio method was almost as identical as the line from the judgement.

Also interesting is the comparison of the equi-ratio method and the line from the judgement is the ICJ Case concerning the continental shelf Tunisia/Libyan Arab Jamahiriya. From the judgement the Kerkennah Island was given effect for drawing the median line whereas Judge Shigeru Oda in his dissenting opinion disregarded the existence of the Kerkennah Island.[130] After comparing the equi-ratio boundary line with Judge Oda's equidistance line, or the boundary line decided upon by the Court, Langeraar observed that the equi-ratio line brushes both lines alternatively and stated that

> The equi-ratio boundary line can be constructed in a mathematically unambiguous manner, leaving out the possibility of any subjective approach and that the equi-ratio also the exposed parts of the Kerkennah Islands could be fully taken into account. Moreover, by slightly changing the ratio, small variations in the boundary line can be achieved, thereby enhancing the possibilities that an agreement between negotiating parties can be reached on the final value of the ratio to be utilized.[131]

An equidistance line is usually adjusted by special circumstances which are politics, strategy, history, legal regime, economy, environment or geography to meet the equitable solution. Equitable solution is often from the negotiation process. The relevant evident accounted for special circumstances can be either subjective or objective. Because of various interpretations on special circumstances, the disagreement on substantial special circumstances, such as whether the island will be full effect or partial effect or whether the isolated feature can be considered as

[128] Wijnand Langeraar, The equiratio method – new approach.
Available at http://www.csc.noaa.gov/mbwg/_pdf/biblio/Langeraar.pdf. (Accessed on 27 August 2014).
[129] Ibid.
[130] Ibid.
[131] Ibid.

an island, can result in the generation of a line that is not. The mathematic method, such as Equi-Ratio, may provide a solution.

3.1.2 The Euclidean Allocation Analysis

The sea area dominated by the closest feature can be calculated by the Euclidean Allocation Analysis in ArcGIS software. ArcGIS software can analyse the Euclidean Analysis in three different ways; the first Euclidean Distance the second Euclidean Direction and the third Euclidean Allocation. The result, allocation area, from the Euclidean Allocation Analysis will be the equivalent of the Equi-Area/Ratio method to find the equitable solution in maritime delimitation. The median line is most recognised method for maritime delimitation. In a straight forward case where no special circumstances are considered, maritime boundary will be delineated by median line. The first step is to prove that the Euclidean Allocation is applicable for constructing the median line. The interested area between two or more sources, points, line or polygon (not matter in size and shape), can be calculated and assigned to the single closest source. The line dividing the area is automatically the median line. The following example illustrates that the interested area (blue area) is calculated and assigned to individual point.

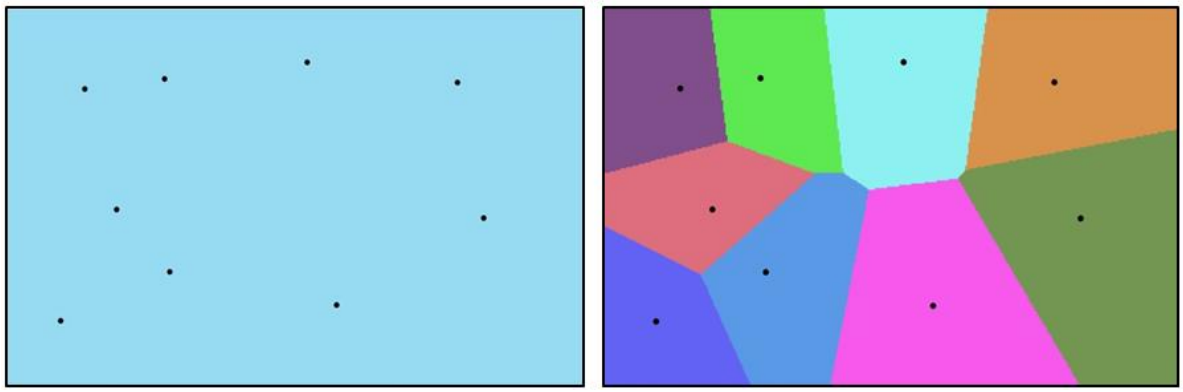

Figure 37: Allocated Areas by Euclidean Allocation
Source: Author

Attributes, field data, of the sources will be assigned for classifying calculation. The next Euclidean Allocation illustration shows that the interested area is classified by different three States (State red dots, State blue dots and State yellow dots).

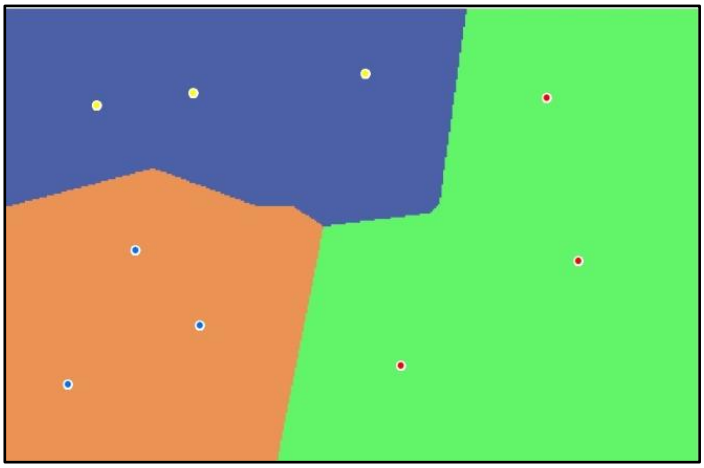

Figure 38: Allocated area by State criteria
Source: Author

Euclidean Allocation method can use points, lines and polygons. The next illustrations show the sea area is separated and individually assigned to the closest feature.

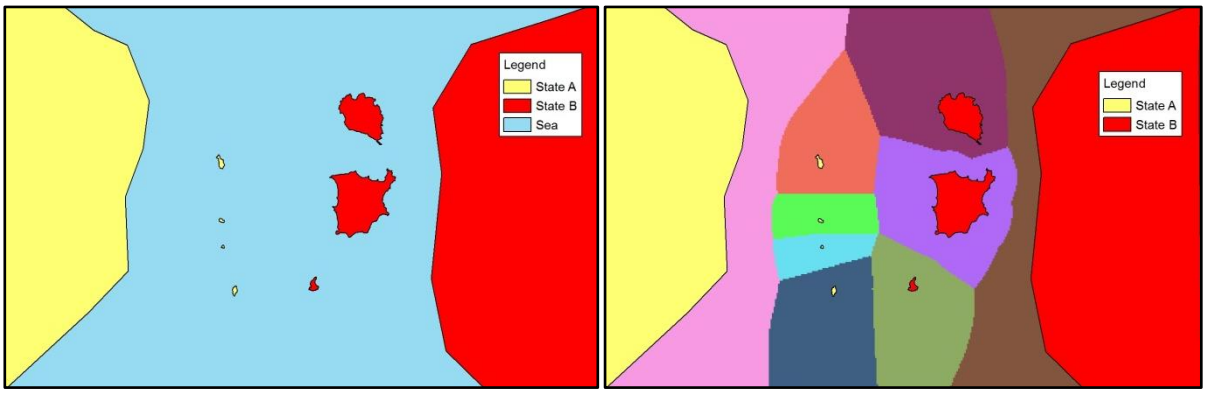

Figure 39: Allocated areas by individual feature
Source: Author

The State category criterion, State A and State B, is set for Euclidean Allocation calculation. The result is as following. The interested area, sea are, is divided into two colours as State criterion. The blue colour is the sea area close to State B, mainland and islands, whereas the green colour is the sea area close to State A, mainland and islands.

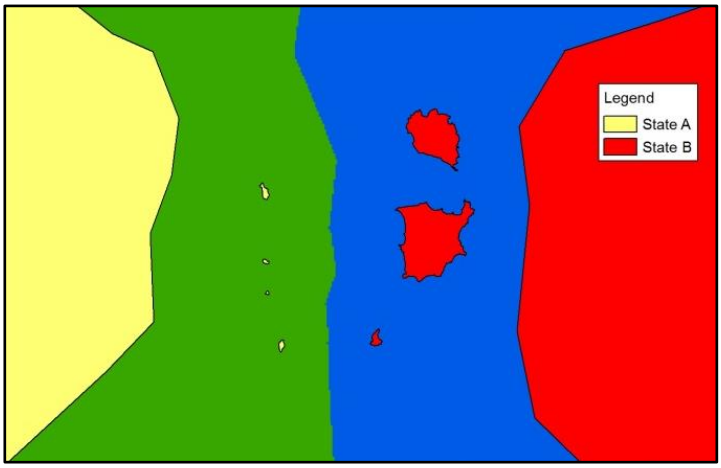

Figure 40: Allocated area by State criteria
Source: Author

The next test will be adjacent States test. The first adjacent States test will assume ignoring the State A's island which is off shore main land and the second adjacent States test will assume counting the same islands. The Euclidean Allocation analyse the first situation as that the median line cuts the State A's island. Regarding counting the State A's island, the median line bends toward State B.

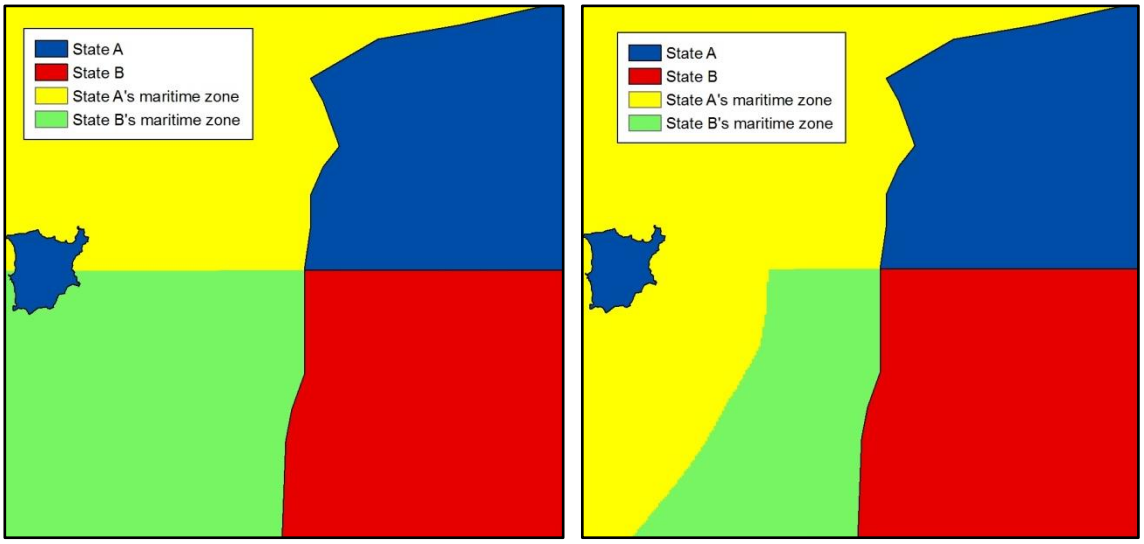

Figure 41: Euclidean Allocation median line for counting island
Source: Author

The more distance between features, the more area of each feature. It means that an offshore isolated rock will have sea area more than a near shore island when calculating both features with mainland separately. The shapes of allocated area depend on the place where the features are. The more complicated shapes of allocated area are from that the features are not in pattern. The shape of polygon of feature which is surrounded by fewer features will be less complicated

shape than feature which is surrounded by more features. The following comparison pictures show that features, points, different in position will make the polygon, allocation area, different in shape.

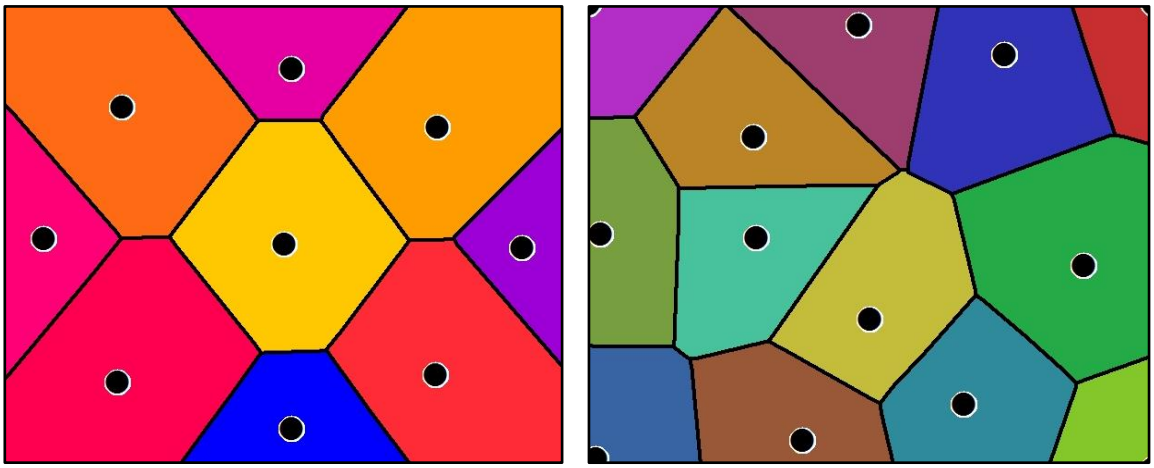

Figure 42: Shape of Allocated areas
Source: Author

3.2 Section B The new method for maritime delimitation

During continuing research on maritime delimitation at the National Oceanography Centre, Southampton, efforts were made to reduce the ambiguousness of selecting features for maritime delimitation by inventing a new method for maritime delimitation called the Equi-Area/Ratio. It can be divided into two categories the Equi-Area and Equi-Ratio. The methodology of this Equi-Ratio is totally different from Langeraar's Equi-Ratio. The Equi-Area/Ratio is calculation of total area and sea area.[132] In case of none of ratio consideration between area of an island per either total area or sea area, The Equi-Area method considers the areas which are either sea area or total area. The Equi-Area method will give the equitable area to each feature. The result of the Equi-Area analysis will be gain and lose area. The amount of the gain area must be the same as the lose area if the mathematic calculation is correct. The provisional median line can be adjusted by the gain and lose area to make each segment area meet the average of area. In case of ratio consideration between area of an island per either total area or sea area, the Equi-Ratio method also considers the area but the difference from the Equi-Area that the Equi-Ratio will consider the area in term of ratio between either area of a feature per sea area around the same feature or area of a feature per total area, sea area around the feature and area of the feature.

3.2.1 The Equi-Area method

Wijnand Langeraar invented the equi-ratio method for adjusting median line to meet the equitable solutions. Langeraar suggests replacing the parabolic equidistance boundary line

[132] Total Area is area of an island and sea area around an island. Sea area is sea area around an island excluding area of an island.

between an island State and a continental one by an elliptic curve. Ellipse can be given different dimensions and as these dimensions are directly functionally related to the ratio agreed upon. This approach is more flexible than the equidistance method of delimitation and, therefore, can better counter the tendency of the equidistance delimitation to become increasingly inequitable further offshore, i.e. in the particular case of an independent offshore island State opposite the continental coastline of another State.[133] The construction of both normal baseline and straight baseline is described in the LOS Convention. For taking advantage on claiming maritime zones, most of coastal States use all seaward features some not applicable for extending the straight baselines. Also, continental shelf is unilaterally delineated by the most seaward features not by straight baseline if that features are not in the straight baseline system. The disagreement on using features for constructing the median line causes the overlapping claim maritime zones. An island as defined in Article 121 of the LOS Convention must sustain human habitation or economic life of their own. The islands even having tree will be defined as rocks. For example the figure 43, State A counts the most seaward isolated features, the distance between the feature and mainland exceeding territorial sea breadth, for drawing the median line with State B. By ignoring that State A's features, State B claims the maritime zone overlapping State A's maritime zone. The same situation at the State B, State B counts the most seaward feature, but State A disregards that State B's feature. Each State wants to uses all features, which are the most seaward, in the sea for median line construction. The size of the features also is in the argument. Some isolated features, can be called a rock, are too small to be compared with the island which belongs to opposite State. Area of the feature per sea area surrounding the feature is the other equi-ratio for equitable solution.

Ideally and proportionally, the big island should occupy the sea area more than the small island. The proportion between area of an island and area of the sea area around the island can be found by the Euclidean Allocation method. To meet the equitable solution, the proportion must be adjusted and then the median line will be re-drawn to meet the equitable solution.

The Equi-Area/Ratio method testing

The set up scenario[134] is that State A and State B are opposite State. Both States have offshore features State A has islands A1(4.574 sq.km.), A2 (18.657 sq.km.), A3 (1.323 sq.km.) and A4 (2.713 sq.km.). The most landward is an island A2 about 23 nautical miles and the most seaward

[133] Wijnand Langeraar, The equiratio method – new approach.
Available at http://www.csc.noaa.gov/mbwg/_pdf/biblio/Langeraar.pdf. (Accessed on 27 August 2014).
[134] The information used in testing is real, but some are created by an author. Coordinates cannot be displayed.

is an island A1 about 32 nautical miles. State B also has islands B1 (119.583 sq.km.), B2 (231.473 sq.km.) and B3 (6.004 sq.km.). The most landward is an island B1 about 5 nautical miles and the most seaward is an island B3 about 27 nautical miles. State A and State B disagrees on maritime delimitation because State A delineates the median line giving the full effect to all State A's islands whereas State B objects that the offshore features State A uses for delimitation are too small to be recognized as islands. State B proposes that the delimitation should disregard all State A's feature and median line should be delineated by regarding between mainland, island B1 and island B2 of State B and mainland of State A only. State A convinces that island B1 and B2 can sustain human habitation and economic life by themselves and State A does not count island B3 for delimitation because it is too small to sustain human habitation. The median line from mainland is different from median line purposed by both State A and State B. The comparison between three lines, State A median line, State B median line and median line form mainland, is as following.

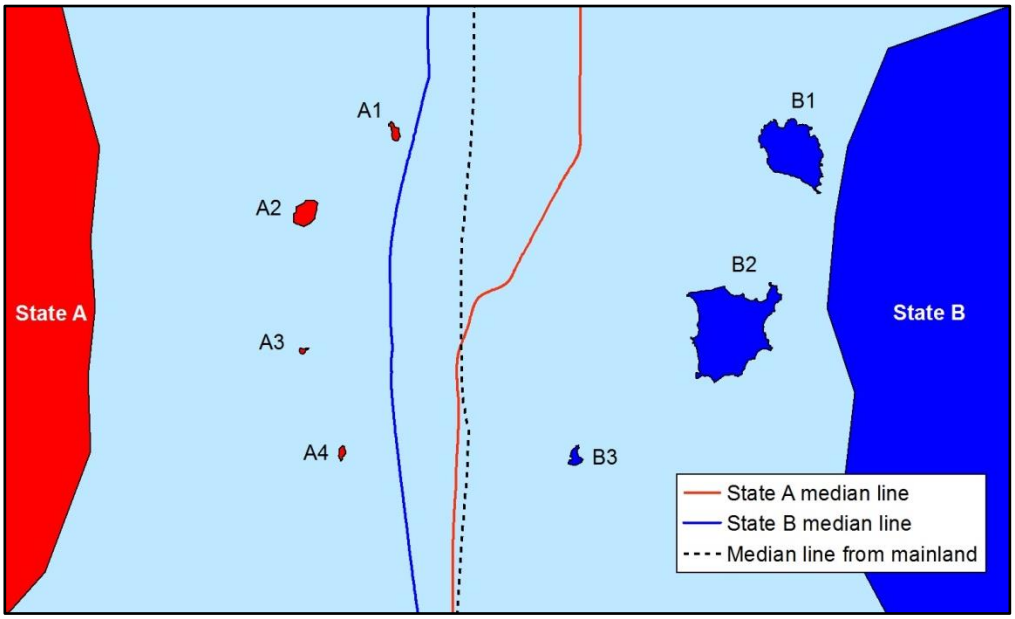

Figure 43: Set up scenario
Source: Author

The result from the Euclidean Allocation analysis is as following figure. The median line between State A and State B if all features in the sea are used can be drawn as the line running from north to south. The first segment of the median line is formed by allocated areas of A1 and B1, the second segment is formed by allocated areas of A1 and B2, the third segment is formed by allocated areas of A1 and B3, the forth segment is formed by allocated areas of A3 and B3, and the last segment, the fifth, is formed by allocated areas of A4 and B3. The allocated area A2 is not relevant to form the median line.

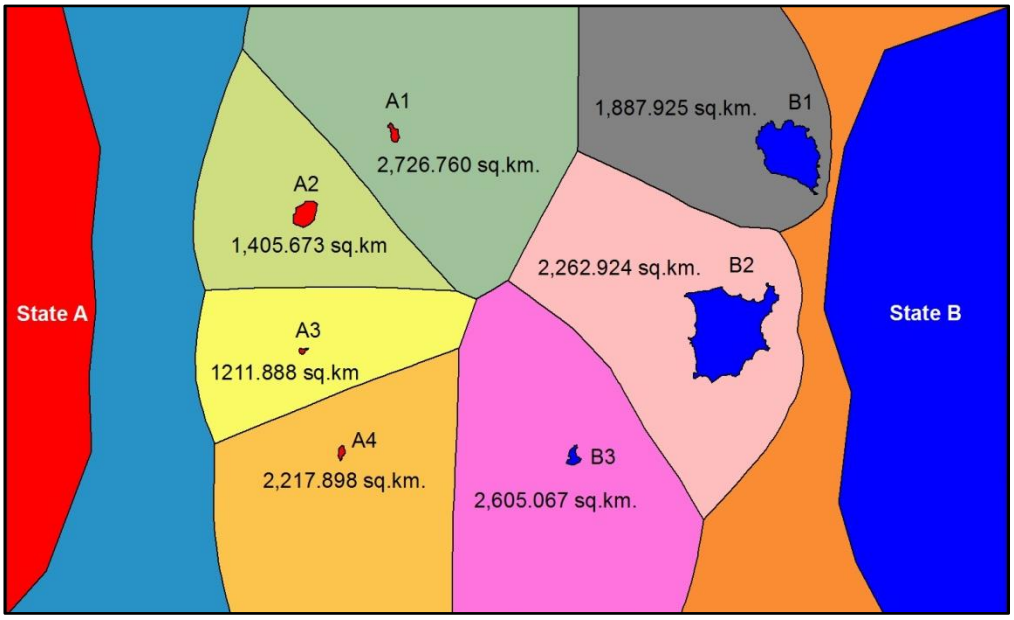

Figure 44: Set up scenario, allocated areas of each feature
Source: Author

The following figure shows the allocated area of each features and the ratio between the sea area per the area of the island (sea area ÷ area of the island) which is in column 5 of the table 10.

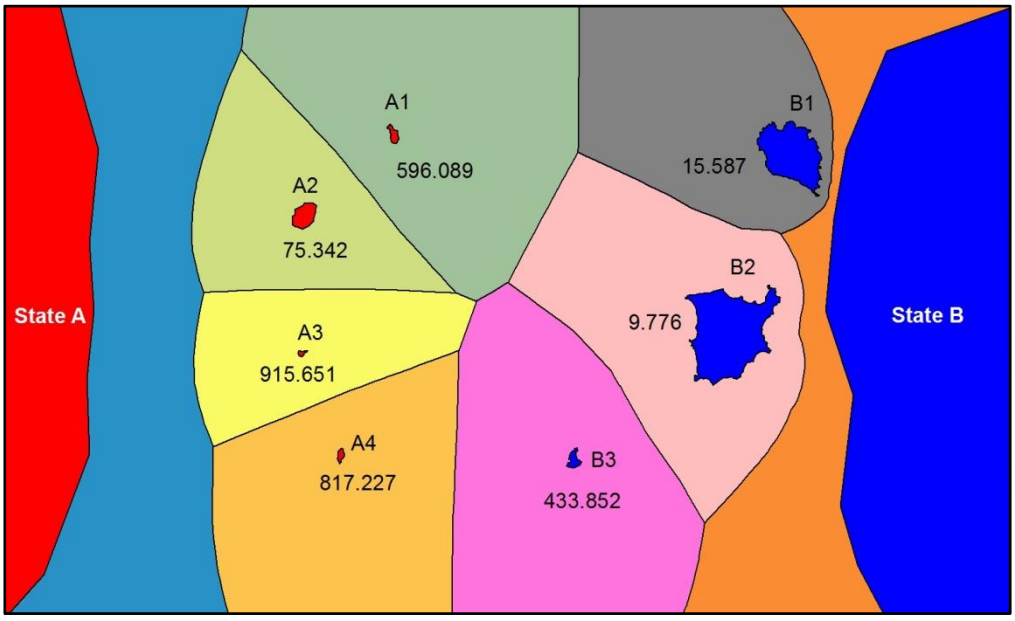

Figure 45: Set up scenario, ratio between area of island per sea area
Source: Author
The static conclusion for all study area (State A and State B) is as following.[135]

Col.1	Col.2	Col.3	Col.4	Col.5	Col.6
Island	Island Area (sq.km.)	Sea Area (sq.km.)	Total Area (sq.km.)	Ratio Col.3÷Col.2	Ratio Col.4÷Col.2

[135] Total Area is area of an island and sea area around an island. Sea area is sea area around an island excluding area of an island. The total area is analysed and generated by the Euclidean Allocation.

A1	4.574	2,726.760	2731.334	596.089	597.089
A2	18.657	1,405.673	1424.329	75.342	76.343
A3	1.323	1,211.888	1213.211	915.651	916.651
A4	2.713	2,217.898	2220.611	817.227	818.227
B1	119.583	1,887.925	2007.507	15.587	16.587
B2	231.473	2,262.924	2494.397	9.776	10.776
B3	6.004	2,605.067	2611.071	433.852	434.852
Maximum		2,726.760	2731.334	915.651	916.651
Minimum		1,211.888	1213.211	9.776	10.776
Sum		14,318.134	14702.464	2864.240	2,870.777
Mean		2045.448	2100.352	409.111	410.111
Standard Deviation		532.291	545.285	355.433	355.433

Table 10: Set up scenario the Equi-Area, statistic of allocated areas
Source: Author

The Equi-Area analysis will occupy information in column 3 (sea area) and column 4 (total area). The Equi-Ratio analysis will use information in column 5 and column 6. The difference in range between col.3 and col.4 is various because of size of islands whereas the difference in range between col.5 and col.6 is 1. Information in column 3, 4, 5 and 6 will be analysed for testing the Equi-Area/Ratio method. The classifications of the Equi-Area are sea area and total area and the classifications of the Equi-Ratio also are sea area and total area.

The Equi-Area sea area

The first analysis will be the Equi-Area analysis by using information in col.3.

Excluding not relevant segment (A2)

From the illustrations, figure 44 and 45, the islands affecting the Euclidean Allocation median lines are A1, A3, A4, B1, B2 and B3. A2 is disregarded because the A2 area generated by the Euclidean Allocation is blocked by areas of A1 and A3. The alternative calculation can perform by discounting segment area A2. The average of sea area will be 2,152.077 (area (A1+A3+A4+B1+B2+B3) ÷ 6). Some areas will be either increased or decreased to meet the average of area. The following table shows the result.

Island	Sea area for each segment (sq.km.)	Difference from average (sq.km.)
A1	2,726.760	-574.683
A3	1,211.888	+940.189

A4	2,217.898	-65.821
Total for State A		+299.685
B1	1,887.925	+264.152
B2	2,262.924	-110.847
B3	2,605.067	-452.990
Total for State B		-299.685

Table 11: Set up scenario the Equi-Area, gain and lose areas excluding relevant segment
Source: Author

The adjustment of the Equi-Area can be done by several ways such as, depending on the negotiation.

- If the gained areas are opposite to lose areas to each other, it will be simple for finding gain and lose areas for negotiation.

- If the gained areas are not opposite to lose areas, the negotiation can be done at any specific area by total gain and lose area.

- Fortunately, this example the gained area is opposite to lose area. Unfortunately, the segment A1 is opposite to segment B1, B2, and B3, segment A2 is opposite to segment B2 and B3. Only individually opposite segments are A3 and B3.

- For adjusting all of the median line, the adjustment for this example will do with total gain and total lose. Total gain for State A is 299.685 sq.km whereas total lose for State B is 299.685 sq.km.

After adjustment, the new equitable line from the Equi-Area (sea area) will be shifted closer to State B as following figure. The area between median line and adjusted median line is equal to gain and lose area.

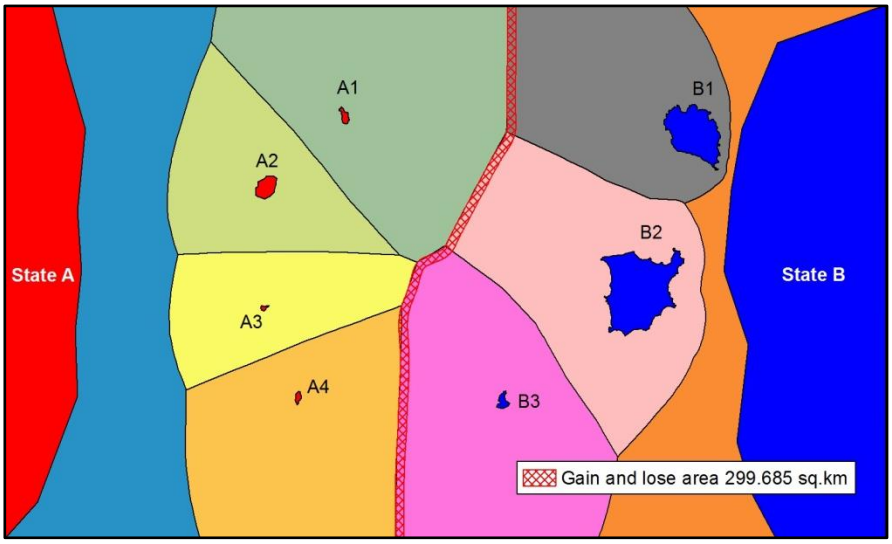

Figure 46: Set up scenario the Equi-Area, adjustment of median line
Source: Author

The result favours State A because State A gains more area and the line is moved estward from median line.

Including irrelevant segment (A2)

The mean of sea area is 2,045.448 (area (A1+A2+A3+A4+B1+B2+B3) ÷ 7) for all segments. Some areas will be either increased or decreased to meet the average of area. The following table shows the result.

Island	Sea area for each segment (sq.km.)	Difference from average (sq.km.)
A1	2,726.760	-681.313
A2	1,405.673	+639.775
A3	1,211.888	+833.560
A4	2,217.898	-172.450
Total for State A		+619.572
B1	1,887.925	+157.523
B2	2,262.924	-217.476
B3	2,605.067	-559.619
Total for State B		-619.572

Table 12: Set up scenario the Equi-Area, gain and lose areas including relevant segment
Source: Author

The result shows the more favourable to State A because the gain and lose area is greater the method excluding a relevant feature (A2).

The Equi-Area total area (area around islands and area of islands)

The second analysis will be the Equi-Area analysis by using information in col.4. The information for calculation is as following and A2 segment will be excluded because A2 segment is irreverent for Euclidean Allocation median line. The mean of total area is 2213.022. (area (A1+A3+A4+B1+B2+B3) ÷ 6). Some areas will be either increased or decreased to meet the mean of area. The following table shows the result.

Island	Total area for each segment (sq.km.)	Difference from average (sq.km.)
A1	2731.334	-518.312
A3	1213.211	+999.811
A4	2220.611	-7.589
Total of State A		+473.910
B1	2007.507	+205.515
B2	2494.397	-281.375
B3	2611.071	-398.049
Total for state B		-473.910

Table 13: Set up scenario the Equi-Area, gain and lose areas for total area excluding relevant segment
Source: Author

The result is still the same as the previous test that State A must gain area and State B must lose area to meet the Equi-Area.

The result shows that the median line from this method is more favourable to State A because of the following reason.

This occurs because area of State A is divided into many areas by many features. It makes allocated area of each segment below the average of area. For that reason, most of all segments of State A must gain more area to meet the Equi-Area. Whereas, less features of State B make most of allocated area segments in State B have area higher than the average. More consideration is on the total area only. State A and State B are equal in sea area and offshore features, and each allocated area of each feature is the same. In this situation, it has no gain and lose area. But, if sea area of State A is divided and allocated by offshore features which State A has more than State B, the bias will arise because of irrelevant features such as features not relevant to provisional median line or features lying between mainland and offshore features.

For reducing this bias, the irrelevant segment must be discounted and the Euclidean Allocation must be re-analysis. From example, it is clear that island A2, which is counted at the first Euclidean Allocation analysis, of State A is not the part of the Euclidean Allocation median line. After reanalysing Euclidean Allocation disregarding island A2, total area of island A2 is allocated to both island A1 and A2 depending on it closer to which island. The result is as the following;

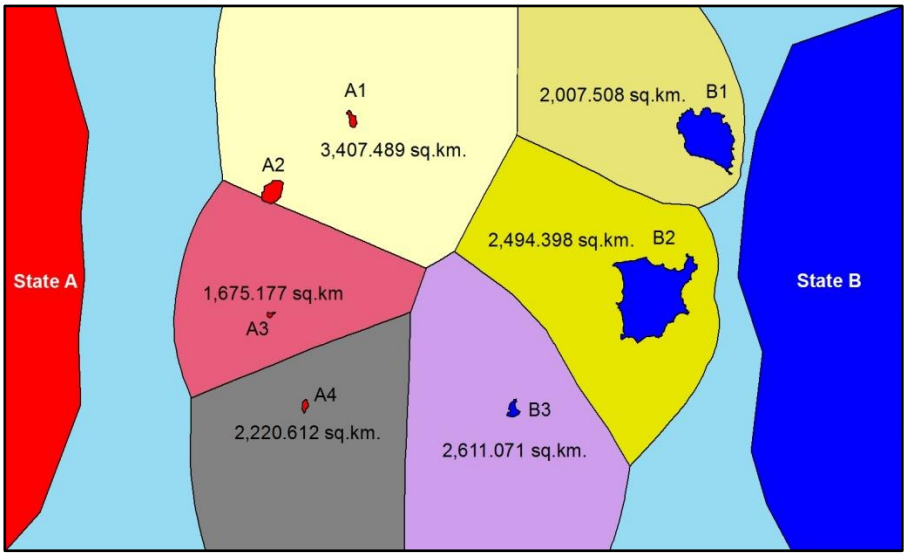

Figure 47: Set up scenario the Equi-Area, reanalysing Euclidean Allocation
Source: Author

After re-analysis (discounted island A2), the statistic shows the ratio, Col.5 and Col.6, having none of difference because each island has ratio is different equally.

Col.1	Col.2	Col.3	Col.4	Col.5	Col.6
Island	Island Area (sq.km.)	Sea Area (sq.km.)	Total Area (sq.km.)	Ratio Col.3÷Col.2	Ratio Col.4÷Col.2
A1	4.574	3,402.915	3,407.489	743.969	744.969
A3	1.323	1,673.854	1,675.177	1,265.196	1,266.196
A4	2.713	2,217.898	2,220.612	817.227	818.227
B1	119.583	1,887.925	2,007.508	15.787	16.787
B2	231.473	2,262.924	2,494.397	9.776	10.776
B3	6.004	2,605.067	2,611.071	433.889	434.852
Maximum		3,402.915	3,407.489	1,265.196	1,266.196
Minimum		1,673.854	1,675.177	9.766	10.776
Sum		14,050.585	14,416.255	3,286.125	3,292.125
Mean		2,341.764	2,402.709	547.687	548.687
Standard Deviation		558.122	544.678	449.326	499.326

Table 14: Set up scenario the Equi-Area, statistic of reallocated areas
Source: Author

Total area re-testing

Reanalysing by using information in column 4 of table 14 (Sea Area from Euclidean Allocation analysis and island area), the mean of total area is 2,402.709 (area (A1+A3+A4+B1+B2+B3) ÷ 6). Some areas will be either increased or decreased to meet the average of area. The following table shows the result.

Island	Total area for each segment (sq.km.)	Difference from average (sq.km.)
A1	3,407.489	-1,004.780
A3	1,675.177	+727.532
A4	2,220.612	+182.097
Total of State A		-95.151
B1	2,007.508	+395.201
B2	2,494.397	-91.688
B3	2,611.071	-208.362
Total for state B		+95.151

Table 15: Set up scenario the Equi-Area, gain and lose areas for reanalysing allocated areas
Source: Author

The first test shows that State A must gain area 299.685 sq.km. and State B must lose area at the same number. The first test includes island A2 for analysis. *Reversely,* if island A2 is disregarded for the Euclidean Allocation, State B will gain area 95.151 sq.km. and State A will lose area 95.151 sq.km. The area of 95.151 sq.km. is various for adjusting delineation. It can be the very narrow strip area along the Euclidean Allocation median line or wider but shorter area at any specific place.

Sea area re-testing

This test is as same as the all area test, but the area in the test will be only sea area around island. All values will be decreased dependently depending on the size of islands. If the segment has a small island, the area taken into analysis will not be significant for analysis. After analysis, the average of interested areas (A1, A3, A4, B1, B2 and B3) is 2,341.764. The important changes are areas in which islands B1 and B2 are because B1 is about 119.583 sq.km. and B2 is about 231.473 sq.km. The smallest island of State B is also larger than the biggest island of State A. The smallest is land of State B is about 6.004 sq.km whereas the biggest island of State A is about 4.574 sq.km. The analysis shows the result as the following.

Island	Sea area for each segment	Difference from average

	(sq.km.)	(sq.km.)
A1	3,402.915	-1,061.151
A3	1,673.854	+667.910
A4	2,217.898	+123.865
Total of State A		-269.376
B1	1,887.925	+453.839
B2	2,262.924	+78.839
B3	2,605.067	-263.303
Total for state B		+269.375

Table 16: Set up scenario the Equi-Area, gain and lose areas for reanalysing allocated areas
Source: Author

The result shows that the gain and lose areas for the Equi-Area is 269.375 sq.km., greater than the previous analysis, island area and sea area, 174.224 sq.km. (269.375 – 95.151). This method, area of island is excluded, illustrates that the size of island is the significant key, if it is taken for the Equi-Area method. The other optional gain and lose area is the average of result from the total area and the sea area method. The alternative gain and lose area is (269.375 + 95.151) ÷ 2 = 182.263 sq.km.

The Equi-Area Conclusion

- Features taken for analysis must be relevant to the median line which is created by Euclidean Allocation. After the first analysing the Euclidean Allocation, the result will show whether features are relevant for the provisional median line. The irrelevant features will be blocked by the other allocated areas. After the irrelevant features are disregarded, the Euclidean Allocation needs to be analysed again for calculating new area of relevant features. In this example, State A needs to be reanalysed for finding new proportion area because of discounting on island A2. Adding irrelevant features' assets to relevant features does not change the area which is inputted for the Equi-Area calculation. Only the numbers of the dividers are changed. The reason is for reducing the bias which makes allocated areas always below the average.

- The Equi-Area method can be classified into two categories. The first is the total area of each segment, island area and sea area around the island. The second is only the sea area around the island. The critical effect is the size of islands. The greater size of the islands, the greater change of gain and lose areas for the second category. The gigantic island can change the area, which is inputted for analysis, to whether above or below the average. The segment with the large island but small sea area around the island will be above the average, but the same segment will be under the average if the analysis is altered to sea area only.

- As same as island A2, the features lying between the mainland and the most seaward features must be ignored because these features are not relevant for the median line construction. If they are still in the Euclidean Allocation Analysis, the areas will be divided into many segments causing the inequitable area average.

- The coastal States usually draw the median line by using the most seaward features even though they cannot be considered as immediate vicinity. The State having the features far from mainland gets more advantage sea area between the mainland and features counted for Euclidean Allocation Analysis, but the more sea area dominated by the same feature will be in the analysis. If the areas analysed from Euclidean Allocation are too above average, such features far away from mainland, their areas will be decreased proportionally to meet the average.

- The answer can be 3 alternative options as the following.

1. Analysis all area, island area and sea area around island.
2. Analysis sea area around island only.
3. (Item 1 + Item 2) ÷ 2

3.2.2 The Equi-Ratio method

The Equi-Ratio total area (area around islands and area of islands)

The analysis will apply the ratio between the total area and area of an island. The statistic conclusion is as following table.[136]

Col.1	Col.2	Col.3	Col.4
Island	Island Area (sq.km.)	Total area of each segment (sq.km.)	Ratio Col.3 ÷ Col.2
A1	4.574	3,407.489	744.969
A3	1.323	1,675.177	1,266.196
A4	2.713	2,220.612	818.227
B1	119.583	2,007.508	16.787
B2	231.473	2,494.397	10.776
B3	6.004	2,611.071	434.852
Maximum		3,407.489	1,266.196
Minimum		1,675.177	10.776
Sum		14,416.255	3,292.125
Mean		2,402.709	548.687
Standard Deviation		544.678	499.326

Table 17: Set up scenario the Equi-Ratio, statistic of allocated areas

[136] Island A2 is excluded from analysis.

Source: Author

Column 4 shows that because of size of the islands, the adjustment of median line regarding the Equi-Ratio is favourable to State B because ratio of State B is below the average of the ratio. To meet the Equi-Ratio, the all sea areas of State B's islands will be increased, but that of State A's islands will be decreased. This method favours that the bigger island, the more sea area. Size of the island as the divider is various. Averaging size of islands to adjust the divider will help to reduce this problem. 60.945 is the average size of islands. The new ratio is as the following table.

Col.1	Col.2	Col.3	Col.4	Col.5
Island	Island Area (sq.km.)	Each segment area (sq.km.)	Ratio Col.3 ÷ Col.2	Ratio Col.3 ÷ 60.945
A1	4.574	3,407.489	744.969	55.911
A3	1.323	1,675.177	1,266.196	27.487
A4	2.713	2,220.612	818.227	36.436
B1	119.583	2,007.508	16.787	32.940
B2	231.473	2,494.397	10.776	40.929
B3	6.004	2,611.071	434.852	42.843
Maximum		3,407.489	1,266.196	55.910
Minimum		1,675.177	10.776	27.486
Sum		14,416.255	3,292.125	236.545
Mean		2,402.709	548.687	39.424
Standard Deviation		544.678	499.326	8.937

Table 18: Set up scenario the Equi-Ratio, new ratio
Source: Author

According to ratio adjustment, the new ratio shows that both States have both gain and lose areas. The average of ratio is 39.424. To meet the Equi-Ratio, each segment needs to be either added or subtracted as the following table.

Col.1	Col.2	Col.3	Col.4	Col.5
Island	Island Area (sq.km.)	Total area of each segment (sq.km.)	Ratio Col.3 ÷ 60.945	Difference from ratio average
A1	4.574	3,407.489	55.911	-16.487
A3	1.323	1,675.177	27.487	+11.937
A4	2.713	2,220.612	36.436	+2.988
Total State A				-1.561
B1	119.583	2,007.508	32.940	6.484
B2	231.473	2,494.397	40.929	-1.505
B3	6.004	2,611.071	42.843	-3.419
Total State B				+1.561

Table 19: Set up scenario the Equi-Ratio, difference from ratio average
Source: Author

The gain and lose ratio is 1.561. The next is converting the ratio to area. The sum of area, island areas and sea areas, is 14,416.255 sq.km. and the average of island areas is 60.945. So, 14,416.255 ÷ 60.945 = 236.545. The gain and lose area will be 236.545 × 1.561 = 369.247 sq.km. It means that to meet the Equi-Ratio solution the median line needs to be adjusted by increasing State B's sea area 369.247 sq.km. Automatically, State A's sea area will be decreased with the same number.

The Equi-ratio sea area

The next Equi-Ratio test will be almost the same. The exception is the each segment area will be sea area around an island only. 60.945 is the average size of islands. The ratio is as the following table.

Col.1	Col.2	Col.3	Col.4	Col.5
Island	Island area (sq.km.)	Sea area (sq.km.)	Ratio Col.3 ÷ Col.2	Ratio Col.3 ÷ 60.945
A1	4.574	3,402.915	743.969	55.836
A3	1.323	1,673.854	1,265.196	27.465
A4	2.713	2,217.899	817.227	36.392
B1	119.583	1,887.925	15.787	30.978
B2	231.473	2,262.925	9.776	37.131
B3	6.004	2,605.067	433.852	42.745
Maximum		3,402.914	1,265.196	55.835
Minimum		1,673.854	9.776	27.465
Sum		14,050.585	3,286.125	230.545
Mean		2,341.764	547.687	38.425
Standard Deviation		558.122	449.326	9.157

Table 20: Set up scenario the Equi-Ratio, sea area
Source: Author

The average of ratio is 38.425. To meet the Equi-Ratio, each segment needs to be either added or subtracted as the following table.

Col.1	Col.2	Col.3	Col.4	Col.5
Island	Island Area (sq.km.)	Sea area around island (sq.km.)	Ratio Col.3 ÷ 60.945	Difference from ratio average
A1	4.574	3,402.915	55.836	-17.412
A3	1.323	1,673.854	27.465	+10.960
A4	2.713	2,217.899	36.392	+2.033
Total State A				-4.420
B1	119.583	2,007.508	30.978	+7.477
B2	231.473	2,494.397	37.131	+1.294
B3	6.004	2,611.071	42.745	-4.321
Total State B				+4.420

Table 21: Set up scenario the Equi-Ratio, gain and lose ratio
Source: Author

The gain and lose ratio is 4.420. The next is converting the ratio to area. The sum of area, sea areas, is 14,050.585 sq.km. and the average of island areas is 60.945. So, 14,050.585 ÷ 60.945 = 230.545. The gain and lose area will be 230.545 × 4.420 = 1,019.010 sq.km. It means that to meet the Equi-Ratio solution the median line needs to be adjusted by increasing State B's sea area 1,019.010 sq.km. The gain and lose areas confirm that the area of the feature is the most effective if the area of the feature is very big. State A's sea area will be decreased with the same

number.The other optional gain and lose area is the average of result from the total area and sea area methods. The alternative gain and lose area will be
(369.247 + 1,019.010) ÷ 2 = 694.1285 sq.km.

The Equi-Ratio Conclusion

- Features taken for analysis are as same as the Equi-Area analysis; features irrelevant to the Euclidean Allocation will be excluded.

- The key for Equi-Ratio is the size of features. The non-comparative size of features will cause ratio to be too high for small area features and to be too low for big area features. Averaging size of the features will proportionally narrow the ratio.

- The Equi-Ratio method can be classified into two categories. The first is the all area of each segment, island area and sea area around the island. The second is only the sea area around the island. The critical effect is the size of island. The greater size of the islands, the greater change of gain and lose areas for the second categories. The gigantic island can change the area to whether above or below the average.

- As same as island A2, the features lying between the mainland and the most seaward features must be ignored because these features are not relevant for median line construction.

- The answer can be 3 alternative options as the following.

1. Analysis all area, island area and sea area around island.
2. Analysis sea area around island only.
3. (Item 1 + Item 2) ÷ 2

Features taken for analysis must be relevant to the median line which is created by Euclidean Allocation. After the first Euclidean Allocation, the irrelevant features will be blocked from the median line by the other features. Then, the Euclidean Allocation needs to be analysed again for calculating new allocation area of relevant features. In this example, State A needs to be reanalysed for finding new allocation area because of discounting on island A2.

- As same as island A2, the features lying between the mainland and the most seaward features must be ignored because these features are not relevant for median line construction. If they are still in the Euclidean Allocation Analysis, the areas will be divided into many segments causing the inequitable area average.

- The State having the features far from mainland gets more advantage sea area between the mainland and features counted for Euclidean Allocation Analysis, but the more sea area dominated by the same feature will be in the analysis. If the areas analysed from Euclidean Allocation are above average, such features far away from mainland, their areas will be decreased proportionally to meet the average of the ratio.

The Equi – Area/Ratio Comparison

From testing, there are four different results. The areas of features are significant factors for calculating gain and lose areas. The following table illustrates the comparison in four different results.

Island	Equi-Area (sq.km.)		Equi-Ratio	
	Including island area	Excluding island area	Including island area	Excluding island area
A1	-1,004.780	-1,061.151	-16.487	-17.412
A3	+727.532	+667.910	+11.937	+10.960
A4	+182.097	+123.865	+2.988	+2.033
Total different area for State A	-95.151	-269.376	-1.561 (369.247 sq.km.)	-4.420 (1,019.010 sq.km.)
B1	+395.201	+453.839	+6.484	+7.477
B2	-91.688	+78.839	-1.505	+1.294
B3	-208.362	-263.303	-3.419	-4.321
Total different area for State B	-95.151	+269.375	+1.561 (369.247 sq.km.)	+4.420 (1,019.010 sq.km.)

Table 22: Comparison gain and lose areas between Equi-Area and Equi-Ratio
Source: Author

Chapter 4 The Equi-Area/Ratio application for maritime delimitation

4.1 Section A The Equi-Area/Ratio real scenario testing

4.1.1 Romania vs. Ukraine, Colombia vs. Nicaragua

Real scenario test

The Equi-Area/Ratio method will be tested with the real scenario to prove that it is applicable for maritime delimitation. The testing is the comparison between the median line from the Equi-Area/Ratio method and the median line from the judgement. The cases which are taken for comparison are Romania vs. Ukraine and Colombia vs. Nicaragua. The difference between these two cases is that the median line of Romania vs Ukraine case is based on the coastlines of each State whereas the median line of Colombia vs. Nicaragua is based on features off shore. Some features which are picked for base points in Columbia vs Nicaragua are not recognized as islands

according to article 121 Regime of islands in the LOS Convention. These different circumstance will prove whether the Equi-Area/Ratio is applicable as the new method for maritime delimitation.

Maritime Delimitation in the Black Sea (Romania v. Ukraine)

Data Preparation

The chart is adapted from International Court of Justice Summary Document *Maritime Delimitation in the Black Sea (Romania v. Ukraine) Summary of the Judgement of 3 February 2009* Sketch-map No.9: Course of the maritime boundary page 34. The technical information found on the chart is WGS84 Mercator Projection at 45°30′N none of scale. The actual size is A4. The chart, JPEG format, is rectified by GIS software to make it have the correct coordinates. After rectification, coastline of each State, Romania and Ukraine, is digitized. Romania coastline is digitized in red and Ukraine coastline is digitized in blue. Different coastlines have different attribute, Romania is attribute data for Romania coastline and Ukraine is attribute data for Ukraine. The result, rectified chart and coastlines, is as the following figure.

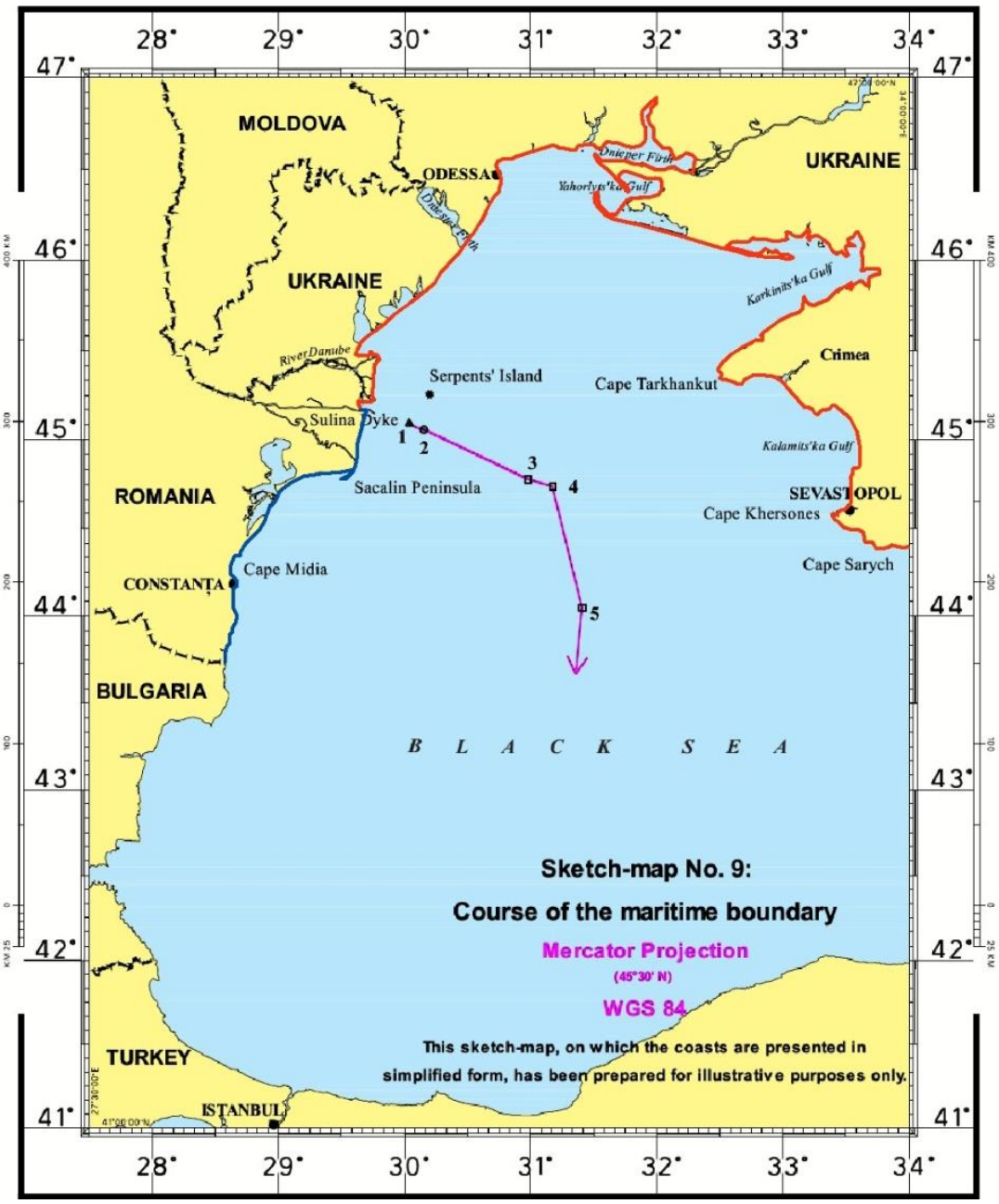

Figure 48: The rectified nautical chart and the digitized coastlines
Source: A nautical chart adapted from Summary of Judgement from ICJ.

The Euclidean Allocation Analysis

All of coastlines, Romania and Ukraine, are as input for the Euclidean Allocation. The difference is that the judgement did not count coastline of Karkinits'ka Gulf for drawing median line, but author puts all coastlines for analysis but excluding Serpents's Island for analysis as same as the provisional median line from judgement.[137] After finishing the Euclidean Allocation, the result shows areas occupied by Romania's coastline, blue, and Ukraine's coastline, red. For this testing, the author did not limit the area for analysing that why the allocated areas from analysis continue into Bulgarian and Turkish waters. The median line from the Euclidean Allocation

[137] Maritime Delimitation in Black Sea (Romania v. Ukraine), Summary of the Judgement of 3 February 2009. ICJ.

analysis, green line, is almost identical to the median line form judgement, magenta line with point 1-5. The median line form the Euclidean allocation starts from the coastline where the terminus point between two State is, but the median line from judgement is from point 1. The illustration is as the following.

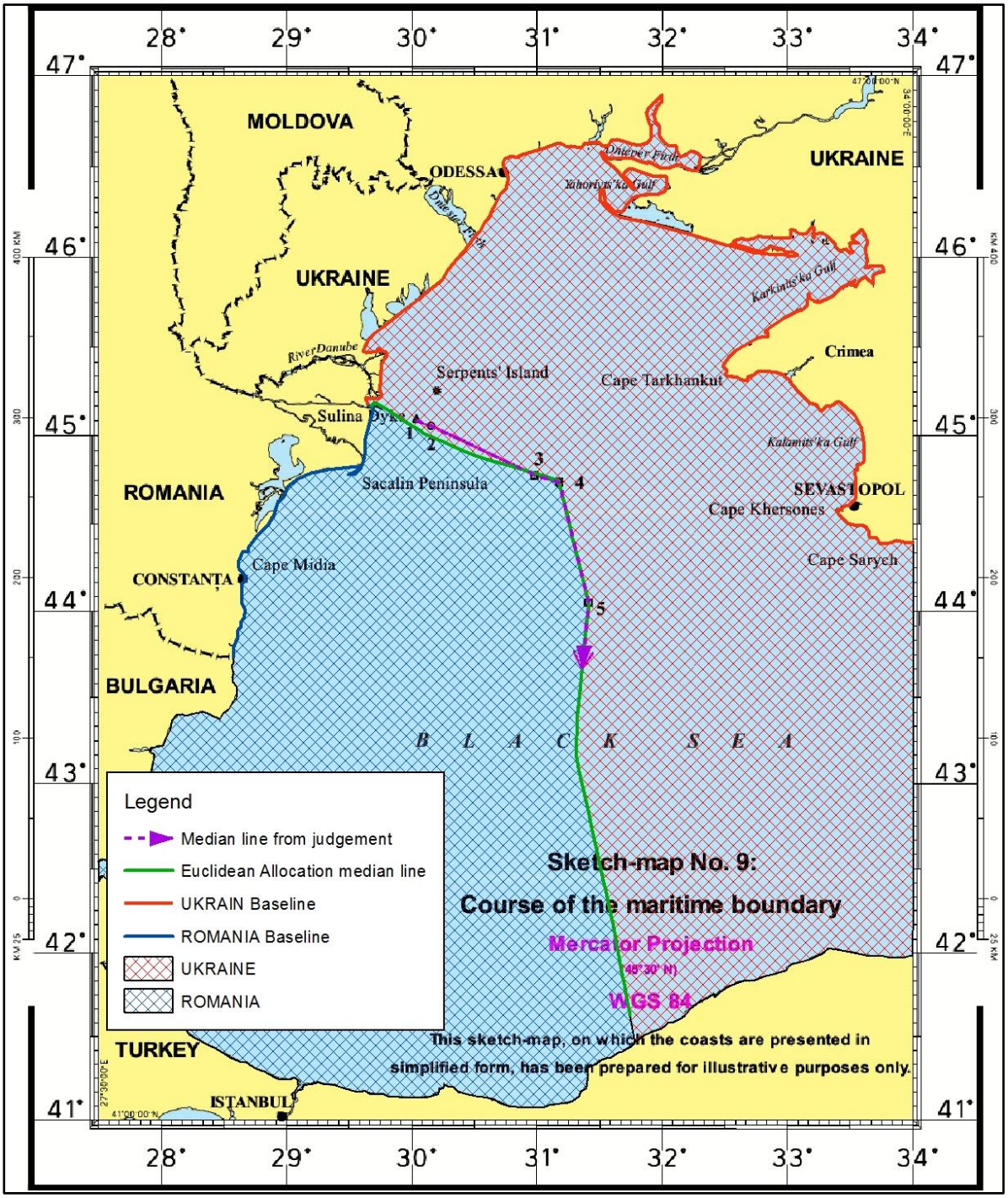

Figure 49: Allocated areas between Romania and Ukraine
Source: A nautical chart adapted from Summary of Judgement from ICJ.

Because the author does not limit the area to be analysed, the median line from the Euclidean Allocation continues to the south and ends at the mainland. Actually, the median line from the Euclidean can be limited according to specific area.

The significant difference of median line from ICJ and from the Euclidean Allocation is between point 1 to point 3. The maximum distance between these two lines, green and margenta, is 3.17 nautical miles. The illustration for this difference is as the following figure. The magenta line and points are displayed on the judgment chart, the green line is median line from the Euclidean Allocation analysis.

Figure 50: Zoom in allocated areas between Romania and Ukraine
Source: A nautical chart adapted from Summary of Judgement from ICJ.

The result strengthens that the median line from the Euclidean Allocation method is applicable for delimiting maritime boundary in case of using coastline only.

Territorial and Maritime Dispute (Nicaragua v. Colombia)

From the result of the ICJ, the maritime delimitation between Nicaragua and Columbia was equitably delimited by adjusting the provisional median line. Length of the relevant coastlines of two States is weighted for adjusting the provision median line to be the final median line. For Nicaragua, the relevant coast is its whole coast and for Colombia, the relevant coast is the entire coastline of its islands, except Quitasueño, Serranilla and Bajo Nuevo.[138] The features in the relevant maritime area, identified by the Court, are for Nicaragua Edinburgh Reef, Muerto Cay, Miskitos Cays, Ned Thomas Cay, Roca Tyra, Little Corn Island and Great Corn Island as well as for Colombia Quitasueño, Serrana, Roncador, Providencia/Santa Cataline, San Andrés, East-Southeast Cays and Alburquerque Cays. A provisional median line is delineated by all

[138] Judgement on Territorial and Maritime Dispute (Nicaragua v. Colombia)

Nicaragua's seven features and only three features Providencia/Santa Cataline, San Andrés and Alburquerque Cays from Colombia side. The testing of the Equi-Area/Ratio will occupy all features in the relevant area to find out how much gain and lost area will be.

Data Preparation

The chart is adapted from International Court of Justice Summary Document *Territorial and Maritime Dispute (Nicaragua v. Colombia) Press Release No.2012/33 19 November 2012* Sketch-map No.7, 8, 10 and 11. The technical information found on the chart is WGS84 Mercator Projection at 12°30′N none of scale. The actual size is smaller than A4. The chart, JPEG format, is rectified by GIS software to make it have the correct coordinates. For convert data from raster to vector, after rectification of negotiation area, relevant features and Nicaraguan coastline are digitized. The first is to find the area between the provisional median line and adjusted median line. The area between provisional median line and adjusted median line is about 15,527.684 sq.km.[139]

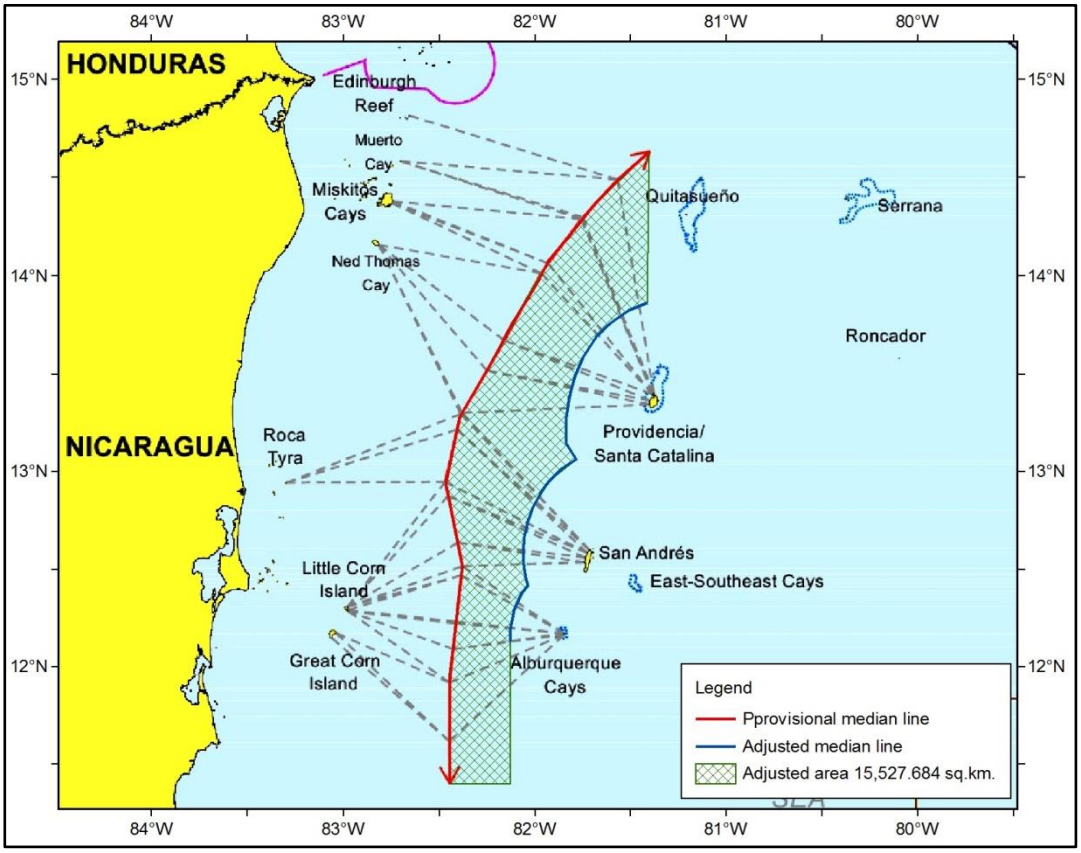

Figure 51: The rectified nautical chart and the digitized area between the provisional median line and adjusted median line
Source: A nautical chart adapted from Summary of Judgement from ICJ.

[139] An author rectifies the charts in the ICJ document to GIS software, digitizes the lines (provisional and adjusted median lines) and makes the polygon by closing the gap between the lines. Then, the area is calculated.

The relevant features which are inputted for the Euclidean Allocation analysis are all features in the relevant area. The relevant area is defined by the court, but the court uses some features to delineate provisional median line. The median line generated by the Euclidean Allocation analysis is different from the provisional median line from the court because Quitasueño is used as control point in the Euclidean Allocation for constructing median line, but the median line from the judgement disregards Quitasueño. Because of this, the median line form the Euclidean Allocation continues running to the north whereas the provisional line from the judgement bends eastward. The following figure shows the allocated areas of each feature in relevant area and comparison between the provisional median line and median line form the Euclidean Allocation.

Figure 52: Allocated area of each feature in relevant area
Source: A nautical chart adapted from Summary of Judgement from ICJ.

The next figure illustrates the difference of median line construction, control points of turning points, between the Euclidean Allocation method and from the judgement. The median line from judgement is formed by turning points connected to each other. The turning points are controlled by the base points on the selected features. The median line from the Euclidean Allocation is formed by the edge of each polygon of each allocated area. When comparing the turning points from both, the median line from the judgement has turning points more than the Euclidean Allocation.

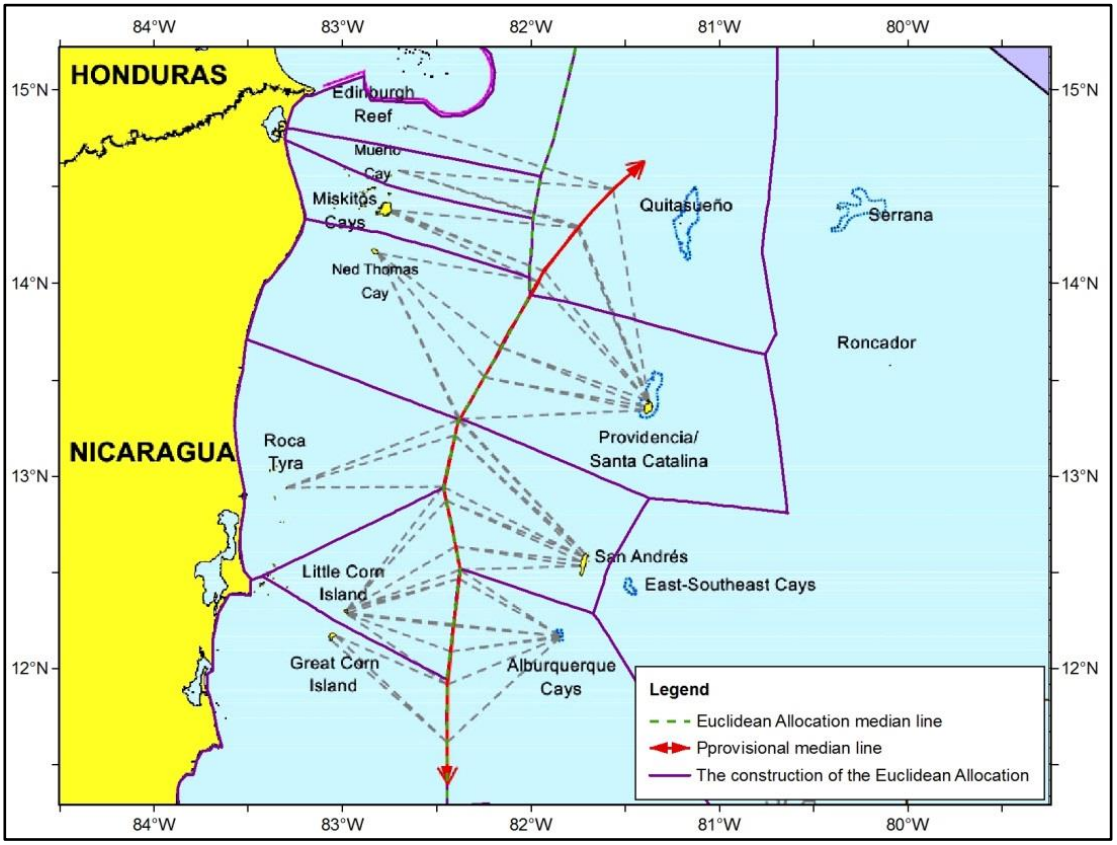

Figure 53: Comparison of median line construction
Source: A nautical chart adapted from Summary of Judgement from ICJ.

The allocated areas as input data for the Equi-Area/Ratio will be for Colombia side Quitasueño, Santa Cataline, San Andrés and Alburquerque Cays and for Nicaragua Edinburgh Reef, Muerto Cay, Miskitos Cays, Ned Thomas Cay, Roca Tyra, Little Corn Island and Great Corn Island. The average area is 11,784.275 sq.km. The result shows that to meet the equi-area the gain and lose area is about 22,723.370 sq.km.Area of each segment and static are as the following table.

Feature name	Area (Sq.km)	Difference from average (sq.km.)
Quitasueño	26,390.709	-14,642.433
Santa Cataline	15,239.877	-3,491.601
San Andrés	7,998.295	+3,749.981
Alburquerque Cays	20,087.593	-8,339.317
Total area of Colombia		-22,723.370
Edinburge Reef	7,056.424	+4,691.852
Muerto Cay	2,970.403	+8,777.873
Miskitos Cays	4,417.189	+7,331.087
Ned Thomas Cay	11,602.878	+146.398
Roca Tyra	11,114.268	+634.008
Little Corn Island	6,419.657	+5,328.619
Great Corn Island	15,934.739	-4,186.463
Total area of Nicaragua		+22,723.370

Table 23: Real scenario the Equi-Ratio, statistic of allocated areas Columbia v. Nicaragua
Source: Author

The difference between the areas from adjustment of median line[140], 15,527.684 sq.km. and areas from the Euclidean Allocation, 22,723.370 sq.km. is 7,195.686 sq.km. The significant effect is the amount of Nicaragua's features which are inputted as divider for finding the average. The Nicaragua's features are seven whereas the Colombia's features are four. Too many features will have area below average.[141] Making inputted features equally, author groups small areas of Nicaragua's features together, Edinburge Reef, Muerto Cay. That Edinburge Reef and Muerto Cay are very small compared with the other Nicaragua's features is the reason why author groups them together. The adjusted areas of regarding features are as the following figure.

[140] See figure 51.
[141] The explanation is in The Equi-Area total area (area around islands and area of islands)

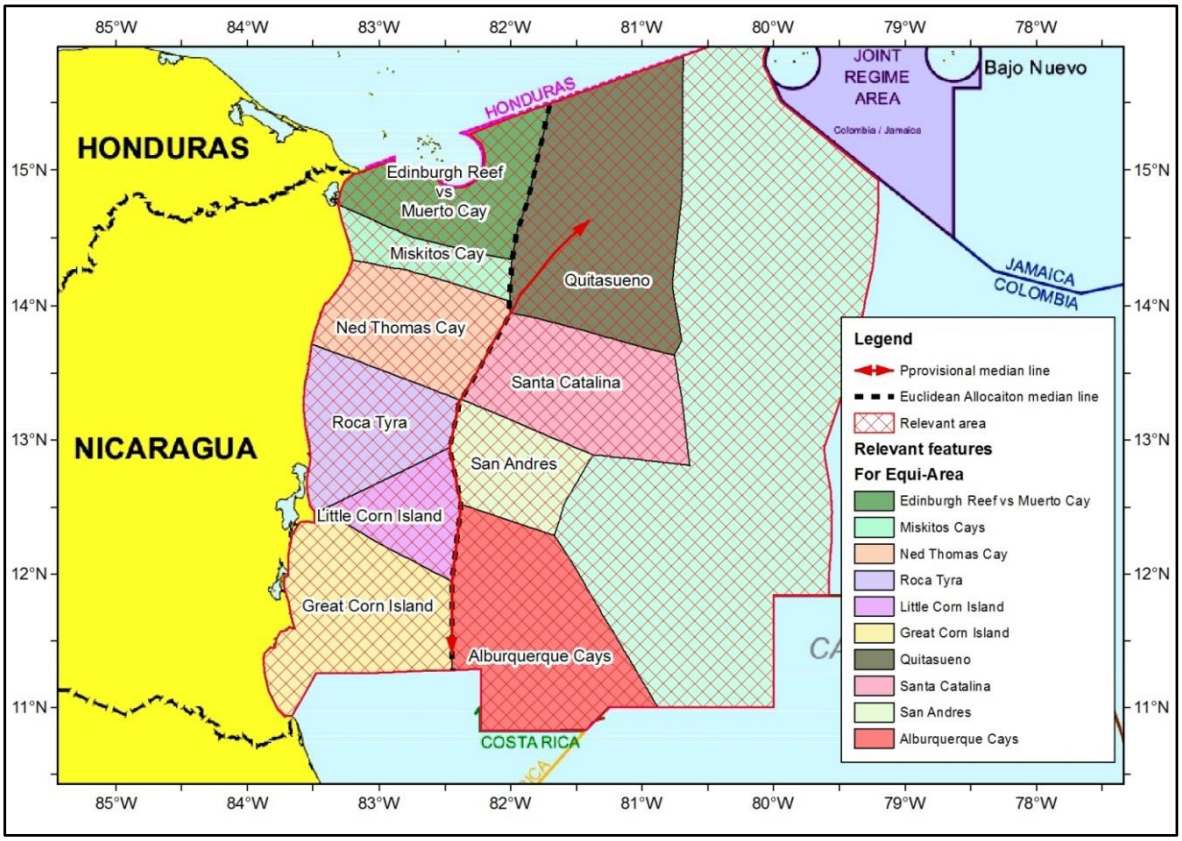

Figure 54: Allocated area of relevant features
Source: A nautical chart adapted from Summary of Judgement from ICJ.

The new average is 12,923.103 sq.km. The new result shows that to meet the Equi-Area the gain and lose area is about 18,024.605 sq.km. Area of each segment and statistic are as the following table.

Feature name	Area (Sq.km)	Difference from average (sq.km.)
Quitasueño	26,390.709	-13,467.606
Santa Cataline	15,239.877	-2,316.774
San Andrés	7,998.295	+4,924.808
Alburquerque Cays	20,087.593	-7,164.490
Total area of Colombia		-18,024.605
Edinburge Reef + Muerto Cay	10,026.828	+2,896.275
Miskitos Cays	4,417.189	+7,331.087
Ned Thomas Cay	11,602.878	+8,505.914
Roca Tyra	11,114.268	+1,808.835
Little Corn Island	6,419.657	+6,503.446
Great Corn Island	15,934.739	-3,011.636
Total area of Nicaragua		+18,024.605

Table 24: Real scenario the Equi-Ratio, gain and lose areas Columbia v. Nicaragua
Source: Author

The new Equi-Area gives the gain and lose area about 18,024.605 sq.km. The difference between the area from the Equi-Area and the area from the median line adjustment, from judgement, is 18,024.605 - 15,527.684 = 2,496.921 sq.km.

The adjusted median line is re-adjusted, shifting of the adjusted median line, eastward to meet the area from the Equi-Area. The difference between area from the judgement[142], area covered by the provisional median line and adjusted median line 15,527.684 sq.km., and from the Equi-Area, 18,024.605 sq.km., is 2,496.921 sq.km. The re-adjusted median line can be done by drawing the line parallel to adjusted median line the distance between adjusted median line and re-adjusted median line is 8.2435 kilometres, 4.451 nautical miles. The gain and lose areas can be adjusted in many ways, but the author wants to make the median line from the Equi-Area/Ratio identical to the median line from judgement. That is why median line from the Equi-Area/Ratio is parallel to adjusted median line from the judgement. The result is as the following figure.

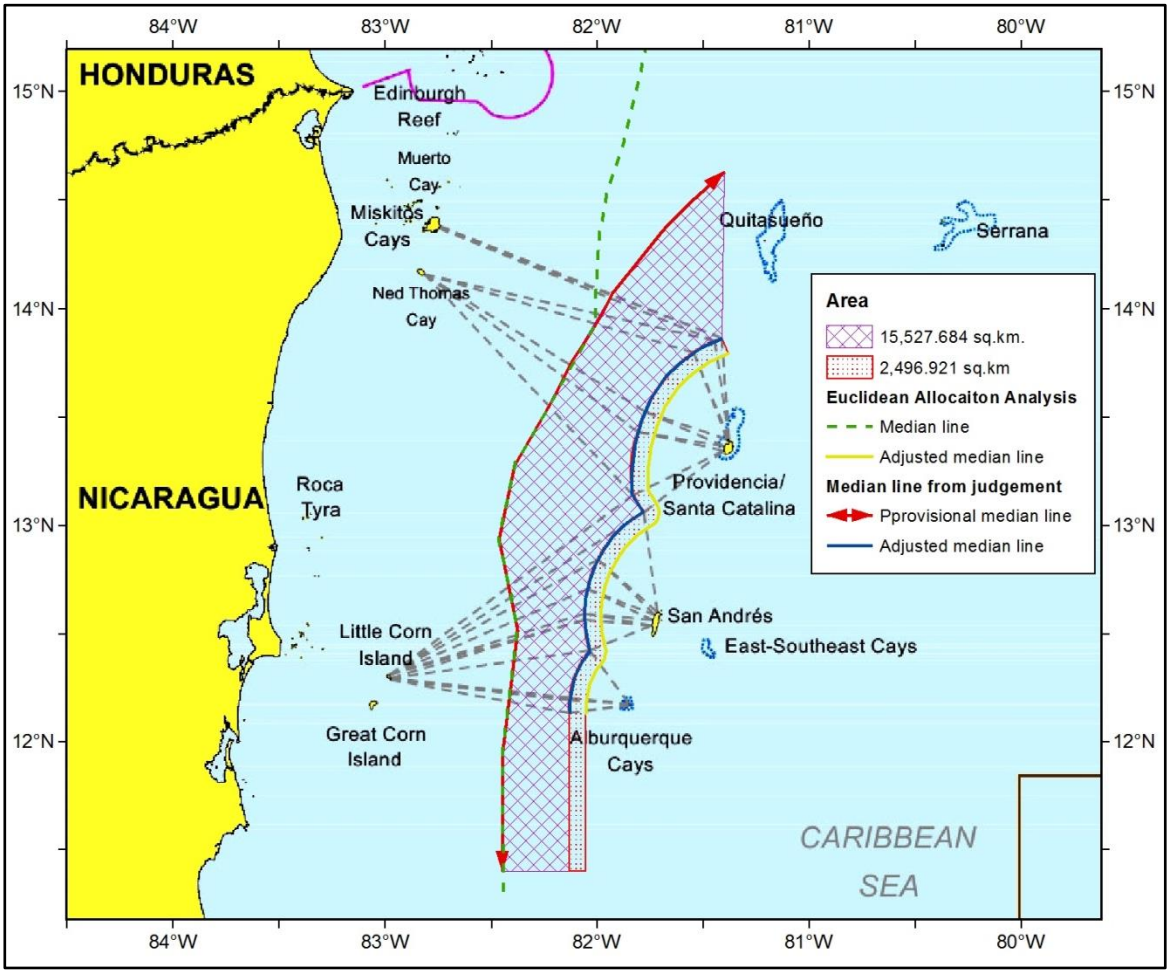

Figure 55: Comparison of median line from judgement and median line from the Equi-Ratio
Source: A nautical chart adapted from Summary of Judgement from ICJ.

[142] See figure 51.

Partial effect to Quitasueño[143]

The significant difference between the Euclidean Allocation median line and provisional median line is around the area allocated to Quitasueño. The difference arises from that the provisional median line does not take Quitasueño for drawing median line, but the Euclidean Allocation does. To give partial effect on allocated area of Quitasueño can adjust the area of gain and lose to be as same as area between the provisional median line and the adjusted median line. The partial allocated area of Quitasueño, the full allocated area 26,390.709 sq.km., will be putted in the calculation is 22,230.081 sq.km. which is 84.23%. The new average is 12,507.041. The table of the new calculation is as the following table.

Feature name	Area (Sq.km)	Difference from average (sq.km.)
Quitasueño	22,230.081	-9,723.041
Santa Cataline	15,239.877	-2,316.774
San Andrés	7,998.295	+4,508.746
Alburquerque Cays	20,087.593	-7,580.553
Total area of Colombia		-15,527.684
Edinburge Reef + Muerto Cay	10,026.828	+2,480.213
Miskitos Cays	4,417.189	+8,089.852
Ned Thomas Cay	11,602.878	+905.162
Roca Tyra	11,114.268	+1,392.773
Little Corn Island	6,419.657	+6,087.384
Great Corn Island	15,934.739	-3,427.699
Total area of Nicaragua		+15,527.684

Table 25: Real scenario the Equi-Ratio, new gain and lose area on partial effect of allocated area
Source: Author

The partial effect, 84.23%, on allocated area of Quitasueño in the Equi-Area will improve that the adjusted median line from the Equi-Area is fit to the adjusted median line from the judgement.

The result strengthens that the median line from the Euclidean Allocation method is applicable for delimiting maritime boundary in case of using features off shore.

4.1.2 The conclusion of the Equi-Area/Ratio method

The Equi-Area/Ratio conclusion

[143] An author is indebted to Mr.Alan Evans, the author's supervisor. He advices the author to give partial effect to Quitasueño because this feature was disregarded in the judgement, but it was putted in the Equi-Area/Ratio method. That is the reason why the median lines from judgement and from the author are different. After applying partial effect, 84.23%, it makes adjusted median line from the Equi-Area/Ratio identical to adjusted median line from the judgement.

The first step for doing the Equi-Area/Ratio is to allocate area to individually nearest feature. This can be done by GIS method called the Euclidean Allocation analysis. The median line will be by-product of the Euclidean Allocation analysis. The result, allocated area, illustrates which features are not relevant to the median line. Disregarding irrelevant features and reanalysing the Euclidean Allocation will reallocate relevant areas. The new allocated areas will be input data for calculating the Equi-Area and the Equi-Ratio. It is as previous mention in the Equi-Area conclusion that *adding irrelevant features' assets to relevant features does not change the area which is inputted for the Equi-Area calculation. Only the numbers of the dividers are changed. The reason is for reducing the bias which makes allocated areas always below the average.*

The allocated areas inputted for calculating can be classified into two categories. The first is sea area around the feature. The second is the total area which is sea area around the feature and area of the feature. It is optional. With two categories of allocated areas, there are four options. The two options are the Equi-Area (sea area/total area), and the next two options are the Equi-Ratio (sea area/total area).

The Equi-Area will be consideration on every segment area which needs to be equitable. Each segment area will be occupied individually by the nearest feature. The area of each segment will be various. The average area for all segments will be resolved simply and mathematically. The inputted areas for the Equi-Area are either sea area or total area.

The Equi-Ratio considers on ratio between area of each segment, either sea area or total area, and area of feature. The significant factor is the size of features, either islands or rocks, because the size is as the divider for finding out the ratio. If features are too different in sizes, such as an island with 100 sq.km. and an isolated rock with 2 sq.km., the minimum ratio will be too different from the maximum ratio. It makes areas of gain and lose inappropriate. For reducing the prejudice against size of features, the ratio needs to be narrowed by using the same divider. The suitable divider can be calculated by averaging the size of relevant features.

The ambiguousness of selecting features for maritime delimitation

The coastal State extends maritime zone by drawing straight base line from the most seaward features. Some features, such as isolated rocks or low tide elevation, are not recognized to be basepoints. The Equi-Area/Ratio can reduce this vagueness because every feature will be scrutinized by this method. The allocated area will answer whether selected features can be counted for the Equi-Area/Ratio as ignorance of an A2 island in set up scenario test.

Basepoints Selection

Selecting basepoints for constructing the straight baselines is various, in case of mainland. Sometime shoreline is very complicated to be picked up as reference point such as beach with many headlands. The maritime zone is measured from either normal baselines or straight baselines. Construction of normal baseline is easier than construction of straight baseline because the normal baseline is as the low-water mark on large scale charts[144] whereas the straight baseline begins with the basepoints selection which is very various in the way to select them. More difficulty of basepoints selection is that.

> Inasmuch as equidistance is to be computed by reference to basepoints, this issue cannot be underestimated in delimitation. Analogously to the delineation of limits, in the computation of equidistance the number of relevant basepoints is variable. It varies with the geography between the coasts involved, notably the adjacency-oppositeness aspect and the distance between coasts.[145]

The following figure shows the different straight baseline which is from different selection of basepoints.

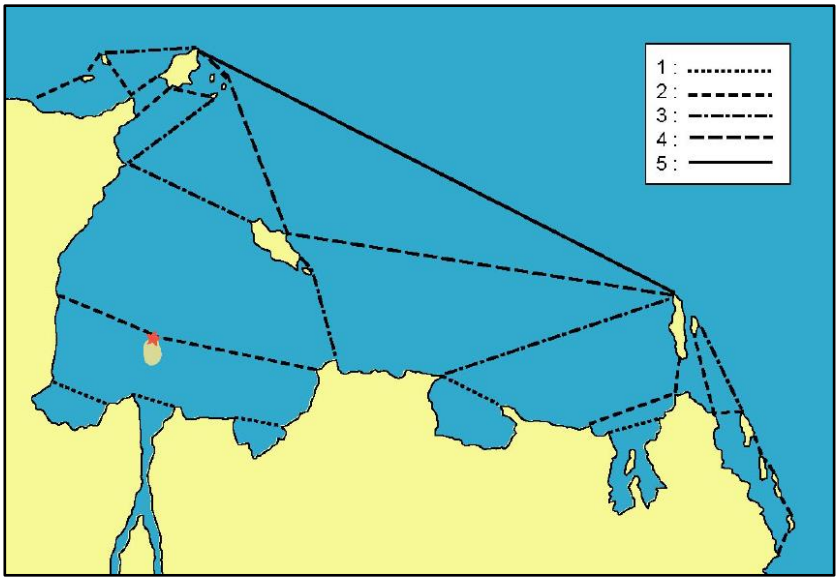

Figure 56: Different selection of basepoints
Source: TALOS 4th Edition

Criterion for basepoints selection is in the TALOS as that.

> Only portions of a State's baseline will affect an equidistance line. By definition, the equidistance line will be constructed by using only the salient (seaward-most)

[144]The LOS Convention 1982.

[145]Antunes, Nuno Sergio Marques (2002) Towards the conceptualisation of maritime delimitation: legal and technical aspects of a political process, Durham theses, Durham University. Available at Durham E Theses Online: http://etheses.dur.ac.uk/4186/

basepoints. The number actually chosen will depend on the interplay of the relevant segments of baseline of both States, on the configuration of the coastline, and on the distance of the median line from the nearest basepoints. The greater the distance, the fewer the basepoints that are likely to affect it, and the greater the distance that may be selected between points along a smooth coast.[146]

The Euclidean Allocation analysis can reduce this ambiguity because the location from the sea will be analysed to be assigned to the closest segment of the shorelines. So, basepoints selection is not necessary as Romania and Ukraine testing.

Attribute criteria selection

GIS system lets the features to be analysed variously by attribute data. For example, the new comer wants to rent the house for his family. The specification of his house is three bedrooms, two bathrooms, two car parking lots, one dinning room and one kitchen. An agency has about 200 houses for selling. Looking in the attribute, data of data, the agency sets up the requirement to meet the criteria as required by the new comer. As same as the example, the relevant features for constructing median line can be selected by attribute data. The consideration of relevant features can be such as area, population, distance from mainland, sustainable habitat or types. The following table demonstrates the use of attribute data for the Euclidean Allocation. If the column State is chosen, the two categories, A and B, will be is the criteria for the Euclidean Allocation analysis. If the column Population is chosen, the five categories, 0, 10,30, 100 and 200, will be is the criteria for analysis. The super selection is the method to narrow the Euclidean Allocation analysis. For example, the median line from the Euclidean Allocation is based on the fefures which are Yes for Sustainble Habitat only. With no super selection, eight features will be analyzed, but with the super selection, Sustainble Habitat features, only features met the criteria will be anallyzed. The other example is the size of the feature. Some features are too small to be given a full effect for drawing median line. The threshold is also applicable in super selection for the Euclidean Allocation. For example, the six islands, column Type, are various in area. Some are very small. The super selection is set to that the islands which have area less than 10 will be discounted for the Euclidean Allocation. From the super selection, only features, islands only, with area greater than 10 will be as input for analysis.

ID	State	Area	Sea Area	Population	Type	Sustainable Habitat
A	A	1,904.77	3,402.92	100	Mainland	Yes
A1	A	4.57	2,726.76	0	Island	No

[146]A manual on Technical Aspects of the United Nations Convention on the Law of the Sea -1982, 4th Edition. (TALOS).

A2	A	18.65	1,405.67	10	Island	Yes
A3	A	1.32	1,211.89	0	Island	No
A4	A	2.71	2,217.90	0	Island	No
B	B	3,940.10	1,903.36	200	Mainland	Yes
B1	B	119.583	1,887.93	0	Island	No
B2	B	231.47	2,262.92	30	Island	Yes

Table 26: Attribute data example
Source: Author

For attribute criteria selection, it is very necessary that each feature must have attribute data. The information from the field can be added to attribute data as much as possible for equitable analysis. Different attribute data inputted for the Euclidean analysis will give the different median lines. Comparison of the diversity of the median lines will give possible ways of adjustment.

Median line construction

Median line from existing methods is constructed by control points on the selected base points. But, median line from the Euclidean Allocation is formed by the edge of each polygon of each allocated area as explanation for figure 53.

GIS software

GIS software is needed for doing the Euclidean Allocation analysis and the result from analysis is a raster format only. But, the GIS application can convert raster format to vector format.

The resolution[147]

The resolution of raster format can affect the result. The core resolution makes the median line not smooth, but the size of result data is small whereas the smooth median line will spend large volume for storing data. The resolution depends on the size of the inputted features. For covering and analysing all inputted features, the resolution of the result must be greater than the resolution of the smallest inputted feature. For example, the island is about 10 square metres that means the resolution cannot be smaller than 10 square metres. If the resolution is smaller than 10 in dot per inch, such as 11, the island will be disregarded from analysis. The following figures are comparison between higher and lower resolution for raster format. The high resolution will give the line smoother than low resolution, but the capacity space and computer specification must be efficient enough for storing and calculating. The low resolution is very quick for processing. The

[147] The smaller the number, the higher the resolution. Such as, the resolution of 1 square metre is better than the resolution of 2 square metres. Oppositely for dpi (dot per inch), the higher number, the higher resolution.

following illustrations for the core resolution show that four small islands of State A and one small island of State B do not have the sea territories because their areas are smaller than the output resolution and for the high resolution show that every feature has its own sea area because each area bigger than the output resolution.

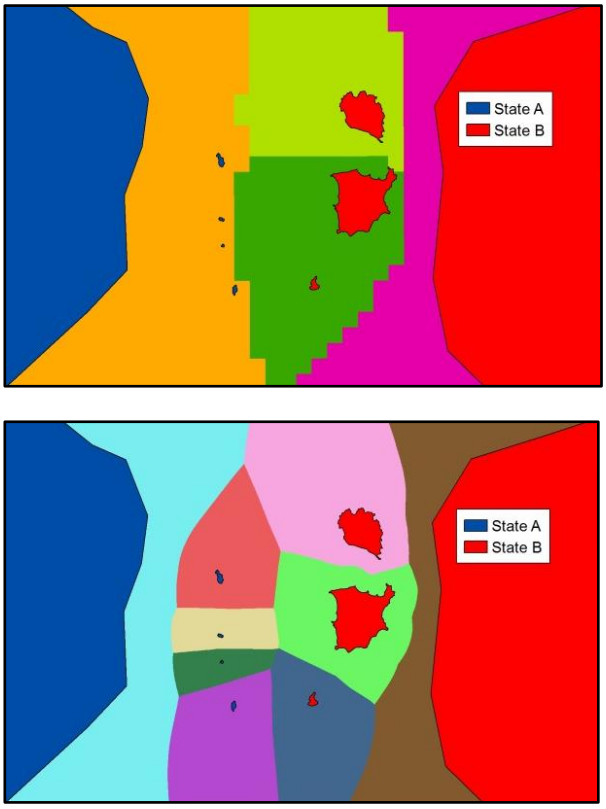

Figure 57: Difference of resolution of raster data
Source: Author

Partial effect

Partial effect in the Euclidean Allocation analysis in GIS software is inapplicable. To meet the equitable solution some features may be given the partial effect, one – third or two – third effect. A tool for partial calculation in the Euclidean Allocation method is unavailable during the date author writing this paper. *But, the partial effect can be recalculated in the Equi-Area/Ratio such as the testing of Colombia vs. Nicaragua in testing section.*

4.2 Section B The Equi-Area/Ratio application for Cambodia and Thailand

The Equi-Area/Ratio for maritime delimitation between Cambodia and Thailand

The Equi-Area/Ratio is the optional method for Cambodia and Thailand to delimit maritime boundary because this method is applicable for every feature in the sea. The following illustration is the median line generated by allocated areas of relevant features in the Gulf of Thailand. All features, including rocks, reefs and low-tide elevation, are as inputted data for analysis. The result is very complicated, because of too many input features. Otherwise, the median line can be predicted by the line running south – west direction from the terminus point

between Cambodia and Thailand to the middle of the Gulf of Thailand and then intersecting the line running south – east direction from north to south. Each coloured polygons represent the allocated area for each feature in the Gulf of Thailand. The median line is generated by the features the most seaward. None of mainland coastline, Cambodia and Thailand, is as the control points for median line turning points. It is because of that the median line from this method is stipulated by the offshore features. So, the length of the coastline is not important. The significant features, which have big allocated area, as basepoints on Thailand's side are Ko Phangan, Ko Samui, Ko Kra and Ko Losin as well as on Cambodia's side are Koh Veer and Poulo Wei. Hon Tho Chu is belong to Vietnam. The median line is composed of ten segments and eleven turning points. The distance of each segment and details are as following table. The median line is shown in the following figure.

Segment	From	To	Formed by Allocated Area		Distance (nm.)
			Cambodia's side	Thailand's side	
1	1	2	Cambodia's coastline	Thailand's coastline	11.574
2	2	3	Cambodia's coastline	Ko Kut	3.638
3	3	4	Koh Kong	Ko Kut	5.191
4	4	5	Koh Kusrovie	Ko Kut	92.767
5	5	6	Koh Kusrovie	Ko Phangan	8.917
6	6	7	Koh Veer	Ko Phangan	28.392
7	7	8	Poulo Wei	Ko Phangan	29.286
8	8	9	Poulo Wei	Ko Kra	60.498
9	9	10	Hon Tho Chau (Vietnam)	Ko Losin	102.040
10	10	11	Vietnam's feature	Ko Losin	40.230

Table 27: Detail of median line formed by allocated areas
Source: Author

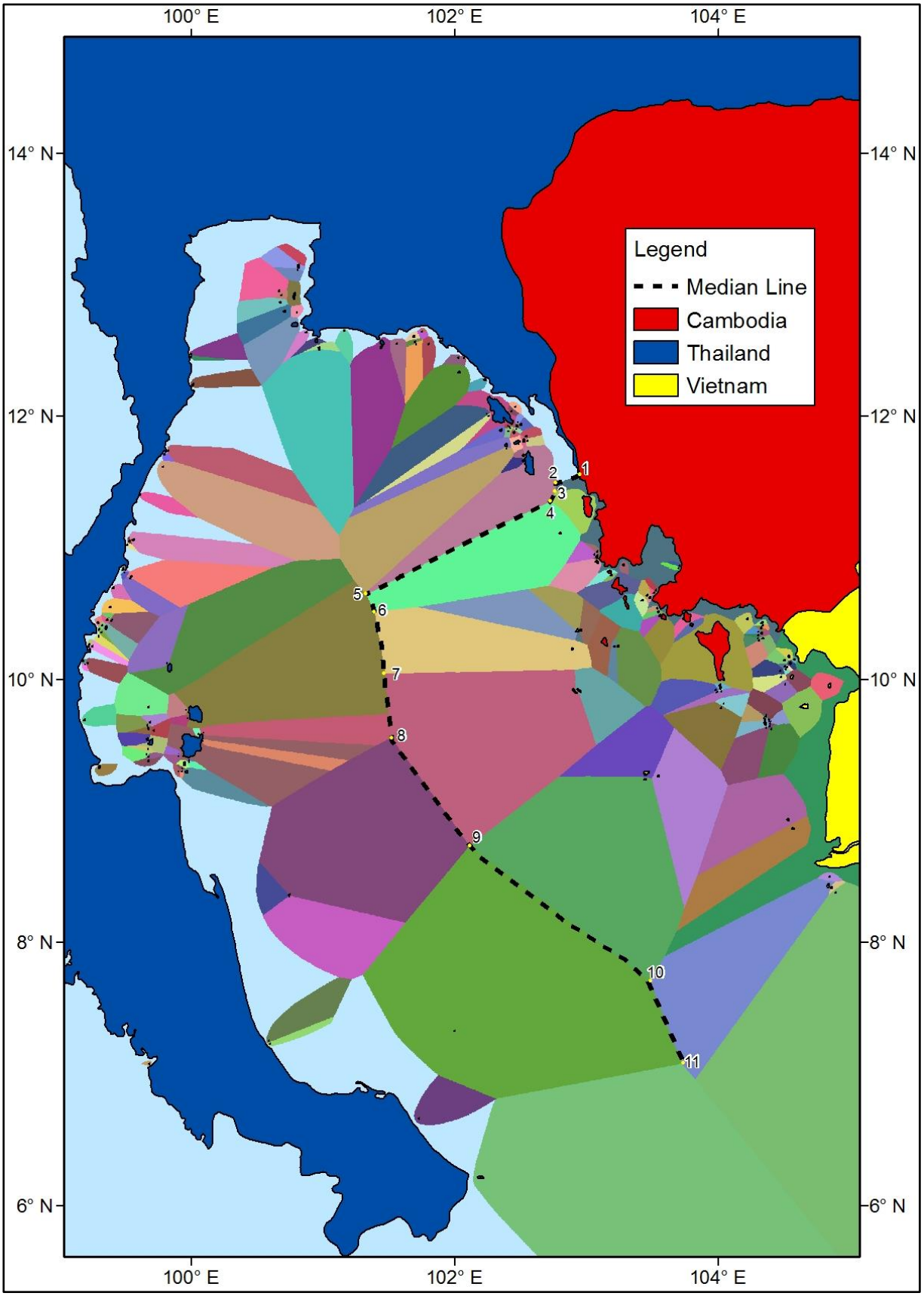

Figure 58: Euclidean Allocation median line in the Gulf of Thailand
Source: Author

4.2.1 The comparison of median line

Testing the Euclidean Allocation median line with Cambodia's median line, the author hypothesizes that Cambodia's continental is delineated by counting all features on Cambodia's side including rocks, isolated rocked, reef, low-tide elevation and only big islands, Ko Phangan and Ko Samui, on Thailand's side. The Euclidean Allocation is settled for analysing the interested area above working arrangement line between Cambodia and Vietnam only. The result shows the median line is almost identical to Cambodia's continental shelf, with the exception of, the first part of the line from the Euclidean Allocation is not identical to the first segment of Cambodia's continental shelf claim because Cambodia unilaterally claimed that the maritime boundary between Cambodia and Thailand is as same as the line was drafted in the Franco-Siam Treaty 23 March 1907. The purpose of the line is just to emphasize the terminus points on mainland with highest summit point on Ko Kut island. From referenced point at Ko Kut, the line was unilaterally continuously delineated to the first turning point. Neither consideration of adjacent States nor existing of Ko Kut is the reason why the first segment of Cambodia's claim is not close to lines generated by the Euclidean Allocation. The Euclidean Allocation analysis obviously shows that the most influence features for analytical median line on Cambodia's side are Koh Kusrovie, Koh Veer, Poulo Wei and none of coastlines whereas on Thailand' side are Ko Phangan, Ko Samui, and coastlines. The other differences of lines are from the different technical aspects of nautical chart such as scale, datum or size of features in the sea. The co-ordinates of Cambodia's 1972 continental shelf claim were listed in Decree of Khmer Republic Cambodia's continental shelf and the nautical chart was from French Navy scale map 1: 1,096,000[148] as stated in the Decree. The Cambodia's claim positions are assumed to be plotted directly on WGS 84 datum nautical chart. The distance of each segment and details are as following table. The median line is shown in the following figure.

Segment	From	To	Formed by Allocated Area		Distance (nm.)
			Cambodia's side	Thailand's side	
1	1	2	Cambodia's coastline	Thailand's coastline	22.994
2	2	3	Koh Kusrovie	Thailand's coastline	91.745
3	3	4	Koh Kusrovie	Ko Phangan	19.249
4	4	5	Koh Veer	Ko Phangan	30.169
5	5	6	Poulo Wei	Ko Phangan	27.802
6	6	7	Poulo Wei	Ko Samui	34.393
7	7	8	Poulo Wei	Thailand's coastline	41.097

Table 28: Detail of median line formed by allocated areas; Cambodia's continental shelf
Source: Author

[148] Mom Ravin, Law of the Sea, Maritime boundaries and dispute settlement mechanisms, page 29

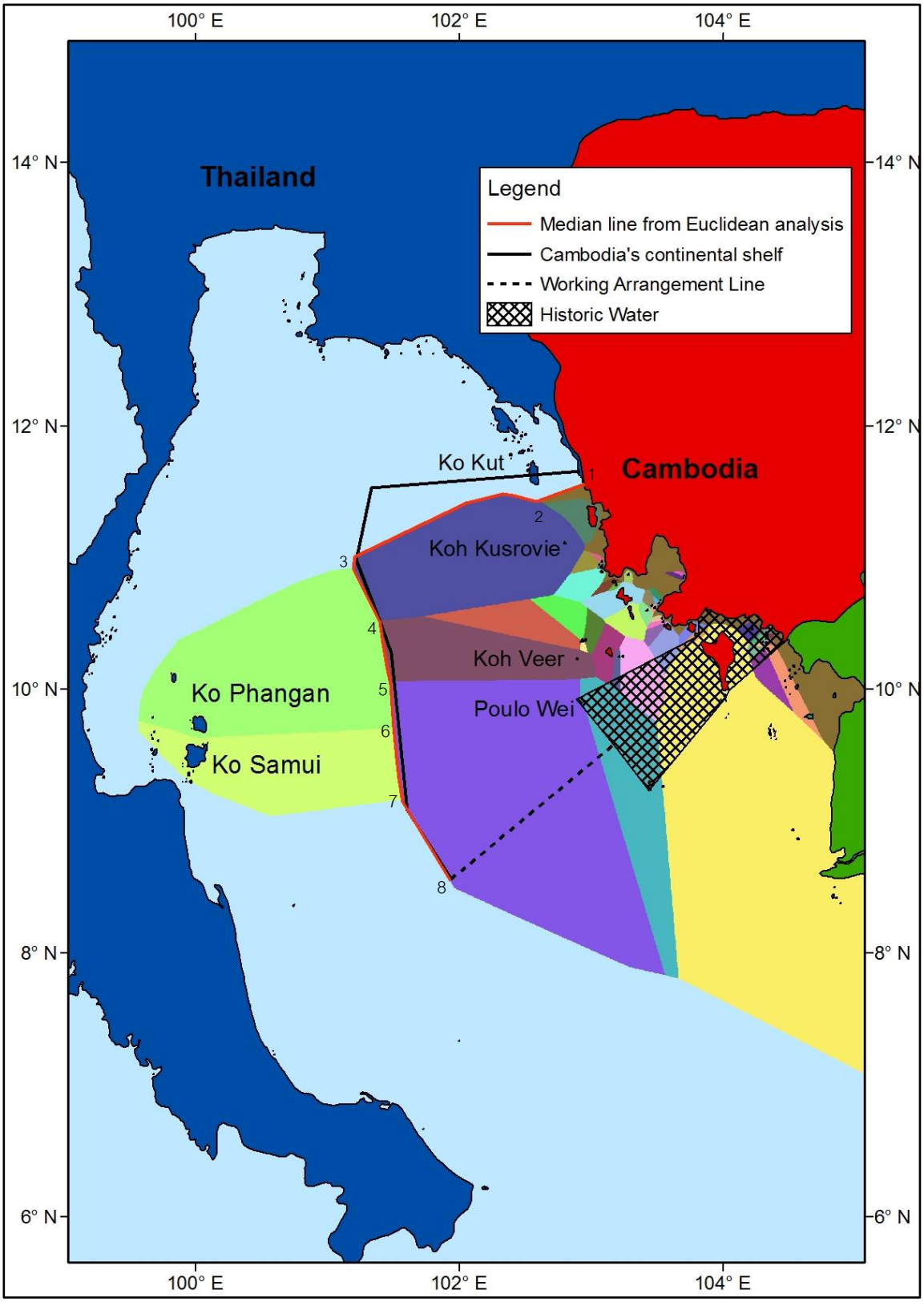

Figure 59: The comparison between Cambodia's continental shelf and the Euclidean Allocation median line
Source: Author

Thailand's continental shelf also can be drawn by the Euclidean Allocation. The inputted data for the Euclidean Allocation analysis are that on Thailand side are mainland Ko Kut, Ko Phangan,

Ko Samui, Ko Kra and Ko Losin and on Cambodia side are mainland and Phu Quoc Island.[149] In general direction of the line running south-west from the terminus point and turning to south-east direction, the median line from the Euclidean Allocation method is almost as same as Thailand's claim line. The difference from the starting point to the turning point around the middle of the Gulf of Thailand is that the Euclidean Allocation Line is median line whereas Thailand's claim is bisector line. The most effective features inputted for the Euclidean Allocation on Thailand side are Ko Kut, Ko Phangan, Ko Kra and Ko Losin whereas on the Cambodia's side are mainland and Phu Quoc Island, as inputted features. The distance of each segment and details are as following table. The median line is shown in the following figure.

Segment	From	To	Formed by Allocated Area		Distance (nm.)
			Cambodia's side	Thailand's side	
1	1	2	Cambodia's coastline	Thailand's coastline	11.808
2	2	3	Cambodia's coastline	Ko Kut	104.959
3	3	4	Cambodia's coastline	Ko Phangan	33.546
4	4	5	Cambodia's coastline	Ko Kra	48.844
5	5	6	Phu Quoc Island	Ko Losin	7.139

Table 29: Detail of median line formed by allocated areas; Thailand's continental shelf
Source: Author

[149] Author's hypothesis.

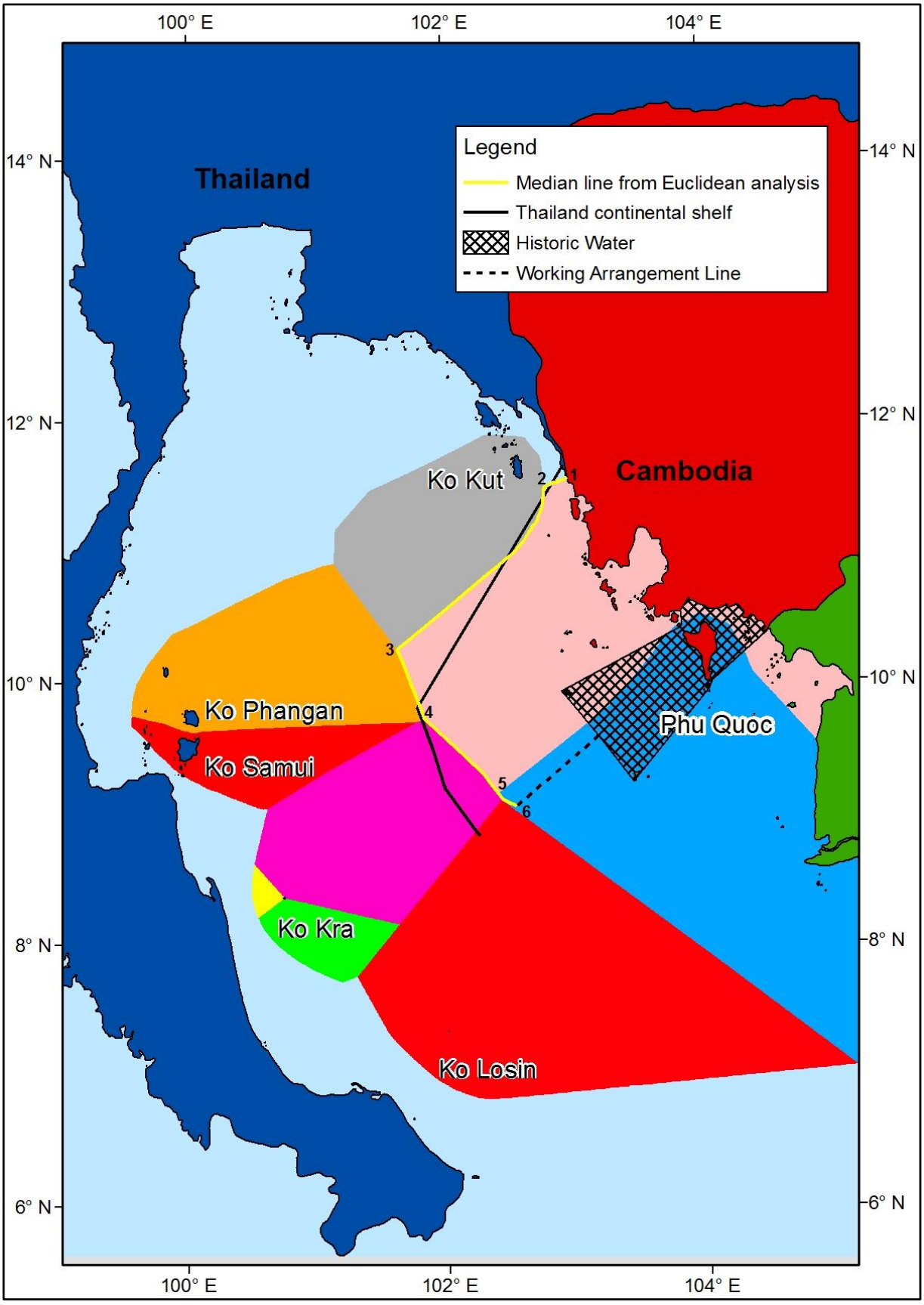

Figure 60: The comparison between Thailand's continental shelf and the Euclidean Allocation median line
Source: Author

4.2.2 The optional method for Cambodia and Thailand

After testing the Euclidean Allocation, features in the Gulf of Thailand countable for analysing the Equi-Area/Ratio on Thailand side are Ko Kut, Ko Phangan, Ko Samui, Ko Kra and Ko Losin whereas on Cambodia side are Koh Kong, Koh Kusrovie, Koh Veer, Poulo Wei and Hon Tho Chau.[150] The resoult after Re-analysing the Euclidean Allocation with only previous features is as the following figure and the distance of each segment and details are as following table. The last segment is delineated further to Vietnam.

Segment	From	To	Formed by Allocated Area		Distance (nm.)
			Cambodia's side	Thailand's side	
1	1	2	Cambodia's coastline	Thailand's coastline	23.078
2	2	3	Koh Kusrovie	Ko Kut and Thailand's coastline	94.076
3	3	4	Koh Kusrovie	Ko Phangan	27.002
4	4	5	Koh Veer	Ko Phangan	27.845
5	5	6	Poulo Wei	Ko Phangan	20.126
6	6	7	Poulo Wei	Ko Samui	8.445
7	7	8	Poulo Wei	Ko Kra	61.787
8	8	9	Hon Tho Chau (Vietnam)	Ko Losin	172.901

Table 30: Detail of median line formed by allocated areas; Re-analysis
Source: Author

[150] The figure in the Euclidean Allocation test for all features in the Gulf of Thailand shows which features are regarded for median line construction.

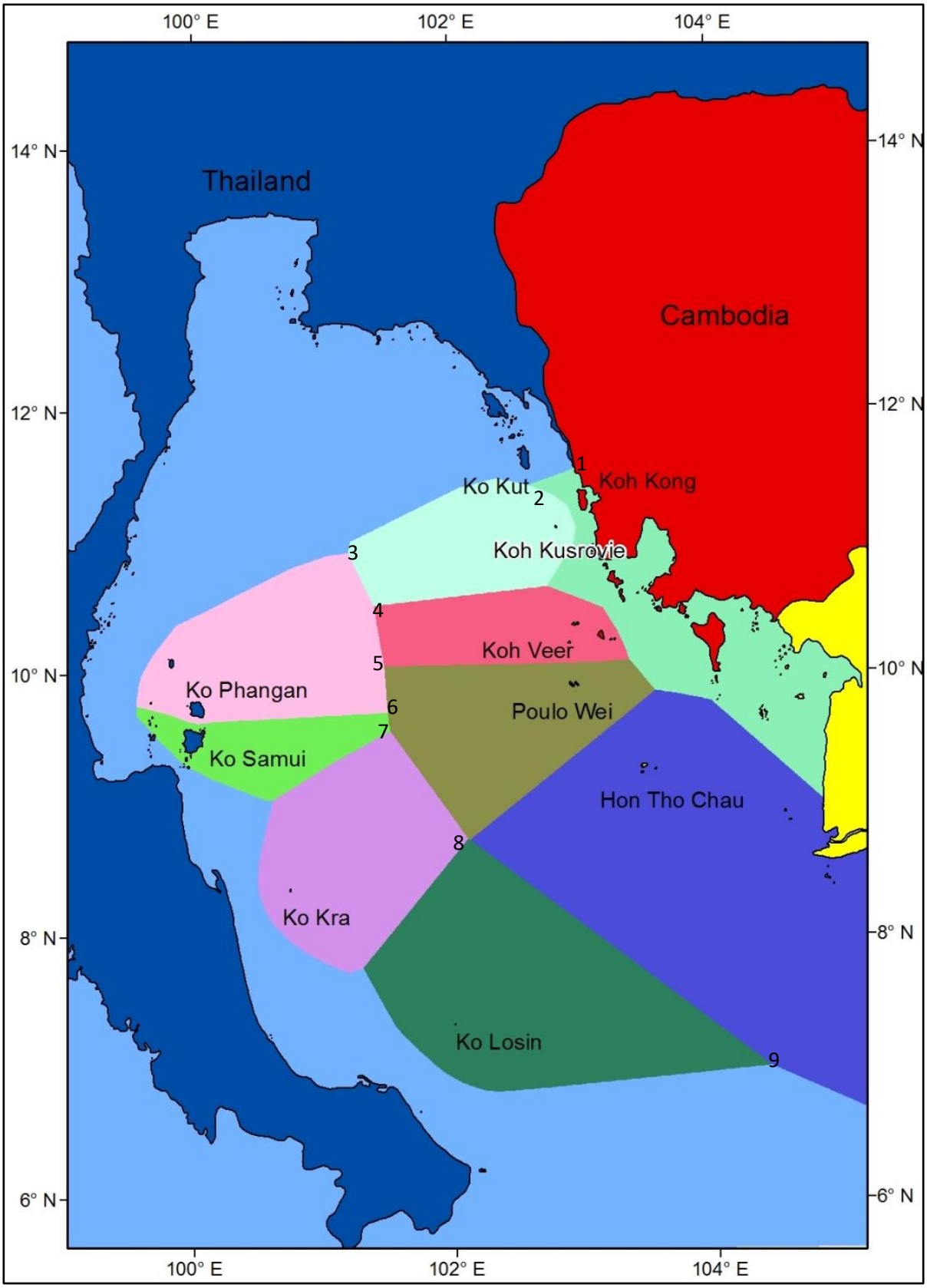

Figure 61: Countable features for allocating areas in the Gulf of Thailand
Source: Author

Not only the most seaward feature, but also the straight baselines can construct the median line. Straight baselines can be analysed by the Euclidean Allocation. The following three figures are the median line created by Cambodia and Thailand straight baselines as the input for allocating area of each feature. The first figure is from Cambodia's 1957 straight baseline, the second is from Cambodia's 1972 straight baseline and the third is from Cambodia's 1982 straight baseline. Thailand is only one version for straight baseline. The results are as the following.

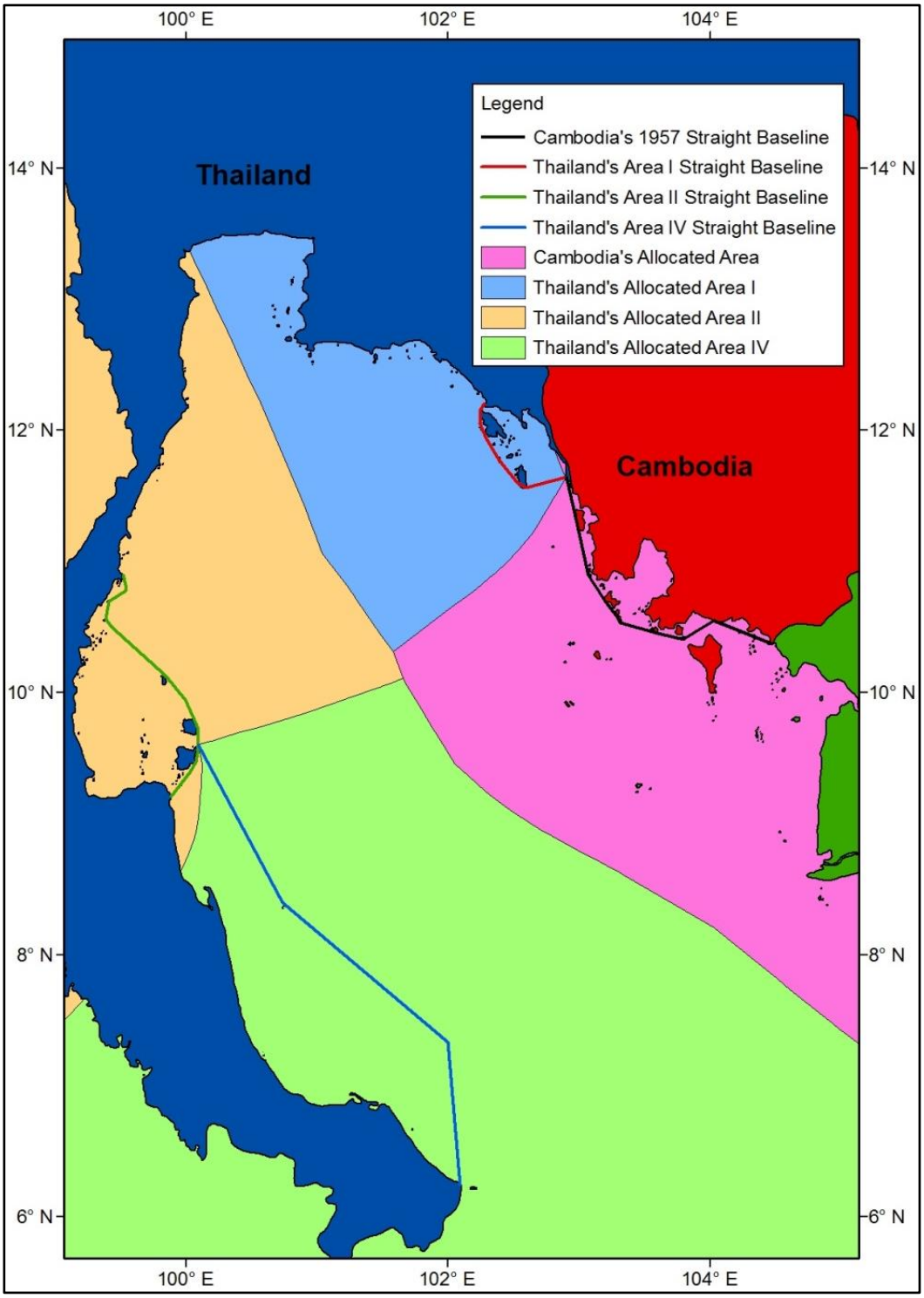

Figure 62: Areas allocated by straight baselines, Cambodia's 1957 straight baseline
Source: Author

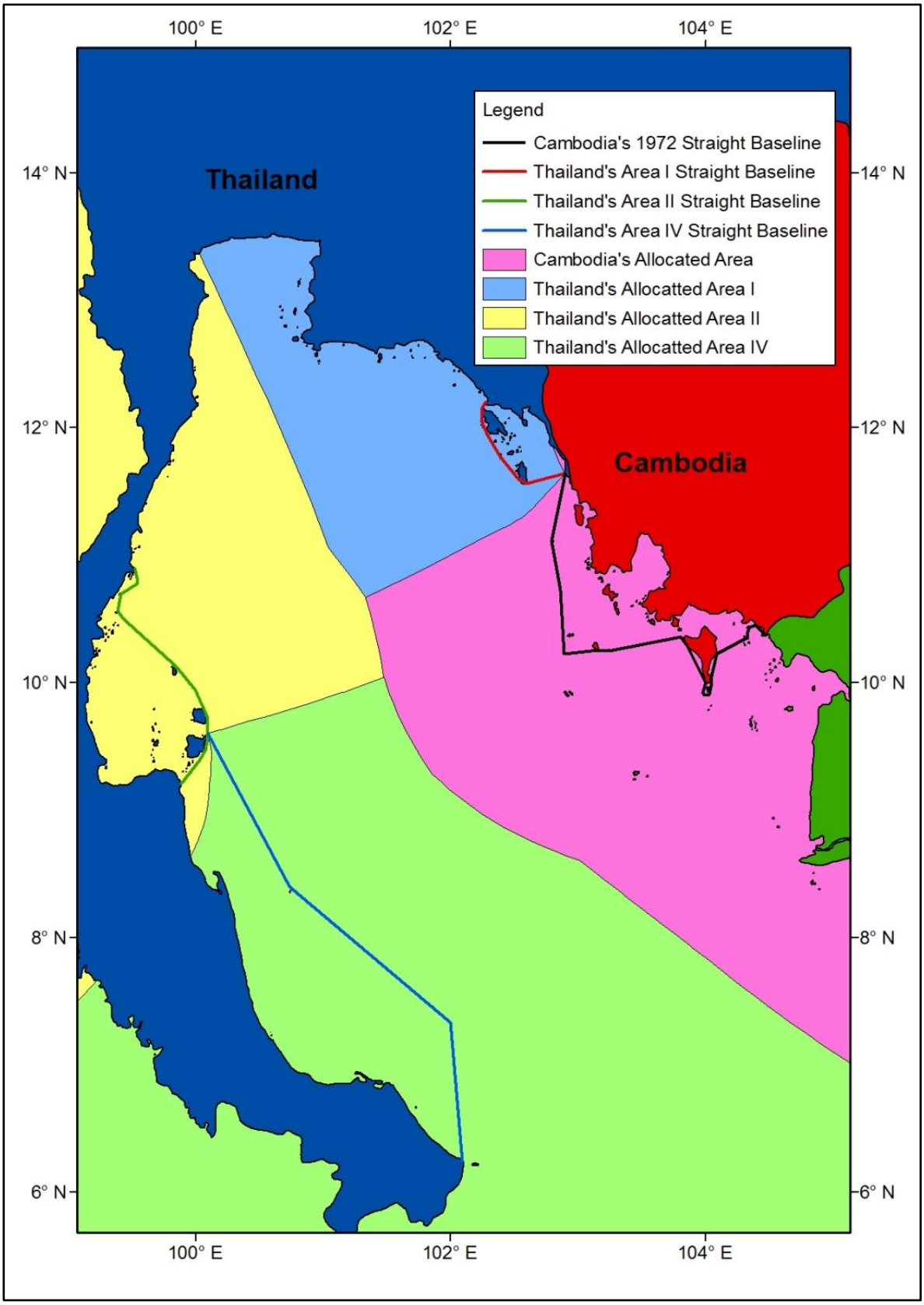

Figure 63: Areas allocated by straight baselines, Cambodia's 1972 straight baseline
Source: Author

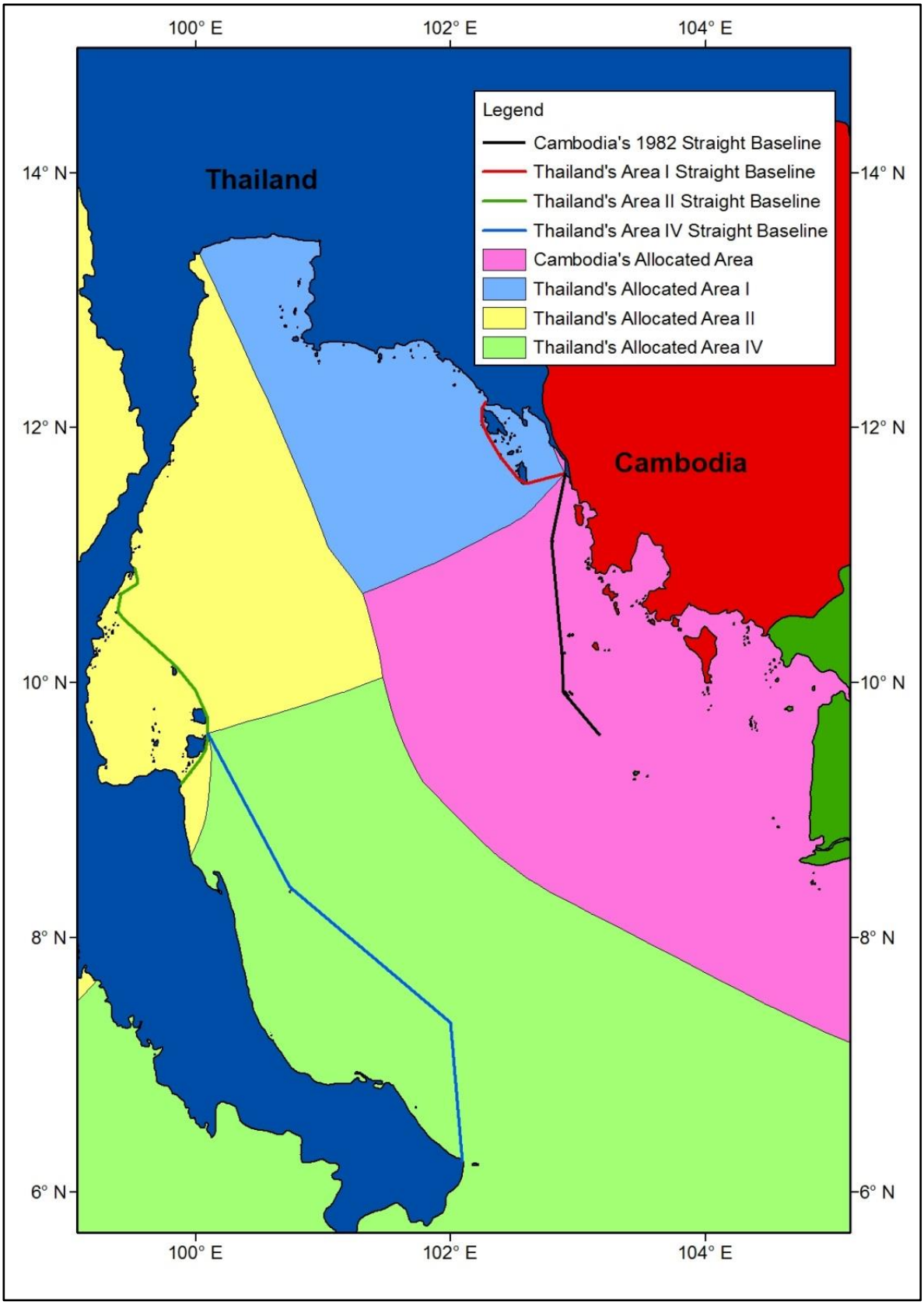

Figure 64: Areas allocated by straight baselines, Cambodia's 1982 straight baseline
Source: Author

The author does not finish the Equi-Area/Ratio for Cambodia – Thailand because of lacking in accuracy of information such as scale of chart too small and areas of each feature in the Gulf of Thailand. The length of median line from Figure 58 is about 380.970 nautical miles, 705.556 kilometres, and the error from chart rectification and datum transfer is 2.688 kilometres, see footnote 96. The area will be in erroneousness about 1,896.535 square kilometres, if details on charts, Thai nautical chart No.045, are digitized.

Conclusion

The delimitation of maritime boundary can be considered either simple or complicated. The complicated maritime boundary is vagueness because of special circumstances or historic title. The special circumstance is various interpretations. It is deviated by coastal States to take advantages for drawing median line. Different understanding historic agreement makes the coastal States delineate the maritime boundary differently. The special circumstances and historic title are too subjective to be specific for solving the difference in maritime delimitation. The final state if the maritime boundary is still in dispute is that the coastal States agree go to the courts such the International Court of Justice, ICJ, or the International Tribunal for the Law of the Sea , ITLOS. Cambodia and Thailand also have the different point of view in maritime boundary. Unfortunately, both special circumstances and historic title play the important role for maritime delimitation between Cambodia and Thailand. Trying to reducing vagueness on these, the Equi-Area/Ratio is the optional method for both States. The testing of the Equi-Area/Ratio with the real scenarios, Romania vs. Ukraine (in case of coastline) and Colombia vs. Nicaragua (in case of offshore features), proves that the Equi-Area/Ratio is applicable for maritime delimitation. The disagreement on selection of features can be solved by the Equi-Area/Ratio method because every feature in the sea can be used as base points for controlling the turning point of provisional median line. The allocated areas of each feature will illustrate whether features are relevant for constructing median line. The provisional area of individual features will be allocated by the Euclidean Allocation analysis. Each allocated area is as input for the Equi-Area/Ratio method. The results of the Equi-Area/Ratio method are the gain area and the lose area. The allocated areas will be adjusted mathematically to meet the equitable solution. Disregarding irrelevant features for reanalysing the Euclidean Allocation should be done carefully because if the irrelevant feature which is disregarded can sustain human habitation or economic life, discounting that feature will against regime of islands.

Appendix – Translation of the Franco-Siam Treaty 23rd March 1907

Subject: Appendix 22, Clause I, translation
From: Sophie Cuenot (sophiecuenot@gmail.com)
To: samharn92@yahoo.com;
Date: Friday, May 23, 2014 8:59 PM

Appendix 22
Clause I of the Protocole concerning the delimitation of the frontiers and annex to the Treaty of 23rd March 1907

Clause I - The frontier between French Indochine and Siam starts from the sea on a point situated opposite of the highest summit of Koh Kut island. It follows from that point a North-East direction from the crest of Phnom Kravanh. It is formally agreed that, in all cases, the East slope of the mountains, including the totality of Klong Kopo bassin, have to stay to the French Indochine.

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