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EDITORIAL UCR

NINETEENTH CENTURY NAVIES' ROLE IN DEVELOPING AN UNDERSTANDING OF THE PACIFIC COAST OF CENTRAL AMERICA (1730-1900)[1]

Jorge León

Resumen

A inicios del siglo XIX, los conocimientos sobre la navegación en la costa del Pacífico de América eran escasos. Antes de 1800, las principales fuentes de información náutica fueron los derroteros españoles. Entre 1808 y 1826, los intereses marítimos y comerciales ingleses, sustituyeron a los de España en la región. Los barcos británicos que comerciaban por la costa, necesitaban de mejores cartas marinas y derroteros, lo cual llevó a la Marina Real a asumir la tarea de levantar cartas marinas. A partir de mediados de los años 1830, el Almirantazgo inglés se convirtió en la principal fuente de información náutica. Más tarde las marinas de Francia y de los Estados Unidos se unieron a esta labor de levantar cartas de los puertos del Pacífico.

En el periodo 1873-1907, Costa Rica mantuvo una pequeña fuerza naval, debido a problemas políticos regionales. Cuando en la década de 1880 aumento de manera importante el interés geopolítico por construir un canal a través del Istmo Centroamericano, el gobierno costarricense decidió mejorar su conocimiento de la propia costa, y mando levantar cartas marinas y direcciones náuticas costeras. La actividad conjunta de las diversas marinas, resultaron en una mejora considerable del conocimiento náutico respecto a un siglo antes.

Palabras claves: Historia marítima, marinas de guerra, cartas marítimas, Costa del Pacífico, Istmo.

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NINETEENTH CENTURY NAVIES ROLE IN DEVELOPING AN UNDERSTANDING OF THE PACIFIC COAST OF CENTRAL AMERICA (1730-1900)

Abstract

Early 19th Century knowledge of nautical affairs was scant, regarding the Pacific coast of Central America. Prior to 1800, the main source of information on that coast was Spanish "derroteros" or sailing directions. Between 1808-1826, British commercial and maritime interests replaced those of Spain in the region. British ships cruising the coast, needed better maritime charts, and thus surveying became an important task for the Royal Navy. From the mid 1830's, British Admiralty charts became the main source of navigational information. Then the French Navy and later the United States Navy became involved in the survey of Pacific coast ports and harbors.

During 1873-1907, Costa Rica established a small naval force due to regional political problems. When in the 1880s geopolitical interest arose in building a canal across Central America, the Costarrican Government decided it required information about its Pacific coast, carrying out surveys and publishing maritime charts and instructions for inshore navigation. Altogether, surveying activities by different navies resulted in a major improvement in nautical knowledge compared to a century earlier.

Keywords: Maritime history, navies, charts, Pacific coast, Central American Isthmus.

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1. INTRODUCTION

Navies, apart from their traditional use by nations as instruments for the projection of power, for the protection of maritime interests and for exercising peacekeeping and war activities, have also played an important role in developing scientific and technical knowledge. The survey work undertaken by various navies since the 18th century has, in particular, been of great benefit to all mariners by improving and making navigation safer on high seas and coasts through the provision of maritime charts and sailing directions. The technical efforts and geopolitical interests behind those efforts in the 19th century and how they affected the maritime trade and foreign affairs of the Central American countries located on the Pacific Coast, are the subject of this study.

The Geographical Context. The area covered in this work extends along the Pacific coast of the Central American Isthmus, between 5º and 18º North, and 78° and 94° West (Map 1). This includes the coasts of Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama lying between the Isthmus of Tehuantepec in México to the north and Cape Corrientes in Colombia to the south. However, the area of influence extends much further, roughly between 40º North and 60º Sout; thus, including the greater part of the Pacific coast of America.

Geographic features of the Pacific coast of Central America. Examining a map of the Isthmus, it can be described as forming an elongated "s", some 1.900 km in length, which follows a general southeast to northwest direction. In its southern portion, the Isthmus is at its narrowest (55 km) in Panama between Panama City and Colon on the Caribbean, and then gradually increases in width, reaching its greatest breadth (about 510 km) between Cape Gracias a Dios on the Caribbean and Point Cosiguina on the Pacific.

While the Pacific coast north of 13° N is generally without major indentations save for the Gulf of Fonseca, the southern portion, extending along the shores of Costa Rica and Panama, has a substantial number of major gulfs and bays. Beginning from southeast to northwest, the first is the Gulf of Panama, the largest by far in the Isthmus, the entrance having a width of some 180 km, and within which lay three significant features: the gulfs of San Miguel and Parita, and the bay of Panama proper, where the port of that name is located. Historically, the city and port of Panama (1519) has been of major importance in Pacific trade since the early 16th century. Further west, between the Peninsula of Azuero and Punta Burica, the two smaller gulfs of Montijo and Chiriquí, cover most of the rest of the Panamanian coast.

Costa Rica, starting at Punta Burica, has a coast trending in a northwestern direction, which encompasses two large gulfs and five bays. After Burica, the next geographical feature is the Golfo Dulce, with a width at entrance of 15 km, and which extends inland for some 50 km. This gulf has a particular geographic characteristic. This is because of its great depth, it is one of the few tropical fiords in existence. The gulf is protected by the large Osa Peninsula which, after minor embayments and points, leads to the entrance of a second and larger gulf, that of Nicoya, the entrance of which is about 55 km in width, and extends inland for about 100 km. The ports of Puntarenas and Caldera are located within this substantial gulf, which are protected by the Nicoya Peninsula. In a NW direction lie the Gulf of Papagayo and the six bays of Tamarindo, Brasilito, Coco, Culebra, Santa Elena and Salinas, occupying the rest of the coast up to the border with Nicaragua.

The coast of Nicaragua continues northwestward, where the bays of San Juan Sur and Corinto, site of the old harbor of El Realejo, are the main features in an otherwise continous coast until the Golfo de Fonseca is reached. This large and island-spotted gulf is shared by three countries: Nicaragua, Honduras and El Salvador, the latter two having ports at La Unión and Cutuco in El Salvador and Ample in Honduras. Only minor coastal features are found along the rest of the Central American Isthmus, from El Salvador and Guatemala into southern Mexico. A small bay at Jiquilisco and Punta Remedios, which provides some protection to the port of Acajutla, and a small bay at Iztapa in Guatemala, offered the only port sites for those countries during colonial times and through the end of the 19th century on the Pacific Coast. Continuing into southern Mexico, the coastline continues unbroken until the wide Gulf of Tehuantepec is reached, which is also where the second major isthmus across Mesoamerica is located. The straight-line distance across this isthmus from Salina Cruz on the Pacific to Coatzacoalcos on the Gulf of Mexico is about 230 km, making it the widest isthmus in the Mesoamerican region.

The broad historical context. The period under study covers from the late 18th century to the first decade of the 20th century. For much of this period, the Pacific coast of America was isolated from the main commercial routes, until the mid-19th century when trade in a number of commodities produced by the countries along that coast, became important for world trade. When the Panama Canal opened a few years after the end of the period under study (1914), the Pacific coast navigation routes carrying those commodities became very profitable. While the canal was built towards the end of the period, the reasoning that led to its construction had been in the making for a long time, propelled by geopolitical and commercial interests of the major naval powers, seeking a shorter route from the Atlantic to the Pacific.

For centuries the direct maritime route between these two oceans was around Cape Horn, which meant that a normal voyage from Europe or the East Coast of the United States to Central America would take four to six months, depending on the season. During the Spanish colonial period, the use of a shorter overland route through the Isthmus of Panama allowed limited traffic between ports on either side the land bridge, principally for persons and high-value goods as well as the transport of silver and gold to Spain.

As long as the traffic did not involve bulky low-value goods, the system functioned adequately for Spanish interests. With the expansion of commerce in America during the 18th century[2], both with the mother country and between the countries along the Pacific coast, the need for a better transport system became obvious. Thus, the centuries old Flotas system where ships navigated in convoy was discontinued after 1740, and substituted by the Registro system. This system allowed individual vessels to use the Cape Horn route, to carry outbound not only the silver from Potosi to Spain, but also other goods and minerals (copper, cacao, quinine) and introduce products like cloth (about 60% of the value in trade) and other manufactured goods, as well as mercury for the silver mines[3].

Once the countries on the Pacific coast obtained their independence (1816-1826), foreign trade evolved rapidly as the previous control of commerce held by Spanish merchants was substituted mainly by that of English merchants and vessels, which dominated the Pacific trade until the end of the 19th century.

Chile and Peru were two countries on the Pacific coast that early became involved in world trade, due to their export of minerals (silver, copper, tin). By the 1830s much of this trade between South America and the Atlantic ports was being carried on British ships. By this time South American ships coming from Valparaiso and Callao, were taking over the trade from Central America as well. The countries forming this region consisted of the Federal Republic of Central America and Panama, the latter being part of the Gran Colombia. Traditionally, foreign trade in Central America had tended to move mostly by way of ports on the Caribbean side of the Isthmus, but beginning in the late 18th century a revival in intraregional trade had been achieved also along the Pacific side. After independence was achieved in 1821, internal disputes between conservative and liberal political parties caused severe disruption of the economies of the Federal Republic, with the sole exception of Costa Rica.

The creation of the Federal Republic of Central America (1824-1839), was a response to the need to establish a viable political body that could govern the territories that Spain ruled formerly as the Capitanía General de Guatemala and to prevent attempts on the part of Mexico to annex the six countries. The economy of this federation was based on a subsistence economy that absorbed the great majority of the population and a small commercial export economy where indigo (añil), cochineal (grana cochinilla) and Brazil wood (palo de brasil) were the main products sent to the world market. During the latter half of the 19th century, coffee and bananas were added as new products, becoming the most important exports by 1900.

The estimated value of exports from Central America during the 19th century rose from about $ 2 million (pesos) in the early 1820s (see Table 1), to about $ 25,5 million in the 1900-1905 period. Over these 80-odd years, the rate of growth of exports for the Central American region averaged about 3.2 percent annually. Therefore, the region's trade performance during the century was similar to the average for all world trade between 1883 and 1913 [4].

Costa Rica was the least populated of the five states that made up the Federal Republic[5], but managed early on to establish foreign trade as an important basis for its economic growth. Initially based on exports of tobacco, Brazil wood and gold, eventually it found in coffee its prize export product, and this would remain so throughout the 19th century. The first coffee exports had expanded so quickly that, in order to handle the increase in coffee trade, a new cart road had to be built in 1844-1845 connecting the coffee growing areas in the central highlands to the port of Puntarenas on the Pacific. By mid century, the rapid growth of coffee exports had made it the most important port in Central America, shipping coffee direct to London, Hamburg, and New York.

The boom in coffee provided the means for the country to pay off its external debt, to invest in making substantial internal progress and even to strengthen its defense capacity sufficiently to take on the filibuster expedition to neighboring Nicaragua, led by William Walker. Walker invaded Costa Rica from Nicaragua in early 1856, and was finally beaten and forced to abandon Central America in May, 1857, under the protection of the United States Navy.

The expansion of the United States to California and the gold rush that followed provided great challenges to Central America, as the westward migration resulted in a sudden need to greatly improve trans-isthmian communications, and the rise in world trade made the isthmus an area of geopolitical interest to the major sea powers. In the early 1850s, a railroad across Panama and a steamboat route across Nicaragua temporarily addressed these needs, but it became increasingly clear that a canal through the isthmus was the solution to the transport required by world trade, and that it was only a question of time and opportunity before such a canal was built.

Map 1. The Central American Isthmus and proposed sites for the canals in Nicaragua and Panama

Other factors intervened to bring the issue of the canal to the forefront. The introduction of steam navigation, first linking South America with Panama (1842) and then Panama and Nicaragua with San Francisco (1850), created new trade routes and greatly changed the nature of navigation along the coasts of the Isthmus, with regular steamer service gaining over sailing ships. From the 1870s onward to 1914, the increase in world commerce fueled the struggle between the major sea powers competing among themselves, in an attempt to build and control the trans-isthmus canal and its approaches.

The geographic area included in this study as presented in Map 1, covers the Pacific coast of the Central American Isthmus, from southern Mexico to Cape Corrientes in northwestern Colombia. This coast runs some 1.900 kilometers in a general NW-SE direction, with the narrowest portion, as mentioned above, being in its southern part. Due to their importance in geopolitical terms, the proposed locations for the Nicaragua and Panama canals are highlighted, as well as other geographic features discussed as part of the maritime surveys to be analyzed further on.

2. THE INCREASE IN EASTERN PACIFIC TRADE 1750-1900

Shipping routes. Since early colonial times, shipping routes were established along the Pacific coast, extending during the 16th and 17th centuries from southern Chile to northern Mexico[6]. The main routes, however, were limited to those linking respectively the main ports of Valparaiso, Callao, and Guayaquil, and between Arica, Callao, and Panama, through which flowed the silver from the Potosi mines to Portobelo and hence to Spain in the Flotas. A secondary route linked Guatemala with Peru, for the trade in wine and "aguardiente" northward, and indigo and ship supplies southward.

However, with the opening of a direct route around Cape Horn at the beginning of the 18th century and the Spanish crown's decision to stop the Flotas to Spain after 1740, and the allowing, after 1776, of limited trade among its possessions, the "comercio libre" as it was known, resulted in a significant redirection of routes and trade. This resulted in a gradual increase during the latter third of the century in the number of annual ship movements along the coast. Thus, direct regional trade during late colonial times in the Pacific, between Central American ports and those of Guayaquil, Callao, and Valparaiso, resulted in an increase in the annual number of ship voyages, from 3 to 4 in the first part of the 17th century to about 5 per year by 1780-89 and 10 in 1800-09 (Leon, 1997, p. 319), after which, with the wars of independence raging, trade dropped somewhat but did not completely stop.

After independence was achieved in 1821, for a few years trade did not immediately increase due to unstable political and economic conditions but by the late 1820s it again began to rise, driven by a demand for wood, natural dyes, and other exports, and especially by imports of cloth, liquors, and manufactured goods, transported to Central America on Chilean, Peruvian, and increasingly, by British ships.

Trade rose to the annual amounts indicated in Table 1, and the number of ship voyages over the eastern Pacific increased accordingly. Ship traffic on the Central American routes to South America and Mexico reached about 30 per year in 1835, and continued increasing to over 100 per year in the 1840-1850 period. In addition to this, trade demands now brought the opening of new, long-distance direct routes between Central America and world markets, particularly with Great Britain and Europe.

TABLE 1

Foreign trade of the Central American nations 1820-1905
Exports in millions of pesos ($) from 1820 to 1885; 1900-1905 in US$ dollars.

PAÍS	CA. 1820	1855-58	1880-85	1900-05
Guatemala	1.01	1.2	2.78	7.74
El Salvador	0.25	1.2	3.07	4.29
Honduras	0.5	0.6	1.85	3.18
Nicaragua	0.2	0.6	1.71	3.6
Costa Rica	0.1	1	3.08	6.65
Central America	2.06	4.5	12.49	25.46

Sources: 1820, León (1997), Table 11-2; 1855-58 and 1880-85 León, Base de Datos Históricos for Costa Rica and Schoonover (1989), Table 19, for the other Central.
American countries; 1900-05, Mitchell (2003), Table E-1.

In the following half-century, from 1850-1860 to 1900-1910, the growth of trade, practically all of which was carried by sea, accelerated in the Central American countries (Panama is not included as it was, until 1904, part of Colombia). As shown in Table 1, Central American exports increased nearly four-fold in terms of value between the mid-eighteen fifties and the first years of the twentieth century. To handle this growing trade, the number of ships in the sailing routes to Central America, based on data for Costa Rica, rose from the 85 per year in the 1850s, to an estimated 160 per year in the 1900s. The number of vessels was not higher, because the overall size of ships increased significantly, from an average of 160 tons burthen just before 1850, to 1070 tons burthen in the late 1890s according to data for those entering the port of Puntarenas (Leon, 1997, pp. 66-70).

The type of shipping had also changed radically, as at mid 19th century all were still sailing vessels, whereas by the end of the century, 88% were steamships. The larger size of ships, the greater speed of steam vessels and their lesser dependence on wind, made them more efficient. However, as in the past, towards the end

of the century ships required navigation aids to arrive safely at Central American ports. Thus, the need for accurate charts also increased.

While the early Spanish "derroteros" provided adequate information for the ships trading on the main routes up to the time of independence, after 1830 the increase in shipping along the coast and the opening of new ports and trade routes, these were no longer sufficient. More detailed information was required, not only in regards to the coastal areas, but especially for navigating the long distance routes now being used on the high seas.

3. IMPROVEMENTS IN NAUTICAL KNOWLEDGE DURING THE EARLY 19TH CENTURY

3.1 Existing sailing aids and their use

During the 18th century, the main instruments available to mariners for navigation were the "derroteros" or sailing directions. Spanish sailors had a long established tradition of making "padrones" or general maps of the oceans, and of using these "derroteros" to provide charts and views of the coast, being especially useful for coastal sailing, and were updated with findings by explorations of Crown possessions along the Pacific coast of America.

From 1529 onwards, individual mariners sailing along the Pacific coast no doubt made their own sailing notes, but the compiling of a general derrotero for the whole coast, was not accomplished until 1661, when, the Piloto Mayor for the South Sea, Ruiz Lozano, formed and published the first such work. According to Ortiz, three additional derroteros dating from 1675-1695, 1730 and 1764 exist. The 1730 one was edited and published in Peru in recent times (Ortiz-Sotelo, 1993, p. XIII). The quality of the nautical information contained in the derroteros made them highly regarded by mariners. As Dampierre points out, when navigating in infrequently visited area of the Pacific coast: "[…] our pilots being at a loss of these less frequented coasts, we supplied that defect out of the Spanish Pilot-books, which we took in their ships; those we found by experience to be very good guides […]" (Dampierre, 1968, p. 117). The derrotero of 1730 was the result of the work of two Peruvian mariners, Pedro Hurtado de Mendoza and Manuel Joseph Hurtado, whom were active in the merchant trade between the last decades of the 17th century and the first third of the 18th century. This remarkable document provides a detailed description of the Pacific coast from the Peninsula of California to Tierra del Fuego. The derrotero combines both cartographic details of each segment of the coast, with views of the same, including capes, bays, islands, and information of importance for entering ports and anchorages as well as indicating prominent geographical features such as mountains, volcanoes, towns and cities.

Since existing derroteros depicting the coastline were still unreliable due to the empirical methods applied in their construction, this led to the introduction in the 18th century of scientifically based methods of mapping. These developments were much influenced by the creation of the French Depot des Cartes de la Marine (1720) and the new methods were applied during the joint French-Spanish expedition led by La Condamine to measure the meridian at the Equator (1736-1742). Two Spanish naval officers Jorge Juan and Antonio de Ulloa accompanied that expedition and later made good use of this experience by widely diffusing the acquired knowledge and, in particular, by applying it to improved chart-making and navigation in Spain and its colonial empire.[7]

These new ideas slowly began to catch on and by 1783 the Spanish Navy made new derroteros for the coast of Spain using modern methods, resulting in two new sailing directions, one for the Mediterranean and the other for the Atlantic coasts of that country, which led to publication of the Atlas Marítimo de España, containing improved nautical charts, a work which was widely translated and reproduced in Europe (Martin-Meras, 1993, pp. 163-164). In parallel, the Spanish Crown, concerned with the arrival of British and Russian interlopers to the Pacific, which had been considered up to that time as a "Spanish lake", organized scientific expeditions to the Pacific northwest (Pérez and Bodega y Cuadra in 1774-1792) and to the eastern Pacific (Malaspina 1791-1793), greatly increasing information of this ocean, resulting in much improved maritime charts of certain parts of the coast of America. The establishment by the Spanish Navy in 1789 of the Depósito Hidrográfico, as the entity responsible for collecting the basic data, drawing and printing the charts, was an important step toward structuring future maritime survey work (Martin-Meras, 1993, pp. 218-219).

In spite of improved knowledge about the coast and oceans, navigation as practiced by merchant marine captains and pilots, continued to leave much to be desired, as pointed out in the quote by Juan and Ulloa:

> […] Entre tantos defectos no es el menos sensible el faltarles cartas náuticas por donde navegar, de las cuales carecen enteramente, y así no parecerá exageración el decir, que en todo navegan a ciegas, los que gobiernan aquellos navíos en las travesías que hacen […]. (Juan y Ulloa, 1988, p. 128)

According to Juan and Ulloa, early 17th century mariners in the Eastern Pacific applied very rudimentary nautical knowledge in their sailing from port to port. These two naval officers were well versed in navigation because of their training and experience at sea, so when they arrived on the Pacific in 1739, during their initial voyage from Panama to Callao, they were appalled by what they considered dangerous practices by merchant ships. These were routinely overloaded and the lack of navigational instruments, accurate maritime charts, and in general an unprofessional conduct by captains and pilots when at sea, resulted the loss of many ships due to human error[8].

3.2 Charting of the Pacific coast improves from 1830s onward

While soundings of different harbors in the region had been made during the colonial period, this data was sparse, of uncertain precision, and not based on systematic measurements for preparing proper charts. The need for improvement in this regard was obvious, and since the Spanish Navy's survey work in America came to an abrupt end during and after the revolutions that led to the independence of the countries on the Pacific coast, the construction of charts became, by default, a task to be carried out mainly by foreign navies during the remainder of the 19th century[9].

Very important in this respect, was the practical cooperation between navies that normally were rivals at sea but concerning production of maritime charts, permitted the sharing of information between their respective hydrographic offices. This resulted in new charts being produced by various navies, and these were then made available to all seamen; thus, benefiting both merchant and naval services.

David (2008) offers examples of this collaboration in his analysis of the British Admiralty's role in publishing maritime charts. In the period immediately after the end of the Napoleonic Wars and for a considerable period after, Spain's Depósito Hidrográfico provided survey information on South America and the Pacific to the Admiralty, which resulted in publication of a number of new Admiralty charts. The Spaniards eventually provided the British with their most valuable survey information, collected by the ill-fated Malaspina expedition. However, these were published with a delay of thirty years from the time the surveys had actually been made[10]. Other areas where maritime collaboration was essential, was in the building of wind and current charts, like those developed by Maury of the United States Navy.[11] Specific contributions to chart making by each navy, is the focus of the following sections.

3.3 Foreign powers in the Pacific: British dominance under increasing challenge

After Cook's voyages, the first Royal Navy intrusions into the Eastern Pacific took place towards the final years of the Spanish empire in America, and were made under the cover of commercial expeditions to gather not only data useful for trade, but also for naval intelligence purposes. As early as 1793, the Admiralty ordered James Colnett, a Navy officer with previous experience in the North Pacific fur trade, to explore the possibilities of whale hunting in this ocean, while at the same time assessing the state of Spanish forces there. The voyage of the Rattler under Colnett, was, in principle, a commercial enterprise financed by major British commercial whalers, but his instructions, as indicated in his report, came from the Admiralty (Colnett, 1798, pp. vii, ix, and xv).

The presence of individual British naval vessels in eastern Pacific waters became significant during the Napoleonic wars and the War of 1812, and once the wars of independence started in Chile (1816-1818) and later in Peru (1821-1826),

a more permanent presence occurred. The experience of the Royal Navy in these turbulent times in South and Central America and Mexico, are narrated in Captain Hall's book on the voyages of HMS Conway along the Pacific coast of America from 1820 to 1822[12]. As the importance of British-dominated trade increased along the eastern Pacific coast as mentioned in the preceding section, so too grew the presence of the Royal Navy. Due to Britain's expanding its influence over the rest of the Pacific, and partly for commercial reasons and to protect vessels engaged in whaling, a South America Squadron was based in Valparaiso from 1826. As Britain's interests widened, in 1837 it was renamed the Pacific Station, remaining at that port,[13] until the base was transferred in the 1860´s to Esquimalt in British Columbia.

Somewhat earlier, in the 1830s and 1840s challenges emerged to Britain's hegemony in the Pacific from the United States, France, and Russia, although none of these nations had as yet the wide-ranging political and commercial interests in this ocean, as did the British. In order to maintain the lead they had gained through their presence in the Pacific,[14] the Royal Navy developed a program of worldwide naval surveys and scientific expeditions, exploiting the fact that the end of the Napoleonic wars had left it with numerous idle vessels (Morris, 1995, p.10). In the Pacific, this ambitious program was organized in expeditions starting in 1832 and lasting until 1851, with the purpose of simultaneously surveying the coasts and carrying out scientific studies on both land and sea.

The earliest of these was HMS Beagle's two voyages in 1826-1830 and 1832-1836, the latter becoming famous not only for the maritime and geographical information gathered, but because Charles Darwin was the naturalist for the expedition, and the knowledge he acquired during the voyage was later used in support of the scientific revolution he generated, with the proposal of the theory of natural selection. The Beagle under Captain Fitzroy, once having reached the Pacific, had, as its principal task, the surveying of the coasts of Chile and the Galapagos Islands later crossing the ocean to the Orient, before continuing the circumnavigation of the globe. It was in the Galapagos where Darwin was to work out his first ideas on the evolution of nature. This expedition, however, did not extend into Central American waters.

It was through two subsequent expeditions, that the Royal Navy made its earliest important contributions to the surveying of Central American waters in the Pacific. Between 1835 and 1839, two vessels, the HMS Sulphur (Captain Belcher) and Starling (Commander Kellet), traveled over much of the Pacific, from South America to Alaska, the Sandwich Islands, and later to the Orient and China, before returning to England via the Cape of Good Hope. Belcher followed detailed hydrographic instructions that charged the Sulphur with completing survey work on the coast of Chile and Peru, where HMS Beagle had left off, and continuing northward through Central America and Mexico, reaching as far as British Columbia and Alaska. Details of the instructions received by Captain Belcher will be discussed further on, as they provide a clear idea of survey policies and priorities.[15] Important survey work was thus accomplished, resulting in charts published between 1838 and 1842 of various Central American ports and harbors.

The next expedition was in fact very much of a follow-up to the voyage of the Sulphur, as it was led by now Captain Kellet, HMS Herald, who had been second in command to Belcher, accompanied by HMS Pandora (Commander Wood). The enterprise consisted of a circumnavigation of the globe, carried out between 1845 and 1851, but the part of the voyage that is of interest comprised survey activities between the Equator and the southern part of Central America. These were carried out in two periods: the first between January and March, 1846, focused on the Galapagos Islands and the bay of Panama. After an interval during which the ships were sent to the Arctic in search of the ill-fated Franklin expedition, they returned to complete the survey of the bay of Panama, and later extended their work to Coiba Island, Chiriqui Bay and the coast of Costa Rica.

For some time afterward, the Royal Navy relied on adding information through occasional local surveys carried out by warships that were employed on regular patrols between Panama, and the Central American coast as far as Mexico. For example, in 1859 the HMS Gorgon, (Captain Bedford Pim), was assigned to Central America, and within that assignment carried out a survey for a proposed Nicaraguan trans isthmus route. Pim had served previously in similar surveying under Captain Kellet in the HMS Herald in 1845-1849.

3.4 First accurate coastal charts of the Isthmus

Up to the mid 1830s the best general chart of the west coast of Central America and Mexico continued to be that by Felipe Bauza, based on surveys carried out in 1791 to 1794 by the Malaspina expedition. This expedition had carried out surveys along the coast of Peru and Ecuador, and after sailing from Guayaquil in October, 1790, they arrived in Panama in mid November, remaining at Perico harbor for a full month. In this period, studies were made concerning the possible site for building a canal across the isthmus (Caselli, 1929, pp. 119-120).

Leaving Panama early in 1791, Alejandro Malaspina in the corvette Descubierta and José Bustamante in the Atrevida, began the traverse of the Central American coast. Upon both vessels reaching the western entrance of the Golfo Dulce, the Atrevida was detached to explore Cocos Island, while the Descubierta sailed on to Realejo, where a survey was carried out, before sailing on to Sonsonate[16]. The Descubierta sailed for Acapulco, but along the coast of Guatemala was delayed by lack of winds, requiring a full 50 days to reach the Mexican port. On this track, much of the coast, especially its southern portion, was not directly explored, so the chart later drawn up by Bauza (see Figure 2) (González Claverán, 1989, p.59) relied on earlier work that was not verified. Thus, this chart, reproduced in 1835 by the Admiralty, contained significant errors discussed below, in particular regarding the general trend of the coastline and the outlines of the gulfs of Dulce, Nicoya, and Papagayo.

Figure 1 represents the right portion of the chart by Bauza, and covers the Central American coast from near Punta Burica on the border between Panama and Costa Rica to the coast of Soconusco, then part of Guatemala, but since 1823, part of Mexico. To the experienced eye accustomed to modern maps of the region, Bauza's chart shows errors in various sections, in particular the southernmost section, on the coasts of Costa Rica and Nicaragua, south of the port of Realejo.

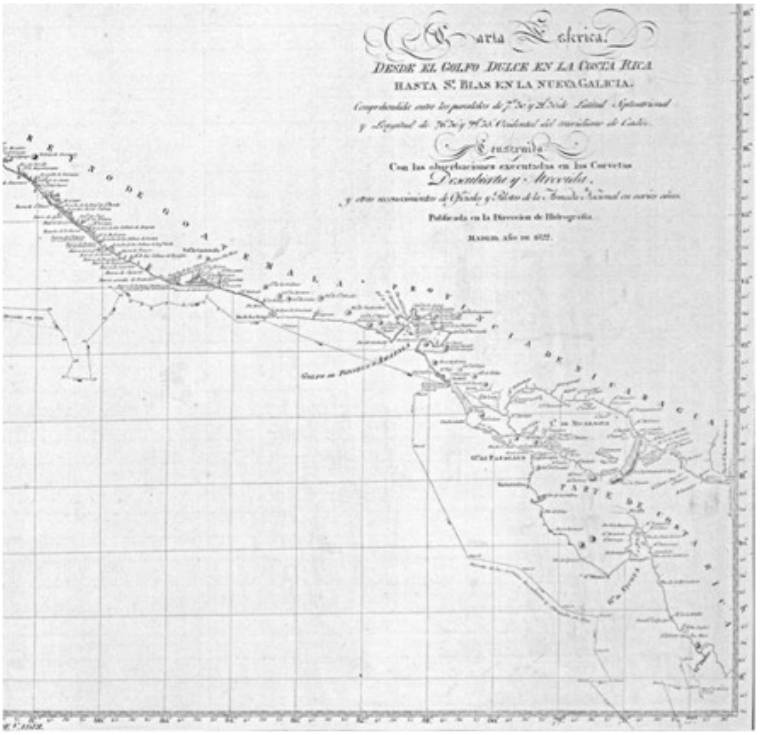

Figure 1. The Golfo Dulce to Caldera section of the Bauza chart (1822)
Source: Martín-Meras, (1993), pp. 207-208.

In particular, in Costa Rica the two major gulfs, Dulce and Nicoya, and their respective peninsulas, are incorrectly drawn. This is especially true for the Golfo Dulce, which is indicated as a bay of limited size, and the peninsula is not delineated as such. In the case of the Golfo de Nicoya, the internal size and direction of the gulf are clearly underestimated. The northern Costa Rican coast after the Gulf of Papagayo and the Nicaraguan coast all the way to Point Cosiguina at the entrance of Fonseca Gulf, trends SE-NW as an almost straight line, shown in Bauza's chart as a series of indentations that do not exist. These deficiencies occurred because the Malaspina expedition, of which Bauza was part, did not follow the coastline, but rather, at the entrance to the Golfo Dulce, a sharp turn was made to the south navigating way from the continent in order to visit Cocos island.

After completing the exploration of Cocos, the vessels turned NW directly towards Realejo, at which port they remained, surveying it and carrying out inland expeditions. Thus, Bauza when setting up his chart in order to complete delineating the coasts of Costa Rica and southern Nicaragua, had to rely on information from other, inaccurate sources[17]. Hence, this part of Central America was very poorly depicted for a number of years, as many other contemporary maps and charts relied on Bauza's draughts. Fortunately, Belcher's surveys of 1837 and 1838 mentioned above, provided much needed corrections on the lay of the land, on soundings and other data, resulting in the publication of new charts for the gulfs of Nicoya and Papagayo in the following years, which rectified many of the existing errors, although the gulf of Osa would continue to be wrongly depicted for some considerable time.

It required the work of many mariners from the British, French, and United States navies, to continue improving the delineation of this coast in the following decades. Since numerous ships were involved in naval patrols and in specific surveys of the coasts, harbors, and ports of Central America between 1822 and 1882, it would require significant space to describe all their activities. A summary of the naval effort is provided as Annex 1 the data being obtained from printed naval reports, newspapers, and other sources.

The data concerns all foreign naval vessels reported operating on the coast of Central America and not only surveying vessels. It includes dates of the voyages, name of the vessels, captains, origin and destination of the ships, and where relevant, a brief description of the places surveyed. About one hundred and twenty voyages were identified, and even though the list is not exhaustive, it provides a good idea of the activities of the three navies on the Pacific coast. This annex table indicates that surveying expeditions were more frequent in the early decades of the 19th century, when the Royal Navy and then the French Navy were actively involved in this work while the US Navy gained presence and became the main surveyor in the Pacific later in the century.

The resulting survey effort in this first period up to the mid eighteen fifties, produced much improved general charts of the Pacific coast between Panama and southern Mexico, as well as numerous charts specific to harbors and ports. An example of this effort is provided in Table 2, which lists British Admiralty charts produced for Central America and its approaches between 1793 and 1849, the period when the Royal Navy was most prominent in survey work.

TABLE 2
Admiralty Charts of Central America and approaches, 1794-1849

DATE	CHART	ORIGINAL SURVEYOR
1793	Cocos, Clipperton, Socorro, Guadalupe, Alijos	Colnett
1794	Coiba Island to Dulce river, with plans Mexico	Felipe Bauza
1836	The River Guayaquil, on the West Coast Ecuador	Kellet, RN
1837	Panama Road Panama	Belcher RN
1837	Acapulco Mexico	Belcher
1838	Nicoya Gulf with a view Costa Rica	Belcher
1838	Culebra Port Costa Rica	Belcher
1838	Port Bolaños Costa Rica-Nicaragua	Belcher
1838	Realejo Port Nicaragua	Belcher
1838	Fonseca Gulf El Salvador	Belcher
1838	Guatulco Port and Morro Ayuca Mexico	Belcher
1839	Bahia Honda Panama	Belcher
1840	Nicoya Gulf to Cape Elena Costa Rica	Belcher
1840	Cape Elena to Cape Desolado C. Rica-Nicaragua	Belcher
1840	Cape Desolado to Fonseca Gulf Nicaragua	Belcher
1840	Fonseca Gulf to Sonsonate Road El Salvador	Belcher
1847	Guayaquil River Ecuador	Kellet, Trollope & Hill RN
1847	Buenaventura Port Colombia	Kellet, RN & Com. Wood
1847	Octavia, Cupica and Cabita Bays… Colombia	Kellet, RN
1847	Panama Bay with Darien harbor, Taboga, Boca Chica	Kellet, RN
1848	Buenaventura to Capa Marzo Colombia	Kellet, RN
1848	Coiba Island Panama	J. Wood
1849	Cape Marzo to Mariato Point, Piña bay Panama	Kellet, RN
1849	Panama Gulf to Parida Island Panama	Kellet, RN
1849	Parida to Nicoya Gulf Panama-Costa Rica	Kellet, RN

Source: Admiralty Catalogue of Charts (1875).

In Table 2, note that the surveys for the earlier charts carried out by Belcher mostly concentrate on Costa Rica, Panama, and Mexico. The later ones by Kellet deal mostly with Colombia and Panama, thus completing the Royal Navy's main surveying work in the region. One of the earliest rectifications of erroneous information contained in the Bauza chart of 1822 concerned the Gulf of Nicoya and was produced by the surveys of HMS Sulphur in 1838. In this chart, reproduced as Figure 2, the surveys provided the proper layout of the gulf, and these were used in drawing the chart. The figure depicts the numerous soundings taken inside the gulf and among the islands, as well as the anchorage at Puntarenas and certain astronomically determined positions. It is interesting to note that the outline of this gulf prior to Belcher's chart had been accurately depicted three hundred years earlier in 1529 in a map by Gonzalo Fernandez de Oviedo, who participated in the first explorations along the coast of Central America by the Spaniards. This information however, was lost in the Spanish archives for centuries.

Figure 2. Chart of the Gulf Nicoya (1838). Source: Molina (1851), between pp. 56-57.

4. INCREASING GEOPOLITICAL IMPORTANCE OF THE ISTHMUS: 1850-1900

From the preceding sections it is clear that during the first half of the 18th century, foreign warships visited the Central American Pacific coast irregularly, with the exception of the Royal Navy's survey expeditions. However, in the second half of the century, in response to a rising interest by the major naval powers in controlling the Pacific and accesses to this ocean, the frequency of warship visits to Central American ports rose significantly. Beside the warships visiting ports in the region, new surveys were carried out by the different powers, each one seeking to obtain

advantage over its rivals in relation to trade and political influence. Increasing world trade, improvements in marine technology and competition between the main industrial countries for markets located on the rim of the Pacific, were the principal driving factors in this fight for control of the ocean.

4.1 The steamship comes to the west coast and new routes emerge

As mentioned above, the main maritime route from the Pacific coast of Central America to the North Atlantic, from the mid 18th century onwards was that around Cape Horn, the older more direct route through Panama being abandoned as the cost of transshipping goods and passengers across that Isthmus was too costly. The improvement in the sailing qualities of vessels at this time, made it possible for ship owners to offer rates via the Cape that were economical, in spite of the lengthy route of some 18,000 kilometers and the time consumed in these voyages. By the 1840s however, a new factor was introduced as steam ships began cutting into the advantages held by sailing ships using the Cape route. The British owned Pacific Steamship Navigation Company (PSNC) began operating as early as 1842 from the ports of Valparaiso and Callao, providing service to Europe mainly via Cape Horn. However, by 1846, when the Royal Mail Line began servicing Colon in Panama as part of its mail contract with the British Government to service the west coast of America, the PNSC extended its Pacific service northwards to Panama as well; therefore, cutting the time in passage to and from Europe from 4 months to 40 days (Haws, 1990, p. 15). For the time being, this traffic through Panama was limited to passengers and high value cargo, as land transportation across the isthmus continued to be very difficult.

However, a new impetus came with California and the Gold Rush beginning in 1848. California attracted large numbers of immigrants and the number of passengers traveling west through Panama quickly increased. Therefore, the importance of making a fast passage across the Isthmus by land transport made it imperative that a solution be provided. Soon two routes were opened: the Panama Railroad (1851-1855) and the competing Accessory Transit Company of Nicaragua (1852), both established by US capital. Given that the great majority of the travelers passing through Panama or Nicaragua were US citizens, the need to protect their passage through the Isthmus led to United States geopolitical interests in the Central American region increasing correspondingly.

One issue that arose with the increasing use of oceangoing steamships was that these had to rely on coal, and this fuel was not available except at a few ports on the Pacific. Most coal was shipped from ports of England or the Eastern United States, using it as ballast in sailing ships which were more economical for carrying this heavy cargo over long distances. Eventually coal deposits began to be mined in Chile, but coaling remained a problem for both merchant and naval ships. For the latter, which had to operate for extended periods, even years, far from home bases, the obtaining of coaling stations became an important issue for the vessels crews, and their naval commands.

For the United States, its continuing expansion as a sea power in the Pacific depended, to a large extent, on developing the logistics to provide coal to its vessels. How much depended on coal being available was brought up clearly during Admiral Perry's expedition to the Orient in 1852-1854 (Schulman, 2007, pp. 64-65). Establishing coaling stations thus became an important issue in ensuring the operation of naval steam vessels in the Pacific.

4.2 Increasing competition between the major foreign powers

As stated earlier, through the mid-eighteen forties, Great Britain was basically unchallenged in the eastern Pacific, as the main maritime countries in the region such as Chile and Peru were under its direct commercial and naval influence. As the main naval power in the eastern Pacific after the departure of the Spaniards in the early and mid 1820s, Britain basically sought to maintain the status quo. This was possible, because the countries located on the South and Central American coasts of the Pacific were expanding their presence in the European markets at this time and the majority of the trade involved was either financed by British commercial capital or transported in British ships. Hence, there was no interest at this time in the Latin American nations of openly challenging the predominance of Great Britain.

In the northern Pacific, however, the territorial expansion of Britain in America reached a maximum when it settled the Canadian west coast in the early 19th century. Meanwhile, the landward expansion of the United States westward from the Mississippi river, marked signally by the Louis and Clark expedition (1804-06), was under way. This led to a series of territorial disputes with Great Britain on the west coast, and a 1818 agreement for joint occupancy of the Oregon Territory allowed for a period of tranquility but new issues arose and these were eventually settled through the Oregon Agreement of 1846 which also established the common boundary at the 49th parallel.

However, the geopolitical situation changed drastically in the late forties, after the United States won the war with Mexico (1846-1848) and obtained about 1.2 million additional square miles of new territory, incorporating the coast of California and inland all the territory eastward up to the Louisiana Purchase (1803). With great speed the United States filled in these enormous, nearly empty spaces, and by 1850 became a power to be reckoned along the Pacific coast. This fait accompli, forced the other sea powers to respond: the British sought accommodation with the United States, the French instead sought to expand their presence in the region.

Changes in global geopolitical interests were behind the different actions taken by Britain and France. British imperial policy had, for some time, been focused on Southern Asia, where the East India Company had, by the mid 18th century, carved out a private empire in India, a role taken over gradually by the British government over the next century. The major task of managing their empire in Asia

led Britain to concentrate on this continent, but only after reaching an agreement with the United States about their respective roles in controlling any future trans–isthmian route across Central America. The resulting Clayton-Bulwer treaty of 1850 for half a century provided Britain with a significant upper hand in dealing with United States' ambitions in Central America, without having the expense of maintaining a major naval force in the region.

On the other hand, by the early 1850s the French Navy had begun to play a significant role in the coast of Central America, as a result of both commercial and geopolitical needs. Given that few French mercantile vessels reached the Isthmus before 1850, the French had only provided general sailing directions for the Central American ports following the Cape Horn route. However, more detailed indications for entering specific ports like Puntarenas and Realejo were provided by the French merchant barque Le Melanie which from 1840 to 1846 carried coffee between Bourdeux and Central American ports[18]. The formal involvement of the French Navy in surveys in Central America started in 1852, when the corvette Le Brillante, Captain de Lapelin, was ordered to carry out a hydrographic survey of the coast between Iztapa in Guatemala and Point Platanal, near Point Burica in southern Costa Rica. notae The objectives of this survey were: 1) to provide more accurate information on Central American ports and harbors resulting in improved sailing directions; 2) to explore stretches of the coast that were poorly mapped, and 3) to make a more specific, detailed survey of the Golfo Dulce, at the southernmost limit of Lapelin's study area.

This last was an strategic objective given that the Government of Costa Rica in 1849 had signed a contract with a private French company to colonize the region around the Gulf, and as part of the contract, authorized it to build a road or railroad across the Isthmus to the Bay of Bocas del Toro on the Caribbean[19]. A French interest in a possible canal across the Isthmus was apparent from the 1840s onward and would continue to exist until it reached a maximum in the 1870s and 1880s when a French company actually began the construction of a canal through Panama. This matter would then result in increasing competition for primacy in canal building, particularly with the United States, as the British had abandoned any intentions for a canal through the Isthmus, being absorbed as mentioned by imperial expansion in South Asia and later in Africa.

After the mid-eighteenth century, other European powers began showing an interest in the west coast of the Pacific. Spain for instance, nearly 40 years after it had been forced from this area, organized in 1864-1866 the Spanish Scientific Expedition to the Pacific. This enterprise was soon involved in problems between Spanish interests and those of Perú and Chile, and it came to be used as a political and military instrument to punish those countries, drastically changing the original objective, and producing few tangible results in scientific terms (García, 1941, pp. 5-13). The Spanish expedition coasted along Central America, Mexico, and reached as far as San Francisco, but no information on results relating to improving navigation was produced.

4.3 A canal across the Isthmus: Many attempts but few accomplishments

The need for a canal to cross from Atlantic to Pacific had been a long-existing dream. At various times the Spanish government made attempts at studying the possibilities but were dissuaded from going forward. Even before independence from Spain was achieved, Spanish-Americans like Simon Bolivar (1817) had proposed the building of a canal and others like the President of the Central American Federation, Francisco Morazán in 1826 went forward with preliminary studies. The British carried out their own studies but the enterprise was not deemed viable, as the future interests of the empire lay elsewhere, in Asia. The French were drawn in early, and the future Napoleon III even drew up a proposal in the 1840's for a canal, and maintained interest in its construction during his long reign.Nevertheless, it was the United States, after its territorial gains obtained in the War of 1846-1848, the nation whose geopolitical interests were most directly affected by construction and control of a trans-isthmian canal.

For a half-century, the United States government was limited in its official intentions of building a trans-isthmian canal because of the Clayton-Bulwer treaty signed in 1850 with Britain.[20] Under this treaty, both powers agreed that neither part would seek to control a future canal, it guaranteed that any canal or railway built across the isthmus would be considered neutral territory, and that both nations would take actions against any third party intending to occupy Nicaragua, Costa Rica, the Mosquitia, or any other country in Central America. The treaty did not exclude private companies from carrying out this enormous project, but it would be obviously very risky for private capital to attempt to build the canal unless there was some form of government support, in financial as well as security matters.

The already mentioned massive flow of immigrants to California had opened two transportation routes: the Panama Railway which was operational by 1855, and the Accessory Transit Company, that from 1852 began to use small steamers and land transport on the Rio San Juan-Lake Nicaragua route. However, neither route had the capacity to handle the large volumes of cargo that were being transported to and from markets on the Pacific. The Nicaragua route involved various transfers making it uneconomical while the Panama Railroad justly earned recognition as having the world's highest transport rates and could transfer only a limited volume of high value goods.

Increasing rivalry about controlling a proposed canal plus the increasing needs of maritime commerce among industrial and Pacific coast countries, generated an interest in continuing the surveys of the major maritime geographical locations along the Isthmus -ports, bays, and gulfs. Continuing coastal surveys by the British and French Navies, and especially by the US Navy in later years (1870-1900), had the objective of improving maritime safety of vessels of all countries operating in Central America, but in many cases also began to focus on strategic points such as the coasts near to the possible entrances to proposed canals or potential bases for use by naval vessels.

4.4 The changes in sailing directions: 1730, 1852, 1875 and 1938

After reviewing the surveying carried out by the navies of the three foreign powers active in the region, it is important to analyze the useful applications resulting from those surveys. Apart from the preparation of sailing charts mentioned above, that provided the basic cartographic data useful for navigation, the other main product of survey work was sailing directions, an indispensable complement to the charts, as they provide navigation information of coastal areas in greater detail. These sailing directions are written instructions provided to navigate near coasts and into and out of harbors and ports, and are published as manuals for use by ships at sea, each manual referring to a specific portion of a coast. The sailing instructions add data on ports and cities in coastal areas, the topographic layout behind the coast (oftentimes the first indications upon approaching a coast), as well as facts useful to seamen such as the availability of water and provisions in each harbor[21].

In relation to the Pacific coast of America, mention was made above of the Derrotero General del Mar del Sur made by the captains Hurtado in 1730[22] which showed a combination of images of the coast with detailed sailing directions, including the compass directions to be followed, the distances from one important reference point to another, the location of navigational hazards like reefs and shoals, and in a few cases, the latitude of important harbors or ports. Depths at some anchorages or harbor and river entrances were also provided in the Derrotero, making it a remarkable navigational achievement for its day.

In addition to the 1730 Derrotero covering all the western coast of the Pacific, three other sailing directions manuals are available for historical comparison to determine the changes that took place in navigational information over an extended period of some 200 years. These are: Lapelin's Pilote Cotier du Centre-Amerique (1854)[23] which only includes the coast from Guatemala to Costa Rica; Imray's The North Pacific Pilot (1875)[24] covering the coast from Canada to Panama; and the US Navy's Sailing Directions for the west coasts of Mexico and Central America (1937), which included Panama[25].

The data taken from each of the manuals was standardized in terms of the direction of sailing: the 1730 Derrotero and the North Pacific Pilot of 1870 present their data starting from South to North along the Pacific coast, while the 1854 Pilote and the 1938 Sailing Directions take the opposite direction, presenting their data from North to South. For comparison purposes, this was standardized to follow a common South to North direction. Each geographic feature or locality identified was then listed in the S-N direction, and the page number in the sailing directions, making reference to the features described, was indicated. A short description of the place or feature, taken verbatim from the sailing directions was included, as well as notes on the survey itself, such as the astronomical position when included. As the data gathered is very voluminous, a single site, that of the port of Panama, was selected and the information is presented in comparative form in Table 3, as an example of the type of instructions contained in these sailing directions and of the changes that took place in the sailing directions.

It is instructive in studying Table 3, to note that even as early as 1730, latitude is included in the information for the Islas del Rey, a short distance south of and on the approaches to Panama City although at that time it was not yet possible to measure longitude. The Northern Pilot and the Sailing Directions both provide latitude and longitude, although differing somewhat, indicating the improvements in measuring coordinates was a continuing process[26].

Another aspect which the comparison brings out, is that the 1938 Directions clearly distinguish between the port of Panama City and the entrance to the Panama Canal and the adjoining port of Balboa, underlining the great changes in sailing routes and sailing directions brought about by the construction of the Panama Canal in 1914. The specific harbor descriptions however, do not differ much considering the long interval of time between which these were formulated[27].

Sailing Directions	Pages	Position	Description
Derrotero 1730	33, 34, 35	"Las Islas del Rey estan en 8° más o menos"	De Panama al SO, a 2 leguas está el puerto de Perico. Cuando estais cerca de Perico, sabed que hay una baja entre Panamá y Perico en frente de Paitilla. (Para evitarlo, tomar mar afuera hasta divisar la Isla de Taboga) y estaras fuera de esa baja. De allí irás bien al puerto y poniendo el farallón de San Joseph por el canto de la isla de Perico, se puede dar fondo a una amarra al SE y otra al NO
Royal Navy North Pacific Pilot: Part I (1870)	15	8° 57'N; 79° 81' W	The port is formed by Perillo(sic) Point to the N and Buey point on which the city is located. The landing from small vessels is at Monk's Gate. No piers exist (1859) but there are facilities for building these. A great portion of the bay is dry at low water. Panama road, although shoal, may be considered secure; the ground being muddy holds well....A resident in Panama for five years, stated, that during that time there was no known case of a vessel being driven from her anchor; and with good ground tackle and common precaution a vessel might lie there all the year round with one anchor down. P. 18
US Navy Sailing Directions 1938	Panama Harbor pp. 376-379		Paitilla Point 1 1/4 miles NE of the city of Panama is a ...rocky promontory with two hills ... and between them is a rivulet which admits boats at high tide... The harbor between the point and the city, recedes about 3/4 mile to the NW and has depths of 8 feet ot less.
	Entrance to the Panama Canal and Balboa Harbor pp. 366-369	8° 57'N; 79° 34'W	The channel leading from the deep water o Panama Bay to Balboa and the entrance to the canal, passes between Guinea Point on the port hand and Naos, Culebra, Perico and Flamenco Islands on the starboard. This channel is 4 miles long, 500 feet wide and has a ... depth of 35 feet
Source: Annexes II, III & IV.			

Table 3. Port of Panamá: Comparison in sailing directions 1730 to 1938

Similar exercises could be made for each locality but that lies outside the scope of this paper. The main purpose has been to provide an example, as part of an overall view of the nautical data gathered and its use for developing sailing directions.

5. LATE AWARENESS OF THE IMPORTANCE OF IMPROVED NAUTICAL INFORMATION: THE CASE OF COSTA RICA

The coast of Central America, as noted earlier, was explored and a general knowledge of the main geographical and maritime features was developed from the 16th century onward, and recorded in the Spanish "derroteros", and later in sailing directions made in the 19th and early 20th centuries. While the general outline of the coast was known, more detailed information of individual harbors was scant through the beginning of the 19th century[28]. In addition, wide sections of the Central American coast were of little interest to foreign sailors as, with the existing commercial sailing routes, there was no need to approach the coast; and, therefore, there was little precise knowledge of these areas. While the waters around the main ports and approaches such as Panama, Puntarenas, Realejo, and Acajutla, had been described in some detail in the "derroteros" and sailing directions, few details existed on depth soundings in the ports, except for a number of selected anchorages.

Earlier, in sections 1 and 4, mention was made of the increasing geopolitical interest after 1850 by foreign powers on the prospect of a canal being built across the Central American Isthmus. While the geography did not directly favor Costa Rica, since its central and southern territory had some of the highest mountains in the Isthmus making it impossible to build a canal through the country, it had the advantage that its location was close to sites where conditions for building such a canal did exist, both to the south in Panama, and even more favorably with regards to the northern option through Nicaragua, where the boundary between both countries roughly followed the proposed route of a canal.

The Accessory Transit Company, a private venture established in 1852 and led by the American entrepreneur Cornelius Vanderbilt, first exploited the geographic advantage in Nicaragua, putting into operation a mixture of lake and river steamships, and a short land transit to convey passengers from the Atlantic to the Pacific. The success of this operation, however, was threatened by William Walker's filibuster expedition to Nicaragua in 1855, when Walker's government canceled Vanderbilt's concession and granted it to a rival navigation company. After the expulsion of the filibusters in 1857, since the Costa Rican army had played a crucial role in capturing the steamships and stopping supplies and reinforcements from reaching Walker, Costa Rica was left in a favorable position, since for some time it remained in control of the Transit route, allowing it to negotiate with Nicaragua a new border treaty, which included the obligation for either country to consult with the other in case a trans isthmus canal was negotiated with a third party. Costa Rica thus obtained a say in any future canal through southern Nicaragua.

Regarding the other canal option, that to the south through Panama, Costa Rica's possibilities of benefiting directly were few because the proposed canal site was located far from its border with Panama. However, it did have a potential strategic advantage, in that through its possession of the Isla del Coco, located astride some of the trade routes that would be used by ships using a canal, it could have a role in the defense of a future canal.

The Costa Rican coast, additionally, contained two excellent anchorages at Bahia Culebra and in the Golfo Dulce, which would be of interest as bases to any power that operated fleets in the Pacific.

5.1 Coping with limited nautical knowledge: the case of Costa Rica

However, Costa Rica, as well as the other Central American republics, were, for decades after independence, too involved in settling internal political and economic problems. Under the Federal Republic, all foreign relations matters were handled by the Federal government, which left little room for the fostering of foreign relations by the individual states. However, after 1848 when the Federation was formally dissolved, conditions changed and the country promptly began to develop direct relations with its principal trading partners by signing treaties of friendship, commerce, and free navigation, initially with Britain and the Hanseatic cities and later with France and the United States. These trade and navigation agreements were very important for Costa Rica, as they constituted a first formal recognition of the nation by foreign powers[29].

Central America in the early 1850s began to become aware of foreign economic and geopolitical interests that were beginning to have an impact on the region's internal affairs. As the rivalry increased among the major European powers and between these and the United States, the rising continental power, the region was exposed to potential and real conflict. An early warning of the threat to Central America and particularly to Costa Rica, due to its geographical position and the resulting external geopolitical pressures, was clearly expressed by President Mora in his 1856 presidential address[30]. In this speech, he specifically refers to the United States as posing the most immediate threat, reflecting the recent actions against Mexico and the role of capital investments by United States' citizens in the opening of the Panama Railroad and the Accessory Transit Company through Nicaragua. In response, Costa Rica had, as of 1852, begun to strengthen its diplomatic ties with Britain and France, using the existing treaties with those powers to negotiate support (such as the purchase of modern weapons) that could counterbalance perceived threats. This proved to be an effective, precautionary policy, since William Walker and his filibuster army took over Nicaragua in late 1855. Having rearmed the army, Mora declared war on Walker in early 1856 and obtained important support from Britain and France in that warships from those powers began patrolling the Central American coast and protecting the Costa Rican port of Puntarenas from possible filibuster attacks.

Eventually, the canal was to be built in Panama rather than in Nicaragua, and Costa Rica; thus, did not receive any direct political benefits from its construction[31]. The country's experience with foreign powers during the 19 century, did provide a significant lesson that in order to defend its international rights and its boundaries, it was important for the country to become familiar with its territory, resulting in an increased interest in occupying any unoccupied areas, in particular along the borders.

To this end, a much better geographic understanding was needed of the national territory and the seas surrounding it. Land maps were gradually improved from the 1870s onward[32]. The general lack of locally generated information existing at mid century concerning the coasts and islands was gradually improved by the end of the century. Four instances of this process whereby Costa Rica's national interests benefited will be briefly analyzed in the following sections.

5.2 Mapping unknown territory: the Golfo Dulce experience

In section 4.2, reference was made to the French Navy surveys in the Golfo Dulce in 1852, in response to a request by a private investor to the French government[33] that a study be made of that area. This investor, Gabriel Lafond, had received a large land concession from the Costa Rican government, with the objective of establishing a colonization project in this nearly unpopulated part in the south, along the border with Colombia (later Panama). The Costa Rican objective was to settle this area, in order to establish its rights over this territory, which were in dispute with Colombia at that time.

Nothing came out of Lafond's project, even though he continued trying for many years, to sell his supposed rights over the territory, which had reverted to Costa Rica, once the concession period had ended. All sorts of shady speculators were, however, on the lookout for opportunities and took advantage of the lack of clear demarcation of the boundary between Panama (then a department belonging to Colombia) and Costa Rica. Such was the intent in 1859 by the Chiriqui Improvement Company, formed by various speculators who had obtained old concessions authorized by Colombian and Chiriqui authorities. It sought a contract with the US Navy to provide coaling stations and harbors for the fleet in the Pacific and southern Caribbean. The coal was to come from mines presumed to exist in the Talamanca Cordillera, but these only produced inferior quality coal and in fact, very minor deposits existed. The company offered the US Navy the use of two excellent harbors, Almirante on the Chiriqui Lagoon on the Caribbean side, and the Golfo Dulce on the Pacific[34]. In declarations presented before a United States Congressional committee, that was analyzing authorization of a Navy contract with the company led by a well known promoter, Ambrose Thompson, no mention was made of the fact that Golfo Dulce was in another country. A mixture of filler material and the reports made by the French expeditions in 1850 and 1852 and the USS Fulton in 1858, were used to create the impression that the information provided was correct and that the proposed contract was legitimate. The newly installed Lincoln administration briefly considered the proposal, in the context of both the potential of establishing coaling stations and more importantly, from the political point of view, as a place where liberated slaves could be settled by the United States[35]. On this intention being made public, Costa Rica's envoy in Washington objected, and the matter was finally put to rest, and the use of the gulf as a possible naval base went no further, to the relief of Costa Rica[36].

Nevertheless, in 1880s, the US Navy again showed interest in the Golfo Dulce and Golfito, the main port lying within. Geopolitical issues, this time related to opposition by the United States to the start of construction of a canal through Panama by a French company in 1881, resulted in the Navy being ordered to send ships to explore the gulf, under the allegation that the old concessions of the Chiriqui Improvement Company were still valid and that the navy needed coaling stations in the Pacific. Little resulted out of this second intent to establish a base, especially as the USS Adams, the vessel sent to the gulf stayed only enough time to lay out an area of about an acre for the coal deposit, and then left when Colombian authorities complained of its presence there, as that country had an ongoing border dispute with Costa Rica. Still, years later in 1885, the USS Ranger, during an extended voyage along the Central American coast, made a new detailed survey of the Golfo Dulce, the results of which were published as Hydrographic Office chart 1037, clearly underlining the continuing interest by the Navy in this harbor[37].

While these different actions were taking place in the Golfo Dulce, the Costa Rican government remained oblivious to these many intrusions into its territory, as population and local authorities in this the region were few and had little communication with national authorities in San Jose. It was luck rather than any specific government action that prevented the country from losing control of this environmentally rich area and the natural harbors it held[38].

5.3 Extending the maritime territory: the Isla del Coco

The Isla del Coco, or Cocos Island, is located some 500 kilometers from the mainland of Costa Rica. From early in the Spanish colonial period, this island served as a useful navigation point, mainly in the N-S commercial routes between Mexico and Peru. By the late 18th century the rich fishing grounds surrounding the island attracted the attention of whalers to Cocos island, which used it to replenish their water supplies. Later, interest in Cocos Island focused on treasures that had presumably been buried there by pirates, although their existence has never been properly documented. However, during the 19th and 20th centuries its possible value was demonstrated by various expeditions signaling the interest of the Spanish and British navies; Malaspina visited the island in 1791 and fixed its position, while Captain George Vancouver visited in 1795, and left profiles of the island. In the 19th century Royal Navy ships visited Cocos, and one of the first tasks assigned to HMS Sulphur under Captain Belcher, was to establish the exact dimensions and position of the island. This was determined to be at 5° 53'N and 87° 02'W, during HMS Sulphur's two visits in April, 1838 and March,1839. Today the island's position is fixed at 5°31'N, 87°04'W. Belcher also drew up the first chart of the island, although the SE part could not be visited. In 1889, the French Navy's Duquesne produced a new chart of Cocos during a visit there.

After the mid 19th century, when steamers began to take over commerce from sailing ships, Cocos Island was less frequently visited and to some extent, forgotten. Costa Rica itself was the nearest country but, lacking a significant maritime tradition, did not occupy the island considering it was too distant from land. Only occasionally, for example, when a ship was wrecked at Cocos in 1832, did the government take any action, but once the survivors were removed it was again left to birds and sharks. It was only in 1868, when a group of enthusiastic treasure hunters sought government support for carrying out an expedition to the island, and then President Jesus Jimenez authorized that the expedition be given official status and designated its leader as governor of the island. The raising of the flag on the island in September, 1868, made Isla de Cocos part of the national territory, even though the expedition remained there for barely one month.

The Costa Rican government briefly considered setting up a penal colony at Cocos in 1874, but again the distance from the nearest port at Puntarenas, as well as a lack of government vessels made its establishment impossible. However, in 1878, Costa Rica finally purchased a warship, and it began making trips to Cocos to reaffirm its rights over the island, and then President Guardia visited Cocos in 1880. Subsequently, aside from occasional treasure hunters, the island remained unoccupied until 1889, when August Gissler, a German sailor, made the island his home, living on and off it for the next 16 years. Gissler contracted with the government to bring settlers, but this proved unfeasible and he continued living a lonely life there except for trips to replenish his provisions. In 1891, a newly acquired naval vessel began a series of routine visits, which were kept up for the next 15 years, until the small national naval force was cancelled in 1907 because of fiscal problems. The ship named Turrialba was used to carry out the first Costa Rican scientific expeditions to Cocos and a new map of the island was produced by the captain of the vessel, resulting in an improved delineation of the coast as compared to previous charts[39].

Having established its territorial rights, for the next 70 years the Costa Rican government did little or nothing to continue exploring the island and its resources. During this period, Cocos continued to be visited by a number of officially recognized treasure hunting expeditions and occasionally by passing ships, including US Navy vessels[40]. Shortly before World War II, the United States demonstrated a certain interest in the island for use as a strategic defense position for the Panama Canal but Cocos topography was not suitable for a military air base, and this was instead established on the Galapagos Islands to the south. In any case, since it was a good source for fresh water, the US Navy made a watering station for use by patrol vessels that protected the approaches to the Panama Canal (Weston, 1992, p. 208).

Finally declared a national park in 1978, the island has become an important site for international research in a number of fields, being designated a World Heritage Site in 1997. It is in this latter role, as a worldwide recognized protected area and more recently as a result of the ocean around the island being claimed as an exclusive economic zone, Cocos great importance to Costa Rica has finally been recognized.

5.4 Improving sailing instructions and maritime charts for the Gulf of Nicoya

The sailing directions reviewed briefly in section 4.5 involved major efforts by the navies of four major powers, and were designed for navigation on the ocean and on the coast of the eastern Pacific. Although Costa Rica lacked a maritime tradition, towards the end of the 19th century, as the coastal areas of the country became increasingly populated, coastal and inland transportation became important, in particular in the Golfo de Nicoya and its surrounding peninsula. Having established a small naval force (1873) as indicated above, the government became interested in improving coastwise navigation, so its ships and those involved in local commercial operations would not run unnecessary risks due to underwater hazards. It was decided that sailing directions and improved charts be developed for the Gulf of Nicoya, and to that effect a French naval officer was contracted to carry out the necessary survey work, first in the gulf itself, and later in selected bays on the NW part of the Nicoya peninsula. These bays were used by sailing vessels from northern Europe as sites to load valuable lumber, and since a number of these had been sunk by hitting unmarked reefs and rocks, the need to prevent further losses was obvious.

The French officer, Captain Eliseo Fradin, undertook to carry out the necessary survey work and these were completed in 1891-1892. The result was a detailed report describing the internal coast from Punta Blanca on the northwestern entrance to the gulf to Punta Mala on the southeastern entrance[41]. A second part of the sailing directions provided information on currents and winds inside the gulf. The chart accompanying the report has not been found, but it received criticism because it was claimed that the information included was in some cases considered faulty. Later Fradin also produced a study and a detailed chart for setting up a quarantine station on Isla Cedros within the gulf, where steamers could disembark sick passengers.

By the early 1900's the gulf had become an important area for coastal transport, with significant traffic being carried on between the Nicoya Peninsula and Guanacaste province and the country's interior, through the port of Puntarenas. The sailing directions were thus provided at an opportune time and presumably put to good use by transport within and outside the gulf of Nicoya.

5.5 Gaining information about strategic sites: Bahía Culebra

Mention was made earlier of surveys carried out by foreign naval vessels, seeking possible sites for naval bases or coaling stations. Beside the Golfo Dulce, another bay that offered excellent conditions for establishing a naval base was Bahia Culebra, on the outer edge of the Nicoya Peninsula. Captain Belcher in HMS Sulphur made a first survey of this bay in 1838 (see Table 2), stating that it was a magnificent port, and this was followed by a new survey carried out by the USS Ranger in 1885 using Belcher's previous work.

In spite of a chart of Culebra being published by the US Navy in 1887, the Costa Rican government contracted again with Fradin to produce a new chart including more detail, this work being completed in 1892. This is a remarkable work (see Figure 4) both in terms of the number of soundings indicated, and of the format used to record the data, following a square pattern, rather than lines of soundings. It also represented a major effort on the part of the government to generate a navigational aid that in its detail appears to surpass the earlier charts, and was, by itself, an important contribution to developing the national capacity to produce and publish nautical information.

In spite of the mentioned survey work carried out in the 1890s and early 1900s, this was discontinued as a direct consequence of the small national naval force being disbanded in 1907. As a consequence, the technical gains obtained were forgotten over time and the improved understanding of nautical affairs that resulted from these was lost. However as indicated above, in some cases sufficient knowledge remained of these important maritime sites and this was used to defend the national interest, ensuring that these were not taken over by other countries. In the long run, all those geographical sites have contributed significantly to Costa Rica's economic development and to the conservation of natural resources of global importance.

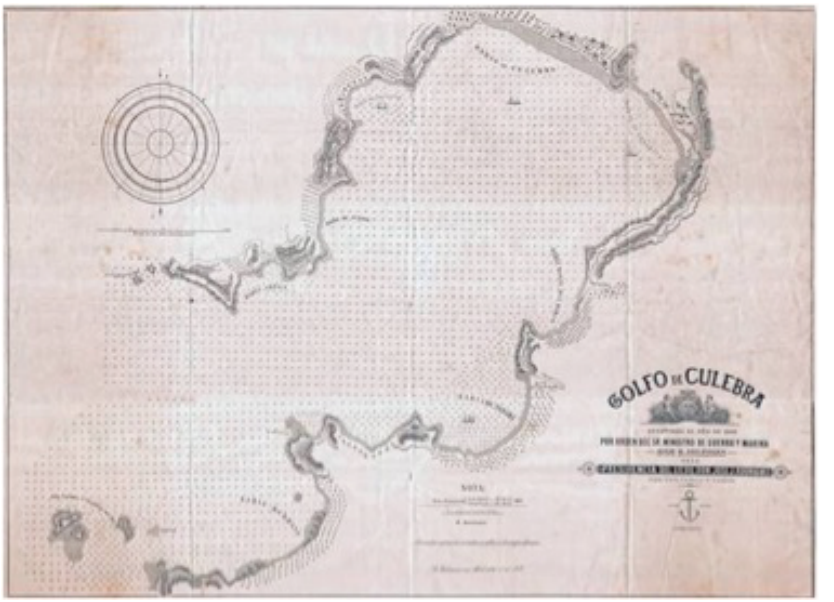

Figure 4. The Bay of Culebra, Fradin 1892.

Source: Fradin (1892). Golfo de Culebra. San José, Ministerio de Guerra y Marina.

6. CONCLUSIONS: BENEFITS FROM IMPROVED NAUTICAL KNOWLEDGE

From the survey work carried out by ships of different navies in the eastern Pacific, described and analyzed in the preceding sections, important benefits to navigation and to science in general were derived. The most significant included the validation of the geographical position of numerous geographical features important for maritime navigation, through repeated measurements of position, using astronomical and magnetic measurements, and the determination of measures of magnetic variation led to worldwide magnetic surveys that corrected observations[42]. These, together with the development of better instruments for astronomical observation and timekeeping, systematic measurement of wind and current charts, all contributed to vastly improved scientifically based knowledge for mariners worldwide. This was by itself a fundamental achievement, as it made possible the positioning of ships at sea and in relation to their planned points of arrival, as well as the need to adjust their routes if required.

Moreover, the new, improved maritime charts produced and made available for commercial shipping from the late 1820s onward, facilitated navigation, especially to new destinations in relatively unknown waters of the eastern Pacific. This applied particularly to Central American ports and harbors where the boom in trade after 1840, created a demand for better information for the large number of ships, initially sailing ships, but later also steamers, that served the ports of this region.

In third place, the nautical information gathered by the survey ships of the various navies, no doubt was found useful by political and military planners of the different nautical powers, in their quest to obtain geopolitical advantages over their rivals. The Central American isthmus being strategically placed between the two major oceans, the need to acquire accurate geographic and nautical data concerning the region, but in particular of specific areas like the proposed Panama and Nicaragua Canal routes, became imperative and was duly carried out by the naval vessels. However, these navies' collaboration resulted in the publication of maritime charts useful to all mariners, benefiting world shipping in general.

On the other hand, the charts of the coast of Central America were published mainly by foreign navies. Their use, however, benefited mainly the captains and pilots of the merchant ships that plied its waters, but because the region was poorly prepared to develop its own merchant marine, once again the main beneficiaries were foreign sailors. The increase in shipping in the region during the second half of the 19th century was accompanied by maritime accidents, caused mostly by error on the part of crews, and to a lesser degree by unmarked nautical hazards. The overall increase in safety of passage of traded goods, both exports and imports, was, on the other hand, a great benefit for the countries of the region. As more precise nautical information was gradually built up during the century, charts and sailing directions were greatly improved by the beginning of the 20th century.

Concern on the part of the Central American countries about their security, given the external geopolitical interests focused on the region and practical needs for local coastwise navigation made it possible for a short period, in the case of Costa Rica, given availability of naval resources, to carry out limited coastal survey work. This resulted in a number of charts of harbors and of sailing directions, which contributed to improved nautical information on areas of national interest. Once external pressures subsided, the country abandoned this effort, although in the meantime it had consolidated its hold on the Isla del Coco and other geographically significant resources, being very notable benefits, even though these would only be appreciated in their full potential more than a century later.

ENDNOTES

1 Paper presented at the 2017 McMullen Naval History Symposium, held in September 2017 at the United States Naval Academy, Annapolis, Maryland.

2 For a description of trade among the countries of the Americas in the Pacific during the 18th and 19th centuries, see Leon (2001)

3 The goods traded are described in León, "Productos en el comercio intra-regional por el Pacífico, 1700-1850", unpublished paper presented at the Congreso Internacional: El Pacífico, 1513-2013, Seville, October 2013.

4 For the 1883-1913 period, total World trade grew at 3,7% per annum, and that of tropical countries at 3,1% per annum. Lewis (1983), pp. 283-284.

5 A sixth state, Chiapas decided to join Mexico in 1824, withdrawing from Central America, despite having being part of the region during colonial times.

6 A third very important sea route was that across the Pacific, carried out between Acapulco in México and Manila in the Philippine Islands by the Manila Galleons, but this is not included in this analysis as it was not formally linked to the North-South trade along the coast.

7 A specific result was Jorge Juan y Antonio de Ulloa, Observaciones astronómicas y phisicas … de las cuales se deduce la figura y magnitud de la Tierra y se aplica a la navegación, Madrid, 1748.

8 "Aunque hay en Lima un cosmógrafo …., no por esto se esmeran los pilotos que han pasado por su examen en guardar la formalidad que deberían ellos observar en las derrotas de sus viages, formando diario y llevando el punto con el rigor que prescriben las reglas de pilotaje. Los pilotos no solo cometen este sensible descuido que propiamente es omisión, mas quedando a su cuidado el llevar todos los instrumentos necesarios para la navegación, son estos de tal naturaleza, que es cosa lastimosa ver fiadas las vidas de tantas gentes , y los caudales de aquel comercio en unos rumbos tan inciertos como los que se puede dirigir con una ordinaria y maltratada ballestilla… A este respecto son todos los demás instrumentos de que se sirven, y entre tantos defectos no es el menos sensible el faltarles cartas náuticas por donde navegar, de las cuales carecen enteramente, y así no parecerá exageración el decir, que en todo navegan a ciegas, los que gobiernan aquellos navíos en las travesías que hacen…" Juan y Ulloa (1988), p. 128.

9 En el Pacífico, una excepción fue la Marina Chilena que desde 1843 dio inicio al levantamiento de cartas marítimas, actividad que después de 1865 adquirió mucho más relevancia. Wilson (2017), p. 2.

10 The Royal Navy's Hydrographic Office published as early as 1817-1819, a number of charts for South America and Acapulco, using Spanish surveys. Years later, when Felipe Bauza, one of Malaspina's collaborators and a former director of the Depósito Hidrográfico, was exiled in London, he shared many original survey materials with the Hydrographic Office. David (2008), pp. 8-9.

11 Measurement of winds and currents by survey ships in the Pacific, complemented the large number of observations made in commercial ship's logs, which over time were accumulated and in the late 1840's enabled Captain Matthew Maury, USN, in establishing the Wind and Current Charts, which contributed to greatly reducing sailing times on long voyages.

12 See Hall (1920), El General San Martín en el Perú. Extractos del diario escrito en las costas de Chile, Perú y México en los años 1820, 1821 y 1822. The Conway was among the first vessels assigned to the Royal Navy Pacific Squadron based in Valparaiso.

13 A history of the establishment of the Royal Navy Pacific Station, is found in Ortiz Sotelo (1998).

14 The antecedents of these expeditions during the latter part of the eighteenth century were those of Bougainville (1767-68), followed by Captain Cook's three voyages (1768-71, 1772-75 and 1778-79), La Perouse (1785-88) and finally that of Malaspina (1789-94). Fernández-Armesto (2006), pp. 298-307.

15 Hydrographic Instructions p. xvii- xxii, Belcher (1843), Narrative of a Voyage Round the World Performed in Her Majesty's ship Sulphur during the years 1836-1841. Under Belcher, a number of charts were made of the coast of Mexico, of places such as Acapulco (1837) Guatulco (1838) and the coast of California, including San Juan and San Quintin (1839). Orozco y Guerra (1871). Towards the end of 1838, Belcher considered a plan for constructing a canal through Central America connecting both oceans.

16 González Claverán (1989), p.59.

17 Bauza was not the only prominent surveyor to be misled into using incorrect data for producing maps. Humboldt's own contributions to mapping the southern part of Central America are equally as wrong in showing the coast line; see for instance, his "Carta Generale della Colombia, compilata de Brue sulla base delle indicazioni di Humboldt", in Humboldt (1819) Voyage aux Regiones Equinoxiales, 13th volume.

18 Depot des Cartes et Plans (1843) Renseignements sur le Central Amerique, recueillis pendant le voyage de la Melanie, 1842.

19 "Lafond comunica al gobierno de Costa Rica que "el nuevo comandante de la estación francesa en el Pacífico es amigo mío, se llama Alfonso Pellion, capitán de navío y que lo ha visto con el Ministro de la Marina y le han prometido los dos que iban hacer un mapa hidrográfico de Costa Rica y de toda la costa que no ha sido en la parte de Golfo Dulce." Lizama (2014), p. 123.

20 Mahan quotes a British source that stated: "In the United States was recognized a coming formidable rival to British trade. In the face of the estimated disadvantage to European trade in general, and that of Great Britain in particular, to be looked for from a Central American canal, British statesmen, finding their last attempt to control the most feasible route (by Nicaragua)

abortive, accomplished the next best object in the interest of British trade. They cast the onus of building the canal on the people who would reap the greatest advantage from it, and who were bound to keep every one else out, but were at the same time very unlikely to undertake such a gigantic enterprise outside their own undeveloped territories for many a long year; while at the same time they skilfully handicapped that country in favor of British sea power by entering into a joint guarantee to respect its neutrality when built. This secured postponement of construction indefinitely, and yet forfeited no substantial advantage necessary to establish effective naval control in the interests of British carrying trade." Mahan (1897) The Isthmus and sea power.

21 The importance of sailing directions is emphasized in the Hydrographic Instructions provided by the Admiralty to Captain Belcher in 1838, which stated that: "[…] there will also be opportunities of collecting auxiliary information which, when digested, made extensively useful to those who may have to visit that coast; - such as places of refuge after any disaster at sea; ports where pilots are requisite; the most advantageous methods of obtaining water, wood, and other supplies; the general resources and productions on which vessels may depend; the usual effects of the climate […] and those spots which are particularly unhealthy." Belcher (1842), p. xxvii.

22 Reproduced in Ortíz (1993).

23 Depot General de la Marine (1854). Le Pilote Cotier du Centre-Amerique makes up most of Captain Lapelin's report on the hydrographic activities of the corvette La Brillante in Central America in 1852.

24 Imray (1870). North Pacific Pilot: Part I.

25 US Navy Department, Hydrographic Office, (1938).

26 Present cartographic data indicates Panama City's coordinates as 8° 58'N and 79 32"W. www.mapsofworld.com/lat_long/panama-lat-long.html

27 The Pilote (1854) does not appear in Table 3, as Panama was not included in it.

28 For instance in Costa Rica the first chart for the port of Puntarenas, dates to 1804, when it was commissioned by the then Spanish Governor, Tomas de Acosta. This consisted in a crude outline of the entrance of the gulf of Nicoya, with the position of the port sketchily presented, and some soundings at the anchorage.

29 The first President of Costa Rica, José María Castro and his successor, Juan Rafael Mora, both very actively promoted policies for improving foreign relations, as can be seen in the annual presidential addresses to Congress. Meléndez (1981), page 160 and following.

30 "La posición geográfica de Centroamérica la hace hoy ponerse en roce continuo con todos los pueblos, y en especial con el más activo, emprendedor y arrojado que han conocido los siglos. Costa Rica se halla en medio de dos océanos, de dos istmos los más importantes para el comercio del globo […] La pujante y joven civilización del Norte de la America, asimiladora, absorbente, expansiva e impetuosa, choca […] con la añeja civilización colonial […] Si el espíritu de empresa de unos, el de anexión de otros y el de rapiña de muchos, puede envolver un peligro inminente para nosotros, quién puede disimularse que el más grave y terrible riesgo consiste en la desunión […] en la falta de comunicación, de población y adelantamientos políticos y sociales de nuestras precarias nacionalidades? Los pueblos que no progresan, sucumben". J. R. Mora, as quoted in Meléndez (1981), p. 201.

31 The checkered history of building the canal across the Isthmus and of the failures before success was finally achieved by the conclusion of the Panama Canal in 1914 has been detailed by various authors. See for instance McCullough (1977) and Castillero et al (2004).

32 See Bedoya (2012).

33 In a panflet published to attract investors to finance a colonization scheme in Golfo Dulce, Lafond de Lurcy the statement is made that the author had met with and obtained support for this project from Emperor Napoleon III, the Minister of Marine and the commander of the French Pacific Squadron. Lafond (1856), p. 7.

34 US Congress (1860).

35 Shulman (2007), pp. 67-70, 96-111.

36 Shulman (2007), pp. 118-121.

37 After the Golfo Dulce, the USS Ranger during 1885 continued surveying various harbors in Costa Rica, including Gulf of Nicoya, Ballena Bay, Murcielago Bay, Punta Uvita, Juanilla Bay, Piedra Blanca Bay, Port Elena, Puntarenas anchorage, Potrero and Braxilito bays and Port Culebra. The ship involved in the attempt was the USS Adams. Barrantes (2014), pp. 130-134.

38 In 1936 the United Fruit Company contracted with the Government the establishment of one of its large banana plantations, located in the area of the Golfo Dulce, and the company made full use of the port of Golfito for the export of millions of tons of bananas between 1941 and 1974. Today the peninsula of Osa, bordering the Golfo Dulce, is largely a conservation area and recognized as one of the world's richest natural reserves, as well as the site of one of the very few tropical fjords, becoming an important tourist attraction.

39 Isla del Coco, según los mapas existentes del Capitán R. McCartney Passmore y del Almirantazgo Yngles. 1899. Escala 1:5000. San José. Tipografía Nacional. Aside from the Belcher chart of 1838, the only other identified is: Ile des Cocos, Levée en 1889 par M. Le Chapeline et les officiers du Duquesne.

40 President Franklin Roosevelt visited Cocos in three different occasions in US Navy ships during the 1930's, being very fond of the excellent fishing found in its waters.

41 The detailed report contains 110 pages, see Fradin (1892).

42 Sabine (1841) provides information confirming the magnetic declination of measurements carried out and their correction by verifying the magnetic state of the compass needles used and making corrections to the calculations. Belcher's measurements over many years were used, and corrections made to positions for Panama (8° 37" N, 79° 29" W in 1837), Realejo (12° 28" N; 87° 12" W in 1838) and Isla del Coco (5° 53"N; 87° 02" W, measured both in April 1838 and March 1839).

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ANNEX

Annex I. WARSHIPS BELONGING TO MAJOR NAVAL POWERS ON THE COAST OF CENTRAL AMERICA 1822-1882

Year	Dates	Type	Flag	Name	Captain	Coming from	Going to	Activities
1822	2-2 en Panamá 8-3 en Acapulco	20 gun sixth rate (1814-1825)	Inglesa	Conway	Basil Hall	Callao-Guayaquil	Galápagos, Panamá, Costa de CA y Acapulco	Experimentos (*) con el péndulo invariable de Kanter en el Ecuador, Islas Galápagos. Primer barco de guerra inglés en entrar a Acapulco
1837	29-1 a 15-3	Sloop	Inglesa	Sulphur	Belcher	Guayaquil	Al mar	Reconocimiento de la bahía de Panamá (junto con HMS Starling)
	15 a 28-3	Sloop	Inglesa	Sulphur	Belcher	Panamá (Taboga)	Corinto	Recorrido costa de Panamá y Costa Rica
		Sloop	Inglesa	Sulphur	Belcher	Realejo- La Libertad	Mazatlán	Recorrido costa de Nicaragua y El Salvador
1837	27-nov	Fragata	Inglesa	¿?		Guayaquil	Ptos. C.A.	
1838	19-1 a 20-2	Sloop	Inglesa	Sulphur	Belcher	Acapulco	Realejo	Recorrido de costa Huatulco, Tehuantepec, costa de Guatemala, Sonsonate
1838	20-2 a 25-3	Sloop	Inglesa	Sulphur	Belcher	Realejo	Bahía Culebra	Reconocimiento del Golfo de Papagayo, San Juan Sur y Bahía Culebra (con Victoria)

1838	27-3 a 15-4	Sloop	Inglesa	Sulphur	Belcher	Bahía Culebra	Isla del Coco y Callao (*)	Reconocimiento de Isla del Coco
1838	30-nov	Corbeta de 26 cañones	Inglesa	Imogene	W. Bruce	Callao	San Blas	
1838	5-10 a 8-1	Sloop	Inglesa	Sulphur	Belcher	Guayaquil y Panamá	Realejo y Conchagua	Reconocimiento de Realejo
1838-1839	8-1 a 17-1	Sloop	Inglesa	Sulphur	Belcher	Realejo	Puntarenas	Reconocimiento del Golfo de Nicoya
1839	17-1 a 30-4	Sloop	Inglesa	Sulphur	Belcher	Puntarenas	Panamá	Reconocimiento de Bahía Honda, río Santiago, Quibo
1839	6-7 abril	Sloop	Inglesa	Sulphur	Belcher	Panamá	Isla del Coco , Clipperton Rock y Oahu	Segunda visita a Isla del Coco
1843			Francesa	La Melanie	A. Maire			Direcciones para los puertos de CA, desde Cabo de Hornos
1846	1-3 a 16-4		Inglesa	Hearld	Kellet	Buenaventura	Panamá y Juan de Fuca	Reconocimiento de bahía de Buenaventura y en Panamá reabastecimiento
1847	17-1 a 30-4		Inglesa	Hearld	Kellet	Acapulco	Panamá	Reconocimiento de la bahía de Panamá y Darién
1842	02-oct	Corbeta	Inglesa	Champion	E. Briscoe	La Unión	Realejo	

1847	07-ene	Corbeta	Inglesa	Calypso			Ptos. C.A.	
1847	20-nov	Bergantín	Francesa	Le Génie			Istapa	
1847	24-nov	Vapor	Inglesa	Lampson			Realejo	
1848	12-mayo/	Bergantín	Francesa	Le Génie		Realejo	Istapa	
1849	16 a 19-11	Vapor	Inglesa	Gorgon		La Unión	Panamá	
1850	08-mar	Corbeta de 28 cañones	Francesa	Serieuse		Panamá		
1850	41347	Navío de 84 cañones	Inglesa	Asia		Panamá	Realejo	
1851	26-mar	Vapor	Inglesa	Gorgon		Ptos. C.A.		
1852	11/04/	Corbeta	Francesa	Brillante		San Juan Sur	Costa de Pen. de Nicoya	Misión hidrográfica francesa costa norte
1852	22-may	Corbeta	Francesa	Brillante		Golfo Dulce		Reconocimiento del Golfo Dulce
1854	11-feb	Corbeta de 20 cañones	Francesa	Obligado		Golfo Dulce		Reconocimiento del Golfo Dulce
1856	09/02/	Corbeta de 30 cañones	Francesa	Ambuscade	M. Jasom	San Juan Sur	Perú	

1856	21-may	Corbeta de 30 cañones	Francesa	Ambuscade				
1856	31-5 a 30-6	Vapor	Inglesa	Brisk		Callao	Panamá	
1856	29 a 30-6	Corbeta de 30 cañones	Francesa	Ambuscade		Panamá	San Juan Sur	
1856	01-jul	Fragata	Inglesa	Havannah			Sandwich Is.	
1856	29-7 a 4-8	Corbeta	Francesa	Lavoisier		San Juan Sur		
1856	31-oct	Vapor de 24 cañones	Inglesa	Pearl				
1856	26-11 a 3-12	Navío de 84 cañones	Inglesa	Monarch		Acapulco		
1856	26-11 a 3-12	Vapor de 24 cañones	Inglesa	Pearl		Panamá		
1856	23-12 a 1-1	Corbeta de 21 cañones	Inglesa	Esk		Panamá	Ptos. C.A.	
1856	27-dic	Bergantín	Francesa	Alcibiades		San Juan Sur		
1857	14-ene	Bergantín	Francesa	Alcibiades			Valparaíso	
1857	6-2 a 5-5	Corbeta (***)	EEUU	Saint Mary's	Davis	San Juan Sur		Evacuación de filibusteros de W. Walker de Nicaragua
1857	27-2 a 6-3	Corbeta de 21 cañones	Inglesa	Esk		San Juan Sur	Panamá	
1857	30/05/	Corbeta de 30 cañones	Francesa	Ambuscade	Gisolme	San Juan Sur	Panamá	
1857	26-5 a 15-7	Bergantín de 14 cañones	Chilena	Ancud	Williams	Valparaíso	Callao	Misión Astuaburaga¿?
1857	28-jun	Corbeta de 22 cañones	EEUU	Decatur	Thatcher	Panamá		
1857	-12	Vapor	Inglesa	Magicienne	Vansittart			
1858	08-feb	Fragata	Francesa	Perceberante			Panamá	
1858	11-dic	Vapor de 6 cañones	Inglesa	Vixen			San Juan Sur	
1859	14 a 23-1	Corbeta de 28 cañones	Francesa	Serieuse		Panamá		
1859	24-3 a 13-4	Fragata de 52 cañones	Francesa	Andromeda		Panamá	San Juan Sur	
1859	21/04/	Vapor de 6 cañones	Inglesa	Vixen			San Juan Sur	
1859	25-abr	Fragata	Inglesa	Havannah			Al mar	
1859	30-4 a 16-5	Vapor de 6	Inglesa	Vixen		San Juan Sur		

		cañones					
1859	11/05/	Corbeta de 18 cañones	EEUU	Cyane	San Juan Sur		
1859	26-5 a 1-6	Vapor de 6 cañones	Inglesa	Vixen	Realejo		
1859	21/06/	Corbeta de 22 cañones	Francesa	Constantine	Valparaíso		
1859	04-jun	Corbeta de 20 cañones	Inglesa	Havannah		Al mar	
1859	11-6 a 5-7	Corbeta de 18 cañones	EEUU	Cyane	B. Honduras		
1859	14-jun	Corbeta	Inglesa	No dio nombre	¿?		
1859	30-jun	Corbeta de 20 cañones	Inglesa	Havannah		Al mar	
1859	22 a 31-7	Corbeta de 22 cañones	Francesa	Constantine	Realejo		
1859	28-7 a 23-8	Corbeta de 28 cañones	Francesa	Serieuse	Callao	Al mar	
1859	11-ago	Corbeta de 18 cañones	EEUU	Cyane	Realejo		

1859	10/10/	Corbeta de 18 cañones	EEUU	Cyane	San Juan Sur		
1860	17/02/	Corbeta de 18 cañones	EEUU	Levant	San Juan Sur	Realejo	
1860	14-abr	Corbeta de 18 cañones	EEUU	Levant	Pta. Icacos, Realejo		
1860	-10	Corbeta	EEUU	Saint Mary's	W. Porter	Golfo Dulce	Reconocimiento hidrográfico completo del Golfo Dulce, posible base naval (****)
1862	20-feb	Corbeta de 28 cañones	Francesa	Galatea	Golfo de Fonseca		
1862	24 a 27-12	Corbeta de 5 cañones	EEUU	Narraganset	Panamá	Ptos. C.A.	
1863	06-sep	Goleta de 2 cañones	España	Virgen de Covadonga	Panamá	Corinto	Formaba parte de la expedición científica española a América 1861-1865
1863	13/09/	Goleta de 5 cañones	EEUU	Saginaw	Realejo	Al mar	
1863	03/11/	Goleta de 5 cañones	EEUU	Saginaw	Panamá	La Unión	
1863	15-nov	Bergantín de guerra	El Salvador	Experimento			

1863	24 a 26-11	Vapor de 35 cañones	Inglesa	Sutlej	La Unión	Panamá	
1864	14-dic	Bergantín de guerra	El Salvador	Experimento			
1867	02/05/	Vapor de 11 cañones	EEUU	Saranac	San Juan Sur		
1868	13 a 16-5	Vapor de 8 cañones	EEUU	Ossippee	Realejo	Al mar	
1868	13 a 17-6	Vapor de 4 cañones	Francesa	Lamotte-Piquet	Corinto	Al mar	
1870	24-may	Vapor de 4 cañones	Francesa	Lamotte-Piquet M. St Hilare	Paita		
1873	03/03/	Vapor de 11 cañones	EEUU	Saranac	Acapulco	Corinto	
1873	05/08/	Vapor de 18 cañones	EEUU	Benicia			
1875 -76	21-12 a 21-1	Nave de guerra	Francesa	L'Infernet	Panamá	Corinto	

1876	06/03/	Nave de guerra	Inglesa	Phantom	La Unión	Panamá	
1876	24 a 25-4	Vapor de 6 cañones	Inglesa	Amethyst	Panamá	San Juan Sur	
1876	09/05/	Vapor de 8 cañones	Francesa	Seignelay		Corinto	
1878		Vapor de 4 cañones	C.Rica	Irazú			
1878		Vapor de 6 cañones	Inglesa	Osprey			
1878		Vapor de 8 cañones	Francesa	Seignelay			
1878		Vapor de 9 cañones	Chilena	Chacabuco			
1878		Vapor de 4 cañones	C.Rica	Irazú			
1878		Vapor de 4 cañones	C.Rica	Irazú			
1878		Vapor de 12 cañones	EEUU	Alaska			

		cañones					
1879		Vapor de 4 cañones	C.Rica	Irazú			
1880-1881	29-2-80 a 11-6-81	Screw sloop (3rd rate)	EEUU	Adams	San Francisco	San Francisco	Reconocimiento del Golfo Dulce, para su uso como puert carbonero
1881-1889		Survey Vessel	EEUU	Ranger			Durante 7 años realizó trabajo hidrográfico en la costa Pacífica de CA
1881	08-ene	Vapor de 4 cañones	C.Rica	Irazú	Del mar		
1881	13 a 18-6	Vapor de 6 cañones	EEUU	Adams	Panamá	Al mar	
1881	24 a 25-11	Corbeta de 12 cañones	Inglesa	Thetis	Corinto	Panamá	
1882	18-mar	Corbeta de 8 cañones	Francesa	Elaicreur	San José de Guatemala		
1882	11-jun	Corbeta de 6 cañones	Inglesa	Kingfisher	Panamá		
1895-96		Cañonera	EEUU	Bennington			Levantamiento hidrográfico de la Bahía de Jiquilisco (#)

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(*) Resultados publicados en los Philosophical Transactions of the Royal Society de 1823. Hall (1824/1920), p. 215.

(**) "3 Jun 1838, arrived Callao, after a passage of 74 days, the last 4 being without bread and flour, where the Imogene and Harrier, along with the

French vessels Andromede, 60, and brig Alacrité, and the US vessel North Carolina, 80, and corvette Lexington, who were all watching the motions

of the belligerents, Peru and Chile, the Sulphur, Starling and Victoria undergoing a refit, and examined the possibly strategic Boqueron Passage."

(***) Obregón (1991), p. 348

(****).Costa Rica-Panama Arbitration. (1913). Documents annexed to the Argument of Costa Rica before the Arbitrator

(#)Gallardo, Roberto (2016). Patrimonio Cultural Marítimo de El Salvador. Registro de Pecios., pp 174 y 234.