

No. 20/02

Working paper

The risk of sargassum to the economy and tourism of Quintana Roo and Mexico

Luis Antonio Espinosa

Juan José Li Ng

February 2020



The risk of sargassum to the economy and tourism of Quintana Roo and Mexico

Luis Antonio Espinosa
BBVA Research

Juan José Li Ng
BBVA Research

Summary

This study makes an analysis, of economic variables and through the Big Data of acquiring business operations affiliated with the BBVA network, to determine the effects that could be attributed to excess sargassum on tourism activity in Mexico in 2019. From January to September 2019, there was a drop of -2.2% to -5.0% in hotel occupancy in Quintana Roo; however, domestic (+2.4%) and international (+0.1%) air passengers and cruise ship visitors (+7.8%) increased, and unemployment, underemployment and informality indicators were very similar to the previous year. The Big Data analysis for 2019 shows that: a) Cancún and the Riviera Maya had real contractions of economic activity of -1.8 and -3.3%, respectively, b) for the 2018-2019 end-of-year holidays, Easter and summer vacations Quintana Roo saw lower economic performances on average than other beaches in Mexico, and c) contractions in economic activity can be explained by the drop in retail sector sales and not by activities directly linked to tourism: the hotel sector (+5.3%), restaurants and prepared foods (+2.0%), travel agencies and websites (+2.5%) and other sectors had positive performances in real terms, and in some cases above the average of other beaches in the country. Thus, these results do not seem to support the hypothesis of a serious impact of sargassum on the tourism activity of Quintana Roo in 2019, either because it was not a relevant factor on tourist demand or because of the success of the mitigation actions.

Key words: sargassum, big data, tourism, environmental economic effects, public policy.

JEL classification: C55, L83, Q51, H50, Z38.

1. Introduction

The beaches of the Caribbean in Quintana Roo, where Cancún, Playa del Carmen, Riviera Maya, Cozumel and Tulum are located, are one of the favorite beach destinations in Mexico for both domestic and international tourists. Between 2018 and 2019, thousands of tons of sargassum arrived on the coasts of Quintana Roo. This floating macroalgae, mainly composed of the species *Sargassum natans* and *Sargassum fluitans*, serves as habitat for marine animals, fertilizes the sand dunes and protects the stability of the coasts, in addition to its various industrial uses as marine product (Optical Oceanography Lab, 2019a).

However, excessive quantities on beaches can cause many problems and must be removed. The sargassum covers beaches in a brown color, its decomposition emits an unpleasant odor and attracts insects, and can cause serious environmental problems (it affects the reproduction of turtles and increases the mortality of fish) and economic (it decreases fishing activity and tourism). This has caused concern in the business sector, as well as within local, state and federal governments, about the consequences of the damage to the emblematic image of these beaches (turquoise waters and clear sands) and the effect of this on the tourism activity of the region (Optical Oceanography Lab, 2019a; Robledo & Vázquez-Delfín, 2019).

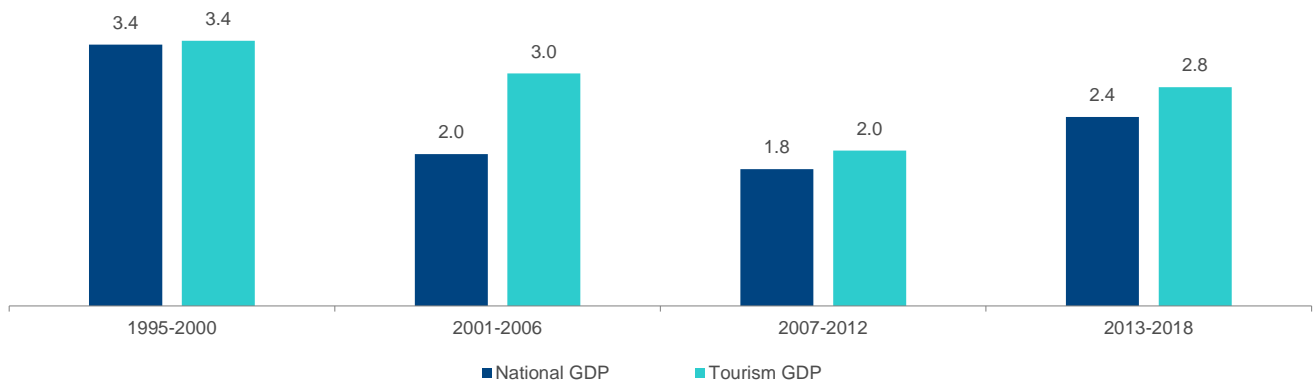
This study seeks to contribute data on whether the excess sargassum during 2019 had an effect on the economy and the tourism sector in the state of Quintana Roo and Mexico. The second section begins by describing the economic importance of tourism in Mexico and, in particular, for the economy of Quintana Roo. Following this, the third section presents the main facts and actions of public policy carried out during the arrival of sargassum in the 2015-2018 period and in greater detail for the year 2019. In the fourth section, we investigate whether there was a correlation between public interest and the amount of sargassum that reached beaches in the Mexican Caribbean, and examine the possible effects on the variables of tourism and economic activity in Quintana Roo in 2019, which could possibly be attributed to sargassum.

The fifth section describes the methodology for analyzing the potential effects of sargassum in Quintana Roo using Big Data. Operations in acquiring businesses affiliated with the BBVA network in Mexico are analyzed for three vacation periods in 2019: end-of-year holidays, Easter and summer vacation. The figures are presented against similar periods in 2018 and are used as a comparison group to the average performance of the other 10 main beach destinations in Mexico that were not exposed to the problem of sargassum. The sixth section shows the results of the Big Data analysis in aggregate form, for the three main vacation periods and by sector of economic activity; and finally, the last section presents the conclusions.

2. The importance of the tourism sector for Mexico and Quintana Roo

At present, the economic activity of tourism in Mexico plays a significant role. According to the Tourism Satellite Account of Mexico, the Gross Domestic Tourism Product (GDPT) reached \$1,541 billion pesos in 2018 (base 2013), which represented 8.7% of national GDP, with the accommodation services sector (28%) having the greatest weight within the GDPT. Tourism has been a dynamic sector for the Mexican economy with average real growth, between 2001 and 2018, higher than national GDP. In 2018, GDPT grew 2.2% in real terms (Inegi, 2019).

Figure 1. **Average annual rate of real national GDP growth and Tourism GDP in Mexico, 1995-2018**



Note: The 2018 data are preliminary.
Source: BBVA Research based on data from Inegi, System of National Accounts.

In terms of employment, economic activities related to tourism (accommodation services, passenger transportation services, sports and recreational services, travel agencies, tourism trade, etc.) reported about 2.3 million people in paid employments, representing 6.0% of total paid jobs in Mexico in 2018 (Inegi, 2019).

Sánchez Flores (2016) points out that Quintana Roo is the state where tourism contributed more to economic growth, it is estimated that this sector explained 21% of real growth of its state GDP between 2004-2012. Between 1993 and 2000, the tourism sector in Quintana Roo contributed about 34% of the foreign exchange that entered the country (Lozano Cortés, 2002). For 2017, the Secretariat of Tourism of Quintana Roo (Sedetur) estimated that this sector left an economic income of \$8.81 billion dollars, equivalent to 45.9% of total foreign exchange received by Mexico from international tourists in that year, which was \$19.18 billion dollars (Banco de México, 2019; Sedetur, 2017).

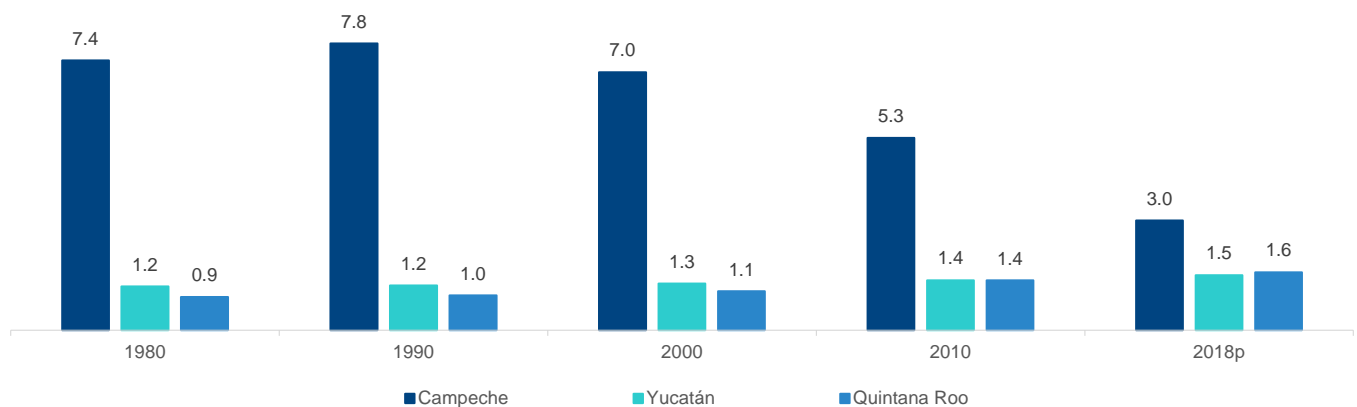
In the last 40 years, Quintana Roo has increased its percentage share with respect to Mexico's GDP, from 0.9% of the national GDP in 1980 to 1.6% in 2018 (Inegi, 2019a), positioning itself as the most dynamic state in the Yucatan Peninsula. This rapid economic growth, driven by tourism, attracted a significant flow of internal migration to Quintana Roo. In 2015, 53% of the state's population were born in another federal entity, mainly from: Yucatan, Tabasco, Veracruz, Chiapas and Mexico City (BBVA Bancomer Foundation, BBVA Research, & Conapo, 2017).

The tourist activity in Quintana Roo emerged from the impulse that the federal government gave to this sector in the 1970s. Cancún, Quintana Roo, is the most successful case of the government's five Integrally Planned Center development projects (CIPs) (the other four being Los Cabos, Ixtapa, Huatulco and Loreto). The selection of this site was the result of its strategic location, the gateway to the Caribbean Sea and the Mayan region, its proximity to the United States market, and the beauty and quality of its natural attractions (Sector, 2006). Through the concentration of resources from programs to promote economic development in Latin America of the Inter-American Development Bank (IDB) and the resources of the National Tourism Fund (Fonatur), created by decree in 1974, planned tourism development in Mexico was promoted.

The main objectives of the Cancún CIP were: to develop the region's economy, to create jobs for the local population and to generate foreign exchange for the country. The impact of tourism on the economic structure of Quintana Roo was radical, placing the tertiary sector as the main engine of development (Daltabuit, Cisneros, & Valenzuela, 2007). Over the course of four decades, the population of this municipality exceeded that of the state capital (Chetumal), and now has more than half a million inhabitants with intensive tourist activity (Aldape, 2010).

Today, Cancún is a global benchmark as a region that developed through tourism economic activity. According to World Travel & Tourism Council (WTTC) data, 49.6% of GDP of Cancún comes from the tourism sector, occupying first position among the top 72 cities in the world with high dependence on the tourism sector. In addition, the study reveals that 37.7% of jobs in Cancún are directly related to tourism economic activity (WTTC, 2018).

Figure 2. **Percentage share of states of the Yucatán Peninsula in GDP of Mexico, 1980-2018**



p/ preliminary.

Source: BBVA Research based on data from Inegi, System of National Accounts.

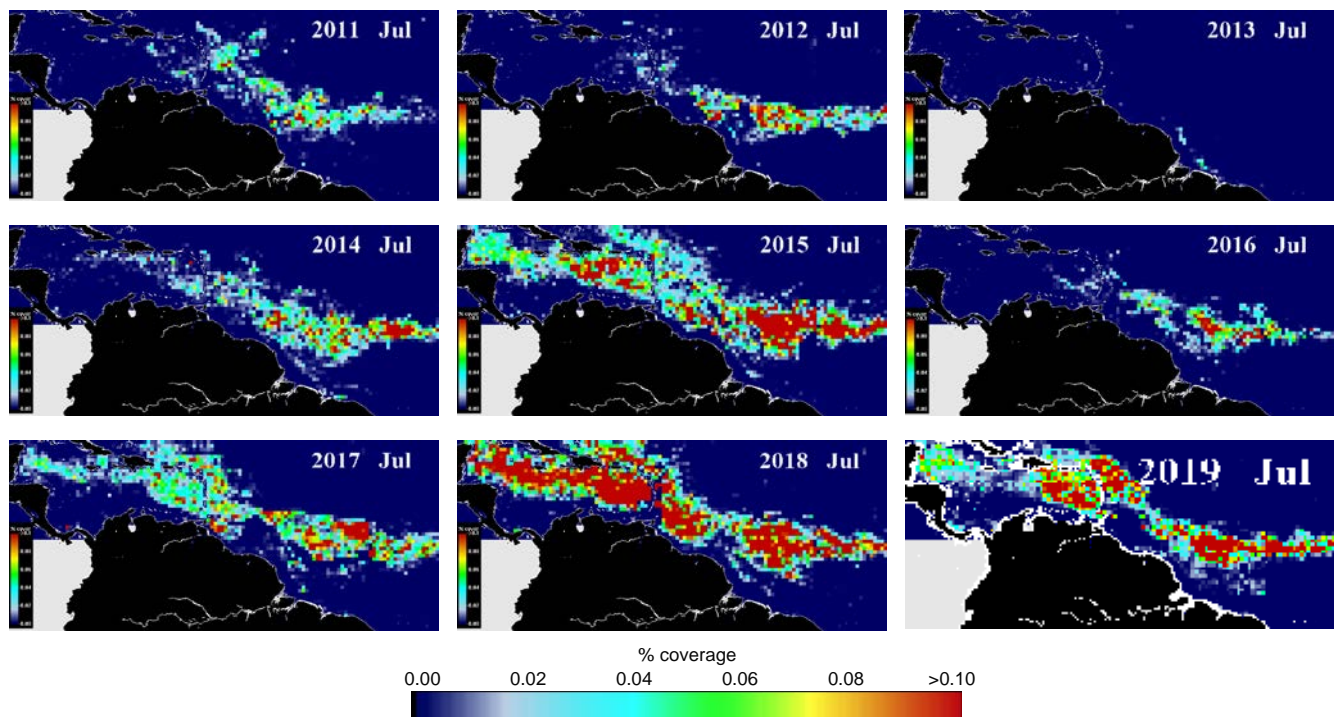
3. Sargassum's arrival on the beaches of the Mexican Caribbean

3.1. The arrival of sargassum, 2011-2018

Sargassum is not new, its existence has been recorded at least since Christopher Columbus voyaged through the Caribbean Sea. Through a MODIS (Moderate-Resolution Imaging Spectroradiometer) satellite image analysis between 2000 and 2018, academics at the University of Florida discovered a rapid and enormous bloom of sargassum since 2011, which they named the "Great Atlantic Sargassum Belt." In the summer of 2018, this large mass formed a belt 8,850 km long with an estimated weight greater than 20 million tons that extended from West Africa, crossing the Central Atlantic Ocean through the Caribbean Sea, all the way to the Gulf of Mexico (Wang et al., 2019). Figure 3 shows a representation of the sargassum coverage.

On the beaches of Quintana Roo, there are records of sargassum blooms going back to at least 2011 (Franks, Johnson, & Ko, 2016). However, it was with the bloom of 2015 that it became a topic of national interest that motivated various actions of the local and federal government, as well as individuals and society, to continue providing tourists with clean beaches free of sargassum (Aguirre Muñoz, 2019; Presidency of the Republic, 2015; Varillas, 2015a).

Figure 3. **Percentage of sargassum coverage on the surface of the Caribbean Sea and Gulf of Mexico via MODIS satellite images, for the month of July, 2011 to 2019**



Source: University of South Florida, Optical Oceanography Laboratory.

In 2015, the federal government allocated resources from the Temporary Employment Program (PET) of 12 million pesos to address the problem and then made a second investment of 150 million pesos that was channeled back into the PET and for machinery and equipment support for the removal of sargassum (Semarnat, 2015; Sectur, 2015). Furthermore, guidelines were issued for the cleaning and collection of sargassum from the beaches by the Secretariat of the Environment and Natural Resources (Semarnat), in which the use of light machinery is established for the collection (to protect the fauna) and the depositing of the sargassum on two sand banks provided by the state government for this use (Varillas, 2015b).

In 2018, another unusually large sargassum bloom was reported on the beaches of the Mexican Caribbean during the spring and summer (Semarnat, 2018a). 2018 was the year with the largest presence of sargassum in the Caribbean Sea and the Gulf of Mexico since 2011 (Optical Oceanography Lab, 2019c). Some of the most significant actions to deal with the problem of the arrival of sargassum are:

- The installation of a working group made up of representatives of the federal, state and municipal governments and the business sector to support projects that seek to address the problem (Semarnat, 2018a).
- The development of the "implementation of emerging actions for the cleaning, collection and final disposal of the sargassum of the coasts of Quintana Roo 2018" plan of the government of the state of Quintana Roo with an approximate cost of 62 million pesos (Semarnat, 2018b).

The Quintana Roo government reported that in 2018, 522,226 tons of sargassum were collected from beaches and coastal areas, with an investment of 332 million pesos (Government of Quintana Roo, 2019). However, despite the collaboration of the federal and state government, the private sector and other sectors of society in the actions and investment aimed at this problem, the general assessment by entrepreneurs of the manner and speed with which the problem was addressed was not positive (SIPSE, 2018). In addition, researchers at the National Autonomous University of Mexico (UNAM) warned of great dangers and damage to ecosystems as a result of not addressing the problem using a truly comprehensive strategy (Rivera, 2018).

3.2. The sargassum problem in 2019

During the first months of 2019 there was almost no sargassum bloom on the beaches of the Mexican Caribbean. In these months, different federal units together with the state government of Quintana Roo, private sector and academia formulated plans to face the upcoming sargassum season for the year (UNAM Newsletter, 2019; Semarnat, 2019a). In April, although reports already showed significant volumes of sargassum in the Atlantic Ocean threatening the beaches of Quintana Roo, they remained free of macroalgae during the Easter vacation period (NITU, 2019; Optical Oceanography Lab, 2019b). It was not until the end of April that the first large quantity of sargassum was recorded in Tulum and Playa del Carmen (El Financiero, 2019a, 2019b).

In the month of May, tensions grew due to stress caused by the sargassum. The Quintana Roo government announced that it would immediately allocate 15 million pesos to address the problem and requested 405 million pesos from the federal government at the end of April to initiate a comprehensive strategy (resources that were not granted), and announced that the municipalities had funds to finance the cleaning of the beaches (Caballero, 2019; CGC Quintana Roo, 2019; Varillas, 2019). The private sector estimated that the cost of cleaning up the sargassum would be high, around 800 million pesos, and warned about the fall in hotel occupancy that would result (Águila Arreola, 2019). For its part, the federal government appointed the Navy Secretariat (Semar) to coordinate the actions of the three levels of government, which in the middle of the month began "Operation Sargassum 2019" with actions such as: The deployment of containment barriers and networks, helicopter overflights and training conferences (24 Hours, 2019; Notimex, 2019). Meanwhile, Josefa González Blanco resigned as the head of Semarnat (Gómez, 2019).

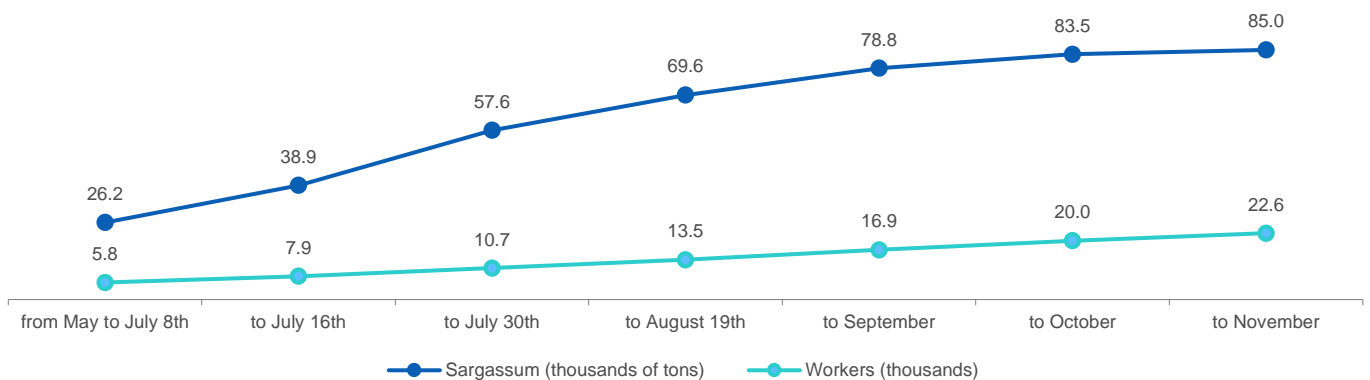
In June, the federal government announced the allocation of 52 million pesos to address the sargassum bloom, resources that would be administered by Semar. In this regard, President Andrés Manuel López Obrador, who took office in December 2018, said that the sargassum was a minor problem. The resources would go toward the construction of four "sargaceras" (boats to clean up the sargassum) at a cost of 24 million pesos, the purchase of a sweeper for 5.5 million pesos, sargassum retaining barriers for 14.5 million, as well as materials and equipment to support "Operation Sargassum 2019" (Presidency of the Republic, 2019).

During the summer vacation period, tensions also arose regarding the sargassum situation. Although Semar periodically announced by official means the advances in the collection and containment of sargassum (Semar, 2019a, 2019b, 2019c, 2019d, 2019e) and Semarnat published the "Technical and Management Guidelines for Contingency Care caused by Sargassum in the Mexican Caribbean and the Gulf of Mexico" which replaced those published in 2015 (Semarnat, 2019), hotel and tourist guilds reported that the problem continued, although they agreed that there were staff working to remove the algae (Ureste, 2019).

It is estimated that in July 2019 there was more than 10 million tons of sargassum in the Caribbean Sea and the Gulf of Mexico, similar to the quantity observed in July 2015 (11 million tons), but less than that posted for the same month of 2018 (more than 17 million tons) (Optical Oceanography Lab, 2019c).

On October 16, President López Obrador announced that the beaches were already free of macroalgae, marking the end of the 2019 sargassum season (Urrutia & Muñoz, 2019). From May to November 2019, Semar reported that, with the coordination of the three levels of government, concessionaires and society, 85,000 tons of sargassum were collected with the participation of 22,600 people (Semar, 2019e).

Figure 4. **Cumulative numbers of collected sargassum and workers involved, 2019**
(thousands of tons and thousands of workers)



Note: The statistics refer to figures accumulated since May. The number of workers involved refers to the total number of people who worked in Operation Sargassum 2019 coordinated by Semar.

Source: BBVA Research based on Semar reports.

4. Economic perception and effects of sargassum

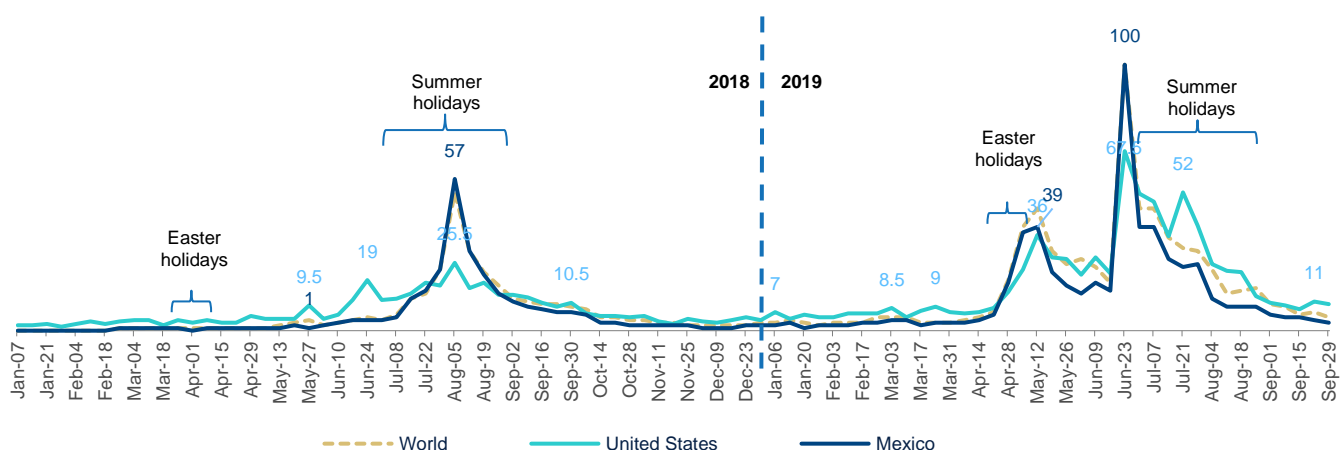
4.1. Sargassum in the public interest

By means of the tools for monitoring trends of topics on the Internet, it is possible to observe the evolution of the public's interest in sargassum. Figure 5 shows the relative interest rate of Google Trends for the topic of sargassum globally, for Mexico and for the United States (the main country of origin of international tourists to the beaches of Quintana Roo). In the period January 2018 to September 2019, June 25, 2019, was the day with the greatest interest (100 points) on the Internet for the topic of sargassum¹. We can see that in Mexico and on a global level there was more interest in the topic of sargassum in 2019 than in 2018. The main interest in the subject coincides for both years with the summer season, which seems to respond to a combination of two factors: Higher concentrations of sargassum due to the climatic conditions and the high season of tourism in these dates for the summer vacation period.

However, it should be noted that the "peak" points of greatest interest do not seem to respond to causes related to the increased presence of sargassum on the beaches. In 2019, the date on which the greatest interest was reached was June 25, which can be explained by the media coverage given to the presentation one day before the federal strategy for attention to the problem of sargassum and the declarations of President López Obrador alluding to an exaggeration of this issue.

According to the Cancún Sargassum Monitoring Network (2019), the period with the highest percentage of beaches with excessive concentration of sargassum during 2019 was between late April and early June, reaching excessive concentrations of sargassum in up to 50% of the beaches monitored in Quintana Roo. It is important to note that during this period there was relatively little interest on the Internet both in Mexico and in the United States on the issue of sargassum.

Figure 5. **Trends in the interest in sargassum on the Internet, 2018-2019**
(Relative interest index, 100 = maximum interest in the topic)

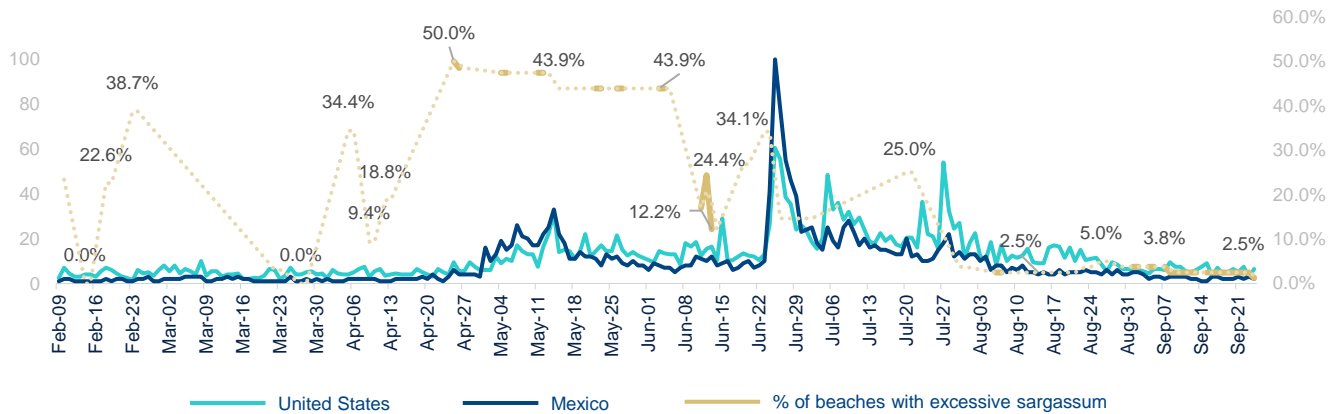


Source: BBVA Research based on Google Trends data.

¹Google Trends search for "sargassum" for Mexico and "sargassum" for the United States.

Figure 6. **Percentage of beaches with excessive sargassum accumulation and trends of interest in sargassum on the Internet, 2019**

(% of monitored beaches and relative interest index, 100 = maximum interest in the topic)



Source: BBVA Research based on data from the Cancún Sargassum Monitoring Network and Google Trends.

4.2. Possible economic effects of sargassum

The sargassum blooms on the beaches of the Mexican Caribbean have generated conflicting opinions. While the government, legislators and the tourism sector in Quintana Roo considered it a major problem, the federal government and the President of the Republic considered it a minor issue (Águila Arreola, 2019; Presidency of the Republic, 2019). In this section, we analyze different variables in order to determine whether the sargassum had economic effects in Quintana Roo in 2019.

Table 1. **Percentage of hotel occupancy in Quintana Roo beach destinations, January to September 2018 and 2019 (%)**

Month	Cancún and Puerto Morelos		Cozumel		Isla Mujeres		Riviera Maya	
	2018	2019	2018	2019	2018	2019	2018	2019
January	82.4	75.9	71.8	73.4	72.4	70.3	81.4	79.6
February	87.1	83.2	83.7	82.8	80.8	78.7	84.8	84.0
March	86.9	84.1	82.1	83.8	80.2	78.0	83.5	83.8
April	86.1	80.2	63.8	68.1	76.2	71.9	87.1	83.0
May	78.8	76.7	55.8	57.8	67.8	69.9	83.6	80.6
June	82.5	79.0	67.2	62.2	66.8	70.8	84.5	80.8
July	88.3	82.3	78.0	67.9	72.3	73.0	88.8	84.4
August	78.3	72.8	62.2	55.0	73.6	66.4	79.1	75.1
September	61.4	60.8	40.5	40.3	57.9	54.7	62.3	60.9

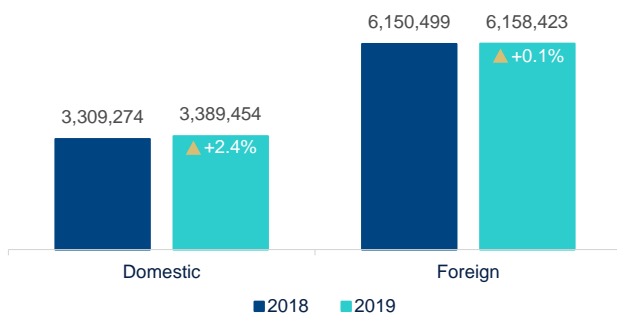
Source: BBVA Research based on data from the Secretariat of Tourism of Quintana Roo.

Hotel occupancy. According to the Quintana Roo Tourism Secretariat (Sedetur, 2019), hotel occupancy in the main beach areas of the state had negative growth rates from January to September 2019 compared to the same period in 2018. Cancún and Puerto Morelos had a fall in occupation of 5.0%, Riviera Maya of 3.1%, Cozumel of 2.3% and Isla Mujeres of 2.2%. In the specific case of Cancún and Puerto Morelos, a fall in occupation was observed in 2019 each month compared to 2018. It is difficult to know to what extent sargassum contributed to this drop in hotel occupancy. Espinoza (2019) indicates that it is not attributed to sargassum, but to the increasing volume of rooms available through applications such as Airbnb².

Domestic and international air passengers. Despite not being one of Mexico's most populated cities, Cancún has the second most important airport in the country due to tourist activity: It almost doubles the attended capacity of passengers from cities such as Guadalajara or Monterrey. Data from the Secretariat of Communications and Transport (SCT) indicate that, from January to September 2019, the arrival of domestic air passengers to Cancún increased by 2.4% in annual terms, an additional 80 thousand visitors, while the number of international air passengers, representing almost 65% of the total, increased marginally by 0.1% (SCT, 2019a).

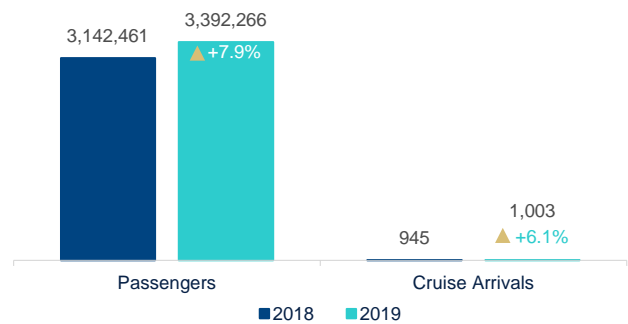
Arrival of cruise ships. Cozumel, in Quintana Roo, is the most important port for the arrival of cruise ships in Mexico. During the first nine months of 2019, there was a 6.1% increase in cruise ship arrivals at this port, from 945 to 1,003, which meant an annual increase of 7.9% more passengers who visited Cozumel, almost 250,000 more people from January to September (SCT, 2019b). Thus, the arrival data of passengers by plane and cruise do not seem to indicate a decrease in domestic and foreign tourists attributable to sargassum.

Figure 7. **Arrival of passengers at Cancún Airport, Quintana Roo, by passenger type, January to September 2018 vs. 2019**



Source: BBVA Research based on data from the Secretariat of Communications and Transport, Airports and Auxiliary Services.

Figure 8. **Arrival of cruise ships and number of passengers to the port of Cozumel, Quintana Roo, January to September 2018 vs. 2019**



Source: BBVA Research based on data from the Secretariat of Communications and Transport, General Directorate of Ports.

Visits to archaeological sites. In addition to beaches and the weather, Quintana Roo also offers archaeological attractions. On the one hand, it could be argued that they are a type of complementary or correlated assets, that is, the more people come to visit the natural attractions of the state, the more visitors to the archaeological sites would increase. On the other hand, with the arrival of the sargassum that affects the image of the Caribbean beaches, there could be an increase in consumption of substitute assets: people would spend less time on beaches and

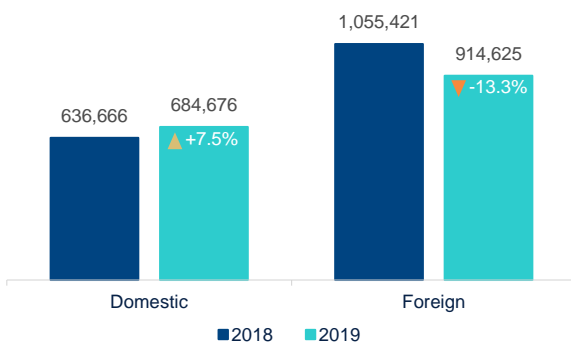
²Airbnb is the world's largest online platform that connects people who want to rent out their homes, apartments or rooms with visitors looking to stay.

water activities, and replace them with cultural activities, such as archaeological activities, leading to an increase in visits to these areas.

Tulum and Cobá are the two archaeological sites with the highest number of visits in Quintana Roo and occupy the third and fifth place at the national level. In both cases most visitors are foreign: 57% of the visitors in Tulum are international, while in Cobá the proportion rises to 80%. In the first nine months of 2019, the number of visitors to the archaeological zone of Tulum of national origin increased by 7.5% from the same period of the previous year, while the number of international visitors fell by 13.3%, equivalent to more than 100,000 visits. For the same comparison period, the archaeological site of Cobá showed a 0.3% contraction in the number of national visitors and a 1.2% reduction in international visitors.

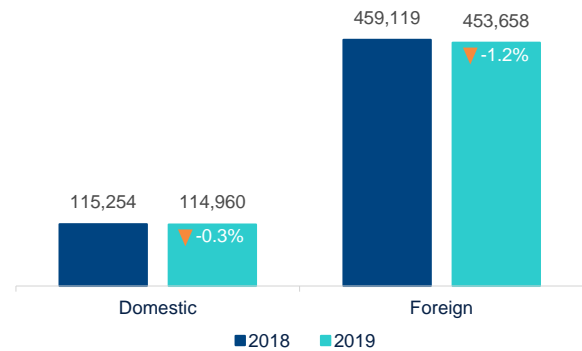
These data might suggest that the hypothesis of archaeological sites as substitute assets is not supported. In other words, the arrival of sargassum to the beaches of Quintana Roo, it would seem, does not make more tourists choose to increase their visits to archaeological sites in substitution of the benefits of enjoying the beaches and other water activities. The hypothesis of the archaeological sites as a complementary or correlated asset still stands, but further analysis would have to be made on this issue.

Figure 9. **Visits to the archaeological site of Tulum, Quintana Roo, by type of visitor, January to September 2018 vs. 2019**



Source: BBVA Research based on data from the National Institute of Anthropology and History.

Figure 10. **Visits to the archaeological site of Cobá, Quintana Roo, by type of visitor, January to September 2018 vs. 2019**



Source: BBVA Research based on data from the National Institute of Anthropology and History.

Employment indicators. Other economic variables analyzed are those relating to employment and occupation. The National Survey of Occupation and Employment (ENOE) is conducted quarterly and captures representative information for the main cities of the country, including Cancún. During the third quarter of 2019, the unemployment rate in Cancún was 4.2%, a point value higher than that observed in the same period of 2018, which was 3.5%; however, when considering the confidence intervals, the difference between these two years is not statistically significant. For the third quarter of 2019, it is noted that the underemployment rate increased from 4.1% to 4.6% but, similarly, the difference is not significant. Nor is it observed that in 2019 was there a significant increase in the informality rate due to the problem of sargassum; on the contrary, the point indicator decreased from 39.1% to 38.3% (Inegi, 2019a).

Figure 11. **Employment and occupation indicators for the metropolitan area of the city of Cancún, 2018q1 - 2019q3 (%)**



Notes: 1/ Percentage of the Economically Active Population (EAP) that is not working but is looking for work. This is the unemployment rate.
 2/ Percentage of the employed population that has the need and availability to offer more working time than their current occupation allows.
 3/ Informality 1 (TIL1). Proportion of the employed population that comprises the sum, without doubling, of employed persons who are occupationally vulnerable due to the nature of the economic unit for which they work, with those other employed persons whose employment relationship or dependence is not recognized by their source of employment. Thus, this rate includes—in addition to the component working in unregistered economic units or the informal sector—similar modalities, such as those employed in paid domestic service without social security, self-employed in subsistence agriculture, unpaid workers, as well as subordinate and paid workers working without the protection of social security and whose services are used by registered economic units.
 Source: BBVA Research based on data from Inegi, National Employment and Occupation Survey (ENOE), 2018-2019.

5. Analysis of the impact of sargassum on economic activity through Big Data

5.1. Timing and periods of analysis

Through the Big Data of the operations in acquiring businesses affiliated with the BBVA network in Mexico, indicators were obtained to be able to analyze in more detail the situation of the beach destinations in Quintana Roo. A comparison was made for the three major vacation periods in the country in the 2018-2019 cycle, with respect to what was observed in the previous period of the 2017-2018 cycle. The data were analyzed by date of operation.

For the Mexican population there are three important high-season vacation periods: end-of-year celebrations, Easter and summer. These periods are mainly defined for two reasons: 1) the traditions, customs and beliefs of Mexicans, and 2) the school calendar of basic education (primary and secondary level) that is observed at the national level. The following table shows the dates for each period of analysis, which were defined by considering the school calendar of basic education in Mexico (SEP, 2017, 2018, 2019). For the end-of-year and Easter vacation periods, a total of 16 days were taken, while for the summer holidays, the full months of July and August were used.

The data for the period outside of the holidays between January and June of each cycle are also presented as a basis for comparison; that is, excluding the days corresponding to the end-of-year and Easter holidays. Thus, in the 2017-2018 cycle data were analyzed from December 23, 2017 to August 31, 2018, while for the 2018-2019 cycle data refer to the period from December 22, 2018 to August 31, 2019.

Table 2. Dates for the analysis periods, 2017-2018 and 2018-2019 cycles

Period	Days	2017-2018 cycle dates	2018-2019 cycle dates
End-of-year holidays	16	From Saturday, December 23, 2017 to Sunday, January 7, 2018	From Saturday, December 22, 2018 to Sunday, January 6, 2019
Easter holidays	16	From Saturday, March 24, 2018 to Sunday, April 8, 2018	From Saturday, April 13, 2019 to Sunday, April 28, 2019
Summer holidays	62	July and August 2018	July and August 2019
Outside vacation periods from January to June	158 in 2018 and 159 in 2019	January to June 2018 excluding days during vacation periods	January to June 2019 excluding days during vacation periods

Source: BBVA Research.

5.2. Comparison scenario and geographical coverage

Following the review of the data available in the "Statistical Compendium of Tourism in Mexico" published by the Secretariat of Tourism (Sectur, 2019) and the daily hotel occupancy records of the Secretariat of Tourism of

Quintana Roo (Sedetur, 2019)³, it was decided to analyze the data grouped in the four main beach destinations of the state of Quintana Roo: Cancún, Riviera Maya, Cozumel and Isla Mujeres.

Ideally, a counterfactual scenario could be designed to make comparisons; however, the lack of accurate information and/or the many assumptions that would have to be made would make it impractical and beyond the scope of this article. This study explored a comparison scenario with certain desirable characteristics with respect to the demand for short-term tourism in 2019, such as: 1) the global demand for beach tourism, 2) Mexico's participation in global tourism, 3) variations in national demand by beach destinations, and 4) the differentiated patterns in terms of magnitude and periodicity of the seasonal effects by vacation period in Mexico's beach destinations.

It would be expected that if global demand for beach tourism increases/declines, both the economic activity on the beaches of Quintana Roo and the comparison group should increase/decrease. If Mexico's share of the world beach tourism market increases/decreases, it should increase/decrease activity on the beaches of Quintana Roo and on the other beaches of the country. If domestic demand for beach centers (e.g. associated with economic factors) increases/decreases, activity on the beaches of Quintana Roo and, in general, Mexico should increase/decrease. It should be noted that there are undoubtedly many factors that determine the changes in demand for beach tourism.

Taking these factors into account and considering Sectur data (2019), it was decided that the comparison scenario would be made up of the 10 main beach centers of Mexico outside Quintana Roo, hereinafter referred to as "10 other beach destinations." These 10 other beach destinations are: Acapulco, Huatulco-Puerto Escondido, Ixtapa Zihuatanejo, Los Cabos, Manzanillo, Mazatlán, Playas de Rosarito, Puerto Vallarta, Riviera Nayarit and Veracruz-Boca del Río. Map 1 shows the beaches selected for Quintana Roo and the comparison scenario.

Thus, the comparison group conforms to the weighted data of these 10 other beach destinations. This analysis structure aims to isolate external effects as much as possible. To avoid problems resulting from the particular seasonal patterns of each beach destination in Mexico, data are presented at annual rates of variation.

The Big Data does not have a field containing municipality keys or their exact names, but it does have a federative entity code, a text field describing the location of the operation and a zip code record. From these fields, an algorithm was applied to identify the municipalities that make up each beach destination to be analyzed. A detailed list of the municipalities can be found in the Annex.

The information presented refers to the operations of the acquirers registered in the municipalities indicated. It is worth mentioning that the location of the operation's establishment at the Point of Sale (POS) does not always coincide with the address recorded in the system because sometimes the fiscal address of an office or warehouse is recorded. In businesses with 100 or fewer employees, classified as micros, small and medium-sized businesses (MiSMEs, Inegi, 2015), it is more common for this coincidence not to be found; whereas in large businesses (more than 100 employees) the locations of the operation generally coincide with the one recorded in the system.

³The Secretariat of Tourism of Quintana Roo incorporates information on hotel occupancy from the following sources: Hotel Association of Cancún and Puerto Morelos, Hotel Association of Cozumel, Hotel Association of Central and Southern Quintana Roo, Tourism Directorate of the H. Municipality of Isla Mujeres and Tourism Promotion Council of Quintana Roo.

Map 1. **Selected beach destinations for analysis in Quintana Roo and in other states of Mexico**



Source: BBVA Research.

5.3. About Big Data

The study analyzed the operations carried out by acquiring businesses affiliated with the BBVA network of Mexico in the selected geographical boundaries. For the four beach destinations in Quintana Roo, the information comes from about 4,000 acquiring businesses that perform about 50 million POS operations per year. For the 10 other main beach destinations in Mexico, data were analyzed from nearly 7,000 acquiring businesses that perform more than 70 million POS operations per year.

Located in Quintana Roo, Cancún is the most important beach destination in terms of economic output in Mexico. On average, between 60 and 70 million pesos a day are processed in the acquiring businesses from the BBVA Mexico network. Second place is also located in Quintana Roo—the Riviera Maya has an average daily turnover of between 30 and 35 million pesos. Acapulco, Veracruz-Boca del Río and Los Cabos are the third most important beach destinations in the country in terms of the amount of operations carried out by acquirers.

The Big Data analysis presents information on the acquiring businesses of the BBVA Mexico Network on four variables:

- Total amount traded per day: the sum of the amount of all transactions made on a day adjusted to constant August 2019 prices.
- Daily operations: the number of POS transactions recorded in one day.
- Daily active businesses: this is the number of businesses that carried out at least one transaction at their POS during the day.
- Average transaction: the average amount of operations in constant pesos as of August 2019.

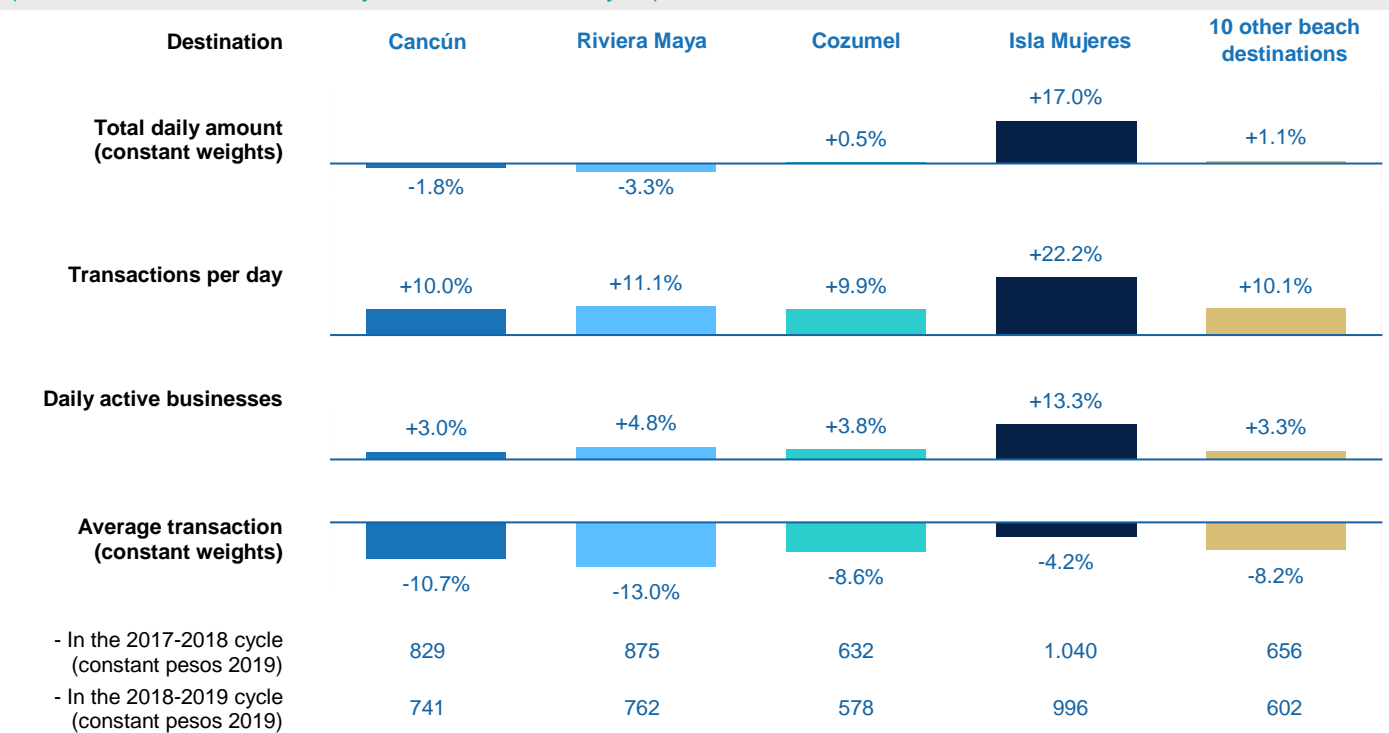
6. Big Data analysis results

6.1. Aggregate results: contraction of 2.0% in Quintana Roo in real terms for the 2018-2019 cycle, other beaches in Mexico increase 1.1% in real terms

We can see that the total amount recorded in acquiring businesses in Cancún recorded a decline of 1.8% in real terms in the 2018-2019 cycle, compared to the previous period, while the Riviera Maya presented a real contraction of 3.3%. Cozumel, meanwhile, had a real growth of 0.5% in its turnover, and Isla Mujeres reported an increase of 17.0% explained by a base effect, given that having a smaller economic sector becomes more sensitive to changes. It should be noted that Cancún and the Riviera Maya account for almost 95% of the turnover of acquiring businesses operating on these four beaches. If the weighted average is estimated, Quintana Roo showed a real contraction of 2.0% in the 2018-2019 cycle.

In the 2018-2019 cycle, the 10 other beach destinations in Mexico had an increase of 1.1% in the total amount invoiced in real pesos. This may indicate that the beach destinations of Quintana Roo had a lower economic performance compared to the other important beach destinations in the country. During this period, the beach destinations that registered real growth in acquiring business sales were Manzanillo (+13.3%), Playas de Rosarito (+12.5%), Puerto Vallarta (+5.3%) and Mazatlán (+4.6%). The other six beach destinations in Mexico recorded contractions in real terms, with the Huatulco-Puerto Escondido corridor (-13.3%) having the greatest fall.

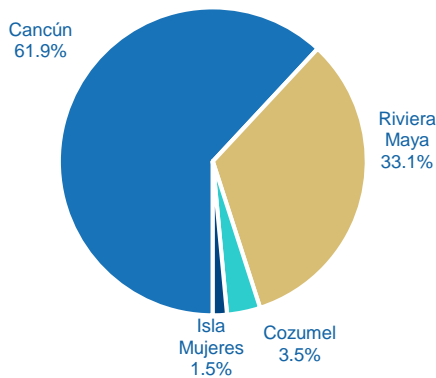
Figure 12. **Results of activity in acquiring business operations**
(Variation % real 2018-2019 cycle vs. 2017-2018 cycle)



Source: BBVA Research based on BBVA Big Data, data on transactions of acquiring businesses 2017–2019.

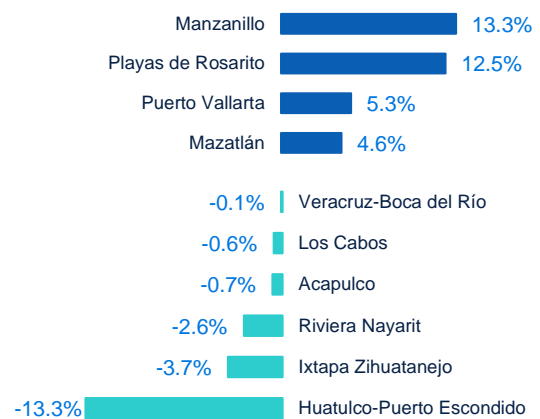
In beach destination municipalities, both nationally and in Quintana Roo, there was a weighted average growth of about 10% in the number of transactions in acquiring businesses and an increase from 3% to 5% in the average number of businesses operating. However, the average amount per transaction, in real terms, decreased 8.2% in the 10 other beach destinations in Mexico, decreased 10.7% in Cancún and contracted 13.0% in the Riviera Maya. For this latter destination, the average transaction went from 875 pesos in the 2017-2018 cycle to 762 pesos in real terms in the 2018-2019 cycle.

Figure 13. **Percentage distribution of the total amount registered in acquiring businesses of the four main beach destinations in Quintana Roo, 2018-2019 cycle**



Source: BBVA Research based on BBVA Big Data, data on transactions of acquiring businesses 2017–2019.

Figure 14. **Real growth in the total amount registered in acquiring businesses in the 10 other beach destinations in Mexico (% 2018-2019 cycle vs. 2017-2018 cycle)**



Source: BBVA Research based on BBVA Big Data, data on transactions of acquiring businesses 2017–2019.

6.2. Results by vacation period

End-of-year vacation period 2018 and beginning-of-year 2019 with mixed results in Quintana Roo: Cozumel increased 6.8% and Cancún decreased 1.4%

In this 16-day period from Saturday, December 22, 2018 to Sunday, January 6, 2019, the results were varied in the beach municipalities of Quintana Roo. As it is a cold season, it could be argued that there should be no effects on tourist activity arising from the arrival of sargassum on the Caribbean beaches.

The municipality of Cozumel had significant growth in the total amount of turnover in the acquiring businesses, increasing 6.8% in real terms during this vacation period, higher than the average of the 10 other beach destinations in Mexico, which recorded a real increase of 5.4%. Isla Mujeres and the Riviera Maya had more moderate increases of 2.8% and 2.6%, respectively, while Cancún recorded a contraction in the total amount of transactions of 1.4%.

Table 3. **Results of operations in acquiring businesses by vacation period**
 (Variation % real 2018-2019 cycle vs. 2017-2018 cycle)

Period	Total daily amount (constant pesos)	Transactions per day	Active businesses per day	Average transaction (constant pesos)
Cancún				
Outside vacation periods 2019	+0.1%	+10.9%	+3.0%	-9.7%
End-of-year holidays 2018-2019	-1.4%	+12.1%	+2.1%	-12.1%
Easter 2019	-3.2%	+6.4%	+2.4%	-9.1%
Summer 2019	-6.4%	+7.5%	+3.1%	-12.9%
Riviera Maya				
Outside vacation periods 2019	+0.4%	+12.6%	+5.5%	-10.9%
End-of-year holidays 2018-2019	+2.6%	+14.8%	+6.0%	-10.7%
Easter 2019	-8.1%	+8.6%	+4.5%	-15.4%
Summer 2019	-12.6%	+6.8%	+2.7%	-18.2%
Cozumel				
Outside vacation periods 2019	+2.3%	+11.5%	+5.1%	-8.3%
End-of-year holidays 2018-2019	+6.8%	+12.7%	+7.6%	-5.3%
Easter 2019	-7.0%	-0.0%	+0.1%	-7.0%
Summer 2019	-3.8%	+8.1%	+0.5%	-11.0%
Isla Mujeres				
Outside vacation periods 2019	+16.2%	+24.2%	+12.9%	-6.5%
End-of-year holidays 2018-2019	+2.8%	+14.3%	+3.3%	-10.1%
Easter 2019	+10.2%	+11.9%	+21.1%	-1.5%
Summer 2019	+24.5%	+21.4%	+14.6%	+2.5%
10 other beach destinations				
Outside vacation periods 2019	+2.8%	+11.0%	+3.6%	-7.4%
End-of-year holidays 2018-2019	+5.4%	+12.3%	+3.0%	-6.2%
Easter 2019	-2.3%	+8.4%	+2.7%	-9.9%
Summer 2019	-3.5%	+7.2%	+2.5%	-10.0%

Source: BBVA Research based on BBVA Big Data, data on transactions of acquiring businesses 2017–2019.

In general, activity in Mexico's beach destinations contracted during Easter Week 2019

In the Easter vacation period of 2019, in the main beach tourism destinations in the state of Quintana Roo and, in an aggregate way, in the other 10 beach destinations in the country, a contraction in real terms of the total amount of transactions in acquiring businesses was observed. In Cancún, the Riviera Maya and Cozumel showed real variations of -3.2%, -8.1% and -7.0% in this variable, respectively; whereas in the 10 other beach destinations in Mexico it was -2.3% on average. Thus, the beach destinations of Quintana Roo showed larger contractions than the average of other beaches in the country. In Isla Mujeres alone, which has relatively few acquiring businesses, there was an increase of 10.2%.

Poor performance for Mexican beaches during the summer of 2019: -3.5% real in total amount traded, -6.4% in Cancún and -12.6% in the Riviera Maya

Big Data's analysis for the summer of 2019 indicates that it was not a good year for beach destinations in Mexico. During the summer vacation period of that year, which covers the months of July and August, beaches generally performed worse than in 2018. On average, Mexico's 10 other beach destinations had an annual decline of 3.5% in the total amount traded in real pesos, and for the specific case of Quintana Roo destinations, larger contractions were recorded than at the national level.

The Riviera Maya reported a decrease of 12.6% in real terms in the total amount of transactions, compared to the same period of the previous year; while Cancún and Cozumel had decreases of 6.4% and 3.8%. Despite the increase in the volume of transactions on the beaches of Quintana Roo, these declines can be explained by greater contractions in the average amount per transaction in real pesos. Only Isla Mujeres showed a 24.5% increase in the total amount traded, explained by a base effect.

Real increases in activity at Mexico's beach destinations in the periods outside of the 2019 vacation period

On the days outside of the three main vacation periods in Mexico, data indicate that, on average, the other 10 main beach destinations in the country saw a real increase of 2.8% in 2019 compared to the previous year in the total amount traded in acquiring businesses. In the same period, Cozumel saw a real increase of 2.3% in the total amount, while Cancún and the Riviera Maya had real increases of 0.1% and 0.4%, respectively.

Thus, compared to the performance of the 10 other beach destinations in Mexico, we can see that the beaches of Quintana Roo had significant decreases in the total amount traded, mainly during vacation periods. These effects, in comparative terms, were greater during the summer vacation period of 2019 and, secondly, during the Easter holidays of that year.

However, it is important to note that the period with the greatest sargassum bloom on the beaches of the Mexican Caribbean was between the end of April and June 2019, which includes months outside the main vacation periods. During the Easter period there was almost no sargassum on the beaches of Quintana Roo (NITU, 2019), while during the months of July and August, which comprise the summer holidays, most of the beaches had low or moderate concentrations of sargassum (Cancún Sargassum Monitoring Network, 2019). Some selected newsletters on the monitoring of sargassum on the beaches of Quintana Roo are presented in the Annex.

Therefore, there is no relationship between the economic activity of tourism in Quintana Roo through the different vacation periods and the dates with the highest concentration of sargassum on its beaches.

6.3. Results by sector of economic activity

For the four beach destinations analyzed in Quintana Roo and for the main beaches in Mexico, tourism activity generates a large part of both direct and indirect jobs in the local economies. However, for the beach destinations of Veracruz-Boca del Río and Manzanillo, tourism is of lesser importance due to the size of other economic sectors such as services and port activity. In this regard, an analysis of the data disaggregated by the economic activities that could most be impacted by an external effect affecting tourism in the state of Quintana Roo is appropriate.

In "Economía y Turismo" (Economy and Tourism) by Mochón F. (2004), it is noted that the nature of tourism enterprises is very broad. The main types of companies are: passenger transportation, lodging, travel agencies and tour operators, food and beverages, recreational and sightseeing activities, and multiple peripheral services

(guides, car rental, craft sales, souvenirs, banking services, etc.); in addition to the other indirect activities that provide support to enterprises and the employed population in the tourism sector.

In this study, through Big Data, four economic activities directly related to tourism were analyzed: hotels, travel agencies and websites, car rental, and buses; and three sectors with a minor or indirectly related link: restaurants and prepared foods, self-service and departmental stores, and retail sales (sale of clothing, footwear, grocery stores, liquor stores, perishable goods, bakeries, cosmetics, books, electronics, etc.). The airline sector was not included because a significant portion of the airline tickets are purchased online (not at POS terminals) in the traveler's home city and/or via international travel websites. The cruise and ship sectors were not analyzed either.

Table 4. **Results of transactions in acquiring businesses by economic activity**
 (Variation % real 2018-2019 cycle vs. 2017-2018 cycle)

Economic activity	Total daily amount (constant pesos)	Transactions per day	Active businesses per day	Average transaction (constant pesos)
Quintana Roo (4 beaches)				
Hotels	+5.3%	+20.8%	+9.6%	-12.8%
Travel agencies and websites	+2.5%	-4.9%	-2.1%	+7.8%
Car rental	-52.7%	-15.3%	-4.4%	-44.2%
Buses	+155.1%	+113.9%	+6.2%	+19.3%
Restaurants and prepared food	+2.0%	+5.8%	+5.0%	-3.6%
Self-service and departmental	+9.2%	+18.0%	+7.6%	-7.4%
Retail sales	-21.2%	+7.9%	+2.9%	-26.9%
Other	+10.2%	+8.9%	+1.4%	+1.2%
10 other beach destinations				
Hotels	+1.0%	+1.1%	+3.8%	-0.1%
Travel agencies and websites	+12.2%	-10.2%	+0.3%	+25.0%
Car rental	-8.2%	-5.2%	-15.2%	-3.2%
Buses	+24.6%	+47.1%	+3.7%	-15.3%
Restaurants and prepared food	+3.3%	+7.3%	-1.4%	-3.7%
Self-service and departmental	+5.0%	+10.4%	-1.9%	-4.9%
Retail sales	-11.9%	+9.1%	+4.3%	-19.2%
Other	+18.8%	+19.6%	+6.4%	-0.7%

Source: BBVA Research based on BBVA Big Data, data on transactions of acquiring businesses 2017–2019.

When comparing the 2018-2019 cycle to the 2017-2018 cycle, in the 10 other beach destinations in Mexico the total amount traded in the hotel sector increased 1.0% in real pesos, driven by a 1.1% increase in the average number of daily transactions and a 3.8% increase in the number of trades. An external shock to a region's tourism would be expected to result in lower levels of activity in operations than the national average. The data present an opposite result, since the activity in hotels in Quintana Roo in the 2018-2019 cycle increased 5.3% in real terms the total amount of turnover, compared to the previous year. Although the average transaction decreased by 12.8%, there was a 20.8% increase in the total number of transactions and 9.6% in businesses that recorded at least one transaction a day.

In the other sectors directly linked to the tourist activity of the beaches of Quintana Roo, on the one hand, the increase of more than 150% in the total amount traded on bus tickets stands out. Possibly partly explained by an increase in the proportion of purchases using POS terminals rather than cash, but on the other hand, car rental recorded a contraction in the total amount operated of more than 50%. This last result would need to be analyzed in

more detail, given that in the other 10 beaches in Mexico the contraction was 8.2%. The activity of acquiring travel agencies and websites based in Quintana Roo had an increase of 2.5% in real terms in the period analyzed.

The restaurant and prepared food sectors on the beaches of Quintana Roo recorded a real increase of 2.0% in the 2018-2019 cycle, lower than the average observed in the other 10 beach destinations in Mexico, which was 3.3%, while self-service and department stores had a real increase of 9.2%, higher than the 5.0% presented by this sector in the 10 other beach destinations.

The data indicate that a significant contraction in retail stores occurred in real terms of 21.2% during the 2018-2019 cycle on the beaches of Quintana Roo. The number of retail stores and their transaction volume grew; however, each transaction was on average 27% lower compared to the previous year. It is possible that people continued to purchase goods in a growing retail market, but spent less on each visit compared to 2018. The increase in competition in this market, changes in consumption patterns and a substitution effect toward other sectors such as self-service, department stores and Internet commerce, could be reasons that explain in part this greater atomization in purchases in retail stores and the lower levels of total amounts invoiced. For the 10 other beaches in the country, a significant contraction of 11.9% in retail sector sales was also reported.

Thus, the drop at the aggregate level in the total amount operated on the four beaches of Quintana Roo during the 2018-2019 cycle can be explained by a contraction in the level of activity of retail businesses and not by the performance of economic activities directly linked to tourism, which grew in real terms in the aggregate.

7. Conclusions

In Mexico, the arrival of sargassum on the beaches of Quintana Roo has generated much controversy, due to its possible economic effects on the tourism sector. While the federal government thinks that it is a minor problem, the government and the private sector of this federative entity consider it to be a major problem, with high costs and economic losses.

In 2018, the tourism sector contributed 8.7% of national GDP and generated 2.3 million direct jobs, or 6.0% of the country's total paid jobs. This is why the issue of sargassum has become of great interest in Mexico between 2018 and 2019. The analysis of trends on the Internet and social media shows that interest in the subject increased during the hot Easter and summer vacation periods, when the macroalgae can be more prevalent; although the higher peaks can be explained by the media coverage of the government's presentations of strategies for dealing with the sargassum.

On the one hand, a fall in hotel occupancy from 2.2% to 5.0% in annual terms was observed between January and September 2019 on the main beaches of Quintana Roo (possibly attributed to increased competition from platforms such as Airbnb); on the other hand, passenger arrivals to Cancún airport grew, both domestic (+2.4%) and international (+0.1%), and tourists arriving by cruise ship to Cozumel port (+7.9%). The number of international tourists to Tulum, the most visited archaeological site in the state, decreased by 13.3%, but domestic tourists increased by 7.5%. With regard to the employment indicators, there were no statistically significant differences observed in the variations in the unemployment rate, the underemployment rate and the informality rate.

We attempted to better explain the results using the Big Data of the operations in acquiring businesses affiliated with the BBVA network in Mexico. We analyzed the economic performance of four beach destinations in Quintana Roo (Cancún, Riviera Maya, Cozumel and Isla Mujeres) during the three main vacation periods in Mexico for the 2018-2019 cycle: End-of-year holidays 2018 and beginning-of-year holidays 2019, Easter week of 2019 and summer of 2019. In order to contrast the information, a comparison group composed of 10 other beach destinations in Mexico, which are outside the area affected by sargassum, was compiled

Considering all sectors of economic activity, the Big Data analysis indicates that in the 2018-2019 cycle the total amounts traded by acquiring businesses in Cancún and the Riviera Maya had a real annual contraction of 1.8% and 3.3%, respectively. This can be mainly explained by a real 21.2% drop in the sales of acquiring retail businesses in the state of Quintana Roo. Thus, beach destinations in this state had a worse performance than the average of other beaches in Mexico, which increased 1.1% in real annual terms, driven by good results in Manzanillo, Playas de Rosarito, Puerto Vallarta and Mazatlán.

If the results are disaggregated by vacation period, it is again observed that the beach destinations of Quintana Roo had lower performances than the average of the other 10 beaches analyzed in Mexico:

- a) During the 2018 end-of-year and 2019 beginning-of-year holidays, it would be expected that there would be no significant effects of sargassum on economic activity in Quintana Roo due to the cold season. For this vacation period, data indicate that Cozumel had a real growth of 6.8%, higher than other beach destinations in the country (+5.4%), but the Riviera Maya (+2.6%) performed below the national average and Cancún contracted at 1.4%.
- b) During the Easter and summer holidays of 2019 there were real decreases in the other 10 beach destinations in Mexico, of 2.3% and 3.5%, respectively. The beaches of Quintana Roo showed greater economic contractions: Cancún (-3.2% and -6.4%, respectively), Cozumel (-7.0% and 3.8%) and the Riviera Maya (-8.1% and -12.6%) being the most affected.

It should be noted that the period with the largest amount of sargassum on the beaches was from the end of April to June 2019. During the 2018 end-of-year and 2019 beginning-of-year holidays and the 2019 Easter week holidays, minimal sargassum blooms were observed, while during the summer vacation period most of the beaches had low or moderate concentrations of sargassum, so it is difficult to attribute direct effects to the sargassum.

The analysis for economic activities related to tourism for the 2018-2019 cycle indicates that the total amount operated in the hotel sector increased in Quintana Roo by 5.4% in real terms, higher than the beaches in other states of the Mexican Republic which was 1.0%; while other sectors directly linked to tourism, such as travel agencies and websites, and buses had positive real growth. The restaurant and prepared food sector in Quintana Roo rebounded 2.0% in real terms, while self-service and department stores increased 9.2%.

In summary, the Big Data analysis for the 2018-2019 cycle indicates that the aggregate economic activity of Quintana Roo beaches had a worse performance than other beaches, but at the same time, the hotel sector, restaurants and prepared foods, travel agencies and websites, and buses had growth in real terms and in some cases higher than the average of other beaches in Mexico.

Thus, the results of the analysis of economic variables and Big Data do not seem to support the hypothesis of a serious impact on the tourism sector derived from the sargassum bloom during 2019. It is possible that, to some extent, the sargassum bloom has been a minor factor in the tourist demand for Quintana Roo beach destinations. Or perhaps, it is possible that the actions of containment and collection of sargassum by the different levels of government, private sector and civil society have been effective and managed to mitigate the negative effects of this macroalgae on Mexican coasts.

Fortunately for the beaches of the Mexican Caribbean, the latest satellite image records indicate that the sargassum bloom could be very low for 2020. On average, the presence of sargassum in 2019 in the Caribbean Sea and Gulf of Mexico was significantly greater than most years between 2001 and 2018; however, in the last quarter of 2019, there was a drastic fall to levels not observed in the last five years. The reasons behind this record bloom and the sharp decline since September 2019 have not yet been determined (Optical Oceanography Lab, 2019a, 2019d).

As noted in Wang et al. (2019), the "anomaly" of the great Atlantic Sargassum belt may become the new norm. Federal, state and local governments, along with the private sector, must have plans, actions and resources prepared to deal with the problem of sargassum in case it occurs in 2020 or the years that follow.

8. References

- 24 Hours. (May 31, 2019) SEDETUR reports on sargassum on the beaches of Quintana Roo. *24 Horas*. Retrieved from <https://www.24-horas.mx/2019/05/31/sedetur-informa-respecto-al-sargazo-en-las-playas-quintana-roo/>
- Águila Arreola, C. (May 6, 2019) The State Government takes over in the battle against sargassum. *La Jornada Maya*. Retrieved from <https://www.lajornadamaya.mx/2019-05-06/Gobierno-estatal-toma-las-riendas-en-el-combate-al-sargazo>
- Aguirre Muñoz, A. (2019) Sargassum in the Mexican Caribbean: from denial and volunteerism to reality. *Sustainability, Digital Gazette of the Interdisciplinary Center for Biodiversity and Environment, A.C. CeIBA, September (2)*.
- Aldape, P. (2010) The construction of a tourist space in Cancún, Quintana Roo, Mexico. *TDX (Doctoral Thesis in Xarxa)*.
- Banco de México. (2019) Balance of Payments. International Travelers Account. Retrieved from <http://www.anterior.banxico.org.mx/SielInternet/>
- UNAM Newsletter. (January 14, 2019) For 2019, a massive arrival of sargassum is expected in the Mexican Caribbean. *UNAM Newsletter*. Retrieved from https://www.dgcs.unam.mx/boletin/bdboletin/2019_027.html?fbclid=IwAR0D_sCba-qZA2CrhY9PljuihgdcnNZDepj_58DgVEx9Fs65wfQtsh40fB0
- Caballero, S. (May 6, 2019) Governor of QR asks municipalities to finance sargassum cleaning. *Proceso*. Retrieved from <https://www.proceso.com.mx/582741/gobernador-de-qr-pide-a-municipios-financiar-limpieza-de-sargazo>
- General Coordination of Communication of Quintana Roo [CGC Quintana Roo]. (May 5, 2019) The State Government implements the Emergency Protocol for Handling Sargassum in Quintana Roo. Retrieved from <http://cgc.qroo.gob.mx/implementa-gobierno-del-estado-el-protocolo-emergente-para-la-atencion-del-sargazo-de-quintana-roo/>
- Daltabuit, M., Cisneros, H., & Valenzuela, E. (2007). *Globalization and sustainability. Tourism in the south of Quintana Roo*. UNAM, Regional Multidisciplinary Research Center.
- El Financiero. (April 26, 2019a) They report massive arrivals of sargassum in Playa del Carmen. *El Financiero*. Retrieved from <https://www.elfinanciero.com.mx/peninsula/reportan-llegada-masiva-de-sargazo-en-playa-del-carmen>
- El Financiero. (April 29, 2019b) Sargassum patch reaches Quintana Roo coast. *El Financiero*. Retrieved from <https://www.elfinanciero.com.mx/peninsula/mancha-de-sargazo-prevista-llega-a-costas-quintanarroenses>
- Espinoza, A. (July 30, 2019). Quintana Roo hotels survive amidst sargassum and Airbnb. *Expansión*. Retrieved from <https://expansion.mx/empresas/2019/07/30/hoteles-en-quintana-roo-sobreviven-con-sargazo-y-competencia>
- Franks, J. S., Johnson, D. R., & Ko, D. S. (2016). Pelagic Sargassum in the Tropical North Atlantic. *Gulf and Caribbean Research*, 27(1). <http://doi.org/10.18785/gcr.2701.08>
- BBVA Bancomer Foundation, BBVA Research, & Conapo. (2017) *Yearbook of Migration and Remittances Mexico 2017*. Mexico.
- Government of Quintana Roo. (2019) *3rd government report Carlos Joaquín Quintana Roo*.
- Gómez, C. (May 25, 2019). Josefa González Blanco resigns from Semarnat; AMLO accepts the decision. *La Jornada*. Retrieved from <https://www.jornada.com.mx/ultimas/politica/2019/05/25/renuncia-josefa-gonzalez-blanco-titular-de-la-semarnat-1687.html>
- National Institute of Anthropology and History [INAH]. (2019) RMEV format-Annual report of statistics on visits to museums and archaeological sites. Retrieved December 30, 2019, from <https://www.estadisticas.inah.gob.mx>
- National Institute of Statistics and Geography [Inegi]. (2015) *Micro, small, medium and large enterprise. Economic census 2014*.
- National Institute of Statistics and Geography [Inegi]. (2019a) National Survey of Occupation and Employment (ENOE). Retrieved December 30, 2019, from <https://www.inegi.org.mx/app/buscador/default.html?q=subocupación>
- National Institute of Statistics and Geography [Inegi]. (December 16, 2019b) Gross Domestic Product by Federative Entity. *Sistema de Cuentas Nacionales de México* [National Accounts System of Mexico]. Retrieved from <https://www.inegi.org.mx/programas/pibent/2013/default.html>
- National Institute of Statistics and Geography [Inegi]. (December 18, 2019c) Mexico Tourism Satellite Account, 2018. Retrieved from <https://www.inegi.org.mx/temas/turismosat/default.html>

- Lozano Cortés, R. (2002). Measurement of tourist activity and its multiplier effect in Quintana Roo. In A. Pereira, I. Boxill, & J. Maerk (Eds.), *Tourism, development and natural resources in the Caribbean* (p. 264). Plaza and Valdes.
- Mochón Morcillo, F. (2004). *Economía y Turismo* [Economy and Tourism]. Madrid: McGraw-Hill.
- NITU. (April 24, 2019) Sargassum on the beaches of Quintana Roo at Easter - Tourism Industry News. *NITU*. Retrieved from <https://www.nitu.mx/index.php/2019/04/24/perdona-sargazo-las-playas-de-quintana-roo-en-semana-santa/>
- Notimex. (May 18, 2019) They collect 10 tons of sargassum on the Mexican Caribbean coast. *Informador*. Retrieved from <https://www.informador.mx/tecnologia/Recolectan-10-toneladas-de-sargazo-en-costas-del-Caribe-mexicano-20190518-0066.html>
- Optical Oceanography Lab. (2019a) Satellite-based Sargassum Watch System (SaWS). Retrieved December 30, 2019, from <https://optics.marine.usf.edu/projects/SaWS.html>
- Optical Oceanography Lab. (April 30, 2019b) Outlook of 2019 Sargassum blooms in the Caribbean Sea. *University of South Florida*. Retrieved from https://optics.marine.usf.edu/projects/SaWS/pdf/Sargassum_outlook_2019_bulletin04_USF.pdf
- Optical Oceanography Lab. (July 31, 2019c) Outlook of 2019 Sargassum blooms in the Caribbean Sea. *University of South Florida*. Retrieved from https://optics.marine.usf.edu/projects/SaWS/pdf/Sargassum_outlook_2019_bulletin07_USF.pdf
- Optical Oceanography Lab. (December 1, 2019d) Outlook of 2019 Sargassum blooms in the Caribbean Sea. *University of South Florida*. Retrieved from https://optics.marine.usf.edu/projects/SaWS/pdf/Sargassum_outlook_2019_bulletin11_USF.pdf
- Presidency of the Republic. (June 28, 2015) Sargassum cleaning actions continue on 180 km of beaches in Quintana Roo. Retrieved from <https://www.gob.mx/ejn/es/articulos/continuan-acciones-de-limpieza-de-sargazo-en-180-km-de-playas-en-quintana-roo>
- Presidency of the Republic. (June 24, 2019) Press Conference of President Andrés Manuel López Obrador, June 24, 2019. Retrieved from <https://www.gob.mx/presidencia/prensa/conferencia-de-prensa-del-presidente-andres-manuel-lopez-obrador-del-24-de-junio-de-2019-206191>
- Cancún Sargassum Monitoring Network. (2019) Cancún Sargassum Monitoring Network. Retrieved November 29, 2019, from <https://www.facebook.com/RedSargazo/>
- Rivera, A. (August 7, 2018). Experts fear that sargassum will alter Caribbean ecosystems. *El Universal*. Retrieved from <https://www.eluniversal.com.mx/nacion/politica/temen-especialistas-que-sargazo-altere-ecosistemas-del-caribe>
- Robledo, D., & Vázquez-Delfín, E. (2019). Sargassum, knowing the "enemy." *Avance y Perspectiva*, 5(3).
- Sánchez Flores, E. (2016). The contribution of tourism to economic growth: regional analysis in Mexico. *Transitare*, 2(2), 183–204.
- Secretariat of Communications and Transport [SCT]. (2019a) Passenger arrivals at the country's airports. *Airports and Auxiliary Services*. Retrieved from <https://www.datatur.sectur.gob.mx/SitePages/TrasnAerea.aspx>
- Secretariat of Communications and Transport [SCT]. (2019b) Cruise ship movement in the country's main ports. *Directorate General of Ports*. Retrieved from [http://www.datatur.sectur.gob.mx/SitePages/Actividades en Crucero.aspx](http://www.datatur.sectur.gob.mx/SitePages/Actividades%20en%20Crucero.aspx)
- Secretariat of Public Education [SEP]. (2017) School calendar 2017-2018. Retrieved from <https://www.gob.mx/sep/articulos/calendario-escolar-para-el-ciclo-escolar-2017-2018>
- Secretariat of Public Education [SEP]. (2018) School calendar 2018-2019. Retrieved from <https://www.gob.mx/sep/articulos/consulta-el-calendario-escolar-para-el-ciclo-escolar-2018-2019>
- Secretariat of Public Education [SEP]. (2019) School calendar 2019-2020. Retrieved from [https://www.gob.mx/sep?tab=Calendario escolar 2019-2020](https://www.gob.mx/sep?tab=Calendario%20escolar%202019-2020)
- Navy Secretariat [Semar]. (July 8, 2019a) SEMAR reports results of the strategy to contain sargassum on the coasts of the Mexican Caribbean and the State of Quintana Roo. *Prensa*. Retrieved from <https://www.gob.mx/semar/prensa/la-semar-informa-resultados-de-la-estrategia-para-contencion-del-sargazo-en-las-costas-del-caribe-mexicano-y-del-estado-de-quintana-roo>
- Navy Secretariat [Semar]. (July 19, 2019b) Through the General Plan for Handling Sargassum, SEMAR, Institutions and Civil Society have collected more than 38,000 tons. Retrieved from <https://www.gob.mx/semar/prensa/en-el-plan-general-de-atencion-al-sargazo-la-semar-instituciones-de-los-tres-ordenes-de-gobierno-y-sociedad-civil-han-recolectado-mas-de-38-mil-ton-209527>

- Navy Secretariat [Semar]. (August 23, 2019c) SEMAR defines its institutional goals for actions to be executed in the General Plan for Handling Sargassum. *Prensa*. Retrieved from <https://www.gob.mx/semar/prensa/la-semar-define-sus-metas-institucionales-sobre-acciones-a-ejecutar-en-el-plan-general-de-atencion-al-sargazo>
- Navy Secretariat [Semar]. (September 23, 2019d) The Mexican Navy Secretariat is making a consistent effort to clean up the sargassum on the beaches of the State of Quintana Roo. Retrieved from <https://www.gob.mx/semar/prensa/la-secretaria-de-marina-armada-de-mexico-realiza-un-esfuerzo-constante-en-la-limpieza-del-sargazo-en-las-playas-del-estado-de-quintana-roo-218490>
- Navy Secretariat [Semar]. (October 24, 2019e) They add up to more than 80,000 tons of sargassum from the coordinated effort between institutions of the three orders of government and civil society. Retrieved from <https://www.gob.mx/semar/prensa/suman-mas-de-80-mil-toneladas-de-sargazo-del-esfuerzo-coordinado-entre-instituciones-de-los-tres-ordenes-de-gobierno-y-la-sociedad-civil>
- Secretariat of Tourism [Sectur]. (2006) *Behavior, advances and prospects of Tourism in Mexico*. Mexico City: Economic Culture Fund.
- Secretariat of Tourism [Sectur]. (July 31, 2015) The Government of the Republic has allocated 150 MDP for the removal of sargassum on the beaches of Quintana Roo. Retrieved from <https://www.gob.mx/sectur/prensa/destina-gobierno-de-la-republica-150-mdp-para-remocion-de-sargazo-en-las-playas-de-quinta-roo>
- Secretariat of Tourism [Sectur]. (2019) Statistical compendium of tourism in Mexico 2018. Retrieved from <http://www.datatur.sectur.gob.mx/SitePages/ActividadHotelera.aspx>
- Secretariat of Tourism of Quintana Roo [Sedetur]. (2017) *Quintana Roo annual tourism report 2017*.
- Secretariat of Tourism of Quintana Roo [Sedetur]. (2019) Daily hotel occupancy of the main destinations of the Mexican Caribbean. Retrieved from <https://qroo.gob.mx/sedetur>
- Secretariat of the Environment and Natural Resources [Semarnat]. (July 23, 2015) Government of the Republic delivers resources for the cleaning and removal of sargassum in Qroo. Retrieved from <https://www.gob.mx/semarnat/prensa/entrega-gobierno-de-la-republica-recursos-para-limpieza-y-retiro-de-sargazo-en-qroo>
- Secretariat of the Environment and Natural Resources [Semarnat]. (June 27, 2018a) Do you know what sargassum is? Retrieved from <https://www.gob.mx/semarnat/articulos/sabes-que-es-el-sargazo?idiom=es>
- Secretariat of the Environment and Natural Resources [Semarnat]. (July 19, 2018b) Progress and achievements. Retrieved from <https://www.gob.mx/semarnat/acciones-y-programas/avances-y-logros-sargazo>
- Secretariat of the Environment and Natural Resources [Semarnat]. (February 22, 2019a) Inter-institutional Group announces Action Plan to comprehensively address the arrival of sargassum in the Mexican Caribbean. Retrieved from <https://www.gob.mx/semarnat/prensa/grupo-interinstitucional-anuncia-plan-de-accion-para-atender-de-manera-integral-arribo-de-sargazo-en-caribe-mexicano?idiom=es>
- Secretariat of the Environment and Natural Resources [Semarnat]. (July 25, 2019b) Technical and Management Guidelines for Contingency Care caused by Sargassum in the Mexican Caribbean and the Gulf of Mexico. Retrieved from <https://www.gob.mx/semarnat/documentos/lineamientos-tecnicos-y-de-gestion-para-la-atencion-de-la-contingencia-ocasionada-por-sargazo-en-el-caribe-mexicano-y-el-golfo-de-mexico>
- SIPSE. (August 5, 2018) Sargassum only affects 5% of the beaches of Quintana Roo. *La Palabra del Caribe*. Retrieved from <https://www.lapalabradelcaribe.com/sargazo-solo-afecta-al-5-de-las-playas-de-quintana-roo/107120/>
- Ureste, M. (July 16, 2019). Travel agencies and the state government minimize the crisis of sargassum to avoid losing tourists. *Animal Político*. Retrieved from <https://www.animalpolitico.com/2019/07/agencias-viajes-gobierno-quintana-roo-crisis-sargazo-turistas/>
- Urrutia, A., & Muñoz, A. (October 16, 2019). Tourism is key to the economy, says AMLO. *La Jornada Maya*. Retrieved from <https://www.lajornadamaya.mx/2019-10-16/Turismo--clave-para-la-economia--afirma-AMLO>
- Varillas, A. (July 14, 2015a). Call for immediate collection of sargassum on the beaches of Cancún. *El Universal*. Retrieved from <https://www.eluniversal.com.mx/articulo/estados/2015/07/14/piden-recoleccion-inmediata-de-sargazo-en-playas-de-cancun>
- Varillas, A. (July 15, 2015b). Guidelines issued for removing sargassum in Quintana Roo. *El Universal*. Retrieved from <https://www.eluniversal.com.mx/articulo/estados/2015/07/15/emiten-lineamientos-para-retirar-sargazo-en-q-roo>

- Varillas, A. (April 30, 2019). Sargassum, the nightmare returns to Cancún and affects Playa del Carmen, Puerto Morelos and Tulum. *El Universal*. Retrieved from <https://www.eluniversal.com.mx/estados/sargazo-la-pesadilla-vuelve-playas-de-cancun>
- Wang, M., Hu, C., Barnes, B., Mitchum, G., Lapointe, B., & Montoya, J. (2019). The Great Atlantic Sargassum belt. *Science*, 365, 83–87. <http://doi.org/10.1126/science.aaw7912>
- World Travel & Tourism Council [WTTC]. (2018) *City travel & tourism impact 2018*.

9. Annexes

Table 5. **Municipalities that make up the beach destinations selected for analysis in Quintana Roo and in the 10 other beach destinations in Mexico**

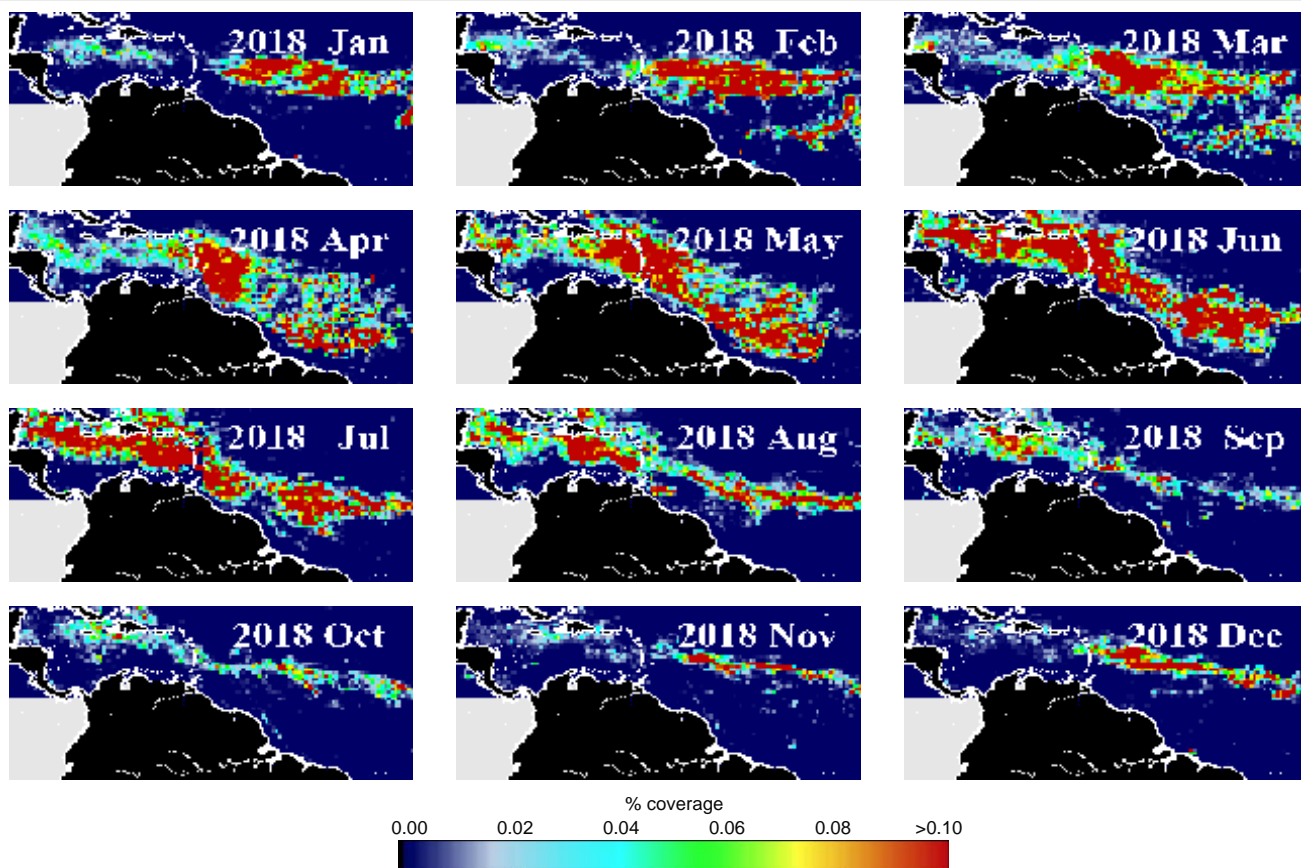
Group	Beach destination	Federative entity	Municipalities
Analysis group: Quintana Roo	Cancún	Quintana Roo	Benito Juárez Puerto Morelos
	Riviera Maya	Quintana Roo	Solidaridad Tulum
	Cozumel	Quintana Roo	Cozumel
	Isla Mujeres	Quintana Roo	Isla Mujeres
Comparison group: 10 other beach destinations	Acapulco	Guerrero	Acapulco de Juárez
	Huatulco-Puerto Escondido	Oaxaca	Candelaria Loxicha
			Pluma Hidalgo
			San Agustín Loxicha
			San Baltazar Loxicha
			San Bartolomé Loxicha
			San Mateo Piñas
			San Pedro el Alto
			San Pedro Mixtepec
			San Pedro Pochutla
			Santa Catarina Loxicha
Santa María Colotepec			
Santa María Huatulco			
Santa María Tonameca			
Santo Domingo de Morelos			
Ixtapa Zihuatanejo	Guerrero	Zihuatanejo de Azueta	
Los Cabos	Baja California Sur	Los Cabos	
Manzanillo	Colima	Manzanillo	
Mazatlán	Sinaloa	Mazatlán	
Playas de Rosarito	Baja California	Playas de Rosarito *	
Puerto Vallarta	Jalisco	Puerto Vallarta	
Riviera Nayarit	Nayarit	Bahía de Banderas Compostela	
Veracruz-Boca del Río	Veracruz	Boca del Río Veracruz	

Notes: The table lists the main beach destinations in Quintana Roo and other Mexican states that were selected for analysis. In both cases more beach destinations exist.

* Due to the geographical proximity to the municipality of Tijuana, after applying the programmed selection filter, some businesses marked as Tijuana shops were manually included but which the authors considered should be included in this beach destination.

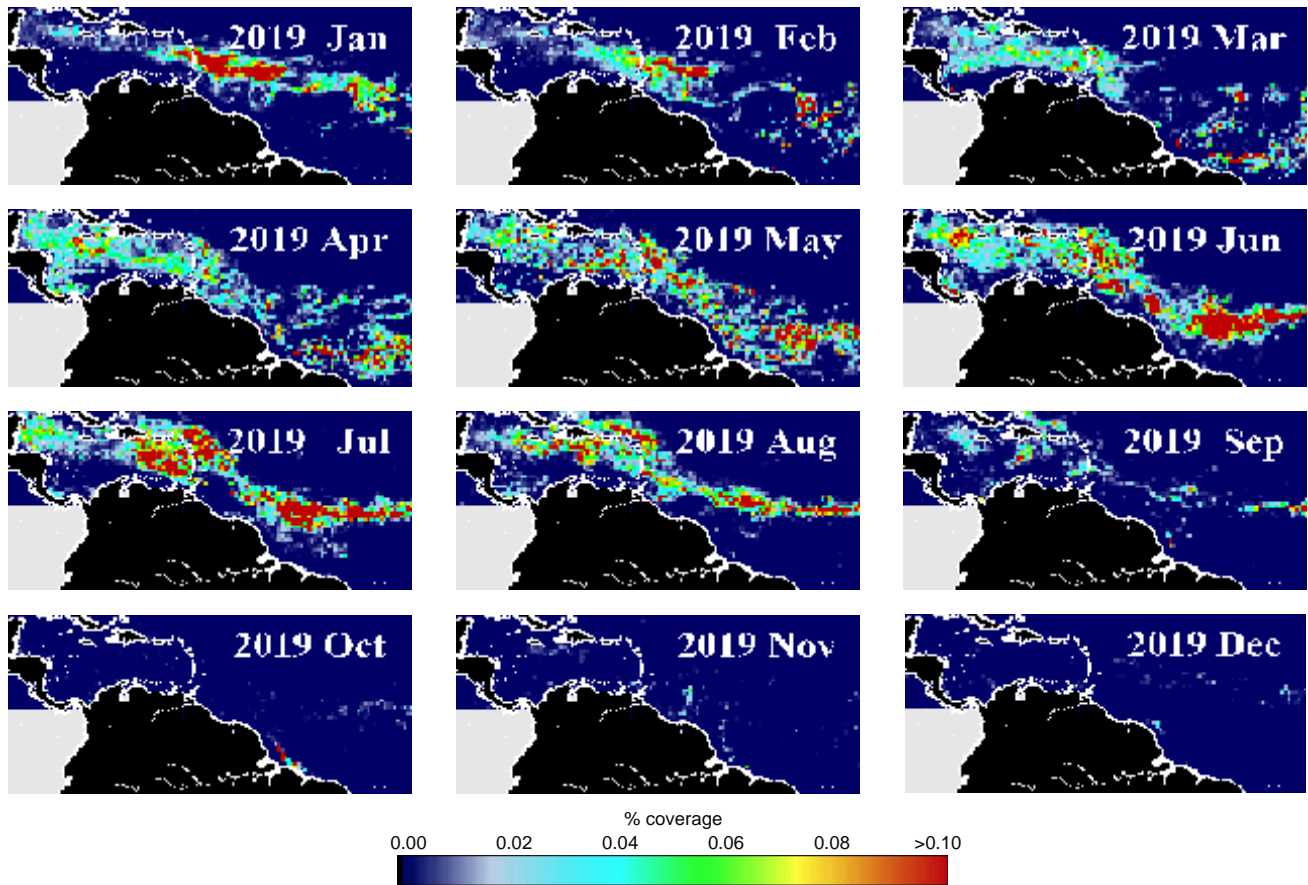
Source: BBVA Research.

Figure 15. **Percentage of coverage of sargassum on the surface of the Caribbean Sea and Gulf of Mexico through MODIS satellite images, 2018**



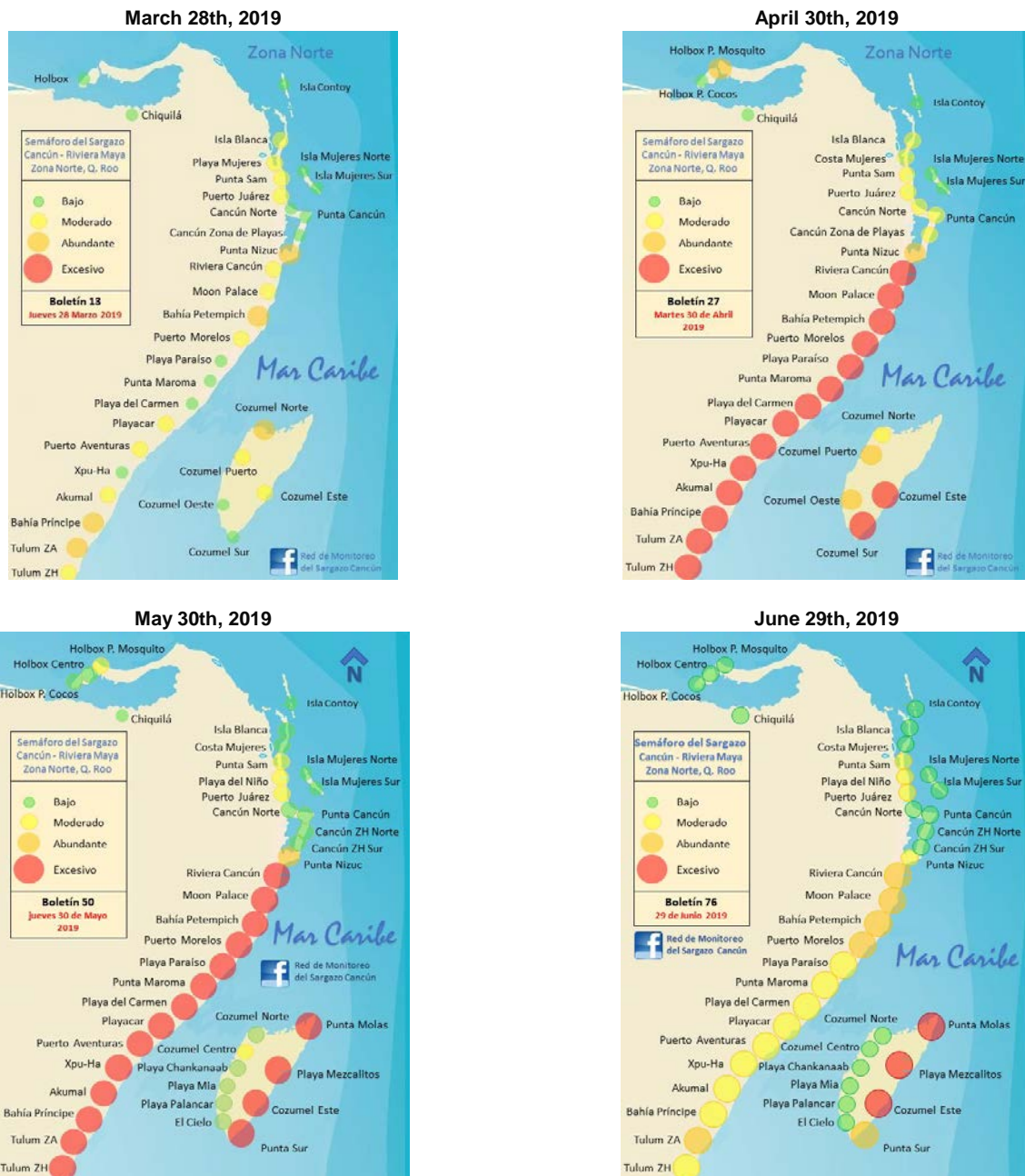
Source: University of South Florida, Optical Oceanography Laboratory.

Figure 16. **Percentage of coverage of sargassum on the surface of the Caribbean Sea and Gulf of Mexico through MODIS satellite images, 2019**



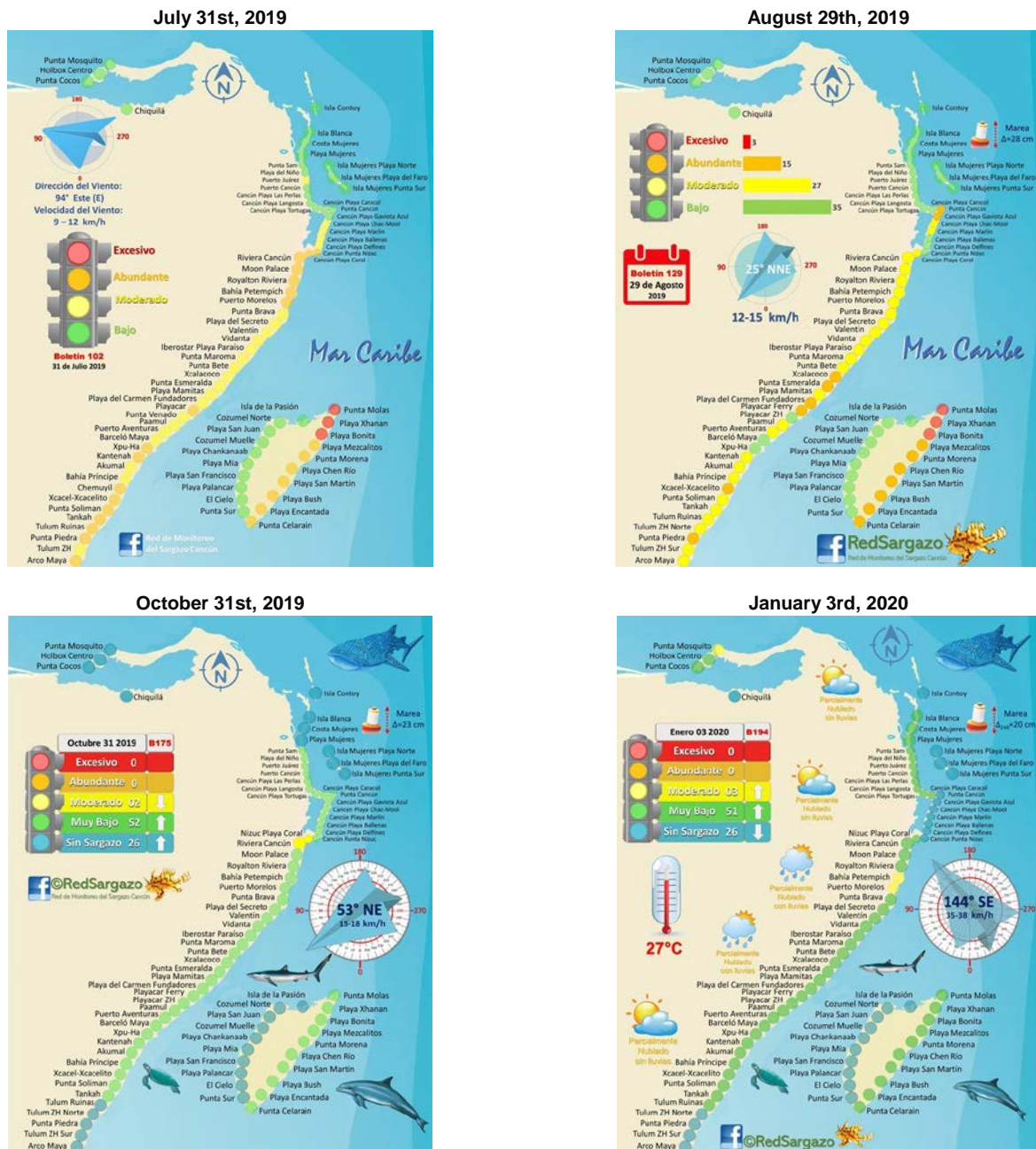
Source: University of South Florida, Optical Oceanography Laboratory.

Figure 17. **Selected newsletters of the Cancún Sargassum Monitoring Network (RMSC) (part 1 of 2)**



Source: Cancún Sargassum Monitoring Network (RMSC).

Figure 18. Selected newsletters of the Cancún Sargassum Monitoring Network (RMSC) (part 2 of 2)



Source: Cancún Sargassum Monitoring Network (RMSC).

Working Papers

2020

20/02 **Luis Antonio Espinosa and Juan José Li Ng:**

ENG / The risk of sargassum to the economy and tourism of Quintana Roo and Mexico.

ESP / El riesgo del sargazo para la economía y turismo de Quintana Roo y México.

20/01 **Ángel de la Fuente:** La dinámica territorial de la renta en España, 1955-2018. Los determinantes directos de la renta relativa: productividad, ocupación y demografía.

2019

19/13 **Filip Blazheski and Adrian Casillas:** Tripping over the edge of the cliff – business and credit cycles, financial instability and recession triggers.

19/12 **Ángel de la Fuente:** La evolución de la financiación de las comunidades autónomas de régimen común, 2002-2017.

19/11 **Alfonso Arellano, Noelia Cámara and Diana Mejía:**

ENG / Disentangling Vulnerability through Consumer Behavior: The Role of Financial Health.

ESP / Desentrañar la vulnerabilidad mediante el comportamiento del consumidor: el papel de la salud financiera.

19/10 **Ángel de la Fuente:** La liquidación de 2017 del sistema de financiación de las comunidades autónomas de régimen común.

19/09 **Guillermo Jr. Cárdenas, Luis Antonio Espinosa, Juan José Li Ng y Carlos Serrano:** La crisis por escasez de gasolina en México: un análisis de Big Data.

19/08 **Ángel de la Fuente:** Series largas de algunos agregados económicos y demográficos regionales: Actualización de RegData hasta 2018.

19/07 **Ángel de la Fuente:** La dinámica territorial de la renta en España, 1955-2016: una primera aproximación.

19/06 **Ángel de la Fuente:** Las finanzas autonómicas en 2018 y entre 2003 y 2018.

19/05 **J. E. Boscá, R. Doménech, J. Ferri and J. Rubio-Ramírez:** Macroeconomic Effects of Taxes on Banking.

19/04 **Santiago Fernández de Lis and Olga Gouveia:** Central Bank digital currencies: features, options, pros and cons.

19/03 **Santiago Fernández de Lis y Olga Gouveia:** Monedas digitales emitidas por bancos centrales: características, opciones, ventajas y desventajas.

19/02 **Santiago Fernández de Lis and Pablo Urbiola Ortún:** Digital transformation and competition in the financial sector.

19/01 **Santiago Fernández de Lis y Pablo Urbiola Ortún:** Transformación digital y competencia en el sector financiero.

CLICK HERE TO ACCESS THE WORKING DOCUMENTS PUBLISHED IN
Spanish and English

The analysis, opinions, and conclusions included herein are the exclusive property of the author of the report. They are not necessarily the property of Grupo BBVA.

BBVA Research publications can be viewed at : <http://www.bbvarresearch.com>

CONTACT DETAILS:

BBVA Research - BBVA Mexico: Paseo de la Reforma 510, Col. Juárez, CP 06600, Mexico City, Mexico.
bbvarresearch@bbva.com www.bbvarresearch.com

