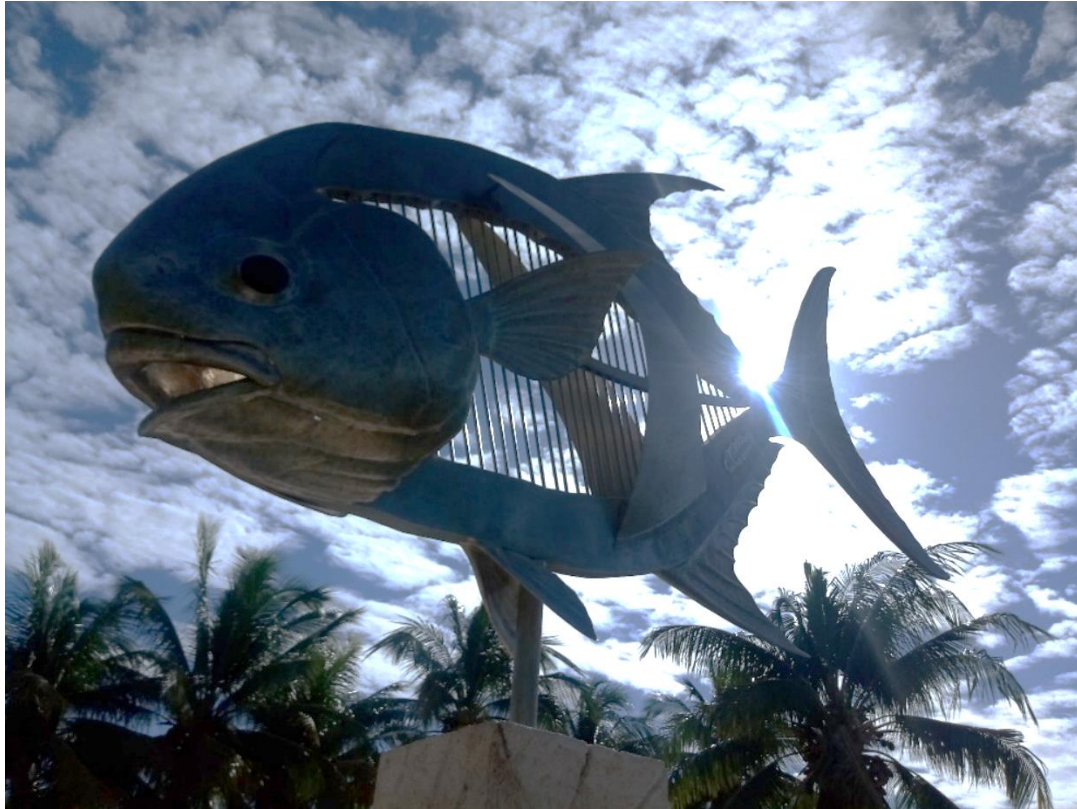


2019 ECONOMIC IMPACT OF FLATS FISHING IN QUINTANA ROO, MEXICO



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Executive Summary

Flats fishing is one of several forms of recreational-sport fishing in Mexico (Perez-Cobb et al., 2014; Perez et al., 2019). This fishery practices catch-and-release (CR) as a conservation tool that ensures the survival of most fish that are released. Fly fishing is one of several techniques used in this fishery which requires the use of rod, reel and lure that mimics the natural prey of the species of interest. It is an activity of great economic importance as it attracts many international anglers generating multiple benefits to the tourism sector.

In Quintana Roo, Mexico, the presence and health of coastal ecosystems comprised of areas of sandy and muddy bottoms, seagrasses beds, coral rubble and mangrove associated habitats, allow species such as permit, tarpon, bonefish and snook to be abundant. The interaction of these ecosystems and fish populations is important for the flats fishery, which generates income and jobs for local fishing guides who provide guided services to international anglers. These anglers directly contact and hire independent guides, tour-operators, fishing clubs or fishing lodges for fishing trips.

This study used questionnaires with independent guides, fishing lodge managers and tour-operators to estimate, in US dollars, the economic impact of the flats fishery in Quintana Roo, Mexico, for 2019. The resulting estimates indicate that anglers who depend on the services of independent guides directly generated \$3.3 million, while anglers who hire services in fishing lodges generated \$15.7 million. Incorporating the value-added effects of direct expenditures by anglers, this activity generated a total economic impact of \$45.2 million and supported approximately 1,674 jobs in 2019.

The flats fishery requires greater promotion and assistance of local governments to increase visitations and improve roads to coastal communities. In addition, conservation tools such as co-management (Perez-Cobb et al., 2014) to ensure the local presence of a regulatory body for monitoring, control and surveillance of fisheries activities is needed. Finally, to ensure the conservation of habitats and fish populations, it is important to update the Official Mexican Standard NOM-017-PESC-1994 to protect bonefish, tarpon and permit as exclusively catch and release species, and to establish protections for the foraging, refuge and reproduction areas of these species (Perez et al., 2020, 2021). This economic impact assessment should provide much-needed incentive to address these needs.

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Introduction

Flats fishing in the state of Quintana Roo, Mexico, is generally promoted by tourism service operators from the social sector and private companies that offer fishing services to foreign anglers. This fishing and tourist activity promotes regional economic development, generates jobs, and contributes significantly to the national economy.

Fly fishing is the most common method used in the flats fishery, and the fishery is almost entirely catch and release. Catch and release ensures that most fish survive, which increases the sustainability of the fishery. Most habitats in Quintana Roo are part of a natural protected area and the healthy habitats and abundant fish populations offer an eco-tourism alternative livelihood for coastal fishing communities, generating employment, social awareness of caring for the environment, protection of species and natural resources.

However, one of the main threats to this activity is the lack of protection and management regulations for important flats species, like bonefish (*Albula vulpes*), tarpon (*Megalops atlanticus*), permit (*Trachinotus falcatus*) and snook (*Centropomus undecimalis*). The lack of regulation means that these species are caught commonly as bycatch in gillnets of commercial artisanal fisheries. The exception is snook, which targeted for consumption and trade. Regardless, communities in Quintana Roo informally practice CR of these species because they understand the economic value of this eco-tourist activity.

Tourism service operators promote flats fishing by offering anglers the opportunity to catch any of the four species year-round. Anglers can also catch any three species in a single day, which is known as a "Grand Slam", or all four species known as a "Super Grand Slam". These definitions are also validated by the International Game Fish Association (IGFA), who maintain and publish world records, while promoting ethical fishing practices and habitat conservation.

Recreational-sport fishing in Mexico

Recreational-sport fishing in Mexico is regulated through the Official Mexican Standard, which regulates recreational fishing in waters under federal jurisdiction (NOM-017-PESC-1994). The definition of recreational fishing is very general "an activity that is practiced for leisure purposes and that links the human being with nature, mainly with the sea and its resources" (DOF-SEMARNAT, 1995). Likewise, it is recognized as an activity that generates income, foreign exchange, employment, regional development and has a multiplier effect in the tourism, fishing, and industrial sectors.

In 2019, the tourism sector contributed 8.7% to the Gross Domestic Product (GDP) of Mexico, ranking seventh in the world for the arrival of international tourists, earning \$24.6 billion dollars in foreign exchange (SECTUR, 2020). The statistical yearbook on fishing and aquaculture of 2018 highlights the importance of recreational-sport fishing through the National Sport Fishing Program, generating a total income for the country of MX\$40.6 million through the sale of permits equivalent to 0.26% of the national GDP. The area of the Gulf coast and the Caribbean contributed MX\$1.4 million, the largest number of permits sold per year in Quintana Roo, amounting to almost MX\$514,000 in 2017 (CONAPESCA, 2018). However, the sale of permits is only a small fraction of the economic impact from the recreational fishery because of the extensive fishing-related expenditures made by recreational anglers.

Flats fishing in Quintana Roo State

Flats fishing is practiced along much of the approximately 900 km of coastline of Quintana Roo, which includes just over 370,000 hectares of lagoons, estuaries, and coastal bays in the municipalities of Lazaro Cárdenas, Isla Mujeres, Benito Juárez, Cozumel and Solidaridad. CR species are abundant in these coastal habitats, as they are part of the Natural Protected Areas of Yum Balam, the Isla Contoy National Park, the Arrecife de Cozumel Marine Park, the Arrecifes de Xcalac National Park and the Sian Ka'an Biosphere Reserve (Ibáñez, 2011).

Flats fishing attracts international anglers as tourists that consider the fishing sites in Quintana Roo similar to those in Belize, the Bahamas, Cuba or Florida. Most anglers arrive at the Cancun airport, where they travel by land to the fishing communities. The main places where recreational fishing is carried out in Quintana Roo, from north to south, are: Holbox, Isla Blanca (Cancun), Cozumel, Bahía de la Ascension (Punta Allen), Bahía del Espíritu Santo (Punta Herrero), the coasts of Mahahual and Xcalak, as well as Chetumal Bay.

It is estimated from previous studies that recreational-sport fishing in Ascension Bay, Espiritu Santo Bay, Isla Mujeres Bay and Chetumal Bay contributes approximately \$15 million dollars annually (Medina-Matos, 2004). According to Association of Tourism Secretaries in Mexico (ASETUR), there are more than 3,000 sports fishing boats in the country, each with the potential of generating five direct jobs and 10 indirect jobs. However, these statistics do not differentiate between the different types of recreational-sport fishing. Thus, the economic impact of flats fishing in Quintana Roo remains unknown.

The relative abundance of flats species varies based on the type of habitats, other biological factors. Combined with angler preference, the target species also differ among locations. For example, fishing in Holbox is almost exclusively for tarpon. In contrast, in Ascension Bay the top species is permit, though bonefish, tarpon, and snook are also present and represent smaller portions of the fishery.

Flat fishing services are offered in two ways. Independent guides are hired directly by the anglers, who pay separately for transportation, lodging, food, among other expenses. Fishing lodges and some hotels offer guided fishing trips, accommodation, and meals in a package at a fixed rate. In both cases, there are additional expenses made by the angler that include tips to guides and staff, personal purchases, and visits to other areas during non-fishing days.

Justification

Currently, there is no report on economic impact of the flats fishery in Quintana Roo, despite the fishery being widespread in the region. Available data are limited, and often combined across different fisheries (e.g., license sales for fishing on reservoirs, inland lakes, flats, or deep-sea are combined) In addition, license sales only estimate fishing activity, they don't allow estimation of direct and indirect expenditures or induced and multiplier effects, information needed to assess economic impact.

Objectives

The objectives of this study was to determine the economic impact of the flats fishery in Quintana Roo in 2019 season, to include the direct, indirect and induced effects, and the number of jobs that generated.

Methodology

The state of Quintana Roo was divided into a northern and southern region. The north region consisted of Holbox, Isla Blanca and Cozumel and was the most developed in mass tourism. The south region included communities of Javier Rojo Gómez (Punta Allen) which is the access to the Ascension Bay, Punta Herrero with access to the Espiritu Santo Bay, Chetumal Bay, Mahahual and Xcalak (Figure 1). This region, in contrast to the north region, represented ecotourism development more aligned with international sustainability criteria.

A Mixed-Methods Approach (Perez-Cobb et al., 2014; Perez et al., 2019) and a Multi-Methods Approach (Palomo and Hernández-Flores, 2019, 2020) was used to compile socioeconomic information from service providers of flats fishing for 2019. Primary sources of information were obtained by: a) compiling a list of all flat fishing service providers in each community using websites and social networks, b). interview appointments were made and were followed by the application of face-to-face or video call interviews using semi-structured questionnaires, and c) in some cases, emails were sent when interviews were not possible. The estimates of economic impacts were conducted following the methodology described by Fedler for other countries (Fedler and Hayes, 2008; Fedler, 2014), with some adaptations to the characteristics of the activity in the region.

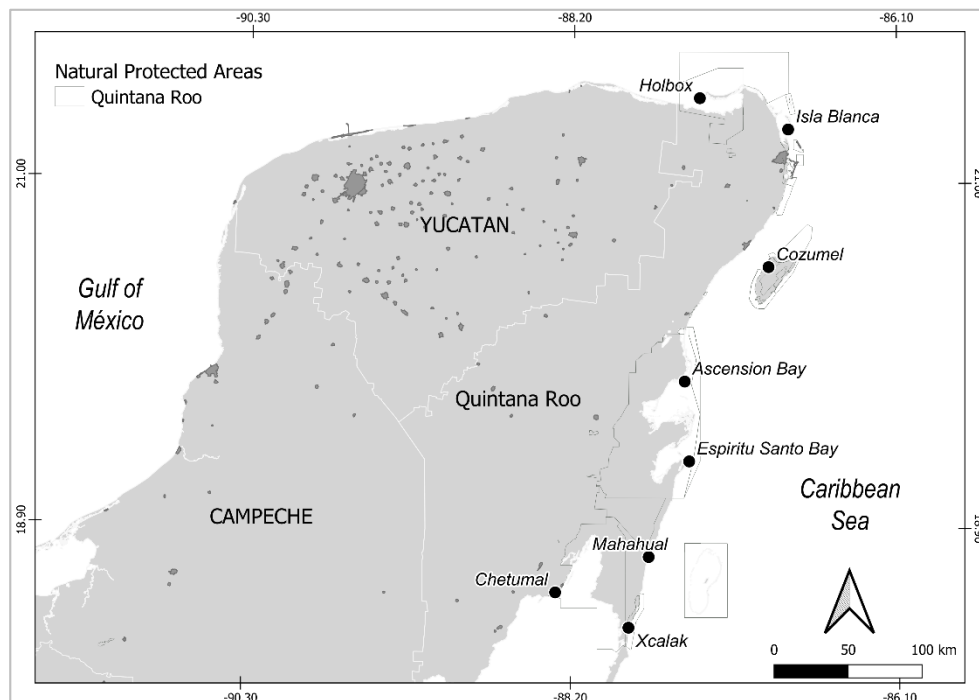


Figure 1. Flat fishing locations in Quintana Roo.

Secondary sources of information such as reports and statistics on recreational-sport fishing were obtained from national and international sources.

As with previous economic impact assessments (EIAs), two service sectors were identified: independent guides and fishing lodges. In the independent guide sector, the guides only offered the fishing service and the angler paid separately the costs of transportation between the airport and the fishing destination, lodging and food. In the fishing lodge sector, all-inclusive packages were offered for 3 to 6 or more fishing days, which included airport transfers, accommodation, food, and fishing service. The rates for these services were per angler in a double room and it was common for two anglers to share a boat. In this report, the monetary references are expressed in US dollars, with an average exchange rate in 2019 of MX\$19.26 pesos equivalent to \$1 USD (<https://data.worldbank.org/>).

Independent Fishing Guides

Independent fishing guides were freelancers, meaning they had their own boats and in most cases were hired directly by the angler. In other cases, they offered fishing services to anglers from fishing lodges, tour operators or other guides.

The economic information collected for the independent guides sector were as follows:

- Number of independent guides.
- Total number of anglers guided.
- Average number of fishing days per angler.
- Number of guiding days (fishing days).
- Percentage of days guiding a single angler.
- Fishing trip rates.
- Average tips.
- Average expenditures made by anglers for lodging and food.

The average expenditures of anglers were estimated from the cost rates of hotels and associated expenditures during their stay. Additionally, the average expenditures per stay and by region were obtained from reports published by the Secretary of Tourism in Quintana Roo (SEDETUR, 2019).

The percentage of anglers guided as solo and duos was first estimated to obtain an accurate estimate of the average number of anglers per day. The procedure is explained in the following equation:

$$AAD = \frac{(TDG \times \%DP1) + (TDG \times (1 - \%DP1) \times 2)}{TDG}$$

Where:

- AAD. Average Anglers per Day
- TGD. Total Guiding Days
- %FD1. Percentage of fishing days of 1 recreational angler.
- (1-%FD1). Percentage of fishing days with 2 recreational anglers.

For example, if an independent guide made 100 trips per year, this was equivalent to the days guiding per year and if 60% of the trips were by a single angler, that was 60 fishing trips. Therefore, (1-0.60 = 0.40) 40 trips were by two anglers. The average number of anglers per day was calculated to:

$$AAD = \frac{(100 \times 0.6) + (100 \times (1 - 0.6) \times 2)}{100} = \frac{60 + 80}{100} = 1.4$$

Therefore, the previous example obtained an average of 1.4 anglers per day, equivalent to the number of anglers per boat for a particular guide. The average number of anglers per day and per region was multiplied by number of total days guiding for all guides, obtaining the total number of angler fishing days.

Most independent guides had no record of their 2019 activities which made it difficult for them to recall the number of guiding days and anglers guided in 2019. Given this scenario, we opted to ask a series of questions that were effective in estimating the above information using a deductive method. This consisted of guides determining the months they did not work, and then in the months they worked estimating the number of working weeks per month. Subsequently, guides were asked which number of days was most requested (e.g., 1 or 2-6 fishing days) and how much this represented in terms of percentage in the overall fishing.

Fishing Lodges

The fishing lodges offered all-inclusive packages that include transportation to-and-from the airport to the lodge where accommodation, meals, and fishing services were provided. Lodges used both guides who were employees of the lodge (dependent guides) and freelancers (independent guides). The following information collected included:

- Number of dependent guides.
- Number of anglers guided.
- Number of guiding days (fishing days).
- Most requested fishing day package and rates
- Average tip for staff and fishing guides.
- The number of rooms in the lodge.
- Percentage of hotel occupancy
- Months of operation.

Economic multipliers

EIAs are useful tools for estimating the socioeconomic benefits of a tourism and fishing activity. This can be done at different organizational levels, by including detailed information on the expenses generated by the interaction of the different actors involved in recreational fishing, providing information on the direct, indirect, and induced effects of the activity (Fedler, 2013, 2014; Meng and Siriwardana, 2017).

Direct effects are estimated from the immediate expenditures made by the angler for the payment of the fishing service, as well as for the purchase or rental of equipment or other materials necessary to carry out the activity. These include costs for ground transportation, accommodation, food, fishing permits, guide fees, and fishing gears.

Indirect effects are the expenditures incurred by tourism service operators such as guides, companies, or tour-operators, for the purchase of goods and services from various suppliers that allows them to perform the services they provide. In this way, other services providers from the economic sector also benefit, including food markets, gas stations, tourist permits, among others.

Induced effects are generated by the economic activity that derives from the expenditures produced by the direct and indirect effects. This allows an increase in income of households of the multiple beneficiaries which allows for expenses incurred by entrepreneurs, tour operators, guides, and employees. These individuals and groups trigger the demand and internal consumption of other products and services.

The total economic impact of the flat fishery in Quintana Roo was estimated by quantifying the direct costs and apply the multiplier of the indirect and induced effects to obtain the total economic production (Marquina Benítez, 2014; Kido-Cruz et al., 2016; Kido-Cruz and Kido-Cruz, 2018; Arriaga Navarrete and González Pérez, 2019). These studies are based on the Tourism Satellite Account in Mexico, which show the percentage of participation in the total tourism gross domestic product (GDPT) of the different economic sectors that comprise it, as well as on Input-Output matrices derived from economic statistics of the System of National Accounts of the National Institute of Statistic and Geography (INEGI, 2020).

Moreover, the World Travel and Tourism Council (WTTC) collects and uses statistical data from the tourism sector in Mexico and many other countries annually. The models they use have methodological robustness and international recognition, making it possible to estimate the indirect and induced effects of tourism, as well as the multipliers of jobs generated and employment.

Indirect and induced effects multipliers are known as value-added multipliers, which are used to estimate the total economic impact on the direct expenditures incurred in this case by anglers. For the state of Quintana Roo, no specific models have been developed to estimate the multipliers of recreational tourism, therefore, based on the studies described above, the multipliers of indirect and induced effects available for Mexico are shown in Table 1. The 6 multiplier values were averaged to 1.37 which was used as the added value of indirect and induced impacts and included the multiplier effects of tourism spending towards other economic sectors.

Table 1. Economic multipliers from tourist studies in Mexico.

Multiplier source	Year studied	Sector	Multiplier
Marquina-Benitez, S., 2014	2003	tourism	2.02
Kido-Cruz, et al., 2016	2015	tourism	1.17
Kido-Cruz A. & Kido-Cruz M., 2018	2013	tourism	1.24
Arriaga-Navarrete R. & González-Pérez C., 2019	2008	tourism	1.76
WTTC, 2015	2015	tourism	1.17
WTTC, 2020	2019	tourism	0.87
Average			1.37

Regarding the total contribution to employment, the multiplying factor was obtained from the economic impact report in Mexico (WTTC, 2020), estimating the proportion of jobs generated by the total contribution of tourism. This document provides updated information on the number

of jobs created in the travel and tourism sector in 2019. In this context, it was estimated that 37 jobs were created in 2019 for every 1 million dollars that contribute to the tourism sector in direct, indirect, and induced expenditures.

Results

Economic impacts of independent guides

Based on field work 92 flat fishing guides we registered in Quintana Roo: 23 were independent and 69 were dependent of which 82% and 54% were interviewed, respectively (Table 2).

Table 2. Number of flat fishing guides in Quintana Roo.

Region	Dependent guides	Independent Guides	Total guides
North	17	13	30
South	52	10	62
Total	69	23	92

From the field work the minimum and maximum number of anglers guided was registered for the north region (Table 1). The average number anglers was obtain by adding each case which was then averaged to obtain an average per zone (Table 3). More than twice as many anglers were observed in the northern region than in the south, which was consistent with the fact that more tourists arrive in the northern region due to the high level of tourism development such as Cancun and its surroundings. The surveys also registered total anglers for each region which was also obtained by adding responses from the 82% of guides (n=19) and remaining 18% of responses (n=4) which were approximate estimates also obtained during interviews. A total of 2,439 anglers were guided in Quintana Roo in 2019.

Table 3. Statistics on the number of anglers guided by region.

Region	Min	Max	Average	Total anglers
North	15	500	136	1,767
South	16	180	67	672
Total				2,439

Similarly to the abovementioned procedures, the minimum, maximum and average number of fishing days by an angler in each region was obtained from guides (Table 4). The minimum and maximum number of days fishing was the same for both regions. The minimum and maximum also indicate anglers regularly take fishing trips of 1 to 6 days, sometimes longer, in both regions. However, the average number of fishing days was higher in the south than the north and was likely due to more travel time required to reach the communities.

Table 4. Average number of fishing days per angler per stay for each region.

Region	Min	Max	Average fishing days
North	1	6	2.1
South	1	6	4.0

As earlier procedures for estimates, the number of days guided by each guide was added for each zone and then both zones were summed (Table 5) to a total of 3,329 days for 2019. It is also observed that independent guides in the northern region guided more days than guides in the south. The number of anglers per boat was also summed and averaged for each zone (Table 5). Although there was not much difference in anglers per boat between zones, an overall average of 1.45 anglers per boat was obtained for 2019. The guiding days was multiplied by the average anglers per boat for each region to obtain the total fishing days. An overall sum of 4,872 fishing days was registered for independent guides in Quintana Roo with the north being higher.

Table 5. Number of guiding days, average anglers per boat and total fishing days by region.

Region	Guiding days	Average anglers per boat	Total fishing days
North	2,078	1.49	3,096
South	1,251	1.42	1,776
	3,329	1.45	4,872

The daily expenditures by an angler associated to fishing (boat and guide) was estimated by first finding the average price/cost for fishing per day by each independent guide along with the average tip for each region (Table 6). The average price rate was higher for the north region than the south region. However, tip was lower in the north region. The average price for fishing was per boat trip, so the costs are divided between anglers that share a boat. Therefore, to obtain the daily expenditures per angler, the average price for fishing was added to the average tip and then divided by the average number of anglers per boat. An angler spent more money in fishing in the north and then south region.

Table 6. Estimated daily expenditures by an angler for fishing.

Region	Average price for fishing	Average tip	Anglers per boat	Daily expenditures for fishing
North	\$400	\$65	1.49	\$312
South	\$315	\$70	1.42	\$271

Subsequently, the daily expenditures for stay associated to lodging, transportation and food was estimated (Table 7). This represented the expense that each angler makes on a daily basis and was independent to the daily expenditures for fishing. However, the estimated daily expenditures incurred by anglers at each location ranged from \$100 to \$1,500. Given this high variation, we chose to use the daily expenditures from the 2019 Tourism Indicators published by the Ministry of Tourism of the state of Quintana Roo (SEDETUR, 2019). These reports were more reliable as the methodology compiled data by establishment and resort on a weekly basis and reported monthly which allowed

for greater precision in estimating population parameters. The average daily expenditure according to the Tourism Indicators was US \$319 for the northern region and \$179 for the southern region (SEDETUR, 2019). The daily expenditure was multiplied with the number of anglers per boat to obtain the daily expenditures for stay which was higher in the north than the south.

Table 7. Estimated daily expenditures by an angler associated to lodging, transportation and food

Region	Daily expenditures (SEDETUR, 2019)	Anglers per boat	Daily expenditures for stay
North	\$319	1.49	\$475
South	\$179	1.42	\$254

Thus, the sum of the daily expenditures per angler for fishing and the daily expenditures for stay, resulted in the total daily expenditures per angler by region (Table 8).

Table 8. Estimated daily and total expenditures per angler per day.

Region	Daily expenditures for fishing	Daily expenditures for stay	Total daily expenditures
North	\$312	\$475	\$787
South	\$271	\$254	\$525

Consequently, the total daily expenditures multiplied by the fishing days resulted in the total expenditures per fishing days (Table 9). Thus, the highest expenditures were generated by guided anglers in the northern region, contributing 73% of the total expenditure, which amounted to around \$3.3 million.

Table 9. Estimate of angler's expenditures by fishing days.

Region	Total daily expenditures	Fishing days	Total expenditures per fishing days
North	\$787	3,096	\$2,436,552
South	\$525	1,776	\$932,400
Total		4,872	\$3,368,952

Economic impacts of fishing lodges

A total of 13 fishing lodges were registered for Quintana Roo, with a total capacity of 78 rooms: two lodges with nine total rooms in the northern region, and 11 lodges with 69 total rooms in the southern region. Fishing lodges in the northern region have the capacity to accommodate 8 to 10 anglers and in the southern region between 8 and 24 anglers. Of the 13 fishing lodges, five provided information on the number of anglers they received, four were estimated through interviews with managers and guides, and four were unable to provide information.

For the cases that provide information and those derived from interviews, lodges in the northern region had an average of 160 anglers per year, while in the southern region had an average of 306 anglers per year. All the numbers provided by lodges were added and total estimate of 3,686 anglers. However, the variations in the number of anglers each lodge received were large, as some received 100 anglers while others received 655 anglers. The variations and the fact that 4 lodges did not provide information this study opted in making estimates on the number of anglers by using the number of rooms and the percentage of hotel occupancy.

Therefore, the annual availability of room (unoccupied) for each of the 13 lodges was calculated by multiplying the number of rooms in the lodge with the operating days per year (Table 10). This annual availability was then multiplied by the percentage of hotel occupancy which was obtained as an indicator from the Secretary of Tourism of the State of Quintana Roo (SEDETUR, 2019) as presented in Table 10. The percentage of hotel occupancy was higher in the northern region, which is consistent with the higher tourism development it presents. From this estimate we obtained the occupied rooms per region (Table 10) which showed the supply of accommodation per night was much higher in the southern region compared to the north, due to the large number of fishing lodges in this area.

Table 10. Supply and demand of hotel occupancy in fishing lodges.

Region	Rooms available per year	% Annual hotel occupancy	Occupied rooms
North	2,430	0.701	1,703
South	16,110	0.651	10,488
Total	18,540		12,191

Subsequently, to estimate the number of anglers, the occupied rooms in each lodge was divided by the average number of days per stay by region (Table 11). The information collected from the interviews made it possible to establish an average number of days per stay in lodges, which was 6.0 days in the northern region and 6.8 in the southern region. Most of the anglers stayed between 2 nights (1 fishing day) and 7 nights (6 fishing days) on a double-occupancy basis. The number of packages for each region was estimated by dividing the number of occupied rooms by the average number of days per stay (Table 11) where the south was more than five times higher. To obtain the total number anglers per region, the number of packages was multiplied by 2 because this study found anglers always travel with another angler (Table 2). An estimated 3,644 anglers that visited lodges in for 2019. Finally, when this estimate was compared to the estimates from the interviews (3,686 anglers) we noted estimates from the interviews were being overestimated and thus using hotel occupancy was a more reliable method.

Table 11. Estimate of anglers by region.

Region	Occupied rooms	Average number of days per stay	Number of packages	Anglers per pack (x2)
North	1,703	6.00	284	568
South	10,488	6.82	1,538	3,076
Total	12,191	6.41	1,822	3,644

The expenditures per stay by anglers in lodges were calculated (Table 12). Anglers typically stayed a minimum of 3 days but up to 7 days fishing, while others stayed up to two weeks. For reference, each angler paid the same rate that on average was 5 nights, 4 days fishing and for others 7 nights, 6 days fishing: rates ranged from \$3,050 minimum to \$6,495 maximum, with an average of \$4,070 for stays of 7 nights, 6 days fishing. However, these prices varied from one lodge to another due to the periods of high or low season, holidays or special promotions. As Fedler (2013) mentions, these variations present a high level of complexity to calculate expenses by anglers by day and rate. Therefore, an average rate per region was also calculated for packages of 7 nights and 6 days in double occupancy, which was the most requested package by anglers. When these were added and then averaged a total of \$4,170 was obtained as the overall average rate for 2019. The results of the expenditures per stay of anglers by region was obtained by multiplying the number of anglers with average rates which was more than five times higher for the south. Anglers made a total of \$14,566,788 in expenditures for 2019.

Table 12. Estimate of accommodation costs for anglers by region. Note: Average rates and expenditures per stay in the table are rounded figures; exact values are not shown for presentation purposes.

Region	Anglers	Average rates	Expenditures per stay
North	568	\$4,688	\$2,661,947
South	3,076	\$3,870	\$11,904,841
Total	3,644		\$14,566,788

Likewise, the extra expenditures anglers made daily in tips on guides and staff were calculated (Table 13). Most fishing lodges from both regions suggested these expenditures on were most of the time \$75 and \$20 per day respectively. The sum of these indicates that anglers spend \$95 per day on tips and gratuities. This amount was multiplied by the days of fishing (equivalent to the annual occupancy of the lodges) to obtain the extra expenditures of fishing days for each region which was higher for the south region. The total extra expenditures of fishing days was \$1,158,145.

Table 13. Estimate of extra expenditures per fishing day.

Region	Fishing days	Tips and gratuities	Extra expenditures for fishing days
North	1,703	95	\$161,785
South	10,488	95	\$996,360
Total	12,191		\$1,158,145

Finally, the extra expenditures were added to the expenditures per stay to obtain the total expenditures by anglers in their lodge-based fishing activity by region (Table 14). The southern region of the state generates a greater economic impact and represented 82% of the total direct spending, which was \$15.7 million.

Table 14. Total anglers expenditures on fishing lodges.

Region	Expenditures per stay	Extra spending on lodges	Angler's expenditures in lodges
North	\$2,661,947	\$161,785	\$2,823,732
South	\$11,904,841	\$996,360	\$12,901,201
Total	\$14,566,788	\$1,158,145	\$15,724,933

Economic impact of multiplier effects

The value-added effects multiplier calculated from the average of economic studies in Mexico of 1.37 was used to estimate the total economic impact of the flats fishery. The employment multiplier was based on the amount of employment generated per million dollars contributed by tourism, setting a value of 3.7 0E-5, estimated from the WTTC travel and tourism reports for the year 2019 (WTTC,2019). This multiplier was applied to the total economic impacts, to obtain an estimate of the type of full-time jobs that recreational fishing generates in its direct, indirect, and induced effects (Table 15).

Table 15. Total Economic Impact by independent guides and lodges by region.

Region	Direct Expenditures	Impacts of Added Value	Total Economic Impacts	Jobs
North				
Guided Anglers	\$2,436,552	\$3,338,076	\$5,774,628	214
Lodge Anglers	\$2,823,732	\$3,868,513	\$6,692,245	248
Subtotal	\$5,260,284	\$7,206,589	\$12,466,873	461
South				
Guided Anglers	\$932,400	\$1,277,388	\$2,209,788	82
Lodge Anglers	\$12,901,201	\$17,674,645	\$30,575,846	1,131
Subtotal	\$13,833,601	\$18,952,033	\$32,785,634	1,213
Total	\$19,093,885	\$26,158,622	\$45,252,507	1,674

Regarding the direct expenditures of the northern region, the independent guided anglers and the lodge guided anglers had similar direct expenditures, which totaled \$5.2 million. In the southern region, direct expenditures were different among independent guided anglers and lodge guided anglers, who generated \$0.9 and \$12.9 million respectively, for a total of \$13.8 million (Table 15). Thus, the total direct expenditures amounted to nearly \$19 million. The contributions of the added value to the direct expenditure of flat fishing in Quintana Roo were \$7.2 million in the northern region and \$18.9 million for the southern region, for a total of \$26.1 million in indirect and induced impacts. Finally, the sum of direct spending and the added value that includes indirect and induced effects resulted in a Total Economic Impact of \$45.2 million for flats fishing in Quintana Roo in 2019.

The estimate of employment generated was higher in the southern region than in the northern region, due to the numerous lodgings of anglers in this part that hire both fishing guides and service personnel. In this sense, the equivalent of 461 jobs were created in the northern region and 1,213 jobs in the southern region. This gives a total of 1,674 full-time jobs corresponding to the type of formal employment; however, the number of jobs could be higher because temporary or informal jobs in the tourism sector are not counted.

Conclusions and recommendations

This first economic evaluation of the catch-and-release flats fishery in Quintana Roo, Mexico, indicates two sectors of service providers contribute a total of \$45.2 million to the economy and generate 1,674 full-time jobs in communities. Independent guides guided 2,439 anglers and fishing lodges 3,644 anglers making a total 6,083 anglers as part of the 2019 fishing season. For these reasons, the flats fishery deserves recognition as a model of a sustainable activity that preserves the very resource that supports its existence, healthy habitats and populations.

Quintana Roo is the state with the highest tourist affluence in the country, receiving more than 15 million of tourists in 2019, who contributed \$16.213 billion dollars in revenue (SEDETUR, 2019). This study determined that the flats fishery of Quintana Roo generated almost \$45.2 million dollars in 2019 and the direct expenditure of flats anglers of \$19.09 million dollars represented 0.12%. However, the daily expenditures of flats anglers are higher than those of conventional tourists. Moreover, flats anglers participate in an ecotourism activity that is more sustainable than conventional mass tourism activities. These differences should be considered by governments and institutions that implement policies and management strategies for the region (Perez et al., 2020, 2021).

The differences in economic dynamics between the north region and the south provide valuable information on the level of tourism development and the presence of other fisheries. The northern region has a higher concentration of overall tourism, where the tourism industry has prioritized mass tourism as a model to economic development but the development, modernization and expansion of basic infrastructure has come to an ecological price. According to stakeholders, this has caused coastal wetlands to show signs of environmental degradation which has largely affected the quality of fishing and thus expectations of visitors which is vital in eco-tourism. This could be one of the main reasons why anglers prefer the southern region as fish populations are abundant and fish are larger due to less fishing pressure and more pristine and healthy habitats. Also, the northern region was identified by guides as an area of conflict with artisanal fisheries which directly impact fish bonefish, tarpon, permit and snook populations. Furthermore, communities in the southern are involved in an ecosystem model for economic development which goes in accordance to preserve natural habitats using protected areas and based-rights fisheries management. For these reasons, fishing capacities, conflict resolution, zoning and surveillance to mention a few are some of the proposals by stakeholders to reinforce management, protect livelihoods and conserve natural resources.

Many of the flats fishing guides were artisanal fishers and found guiding as an alternative livelihood (Perez et al., 2020) because they recognized there was a decline in target species. They also recognized that guiding was more profitable and was an activity that preserved the target

species for another day. Fly fishing guides acknowledge the importance of conserving habitats in coastal areas so that target species are abundant. These have made them aware for the need for authorities such as CONAPESCA, CONANP, and PROFEPA to ensure monitoring, control and surveillance of recreational-sport fishing and artisanal fishing to avoid the use of non-permitted fishing gear and avoid the incidental capture of species of interest for flats fishing (Palomo and Hernández-Flores, 2019; Perez et al., 2020). Overall, the stakeholders in the southern region resist plans of a mass tourism model which contemplates a multi-destination ecotourism corridor.

Quintana Roo is considered the jewel of the Mexican Caribbean due to its importance in tourism and biodiversity, where the reef ecosystems and coastal habitats support the species important to the flats fishery. However, the main threat continues to be illegal gillnet fishing in coastal areas, which captures all types of species and can affect the abundance of fish stocks. For that reason, studies on the biology and spatio-temporal patterns of the main target species of the flats fisheries are necessary. The connectivity of these habitats is important for the life history of these species, which has implications for the livelihoods of local guides, coastal communities and the protection of marine ecosystems. Thus, sustainable use schemes, such as recreational catch-and-release fishing, should be considered an essential management approach (Perez et al., 2020, 2021).

That flats fishing off the coast of Quintana Roo contributes an important source of income for the state and for the localities where it is practiced. It is an activity that is considered within the range of recreational-sport fishing in the country and has not been seen as a different category from other types of recreational fishing that are practiced, despite attracting almost exclusively international anglers from around the world. In summary, stakeholders see the need to incorporate habitat protection and resolution of conflicts among user groups into fisheries and protected areas management (Perez et al., 2021). Without these, the model of a sustainable fishery will have no foundation and will collapse.

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