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COVID-19 Impacts on Whale-Watching Collaboration Networks

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Abstract: Whale-watching tourism generates high-income seasonal livelihoods in coastal communities on the Mexican Pacific Coast; however, this sector is at risk from accelerated global changes. We evaluated the responses of a collaboration of tourism networks regarding the impacts COVID-19 using a longitudinal social network approach. We used a two-wave snowball method to identify potential interviewees and followed geographic and jurisdictional criteria using a face-to-face survey to map collaboration ties between 38 stakeholders involved in whale-watching tourism before and after the second wave of the pandemic. We also asked this group of stakeholders about their perceived impacts of COVID-19. We found slightly higher connectivity and centralization levels in the social networks after the pandemic. Loss of income and reservations, a decrease in both conservations and pollution, and an increase in the reduction in wildlife tourism were the main self-reported impacts. We also detected harmful pandemic legacies, such as whale-watching tours conducted using unregulated private boats. This research directly informs Mexico's whale-watching tourism policy by showing the management and coordination challenges that stakeholders face in a post-pandemic context. While the social fabric of coastal communities has been resilient to the COVID-19 pandemic, we found indications that the governance of marine resources can easily unravel if rule of law is absent.

Keywords: COVID-19; coastal communities; natural resource governance; longitudinal network analysis; tourism management; wildlife tourism

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1. Introduction

Whale-watching tourism is a mixed blessing; on one hand, it generates seasonal livelihoods and cultural identities to many coastal communities, e.g., in Mexico, the annual benefits of this tourism segment are USD 7.2 million [1]. On the other hand, whale-watching tourism is threatened by accelerated global changes, e.g., anomalies in sea temperature, abandoned fishing gear, minimal law enforcement, and the COVID-19 pandemic, which require effective local governance [2–4].

Given the ecological and social core of whale-watching tourism, a systemic and multidisciplinary vision is required to guarantee its ecological and economic sustainability [5] Whale-watching tourism management involves social processes [6], where stakeholders from different sectors and interests interact in multiple ways [7]. In that sense, new models of tourism management based on polycentric governance networks are needed [8]. Such systems are characterized by "multiple governing authorities at different scale and jurisdictions committed to self-organization and mutual adjustment" [9,10].

The resilience of a social–ecological system is its "capacity to absorb periodic shocks and maintain its essential structures, processes and feedback mechanisms" [11]. Connectivity, diversity, and polycentric governance are three essential elements of resilient socio-ecological systems [12,13]. Connectivity refers to the configuration of the ties of the

distinct parts of the system; a highly connected system can enhance resilience when resources are needed, or isolated parts can reduce transmission of epidemic outbreaks. In that sense, polycentric governance can also facilitate resilience by maintaining multiple decision centers that function semi-autonomously. Finally, diversity refers to the advantages that different elements can covey to a system hit by a shock [13,14].

The emergence of the recent COVID-19 pandemic has generated an unprecedented impact on most countries of the world. To date, 600 million people have been infected, causing 6.9 million deaths [4,15]. Worldwide tourism has been heavily impacted by the COVID-19 pandemic [16]. Although Mexico never closed its borders to international tourism, in the year 2020, it faced a reduction in international (45.9%) and national (55%) visitors [17]. Before the pandemic, in Mexico, tourism contributed 8.5% of the gross domestic product, generating four million jobs [18]. Therefore, it is urgent to understand the social impacts that the reduction in international travel and the resulting confinement had on the wildlife tourism sector in the region [19,20].

The COVID-19 pandemic is undermining human health, sources of employment, and income (whale-watching tourism), as well as the social capital of coastal communities, which will translate into further degradation of coastal and marine ecosystems, inequality, and poverty [21,22]. Effective intersectoral coordination could mitigate the indirect effects of the post-pandemic multidimensional crisis. Thus, assessments of the COVID-19 impact on wildlife tourism are essential for rebuilding this sector towards a more sustainable and resilient trajectory [19]. So far, few studies have used a social network analysis (SNA) in the field of tourism management [23,24], and this research is one of the pioneers regarding the use of SNA to assess the COVID-19 impacts on whale-watching tourism [3].

This study aims to evaluate the impacts of the COVID-19 pandemic on the configuration of social networks using a resilience principles framework [13]. We used a longitudinal social network approach to assess the impacts of the pandemic on whale-watching collaboration networks before and after the second wave of COVID-19. Moreover, we also assessed the stakeholders' perceived impacts of the pandemic and its legacies on such networks on the Mexican Pacific Coast.

2. Materials and Methods

Overview of whale-watching tourism. Humpback whales (*Megaptera novaengliae*) are a highly migratory species that exist in all the world's oceans; these marine mammals have specific areas for feeding during spring and autumn, particularly in waters of medium and high latitudes. Later in the winter, the humpback whales migrate to breeding areas in the tropics [25]. From November to March, humpback whales are found on the Pacific Coast of Mexico; they congregate at the south end of the Baja California peninsula, around Isla Isabel, the Tres Marias Islands, and Bahía de Banderas [1,26].

Whale-watching consists of a diversity of tourist practices, ranging from diving (Colombia) [27] and snorkeling (French Polynesia, Tonga, Dominican Republic), to sighting from boats accommodating 8–11 passengers (23 feet)—occasionally operated by local cooperatives (Mexico, Colombia)—catamarans (75 feet) (Mexico), and cruise ships (Canada, USA, Mexico) [1,2]. In Mexico, each whale-watching season, the federal environmental authority (SEMARNAT) issues temporary authorizations to tour operators (December–March) [28]. In addition, a federal standard regulates the interactions between humpback whales and tour operators (distance and time) [29].

Study area. Mexico was the seventh most visited country in the world in 2019. Accordingly, two of Mexico's top ten international destinations—Puerto Vallarta and Riviera Nayarit—are located inside the Bahía de Banderas. Such spots are popular US and Canadian tourist destinations, with a combined offering of 22,027 hotel rooms [30]. One of the most visited marine protected areas (MPA) in Mexico, Islas Marietas National Park, is also located inside the bay [31]. In addition, the Marietas Islands and the Punta Mita channel are some of the highest concentration zones for humpback whales in the region [26] (See Figure 1). In the year 2020, 420 whale-watching permits were issued to the owners of

tourist boats in Bahía de Banderas [32]. Every year, SEMARNAT also issues a decree that regulates whale-watching, excluding a 1.5 km radius around Islas Marietas National Park and a 2 km strip from the north shore of Bahía de Banderas (See Figure 1). In summary, the conditions described above highlight the relevance of whale-watching tourism for the coastal communities in the region.

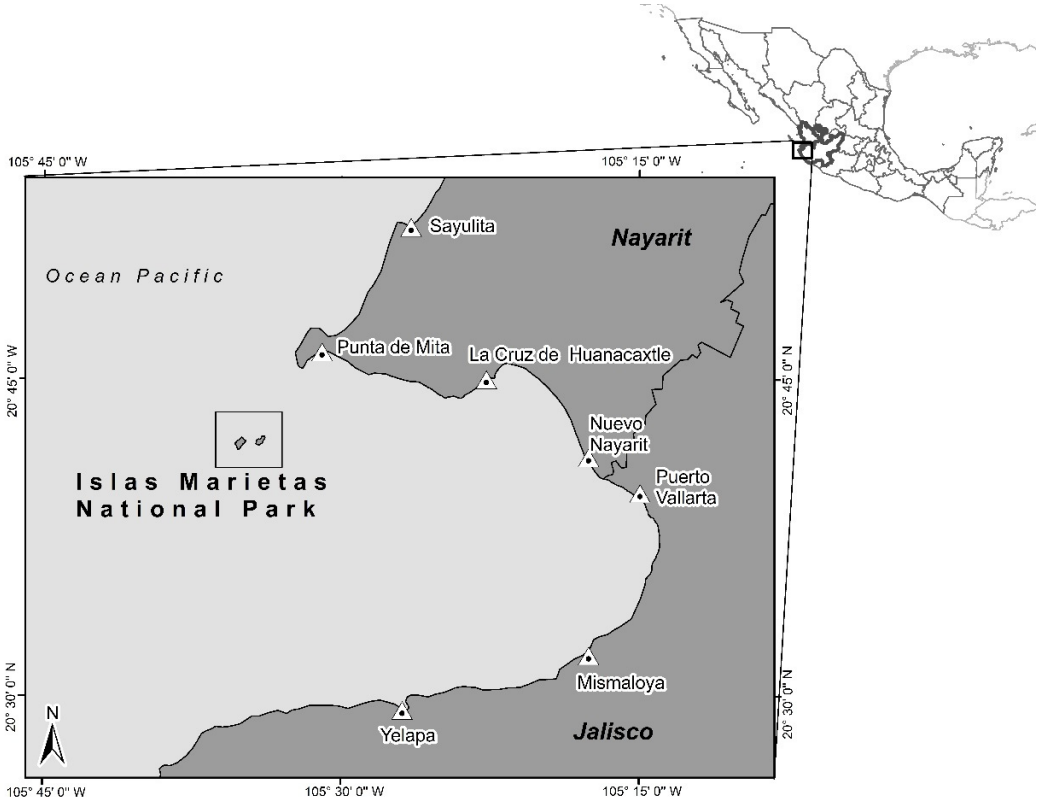

Figure 1. Bahía de Banderas is located in the northeast Pacific in Mexico. The bay belongs to three municipal jurisdictions—Cabo Corrientes, Puerto Vallarta, and Bahía de Banderas—and two states—Jalisco and Nayarit. Nearly half a million people (490,411) live in this inter-state metropolitan area [33]. The most important whale-watching tourism locations are shown (source: own elaboration).

Data collection. We use a non-probability snowball sampling method (SSM), both as a data collection method and as an analytical tool, for social network analysis (SNA) [34]. The former helps locate, access, and engage a target population that would otherwise be impossible to find in a random sample. SNA is an analytical tool that helps to track network actors using their references within the circle of their acquaintances and according to the relationships to be analyzed [35]. SSM can be effective in contradictory environments, such as in the context of the management of wildlife tourism [36].

We interviewed two experts who provided a key informant list of stakeholders involved in humpback whale-watching tourism. We then used two-wave snowball sampling to identify potential interviewees [37]. Respondents had to meet four criteria: (1) they must appear on the list of key informants; (2) they must appear in the snowball; (3) they must represent different social sectors; and (4) they must work in different geographical locations in the Bahía de Banderas, Jalisco-Nayarit. Between April and November 2021, we approached 43 stakeholders who met the criteria and conducted sociometric and semi-structured interviews with 38 of these. In most cases, the interviews were face-to-face; only five interviews were conducted using videoconferencing platforms [34]. The participants interviewed were classified into four categories according to their affiliation: private tour operators, non-governmental organizations (NGOs); government agencies, and universities [38].

Ethics Process. Before the interview, we read aloud a free, prior, and informed consent to each of the research participants describing their role in this research. Once the interviewees agreed to participate, they signed the consent [39]. To protect the identity of the interviewees, we constructed a five-letter code to anonymize them; for example, "GOVC2" means "interviewee number two from government agency C" [40].

Survey. We used name generators [34] with a specific timeframe before and after the COVID-19 pandemic: Who did you collaborate with on whale-watching tourism before the second wave of COVID-19 (December 2019 to March 2020) in Bahía de Banderas? With whom did you collaborate on whale-watching tourism in the last season (December 2020 to March 2021) in Bahía de Banderas? (See Figure 2). There was no limit to the number of names each respondent provided.

Semi-structure interview. We applied a semi-structured questionnaire of 7 questions to the same group of 38 stakeholders [41] to determine their perceptions regarding economic impacts, changes in composition, and tourist demand, as well as the indirect environmental impacts and legacies of the COVID-19 pandemic on the whale-watching tourism (See Annex SI in Supplementary Materials).

Data analysis. We assembled a 38 × 38 adjacency matrix, where each cell represents directed whale-watching collaboration ties. We assembled a set of 38 × 38 adjacency matrices, where each collaboration tie was symbolized with binary numbers. We analyzed the global and nodal properties of the networks using R 4.2.1 [42] and R package network [43], sna [44] (See the glossary for network terminology).

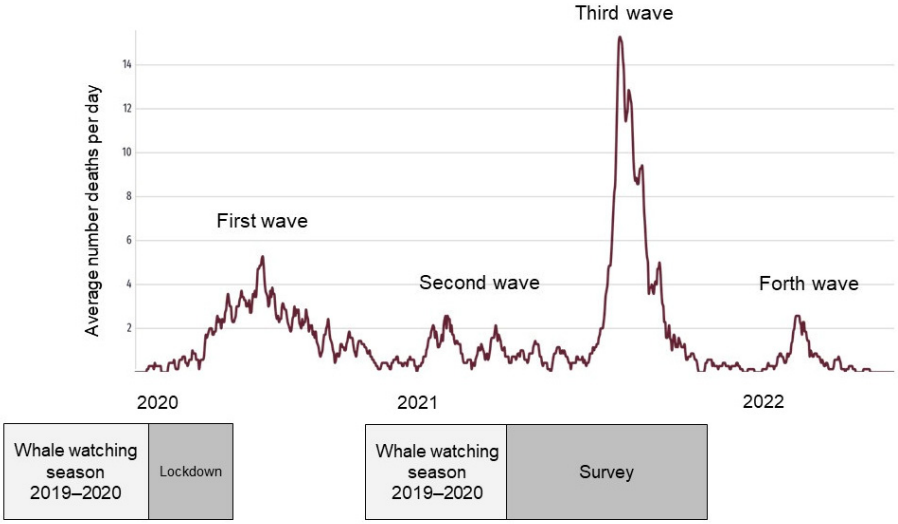

Figure 2. Timeline of the COVID-19 pandemic and whale-watching seasons in Bahía de Banderas, Jalisco-Nayarit. The 2019–2020 whale-watching season was conducted normally. All navigation was restricted between 30 March and 1 June 2020 [45]. However, Mexico never closed its borders to international flights, so the 2020–2021 whale-watching season took place after the reopening of navigation and during the second wave of the pandemic (source: own elaboration based on [28,45]).

Global Properties. In directed networks, the density is given by the number of ties in a network divided by all possible ties: $N \times (N - 1)$ where N is the number of nodes in the structure [35]. Therefore, the density ranges from 0, where there are no ties between any of the stakeholders, to 1, where each stakeholder has a tie to every other stakeholder in the network. The Krackhardt connectedness is defined as $1 - [V/N \times (N - 1)/2]$, which is the total number of pairs of nodes that are not mutually attainable (V) divided by the maximum number of possible pair combinations: $N \times (N - 1)/2$ [46]. The reciprocity is a ratio of mutual dyads ($2 \times M$) divided by the sum of mutual and asymmetric dyads (A); that is $2 \times M/(2 \times M + A)$. Likewise, transitivity is calculated as the ratio of transitive triads versus the total number of potentially transitive triads [44]. Furthermore, these

measures range between 0, for networks without mutual dyads, i.e., transitive triads, and 1, for networks where all non-zero dyads are reciprocal, i.e., non-zero triads are transitive.

Nodal properties. In addition, we compute centralization values for each network based on degree and betweenness centrality. The centralization is given by the sum of the differences of the highest centrality value of all the centrality values in the network [35]. The degree of centralization in a network is an indicator of hierarchy within the structure. It refers to the extent to which a single stakeholder dominates the structure. A maximally centralized network looks like a star, in which the node at the center of the network ties to all the other stakeholders [35]. The centrality of betweenness measures the degree to which a stakeholder is on the shortest path connecting other stakeholders of the network. This nodal metric refers to the proportion of all paths joining stakeholders j and k, passing through stakeholder i. The betweenness of centrality of stakeholder i is equal to the sum of all paths jk. [47].

3. Results

The humpback whale-watching tourism collaboration networks were composed of members from different social sectors (Figure 3). The majority of interviewees corresponded to tour operators (47%) and government officials (34%) (Table 1).

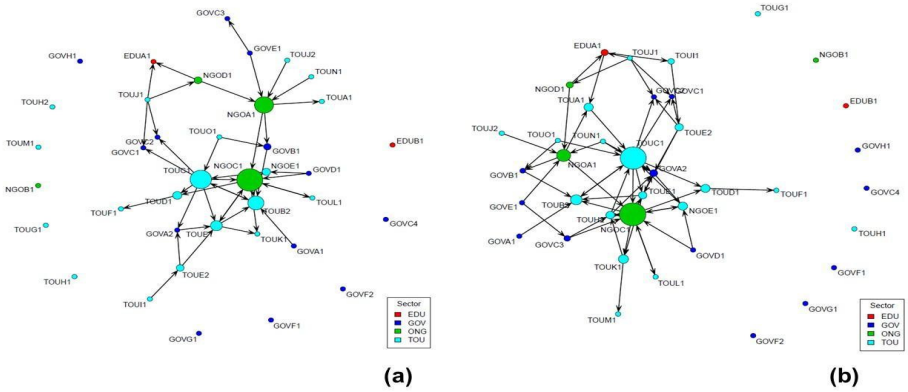

Figure 3. Visualization of the whale-watching tourism collaboration network: (**a**) before the pandemic (2020–2021 season), and (**b**) after the second wave of COVID-19 (2020–2021 season). The nodes represent the participants and the lines of their collaboration ties. The size of the nodes represents the betweenness centrality of the stakeholders. The first three letters of the label of each node indicate the sector to which they belong: tour operators (TOU), government agencies (GOV), non-governmental organizations (NGOs), and universities (EDU).

Table 1. The composition of collaboration networks in whale-watching tourism in Bahía de Banderas, México.

Organization Type	Number of Interviewees
Tour operators	18
Government	13
NGO	5
Education	2
Total	38

The interviewees resided in seven coastal localities of Bahía de Banderas belonging to the three municipalities (Cabo Corrientes, Puerto Vallarta, and Bahía de Banderas) from two states (Jalisco and Nayarit). Almost half were in Puerto Vallarta, Jalisco (See Table 2). A fifth of the interviewees were women (9), while half of the respondents were managers of organizations (21). Almost half of the respondents held bachelor's degrees, and almost all were bilingual. The majority of interviewees came from the upper class (23), followed

by the upper middle class (8), the middle class (6), and finally, the lower middle class (1). Half of the interviewees received income linked to whale-watching tourism, and in the case of tourism service providers, one-third of their annual income came from humpback whale watching.

Table 2. Places of residence of interviewed stakeholders in Bahía de Banderas, México.

Location	Number of Interviewees
Sayulita, Nay.	3
Punta de Mita, Nay.	4
La Cruz de Huanacaxtle, Nay.	7
Nuevo Nayarit, Nay.	2
Puerto Vallarta, Jal.	16
Mismaloya, Jal.	1
Yelapa, Jal.	1
Tepic, Nay.	4
Total	38

Impacts on network diversity. The diversity of the collaboration networks remained nearly the same. The collaboration network after the second wave of the pandemic showed two more nodes (tour operators) (See Table 3).

Table 3. Comparison of diversity of whale-watching networks before and after the COVID-19 pandemic.

Composition of Collaboration Network by Type of Stakeholder	Before the Pandemic (T 2019–2020)	After the Second Wave of COVID-19 (T 2020–2021)
Government	8	8
Tour operator	14	16
NGO	4	4
Education	1	1
	27	29

Impacts on global properties. The main impact of the pandemic on the structure of the networks was an increase in density, connectivity, centralization by degree, and centralization by betweenness; in contrast, we detected a slight decrease in reciprocity and transitivity (Table 3). Impact on nodal properties. Two stakeholders (NGOC1 and TOUC1) increased their betweenness centrality after the second wave of COVID-19; these stakeholders already occupied central positions in the tourism collaboration network before the pandemic. In contrast, other prominent stakeholders decreased their centrality values over time (NGOA1) (See Table 4).

Table 4. Comparison of the global properties of whale-watching tourism networks before and after the COVID-19 pandemic.

Global Property	Before the Pandemic (T 2019–2020)	After the Second Wave of COVID-19 (T 2020–2021)
Density	0.03	0.04
Connectivity	0.17	0.26
Reciprocity	0.10	0.07
Transitivity	0.16	0.13
Degree of centralization	0.20	0.26
Betweenness centralization	0.07	0.09
Reciprocity	0.10	0.07

Economic impacts. We recorded a 43.6% decrease in the number of weekly tours, as well as a 49.1% decrease in the average number of whale-watching tourists per boat before and after the second wave of COVID-19. We also detected changes in the composition of the origin of tourists between both seasons, resulting in a 6.4% decrease in foreign tourists and an increase of 14.7% in domestic tourists (See Table 5).

Table 5. Comparison of the nodal properties of the top ten stakeholders in the whale-watching tourism networks before and after the COVID-19 pandemic.

Stakeholder	Before the Pandemic (T 2019–2020)	After the Second Wave of COVID-19 (T 2020–2021)
NGOC1	7.67	9.53
TOUC1	5.97	9.22
NGOA1	5.11	3.88
TOUB2	4.03	2.80
TOUK1	0.00	2.10
NGOE1	1.15	1.85
TOUD1	1.43	1.80
TOUA1	0.00	1.79
TOUH2	0.00	1.53
TOUE1	2.44	1.38

Perceived economic impacts. Two-thirds of the stakeholders mentioned the loss of income and reservations. A small group of stakeholders mentioned layoffs and debt acquisition (Figure 4).

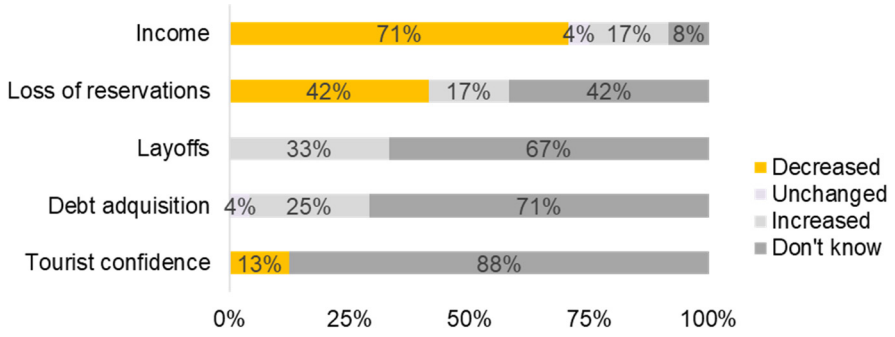

Figure 4. Type of perceived economic impacts of COVID-19 and the percentage of stakeholders that self-reported a change (n = 24).

Indirect environmental impacts. Stakeholders perceived a mixed-blessing combination of indirect environmental impacts. A decrease in conservation actions was mentioned by a quarter of the stakeholders. Almost half mentioned an increase in the reduction of wildlife tourism. In contrast, almost one-third of the stakeholders perceived an increase in the number of boats on clean beaches (Figure 5).

Adaptation mechanisms to the pandemic. Most stakeholders perceived an increase in the use of face masks as a measure to mitigate COVID-19 in whale-watching tourism. In contrast, only half reported the COVID-19 vaccination, and only a quarter perceived changes in their work schedules as mitigation measures (Figure 6).

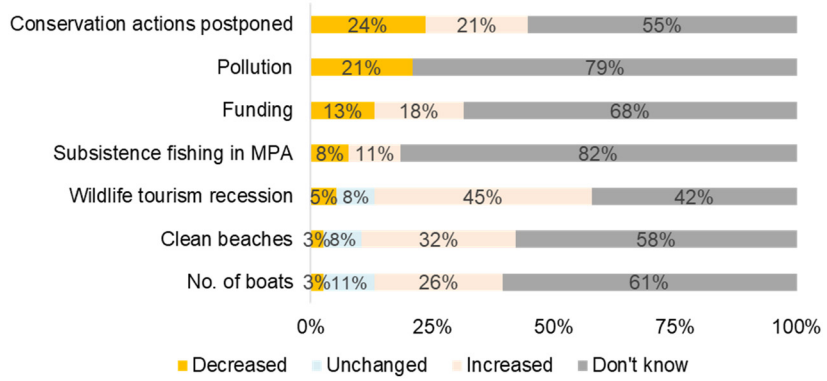

Figure 5. Type of perceived indirect environmental impacts of COVID-19 and the percentage of stakeholders that self-reported a change (n = 38).

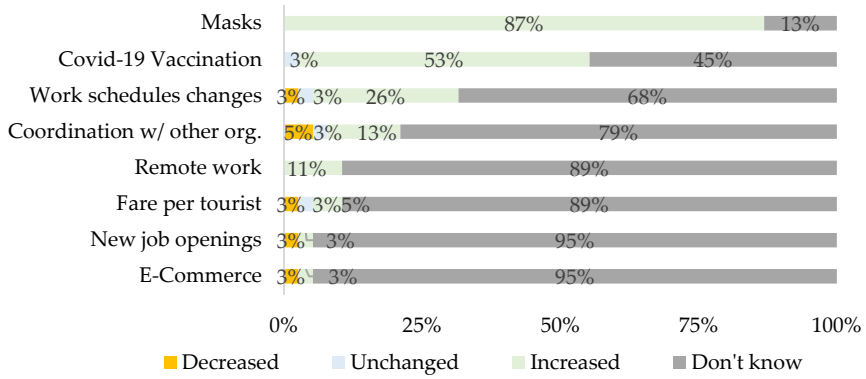

Figure 6. Type of COVID-19 mitigation mechanisms and percentages of stakeholders that self-reported a change (n = 38).

Legacies of the COVID-19 pandemic on whale-watching tourism. Half of the tour operators, one-third of government officials, and one-fifth of NGO members mentioned that "there will be no long-term impacts of COVID-19 on the whale watching tourism." For example, a national parks official mentioned that the pandemic impacts were short-term: "I do not think there will be (long term) impacts. The level of visitation in the national park is already the same as in past years. The next whale season will be normal." Long-term health and hygiene protocols as a pandemic legacy were only mentioned by university employees, 15% of government officials, and 20% of NGO members.

Private boats without permission conducting whale-watching. However, almost half of NGO members mentioned one of the pandemic legacies will be an increase in environmental awareness. Contrastingly, as a COVID-19 legacy, an NGO member mentioned the demand for tours in private boats without permission: "Private fleet offers illegal tours, it will continue, it is a new market niche. Which means an unfair competition, it will normalize in a couple of years," "Tourism is changing, the priority will be given to experiences that involve fewer people, even if they are at a higher cost" (See Figure 7).

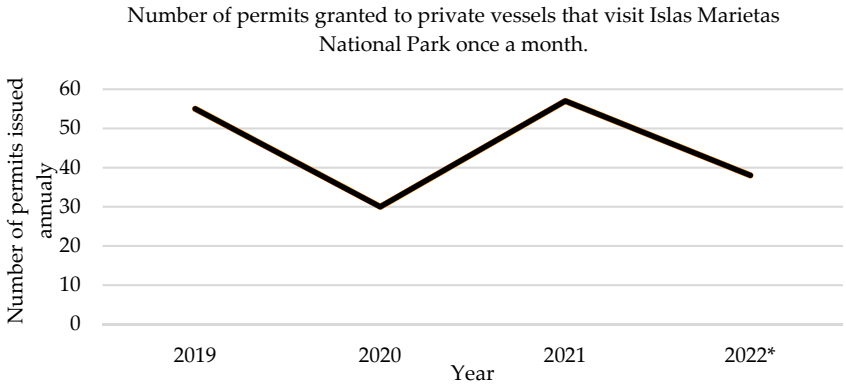

Figure 7. The number of permits granted to private vessels that visited Islas Marietas National Park (IMNP) once a month [48]. Before the pandemic, tourist providers asked the national park to regulate private boats; since 2019, one permit per month per private boat has been issued to visit the park. In 2020, due to the pandemic, the IMNP was closed from the end of March to July; thus, the graph shows a short decrease in the number of permits issued, which increased again in 2021. * For the year 2022, data is only available from January to August. This data can be used to approximate the number of private boats conducting whale-watching activities without permission in Bahía de Banderas (source: own elaboration based on unpublished data from National Commission of Protected Areas).

4. Discussion

We obtained evidence that whale-watching tourism was disrupted by the COVID-19 pandemic; however, we found a diversity of impacts regarding their class and their duration, as well as specific responses of human social networks to the pandemic shock. Regarding the structure of human social networks, we found slightly higher connectivity and centralization and the same level of diversity after the second wave of the pandemic. Loss of income and reservations, and a decrease in both conservation actions and pollution, were the main impacts perceived by the stakeholders. We also found that the use of face masks and vaccinations were the principal mechanisms implemented by members of the whale-watching sector.

In the collaboration networks among whale-watching organizations, we found that the three measures of resilience—connectivity, polycentric governance, and diversity—had different outcomes [13]. First, we found a higher level of connectivity; this is an indication that coastal communities could have resilient responses to crises derived from impacts such as COVID-19. In their analysis of "social-ecological network structures in the face of global change," a previous study [14] consider that connectivity is a resilience mechanism that incentivizes collaborative processes among organizations because it allows for the deploying of a series of strategies for managing, learning, and providing feedback in an adaptative context. This means that the social structures showed hints of social resilience to the shock of the pandemic in terms of higher connectivity [13,49].

Second, we found that the development of a polycentric governance system [9] seemed to have a positive influence on the response to the COVID-19 crisis in Bahía de Banderas. The whale-watching tourism collaboration network was composed of members from different social sectors (local authorities, tour operators, NGOs, universities, and regulators), all of them working at different scales and under different authorities (formal and informal). In theoretical terms, well-developed governance allows for the interactions of multiple subsystems [50] to align factors that support self-organization, cooperation, and problem-solving [51,52]. In this sense, polycentric governance can also facilitate resilience by employing multiple decision centers that function semi-autonomously [53].

Third, we found a tendency toward centralization, as well as the same level of diversity in the whale-watching collaboration networks before and after the COVID-19 pandemic (See Tables 3 and 4). This is an indication that the decentralized structure of the network is in the process of erosion. A decentralized network has multiple benefits at the network level;

it can facilitate the co-management of natural resources [54], it has positive implications for law enforcement [55], and it is a feature associated with polycentric governance [9,49,55].

For instance, historically, the observed collaboration network has been decentralized, and this has positive implications for law enforcement in whale-watching tourism in the region [1]; the rangers of Islas Marietas National Park also collaborate regarding whale-watching vigilance. In the year 2016, this MPA experienced a regulatory shock due to a temporary closure (due to tourist environmental impacts), causing a general reorganization of tourist practices. Most of the operators were grouped under a non-governmental organization to access the benefits of the park and obtain representation in the national park decision-making council (advisory). This highlights the critical role of bridging organizations in the effective governance of MPA [26,56,57]. In terms of diversity, the number of social sectors involved in the social networks before and after the COVID-19 pandemic was the same (See Table 3); however, other networks in the region showed higher levels of sectorial diversity [38,58].

Whale-watching tourism at Bahía de Banderas was affected not only in terms of the impact of acute health stress among the organizations' members, especially in the second wave of the pandemic, but COVID-19 also had an immediate economic impact on employment. Low flows of international tourism incentivized a change in the labor network market among the organizations dedicated to whale-watching tourism. Likewise, organizations concentrated their efforts on participating in the local market (See Table 6). However, certain organizations struggled to adapt and reintegrate into the labor market. In addition, negative budget impacts were recognized among whale-watching tour operators where wage cuts for part-time or seasonal work increased. Although only one small fraction of the stakeholders perceived the reduction in the organization's funds as an indirect environmental effect of the pandemic (13%), the magnitude of this impact was remarkable. The largest nature tour operators mentioned the loss of 400 seasonal employees, thus affecting the organizational capacities, limiting research projects, and reducing beach cleaning campaigns. These impacts have been reported in other research papers on COVID-19. For instance, recently researchers analyzed the pandemic's impacts suffered by stewardship groups at the organizational level [59]; they found changes in the access to natural public spaces and changes in the form of participation of members who went from communicating face-to-face to communicating virtually, altering volunteer engagement. Bahía de Banderas and Islas Marietas National Park were not exempt from the indirect environmental impacts of the COVID-19 pandemic. The temporary suspension of surveillance, along with the layoffs of park rangers, exemplified the MPA's economic dependence on tourist visits [19,20]. This is in line with previous findings [59] regarding the impacts of COVID-19, such as struggles to access natural public spaces and changes in social participation mechanisms in relation to stewardship organizations working on coastal watersheds. The pandemic also increased (in the short term) the demand for providing ecosystem services, such as managing illegal fishing inside the MPA (See Figure 5), and decreased the supply of cultural services, such as tourism (See Figure 4 and Table 6), which is in line with the results of previous studies [60,61]. Nevertheless, stakeholders mentioned that certain fishing gear (e.g., fencing and small mesh size nets) was funded by shadow networks, which would indicate the diversification of criminal markets [62] and future trajectories of resource scarcity and territorial conflicts in the region [63].

One of the pandemic legacies in Bahía de Banderas is the increased use of private boats conducting whale-watching tours; such vessels represent a higher risk because of their low levels of compliance with whale-watching guidelines [1] This tourist use of private boats has been heavily promoted on social media platforms, and the use of these vessels across Bahía de Banderas is entirely underregulated. This tourist activity also represents unfair competition to regulated private boats visiting Islas Marietas National Park, as those vessels must pay for permits and comply with the rules. The proxy data shows a recovery of this activity (See Figure 7), which might affect navigation and generate negative social and ecological impacts [2]. On the Gulf of California, a private vessel fire caused the

temporary closure of a marine protected area due to fuel spills, which highlights the scale of the potential damage of these tourist practices.

Table 6. Self-reported economic impacts of the COVID-19 pandemic on whale-watching tourism in Bahía de Banderas, Mexico (n = 16).

Type of Self-Reported Economic Impact	Before the Pandemic (T 2019–2020)	After the Second Wave of COVID-19 (T 2020–2021)
Average no. of weekly tours	39.4 (116.5)	17.2 (49.3)
Average number of tourists per boat	10.8 (6.5)	5.3 (3.1)
Average percentage of international tourists per vessel	54.7 (24.3)	40 (17.9)
Average percentage of domestic tourists per vessel	45.3 (24.3)	60 (17.9)

Besides the fact that whale-watching policy instruments in Mexico are regulatory oriented, there are pressing issues exacerbated by the COVID-19 pandemic, including weak law enforcement and poor vigilance, highlighting the need for more adaptive and flexible instruments to govern the marine commons [6,8]. The post-pandemic challenges must be addressed in the formulation of new tourism management policies, such as more effective and sophisticated surveillance programs with wider spatial coverage, communication campaigns focused on users of private boats, and accountability schemes for this market. The financing of these programs could arise from direct contributions from tourists (For example, through a fundraising program based on the sale of bracelets for visitors who carry out whale-watching activities within the bay), for which it is necessary to create new local financial arrangements. In the region, in 2018, Islas Marietas National park received 260,000 visitors generating USD 6.5 million. Each visitor donated USD 2 to a local conservation fund co-managed by both the bridging organization and the national park. A total of 92% of the operational costs of the national park relies on these funds.

The main limitation of this longitudinal study is the accuracy of the interviewed stakeholders to recall their social ties before and after the second wave of the COVID-19 pandemic [64]. However, the regulatory policies implemented by the federal government to control the first wave of the pandemic established a clear milestone in the memory of the stakeholders [45]. For this reason, we consider that the whale-watching seasons, with their limited reductions, facilitated a differentiation between the first and second waves of the pandemic. Future research should study competitive ties between tour operators, since the respondents recognized that whale-watching represents 33% of their annual income. Moreover, understanding the factors that could be promoting the formation of collaboration ties in the observed networks, such as socioeconomic level, gender, affiliation, and geography, will be crucial in future research [56]. We also detected the need to further study the regulation dimensions of the market for private vessels for rent in the region [1].

5. Conclusions

The participation of civil society in the management of marine resources of tourist interest is becoming increasingly common [24,55,57]. These groups interact and create management networks that can shape the environment and the benefits that people derive from it [7], such as whale-watching. The features of these collaboration networks are determined by a diversity of social process and events, in which COVID-19 has altered their functioning. In this line, we found that the pandemic shock had multiple implications in terms of social resilience [13], not only regarding the capacity and functioning of organizations, but also in the governance of natural resources associated with the tourism. However, the impacts detected on tourism management groups were multidimensional [19,20,59]; therefore, new effective public policies are required to improve local governance and adaptation capacities concerning whale-watching tourism [1]. On the one hand, the social fabric of coastal

communities showed hints of resilience to the COVID-19 pandemic [14]; on the other hand, we also found that the governance of common marine resources can easily unravel if rule of law is absent [61]. Mapping and analyzing social interactions between the users of common marine resources constitute a critical route to improving the coordination in the context of tourism recovery from the pandemic. This research directly informs Mexico's tourism management policy by showing the coordination challenges that stakeholders in whale-watching tourism face while rebuilding this tourism entity towards more sustainable and resilient trajectories.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su142113846/s1. References [65–67] are cited in the Supplementary Materials.

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