

Article

# Sustainable Cruise Tourism in Marine World Heritage Sites

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Received: 15 November 2019; Accepted: 9 January 2020; Published: 14 January 2020



**Abstract:** Cruise-ship tourism is one of the fastest growing industry sectors, with itineraries that regularly visit marine parks and protected areas. UNESCO Marine World Heritage (MWH) Sites feature some of the world's most exceptional ecosystems, resulting in some cruise lines targeting these sites. To understand the extent of cruise ship visitation and determine perceptions of cruise ship sustainability within and across environmental, economic, and sociocultural dimensions, we conducted an online survey of 45 (out of 50) sites. The survey included responses about the characteristics of cruise ship visitation, strategies for sustainably managing ships, and ideas for encouraging sustainable practices. Among the 45 respondents, 30 (67%) indicated that their MWH site hosts cruise ships or cruise ship passengers, and 25 sites have cruise ships that enter the protected area marine waters. Most sites (62%) indicated an increase in cruise visitation over the last three years. While most sites regulate ballast water (73%) and wastewater (73%) discharge, common concerns focused on ship air emissions and wildlife interactions. Lack of funds generated by cruise ships toward community infrastructure was noted. MWH site managers expressed interest in developing site networks to facilitate sharing of ideas as a first step for increasing sustainability across all sites.

**Keywords:** nature-based tourism; sustainability; cruise ships; marine-protected areas; social-ecological system; governance

## 1. Introduction

Tourism is a global industry that generates employment and earnings worldwide, playing a critical role in the economies of many nations. The tourism industry is projected to increase at 3.3 percent annually from 2010 to 2030 [1], with a key component of the industry coming from cruise-ship tourism. Cruise tourism has increased 7% annually over the past four decades, with demand exceeding 60% between 2005 and 2015 [2]. In 2018, there were 28.2 million cruise passengers globally, generating more than 1.1 million jobs and \$45 billion in wages worldwide [3]. Markets for potential cruise travelers are expanding, particularly in Asia, and the industry continues to build more and larger ships to keep up with demand. In 2019, 18 new cruise ships were brought to market, including some 'mega-ships' (5000 passengers or more) but also compact 'expedition' and 'adventure' sized ships (fewer than 100 passengers) that travel to more remote destinations [3]. Cruise ships are now journeying to almost every part of the globe to provide unique visitor experiences, including marine-protected areas.

The economic and environmental sustainability of cruise travel is of high importance to international policymakers, national governments, and industry officials. Based on notions of sustainability originating with the UN Brundtland Report [4], sustainable tourism "takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities" [5] (p. 12). For the United Nations World Tourism Organization (UNWTO), the goal is to encourage tourism activity that upholds existing ecological

processes, conserves natural and cultural heritage, recognizes and includes host communities, generates employment, and reduces poverty [5]. At its core, sustainable tourism practices encourage resilience in both ecological systems and human communities.

While cruise tourism can generate considerable economic opportunities, the environmental and sociocultural implications of cruise-ship tourism have been well documented [6–11]. Concerns have been raised about the impacts of operations on natural resources at sites where the ships visit, including from air emissions, wastewater effluent, fuel leakage, oily water bilge and ballast water discharge, biocides, sound and light effects, and physical disturbances to local habitats [6]. While the cruise industry has stipulated its commitment to sustainable practices and has begun to document progress [12], challenges remain. In 2019, Carnival Corporation was fined \$20 million for dumping plastic and food waste in the Bahamas and attempting to conceal their actions. In 2016, Princess Cruise Lines was fined \$40 million for seven felony violations on five ships and for altering their ship-board systems to by-pass the water treatment system. Impacts are not limited to natural resources. Cruise-ship visitors can put pressure on existing infrastructure, facilities, and resources, and lead to congestion at particular sites [9,10]. Tourism can also result in an influx of nonlocal workers and proprietors and introduce concerns about cultural appropriation [13]. Understanding the distribution of benefits and costs for host communities remains an important step towards seeking sustainability for sites visited by cruise ships.

Cruise lines are increasingly offering itineraries to remote destinations to address customer demand for nature-based tourism, including Marine World Heritage (MWH) sites. The 1972 World Heritage Convention set out to preserve the world's most outstanding natural and cultural sites that "need to be preserved as part of the world heritage of humankind as a whole." [14] (p. 1). In 2005, UNESCO's World Heritage Marine Program was developed to address the need to focus on marine ecosystems and to ensure conservation for marine sites of 'outstanding universal value.' [15]. Sites include coral reefs, such as Australia's Great Barrier Reef or the Belize Barrier Reef, sea grass estuaries, such as the vast Wadden Sea, atolls and islands in the south Pacific, and geologically unique islands, such as Iceland's Surtsey, to name a few. By 2019, 50 marine sites in 37 nations worldwide had been inscribed on the World Heritage list based on their biodiversity, beauty, or geology [16]. The World Heritage Marine Program draws global attention to these exceptional sites, which owing to name recognition, also generates keen interest from cruise lines.

Cruise ship visitation to Marine World Heritage (MWH) sites provides important opportunities to generate support for conservation and creates economic opportunities for nearby communities, but also raises concerns about the health and integrity of these sensitive ecosystems. In 2010, site managers attending the UNESCO Marine World Heritage Manager's Conference identified cruise-ship travel as an important area of mutual concern and a ripe issue for multi-site collaboration [17]. Since then, some sites have been proactive and implemented policies (incentive-based and regulatory) conducive to more sustainable forms of cruise tourism. Other sites are not yet engaged, may not have the regulatory framework to implement operational restrictions, or may not have a holistic understanding of the type of programs that can enhance the sustainability of site visits as they face the impending arrival of their first cruise ship. Currently, there are no established or accepted criteria for sustainable cruise-ship practices in MWH sites, although precedents do exist for promoting sustainable cruise tourism. For example, the Association of Arctic Expedition Cruise Operators has developed guidelines and voluntary standards for increasing the sustainability of itineraries for smaller ships that target certain Arctic areas. There are also numerous standards and guidelines to regulate tour boat travel in marine mammal habitats and also for safe diving practices in sensitive reef systems. Collaborative approaches among MWH sites and partnerships with industry may help sites develop a pathway toward sustainable cruise operations that can be adapted for their unique settings [17,18].

The purpose of this paper is to explore questions about sustainability in the context of cruise-ship tourism to MWH sites. As social-ecological systems and environmental governance are critical considerations in sustainable cruise-ship tourism, we draw from the literature on these topics to

develop a framework for understanding cruise-ship tourism to MWH sites. Building on this framework, we present data gathered in 2019 from a survey of site representatives from 45 of the 50 MWH sites globally. In our results section, we first describe overall trends in cruise ship visitation to MWH sites, including ship size, arrival frequency, and visitation locales. Next, we discuss manager perceptions of the environmental, economic, and sociocultural implications of cruise ships for their site as well as the overall assessment of benefits and costs. Then, we describe measures and policies currently in place to regulate cruise ship visitation, as well as additional measures that site managers believe could enhance sustainable cruise-ship operations. We conclude by exploring managers' ideas for working together to develop adaptive operations guidelines for UNESCO MWH sites and discuss existing models for cross-site collaboration that may open pathways for future discussion. Given the sensitivity of the issue for host communities and national governments, and varying legal protections, we withhold the names of the different sites with specific responses, focusing on overall trends and common responses to generate a holistic view of cruise travel to MWH sites.

## 2. Literature Review

### 2.1. Coastal Tourism, Cruise Ships and Sustainability

Marine-protected areas (MPAs) are prime destinations for nature-based tourism, due to natural and cultural amenities, scenery, and recreation opportunities [19]. Tourism can present an important means for generating employment, increasing foreign exchange, developing infrastructure, and financing protected areas management to achieve conservation goals [20,21]. A destination's rich natural and cultural heritage can contribute to its brand reputation, increases a destination's value and drives further tourist demand [22]. As tourism grows, coastal destinations can face population growth due to the influx of workers, leading to development pressure and competition for resources, as well as increased energy needs that can threaten to destroy natural and cultural attributes [23]. Planning and managing tourism growth can help to protect a destination's natural and cultural heritage and facilitate long-term economic opportunity [24]. Ideally, sustainable tourism "takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities" [5]. To achieve this goal, sustainable tourism practices arguably must encourage ecological and community resilience [25].

Cruise ships are 'floating cities' requiring complex systems for energy use, waste disposal, communications, and operations to care for the needs of passengers and crew. The UN Environmental Program (UNEP) has identified cruise ships and other tour boats as one of the principal pollution sources of marine ecosystems [26]. Concerns associated with cruise ships in marine waters have been well synthesized [6,7,9,11,24,27]. Issues include marine litter (solid waste), dumping of hazardous waste (e.g., toxic cleaning chemicals, air emissions from diesel engines, wastewater and greywater emissions), ballast water emissions that contain invasive or non-native species, ship strikes with marine species, noise pollution (both above air and underwater), and light pollution [6]. Cruise ships can disturb marine mammals [28], create turbidity, and disturb sediment systems in shallow zones [29]. Marine scientists have suggested a variety of mechanisms that the cruise industry and destinations can adopt to minimize unwanted effects on the environment. Operators can vary itineraries to reduce impacts on communities, diversify market segments and expand small ship voyages, improve systems for waste management, enhance safety systems, shift to natural gas as a fuel source, and provide onboard environmental programs and staff training [11]. Many have touted the value of financial mechanisms to expand cruise line contributions to destination sites for conservation or infrastructure management [24].

Meanwhile, the cruise industry is improving onboard systems and carving a path toward sustainable operations. Many cruise ships have installed onboard wastewater and sulfur treatment plants, and are exploring new hull coatings and hull design as well as systems for air lubrication. New advances in waste management and recycling systems mean zero waste-to-landfill [12].

Liquefied natural gas technologies and biofuels have helped to lower fuel use, reduce reliance on fossil fuels, and make cruise travel more efficient. Many ships use shore-based electricity when in port to reduce reliance on fossil fuels. New technologies have helped to improve the quality of wastewater and reduce toxic air emissions [30]. Eco-tour operators catering to cruise passengers expand the reach of cruise ship impacts beyond the dock or anchorage [13]. The popularity of whale watching has led to safety concerns, due to the potential for animal strikes, and also concerns about stress to mammals during feeding, breeding, or other sensitive times. Marine-protected areas have begun to adopt 'best practices' or implement mandates for maintaining safe distances [31]. Dive tours also create pressure on reefs and other underwater attractions, threatening sensitive systems and creating the need for guidelines [32]. For many developing regions, cruise tourism presents a development tool, but these areas are especially vulnerable to pollution, particularly when host governments lack the infrastructure, governing mechanisms, technical capacity, or resources for monitoring.

Cruise tourism does facilitate economic opportunities in port communities and can be important for generating revenues to support protected area management [33,34]. Leakage of visitor spending outside the community occurs due to the predominance of businesses owned by the cruise lines [35]. Cruise lines are multi-national conglomerates with assets distributed globally and can shape local destinations through purchasing power, branding, and control of access to tourism opportunities, which can create a pattern of economic dependency [23]. The uneven distribution of economic benefits in cruise ship destinations has been noted [8]. Local businesses can find it difficult to compete, particularly in ports where cruise lines have invested in onshore tourism enterprises, and when they earn a commission from shore excursions sold on board [13]. Most cruise ships have diverse onboard dining options, shops, and entertainment, which curbs tourist spending in ports of call. Cruise ships are also easily mobilized and can be reassigned quickly in response to shifting market demand for new destinations, itineraries, products, and experiences [36]. This puts local officials on an uneven playing field, since cruise line executives can decide to forgo visitation and leave the community without a ship, with economic reverberations in its wake [13]. Questions remain about the extent to which cruise tourism helps to alleviate poverty or advance the well-being of marginalized populations, which are UNESCO sustainable development goals.

The steady growth of cruise-ship travel globally has led to increasing concerns about the industry's effects on the social environment of cruise destinations. Cruise ships represent a small portion of the total tourism industry (less than 3 percent), yet the sheer magnitude of ships and the high concentration of visitors arriving concurrently can intensify effects [27]. In most coastal ports, cruise ships remain docked for several hours before moving to a new destination [24]. Over the past two decades, there has been a tendency toward large cruise ships, which typically are more profitable due to economies of scale [37]. The short duration of stay and the rapid dispersal of hundreds or thousands of visitors can present challenges, due to logistical need for buses, boats or other transport to the site, coordination with tour operators, and on-site management of visitors [10]. Larger coastal communities can absorb the effects of thousands of ship passengers onshore for short durations, but for many remote ports, cruise ship arrivals can strain infrastructure, create competition for resources, and overwhelm communities [38]. Destination communities face challenges managing visitor flow, which can disrupt routines, alter social relationships, and raise questions about community identity [8,9,13]. Because of the packaging of tours, many visitors do not interact authentically with local residents and have difficulty finding products crafted by local artisans [39]. Training of tourism providers on the area's natural and cultural heritage as well as opportunities for direct visitor contact with local people may improve sustainable operations [40].

## 2.2. *Tourism as a Social-Ecological System*

A tourism destination is a highly complex social-ecological system (SES) in that it allows for the interaction between visitors and sites, includes both human and natural resources, and is often mediated by a multi-layered array of institutions, processes, and forces [41]. SES thinking is required to bridge the

gap between social science and biophysical sciences to achieve sustainability [42,43]. An SES approach to understanding tourism helps to disentangle the complex interactions and components of a system along with the internal and external forces putting pressure on that system, with implications for the natural environment [44]. Taking an SES approach to tourism can help identify which institutions cooperate, which institutions have potential for collective action [45], and those that could enhance or thwart opportunities for adaptive co-management [46]. SES thinking is prevalent among tourism scholars as a framework to address complex and dynamic systems [47].

In the context of tourism in protected areas, such as MWH sites, systems thinking encourages a holistic management perspective [46,48], recognizing the impact of external forces such as large-scale environmental change, political or economic shifts, new migration patterns, warfare, or other changes in sociocultural context [25,49]. Community resilience models have helped to identify the intrinsic connections between people and protected areas [50,51] and improved our understanding of the benefits of community-based tourism for promoting social and ecological resilience [52]. To manage complex systems sustainably, policymakers require a clear understanding of the interconnectedness between system components and how these connections influence system behavior. Mai and Smith [53] used an SES framework to understand human–environment interactions and threats to sustainability on Cat Ba Island in Vietnam. The authors conceptualized a complex tourism system and explored eight feedback loops related to tourism growth, such as the effects of infrastructure development on visitor arrivals, the increase in pollution and decline in water availability associated with tourism development, the increase in immigration required to fill tourism jobs, the conversion of agriculture and conservation lands leading to poverty and forest exploitation, and the role of tourism on poverty reduction as tourism jobs were created. An SES framework helped to track these dynamic forces among critical actors within the system [53]. Thinking of tourism using an SES framework is especially helpful in coastal regions, which face dynamic changes in ocean systems [54].

### 2.3. Governing Sustainable Tourism in Protected Areas

Sustainability is difficult to achieve without feasible policy options that help to translate ideas into action [55]. The commitment to promoting sustainable tourism in protected areas must be shared between national and provincial governments, international agencies, tourism operators, stakeholders, and travelers. Governance involves a system of norms, rules, and procedures designed to regulate behavior [56]. Characteristics of effective tourism governance and known barriers to implementing sustainable practices are listed in Table 1.

**Table 1.** Characteristics of effective tourism governance juxtaposed with known barriers to the implementation of sustainable practices.

Characteristics of Effective Tourism Governance [57–59]:	Known Barriers to the Implementation of Sustainable Practices [60,61]:
<ul style="list-style-type: none"> <li>• Coordination and monitoring of activities;</li> <li>• Engaging multiple sectors and stakeholders in collective action;</li> <li>• Public involvement;</li> <li>• Use of a consensus-based approach;</li> <li>• Shared strategy and vision;</li> <li>• Responsiveness to stakeholders;</li> <li>• Effectiveness, efficiency, and accountability;</li> <li>• Transparency, and</li> <li>• Law and equity.</li> </ul>	<ul style="list-style-type: none"> <li>• Preference for short-term economic gains over long-term social and environmental concerns;</li> <li>• Absence of a planning process;</li> <li>• Lack of stakeholder engagement;</li> <li>• No shared understanding of sustainability goals;</li> <li>• Lack of integration and coordination of government agencies;</li> <li>• Lack of accountability, and</li> <li>• The absence of capacity or political will to implement policy.</li> </ul>

New approaches are needed to integrate the interests of site managers, stakeholders, industry, and governing institutions at various levels and across multiple sites, particularly approaches that integrate inputs from multiple spatial scales [47]. Marine-protected area networks have emerged

in many regions (i.e., Mexico, Belize, Red Sea, Australia, and the Philippines) to connect multiple sites and encourage them to coordinate efforts toward sustainable outcomes [62]. These networks share information about best practices and policies that lead to sustainable outcomes, and engage in mutual learning [18]. On the large scale, the Coral Triangle coordinates sustainability approaches across the Philippines, Malaysia, Indonesia, Papua New Guinea, Solomon Islands, and East Timor [63]. On the regional scale, the Great Barrier Reef Marine Park Authority (GBRMPA) helps to maintain biodiversity and protect world heritage values, emphasizing sustainable management of all industries including tourism [64]. The GBRMPA operates with significant engagement from governing entities, nongovernmental organizations, traditional owners, industry officials, and international agencies. The GBRMPA identified tourism as a critical issue in the site and focused on protecting environmental resources in high-visitation areas, providing industry training in sustainability, establishing best practices for tour operators and cruise lines, and developing a performance-based co-management approach with recreation and tourism visitors [64–67]. Success in implementing sustainability approaches and policies depends on the capacity of individual sites, and commitment by national sponsors and their networks [68].

Another example of cruise ship governance in an MWH site can be found in Glacier Bay National Park, in Alaska (USA). This unique marine park, widely considered a premier attraction in the Alaska cruise itinerary, is managed by a government agency that controls access to the site and manages cruise-ship travel using limited entry permits. Every 10 years, Glacier Bay National Park issues a prospectus soliciting proposals for cruise visitation, which are reviewed by a panel of experts [17]. Concessions contracts are awarded based on many factors, including efforts by the cruise lines to practice more sustainable operations with innovative technology or change in practices. In addition, contracts are awarded based on ships providing onboard educational experiences. Permittees are required to adhere to park regulations for emissions, vessel speeds, maintaining safe distance from wildlife, and proper channel travel, and can be penalized for mistakes. The model encourages intense competition among the cruise lines to win a coveted permit and puts the National Park in a position to oversee operations and enforce regulations. Contracts require that Park cultural interpreters be present onboard for visitors to understand the unique marine ecosystem and cultural history. The park limits entry to two daily cruise ships and allows cruise visitation for a five-month period. Spatial restrictions leave some areas of the park closed to cruise-ship travel. Passenger fees collected fund research and resource protection efforts in the park [17]. Similar models are being implemented in another MWH site, the West Norwegian Fjords, where fuel and emissions requirements will be managed by the protected area. In 2019, Glacier Bay and the West Norwegian Fjords formed a sister-site partnership with intent to share information and ideas to improve the sustainability of cruise-ship travel. Unlike protected site networks based on geographic proximity or shared resources, this partnership focuses on common interests and a desire to negotiate with the cruise lines as allies.

### 3. Methods

To better understand cruise ship visitation to UNESCO Marine World Heritage sites and determine perceptions of cruise ship sustainability, we conducted a survey of site representatives. The survey was circulated to each of the 50 UNESCO Marine World Heritage sites in May 2019. This is the first known systematic effort to understand the nature of cruise visitation to these areas. The survey was distributed to site representatives planning to attend the UNESCO Marine World Heritage Conference in September 2019. Conference attendees were asked to provide logistical information to conference organizers, and their participation in this survey was also requested at that time. Respondents were asked to indicate (“yes” or “no”) whether their UNESCO World Heritage site received visits either from cruise ships entering the site or from cruise passengers who arrive by other means (i.e., ships are docked or anchored outside the site boundaries). If they answered negatively (“no”), the response was tallied and the questionnaire was considered complete. If they answered “yes” (indicating visits from cruise ships

or passengers), they were automatically directed to a 27-question survey, containing multiple-choice, multiple-response, Likert-scale, and open-ended questions.

The survey included five parts: (a) overview of cruise travel to the MWH site (volume, frequency, seasonality, docking locations, and trends); (b) visitor services and activities at the MWH site; (c) effects of cruise tourism on the MWH site, (environmental, economic, and sociocultural); (d) regulatory measures used at the MWH site (existing and desired); and (e) ideas about what would make cruise tourism more sustainable. The survey was conducted in English, which was a second language for many respondents. Participation was voluntary, and not every respondent answered all of the questions. It took between 10 and 20 minutes to complete the survey for fluent English speakers. Data were entered into a spreadsheet, and we conducted descriptive analysis to explore trends. Qualitative data were coded and tallied based on similar responses. Because of the survey length and potentially because of language barriers, the qualitative responses were brief or missing in many surveys.

During the UNESCO Marine World Heritage conference, we presented a selection of relevant quantitative and qualitative survey results to a group of approximately 26 UNESCO MWH site representatives attending a breakout session on cruise-ship tourism in UNESCO MWH sites. Following the presentation, we held an open discussion during which individuals voluntarily responded to the following questions:

- What types of cruise ships are you seeing in your site? What issues have emerged?
- What strategies have helped you manage cruise-ship tourism in your MWH site?
- What criteria should be included in developing 'best practices' for MWH sites?

We held an open discussion among the session attendees to provide a space for sharing challenges and solutions regarding cruise-ship tourism in MWH sites, and for site representatives to connect over commonalities.

#### 4. Results

We received responses from 45 UNESCO MWH site representatives. Survey respondents represented a range of managerial positions with regard to the MWH site. Positions included superintendents (6), directors or sub-directors (4), site managers (3), rangers (3), scientists (3), policy advisors (3), ministers or mission directors (3), and technical staff (3). Some respondents live on or near the site, while others serve as site representatives and are based in sponsoring nations or other locations. Respondents all were assumed to have significant knowledge of the site. We acknowledge that while the title of site representatives varied (e.g., superintendents, site managers, chief rangers, mission directors), many served in a similar functional capacity at the site.

Among the 45 respondents, 30 (67%) indicated that their MWH site hosts visits from either cruise ships or cruise ship passengers. The UNESCO MWH sites that receive cruise ships are listed in Table 2, along with a brief site description. Of these 30 sites, 25 have cruise ships enter the marine waters within the protected area, seven have cruise ships dock in nearby ports and passengers are transported to the protected area, and six have cruise ships anchor outside the protected area boundaries. In 21 MWH sites, passengers visit on smaller marine vessels or on land, while five sites have passengers visit only by boat. For three of the sites, passengers remain onboard the cruise ship during their visit.

**Table 2.** UNESCO Marine World Heritage sites that indicated that cruise ships and/or cruise ship passengers visit their site.

Country	World Heritage Site	Site Description
Argentina	Peninsula Valdes	Peninsula on the Atlantic coast of Argentina
Australia	Ningaloo Coast	Near-shore reef and caves in western Australia
Australia	Great Barrier Reef Marine Park	World's largest collection of coral reefs, on the north-east coast of Australia
Australia	Macquarie Island	Oceanic island in the Southern Ocean, 1500 km southeast of Tasmania and halfway between Australia and Antarctica
Bangladesh	The Sundarbans	Mangrove forest on the Ganges delta, shared by Bangladesh and India
Belize	Belize Barrier Reef Reserve System	Coastal area of Belize in Central America
Brazil	Brazilian Atlantic Islands: Fernando de Noronha and Atol das Rocas Reserves	Group of islands formed by volcanic peaks 340 km off the northeastern coast of Brazil
Colombia	Malpelo Fauna and Flora Sanctuary	Island and surrounding marine environment 500 km off the coast of Columbia
Costa Rica	Area de Conservación Guanacaste	Land and sea areas in the northwest of Costa Rica
Finland/Sweden	High Coast/Kvarken Archipelago	Archipelago and coastline co-managed between Finland and Sweden, in the Gulf of Bothnia, Baltic Sea
France	Lagoons of New Caledonia	Six marine clusters in the French Pacific Ocean archipelago of New Caledonia
Iceland	Surtsey	Volcanic island 32 km off the south coast of Iceland, formed by eruptions in 1963–1967
Indonesia	Komodo National Park	Volcanic archipelago in central Indonesia
Kiribati	Phoenix Islands Protected Area	Marine and terrestrial habitats in the Southern Pacific Ocean, including an island group
Mexico	Whale Sanctuary of El Vizcaino	Coastal lagoons and surrounding habitat in Mexico's Baja California Peninsula
Mexico	Islands and Protected Areas of the Gulf of California	Islands islets, and coastal areas spanning 12 locations in the Gulf of California in north-eastern Mexico
Mexico	Revillagigedo Archipelago	Archipelego of four islands and their surrounding waters in the eastern Pacific Ocean
New Zealand	New Zealand Sub-Antarctic Islands	Five island groups in the Southern Ocean, southeast of New Zealand
Norway	West Norwegian Fjords	Two fjord sites in western Norway
Panama	Coiba National Park	Group of 38 small islands off the southwest coast of Panama
Philippines	Puerto Princesa Subterranean River National Park	Cave system in southwestern Philippines
Philippines	Tubbataha Reefs Natural Park	Two reef systems located in the Sulu Sea, Philippines
Russia	Natural System of Wrangel Island Reserve	Two mountainous islands located north of the Arctic Circle in Russia
Seychelles	Aldabra Atoll	Four large coral islands enclosing a shallow lagoon north of Madagascar
Spain	Ibiza-Eivissa (Spain)	Island off the east coast of Spain, in the Mediterranean Sea
Sudan	Sanganeb Marine National Park and Dugonab Bay—Mukkawar Island Marine National Park	Two sites in the Red Sea, including coral reefs
United Kingdom	Gough and Inaccessible Islands	Two uninhabited islands in the south Atlantic
United Kingdom	St Kilda	Volcanic archipelago off the west coast of Scotland
USA	Glacier Bay	Bay in southeastern Alaska containing glaciers and mountain peaks
Vietnam	Ha Long Bay	Bay in the Gulf of Tonkin, Vietnam, including 1600 limestone islands and islets

#### 4.1. Cruise Ship Trends

MWH sites host cruise ships of a variety of sizes, from expedition-size to mega-ships. Twenty-one MWH sites are visited by small ships, with fewer than 400 passengers, including 15 sites that host only small ships. One MWH site hosts only mid-sized ships (400–1499 passengers). Six sites host large ships (1500–3499 passengers) or ‘mega’ ships (3500 passengers or more). Finally, eight MWH sites host a combination of ships of all sizes (Table 3).

**Table 3.** Number of responses for each combination of ship sizes.

Ship Sizes Visiting Site	Number of MWH Sites
Small ships (fewer than 400 passengers) only	15
Mid-sized ships (400–1499 passengers) only	1
Large (1500–3499 passengers) or mega-ships (3500 or more) only	6
Combination of small, medium, large, and mega-ships	8

We asked survey respondents about cruise ship visitation trends for their sites over the past three years. Eighteen site representatives (62%) indicated that the number of cruise ships visiting their site had increased over the last three years, while cruise ship visitation had remained constant in six sites (21%) and had decreased in five sites (17%). We also asked site representatives about cruise industry demand for their site. Nine sites (33%) indicated that the cruise industry demand for their site is ‘increasing strongly.’ For 18 sites (60%), cruise industry demand was reported as steady or growing slowly. No sites reported a decline in cruise industry demand. In addition, we were interested in understanding whether MWH site representatives believed that their site could accommodate more cruise ships. Responses were divided, whereby 38 percent of respondents indicated that their site could accommodate more cruise ships (under capacity), and 38 percent said they had met current levels of demand and could handle no more (at capacity). Meanwhile, 23 percent believed that they already had too many visitors (exceeded capacity).

#### 4.2. Perceived Effects on Environmental, Social, Cultural, and Economic Resources

We asked MWH site representatives about the effects of cruise-ship tourism on the environmental, social and cultural, and economic resources at and around their site. For consistency, we listed potential effects (all phrased negatively), and asked respondents to indicate to what extent this effect was currently a problem at their site. Response choices included: ‘not a problem,’ ‘mild problem,’ ‘moderate problem,’ or ‘significant problem.’ Respondents could only mark one answer.

Fifteen environmental effects were listed. Based on respondents’ perceptions, the most problematic environmental effects can be assessed in two major categories: ship emissions and wildlife interactions, although impacts via other operations or activities of the ships or via their passengers were also noted (Table 4). Items identified by site representatives as being a moderate or significant problem included: wastewater discharge (27%), air emissions (27%), chemical leakage from ships (22%), and solid waste disposal (18%). In terms of wildlife interactions, the issues identified as moderate or significant included: marine wildlife habitat (35%), noise effects on wildlife (35%), transport of invasive or non-native species (28%), ship encounters with marine mammals (32%), and visual effects of cruise ships for marine or terrestrial wildlife (25%). Site representatives were least concerned about ship effects on geo-physical, terrestrial, and benthic resources.

**Table 4.** The degree to which respondents view a range of potential environmental effects of cruise-ship tourism on their MWH site. For each effect, the percent of responses (out of n respondents) is shown for each response category, including “not applicable” (NA). The number of responses (N) for each question varied slightly.

	Not a Problem	Mild Problem	Moderate Problem	Significant Problem	NA	N
Geo-physical effects (erosion, landslides)	57%	11%	4%	4%	25%	28
Ship effects on terrestrial wildlife habitat	46%	15%	8%	4%	27%	26
Conflict between cruise visitors and wildlife	39%	29%	11%	4%	18%	28
Ship effects on coral, benthic resources or marine vegetation	41%	14%	14%	3%	28%	29
Visual effects of ship’s lights on wildlife	36%	29%	21%	4%	11%	26
Ship effects on fish health or abundance	43%	25%	11%	4%	18%	28
Ship effects on terrestrial vegetation	43%	18%	11%	4%	25%	28
Solid waste disposal from ships	43%	21%	11%	7%	18%	28
Wastewater discharge from ships	28%	28%	17%	10%	17%	29
Ship encounters with marine mammals	32%	25%	21%	11%	11%	28
Chemical leakage, seepage from ships	36%	21%	11%	11%	21%	28
Ship effects on marine wildlife habitat	19%	35%	23%	12%	12%	26
Transport of invasive or non-native species	29%	21%	14%	14%	21%	28
Noise effects of vessels on sea life or wildlife	28%	28%	14%	21%	10%	29
Air emissions or air quality from ships	41%	28%	3%	24%	3%	29

Site representatives also responded to questions about their perception of the economic effects of cruise-ship tourism (Table 5). Forty-two percent of site representatives identified the lack of funds generated by cruise ships toward community infrastructure to support visitation as a ‘moderate’ or ‘significant’ problem. The ability to use revenue from cruise ships to support park management was not a problem or a mild problem for 55 percent of sites, but was a significant problem for 21 percent of sites. This might indicate that many sites have an existing system for allocating ship revenues, while others do not.

**Table 5.** The degree to which respondents view a range of potential economic effects of cruise-ship tourism on their MWH site. For each effect, the percent of responses (out of n respondents) is shown for each response category, including “not applicable” (NA). The number of responses (N) for each question varied slightly.

	Not a Problem	Mild Problem	Moderate Problem	Significant Problem	NA	N
Lack of funding for community infrastructure (piers, roads) to support visitation	25%	14%	21%	21%	18%	28
Inability to use revenue from cruise ships to support park management	45%	10%	7%	21%	17%	29
Challenges negotiating with cruise line corporations	30%	30%	4%	15%	22%	27
Inability of cruise tourism to generate jobs or economic opportunities for residents	38%	17%	10%	14%	21%	29
Inability to retain economic benefits from cruise ships locally	31%	21%	7%	14%	28%	29
Lack of funding for regional tourism management or planning	32%	29%	7%	11%	21%	28
Uneven distribution of economic benefits	25%	25%	14%	11%	25%	28
Affordability of communities for tourism workers and residents	33%	15%	26%	4%	22%	27
Conditions of cruise ship workers (labor, health)	37%	22%	7%	4%	30%	27

The ability of cruise lines to contribute to the local economy was also a common theme. One quarter (25%) of site representatives considered the uneven distribution of economic benefits as a moderate or significant problem. Also identified as a moderate or significant problem was the affordability of communities (30%), the lack of local jobs generated (24%), and the ability of the locality to retain economic benefits from cruise ships (21%). Nearly one fifth of representatives (19%) expressed concern about the challenges of negotiating with cruise-ship corporations.

Overall, site representatives identified few social and cultural effects of cruise ships as a significant problem for their site (Table 6). Crowding or concerns about a diminished visitor experience was

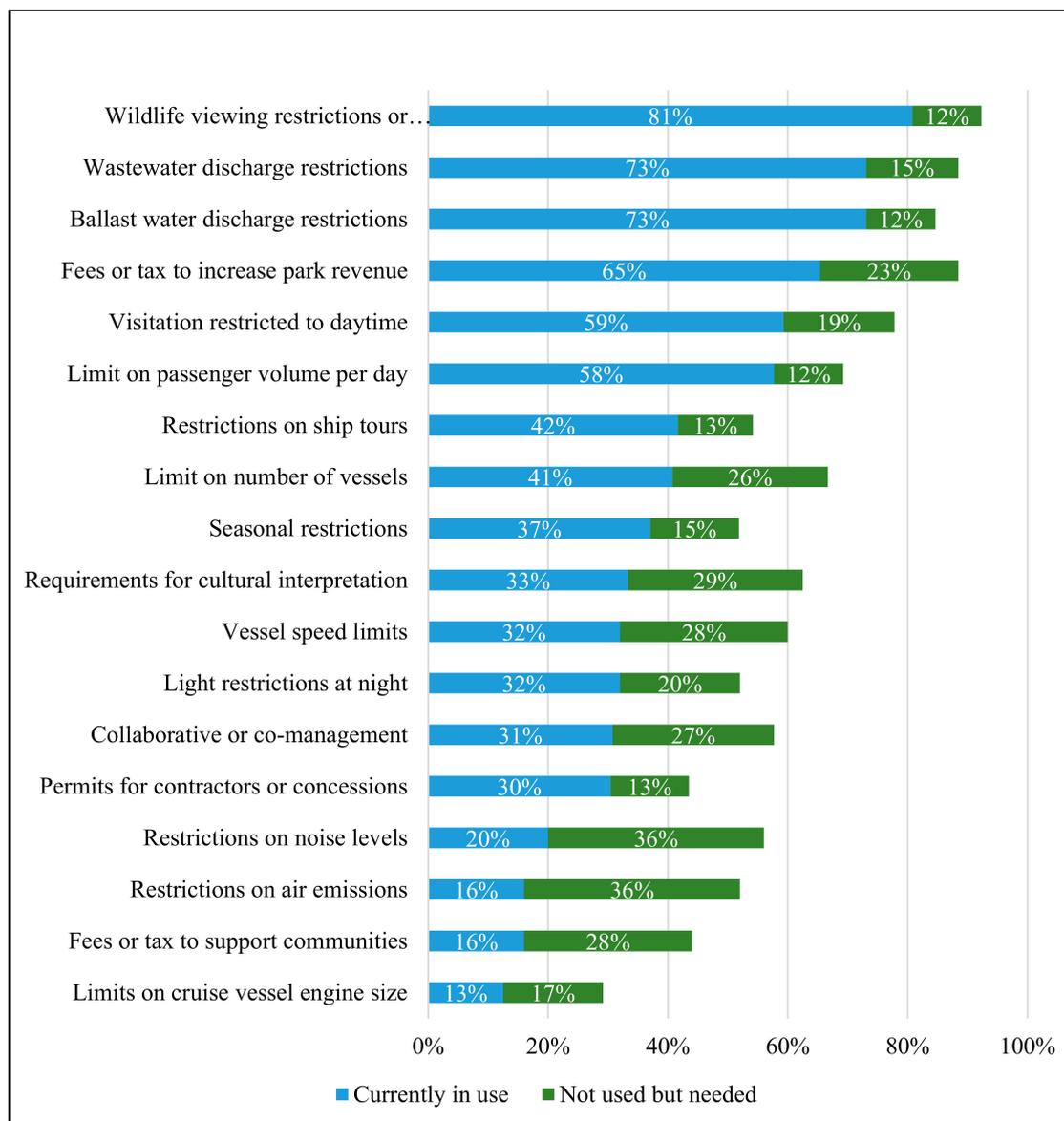
listed as a moderate or significant problem by 37 percent of site representatives. Nearly one third (32%) mentioned the high volume of visitors entering the site as a moderate or significant concern. Fewer observed that crowding in local communities was moderately or significantly problematic (14%), while 36 percent said that this question was not applicable, possibly suggesting the absence of nearby communities. However, 18 percent noted that a detrimental change in community character was a moderate problem. The lack of engagement of indigenous leaders and regional stakeholders in tourism planning was not widely viewed as an issue, which either suggests that engagement is currently strong, or that it is not deemed relevant. Notably, 43 percent indicated that indigenous engagement was ‘not applicable.’ Few respondents were concerned about an increase in crime brought by cruise-ship tourism or about the health of ship passengers.

**Table 6.** The degree to which respondents view a range of potential social and cultural effects of cruise-ship tourism on their MWH site. For each effect, the percent of responses (out of n respondents) is shown for each response category, including “not applicable” (NA). The number of responses (N) for each question varied slightly.

	Not a Problem	Mild Problem	Moderate Problem	Significant Problem	NA	N
Crowding or diminished visitor experience in the site	26%	22%	26%	11%	15%	27
High volume of ship visitors entering the site or park	39%	11%	21%	11%	18%	28
Congestion or crowding in nearby communities	32%	18%	7%	7%	36%	28
Lack of engagement of regional stakeholders or officials	48%	19%	4%	4%	26%	27
Lack of indigenous leadership in tourism management	32%	14%	7%	4%	43%	28
Vandalism; destruction of natural or cultural resources	46%	14%	11%	4%	25%	28
Increase in crime	57%	4%	4%	4%	32%	28
Light effects from cruise ship lights at night	55%	10%	14%	3%	17%	29
Detrimental change in the character of communities	39%	7%	18%	0%	36%	28
Authenticity or accuracy of cultural interpretation	36%	25%	7%	0%	32%	28
Health, disease, sickness of ship passengers	55%	14%	10%	0%	21%	29
Noise effects of ships on residents (engine, horn)	48%	24%	7%	0%	21%	29

### 4.3. Regulations

We asked MWH site representatives about the regulations, policies, or programs that are currently used in their sites to promote sustainable tourism operations. We also asked site representatives to identify regulations, policies or programs that they do not currently have, but they believe would improve the management of cruise-ship tourism to their site (Figure 1). A vast majority of sites (81%) regulate wildlife viewing, ballast water discharge (73%), wastewater discharge (73%), or have fees or taxes to increase park revenues (65%). Few sites have restrictions on vessel engine size (13%), air emissions (16%), or noise levels (20%). Restrictions on air emissions and noise levels were most frequently listed as regulations that are not used but needed (36% each). There appears to be a shared need for requirements for cultural interpretation (29%), fees or tax to support communities (28%), and co-management or collaborative management (27%). Vessel speed limits were also viewed as important (28%).



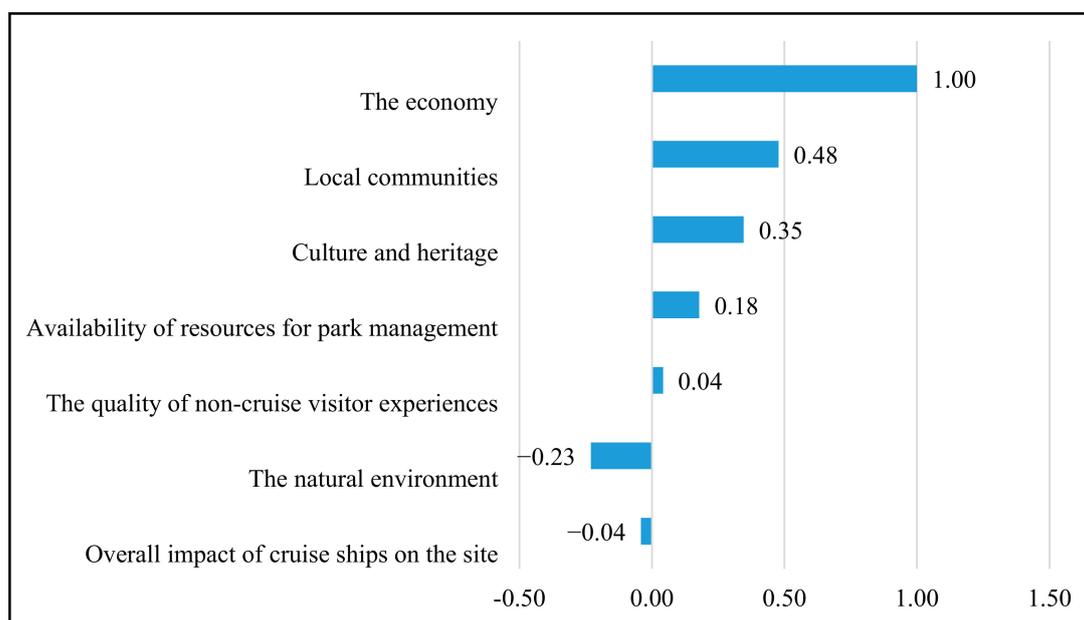
**Figure 1.** Regulations for cruise-ship tourism in Marine World Heritage sites. Site representatives indicated which regulations are currently in use (blue), or not used, but needed (green). The graph is organized in order of regulations most to least frequently currently in use.

More than half of the sites (54%) have some limits on cruise ships allowed into the MWH site, including size/volume restrictions (based on total ship passengers per year or engine size), temporal restrictions (seasonal restrictions, days of arrival, or time of day), or spatial restrictions (designated cruise corridors, with some areas off-limits to cruise ships), to name a few.

#### 4.4. Relationship between Level of Demand and Perceptions of Cruise-Ship Tourism Effects

We asked survey respondents how cruise-ship tourism affects different attributes of their site, and the overall impact of cruise-ship tourism on their site. For each attribute, respondents could indicate that the effects of cruise ships were very positive (score of 2), positive (1), neutral (0), negative (−1), or very negative (−2). Based on the average of all responses across sites, we found that the most positive impacts were on the economy (score of 1.00), local communities (0.48), culture and heritage (0.35) and the availability of resources for park management (0.18). The natural environment was the

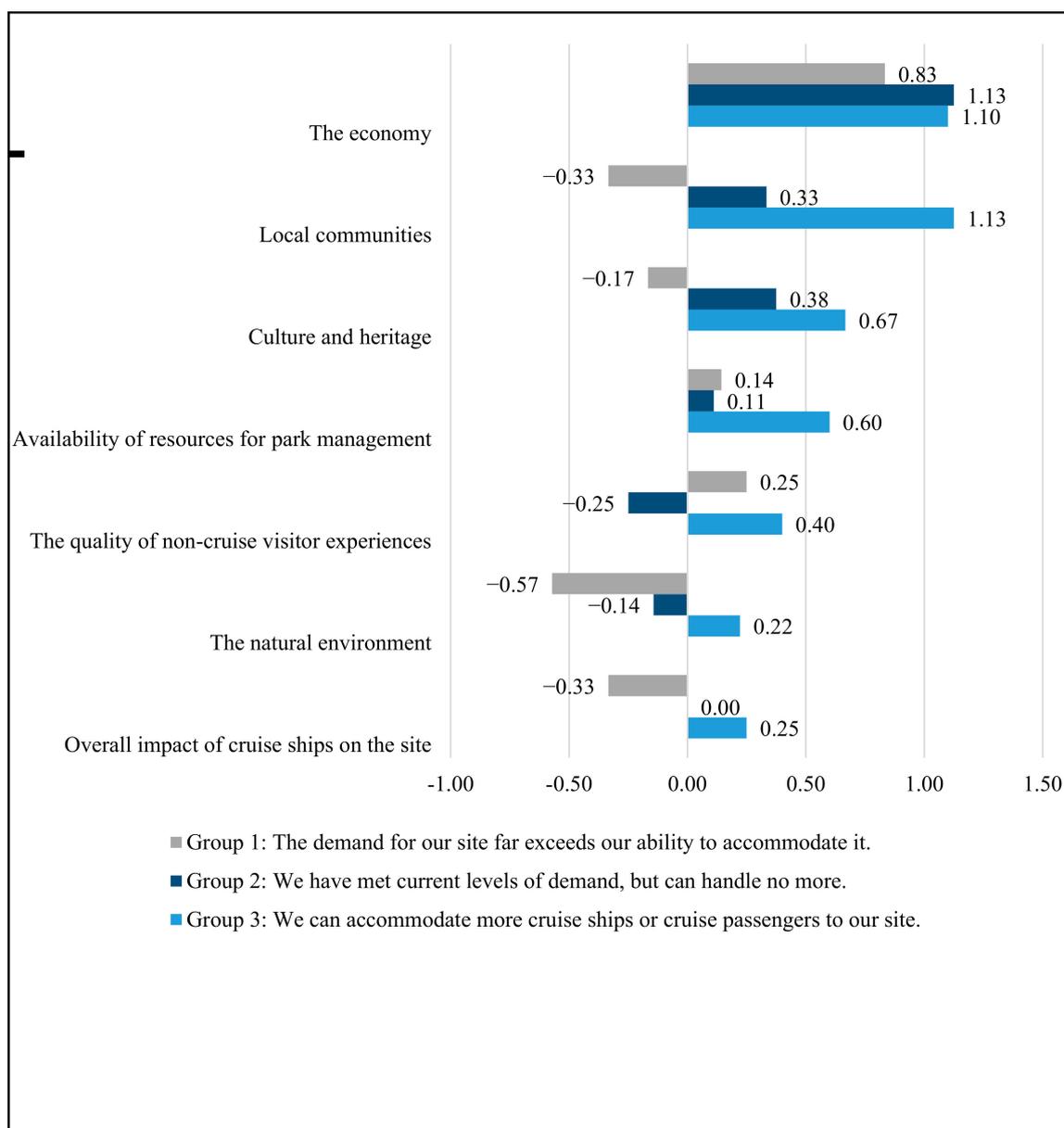
most negatively affected site attribute, with an average score of  $-0.23$ . On average, site representatives indicated a nearly neutral overall impact of cruise ships on their site ( $-0.04$ ) (Figure 2).



**Figure 2.** Average responses of Marine World Heritage site representatives regarding how cruise-ship tourism affects different attributes of their site.

We were also interested in how the ability to meet cruise ship industry demand corresponds with the perceived effects of cruise-ship tourism on MWH sites. To answer this question, we grouped respondents according to their response to a question about the level of demand for cruise ships. We compared responses between Group 1 ( $n = 6$ ), which responded that the demand for their site exceeded capacity, Group 2 ( $n = 10$ ), which responded that they had met current demand levels and could handle no more, and Group 3 ( $n = 10$ ), which indicated that they could accommodate more visitors to their site.

For each group, we found the average value for the question regarding the overall impact of cruise ships on MWH sites. Results suggest that sites' economies were seen to benefit from cruise-ship tourism for all groups. However, there were discrepancies in the direction of the effects of cruise-ship tourism on nearly all other site attributes. In general, Group 1 (demand exceeds ability to accommodate) rated the effect of cruise-ship tourism on local communities, culture and heritage, the natural environment, and the overall impact on the site negatively. Sites in Group 3 (can accommodate more cruise-ship tourism) rated the effect of cruise-ship tourism on all attributes as positive, on average. Average responses for Group 2 were mixed, but mostly positive (Figure 3).



**Figure 3.** Perceived effects of cruise-ship tourism, dividing respondents into three groups by the degree to which their site is able to accommodate current cruise ship demand.

#### 4.5. Strategies for Sustainable Cruise-Ship Visits in Marine World Heritage Sites

Finally, we asked MWH site representatives what would help manage cruise tourism to their site, and what would make cruise tourism more sustainable at their site. These two questions allowed for open-ended responses, which indicated practices the site representatives saw as valuable and offered creative solutions to improve the sustainability of cruise-ship travel in MWH sites. We added to these responses with open-ended responses from site managers in the working group at the UNESCO Marine World Heritage Site Conference. Results from survey responses and the working group discussion were categorized by four sustainability elements: (1) environmental, (2) economic, (3) sociocultural, and (4) governance (Table 7).

**Table 7.** Strategies for guiding sustainable cruise-ship travel in Marine World Heritage Sites. Summaries from survey responses and discussion at the UNESCO Marine World Heritage Site Conference are separated by four sustainability elements: environmental, economic, sociocultural, and governance.

Sustainability Element	Strategies for Sustainable Cruise-Ship Travel
ENVIRONMENTAL	<p><b>Survey Responses:</b></p> <ul style="list-style-type: none"> <li>• Raise environmental standards of cruise ships to reduce emissions; require or incentivize use of alternative fuels (e.g. liquefied natural gas, electric).</li> <li>• Restrict the size of ships that can visit the MWH site, prioritizing smaller cruise ships.</li> <li>• Implement seasonal restrictions, especially during the breeding season for flagship species sensitive to cruise ships.</li> <li>• Implement visitation limits, based on the sensitivity of ecosystems.</li> <li>• Engage in close monitoring of visitor activities within the site.</li> <li>• Establish areas designated for cruise visitation and areas off-limits.</li> <li>• Education programs for tourists should target the reducing of pollution and litter and avoiding disturbance to wildlife.</li> </ul> <p><b>Conference Discussion:</b></p> <ul style="list-style-type: none"> <li>• Reduce the spread of invasive species through hull checks and site observers.</li> </ul>
ECONOMIC	<p><b>Survey Responses:</b></p> <ul style="list-style-type: none"> <li>• Incentivize tours in the low tourism season to offset the demand during the high season.</li> <li>• Promote excursions led by local community members.</li> </ul> <p><b>Conference Discussion:</b></p> <ul style="list-style-type: none"> <li>• Designate revenue from visitor arrivals (passenger fees) to support infrastructure, facilities and services for visitors.</li> <li>• Designate revenue to support conservation goals.</li> <li>• Seek support from cruise ship companies that have conservation funds.</li> </ul>
SOCIOCULTURAL	<p><b>Survey Responses:</b></p> <ul style="list-style-type: none"> <li>• Increase the availability of cultural opportunities led by local community members.</li> <li>• Implement visitation limits based on the needs and desires of communities.</li> </ul> <p><b>Conference Discussion:</b></p> <ul style="list-style-type: none"> <li>• Implement visitation limits based on the level of crowding at critical sites.</li> <li>• Make available onboard cultural interpretation with indigenous voices.</li> </ul>
GOVERNANCE	<p><b>Survey Responses:</b></p> <ul style="list-style-type: none"> <li>• Consider the goals of each stakeholder and maintain dialogue between all stakeholders.</li> <li>• Adopt and secure funding to implement best management practices, which are informed by appropriate data.</li> </ul> <p><b>Conference Discussion:</b></p> <ul style="list-style-type: none"> <li>• Develop a set of standards for cruise-ship tourism to MWH sites. Ensure that these standards should be specific to each site, and should not be more lenient than the existing standards required by the governing body at each site.</li> </ul>

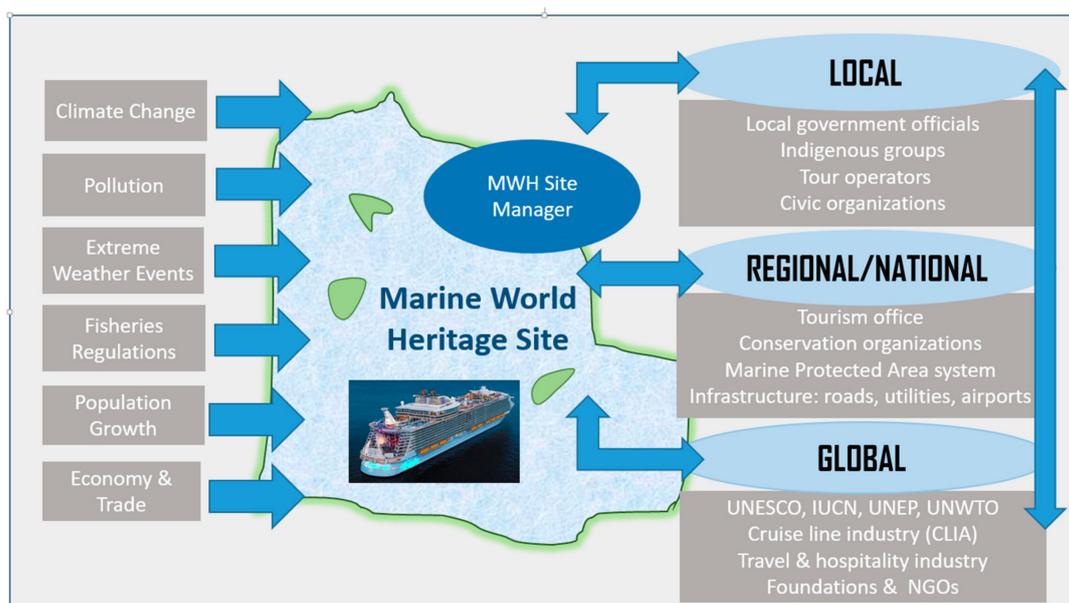
Environmental elements focused on technological upgrades of cruise ships to reduce waste and emissions as well as fuel use. Ideas also focused on spatial or temporal guidelines for cruise ship activity in the MWH sites. Other ideas focused on monitoring of visitor activities, educational programs for visitors, hull checks and boot wash stations to minimize the spread of invasive species. Economic components focused on job creation for local residents and implementing revenue programs to reinvest funds in the community. Sociocultural strategies emphasized the role of local guides and interpreters in providing cultural narratives, and instituting mechanisms for controlling visitor volumes in congested areas. Finally, site managers shared ideas about developing mechanisms for stakeholder

engagement, improving communication with the cruise lines, and enhancing dialogue across public and private sectors. Site managers attending the UNESCO conference sought specific guidelines or standards to promote sustainable cruise-ship operations across the MWH sites, emphasizing the importance of standards that could be adapted and molded to suit local conditions.

## 5. Discussion

Cruise tourism is one of the fastest-growing segments of the tourism market, with new ships being commissioned every year in all segments of the cruise industry, from expedition vessels to mega-ships. Nature destinations are increasingly popular with cruise lines and their customers. The environmental, economic, and sociocultural effects of cruise tourism on communities are well understood [9,10]; however, less is known about the effects of cruise ships on marine-protected areas. Understanding the distribution of benefits and costs for host sites and local communities remains an important step towards seeking sustainability. To better understand the interactions between cruise ships and marine destinations, we have conducted the first systematic assessment of cruise ship operations in UNESCO Marine World Heritage sites, which feature some of the world's most unique and important ecological systems. The growth in cruise ship visitation to these sensitive sites is apparent, which raises questions about the sustainability of cruise travel. Without accepted standards or guidelines for sustainable cruise travel to MWH sites, site officials are comparing notes and weighing alternatives, while accounting for capacity constraints. While some sites have adopted measures to regulate cruise travel and closely manage socioecological conditions, other sites are far behind. Our findings contribute to ongoing theoretical conversations about sustainable tourism, as well as practical considerations for organizations devoted to the future conservation of MWH sites.

A conceptual example of a cruise ship-based tourism system for MWH sites illustrates the dynamic relations among institutions and stakeholders at the local, regional, and global level that revolve around an MWH site (Figure 4). This diagram is informed by our review of the literature and our study data and exemplifies the socioecological dynamics of cruise tourism. The MWH site faces pressure from external forces such as population pressures, treaties, and regulatory changes in ocean management, and transboundary issues such as climate change, spread of invasive species, species migration, and pollution. Coastal areas are particularly susceptible to changes in climate, leading to rising sea levels, frequent and high-intensity storms, temperature changes, and other extreme conditions that alter socioecological systems [29,54]. The arrival of visitors to the MWH site is predicated upon the interaction of multiple actors in this system, including cruise lines, tourism marketing organizations, local tour operators, national governments, UNESCO site managers, and the travelers themselves. Site managers engaged in collaborative planning would include stakeholders, industry representatives, nongovernmental organizations, and governing institutions at multiple levels of this system. Understanding MWH sites as part of a socioecological system helps to identify potential partners and networks that can be activated to address system changes.



**Figure 4.** Elements of a tourism system for cruise travel to Marine World Heritage sites [10,13,44].

Both theoretically and in practice, SES frameworks are useful for understanding the interaction loops between cruise ships, marine environments, and destination communities [53,68]. Our theoretical model of cruise tourism to MWH sites draws attention to the various forces of change and the multiplicity of actors at various levels. A lack of understanding of the intricacies of SESs or the interaction of policy actors can lead to challenges in sustainable tourism management. For example, social media postings about an MWH site may bolster tourist interest, yet the site may not have the capacity to handle visitor arrivals or visitation may place sensitive areas at risk from over-use. An SES approach would allow multiple actors to coordinate efforts around common goals that incorporate all system parts. In developing regions, where visitation may be flat or declining, an SES approach to tourism can identify potential alliances and mitigating forces that may support sustainable levels of visitor growth, potentially resulting in an influx of revenues for site management. In some sites, the potential for visitation is daunting, due to gaps in infrastructure, the absence of tourism providers, or lack of site information or a professionally trained workforce. Recognizing key inputs and relationships would help to coordinate efforts on sustainable management of tourism. These improvements address many of the known barriers to the implementation of sustainable practices identified in Table 1. Theoretical and analytic tools from sustainability sciences and SES may guide an approach that is action-oriented, problem-based, and that occurs across disciplinary boundaries.

Cruise-ship tourism to marine-protected areas echoes a fundamental paradox that threatens sustainability. The unspoiled character of remote destinations, such as MWH sites, renders them attractive to tourists. Yet, if these sites invite mass tourism, the features that make them attractive may be compromised without careful planning [24]. For MWH sites, the implications of lost habitat or resource impairment are especially profound. Our findings show that cruise ships visiting MWH sites vary in size, frequency of visits, and the scale of interactions within the site. In addition, sites experience varying levels of contact with commercial tour operators providing shore excursions for cruise guests (e.g., whale watching or diving tours). Impacts vary widely, and uniform approaches are not likely to be meaningful or effective [1]. Cruise ships can exert additional pressure on environmental and social systems that are vulnerable to climate change and other environmental pressures. Our study indicates that some MWH sites may also be vulnerable to uncontrolled growth in cruise arrivals. Two thirds of MWH site representatives indicated that cruise ships could be found in the area of their site; among those sites, most (83%) were sailing within site boundaries. The predominance of cruise-ship travel appears to be in the small-ship market, with small ships found in 21 of 30 sites. Meanwhile, one in

four MWH sites surveyed were host to large or mega-sized ships, which use more fuel and produce more waste than the smaller vessels. Nearly all MWH site representatives reported steady or growing demand for visitation by cruise lines, and 25 percent said that their site had already exceeded capacity limits for cruise-ship travel, raising questions about the implications of continued growth in these sites.

MWH site managers are becoming more aware of the growing presence of cruise ships in their waters and the implications on the environment, regional economy, and sociocultural context [25]. While many recognize the potential for tourism to generate employment and revenue for adjacent communities and financial support for the MWH site, there are trade-offs to consider. Cruise ships are efficient conveyers of people, bringing many visitors on one large vessel and potentially exposing vast audiences to unique marine ecosystems—creating new conservation champions. At the same time, there are risks to those marine ecosystems from cruise travel. According to the site representatives we surveyed, environmental risks were most palpable, particularly air emissions, invasive species, and wastewater discharge, which is consistent with other studies [6,7,11,19]. Site representatives mentioned an interest in electric or liquefied natural gas (LNG) ships, and new technologies to process and safeguard waste. Awareness of wildlife impacts appeared nearly universal among managers surveyed, which appears unique to our study. Of note was the concern about marine wildlife, particularly related to noise, ship strikes, and diminished habitat conditions. Accordingly, the most commonly mentioned regulatory mechanism, observed by more than 90 percent of MWH site managers, was wildlife viewing restrictions or safe distances, and one of the greatest needs for new regulations involved noise restrictions that could benefit marine and terrestrial wildlife.

The ability to benefit financially from the cruise ships was a top priority for site managers, who talked about lack of funding to support local infrastructure and facilities, the need for revenue sources to finance park management, and a desire to contribute resources to local economies and distribute the economic benefits more evenly, which are findings consistent with other studies [9]. Financial strategies that seek to offset the costs of tourism have been important in nature-based tourism settings worldwide [59]. Cruise lines are large multi-national conglomerates with economies of scale and significant negotiating power [35]. The challenge of negotiating with cruise lines was noted by MWH site representatives. Some scholars have observed the uneven playing field created by cruise lines, who can mobilize their assets (ships) quickly and sail to other destinations, leaving sites behind [8,13]. Case studies have identified examples where local corporations or government entities have developed alliances and operating agreements to create more even negotiating terms [39,69]. Johnson [11] noted that management solutions for cruise tourism should include a long-term integrated approach that emphasizes strong relationships among cruise lines, destination officials, and international agencies. He also emphasized the need for concerted efforts to address the negative effects of cruise ships and the implementation of finance strategies allowing local officials to enhance site protection [11]. If multiple MWH sites form alliances and share information, they may be in a better position to negotiate with cruise lines, particularly when resources are constrained [59].

The sociocultural context of each MWH site is highly unique and variable, with many sites located far from inhabited communities and some islands or areas completely off-limits to human settlement. Concern for communities or cultural resources was not widely mentioned by MWH site representatives, compared to earlier studies of cruise ship effects [13,33]. The social and cultural effects on sites were more often mentioned in sites where demand for cruise travel exceeds capacity, suggesting that large numbers may be associated with greater concern. Some representatives expressed concern about the lack of indigenous engagement in tourism management, which is consistent with tourism in marine-protected areas [70]. Moreover, there was strong interest in the use of cultural interpreters from local communities to board cruise ships and narrate the human story. Emphasis was given to managing the social environment for visitors themselves, with concerns about crowding and a diminished visitor experience for all types of travelers, which has been observed in other cruise settings [71,72]. Visitor management planning tools would be useful to assist MWH site managers in understanding what kinds of experiences visitors may desire, and how to provide

these experiences to large volumes of ship passengers while maintaining a quality tourism product. Tour operators working in concert with cruise lines can disperse visitors to enhance opportunities for more intimate nature-based experiences; however, unless properly managed, dispersed use can have its own ramifications, spreading environmental effects more widely [31].

Governance mechanisms for sustainable cruise tourism to MWH sites are emerging. Successful sustainable tourism planning at the regional scale involves multiple stakeholders and includes tour operators, cruise lines, conservation NGOs, educators, and partners who share common goals and commitment to sustainable tourism outcomes [61]. In the 2002 World Summit on Sustainable Development, global nongovernmental organizations and industry watchdogs shepherded 'Responsible Tourism' initiatives that require tour operators, hoteliers, governments and citizens to take responsibility and initiative to make tourism more sustainable [8,73]. Sustainability is a central concern for the cruise industry, and cruise lines have adopted new technologies and promoted sustainability principles and practices into product development, ship operations, and branding [22]. Industry self-reporting has further helped to promote a pattern of continual improvement and innovation among cruise corporations. Klein [74] observed that nongovernmental organizations and interest groups working in concert have influenced the development of legislation promoting sustainable cruise-ship practices. Collaborative engagement with communities, stakeholders, and indigenous leaders in tourism planning may improve outcomes [66,69].

## 6. Management Implications: Sustainable Cruise Tourism Best Practices

We began this investigation asking the question, 'What does sustainable cruise-ship tourism look like for Marine World Heritage sites?' Empirical evidence suggests that nature-based tourism has the potential to contribute to sustainable lives, families, communities, economies and ecological resources [75,76]. Governance is needed at appropriate geo-spatial and temporal scales to address tourism's potential in MWH sites [77]. Meanwhile, sites may face capacity constraints that constrain their abilities to engage in effective tourism management. Agencies working together to achieve common goals can leverage resources and talent in providing sustainable tourism programs and services. Capacity-building strategies can be employed to focus agency efforts on critical programs, settings, and services and to build resources from the top-down and the ground-up [78]. To encourage sustainable cruise-ship operations in MWH sites, managers, UNESCO officials, cruise line executives, scientists, tourism providers, and conservation organizations could benefit from a collective process that would identify sensitive species or sites, address key issues, and engage relevant stakeholders.

'Best practices' have been developed and used to provide guidelines to industries, managers, and stakeholders in the governance of coral reefs in marine-protected areas, as well as more broadly in tourism management [18,68,79]. At the 2019 UNESCO meeting for MWH site managers, the idea for developing guidelines for sustainable cruise-ship practices was broached. Our study results contribute to ongoing dialogue about the development of a common vision and shared criteria to guide sustainable cruise-ship tourism for MWH sites. While more discussions are needed, our findings suggest potential foundations for a 'best practices' guideline for cruise tourism in MWH sites. Environmental components might include: prohibition of wastewater discharge; restrictions on ballast water discharge; monitoring of air emissions; use of cleaner vessel fuels; prohibition of single-use plastics; practices that reduce above and below-water noise levels; safe travel practices in sensitive areas to protect marine, benthic, and terrestrial habitats; light restrictions at night; and ship-board environmental programs for cruise guests. Economic components might include: fee systems to generate park revenues; revenue sharing to support communities and infrastructure investments; training programs to generate local employment and reduce poverty; and contracts with local tour providers to ensure more even distribution of tourism benefits. Sociocultural components might include: development of cultural interpretation programs that engage local residents; engagement of indigenous leaders and stakeholders; visitor management strategies to address congestion, user conflicts, and safety concerns; and plans to acknowledge and protect cultural heritage resources and practices. Communication and shared commitment to

understanding what sustainable cruise-ship tourism means for these ‘crown jewels of the ocean’ will help to guide future dialogue and decision-making in support of these critical and sensitive ecosystems of global importance.

## 7. Conclusions

Marine World Heritage (MWH) sites offer unique biological and cultural resources that are important for global ecosystem function. Coral reefs, eel grass fields, atolls, mangroves, and lagoons provide biodiverse settings with critical roles in carbon storage and ocean health. MWH sites also draw visitors interested in learning more about their special qualities. Ongoing demand from the cruise industry means that MWH sites will be increasingly visited by cruise ships. This article presents the first comprehensive report of cruise-ship tourism to MWH sites globally, along with site representatives’ perceptions of the implications of cruise-ship tourism to their site. Two thirds of MWH site representatives surveyed indicated that their site currently receives either cruise ships or cruise ship passengers. MWH sites are predominantly visited by ‘expedition’ cruise lines, although several MWH sites are facing increased demand from large ships and mega-ships.

Ongoing interest in cruising is expected to generate new demand for cruise travel, and new cruise destinations are continually emerging as cruise lines attempt to diversify their product line. More than 62 percent of site managers indicated an increase in cruise visitation over the last three years. Site managers identified several implications of cruise travel on their MWH sites, primarily emphasizing the natural environment (air and wastewater emissions, wildlife habitat), with modest attention to the economic and sociocultural environment. Cruise ships were associated with some job growth, but site managers sought ways to increase revenue to local communities and to enhance site management. Some sites are actively instituting administrative and regulatory mechanisms to enhance sustainability and ensure long-term integrity of socioecological systems. While most sites regulate ballast water (73%) and wastewater (73%) discharge, common concerns focused on ship air emissions and wildlife interactions. MWH site managers expressed interest in developing site networks to facilitate sharing of ideas as a first step for increasing sustainability across all sites. Governance approaches that identify best practices and that suggest operating guidelines across multiple sites are being considered. Public–private partnerships with significant industry engagement may result in solutions that protect these special sites while encouraging sustainable cruise tourism.

**Author Contributions:** Conceptualization, L.K.C., A.M., and S.G.; methodology, L.K.C. and A.M.; validation, A.M.; formal analysis, A.M., L.K.C.; investigation, L.K.C., A.M. and S.G.; data curation, A.M.; writing—original draft preparation, L.K.C. and A.M.; writing—review and editing, L.K.C., A.M., and S.G.; project administration, L.K.C. and S.G. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Acknowledgments:** The authors wish to acknowledge Robbert Casier and Fanny Douvere of the UN Educational and Science Cooperation Organization (UNESCO) for providing us with the opportunity to engage site managers in this preliminary assessment.

**Conflicts of Interest:** The authors declare no conflict of interest.

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