



Preparing for Climate Change in the Red Sea

Recognising early impacts through perceptions of dive tourists and dive operators in Egypt.

N.A. Marshall, P.A. Marshall, A. Abdulla, A. Roupael, and A. Ali



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Cover photo: Front Cover: Diver enjoying the experience of diving on biodiverse and healthy Egyptian coral reefs. Photo by HEPCA
Back Cover: Close up of Anthias, the signature fish species of the Red Sea.

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Foreword

Tourism is considered to be a highly climate sensitive sector and the tourism industry has a key role to play in confronting the challenges of climate change. The relation between climate change and tourism is twofold: climate change impacts on tourism and tourism impact climate change.

Climate affects a wide range of environmental resources that are essential attraction factors for tourism. The regional manifestations of climate change such as coral reef damage, extreme weather patterns or water shortages have potentially disastrous effects on many tourism destinations and tourism products.

Kuoni acknowledge that their business has an impact on the climate and are attempting to counter this impact and trying to take responsibility for the emissions caused by their business activities. Kuoni wants to be part of the solution to climate change, by reducing its green house gas emissions as well as by helping the communities where tourism represents a major economic source to prepare for and adapt to the changing climate.

In this context, it is critical to understand the potential impacts of climate change in the Egyptian Red Sea. Raising awareness of this threat among local tour operators and resource managers is crucial to plan actions that can potentially mitigate future impacts to coral reefs and marine-based tourism.

In partnership with local tour operators, IUCN, the Hurghada Environmental Protection and Conservation Association (HEPCA) and Kuoni work together to address three issues: firstly to assess the vulnerability of the tourism industry to climate change. Secondly, to train and empower local capacity to monitor and manage coral reefs in the face of climate change. Thirdly, to undertake an environmental education and public awareness campaign addressing the impacts of anthropogenic activities on marine habitats.

This publication should help to develop practical guidance and capacity building for climate change adaptation. It is designed to provide a pragmatic platform to strengthen the capacity of professionals to understand and respond effectively to the global challenges of climate change in tourism destinations.

We hope that this publication will support efforts to mainstream climate change considerations into tourism planning and management. We further believe that the tourism sector, through its major contribution to global development, can influence other sectors by sending important signals to governments, industries and the public that climate mitigation and adaptation measures are not only vital for our future, but also make economic sense.

Matthias Leisinger
Head of Corporate Responsibility
Kuoni Travel Holding Ltd.

Acknowledgements

Funding for this project was gratefully received from Kuoni Travel Group Ltd; IUCN Marine Biodiversity and Conservation Science Group and Global Marine Program; and from CSIRO, Climate Adaptation Flagship. We sincerely thank the tireless and dedicated field efforts of Richard Anscombe, Heba Shawky, and Amr Ali. Finally, we are grateful for all the time and effort invested in responding to the surveys by the dive tourists and dive operators that were interviewed.

Executive Summary

Tourism generates important economic activity globally and is a major source of foreign exchange income in many countries. Yet, climate change has the potential to permanently alter the attraction and value of many tourism destinations and substantially impact the income streams and social benefits derived from tourism. These impacts can be minimised if tourism operators, sectors and tourism-dependent communities understand their vulnerability to climate change, and take steps to adapt to predicted changes. Some of the more immediate and manageable changes are likely to result from changes in awareness and attitudes among tourists, and these factors are major drivers of destination and activity choice. Here we test for early indications of these potential climate change impacts among Red Sea tourists and tourism operators as a first step to developing climate adaptation strategies for this sector. Our aims were to: (i) identify whether climate change awareness and attitudes were currently evident in dive tourists visiting the Red Sea region, (ii) assess industry awareness of client attitudes, and (iii) evaluate the implications of these results for development of climate adaptation strategies for the Red Sea tourism industry in Egypt.

We interviewed 150 dive tourists in the Egyptian Red Sea for their awareness and attitudes towards climate change and coral reef condition, and 35 dive operators for their opinion of tourist attitudes and awareness. Our data suggest that changes in awareness and attitudes are already apparent in the Egyptian Red Sea tourism sector. Dive tourists are strongly aware of environmental issues and climate change, and place significant importance on environmental quality and the sustainability profile of tourism operators in making holiday decisions. In contrast, dive operators generally ascribe only a moderate level of environmental awareness to their clients and believe them to be relatively insensitive to ecosystem health and the sustainability profile of operators. This 'perception gap' between clients and operators increases the risk that dive operators in the Egyptian Red Sea will experience early impacts of climate change. This study reveals the nature of initial awareness and attitudinal change among tourists visiting the Red Sea, and lays the foundations for early adaptation by the Red Sea tourism industry.

Introduction

Tourism is a major source of economic activity

Tourism generates important economic activity globally and is a major source of foreign exchange income in many countries (Simpson, et al., 2008). In Egypt, tourism generates an estimated US\$ 7.8 billion annually (equivalent to approximately 6% of national GDP), as well as providing employment for 12% of the national work force (AFP, 2007).

Much of the revenue from tourism in Egypt is derived from the Red Sea region. The Red Sea is internationally renowned for some of the most spectacular and diverse coral reefs and marine life on the planet. Egypt hosts the largest live-aboard fleet in the world. Some 540,000 people annually come from all over the world to dive in the Egyptian Red Sea, providing growing demand for tourism infrastructure and delivering important foreign revenue to the regional and national economy (USAID, 2008).

Climate change brings a new threat to tourism

The tourism industry around the globe has had to face many challenges over the last decade. Terrorist attacks, the lung disease SARS, the war in the Middle East and years of rising energy prices are some of the more dramatic. Against the backdrop of largely unpredictable external shocks, the tourism sector is now facing the prospect of a new and pervasive challenge: climate change (Nicholls, 2004). Tourism is often strongly dependent on environmental assets, making it particularly sensitive to the impacts of climate change. Further, the effects of climate change have the potential to permanently alter the attraction and value of a holiday region (Simpson, et al., 2008).

Coral reefs are particularly sensitive to changes in climate (Marshall & Johnson, 2007). As a result of increasing sea water temperatures and ultra-violet (UV) radiation, mass coral bleaching has occurred worldwide, devastating reefs in some regions including the Maldives, Seychelles and Palau and leading some experts to claim that coral reefs are 'in crisis' (Belwood, et al., 2004; Hoegh-Guldberg, 2007). Further, as a result of the uptake of carbon dioxide from the atmosphere, ocean acidification exacerbates the threat to marine animals and plants that produce calcium carbonate skeletons (Marshall & Johnson, 2007). Whilst the Egyptian Red Sea has so far escaped a major mass bleaching event, ecologists working in the region suggest that it is only a matter of time before the effects of climate change manifest here (NCS, 2006; Roupheal & Abdulla, 2007).

Climate change impacts on the tourism industry

A recent review by the United Nations Environment Program (Simpson, et al., 2008) recognised four broad categories of climate change impacts likely to affect tourism destinations, sector competitiveness and business sustainability. We use additional reports (Forsyth, et al. 2007; Ehmer & Heyman, 2008) and our own study and experience to expand this conceptual model to five categories: direct climatic impacts, indirect environmental change impacts, impacts of mitigation policies on tourist mobility, indirect societal change impacts, and attitudinal and behavioural change impacts.

1. Direct climatic impacts

Climate will have direct impacts on tourism by altering destination appeal and by affecting input costs (Simpson, et al., 2008). Destination appeal will be affected where climate itself is a significant tourism resource (i.e. probability of 'sunny days') and where the weather determines the suitability of important

tourism activities. Input costs are often dependent on environmental conditions, such as temperature (for heating/cooling), rainfall (availability of water) and frequency of extreme weather events (infrastructure repair and insurance costs). Changes to climate could result in both negative and positive impacts (e.g. more/less 'sunny days'), depending on the location and nature of activities undertaken at a tourism destination.

2. Indirect environmental change impacts

Many tourism activities are dependent on environmental assets, such as beaches or coral reefs. Climate change is expected to alter many aspects of the natural and built environment, creating a range of indirect impacts for tourism, most of which are likely to be negative. Examples of indirect environmental impacts from climate change include biodiversity losses, loss of coral cover, reduced reef aesthetic, decreased fisheries production as well as a decline in ecosystem services such as coastal protection and beach replenishment.

3. Impacts of mitigation policies on tourist mobility

National or international mitigation policies that seek to reduce the impact of tourism on natural resources or reduce carbon emissions may have an impact on tourist flows (Simpson, et al., 2008; Gossling, et al., 2008). For example, the numbers of tourists to a tourist site might be more tightly managed given that the site may be especially prone to climate change damage. Additionally, mitigation policies may foster tourist attitudes that result in lower propensity for long-haul travel or participation in energy-intensive activities.

4. Indirect societal change impacts.

Climate change has the potential to cause massive social upheaval as a result of impacts on future economic growth and political stability. As a result, climate change is commonly regarded as a national and international security risk that will intensify with warming especially in regions where tourism is very important. Developing countries in particular are likely to experience indirect societal change impacts (Stern, 2006; Simpson, et al., 2008). Worsening situations of social unrest will make each region even more unpalatable for tourism (Hall, et al., 2004; UNEP, 2009).

5. Awareness and attitudinal impacts

As consensus grows about the imperative to take action on climate change, individuals are adopting new attitudes and behaviours in response to new laws and community expectations ('social norms'). These changes will influence the decisions tourists make about destinations, modes of travel, activities and the businesses they patronise (Forsyth, et al., 2007). Changes in awareness and attitudes can be expected to be expressed earlier, and perhaps even more dramatically, than the impacts included in the above four categories. For example, a destination with a poor image for sustainability and climate friendliness could rapidly fall from grace in the perception of growing numbers of travellers with a strong environmental conscience (e.g. see *corporate responsibility assessments at <http://www.kuoni-group.com>*). In contrast to the potential importance of this category of impact, is its amenability to influence by the tourism sector. By changing operating practices and with the support of appropriate communication activities, particular tourism businesses, destinations or sectors can actually position themselves to benefit from changes in tourist' attitudes rather than suffer negative impacts.

Preparing for climate change in the Red Sea

As our awareness of climate change has increased, so, too, has our need to understand the threat it poses and our vulnerability to it. Climate change cannot be fully averted and we must understand, prepare for and adapt to its inevitable effects. Adaptation is essential if the tourism sector in the Egyptian Red Sea is to reduce its vulnerability to climate change and minimise negative changes in tourism visitation to the region (Armitage, et al., 2008; Nicholls, 2004; Williams & Ponsford, 2009).

We focus here on understanding the potential for impacts on the Red Sea tourism industry in Egypt resulting from attitudinal change related to climate change. We hope that this information can assist the dive tourism industry in the Red Sea to respond to the emerging challenge of climate change. We provide dive tourism operators in the Red Sea region with information about dive tourists and their climate awareness and attitudes so as to assist operators to better plan for the effects of climate change. We examine also the perceptions of dive operators to gauge the extent to which they are aware of changes in attitudes and awareness of tourists in their business operations and planning.

This study is a preliminary survey to inform further work on adaptation in the dive tourism sector. Specific aims of the study were to: (i) test for evidence of awareness and attitudes of tourists that could affect choice of destination, activity or business, (ii) assess the perceptions of the dive tourism industry about the awareness and attitudes of tourism clients and (iii) evaluate the implications of these results for adaptation strategies in the Red Sea dive tourism industry.

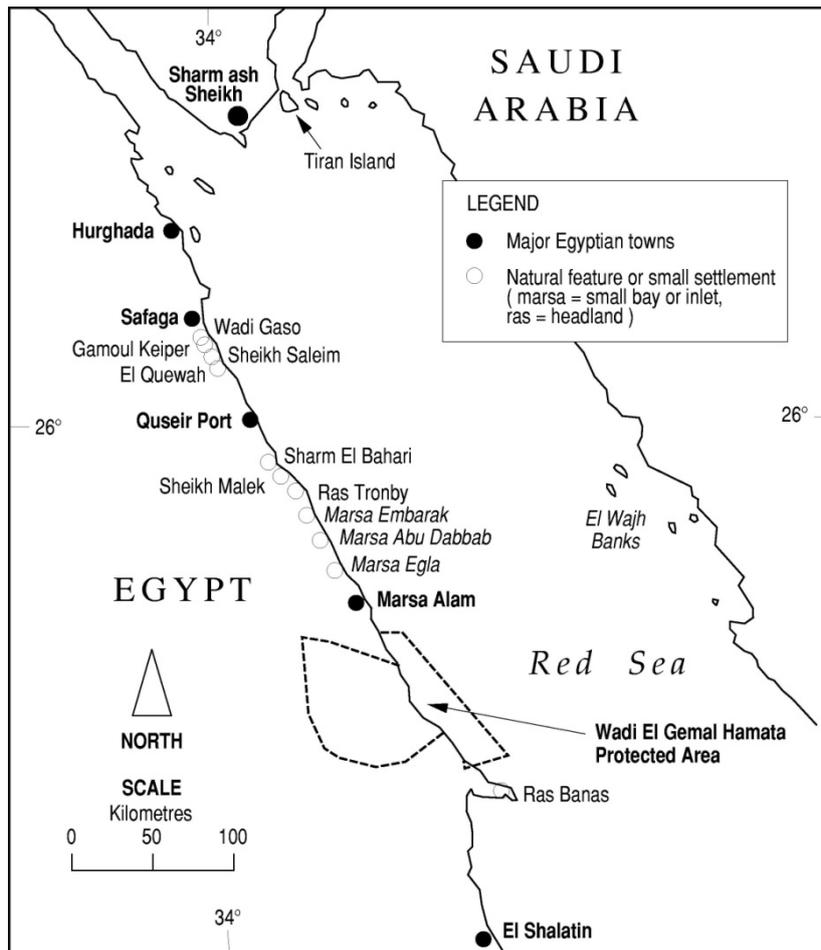
Method

Surveys were developed to assess the awareness and attitudes of dive tourists to environmental conditions and climate change issues, and to examine the perceptions of dive operators about the awareness and attitudes of dive tourists. Statements were created to reflect various perceptions and respondents were asked to rate how strongly they agreed with each statement using a 4-point Likert scale (strongly agree, agree, disagree, strongly disagree). Some open ended questions were also included. This survey structure is most efficient for obtaining large amounts of data in a relatively short time (Likert, 1968).

The **dive tourist** surveys were designed so that the following information could be elicited: (i) demographic characteristics, (ii) dive experience, (iii) dive experience in the red sea, (iv) sensitivity to coral degradation, (v) awareness of climate change impacts, (vi) environmental awareness, (vii) dive holiday preferences, (viii) business opportunities for the Red Sea region (see appendix 1 for a copy of the survey).

The **dive operator** surveys were designed so that the following information could be elicited: (i) demographic characteristics, (ii) dive experience, (iii) perceptions of coral condition in the Red Sea, (iv) perceptions of dive tourists' sensitivity to coral degradation, (vi) environmental awareness, (vii) awareness of climate impacts, (viii) awareness of tourist preferences, (ix) preparing for climate changes (see appendix 2 for a copy of the survey).

A team of trained interviewers was established through a local NGO (Hurghada Environment Protection and Conservation Association; see <http://www.hepca.com.eg>). The team randomly identified and approached day operators and live-aboard dive operators from 6 destinations along the Egyptian Red Sea Coastline that include El Gouna, Saffaga, Qusier, Marsa Alam, Wadi Lahmi and Live-Aboards (see *Map 1*). Over the course of 1 month (May 2009), surveys were administered to a proportionate number of tourists and dive tourist operators. The response rate of tourists was 80% and the response rate of dive operators was 60%. Refusals were most often due to language barriers. Overall, 150 dive tourists and 35 dive operators were sampled.



Map 1. Map of the Northern Red Sea

Results

A. Tourist Results

Demography

Most (72%) of the 150 dive tourists surveyed were aboard a day-trip operation and the remaining 28% were on a live-aboard operation. Dive tourists were of 19 different nationalities (see Figure 1). Most were from Germany (34%) and Britain (30%) with others coming from Holland (5%), Belgium (4%), Poland (3%) and Norway (1%). Most tourists were between 36-46 years of age (32%; see Figure 2). Most had completed their schooling to the age of 18 years (65%), and 50% had undertaken further educational studies.

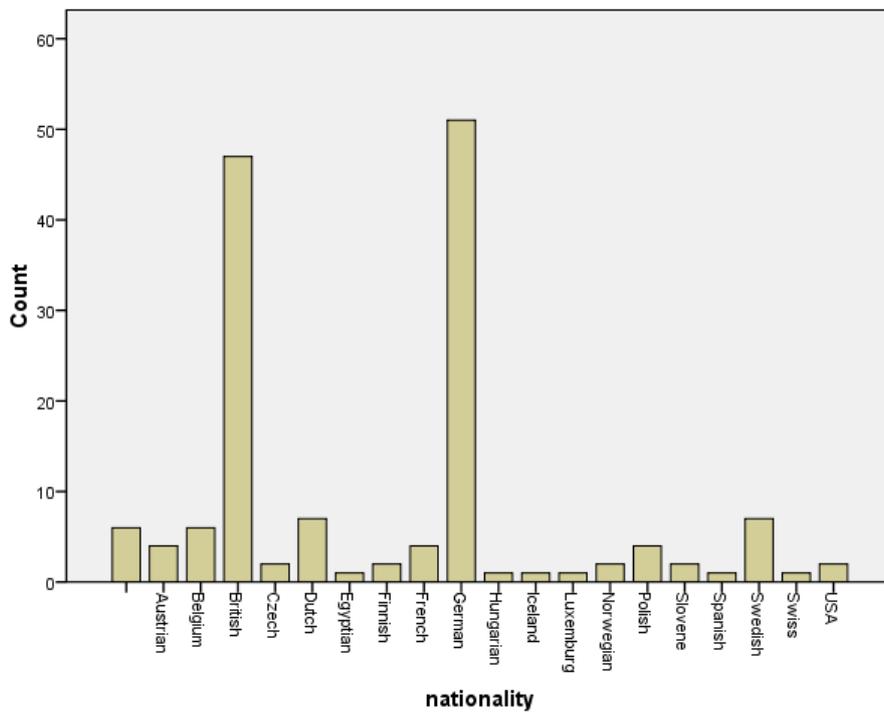


Figure 1. Nationality of dive tourists

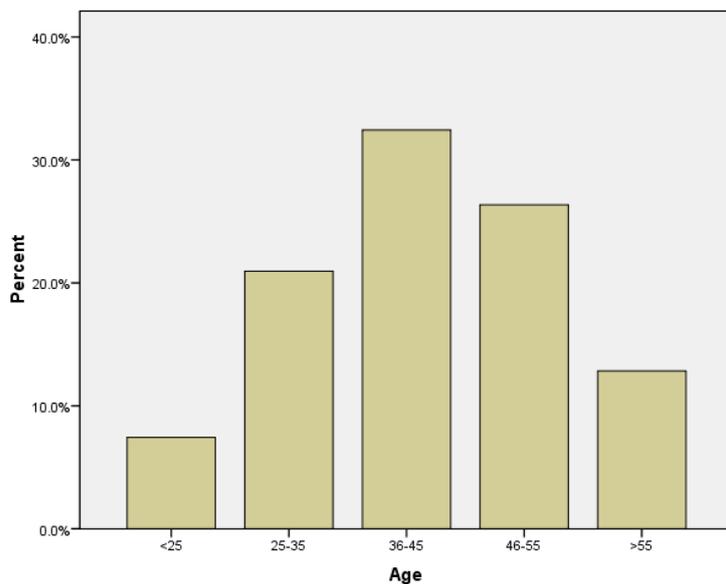


Figure 2. The age distribution of dive tourists

Dive experience

Divers were generally 'advanced' in their dive qualifications (46%), with only 13% recently qualified. Whilst 11% had not dived in any other region, most respondents had dived elsewhere, some in over 10 other dive regions (7%) (see Figure 3).

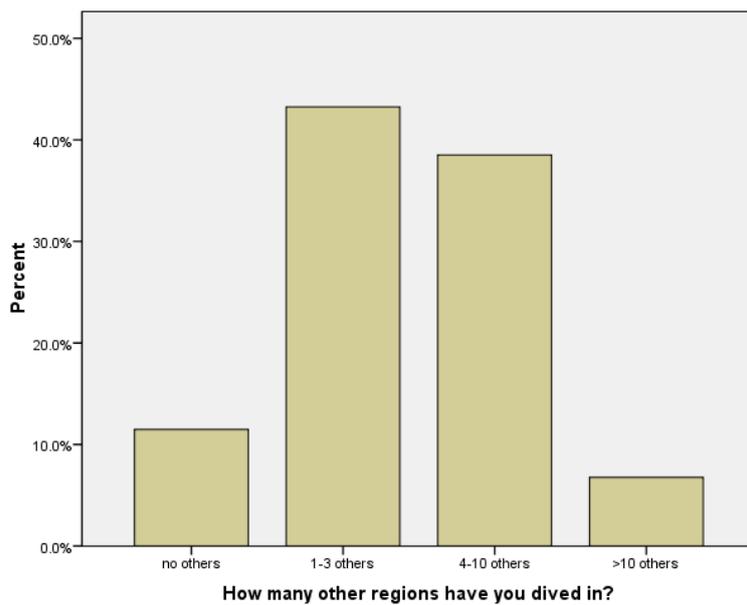


Figure 3. The number of other regions that tourists have dived in

Dive experience in the Red Sea

Tourists ranked big fish (mean=2.85) as the most important factor when rating their dive or snorkel experience. Other factors in their order of importance were: pretty coral formations (mean=2.61), lots of healthy coral (mean=2.50), visibility (water clarity; mean=2.40), and many pretty fish (mean=2.35).

The majority of tourists (79%) had some previous dive experience of the Red Sea. Whilst many had mostly only dived once in the region before (21%), some divers were returning routinely and some returning up to 34 times (see *Figure 5*). Most divers were basing themselves from Hurghada/El Gouna (60%; see *Figure 6*).

Divers were asked to rate the quality of their recent dive experiences in the region on a scale of 1-10 where 10 was the best diving they could ever imagine. Whilst responses ranged from 1-10 (see *Figure 4*), the most frequent response was 8 (mean=7.7 and s.e.=0.1).

Many divers had heard that, “coral condition in the region was great” (66%). Nearly half of visitors (47%) reported that they expected there to be more coral, but most were not disappointed with the colour of corals (59%), nor with the numbers of fish (figure 62%). The majority of divers who were return visitors reported that coral condition in the region had not declined or improved, and was essentially unchanged (70%; see *Figure 7*). Most divers would recommend the Egyptian Red Sea region to their diving friends for holidays (84%). Overall, divers thought the coral reef was beautiful (66%), but few strongly agreed with the statement that the “coral was beautiful overall” (see *Figure 8*).

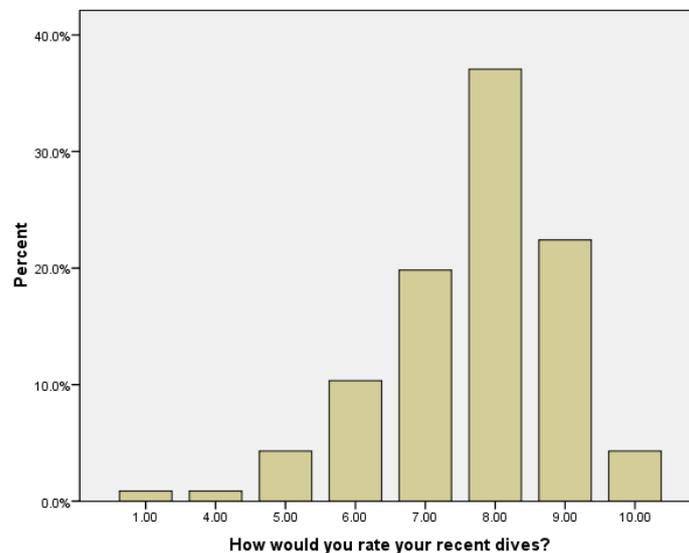


Figure 4. Tourist ratings of their recent dives in the Red Sea

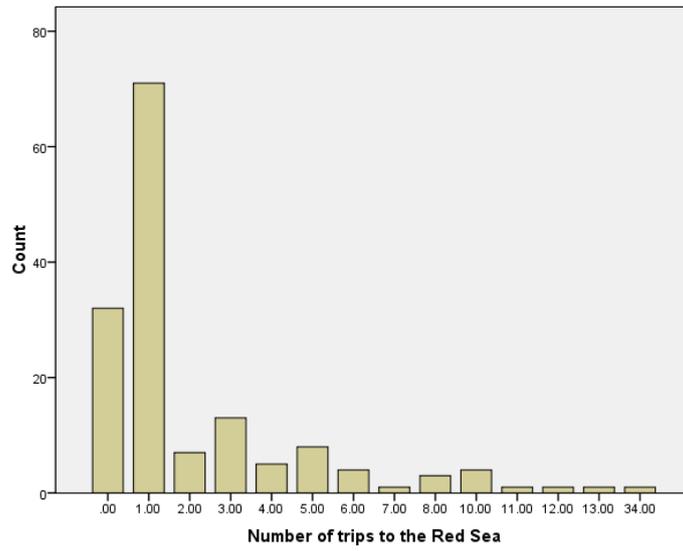


Figure 5. The number of dive trips to the Red Sea region

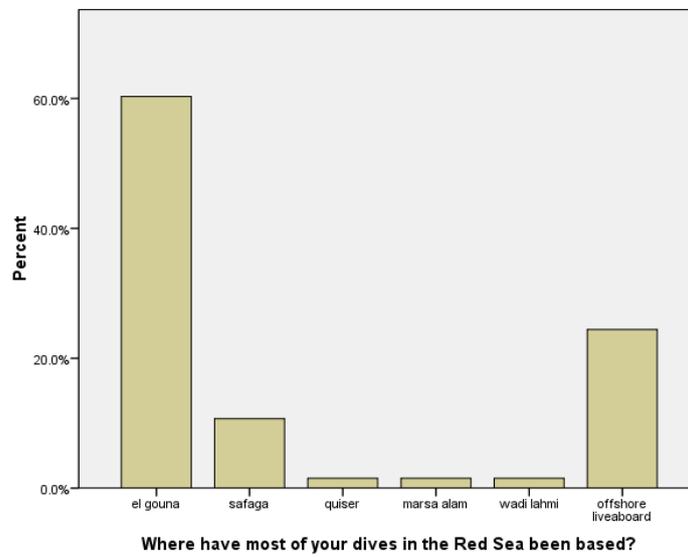


Figure 6. Diving bases of tourists

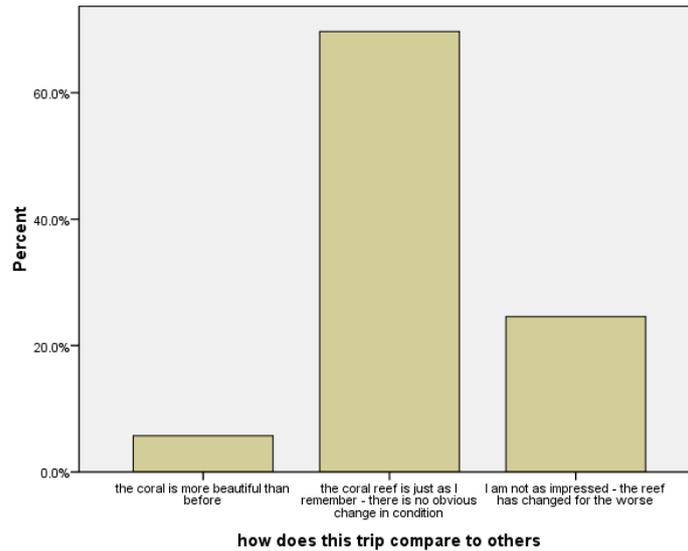


Figure 7. The impression of coral condition from return-tourists

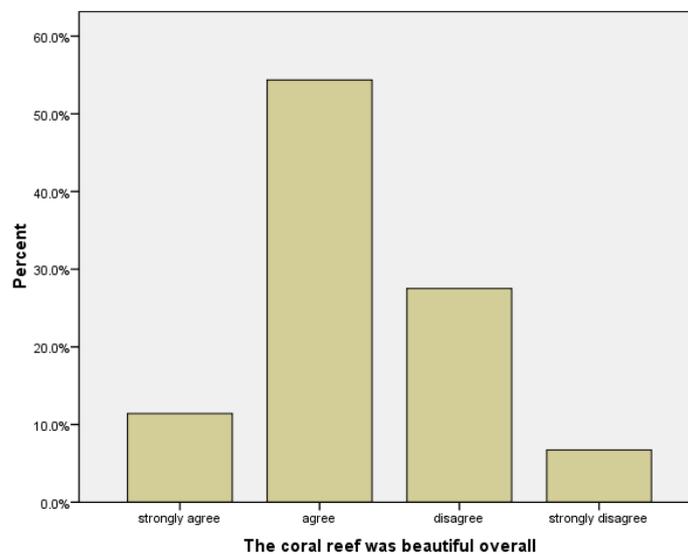


Figure 8. The impression of coral condition from dive tourists

Sensitivity to coral degradation

Half of the divers reported that they noticed a lot of 'dead looking coral' (50%) (see Figure 9). About half (45%) suggested that they would not notice if some (<10%) of the coral reef died (see Figure 10). However, the majority of divers (73%) indicated that they would notice a 25% decline in coral cover (see Figure 11) and 78% of said that they would notice a 50% decrease in coral cover (see Figure 12). Most but not all divers (77%) would notice a loss of most of the coral in the region (see Figure 13).

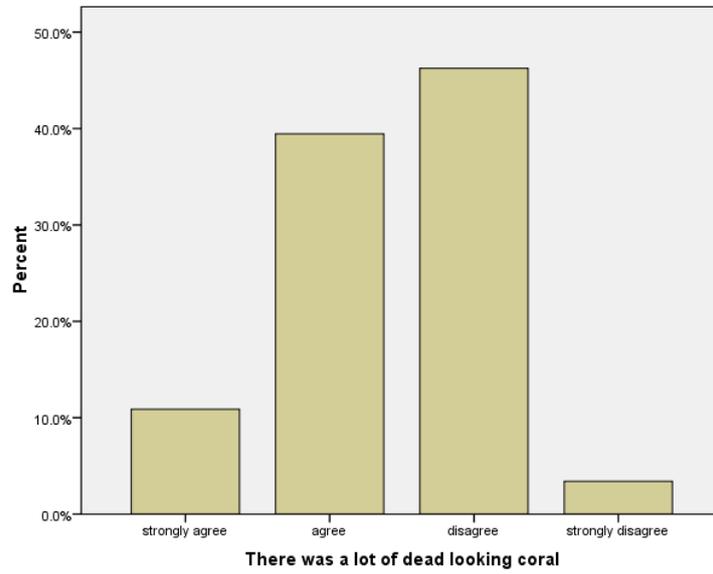


Figure 9. Tourists' impressions of the amount of dead-looking coral

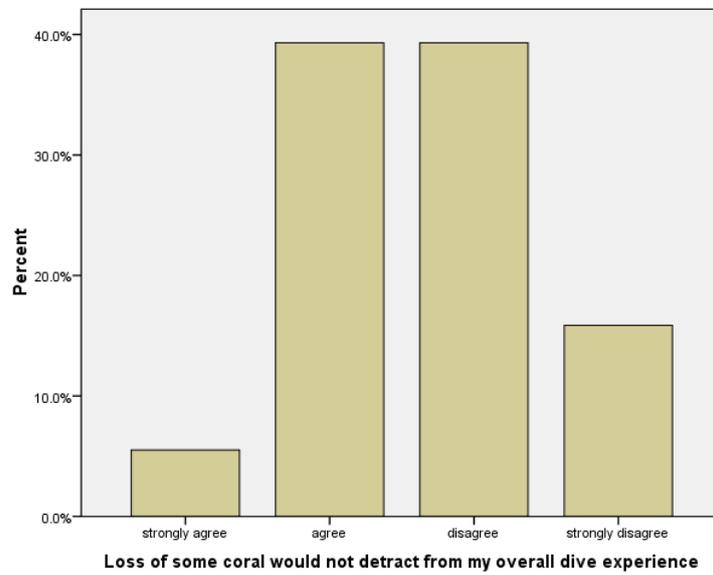


Figure 10. Tourists' sensitivity to some coral degradation

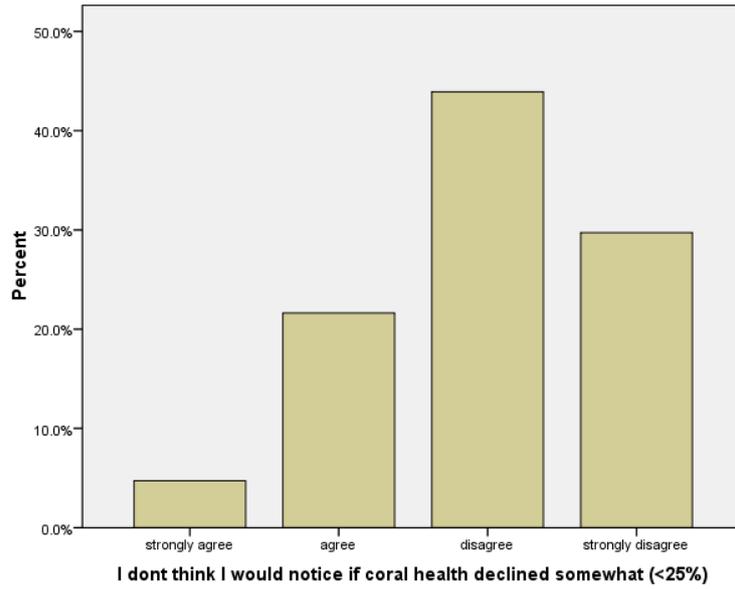


Figure 11. Tourists' sensitivity to 25% coral degradation

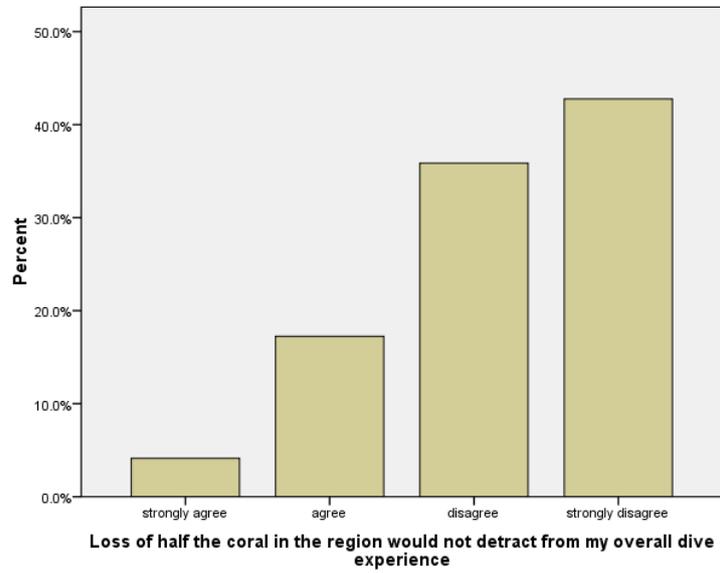


Figure 12. Tourists' sensitivity to 50% coral degradation

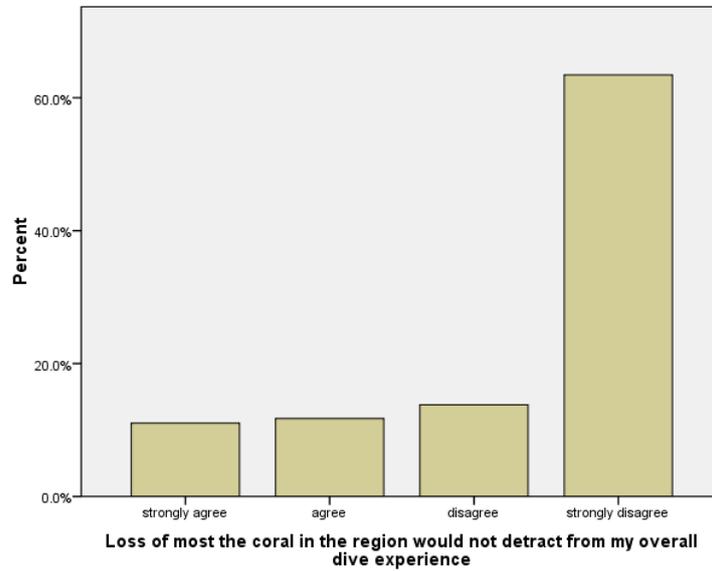


Figure 13. Tourists' sensitivity to severe coral degradation

Awareness of climate change issues

Over 80% of tourists indicated that they were very concerned about climate change and its impacts around the world. The majority of the dive tourists were very climate aware where 73% implied that they read a lot about climate change impacts around the world (see Figure 14). The majority of respondents had heard about coral bleaching (75%; see Figure 15).

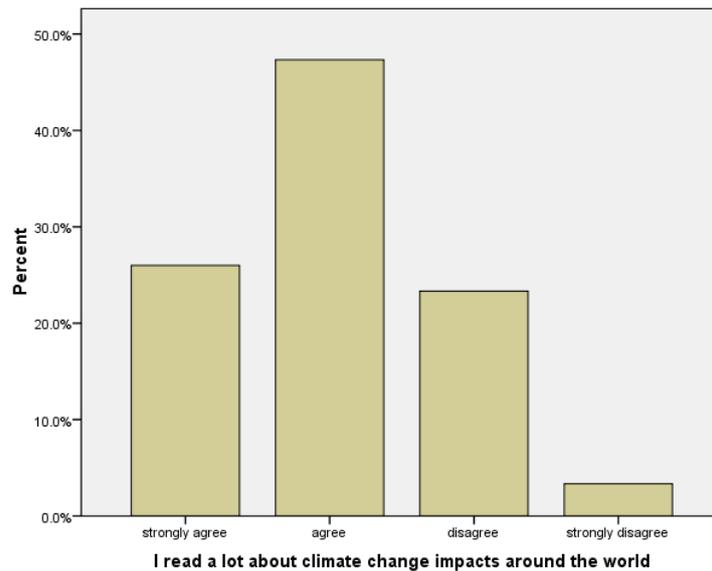


Figure 14. The extent to which tourists read about climate change impacts

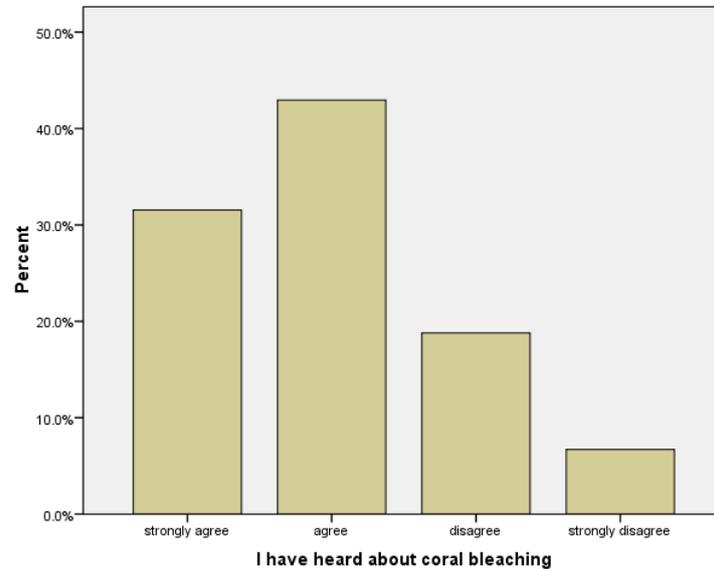


Figure 15. The extent to which tourists have heard about coral bleaching

Environmental awareness

Tourists were asked to list the first, second and third most important threats to the Red Sea region. Those threats listed as the most important included dive tourists (23%), pollution (23%) and urban development (20%; other factors made up 44%).

Pollution (24%) and over-fishing (24%) were most frequently cited as the second most important threats. Climate change impacts were listed as the third most important threat to the region (10%).

Planning processes for tourists

Overwhelmingly (90%) divers stated that they are more likely to choose a dive operation that is 'environmentally friendly' (see Figure 16). The majority said that they plan their holidays according to the dive experience they expect (79%). Over half the tourists that were interviewed said that climate change issues were important for choosing their diver operation (59%; see Figure 17). More than half suggested that how climate change was managed (in general) was an important factor in selecting their holiday destination (59%; see Figure 18). The majority of tourists (76%) indicated that they often talk about coral reef health and fish numbers with other divers they meet (see Figure 19).

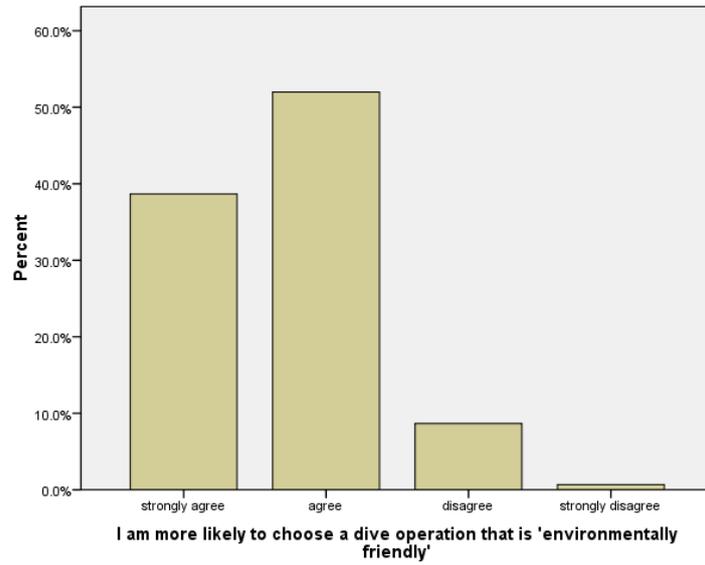


Figure 16. The extent to which tourists are likely to choose a dive operation that is 'environmentally friendly'

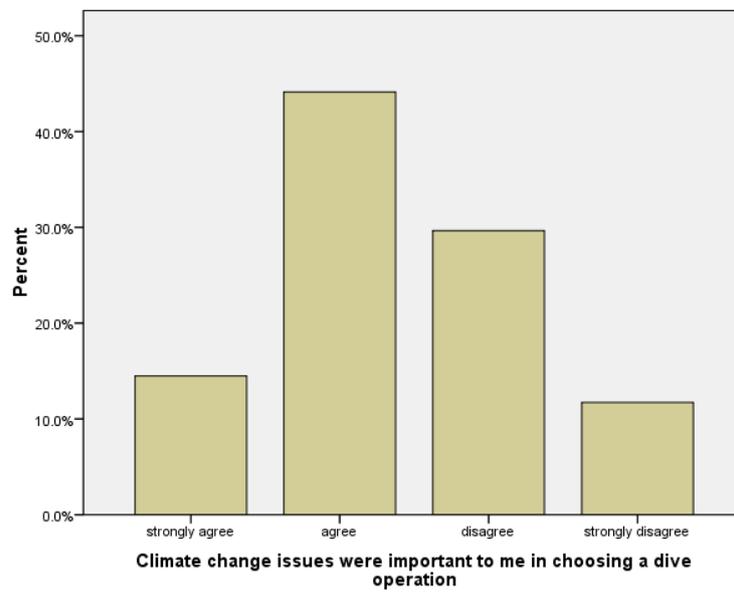


Figure 17. The extent to which tourists incorporate climate change issues into choosing a dive operation

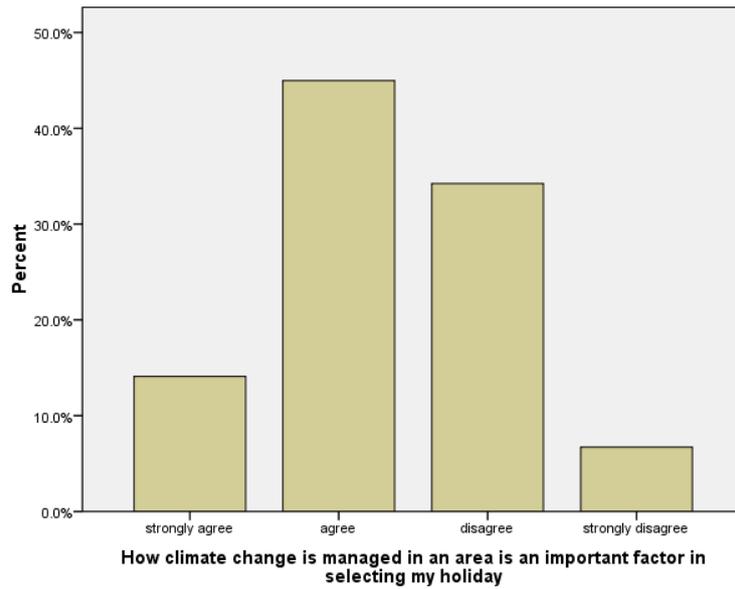


Figure 18. The importance of climate change management to tourists in selecting their holiday

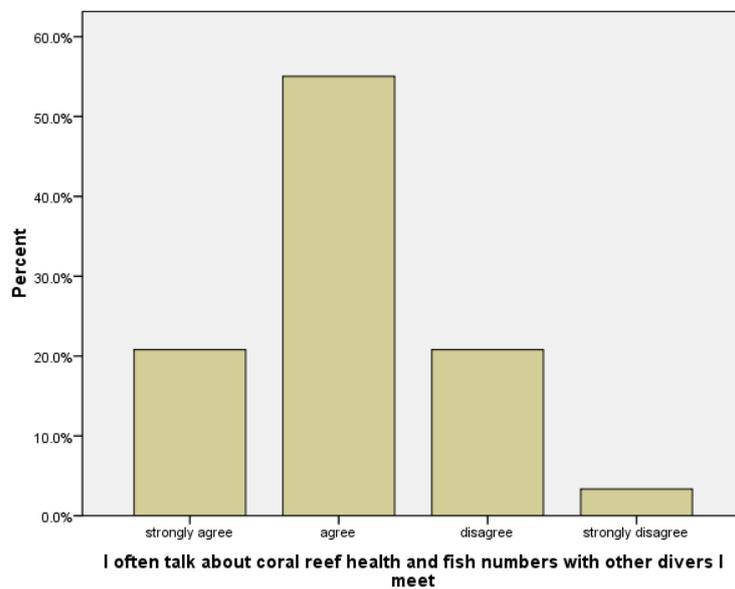


Figure 19. The extent to which tourists communicate about coral reef health and fish numbers with other tourists

Features attracting dive tourists to the Red Sea region

According to this survey, diving is certainly the main attraction for divers visiting the Red Sea region (89%; see Figure 20). The majority of divers were not participating in any other 'interesting activity' in the region (81%; see Figure 21). However, when asked what their most important factor in choosing the Red Sea for a holiday destination, divers included the diving experience (43%), proximity to home (34%) and the good weather (22%).

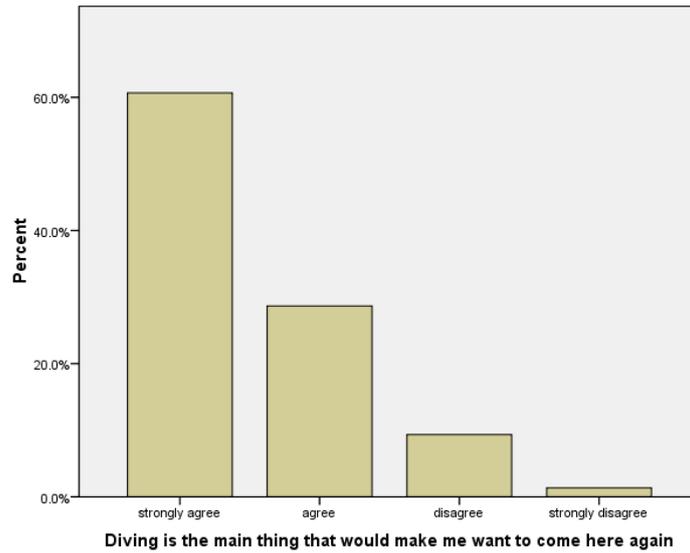


Figure 20. The extent to which diving is the main attraction to the region

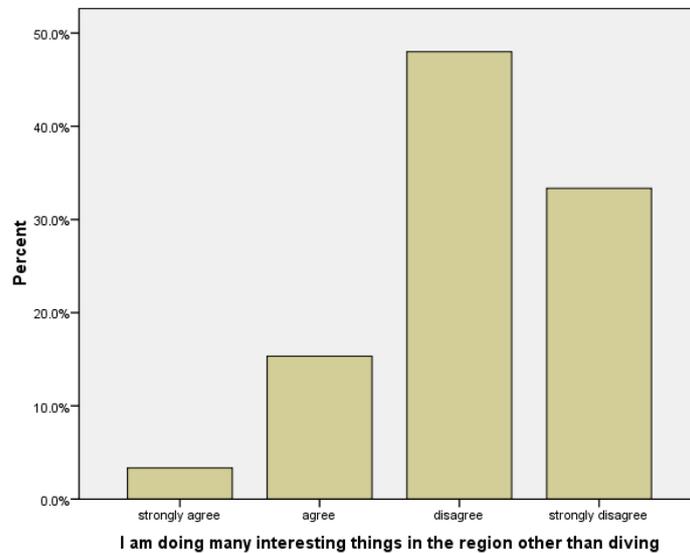


Figure 21. The extent to which other activities in the region is interesting to divers

B. Dive Operator Results

Demography

Of the 35 dive operators surveyed, 50% conducted a day-trip style operation only, and 25% conducted a live-aboard style operation whilst 25% operated as both (see Figure 22). Half of the dive operator respondents owned the dive business, while the remainder interviewed were employees. Some (3.6%) businesses were very small with only 1 or 2 employees, whilst others (3.6%) were very large with around 300 employees (see Figure 23). The mean number of employees per business was 38 (s.e.=11

employees), although the most frequent response was 15 employees. Some (10.7%) business did not own any dive vessels, whereas some (3.6%) owned up to 11 vessels (see Figure 24). The mean number of dive vessels held by businesses was 2 (s.e.=0.5), with the most frequent response of 1.

Thirty two per cent of the operators sampled were Egyptian (see Figure 25). Other operators were mostly British (25%) or German (14%). Most operators were between 36-45 years of age (50%; see Figure 26).

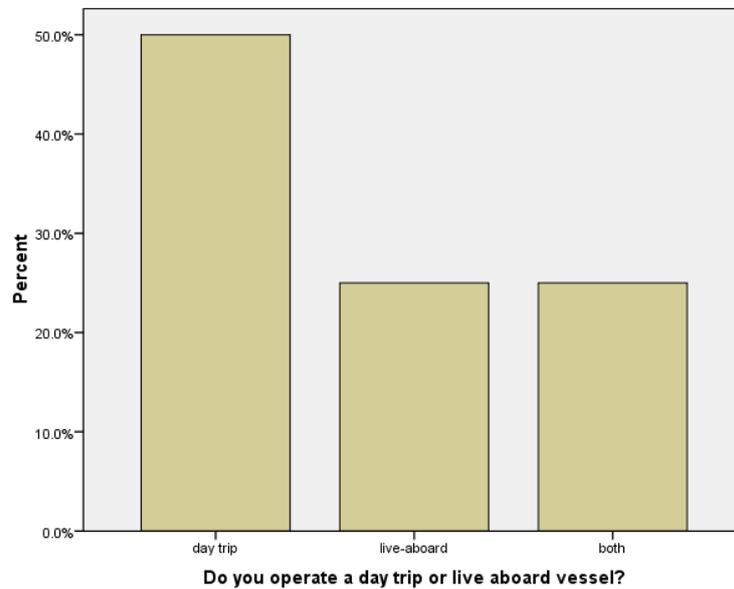


Figure 22. Style of dive operations

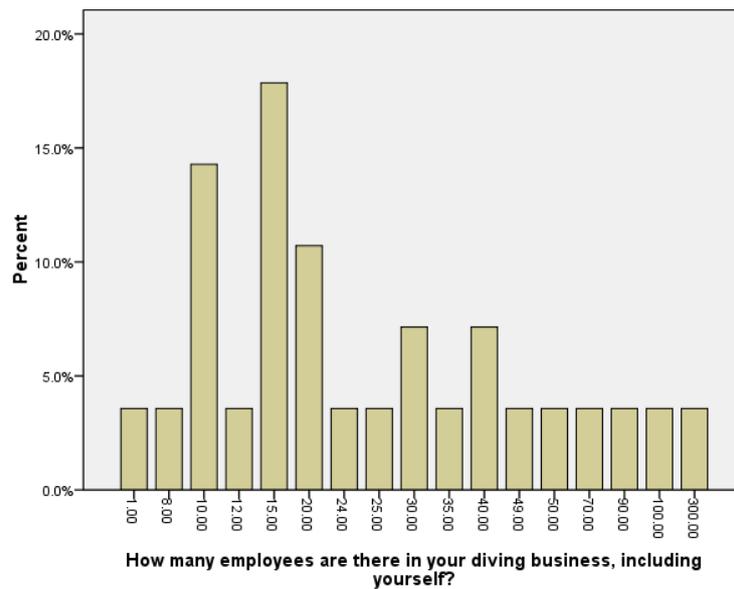


Figure 23. Number of employees within each operation

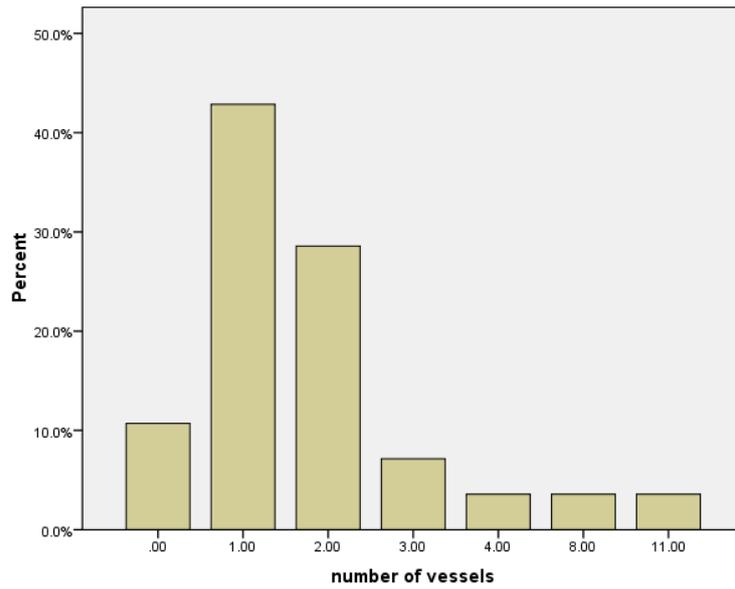


Figure 24. Number of diving vessels within each operation

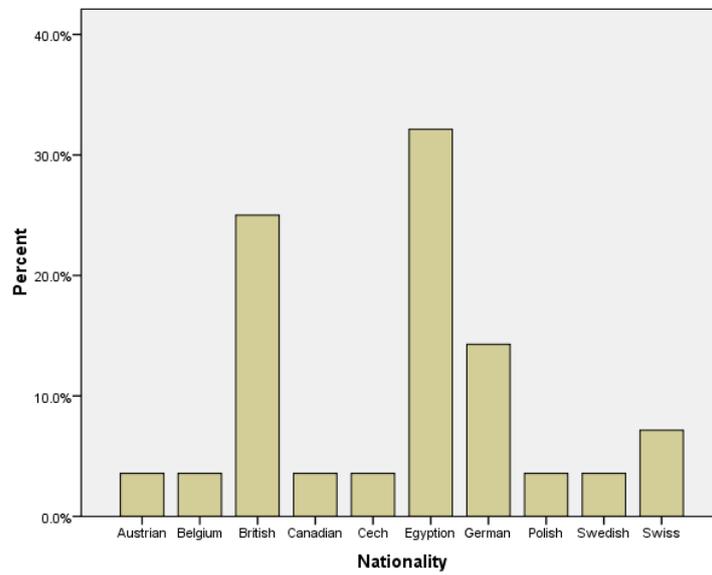


Figure 25. Nationality of dive operators

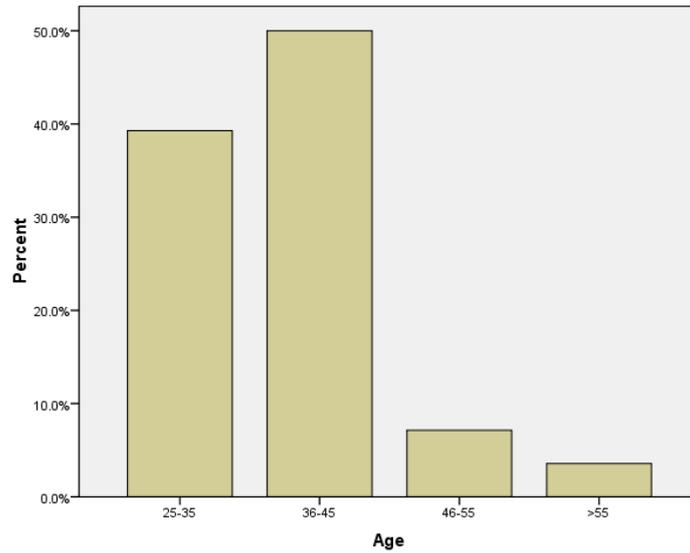


Figure 26. Age distribution of dive operators

Dive operator experience

The experience of dive operators in the Red Sea region ranged from 1 to 22 years. The mean value was 10 years (s.e.=0.9 years). Whilst some dive operators were very new to the local region (7%), most dive operators were extremely familiar with the region, logging up to 7,000 dives in the Egyptian Red Sea (see Figure 27). The mean number of dives for operators in the region was 1996 (s.e. = 321 dives). Whilst some operators had never dived in any other region (25%), most (75%) had dived elsewhere, and some in over 10 other regions (11%; see Figure 28).

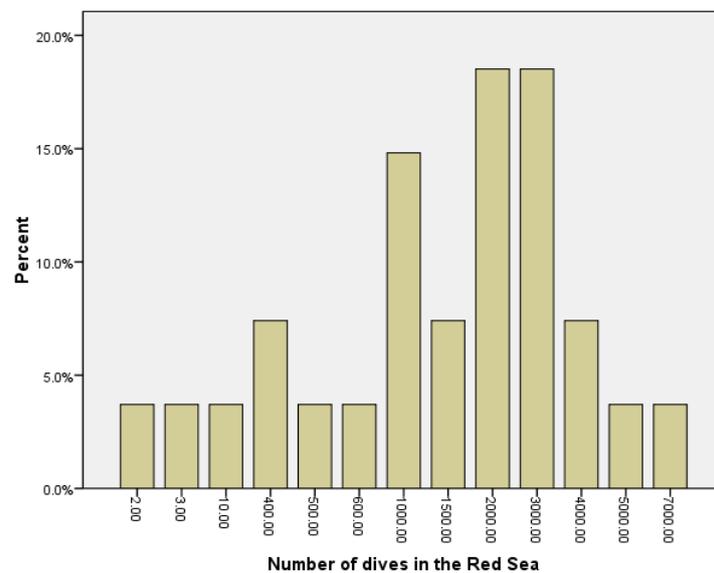


Figure 27. Dive experience of dive operators in the Red Sea

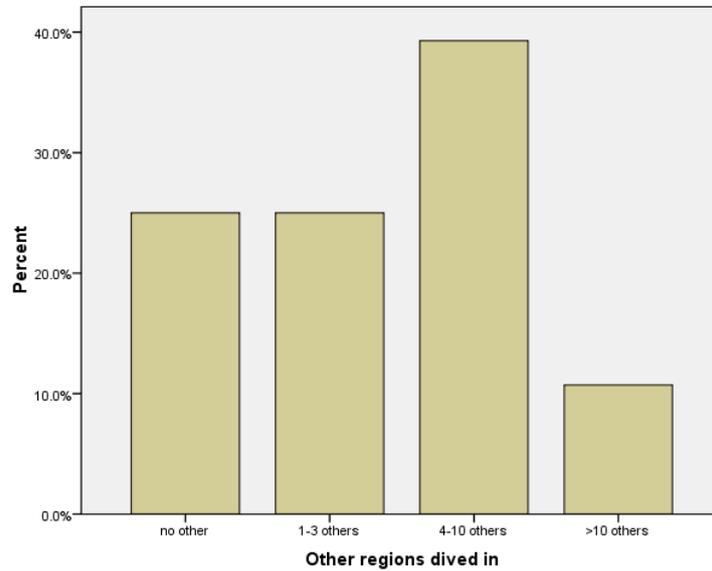


Figure 28. Dive experience of dive operators in other regions of the world

Perceptions of coral condition in the region

Dive operators thought there was a lot of 'dead looking coral in the region' (60%; see Figure 29). They rated coral condition in the region as 'mostly good' (36%) and 'about 50% in good condition' (57%; see Figure 30). Nearly 80% of operators reported some decline in coral condition during their experience in the Red Sea region (see Figure 31) and most operators (71%) believed that the coral reefs in the region were not in 'great' condition (see Figure 32) but did think that fish numbers in the region were impressive (61%; see Figure 33).

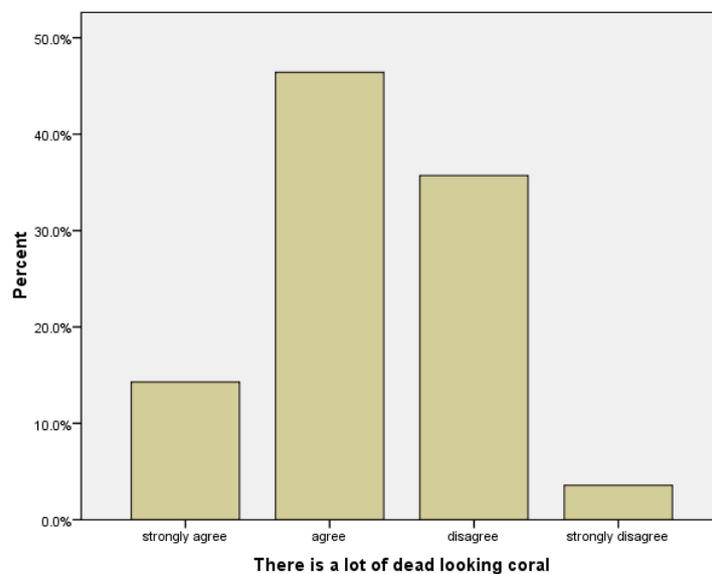


Figure 29. Dive operators' impression of the amount of dead-looking coral

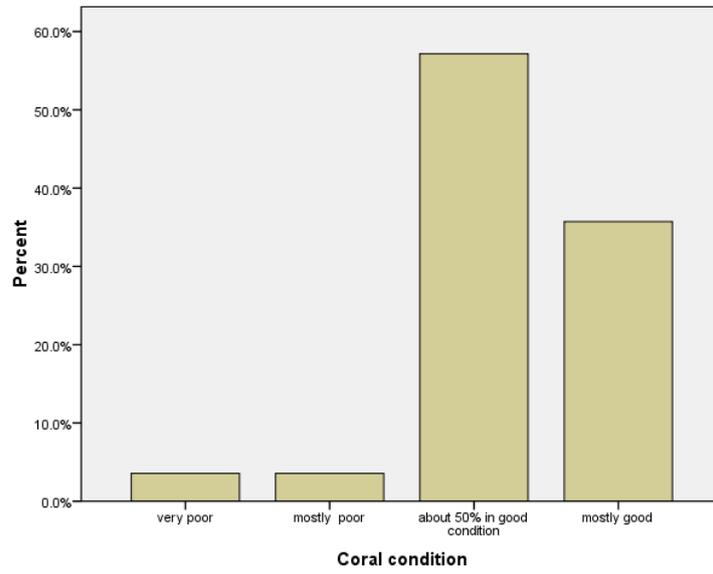


Figure 30. Dive operators' impression of coral condition

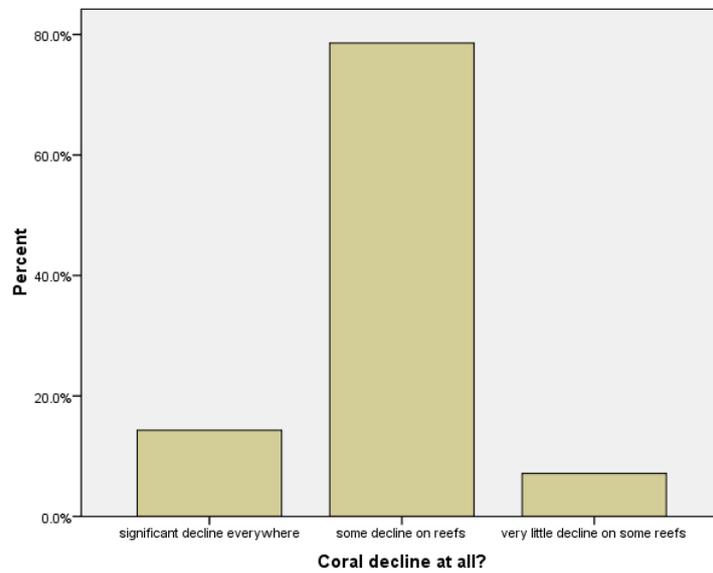


Figure 31. Dive operators' impression of coral condition over time

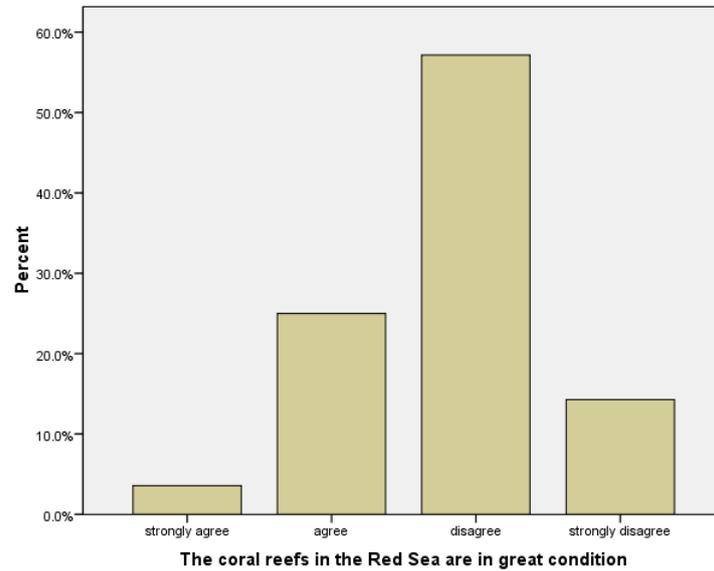


Figure 32. Dive operators' assessment of whether coral reefs in the Red Sea are in great condition

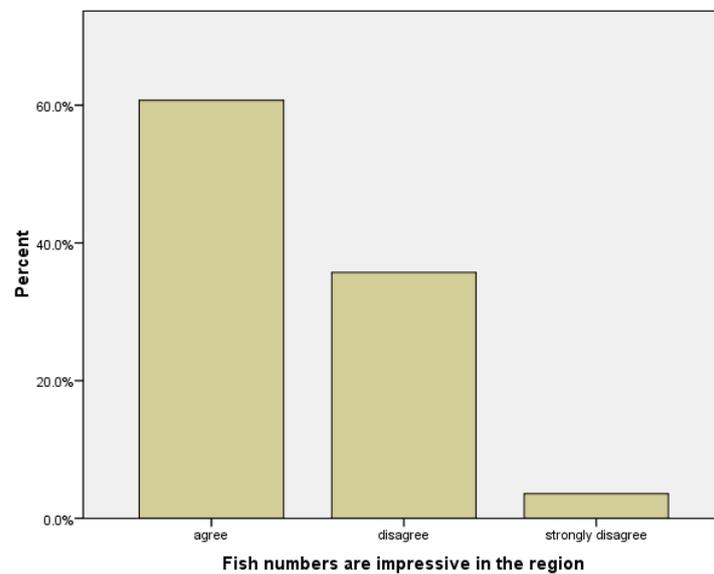


Figure 33. Dive operators' assessment of whether fish numbers in the Red Sea are impressive

Perceptions of dive tourists' sensitivity to change in reef condition

Dive operators thought that tourists were noticing coral decline in the region (78%; see Figure 34). Yet, most operators (71%) thought that loss of some coral in the region would not detract from the overall dive experience for tourists (see Figure 35). About 40% of operators thought that a 25% decline in coral cover would not be noticed (see Figure 36). Most operators thought that loss of half of the coral and most of the coral in the region would detract from a tourist's experience (64% and 79% respectively; see Figures 37 and 38).

Dive operators thought that dive tourists had unrealistic expectations about coral colour (57%; see *Figure 39*). Dive operators were worried that if coral condition declined then tourist numbers would be affected (89%; see *Figure 40*), since most operators thought that reef condition will determine tourist numbers in the future (86%; see *Figure 41*).

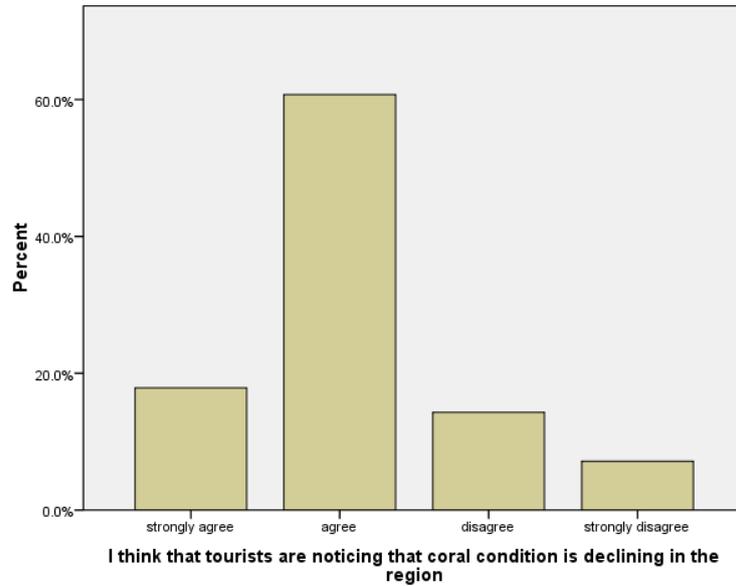


Figure 34. Dive operators' assessment of whether tourists are noticing coral decline

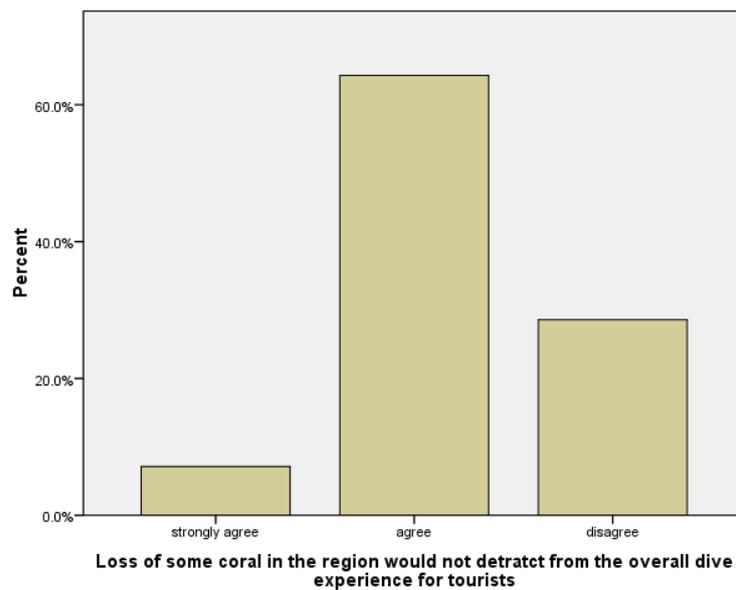


Figure 35. Dive operators' assessment of tourists' sensitivity to some (<10%) coral decline

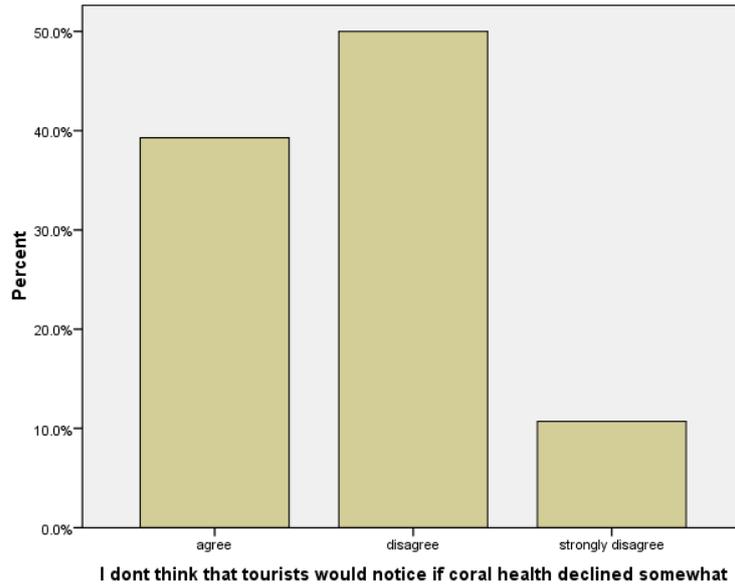


Figure 36. Dive operators' assessment of tourists' sensitivity to some (25%) coral decline

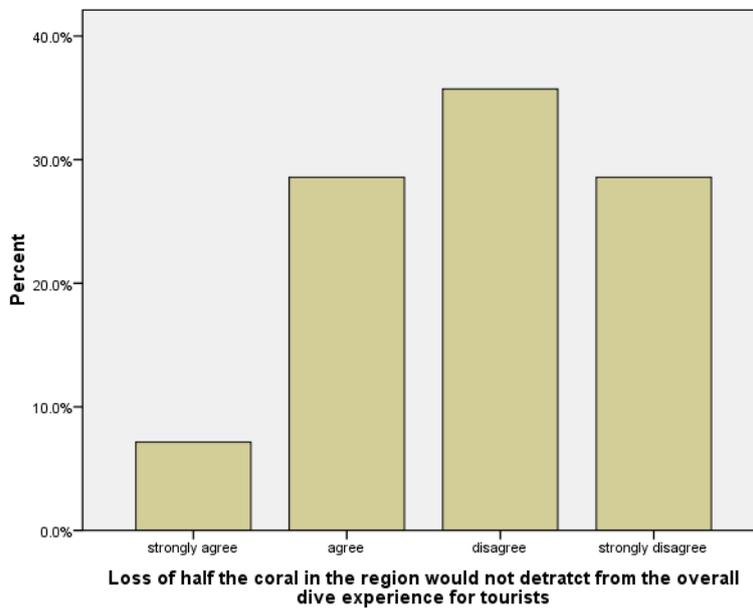


Figure 37. Dive operators' assessment of tourists' sensitivity to 50% coral decline

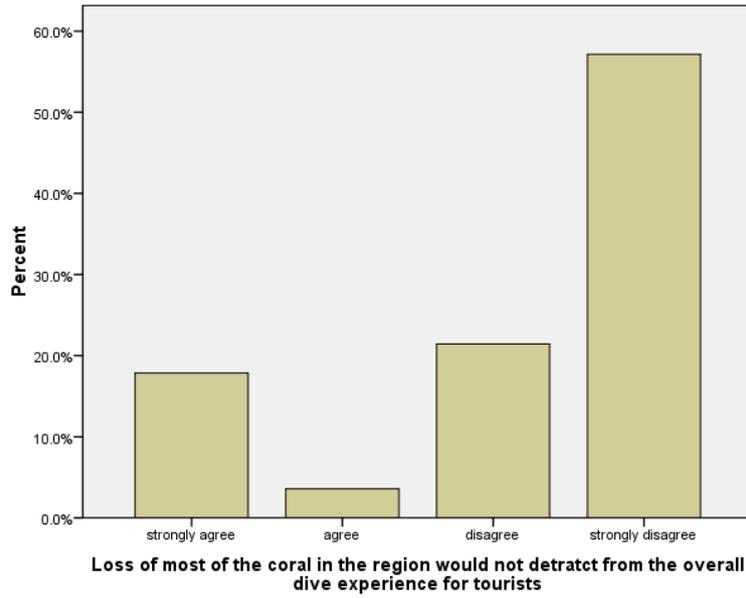


Figure 38. Dive operators' assessment of tourists' sensitivity to significant coral decline

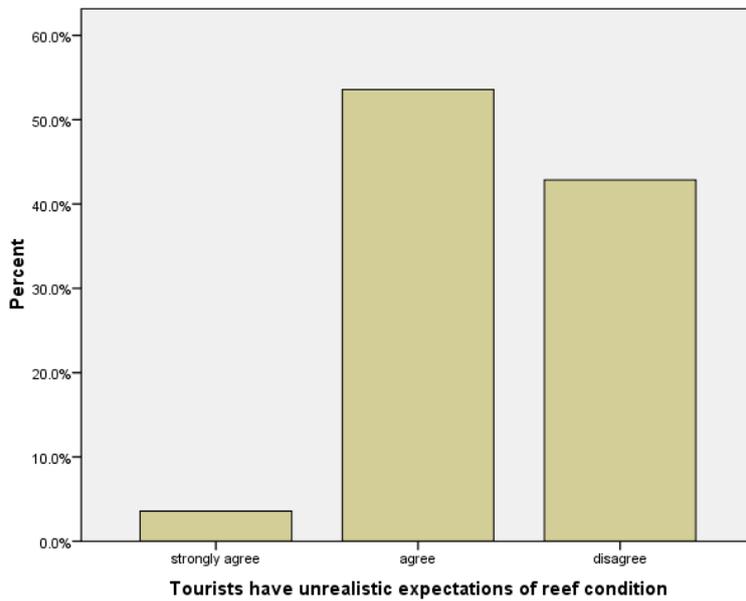


Figure 39. Dive operators' perceptions of tourists' expectations of reef condition

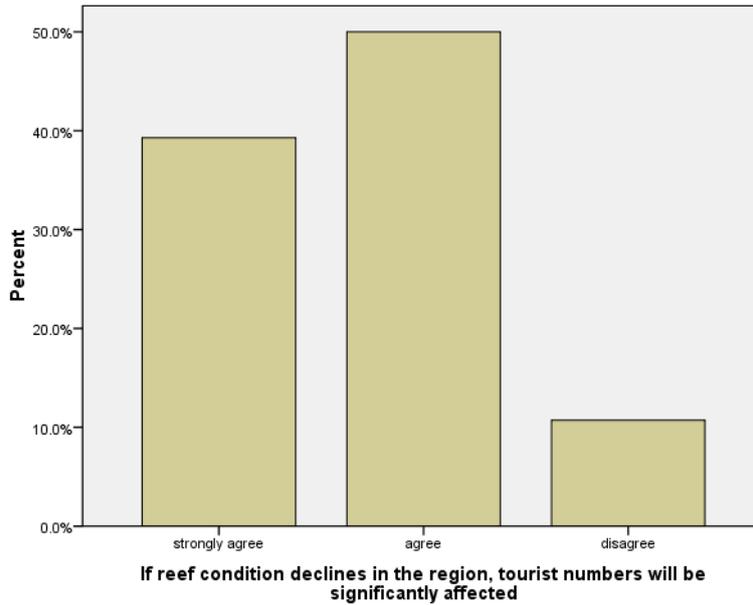


Figure 40. Dive operators' concerns regarding loss of tourist numbers as a result of coral decline

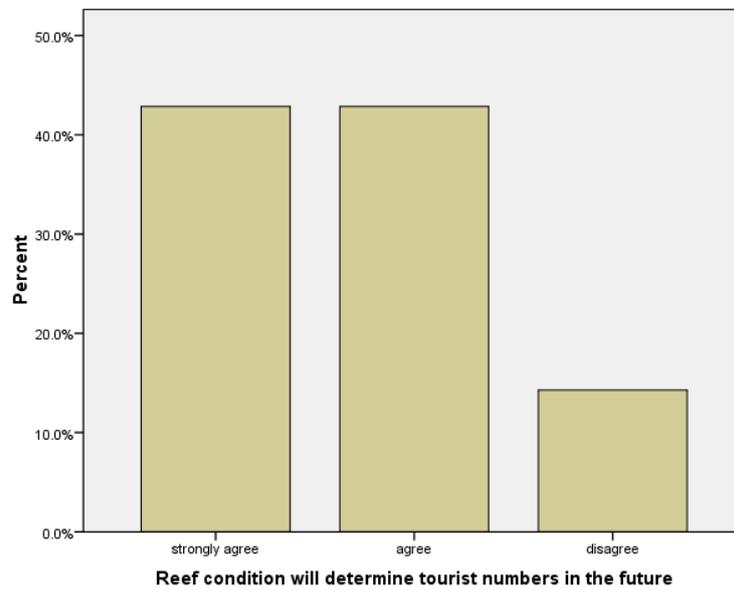


Figure 41. Dive operators' beliefs that reef condition will determine tourist numbers in the future

Environmental awareness of tourism operators

Pollution, commercial fishing and urban development were consistently rated by tourism operators as the first and second most important threats to the Red Sea region. Climate change issues, commercial fishing and dive tourism were the factors most often ranked as the third most important threats (25%, 21% and 18% respectively).

Awareness of climate impacts

Most dive operators (68%) have seen evidence of coral bleaching in the Red Sea region (see Figure 42). Most (93%) were worried about the future of coral reefs in the region as a result of climate change (see Figure 43). Dive operators read a lot about climate change impacts (92%; see Figure 44) and most (96%) were interested in learning more about the impacts of climate change on coral reefs (see Figure 45).

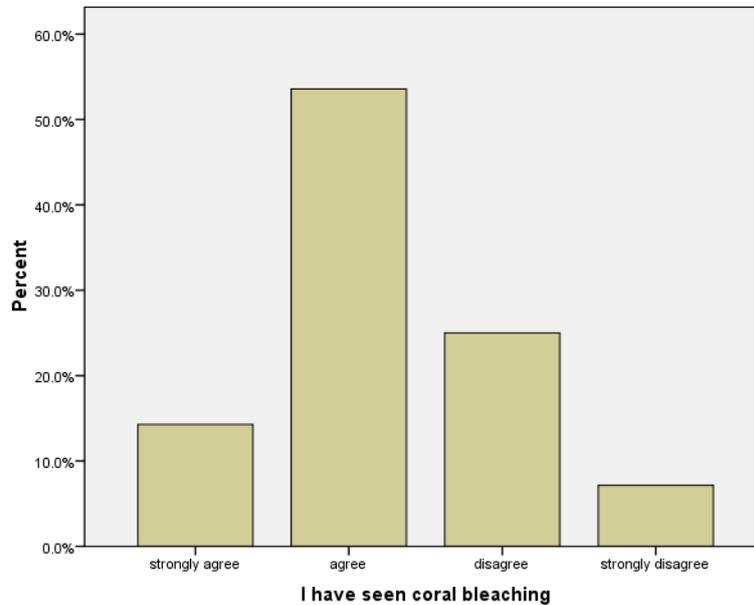


Figure 42. Proportion of tourist operators that have witnessed coral bleaching in the region

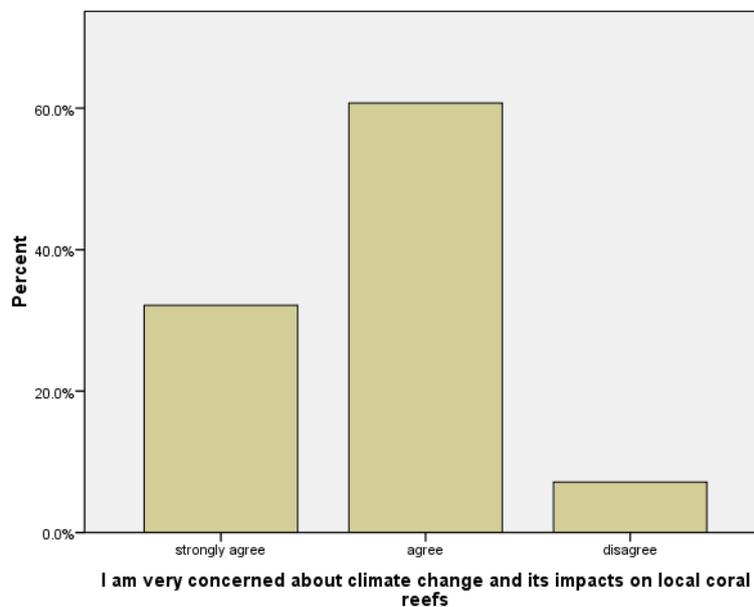


Figure 43. The extent to which tourist operators are concerned about climate change and its impacts on local coral reefs

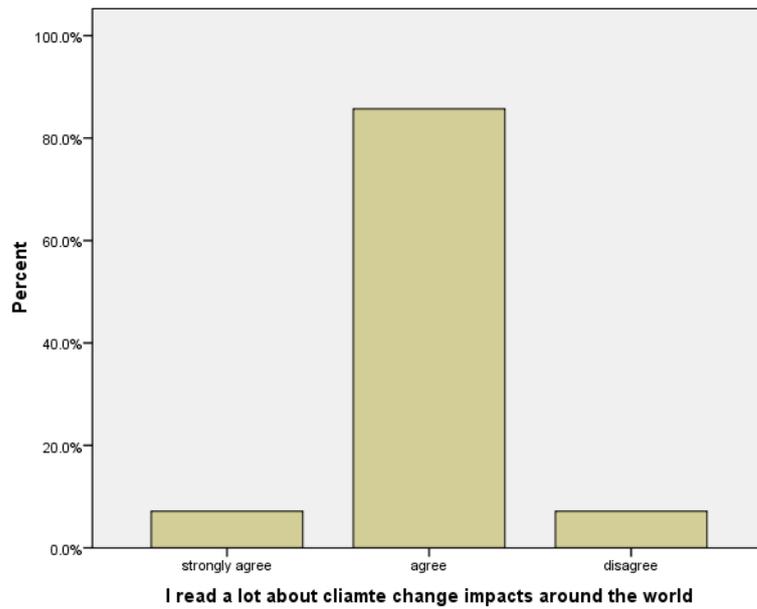


Figure 44. The extent to which tourist operators read about climate change impacts

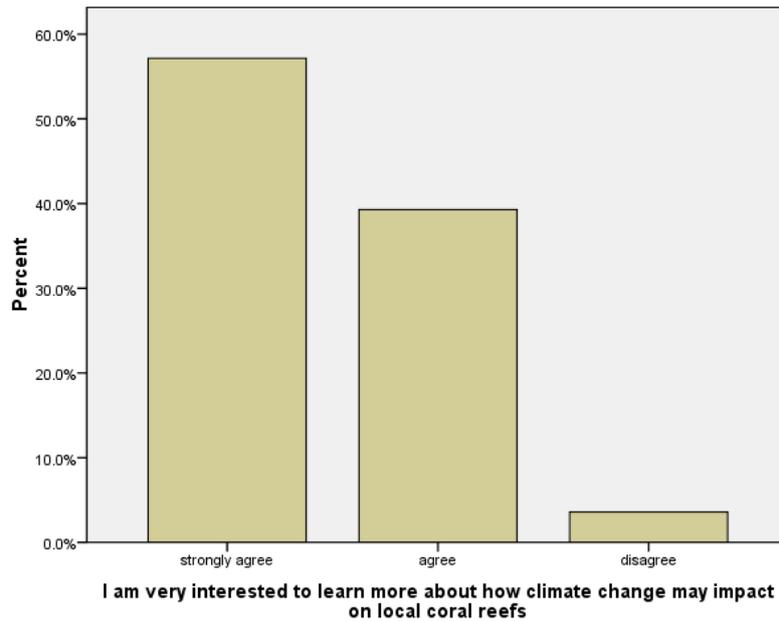


Figure 45. The extent to which tourist operators are interested in learning more about climate change impacts on local coral reefs

Operator's perception of tourist attitudes

About half the dive operators (57%) indicated that tourists want to talk about coral health more than any other subject (see Figure 46). However, most (69%) felt that climate change issues were not important to their diving clients (see Figure 47). Most operators (85%) did not think that tourists select their

holidays by considering how climate change is managed in an area (see Figure 48). Nor did most (57%) think that tourists consider how environmentally friendly dive operators are in choosing an operator for their diving holiday (see Figure 49). Operators mostly (82%) thought that tourists were uninterested in their own climate footprint whilst on holidays (see Figure 50).

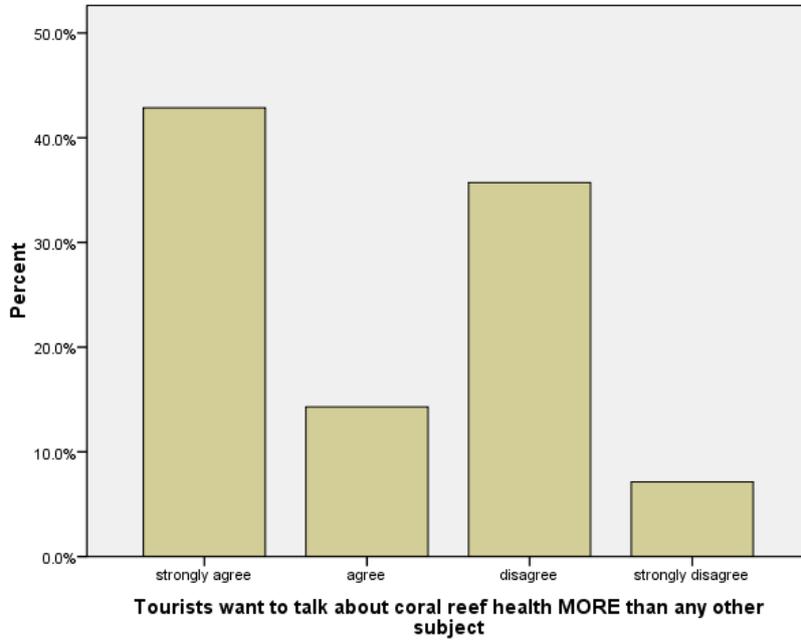


Figure 46. Tourist operator perceptions of the extent to which tourists want to talk about coral reef health

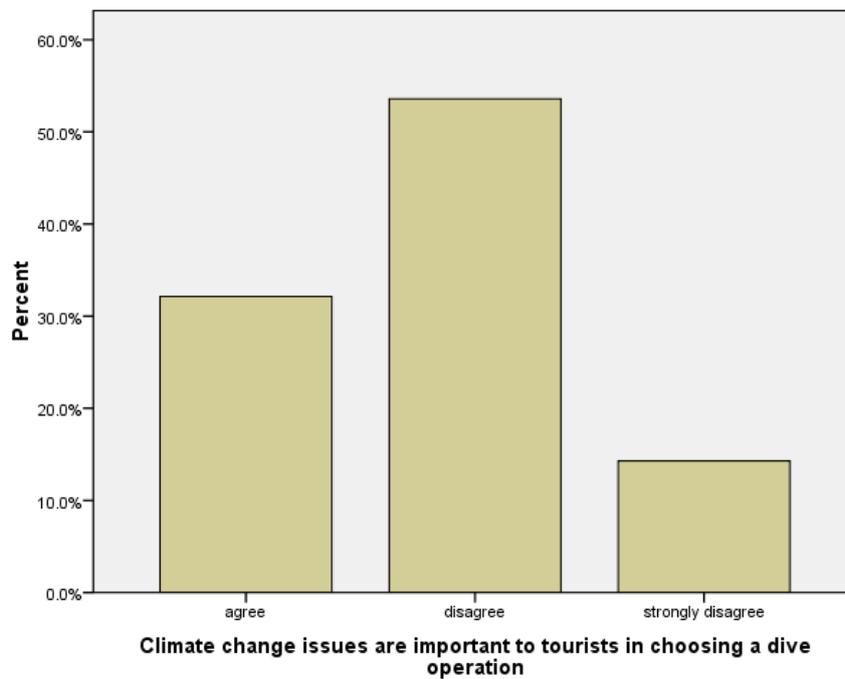


Figure 47. Tourist operator perceptions of the extent to which climate change issues are important to tourists in choosing a dive operation

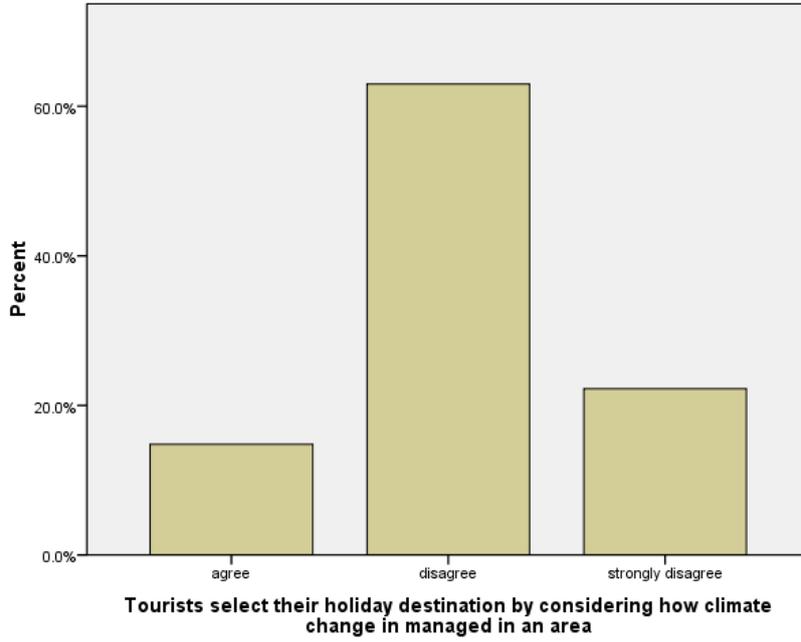


Figure 48. Tourist operator perceptions of the extent to which tourists consider climate change management in an area in selecting their holiday destination

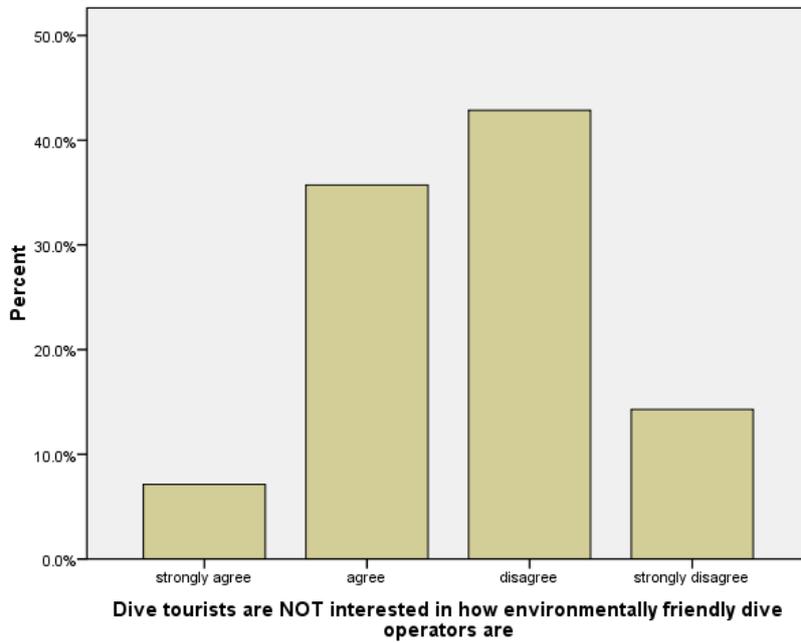


Figure 49. Tourist operator perceptions of the extent to which tourists are interested in how environmentally friendly dive operators are

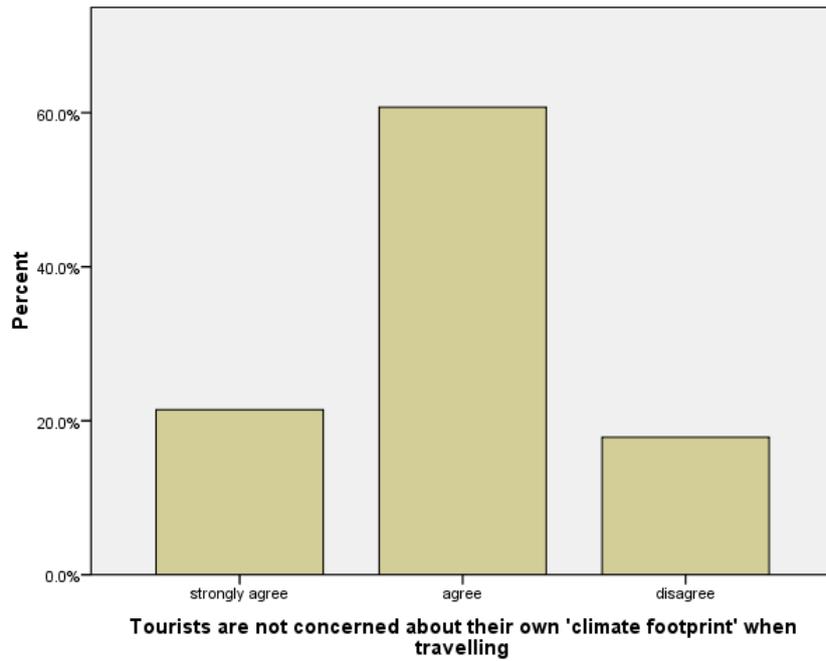


Figure 50. Tourist operators perceptions of the extent to which tourists are concerned about their own climate footprint when travelling

Future options for dive tourism businesses in the Red Sea Region

Dive tourism operators thought that there were not many options for tourists in the region other than diving (78%; see Figure 51). About 25% of dive operators indicated that they would close their business if there was major damage to their main dive sites from climate change within the next 5 years. The remaining operators suggested that they would either continue their operation as is (21%) or look for new reefs (25%). About 35% of operators indicated that they would close their business in response to major climate-induced damage of their reefs within the next 5-10 years.

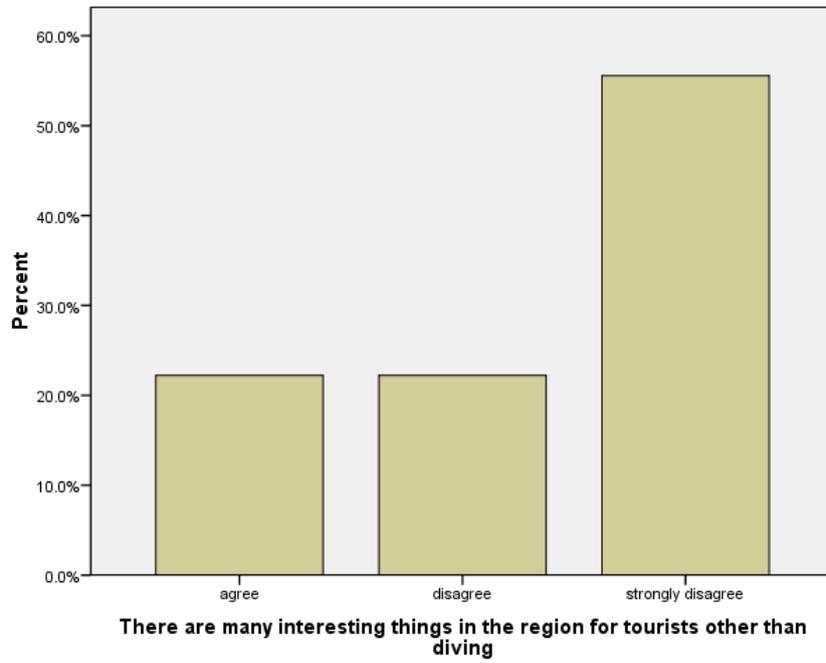


Figure 51. Tourist operator perceptions of the extent to which there are interesting things in the region for tourists other than diving

Discussion

Our results suggest that changes in dive tourist' awareness and attitudes are already being realised in the Red Sea region. Dive tourists are generally well educated, cosmopolitan and are mostly very aware of environmental conditions and climate change issues. Nearly half of the dive tourists indicated that they would be able to detect changes in coral condition of around 25%. This sensitivity to coral condition is consistent with a broader trend in environmental awareness of tourists worldwide (DRET, 2008; Simpson, et al., 2008). Furthermore, the majority of dive tourists in our survey were interested in dive operators that were promoting energy efficiency, environmental friendliness and climate awareness. Results suggest that whilst climate change may have yet to impact the Egyptian coral reef ecosystem, it is already having impact on the perceptions and choices of dive tourists.

The dive industry in the Red Sea region is relatively unaware of the changes in tourist' awareness and attitude and has not yet incorporated information about the 'new dive tourist' into their business thinking. Dive operators focus more on the traditional dive tourist that is less environmentally and climate aware. Dive operators in the Red Sea region generally think that dive tourists have unrealistic expectations about coral condition, are unlikely to notice coral degradation, do not consider climate issues when choosing a dive operation, and do not consider their own climate footprint when travelling. Hence, operators are potentially catering for less than half of their clients' needs and interests. Operators that do not adapt to this emerging 'climate aware' market risk losing market share to more responsive competitors (Berrittella, et al., 2006).

Research conducted in the UK has found that although tourists are climate aware, their behaviour has not yet changed in line with these convictions (DRET, 2008). Long haul travel to tourist destinations has not declined in any way even though tourists are aware of its climate impact. This is encouraging for dive tourism operators in the Red Sea region; there is likely to be a lag period before tourist behavioural change in the region is expressed. This should give dive operators more time to prepare. On the other hand, Egyptian sites can be labelled as short haul trips to the European visitor as compared with dive trips to the Indian Ocean, Asia Pacific, or the Caribbean.

Adapting to climate change requires adequately anticipating, and preparing for, change. Some individuals and some industries will be better able to plan and reorganise than others depending on their capacity to adapt (Marshall, 2008). Enhancing adaptive capacity can significantly reduce risks of adverse impacts from future and unpredictable events. Characteristics that contribute to adaptive capacity include possessing creativity and innovation (for identifying solutions or adaptation options; Folke, et al., 2005; Hiedanpaa, 2005), testing and experimenting options (Walters, 1997; Armitage, et al., 2008), using effective feedback mechanisms (Young, et al., 2006), using adaptive management approaches (Holling, 2004), emotional and financial flexibility for absorbing the costs of change (Gunderson, 1999; Marshall, 2008), and being able to reorganise given novel information (Abel, et al., 2006). These characteristics can be actively targeted for development and enhancement as part of strategic efforts to build capacity to adapt to climate change. These features provide the elements of a conceptual framework for strategic efforts to increase adaptive capacity in sectors such as the Red Sea tourism industry.

Adaptive capacity in the Egyptian tourism sector can be enhanced. For example, accessing information about the future, such as information from this report, reduces the risks associated with it and can help identify opportunities (Grothmann & Patt, 2005). The nature and extent of dependency on natural

resources is another major influence on adaptive capacity (Marshall, et al., 2009; Marshall, et al., 2007). Tourism operations with the flexibility to 'switch' between tourism activities in response to altered conditions, for example, will be better equipped to deal with more permanent changes such as the effects of a shift in climate. For example, switching from coral reef diving to technical diving may be an option for some dive operators to retain/increase diver numbers and/or enhance diver experience. Developing a range of strategic business skills (such as planning and reorganising) can also mitigate against overly dependent resource sectors (Dessai, et al., 2005; Marshall, 2008). There is strong evidence from other sectors that good networks and leadership will be important in helping individuals and sectors adapt to future conditions (Adger, et al., 2005; Gunderson, et al., 2006; Howden, et al., 2007; Nelson, et al., 2007).

Partnerships are fundamental to the success of the adaptation process. Industry associations, for example, foster collaboration by providing venues and opportunities to enhance networking both within the industry (internally) and with local government, community and other locally-based industries (externally). Industry associations can also support their constituents through providing assistance with business planning, assessments of adaptation options and with reorganising. Partnerships that collaboratively learn and encourage creativity whilst sharing the purpose of climate adaptation are critical for identifying, implementing and reviewing adaptation options. Developing adaptation plans and identifying actions in partnerships will also help to identify and achieve broader industry goals (Howden, et al., 2007; Vogel, et al., 2007).

Adapting to climate change will not always mean preparing for the worst; in some cases it may also mean preparing to take advantage of new conditions (Patt & Dessai, 2005; Vincent, 2007). As for negative impacts, flexibility and responsiveness are needed to realise potential benefits. (Fankhauser, et al., 1999; Fenton, et al., 2007; Johnson & Marshall, 2007). Exploring the potential for positive as well as negative outcomes from climate change is important in development of climate adaptation plans.

The results of this study provide a foundation for the development of adaptation strategies by the Red Sea tourism industry. We have elucidated potential impacts on dive tourism in the Red Sea as a result of a mismatch between the awareness and attitudes of dive tourists visiting the Red Sea and the perceptions of the dive industry. This initial analysis of the early manifestation of climate change issues can help the Red Sea tourism industry understand aspects of their vulnerability to climate change, and use it as the foundation for adaptation planning. Through early awareness and pro-active adaptation, industry sectors such as the Red Sea tourism industry can hope to minimise impacts and capitalise on any opportunities presented by this newest of challenges: climate change.

References

- Abel, N., Cumming, D.M. and Anderies, J. (2006). 'Collapse and Reorganization in Social-Ecological Systems: Questions, Some Ideas, and Policy Implications.' *Ecology and Society* 11:17. [online] <<http://www.ecologyandsociety.org/vol11/iss1/art17/>>
- Adger, N.W., Saleemul, H., Brown, K., Conway, D. and Hulme, M. (2003). 'Adaptation to climate change in the developing world.' *Progress in Development Studies* 3:179-195.
- Adger, W.N., Arnell, N.W. and Tompkins, E.L. (2005). 'Adapting to climate change: perspectives across scales.' *Global Environmental Change* 15:75-76.
- AFP. 'Idyllic holiday destinations raise climate change alarm' [online news article] (2 October 2007) <<http://afp.google.com/article/ALeqM5in0Z9oZYviS4nyYZwm8KjWr8Dg9A?index=0>>. Accessed 7 September 2009.
- Armitage, D., Marschke, M. and Plummer, R. (2008). 'Adaptive co-management and the paradox of learning.' *Global Environmental Change* 18:86-98.
- Bellwood, D.R., Hughes, T.P., Folke, C. and Nystrom, M. (2004). 'Confronting the Coral Reef Crisis.' *Nature* 429:827-833.
- Berritella, M., Bigano, A., Roson, R. and Tol, R.S.J. (2006). 'A general equilibrium analysis of climate change impacts on tourism'. *Tourism Management* 27:913-924.
- Dessai, S., Lu, X. and Risbey, J.S. (2005). 'On the role of climate scenarios for adaptation planning'. *Global Environmental Change* 15:87-97.
- DRET (2008). *Tourism and Climate Change - A Framework for Action*. Australia: Australian Government, Department of Resources, Energy and Tourism (Ed.) [online report], <http://www.ret.gov.au/tourism/Documents/Tourism%20and%20Climate%20Change/climate_change_a_framework_for_action.pdf>.
- Ehmer, P. and Heymann, E. (2008). 'Climate change and tourism: Where will the journey end?' Deutsch Bank Research [online report] <http://www.dbresearch.com/PROD/DBR_INTERNET_EN-PROD/PROD000000000222943.pdf>. Accessed 12 September 2009.
- Fenton, D.M., Young, M. and Johnson, V.Y. (1998). 'Re-Presenting the Great Barrier Reef to Tourists: Implications for Tourist Experience and Evaluation of Coral Reef Environments'. *Leisure Sciences* 20:177-192.
- Folke, C., Hahn, T., Olsson, P. and Norberg J. (2005). 'Adaptive Governance of Social-Ecological Systems'. *Annual Review of Environment and Resources* 30:441-473.
- Forsyth, P., Dwyer, L., and Spurr, R. (2007). *Climate Change Policies and Australian Tourism: Scoping Study of the Economic Aspects*. Gold Coast, Australia: Centre for Tourism Economics and Policy Research. Sustainable Tourism Cooperative Research Centre.
- Grainger, A., Stafford Smith, M., Squires, V.R. and Glenn, E.P. (2000). 'Desertification, and climate change: the case for greater convergence'. *Mitigation and Adaptation Strategies for Global Change* 5:361-377.

- Grothmann, T. and Patt, A. (2005). 'Adaptive capacity and human cognition: The process of individual adaptation to climate change'. *Global Environmental Change* 15:199-213.
- Gunderson, L. (1999). 'Resilience, Flexibility and Adaptive Management - Antidotes for Spurious Certitude?'. *Conservation Ecology* 3 (1): 7 [online journal] <<http://www.consecol.org/vol3/iss1/art7>>.
- Gunderson, L., Carpenter, S., Folke, C., Olsson, P. and Peterson G. (2006). 'Water RATs (Resilience, Adaptability, and Transformability) in Lake and Wetland Social-Ecological'. *Systems Ecology and Society* 11:16.
- Hamilton, J.M., Maddison, D.J. and Tol R.S.J. (2005). 'Climate change and international tourism: A simulation study'. *Global Environmental Change* 15:253-266.
- Hiedanpaa, J. (2005). 'The Edges of Conflict and Consensus: A Case for Creativity in Regional Forest Policy in Southwest Finland'. *Ecological Economics* 55:485-498.
- Hoegh-Guldberg, O. (2007). 'Vulnerability of Corals of the Great Barrier Reef to Climate Change'. In: J. Johnson and P. A. Marshall (Eds.) *Climate Change and the Great Barrier Reef: A Vulnerability Assessment*, pp 515-554. Australia: Great Barrier Reef Marine Park Authority and Australian Green house Office
- Holling, C.S. (2004). 'Foreword: The Backloop to Sustainability'. In: F. Berkes, et al. (Eds.) *Navigating Social-Ecological Systems. Building Resilience for Complexity and Change*, pp. 33-47. Cambridge: Cambridge University Press.
- Howden, S.M., Soussana, J., Tubiello, F.N., Chhetri, N., Dunlop, M. and Meinke, H. (2007). 'Adapting Agriculture to Climate Change'. *Proceedings of the National Academy of Sciences* 104:19691-19696.
- IPCC (2007). *Climate Change 2007 - Impacts, Adaptation and Vulnerability - Contributions of Working Group II to the Fourth Assessment Report of the International Panel on Climate Change*. Cambridge: Cambridge University Press.
- Janssen, M.A., Schoon, M.L., Ke, W. and Börner K. (2006). 'Scholarly networks on resilience, vulnerability and adaptation within the human dimensions of global environmental change'. *Global Environmental Change* 16:240-252.
- Johnson, J.E. and Marshall, P.A. (2007) (Eds.) *Climate Change and the Great Barrier Reef: A Vulnerability Assessment*. Australia: Great Barrier Reef Marine Park Authority and Australian Green house Office
- Marshall, N.A. (2008). *A Conceptual and Operational Understanding of Social Resilience. Insights for Optimising Social and Environmental Outcomes in the Management of Queensland's Commercial Fishing Industry*. Saarbrücken, Germany: VDM Verlag.
- Marshall, N.A. and Marshall, P.A. (2007). 'Conceptualising and Operationalising Social Resilience within Commercial Fisheries in Northern Australia'. *Ecology and Society* 12: [online journal] <<http://www.ecologyandsociety.org/vol12/iss1/art1>>.
- Marshall, N.A., Marshall, P.A., Abdulla, A. (2009). 'Using social resilience and resource dependency to increase the effectiveness of a prospective Marine Protected Area (MPA) in Salum, Egypt'. *Journal of Environmental Planning and Management* 52.

- Marshall, N.A., Fenton, D.M., Marshall, P.A., Sutton, S. (2007). 'How Resource-Dependency Can Influence Social Resilience Within a Primary Resource Industry.' *Rural Sociology* 72:359-390.
- Marshall, N.A., Marshall, P.A., Tamelander, J., Obura, D., IMM, D. and Cinner J., M. . (in review). *Sustaining Tropical Coastal Communities & Industries: A Framework for Social Adaptation to Climate Change*. Gland, Switzerland: IUCN
- Marshall, P.A. and Johnson, J. (2007). 'The Great Barrier Reef and climate change: vulnerability and management implications'. In: J. Johnson and P. A. Marshall (Eds.) *Climate Change and the Great Barrier Reef: A Vulnerability Assessment*, pp 773-801. Australia: Great Barrier Reef Marine Park Authority and Australian Green house Office
- Marshall, P.A., Schuttenberg, H. and West, J. (2005). 'Predicting the social and economic impacts of climate change'. In: Marshall, P.A. and Schuttenberg, H. (Eds.) *Adaptive Reef Management in the Face of Climate Change*, Washington D.C.: National Oceanic and Atmospheric Administration
- Nelson, D.R., Adger, W.N. and Brown, K. (2007). 'Adaptation to Environmental Change: Contributions of a Resilience Framework'. *Annual Review of Environment and Resources* 32:395-419.
- Nicholls, S. (2003). 'Climate Change and Tourism'. *Annals of Tourism Research* 31:238-240.
- Patt, A., Dessai, S. (2005). 'Communicating uncertainty: lessons learned and suggestions for climate change assessment'. *Comptes rendus - Geoscience* 337:425-441.
- Rouphael, A . and Abdulla, A. (2007). *Elba Protected Area: Marine Biological Survey and Coastal Sensitivity Mapping*. IUCN and USAID Report. Marine Biodiversity and Conservation Science Series, IUCN Global Marine Program
- Shafer, C.S., Inglis, G.J. (2000). 'Influence of Social, Biophysical, and Managerial Conditions on Tourism Experiences Within the Great Barrier Reef World Heritage Area'. *Environmental Management* 26:73-87.
- Simpson, M.C., Gössling, S., Scott, D., Hall, C.M. and Gladin, E. (2008) *Climate Change Adaptation and Mitigation in the Tourism Sector: Frameworks, Tools and Practices*. Paris, France: UNEP, University of Oxford, UNWTO, WMO.
- Vincent, K. (2007). 'Uncertainty in adaptive capacity and the importance of scale'. *Global Environmental Change* 17:12-24.
- Vogel, C., Moser, S.C., Kaspersen, R.E. and Dabelko, G.D.-. (2007) 'Linking vulnerability, adaptation, and resilience science to practice: Pathways, players, and partnerships'. *Global Environmental Change* 17:349-364.
- Williams, P.W., Ponsford, I.F. (2009). 'Confronting tourism's environmental paradox: Transitioning for sustainable tourism'. *Futures* 41:396-404.
- Young, O.R., Berkhout, F., Gallopin, G.C., Janssen, M.A., Ostrom, E. and van der Leeuw S. (2006). 'The globalization of socio-ecological systems: An agenda for scientific research'. *Global Environmental Change* 16:304-316.



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