

The Impact of Coral Reefs Conservation on SCUBA Diving tourism Sustainability

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Abstract

SCUBA Diving Tourism (SDT) is a growing form of tourism reflecting positively on the economy of coastal communities. However, any negative impacts associated with SDT need to be prevented to safeguard the critical ecosystem services provided by coral reefs. This study provides insights into the problems affecting the sustainability of the SDT industry. So, the present study examines the effect of coral reefs conservation on SDT sustainability in Red Sea, Egypt. The study data is collected using questionnaires completed by 105 diving center's managers working in Red Sea governorate. The results of this study indicate that coral reefs conservation is positively related to SDT sustainability ($p < 0.05$). Moreover, a significant predictive relationship ($p < 0.05$) is found between coral reefs conservation and SDT sustainability, with variability of 66.6%. These findings highlight the importance of natural resources conservation, and emphasize the need to effective management tools to guarantee the sustainability of SDT. Finally, this study discusses managerial implications, introduces recommendations to enhance sustainability include actions ranging from engagement in planning and management to education and social responsibility, and presents suggestions for future research.

Keywords: SCUBA diving tourism, SCUBA diver, Coral reefs conservation, Sustainability, Marine environment.

1. Introduction

Coral reefs are the largest ever built construction on the surface of the planet by living beings and that persisted over time, they are actually extremely complex ecosystems of plants and animals that occur primarily in shallow tropical waters (Salvat, 2015). Coral reefs are one of the most popular resources for tourists use, and due to the large increases in recreational diving and tourist activities, the damage caused by individual divers is often considered minor but, the cumulative effects of these disturbances from the individual divers can cause significant localized decline of coral cover (Worachananant et al. 2008). So, sustainability of dive tourism requires not only the conservative use of natural and social resources, but also community integration and the provision of satisfying diving experiences, in addition, economic viability of all stakeholders including tourists or SCUBA divers, community in which the industry operates, tourism enterprises such as dive operators, boat operators, accommodations, restaurants, and transportation; these people have multiple interests and interact with each other with heterogeneous attitudes and perspectives (Wongthong, 2013).

So, the overall objectives of this study are:

1. Knowing the effects of mass tourism and non-regulated recreational activities that already caused big damage to coral reefs in Red sea area.
2. Knowing the degree of awareness of the community, diver tourists and tour operators about the importance of natural resources and coral reefs conservation for SDT sustainability in Red Sea area.
3. Understanding opportunities and identifying integrated management approach to assist the tourism sector in delivering sustainable development in SDT in Red Sea area.

2. Theoretical Background

2.1 Introduction to corals reefs

Burke *et al.* (2012; p.7), defined coral reefs as: “*physical structures built by the actions of many tiny coral animals that live in large colonies and lay down communal limestone skeletons*”. Although they are often mistaken for plants or rock, corals are simple animals, belonging to a group of invertebrates (spineless animals) called cnidarians (lough, 2008). Basically, there are two groups of corals: hermatypes, or hard corals that build reefs; and ahermatypes, or soft corals that do not build reef while, reefs are classified to fringing reefs, barrier reefs, atolls, and Bank or platform reefs (Salvat, 2015). Coral reefs are distributed throughout the world in the coastal waters of 101 countries and territories, yet they make up only one-tenth of one percent of the total ocean area (Davidson, 2002). Most coral reefs are located around the world within tropical and semitropical waters between 30 degrees north and 30 degrees south of the equator, between the Tropic of Cancer and the Tropic of Capricorn (Souter and Linden, 2000).

2.2 The importance of coral reefs

Coral reefs hold tremendous economic and ecological value to coastal communities throughout the world (Arin and Kramer, 2002). **For people**; tens of millions of people depend on coral reefs as a part of their livelihood or as part of their protein intake (Moberg and Folk, 1999). **For biodiversity**; coral reefs have a very high level of biological diversity; about 95,000 species of marine species in coral reefs, and there are 32 of the 34 recognized animal phyla that exist on our planet, (Salvat, 2015). **For coastal Protection**; reefs dissipate wave energy, reducing routine erosion and lessening inundation and wave damage during storms. This function protects human settlements, infrastructure, and valuable coastal ecosystems such as seagrass meadows and mangrove forests (Burke *et al.*, 2011). About **the economic value**; coral reefs are highly productive ecosystems that provide a variety of valuable goods and services to humans. These goods and services include recreational opportunities for diving, snorkeling and viewing as direct use values; coastal protection and habitat or nursery functions for commercial and recreational fisheries as indirect use values; and the welfare associated with the existence of diverse natural ecosystems as preservation values (Brander *et al.*, 2007). Also, coral reefs have considered an important source of new medicines and help remove carbon dioxide from the atmosphere.

For tourism, aesthetic and cultural value; coral reefs are magnets for tourists, as they present the popular depiction of paradise, the emblematic vision of paradise reef scenery with sun, coconut, white coral sand beach and colorful reef fish is associated with renowned destinations to evolve with sharks (Salvat, 2015). At least 96 countries and territories benefit from tourism related to reefs; in 23 reef countries, tourism accounts for more than 15 % of gross domestic product GDP (Burke *et al.*, 2011). Self-Contained Underwater Breathing Apparatus, SDT in coral reefs environments has become a highly significant component of international tourism market as a result of an increased interest in nature and environmental appreciation (Wongthong, 2013). Coral reefs are also culturally important to many coastal communities, with legends, spiritual values, and religious practices tied to reef life. Cultural ties between human population and the sea are still very much alive especially in communities where the subsistence economy is dominant (Salvat, 2015).

2.3 Coral reef threats

Natural threats: Coral reefs have been altered by natural threats for millions of years, such as storms and hurricanes, volcanic activity which can flatten a reef in minutes. This can lead to compounded problems, such as phase-shifts, in which fast growing algae replaces the slower growing corals (Hallock, 2005), heavy rains that dilute salinity, extreme low tides and sunlight can expose shallow corals to air and ultraviolet radiation which can overheat and dry the coral's tissues, predators such as crown-of-thorns sea stars can consume the tissue of coral polyps and disease outbreaks, that can cause mass mortality in corals and other reef creatures (Nichols, 2013).

Anthropogenic (Human-Caused) Threats: Human activities are threatening the world's reefs at an alarming rate. The main anthropogenic threats include: **Destructive fishing practices and overfishing;** Destructive fishing techniques destroy coral reefs habitats, reduce fish stocks, and prevent coral growth as a result of sedimentation (Souter and Linden, 2000). Types of destructive fishing include: dynamite or blast fishing, cyanide fishing, and bottom-trawling (Davidson, 2002). Overfishing is considered the primary traditional threat to marine biodiversity more generally. Overfishing can cause shifts in fish size, abundance and species composition within reef communities (Westmacott *et al.*, 2000). **Marine-based pollution;** marine-based pollution is harmful to coral reefs, marine pollution comes from: deliberate discharge of oil from tanks and vessels, tanker accidents causing oil leaks, oil leaks from tanks and pipelines, dumping of fuel from airplanes, Ballast and bilge discharge containing oil, tar and other pollutants as well as non-native species that can become invasive (Burke *et al.*, 2011).

Marine debris; marine debris or garbage is also harmful to coral reef inhabitants. Marine debris comes from: garbage washed into the sea from land, materials discarded from boats, fishing nets that have been lost or discarded by commercial fishing vessels otherwise known as ghost nets, and ships or planes wrecks from battles and bombing raids that often release toxic paints and chemicals into the marine environment (Bowdery *et al.*, 2015).

Land-based Pollution; runoff and land-based pollution from effluent discharge of industrial waste, domestic waste, agricultural sources and logging practices do great harm to corals. **Coastal Development;** the growth of coastal cities and towns generates a range of threats to nearby coral reefs. Coastal development is necessary to support growing populations. However, unplanned development and constructions are one of the major causes of acute physical damage to coral reefs (Burke *et al.*, 2011).

According to Bowdery *et al.* (2015), **Tourism** can be a double-edged sword for countries that are home to corals. While tourism generates much-needed revenue, unregulated tourism can lead to irreparable damage to the coral reef systems that many countries depend on economically. The main human impacts related to mass tourism development include sedimentation and loss of habitat by land reclamation, dust, and disposal of solid waste, sewage and sludge. Alongside this, corals also damaged and killed by contact from divers with fins, hands, knees and also boat or anchor damage (Cesar *et al.*, 2003). The damaging impacts of tourism are primarily caused by **coastal development for tourism;** the construction of piers and marinas, resorts, stores, restaurants and parking lots; and the development of artificial beaches and beach replenishment. These activities can greatly affect the health of coral reefs, which can in turn negatively affect the tourism industry (Westmacott *et al.*, 2000).

Hotels, lodging and restaurants; hotels, cruise ships, and lodging operations create solid and liquid wastes from landscaping, sewage, laundry, and other guest services. Restaurants that sell local endangered fish and shellfish are depleting the local marine resources. These activities cause increased sedimentation, increased sewage and other land-based pollutants, increased destructive or overfishing of marine resources (Ghulam Rabbany *et al.*, 2013). **Marine recreation;** in areas that are popular with recreational diving or fishing boats, the reef is subject to physical damage from accidents and carelessness. Boats and ships that run aground on the reef can destroy hundreds of corals in an instant. Boat maintenance and garbage disposal, toilets discharged, and sewage dumping an overload of algae-causing nutrients into the water (Bowdery *et al.*, 2015).

2.4 Coral reefs conservation

International efforts; many international agencies, including organizations of the United Nations, national donors and non-governmental organizations NGOs, assist countries with activities to conserve coral reef biodiversity, reduce threats, introduce integrated coastal management, and assist communities develop alternative and sustainable livelihoods. These efforts are achieving considerable successes (Wilkinson, 2004). International obligations to protect coral reefs must be implemented by national governments by adopting laws and regulations that address the unique challenges confronting reefs within their territories (Bowdery *et al.*, 2015).

Regional efforts; regional co-ordination and co-operation, particularly in relation to capacity building, knowledge creation, sharing and learning and promoting environmentally and socially responsible investment, especially with regard to Marine Protected Areas (MPAs), are key mechanisms to chart sustainable futures for coral reef ecosystems. They are particularly relevant, where they can simultaneously draw on different policies and allow for synergistic use of their respective instruments (Wittmer and Hassan, 2001).

National efforts; governments have an important role to play in conducting scientific research to reduce negative impacts of human activities on coral reefs. A partnership among government agencies, NGOs, and local communities can result in better implementation of conservation strategies and in more efficient monitoring programs to detect problems (Bowdery *et al.*, 2015). **Community-based conservation;** involves the active participation and support of the local communities who depend on coral reefs. Conservation planning should involve representatives from key stakeholder groups such as; developers, dive operators, investors, fishers, local government officials, and NGO's (Burke *et al.*, 2012).

2.5 Reef-based tourism

Diving and snorkeling come immediately to mind as reef related tourism, the United States National Oceanic and Atmospheric Administration found that there are no increasing activities in both volume and diversity between all the activities that take place in coastal areas and the near-shore coastal ocean more than coastal tourism and recreation (Deverell, 2011). Diving often is promoted as a form of 'mass eco-tourism' since many of the participants is actually on a 3S (sea, sand, and sun) format holiday. However, if ecotourism is interpreted as a set of principles rather than being confined to small-scale activities, SDT may be considered one of the original ecotourism practices (Cater and Cater, 2011).

2.6 Introduction to SCUBA diving tourism

SCUBA diving emerged from its original role as a search for food for survival to change over the years and become a sport and a contemporary form of adventure leisure experience. SDT appeals to those with an interest in discovery, exploring marine habitats and features of underwater landscapes, and those like swimming underwater for extended periods of time between flora and fauna in a range of ocean conditions (Klimmek, 2013). SDT defined by Garrod and Gössling (2008; p.7) as: "*Diving tourism involves individuals traveling from their usual place of residence, spending at least one night away, and actively participating in one or more diving activities, such as SCUBA diving, snorkeling, snuba, or the use of re-breather apparatus*". SDT is now a multibillion dollar industry and has become a fast growing component of the marine tourism industry. According to the Professional Association of Dive Instructors (PADI), the global number of certified divers in 2015 was over 24 million, since 1967, compared with 2.5 million in 1988; PADI has averaged over 900,000 diver certifications each year globally for the last 19 years (PADI, 2016).

According to Dimmock and Musa (2015), the central elements of the SDT system are considered to be; **first**, the marine environment where the activity takes place, **second**, the SCUBA divers group which is characterized by those divers creating demand, such as tourists, **third**, the host communities include the residents of the area where SDT takes place, and also local governments and authorities, managers and policy makers of SDT industry, **fourth**, the SDT industry encompasses SCUBA diving businesses, from diving charter businesses to schools, but also all other peripheral suppliers to SDT. Wongthong (2013), mentioned the setting conditions for dive tourism has been brought up recently and includes: **Firstly**, Biophysical setting include underwater rock formation, and the quality, diversity of coral and fish communities. **Secondly**, Human setting refer to cultural and historical values, technological and infrastructural environments, numbers of people at the destination, behavior of others, as well as the types of activities undertaken at a site. **Thirdly**, Managerial settings are linked to quantity and quality of visitor safety programs, the commitment to the environment by dive shops, and management infrastructure, for example, pontoons and buoys.

2.7 SCUBA diver

According to Deverell (2011), the profile of the typical diver therefore could well be described as an American or European male dominated, participants are on average in their mid-thirties, with a college education, and higher than average incomes, which correspond to the relatively high cost of equipment, training, and dive travel. As a tourist activity, SDT is generally recognized as noncompetitive comprising elements of fun, physical activity, and freedom. SCUBA divers can be classified according to five E's, namely; education, esteem, expertise, escape and embodiment. Furthermore, there are six main motivations in SDT, are; adventure, learn, escape, social interaction, stature and personal challenge. And these motivations include; experiencing flora and fauna underwater, exploring new things, experiencing the adventure of diving, having stimulating and exciting experience, and learning about the underwater environment (Kler and Tribe, 2012).

Ince and Bowen (2011), identified the key elements that certified and experienced recreational divers used to determine satisfaction include: marine life, visibility, social aspects, buoyancy, on-board service, sub-interest specialties, personal safety, and equipment and its reliability. Dimmock and Musa (2015), found that a great deal of satisfaction associated with SDT is dependent on quality experiences within the marine environment and this is beyond the service provider's control such as, divers anticipate experiencing high quality marine flora, fauna, good weather and ocean conditions, and in adverse conditions satisfaction can decline.

2.8 The concept of sustainable tourism

The concept of sustainability essentially means that the effects on renewable resources do not exceed the regenerative capacity of the environment (Ragheb, 2015).

The most widely acknowledged instrumental document on sustainability is the Bruntland Report that published in 1987 by the United Nations Commission on Environment and Development titled, 'Our Common Future'. Though the report made no mention of tourism, the sustainable development has been described as the "parental paradigm" of sustainable tourism. The term 'sustainable tourism' emerged in the early 1990s, this new concept, became quickly accepted and promoted by many international and national organizations (Zamfir and Corbos, 2015). Castellani, (2010; p.28) indicated that the United Nation World Tourism Organization (UNWTO) in 1996 defined sustainable tourism as "*tourism which leads to management of all resources in such a way that economic, social and aesthetic needs can be fulfilled while maintaining cultural integrity, essential ecological processes, biological diversity and life support systems*". This definition illustrated that sustainable tourism development requires deep involvement of all relevant interest groups, as well as strong political leadership and local awareness to guarantee wide participation.

SDT and environmental impacts; Zain al Abidin and Mohamed, (2014) noted that while coral reefs are one of the most popular resources for tourist use, there are concrete evidence that due to poorly planned and the large increases interest in recreational diving and tourist activities, coral reefs became degraded and possibly compromise the amenity value of dive site divers can damage corals through direct physical contact with their hands, body, equipment and fins. Some damage may be from diving associated activities, such as boats colliding with reefs, anchoring, rather than solely from diver-induced damage. The over-usage of the reefs has resulted in physical devastation and chemical contamination. Mota (2016), observed that divers' lack of buoyancy control can impact directly on coral structures. Physical stress can asphyxiate coral and influence the optimal growth rate of the coral skeleton, can cause abrasion, and reduce their living coverage with changes on biogeography zone. Cater and Cater (2011), explained that recently most divers request from the dive companies to have a sensitive environmental operation and the most successful companies will have sound environmental policies.

SDT and socio-cultural impacts; Krstić *et al.* (2008), explained that when tourism brings changes in value systems and behavior and thereby threatens indigenous identity, this may lead to degradation and negative changes in the community's heritage and wealth. These changes often occur in community structure, family relationships, collective traditional life styles, local demographics, local housing and labor markets, ceremonies and morality. It's noted that the community suffers more directly than the consumer, who can return to his own community without responsibility for or awareness of the impacts of his activities. Understanding the social science dimensions of the dive experience will ultimately lead to a more successful and sustainable dive industry and a more effective exponent of incentive-driven conservation at work.

SDT and economic impacts; The boom in SDT has led to significant investments in various products, from retail to education and dives, encouraging the emergence and growth in the number of SCUBA diving schools, SCUBA diving equipment shops, and SCUBA diving charter businesses (Lucrezi *et al.*, 2016). Dive tourism has received increased attention for its promising role in financing coral reef conservation. By creating business and employment opportunities in tourist services, provides an alternative to destructive fishing methods for the local community, gives local communities an incentive to actively conserve coral reefs by establishing marine sanctuaries and installing reef protection facilities. This helps secure the continued inflow of tourism revenues in the long run. Nevertheless, tourism itself may also negatively influence coral reefs by encouraging the mining and sale of corals as souvenirs (Arin and Kramer, 2002).

2.9 Conservation and SCUBA diving tourism sustainability

Zain al Abidin and Mohamed (2014), said that to move the sustainability agenda of tourism forward, both the physical impacts of tourism and the social environment need to be considered. The dive tourism must be seen as a socio-ecological system not as separate natural and social science components. In addition, each diving site needs to select the appropriate strategies for its own development requirements because there is no perfect planning or policy process which can be easily translated from one dive tourism management site to another. The sustainability of SDT is a challenge and requires the maintenance of a pristine marine environment, the viability of business, and the satisfaction of divers. These major elements are interconnected but can work against one another and threaten the sustainability of the SDT industry so; the SCUBA diving stakeholders need to strike a judicious balance among these three components to ensure the achievement of the ultimate desired outcome (Musa and Dimmock, 2013). To manage marine-based tourism towards sustainability, numerous managerial concepts are exists, for example:

2.9.1 Coral reef protected areas; Marine Protected Areas MPAs is the most widespread management strategy employed to enhance coastal ecosystem resilience and protect coral reefs. MPA generally refers to a protected area that is officially recognized by a government body (Grimsditch and Salm, 2006). If MPAs appropriately managed and supported by stakeholders, it will be able to bring a variety of benefits to local communities and flourishing ecosystems that deliver services and goods. The space given to the SDT industry revolving around MPAs may still be limited despite the particular benefits, from financial to educational and governance, which MPAs can gain from supporting a balanced form of SDT (Lucrezi *et al.*, 2016).

2.9.2 Integrated Coastal Management (ICM); Grimsditch, and Salm (2006), considered that Integrated Coastal Management is an important management strategy that can complement an MPA network. And they explained that coral reefs do not stand alone as ecosystems and are part of a larger seascape matrix, so the health of surrounding ecosystems is important for the health of coral reefs.

ICM attempts to do this by treating the coastal zone as a single integrated ecosystem. A good ICM program provides the framework for addressing issues such as coastal development, fisheries, tourism, land-based sources of pollution and sedimentation, waste disposal, agriculture, mining, gas and oil industries and shipping activities among others (Westmacott *et al.*, 2000).

2.9.3 Carrying capacity; Houtte (2015), said that carrying capacity is one of the widest used central concepts in the management of nature-based tourism and identified the different types of carrying capacity include: ecological capacity, socio-cultural capacity, psychological capacity, and infrastructural capacity. Also, Zain al Abidin and Mohamed (2014), identified four factors needs to be considered for each dive sites before maximum number of dives per site per year estimated and apply, **first factor**, the morphological composition of coral, that's include the presence of vulnerable types of organisms, such as branching stony corals and sea whips, **second factor**, the level of environmental awareness and training of the divers involved, **third factor**, the presence of other anthropogenic stressors that degrade the reef, such as particulate pollution, and **the last factor**, the size of the dive site, reef topography, current patterns, and other form of exploitations that occurs over the same reef.

2.9.4 The Green Fins approach; the Green Fins approach is a tool for supporting adoption and implementation of the best practice through a set of diving standards. This project is part of the UNEP Regional Seas program and was implemented in 2004 under the Coordinating Body of the Seas of East Asia to reduce unsustainable coastal tourism practices. The Green Fins initiative has developed a comprehensive set of guidelines to encourage the best practice for an environmentally sustainable SDT industry, which is known as the Green Fins Code of Conduct (Zain al Abidin and Mohamed, 2014).

2.9.5 Coral reef recovery and restoration; Westmacott *et al.* (2000), believe that reef recovery will only take place and occur when additional stresses from human activity can be limited. Reef recovery will vary from reef to reef according to the unique set of circumstances at each location. Under suitable conditions, reefs may well be able to return to thriving, diverse communities, providing direct benefits in terms of fisheries, tourism and recreation and indirect benefits, such as coastal protection and scientific research (Souter and Linden, 2000). Nichols (2013), considered artificial reefs are one way to alleviate the problem of coral decline by not only providing structure allowing more areas of the ocean to be colonized by corals and protection from predators for small fish, but also by providing alternative dive sites reducing the diving pressure on natural coral reefs.

2.9.6 SCUBA diver and sustainability; according to Musa and Dimmock (2013), the future of SDT sustainability is strongly related to divers' attitudes, knowledge and behavior, together with the management practices of SCUBA diving operators. The present curricula of SCUBA diving certification programs should include the education of sustainable SDT.

Environmental sensitivity should be encouraged early in a diver's career, even during basic SCUBA diver training programs because improved diving skills can reduce diver impacts at a site. Moreover, the short pre-dive presentation on environmental protecting dive behavior was shown to reduce the damage caused by divers (Worachananant *et al.* 2008).

2.9.7 Awareness; Through education, people gain; appreciation of the beauty and complexity of coral reef ecosystems, respect for the value of coral reefs as sources of protein, income, medicine and recreation, pride in local coral reef resources, foresight and understanding of the long-term consequences of our actions, which might ultimately change our behavior, empowerment with the knowledge necessary to make informed decisions and participate in management discussions, and motivation to participate in or support coral reef conservation projects through donations or time (Harriott, 2002).

Based on the literature review the following hypothesis can be formulated:

Hypothesis 1; Sustainability of SCUBA diving tourism in coral ecosystems is largely dependent on coral reefs conservation.

Hypothesis 2; There is an insufficiency in social responsibility, a strong commitment to nature, and the integration of local people towards the conservation of tourism nature resources.

3. Methodology:

A quantitative research method is employed in this research because of it considers one of the most widely used techniques to reach a large number of target population and to identify and describe the variability in different situations (Rajasekar *et al.*, 2013). Also, the collected data by this method can later on be analyzed effectively through the SPSS program. The basic method applied in this research is the questionnaire method. Based on previous studies in coral reefs conservation and sustainability of tourism (Serour, 2004; Daldeniz and Hampton, 2011; Musa and Dimmock, 2013; Ragheb, 2015; Salvat, 2015), the current study is designed to investigate the relationship between coral reefs conservation and SDT sustainability.

3.1 Stage 1: Research Design:

In this study, the literature review was conducted as an ongoing basis throughout the research to help support the domain of the study. Also, the study not only seeks to understand the nature of reef-based SDT and its impacts but also, offers practical recommendations in response to immediate and specific issues confronting dive tourism sustainability. So, the present study can be considered applied research. In order to reach the goals of this study, the study is conducted at four stages as shown in Figure (2):

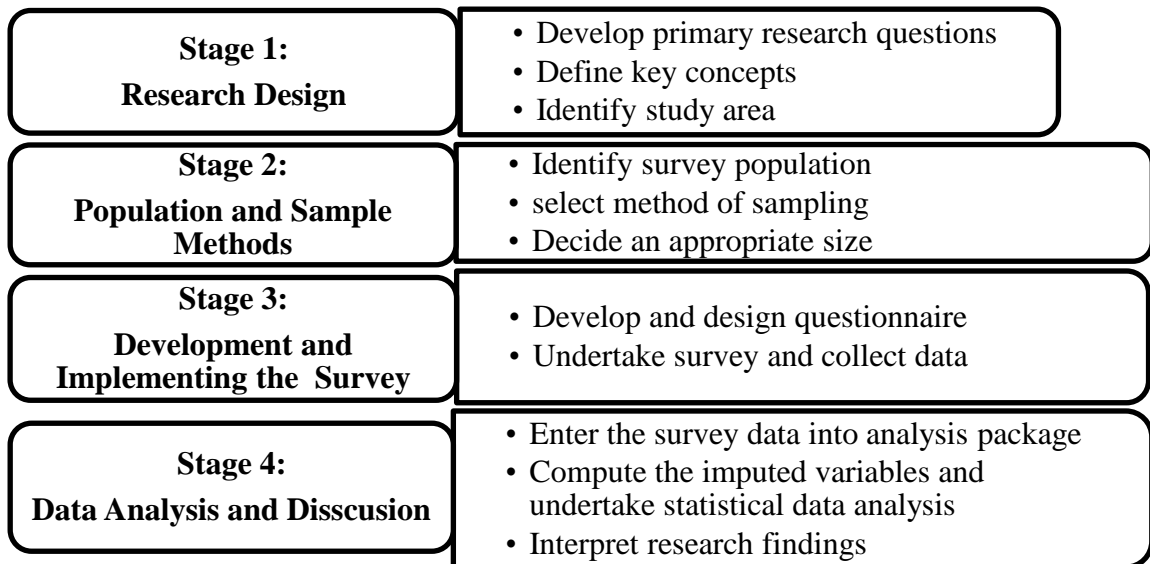


Figure (2): The four stages of conducting the study.

Source: Adapted from (Wongthong, 2013; p.35).

In order to achieve the objectives of this study, Figure (3) shows a model has been developed and used later in constructing the questionnaire. The dependent and independent variables of the study are suggested to be in a theoretical proposed model. Based on previous literature reviews have been used as a guide to develop this model that show the effect and relationship between coral reefs conservation and SDT sustainability.

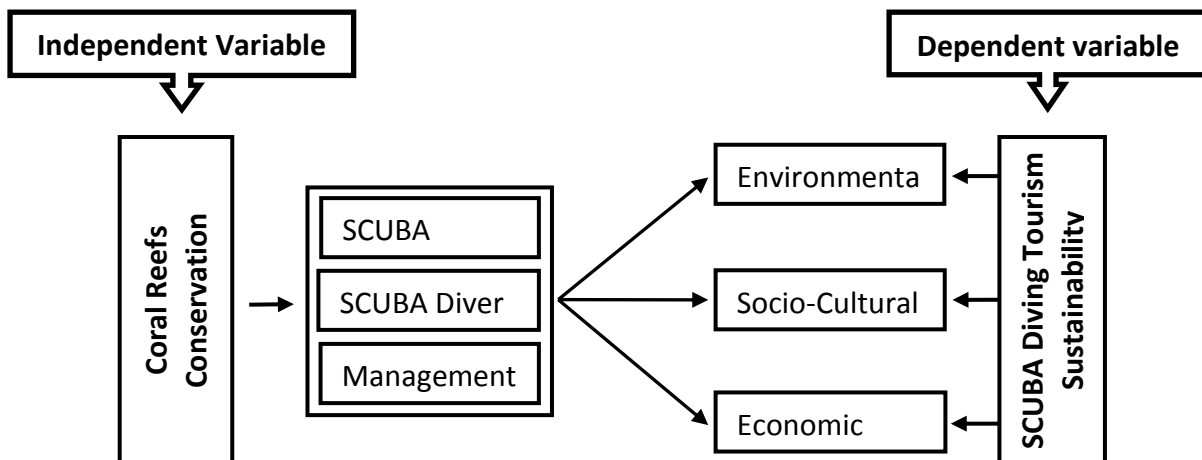


Figure (3): Proposed model for field study

3.2 Stage 2: Population and Sample Methods:

The data in this study were collected using multistage sampling method. **Firstly**, Red Sea has been selected as the study area because it is associated to the study problem. **Secondly**, all managers of the diving centers in all Red Sea cities (Hurghada, Safaga, Al-Quseir, Marsa Alam) had an invitation to participate in the study. All of the managers were having the same chance to participate in the questionnaire. They are chosen as they are believed to be more knowledgeable and to have a basic understanding and acquaintance with the topic of the study in order to obtain meaningful data.

According to Ministry of Tourism data base in February (2018), the total number of operating diving centers in Red Sea governorate is 150 diving centers. The questionnaires were distributed from March to May 2018. One hundred and five completed questionnaires represented around 70 % were returned and all of them were valid and adequate to perform data analysis.

3.3 Stage 3: Development and Implementing the Survey

The data in this study were obtained from primary and secondary sources. Primary data were obtained via a questionnaire distributed to the managers of diving centers while, necessary secondary data were obtained from the previous studies. Data collection was achieved through the development of a 6 pages questionnaire; consist of 57 items distributed in four sections. The questionnaire was administered in English language version only and one method of administering the survey was employed, using a combination of open-ended and closed questions.

3.3.1 Questionnaire Design:

The questionnaire design is based on previous studies and a review of the literature which includes the specific characteristics of SDT and sustainable tourism aspects such as, Worachananant *et al.*, 2008; Nichols, 2013; Wongthong, 2013; Dimmock and Musa, 2015; Lucrezi *et al.*, 2016. The questions were about respondent's demographics and level of experience, their views about threats faced by marine life and diving industry in the study area, and their ideas to mitigate the effects of these threats. During February 2018 the initial questionnaire is prepared and a pre-test has been conducted. It presented to a number of (15) of managers from the population sample were chosen with believe that they have a wide range experiences about SDT industry and the problems which the industry faces. The respondents have suggested some changes in the form of some questions. Throughout this process, the pilot data was conducted and analyzed and a new set of questionnaire was made ready after the items which were not clear have been revised and edited or re-worded.

3.4 Stage 4: Data Analysis and Discussion

The reliability analysis performed to assess the internal consistency of the measurement scales and Cronbach's alpha coefficients (α) of the scales have been computed. Descriptive statistics such as mean scores and standard deviations also are computed according to studied variables. And, Spearman correlation analysis has been conducted to examine the associations among dimensions of coral reefs conservation and SDT sustainability. A series of regression analysis has been conducted to assess the effects of coral reef conservations on SDT sustainability. Standardized beta is used for all of these regression analyze. Finally, statistical significance is considered less than 0.05 for P values. An exploratory analysis of the survey data was conducted using the Statistical Package for the Social Sciences SPSS (Version 20) software.

3.4.1 Results and Discussion

It is expected that the findings from this study will allow for a better understanding of the SDT system. Firstly, to access the reliability of the study factors, Cronbach's Alpha is calculated to test the stability of variables retained in each factor. According to the results, the reliability analysis gave alpha coefficients exceeding (.71) for all study factors which are regarded as acceptable reliability coefficients and a good indication of construct reliability (Nunnally and Bernstein, 1994).

3.4.1.1 Respondents' Profiling; the results of this study indicated that from 105 participants the majority of them 85.7% were Egyptians while, foreigners made up 14.3% from total percent of SCUBA diving managers at Red Sea. Males made up the majority of respondents 96.2% while, females constituted only 3.8% of sample units. Regarding the participants' age, the majority of respondents are between 30 and 49 years old with approximately 90.5% from the total sample. Those results indicated that the position of diving center manager is occupied by youth. With regard to educational background, the results show that the majority of the respondents were graduated from university represented 83.8% from the sample, followed by 9.5% have a diploma and 6.7% have a master degree. The results also shown that the majority of the managers have Instructor Certification (90.5%), followed by (3.8%) of them have Instructor trainer Certification. And the biggest diving organization working in Red Sea is PADI with 81.9% from the total sample followed by SSI 27.6% and CMAS 22.9%.

Also, the experiences of managers indicate that the majority of participants with 73.3% have working experience from 11 to 20 years whereas, (15) represent 14.3% have experience from 6 to 10 years. And, in terms of total number of dives, 82.9% of the respondents have been dived more than 5000 times and 13.3% dived between 3000 and 5000 dives. Moreover, the results of managers' awareness about coral reefs conservation and sustainability of SDT indicate that 99.0% from participants agreed with SDT in coral reefs environments is a highly significant component of international tourism market. While, all of the participants (100.0%) were agreed that diving environment and quality of corals sites is the most significant motives and attraction to SDT. Also, all the participants 100.0% agreed that in Red Sea region the sustainability of SDT is largely dependent on the continued health of the reef resources.

3.4.1.2 Descriptive Statistics and correlate analysis; descriptive statistics means and standard deviations for each of the measures are displayed in Table (1). The descriptive statistics results indicated that items of sustainability which include environmental, social, and economic impacts as three main items have 4.2 mean rating with (SD= 0.429) and items of conservation which have three main items include SCUBA diving operation, SCUBA divers, and management tools - have 4.2 mean rating with (SD= 0.422).

Table (1): Descriptive statistics as, mean and standard deviation for each of the dimensions of sustainability and conservation

Items:	Mean	Std. Deviation
1. Sustainability	4.2	.429
1.1 Environmental Impacts:	4.2	.518
Coral reefs are threatened and endangered ecosystems.	4.5	.539
Corals are damaged and killed by contact from divers with fins, hands, knees and SCUBA diving equipments.	4.1	.870
In the destination, diving centers tend to conduct diving courses without commitment to make friendly environmental dives.	3.4	1.252
Divers request and prefer sensitive environmental dives.	4.1	.944
Damaged coral reefs in the dive sites have negative impacts on the diving tourist's satisfaction.	4.7	.474
Damaged coral reefs in the dive sites have negative impacts on the diving the service quality of the dive.	4.5	.538
There is marine pollution from tourism, such as; garbage and sewage from boats and resorts can be deadly to marine life.	4.5	.694
The amount of damaged and died corals are increase annually.	4.2	.993
1.2 Social Impacts:	3.8	.488
Corals contribute to human welfare at the local and global levels.	4.3	.771
Coral reefs supply vast numbers of people with goods and services.	4.4	.634
The local community cares about the state of coral reefs and marine environments in the area.	2.6	1.246
The diving industry is supported by the local community.	3.1	1.246
The SCUBA diving industry supports the local community.	4.5	.539
SCUBA diving provides local opportunities for local people for training to raise their skills and increase their income.	4.5	.666
The local community is involved in marketing process.	3.3	1.265
The behaviors and attitudes introduced by diving tourists can cause positive impacts across society and affect the local culture.	4.1	.867
1.3 Economic Impacts:	4.4	.543
Coral reef brings economic benefits to the destination.	4.6	.492
Coral reefs improve quality of life at the destination.	4.4	.691
SCUBA diving in coral reef areas is now a multibillion dollar industry and a source for foreign exchange.	4.4	.858
SCUBA diving tourism is seen as an industry that could stimulate economic growth and create employment.	4.6	.494
Diving consider an increasing economic importance for coastal people.	4.3	.930
The fast growing of SCUBA diving lead to significant investments in various products.	4.5	.588
SDT increases property and accommodation value in the area.	4.3	.732
SDT generates economic revenue for conservation and management.	3.8	1.217
2. Conservation	4.2	.422
2.1 SCUBA Diving Operation:	3.8	.485
There are unregulated tourism development leads to negative impacts on coral reefs and marine life.	4.3	.985
Diving centers when marketing sea trips, they are highly depending on underwater environment and what the tourist will see?	4.4	.800
Diving centers organize a cheap sea trips and don't care to safety and service quality of diving	3.5	1.185
Most intro-dives for novice divers are conduct in coral reefs sites.	4.1	.867
Diving centers may allow tourists to get a souvenir from corals.	2.3	1.153
Boats may use coral reefs, if there are no enough mooring buoys.	4.1	.969
Marinas are inappropriate for boats sewage and maintenance.	4.3	.732
Dive guides are qualified and aware enough to the importance of corals	3.6	1.208

2.2 SCUBA Diver:	4.3	.524
Numbers of divers are a lot and not acceptable in the diving sites “Carrying capacity not applied”.	4.0	.961
Diving centers in the destination educate tourists about the importance of coral reefs conservation before dive.	3.9	1.072
Short pre-dive presentation on environment conservation, can reduce the damage caused by divers behaviors.	4.6	.554
Inexperienced divers may be more likely to damage the reef than experienced divers.	4.1	.836
Diving center can control the diver behavior underwater.	4.3	.784
Improve diver’s skills such as buoyancy control can reduce corals damage by divers contact.	4.7	.474
2.3 Management Tools:	4.4	.476
There is a need for reef conservation	4.8	.416
Educational and awareness campaigns by government are not effective in alleviating depreciative behaviors.	4.4	.843
Recreational use of coral reef areas are allowed in high threatens sites.	4.1	.840
Coral reef protected areas are one of the most promising solutions for the survival of coral reefs.	4.3	.793
Artificial reefs are one way to alleviate the problem of coral decline.	4.3	.884
There is a need for more effective management tools to maintain coral reefs and marine life.	4.5	.722

Likert scale: (1 = completely disagree, 2 = disagree, 3 = I don't know, 4 = agree, and 5 = completely agree).

According to Table (1), when ranking the items of sustainability, it is clear that the most important impacts with the highest mean scores are "economic impacts" with 4.4 mean rating with (SD= 0.543), and "environmental impacts" with 4.2 mean rating with (SD= 0.518), then, “social impacts” with 3.8 mean rating with SD= 0.488. The results concerning **economic impacts** confirm the importance of coral reefs in bringing economic benefits to the destination have 4.6 mean rating with SD= 0.492 and improving the quality of life have 4.4 mean rating with SD= 0.691 while, the participants are completely agreed with 4.4 mean rating and SD= 0.858 that SDT in coral reefs areas which became now a multibillion dollar industry and consider a main source for foreign exchange, and by 4.6 mean rating with (SD= 0.494) they consider that SDT have the ability to stimulate economic growth and creating employment.

Daldeniz and Hampton (2011), explained that diving contributes substantially to local economies in the overall economic wellbeing of coastal users and in direct revenues such as generating income and employment, and contributing to government revenues and overall national income. So, this meet with the participants’ opinions that diving tourism has an increasing economic importance for coastal communities with 4.3 mean rating and (SD= 0.930). Managers agree that the fast growing of SDT lead to significant investments in various products by 4.5 mean rating with (SD= 0.588) and 4.3 mean rating with (SD= 0.732) for it is ability to increase the property and accommodation value in the area. Also, they think that SDT industry can generate revenue for conservation and management with 3.8 mean rating and (SD= 1.217).

The **environmental impacts** result indicate that most of SDT centers' managers in Red Sea destination are completely agreed with 4.5 mean score and (SD= 0.539) that coral reefs are threatened and endangered ecosystems while, they agree with 4.1 mean score and (SD= 0.870) that coral reefs in the study area are damaged and killed by contact from divers. These results match with the results of Worachananant *et al.* (2008), study as they clarified that divers can damage corals through physical contact with their hands, body, equipment and fins. Participants are agreed with 3.4 mean rating and (SD= 1.252) that diving centers tend to conduct diving courses without commitment to make friendly environmental dives. However, divers request and prefer a sensitive environmental operation for dives with 4.1 mean rating and (SD= 0.944). These results shown that conducting the diving courses and diving trips without commitment to protect the environment will lead to negative impacts on marine life and coral reefs environment. In addition, the tourist will not be satisfied after the diving trip. While managers agree that damaged coral reefs in the dive sites have negative impacts on the diving tourist's satisfaction and the service quality of the dive by 4.7 with (SD= 0.474) and 4.5 mean rating with (SD= 0.538) respectively. The results of environmental impacts show also that most of the participants agree with 4.5 mean score and (SD= 0.694) that there is marine pollution from tourism. Moreover, they are completely agreed with 4.2 mean rating and (SD= 0.993) that in the destination, the amount of damaged and died corals are increasing annually. This result can lead to significant environmental and economic losses to ecosystem and coastal areas dependent on the tourism industry.

The **social impacts** show the agreement of the participants with 4.3 mean rating and (SD= 0.771) that coral reefs contribute to human welfare at the local, national and global levels while, the majority of diving managers are completely agreed that coral reefs supply vast numbers of people with goods and services with 4.4 mean score and (SD= 0.634). The results also indicate that most of the participants are disagreeing by 2.6 mean score with (SD= 1.246) that the local community of Red Sea area cares about the state of coral reefs. Burke *et al.* (2012), explained that although it is important to address coral reef conservation from a global perspective, but without the support of the local community, most conservation projects will not succeed. The majority of participants tend to agree with 3.1 mean rating and (SD= 1.246) that the SDT industry in Red Sea area is supported by the local community and completely agree with 4.5 mean rating and (SD= 0.539) that the SDT industry supports the local community. Also, the participants believe with Dimmock and Musa (2015), by 4.5 mean score and (SD= 0.666) that SDT can provide local opportunities for local people for training and increase their income from employment while, the managers of diving centers are agreed with 3.3 mean score and (SD= 1.265) that the local community is involved in marketing to promote SDT and completely agree with 4.1 mean rating and (SD= 0.867) that the behaviors, lifestyles or attitudes introduced by diving tourists can cause positive impacts across society and affect the local culture.

This is not the same result of Mota (2016), study who see that in diving tourism destinations the behaviors, lifestyles or attitudes introduced by visitors can cause negative impacts across society and affect local culture.

And when ranking the parts of conservation, the most important impacts with the highest mean scores are “management tools” with 4.42 mean rating and (SD= 0.476), and “SCUBA diver impacts” with 4.25 mean rating and (SD= 0.524), then “SCUBA Operation impacts” 3.82 mean rating and (SD= 0.485). The results of **management tools** show that all the participants agree and most of them completely agree with 4.8 mean score and (SD= 0.416) that there is a need for coral reef conservation. This result indicates that the protection of remaining reefs, including those that have been severely damaged is now critical if reef ecosystems are to have the maximum chance of recovery. The participants are completely agreed with 4.4 mean score and (SD= 0.843) that educational and awareness campaigns by government are not effective in alleviating irresponsible behaviors. This result asserts the need of effective educational and interpretations campaigns to alleviating such irresponsible behaviors.

The managers agree with 4.1 mean score and (SD= 0.840) that recreational use of coral reef areas and SDT are allowed in high threatens and damaged sites. This result mean that the damaged and threaten coral reef sites don't have the chance to recovery or maintain itself because it is not closed and always opened for recreational and other activities. In addition, they completely agree with the same mean score by 4.3 with (SD= 0.793) and (SD= 0.884) respectively that coral reef protected areas are one of the most promising solutions for the survival of coral reefs, and that the artificial reefs consider one way to alleviate the problem of coral decline. The managers' results also indicate that they completely agree with 4.5 mean score and (SD= 0.722) that there is a need for more effective management tools to maintain coral reefs and marine life. This result indicates that there is no touched effect in coral reefs conservation and sustainability of SDT and the need for quickly movement towards these issues is a necessity nowadays.

The result of **SCUBA divers** impacts indicate that participants agree with 4.0 mean score and (SD= 0.961) that the numbers of divers are a lot and not acceptable in the diving sites and the carrying capacity for the sites not applied. The managers also are agreed with 3.9 mean score and (SD= 1.072) that diving centers in the destination educate tourists about the importance of coral reefs conservation before dive. Further, they completely agree with 4.6 mean score and (SD= 0.554) that the short pre-dive presentation can reduce the damage caused by divers' behaviors. In addition, the results show that managers agree with 4.1 mean score and (SD= 0.836) that novice or inexperienced divers may be more likely to damage the reef than experienced divers. The managers agree with 4.3 mean score and (SD= 0.784) that diving centers can control on the diver behavior underwater. And completely agree with 4.7 mean score and (SD= 0.474) that improving diver's skills such as buoyancy control can reduce corals damage by divers contact.

The results of **SCUBA diving operation** impacts reveal with completely agree that there are unregulated tourism development leads to negative impacts on coral reefs and marine life with 4.3 mean score and (SD= 0.985). This result meets with Bowdery *et al.* (2015), observation that tourism overuse and unregulated tourism has disastrous impacts on precisely the coral reefs on which the tourism industry depends. Most of the participants completely agree with 4.4 mean score and (SD= 0.800) that diving centers when marketing sea trips, they are highly depended upon underwater environment. This result confirms the importance of marine life and coral reefs as the main part in marketing campaigns to attract tourists. As well as, they agree with 3.5 mean rate score and (SD= 1.185) that diving centers organize a cheap sea trips and don't care to safety and service quality of diving.

That is mean, if the safety instructions of SCUBA diving are not followed, the potential to create difficult situations will happen. The diving managers are also agreed with 4.1 mean score and (SD= 0.867) that most of intro-dives for novice divers are conduct in coral reefs sites. But they disagree with 2.3 mean score and (SD= 1.153) that diving centers in Red Sea area allow tourists to get a souvenir from corals. The majority of participants agree with 4.1 mean score and (SD= 0.969) that boats use coral reefs instead of moorings, if there are no enough mooring buoys in the diving sites. And they tend to be completely agreed with 4.3 mean score and (SD= 0.732) that marinas in Red Sea are inappropriate for boats sewage and maintenance. Also, the participants agree with 3.6 mean score and (SD= 1.208) that dive guides in the destination are qualified and aware enough to the importance of coral reefs.

3.4.1.3 Correlation Analysis; table (2) illustrates the correlation matrix. As expected, a high positive correlation between conservation and its dimensions exist; it ranges from (0.83) with SCUBA diving operation to (0.90) with management tools. Similarly, correlations between each of the sustainability measures were significant, ranging from (0.80) for social impacts to (0.85) for economic impacts. The results showed that conservation, in line with expectations, significantly and positively correlated with overall sustainability ($r=0.80$, $p<0.05$) and for its three dimensions, SCUBA diving operation ($r=0.67$), SCUBA diver ($r=.70$), and management tools ($r=0.73$). All of these correlations were statistically significant with ($p<0.05$).

Table (2): Correlation between Coral Reefs Conservation and SCUBA Diving Tourism Sustainability

Dimensions	1	2	3	4	5	6	7	8
1. Environmental	-							
2. Social	.49	-						
3. Economic	.85	.55	-					
4. Sustainability	.83	.80	.85	-				
5. Operation	.64	.51	.54	.67	-			
6. Diver	.56	.53	.67	.70	.54	-		
7. Management	.71	.50	.62	.73	.63	.75	-	
8. Conservation	.72	.59	.70	.80	.83	.86	.90	-

According to the results of table (2), it was also observed that sustainability is associated with the three aspects of it. Since, sustainability positively correlated to these aspects, $r = 0.80$ with “social impacts”, $r = 0.83$ with “environmental impacts”, and $r = 0.85$ with “economic impacts”. These positive correlations indicate the possibility that the coral reefs conservation is a good predictor of SDT sustainability. These results match with the study of Lucrezi *et al.* (2016), which indicates that sustainability goals, from conservation to quality service delivery to customers, remain difficult to propose until the interactions between environmental, social, and economic systems affecting the SDT industry are understood. Finally, the above results support the first hypothesis of the study which suggests that the sustainability of SDT depends up on the conservation of coral reefs and marine environment.

3.4.1.4 Regression Analyses; a series of regressions were conducted to explore the predictive power of coral reefs conservation for SDT sustainability. Table (3) is the model summary for the prediction of conservation by sustainability. From the table, conservation accounts for 66.6% variability (influence) on sustainability. The Adjusted R Square suggests that conservation accounts for 66.3% of variability in sustainability. Generally, the model is moderately strong. However, it could be viewed as a strong model, considering the fact that 66.6% is the variability contributed by only coral reefs conservation. Moreover, the value of $r = 0.816$ shows a fairly positive correlation ($r > 0.05$) between coral reefs conservation and SDT sustainability.

Table (3): Regression between Coral Reefs Conservation and SCUBA Diving Tourism Sustainability

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.690	.242	.816	2.848	.005
	Conservation	.830	.058		14.328	.000
a. Dependent Variable: Sustainability						

Note: $R^2 = .666$, $Adj.R^2 = .663$, $R = .816$, $F = 205.282$, $p < .005$.

The result presented in table (3) may justify this argument since, an F-test associated with the prediction of sustainability by conservation. From the table, the test is also significant at 5% significance level, $F = 205.282$, $p = .000$. Thus, conservation significantly predicts sustainability in a linear function. This finding corroborates the argument that the model found in Table (3.12) is not necessarily weak. Moreover, additional justification to this is the significance of the t-test associated with conservation. The significance of the t-test (p value = .000) suggests that coral reefs conservation is a significant predictor of SDT. These results indicate that there is a relationship between coral reefs conservation and SDT sustainability. Findings of current study are consistent with the study of Wongthong (2013), who emphasizes the influence of the high dependence of SDT upon the conservation of natural resources, particularly coral reefs which consider the capital assets of tourism industry.

3.5 Conclusion

Tourism in Egypt is expected to resume its rapid growth in the near future. So, unless corrective measures are taken, it is bound to have negative environmental and socio-cultural impact on natural resources and local community. Sustainable tourism strategies have gone a long way towards minimizing the negative impacts and ensuring that the economic benefits of tourism can contribute to support local people and environment protection.

The suitable balance must be established between sustainability dimensions to guarantee its long-term sustainability. Based on data analysis, the results found that coral reef brings economic benefits to Egypt as a source for foreign exchange. It improves quality of life for local people and creates a lot of jobs for them. The fast growing of SDT lead to significant investments in various products and help to increase property and accommodation value. Also, SDT industry can generate revenue for coral reefs conservation and environmental management.

While, the results indicated also that there are some negative impacts of tourism on coral reefs such as; unplanned and unregulated tourism development, many diving centers make diving trips without commitment to protect the environment, carrying capacity approach not applied, novice divers cause physical damage to corals, there is marine pollution from tourism, and there is a shortage of mooring buoys in diving sites. And, however coral reefs supply vast numbers of people with goods and services. But, there is a poor connection between the local community and SDT and the local community doesn't have enough awareness about the importance of coral reefs. Finally, the results of the correlation between coral reefs conservation and SDT sustainability showed that there is a positive correlation which indicates the possibility that the coral reefs conservation is a good predictor of SDT sustainability while, the results of regression between coral reefs conservation and SDT sustainability indicated that there is a strong relationship between coral reefs conservation and SDT sustainability.

3.6 Recommendations:

Based on the study results, the following recommendations are extracted:

3.6.1 for Ministry of Tourism:

The sustainability principles that mentioned in the strategy of Egypt 2030 should be applied in tourism sector and prevent the unregulated and unplanned tourism development that cause negative impacts on natural resources. Focus on tourism quality rather than quantity. There is a need to enhance quality standards for all tourism sectors in Egypt and a special certification or symbol can be developed to represent this quality standards. The ministry should guarantee that the quality standards are applied in all tourism sectors through effective monitoring programs.

3.6.2 For Ministry of Environment:

Environment protection laws should be developed according to sustainability principles and enforced to protect unique and fragile natural resources and cultural heritage. Make more effort in press, schools, and among people in the natural areas to raise the community awareness about natural resources protection. MPAs must set up around important dive sites. Developing regional action plans and creating a global partnership for conservation of coral reefs. Encouraging research targeted to management needs, conduct valuation studies of coral reefs.

3.6.3 For SDT Operators;

Introduce to tourists relevant environmental regulations, learning them about local laws and regulations designed to protect coral reefs, and give tourists free of charge relevant booklets and newsletters. Encourage clients to participate in cleanups dives and offer free dives on clean-up days. Tell divers to prevent creature harassment and to respect rare flora and fauna.

References

- Arin, T. and Kramer, R. A. (2002). **Divers' willingness to pay to visit marine sanctuaries: An exploratory study**, *Ocean & Coastal Management*, (45): 171–183, Available at: <http://www.sciencedirect.com/science/article/pii/S0964569102000492>, (Accessed on 10th of March 2017).
- Bowdery, C., Vance, C. R., Rodríguez, H., Speights, E., Xu, A., and Yeh, S. (2015). **International regulatory best practices for Coral Reef Protection**, Interamerican Association for Environmental Defense (AIDA), First edition: February, 10-44.
- Brander, L. M., Beukering, P. v., and Cesar, H. S.J. (2007). **The recreational value of coral reefs: A metaanalysis**, *Ecological Economics*, 3, Available at: <http://www.sciencedirect.com/science/article/pii/S092180090600557X>, (Accessed on 10th of March 2017).
- Burke, L., Reyntar, K., Spalding, M., and Perry, A. (2011). **Reefs at risk revisited**, World Resources Institute, 3-94.
- Burke, L., Reyntar, K., Spalding, M., and Perry, A. (2012). **Reefs at risk revisited in the coral triangle**, World Resources Institute, 6-64.
- Castellani, V. (2010). **Development of methodologies and indicators to assess sustainability in tourism and agriculture**, University of Milano, Bicocca PhD Thesis, 28-32.
- Cater, C., and Cater, E. (2011). **Marine Environments**, in Weaver D. B. (ed.), *The Encyclopedia of Ecotourism*, CABI Publishing, 269-271.
- Cesar, H., Burke, L., and Pet-Soede, L. (2003). **The economics of worldwide coral reef degradation**, Cesar Environmental Economics Consulting, 7-12.
- Daldeniz, B., and Hampton, M. P. (2011). **Dive tourism and local communities: Active participation or passive impacts? Case studies from Malaysia**, Working Paper 245, University of Kent, Kent Business School, 3-5.

- Davidson, M. G. (2002). **Protecting coral reefs: the principal national and international legal instruments**, *Harvard Environmental Law Review*, (26): 501-508, Available at: <http://heinonline.org/HOL/LandingPage?handle=hein.journals/helr26&div=17&id=&page=>, (Accessed on 10th of March 2017).
- Deverell, A. (2011). **Developing the Deep: Evaluating the feasibility of establishing a recreational diving sector in the Ísafjarðardjup area of Iceland**, University of Akureyri, Faculty of Business and Science, University Centre of the Westfjords, Master of Resource Management: Coastal and Marine Management Ísafjörður, 1-24.
- Dimmock, K., Cummins, T., and Musa, G. (2013). **The business of scuba diving**, In Musa G. and Dimmock k. (ed.), *Contemporary Geographies of Leisure, Tourism and Mobility “Scuba Diving Tourism”*, Routledge, 162-164.
- Dimmock, K., and Musa, G. (2015). **Scuba Diving Tourism System: A framework for collaborative management and sustainability**, *Marine Policy*, (54): 52–58, Available at: <https://www.sciencedirect.com/science/article/pii/S0308597X14003455>, (Accessed on 30th of September 2017).
- Garrod, B., and Gössling, S. (2008). **New Frontiers in Marine Tourism: Diving Experiences, Sustainability, Management**. Elsevier, Amsterdam, 7.
- GhulamRabbany, Md., Afrin, S., Rahman, A., Islam, F., and Hoque, F. (2013). **Environmental effects of tourism**, *American Journal of Environment, Energy and Power Research*, 1 (7): 124, Available at: http://www.ajepr.com/AJEEPR_Vol.%201,%20No.%208,%20September%202013/ENVIRONMENTAL.pdf, (Accessed on 10th of March 2017).
- Grimsditch, G. D., and Salm, R. V. (2006). **Coral reef resilience and resistance to bleaching**, IUCN Global Marine Programme, Switzerland, 52, 7-31.
- Hallock, P. (2005). **Global change and modern coral reefs: New opportunities to understand shallow-water carbonate depositional processes**, *Sedimentary Geology*, (175): 19-25, Available at: <http://www.sciencedirect.com/science/article/pii/S0037073805000515>, (Accessed on 10th of March 2017).
- Harriott, V. J. (2002). **Marine tourism impacts and their management on the Great Barrier Reef**, CRC Reef Research Centre Technical Report No 46. CRC Reef Research Centre, Townsville, 6-13.
- Houtte, M. V. (2015). **Sustainable tourism management in protected areas using a systemic approach a case study from Þingvellir national park, Iceland**, 30 ECTS Master thesis in geo-information science and earth observation for environmental modelling and management, Faculty of Life and Environmental Sciences, University of Iceland 13-16.
- Ince, T. and Bowen, D. (2011). **Consumer satisfaction and services: Insights from dive tourism**, *The Service Industries Journal*, 31 (11): 1769-1788, Available at: <https://www.tandfonline.com/doi/abs/10.1080/02642069.2010.496480>, (Accessed on 30th of September 2017).

- Kler, B. K., and Tribe, J. (2012). **Flourishing through SCUBA: Understanding the pursuit of dive experiences**, *Tourism in Marine Environments*, 8 (1/2): 19–32, Available at: <https://www.ingentaconnect.com/content/cog/tme/2012/00000008/f0020001/art00003>, (Accessed on 30th of September 2017).
- Klimmek, H. (2013). **An examination of the barriers to local community participation in the dive tourism industry in Flores**, Indonesia, This dissertation is submitted as part of a Master degree in Tourism, Environment and Development at King's College London, 13.
- Krstić, B., Jovanović, S., and Milić, V. J. (2008). **Sustainability performance management system of tourism enterprises**, *Economics and Organization*, 5 (2): 123 – 131, Available at: <https://www.ceeol.com/search/article-detail?id=44680>, (Accessed on 3th of July 2017).
- Lough, J. M. (2008). **10th Anniversary Review: A Changing Climate For Coral Reefs**, *Journal of Environmental Monitoring*, Cutting-Edge Research on Environmental Processes & Impacts, The Royal Society of Chemistry, 10 (1): 21-22, Available at: <http://pubs.rsc.org/is/content/articlehtml/2008/em/b714627m>, (Accessed on 10th of March 2017).
- Lucrezi, S., Milanese, M., Markantonatou, V., Cerrano, C., Sarà, A., Palma, M., and Saayman, M. (2016). **Scuba diving tourism systems and sustainability: perceptions by the scuba diving industry in two Marine Protected Areas**, *Tourism Management*, (59): 385-403, Available at: <http://www.sciencedirect.com/science/article/pii/S0261517716301649>, (Accessed on 3th of July 2017).
- Ministry Of Tourism. (2018). **Ministry Of Tourism data base, February**, The general administration of diving and new activities.
- Moberg, F., and Folke, C. (1999). **Analysis ecological goods and services of coral reef ecosystems**, *Ecological Economics*, (29): 216-222, Available at: <http://www.sciencedirect.com/science/article/pii/S0921800999000099>, (Accessed on 10th of March 2017).
- Mota, L. (2016). **Using Of Natural Spaces For Tourism Activity Scuba Diving And Impacts On Aquatic Animals**, *Int. J. Trop. Vet. Biomed. Res.*, 1 (1): 9-20, Available at: <http://www.jurnal.unsyiah.ac.id/IJTVBR/article/view/5069>, (Accessed on 3th of July 2017).
- Nichols, R. S. (2013). **Effectiveness of artificial reefs as alternative dive sites to reduce diving pressure on natural coral reefs: a case study of Koh Tao, Thailand**, Bsc Conservation Biology, University of Cumbria, 2-10.
- Nunnally, J. C. and Bernstein, I. H. (1994), **Psychometric theory. (3rd Ed.)**, New York: McGraw-Hill.
- Professional Association of Dive Instructors. (2016). **Worldwide Corporate Statistics 2016**, Data for 2010-2015, Updated February, padi.com, Available at: https://www.padi.com/sites/default/files/documents/about-padi/statistics/PADI_2016_WW_Statistics.pdf, (Accessed on 3th of July 2017).

- Ragheb, R. A. (2015). **Sustainable Tourism Development: Assessment of Egyptian Sustainable Resorts**, World Academy of Science, Engineering and Technology International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering 9 (12): 4296-4297, Available at: <http://www.waset.org/publications/10003387>, (Accessed on 3th, July 2017).
- Rajasekar, S., Philominathanet, P., and Chinnathambi, V. (2013). **Research methodology**, Physics ed-ph, 14, 1-53.
- Salvat, B. (2015). **Health and degradation of coral reefs: Assessment and future**, In H. J. Ceccaldi et al. (eds.), **Marine productivity: perturbations and resilience of socio-ecosystems**, Springer International Publishing Switzerland, 343-347.
- Souter, D. W., and Linden, O. (2000). **The health and future of coral reef systems**, *Ocean & Coastal Management*, (43): 657-683, Available at: <http://www.sciencedirect.com/science/article/pii/S0964569100000533>, (Accessed on 10th of March 2017).
- Westmacott, S., Teleki, K., Wells, S., and West, J. M. (2000). **Management of bleached and severely damaged coral reefs**, IUCN, Gland, Switzerland and Cambridge, UK, 1-28.
- Wilkinson, C. (2004). **Status of coral reefs of the world: 2004**, Global coral reef monitoring network (1), Australian Institute of Marine Science, 1, 2-31.
- Wittmer, H., and Hassan, Z.E. (2001). **ACP-EU Fisheries Research Initiative, Proceedings of the INCO-DEV International Workshop on Policy Options for the Sustainable Use of Coral Reefs and Associated Ecosystems. Mombasa, Kenya, 19-22 June, Brussels, ACP-EU Fish.Res.Rep, 10-61.**
- Wongthong, P. (2013). **An integrated approach to sustainable management of reef-based scuba dive tourism: A case study of Koh Tao, Thailand**, thesis submitted for the degree of doctor of philosophy, discipline geography, environment and population, the University of Adelaide, South Australia, 1-85.
- Worachananant, S., Carter, R.W., Hockings, M., Reopanichkul, P. (2008). **Managing the Impacts of SCUBA Divers on Thailand's Coral Reefs**, *Journal of Sustainable Tourism*, 16 (6): 646-657, Available at: <https://www.tandfonline.com/doi/abs/10.1080/09669580802159677>, (Accessed on 3th of July 2017).
- Zain al Abidin, S. Z., and Mohamed, B. (2014). **A review of SCUBA diving impacts and implication for coral reefs conservation and tourism management**, SHS Web of Conferences 12, 01093, EDP Sciences, 1-6, Available at: http://www.shsconferences.org/articles/shsconf/abs/2014/09/shsconf_4ictr2014_01093/shsconf_4ictr2014_01093.html, (Accessed on 10th of March 2017).
- Zamfir, A., and Corbos, R. A. (2015). **Towards Sustainable Tourism Development in Urban Areas: Case Study on Bucharest as Tourist Destination**, *Sustainability*, (7), 12710-12720, Available at: <http://www.mdpi.com/2071-1050/7/9/12709/htm>, (Accessed on 3th of July 2017).

أثر الحفاظ على الشعاب المرجانية على استدامة سياحة الغوص

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الملخص العربي

سياحة الغوص هي أحد أنماط السياحة سريعة النمو والتي تنعكس آثارها بشكل إيجابي على اقتصاد المجتمعات الساحلية. لذلك، ينبغي منع الآثار السلبية المرتبطة بسياحة الغوص لحماية الشعاب المرجانية والتنوع البيولوجي الذي توفره، والتي تعتمد عليها سياحة الغوص بشكل رئيسي في جذب السائحين. تلقى هذه الدراسة الضوء على المشاكل التي تؤثر على استدامة سياحة الغوص وتبحث أدوات الإدارة الخاصة بالحفاظ على الشعاب المرجانية وتأثير ذلك على استدامة سياحة الغوص في البحر الأحمر بمصر. تم جمع بيانات الدراسة باستخدام استبيانات أكملها عدد ١٠٥ من مديري مراكز الغوص العاملين في محافظة البحر الأحمر. وأشارت نتائج هذه الدراسة إلى أن الحفاظ على الشعاب المرجانية يرتبط ارتباطاً إيجابياً باستدامة سياحة الغوص. كما أوضحت النتائج وجود علاقة تنبؤية إيجابية كبيرة بين الحفاظ على الشعاب المرجانية واستدامة سياحة الغوص بنسبة ٦٦,٦٪. حيث سلطت هذه النتائج الضوء على أهمية الحفاظ على الموارد الطبيعية، وأكدت على الحاجة إلى أدوات إدارة فعالة لضمان استدامة سياحة الغوص. وأخيراً، تم تقديم بعض التوصيات لتعزيز استدامة سياحة الغوص تشمل إجراءات تتراوح بين المشاركة في التخطيط والإدارة إلى التعليم ورفع درجة الوعي والمسؤولية الاجتماعية.

الكلمات الدالة: سياحة الغوص، الغواص، الحفاظ على الشعاب المرجانية، الاستدامة، البيئة البحرية.