



Diving Sites in the Gulf of Aqaba; Recreational Diving Activities

Synthetic Report (Report #5)

**Prepared by
The Aqaba Diving Association**

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Executive Summary

CXS With an aim to evaluate the diving sites and the recreational diving, the Aqaba Diving Association (ADA) was assigned to collect field data about the daily diving operations in Aqaba. In addition to diving activities, five diving sites were subjected to Reef Check survey to evaluate the status of coral reefs and the indicator fish species in each one of the targeted diving sites. The followings are list of most important concluding remarks and recommendation associated with the results of the study;

1. The field data was collected on a daily basis (for about two months) by ten active diving clubs (DCs) who reported relevant information about the number of divers and number of dives, the age categories of divers and their nationalities among other things,
2. The data obtained have shown that the DCs used 14 diving sites, among which the Rainbow site received the highest number of visitations, followed by the Cedar Pride Shipwreck, the Japanese Garden and the Plane C 130 diving sites and to a lesser extent the First Bay site.
3. It was noted that the old artificial reefs such as the Cedar Pride Shipwreck Rainbow and Plane C 130 sites outcompeted several natural reefs such as Black Rock and Yellow stone sites. This notion sheds light on the importance of artificial reefs in attracting visitors just like the natural reefs.
4. During the relatively short study period, the total number of divers reported was 1356, who conducted a total of 1505 dives during their visits. Among those, Italy was represented by 306 divers, followed by Jordan and Spain with 231 and 218 divers, respectively.
5. The analysis of the divers' nationalities revealed that there are important countries in Europe and the Arabian Peninsula that were weakly represented with respect to number of divers. For example, Sweden, Belgium and Denmark were represented by 1, 2 and 5 divers, respectively. Also, Oman and Bahrain were represented by only 2 divers each.



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Those countries among others should be targeted in future program in the advertisement and touristic programs to encourage more divers to come to Aqaba.

6. Analysis of the age categories revealed that the most important age category with respect to diving industry is the 26-35 age category. The 36-50 and 16-25 age categories are well represented. This indicates that the potential customers for the diving industry are within these age categories. Therefore, it might be important to design special programs to attract these age categories to visit Aqaba for diving in future.
7. The reef check data constituted a baseline survey to characterize the bottom habitats and the indicator fish species in five selected diving sites. The sites selected include the Underwater Military Museum, Rainbow Reef, Cedar Pride Shipwreck, Black Rock, and Japanese Gardens. The results obtained have shown that all diving sites have reasonable coral cover with healthy corals in most of them. The only exception was found in the Underwater Military Museum, which showed relatively high percent cover of recently killed corals. This might be correlated with the present of algae in the site or may be due to some leaching harmful substances coming from the deployed vehicles. Further research will be needed to verify the exact reason for this notion, especially if the similar results persists in the next year.
8. Analysis of diving sites according to visitations done by certified divers and non-certified divers revealed that there some diving sites that are preferred for beginner divers, while other diving sites are preferred by the more experienced divers. The reasons behind this might be due to easy-access, shallow depths and possibility for conducting short dives, which are more preferred by the diving clubs for customers who are not certified divers. In this regard, it is recommended to restrict beginner divers to certain diving sites that are suitable for beginners, where all diving clubs follow such rules. In this case, the sites will be safer and environmental friendly for this kind of divers, since beginner divers might cause some damage to the environment.



Preview

This study constituted from two main parts; the first one includes the collection of diving-related activities, which were collected by ten partner diving clubs and was collected on a daily basis. The second part of the study was the reef check survey, which was carried out in five selected diving sites and characterized the bottom habitats and communities of certain indicator fish species. Following is a description of the results of both parts of the study, while the more detailed data were sent to the client on separate excel files.

Objectives of the study

The following objectives were set to achieve during this survey;

- quantify visitation frequency of diving sites in terms of numbers of daily dives, guiding diving clubs, sites visited and lengths of the dives in all diving sites visited.
- map the distribution of diving loads in terms of divers' numbers, biographic info, experience, proficiency and observing environmental directives.
- provide daily information on the environmental conditions at the diving sites.
- conduct Reef Check monitoring at five selected diving sites.
- provide detailed descriptions on diving sites attractions, facilities accessibility and environmental stressors including incidental anthropogenic impacts and incidents encountered observed by divers.

1. Diving Sites and Diving Activities in the Gulf of Aqaba

Introduction

The Aqaba Diving Association (ADA) was assigned to collect data during the daily recreational diving operations conducted at the diving sites in the Jordanian coast of the Gulf of Aqaba. The data was collected by eleven acting diving clubs in Aqaba who reported daily diving activities on a daily basis. Information about divers, dives and the diving sites



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were collected and were analyzed. The data collected is meant to quantify visitation frequencies to diving sites in terms of numbers of daily dives and number of dives conducted. The nationalities of divers and their age categories were also reported here. In addition, the divers' qualifications were also analyzed as per site visits.

Methods

Collecting diving data from the diving sites was based on an excel sheet data logging (Table 1). All possible data that can be collected from the diving sites visited by the diving clubs were recorded on an excel file containing the daily data logging and was sent to the client.

In this part of the study, eleven diving clubs have participated in the data collection. Those include; Diving Clubs include the followings; Hammerhead DC, Bait Alaqaba DC, Deep Blue DC, Amwaj DC, Marmaid DC, Aqaba Adventure DC, Aqaba Bro Divers DC, Aqaba Leaders DC, Red Sea DC, and Ayla DC. Here we report the analysis of the data collected by the eleven diving clubs.

The diving sites visited during this survey include the following sites; Japanese Garden, Cedar Pride, Shipwreck, Black Rock, Yellow Stone, Seven Stars, Underwater Military Museum, Rainbow, Plane C130, First Bay, King Abdullah, Power Station, Gorgon 1, Tri Star, and The Tank site.

Table 1: Data log for the diving conducted by the DC

Diving Data Gathering Campaign, August 15th 2023																									
Year	Month	Day	Time	Dive #	Dive Site	Dive Site Coordinates	Dive Centre	Dive Guide(s) Name(s)	Dive Guides Certificate	No. of Guest Divers	Nationality	Age below 15	16-25	26-35	36-50	Age above 50	Guest Dive Certificates	Duration of Dive	Dive Depth	Water temperature	Weather Conditions	Sea Condition	Distinguished Biodiversity Seen	Observations and Notes	
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Results and Discussion

The number of divers who visited the different diving sites have shown high variations among the diving sites. The highest number of divers was recorded in the Rainbow diving site with the Cedar Pride, Japanese Garden, Plane C130, and the First Bay diving sites being next in terms of the number of divers (Fig. 1). The total number of divers reported during the study period (from Aug. 14th to Sep. 25th) was 1281 diver. Since some divers conducted more than one dive, then the number of dives in the diving sites were more than the number of divers reported in some cases (Fig. 2). The total number of dives conducted by divers during the study period was 1421 dives. The number of divers and number of dives varied from week to week, which reflects the touristic activities during this period of the year (Fig. 3 & 4).

The data obtained showed high variations among the different diving sites in terms of the number of divers and the number of dives. This might reflect the variation in their attraction to divers. It might also reflect variation in site access and facilities available for divers and diving clubs. In either case, the sites, which had relatively low number of visiting divers and low number of dives conducted, should be evaluated to identify weak points that might make the site of less attraction compared with the other more attractive diving sites. Site development plans might be necessary to be applied. This should be done in consultation with the diving clubs and the developers.

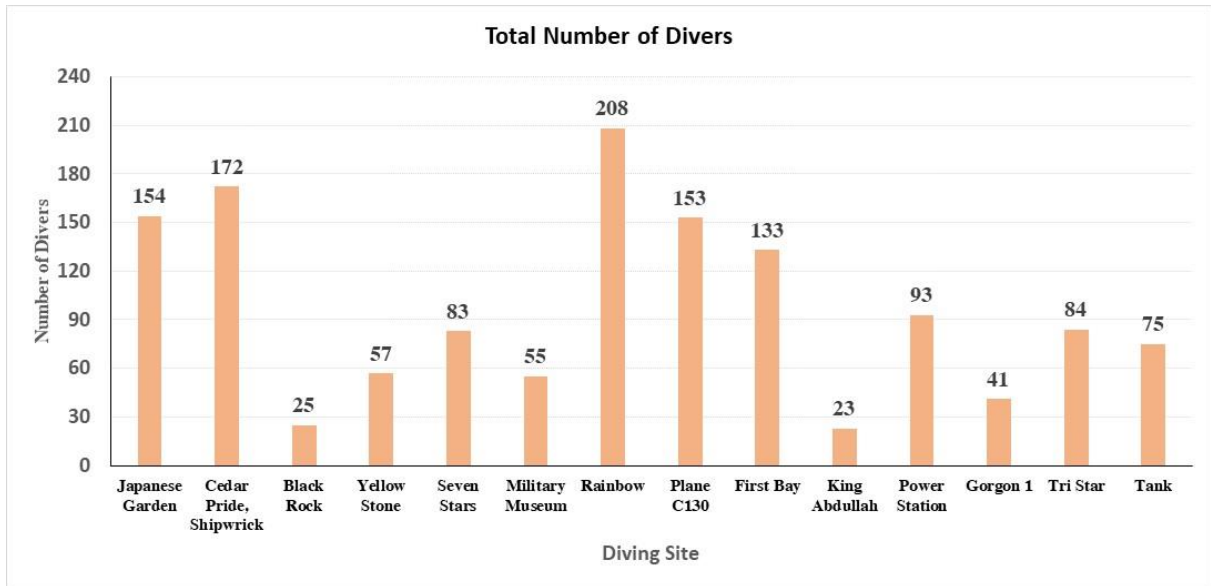


Fig. 1: The total number of divers visited the different diving sites in Aqaba during August and September, the time period of data collection.

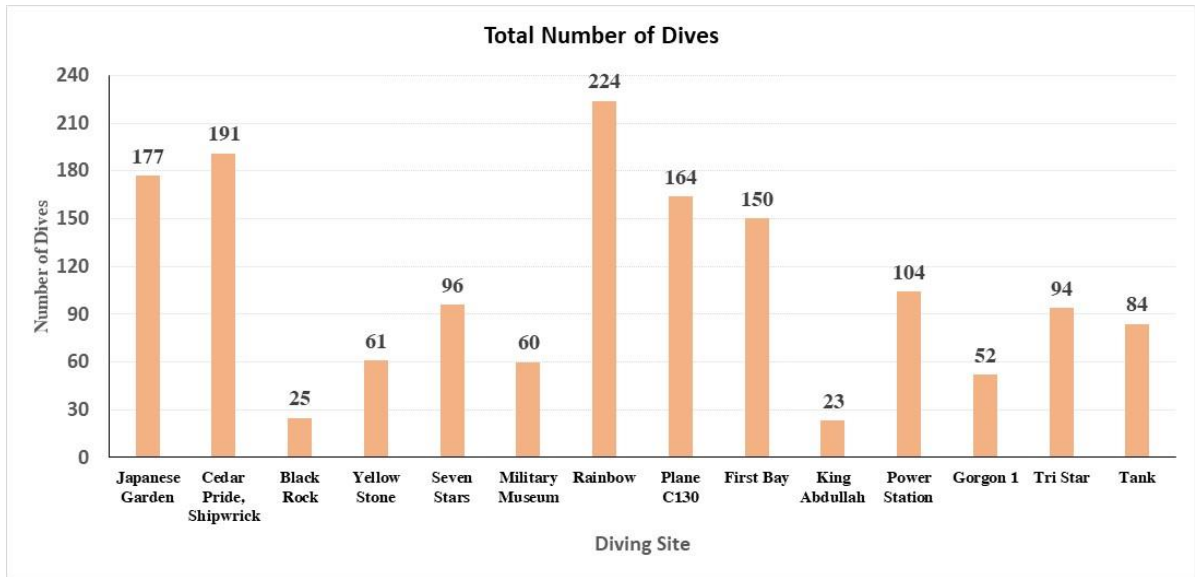


Fig. 2: The total number of dives conducted in the different diving sites in Aqaba during August and September, the time period of data collection.

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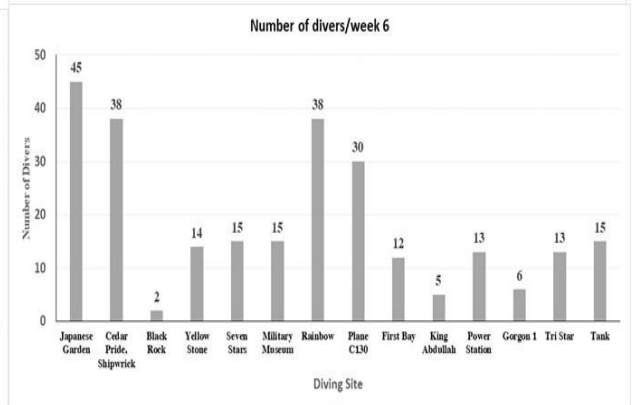
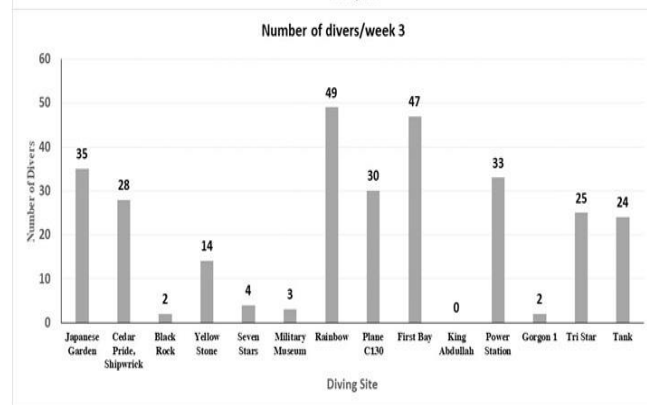
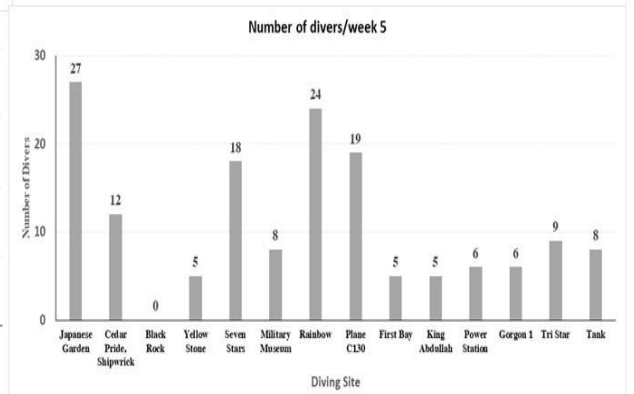
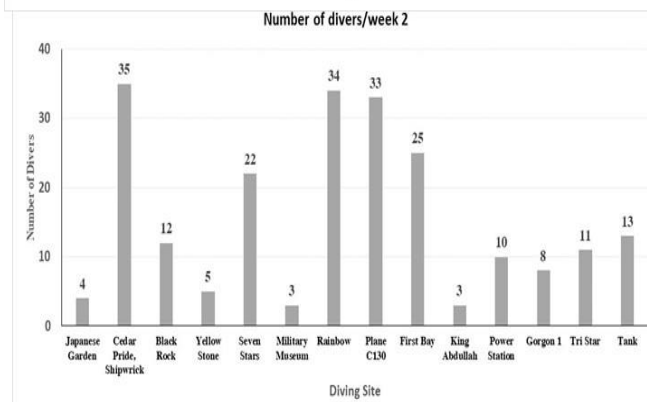
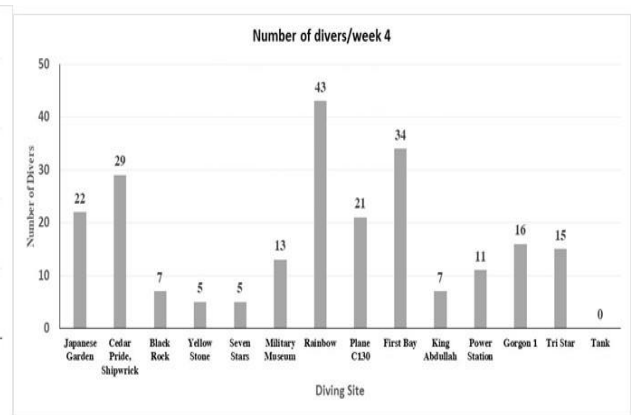
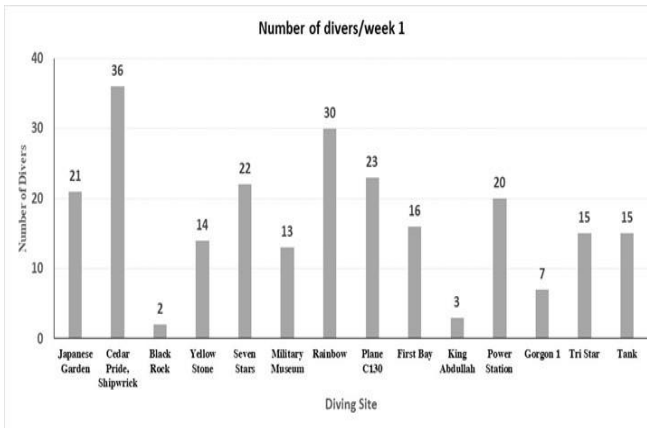


Fig. 3: Weekly variation of the total number of divers visited the different diving sites in Aqaba during August and September.

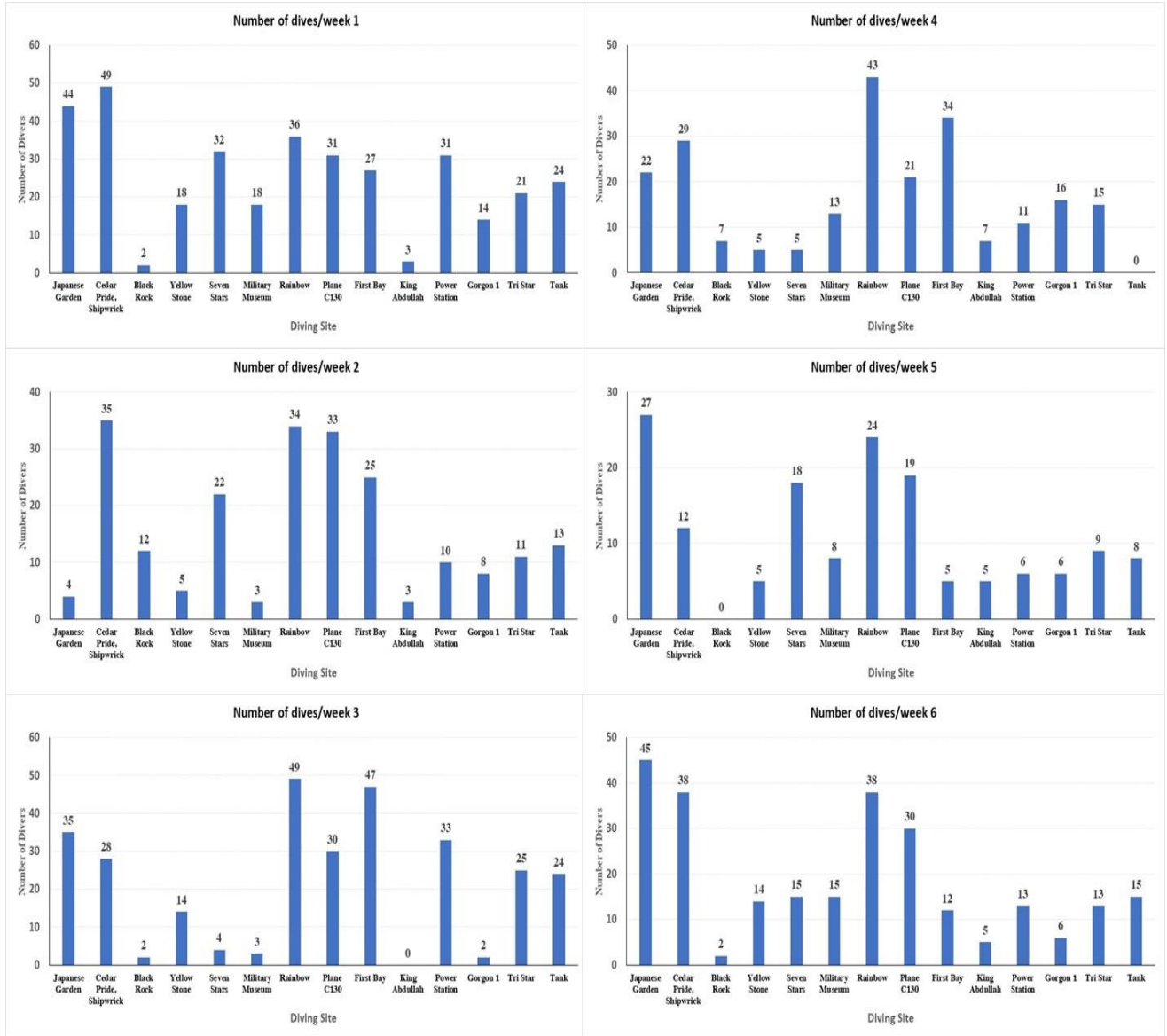


Fig. 4: Weekly variation of the total number of dives conducted at the different diving sites in Aqaba during August and September.

In addition to the number of divers and number of dives conducted, the divers' nationalities were also analyzed in order to identify the source countries of divers visiting Aqaba for diving activities. The data obtained have shown that there are 30 nationalities that were reported during the study period (Fig. 5 and Table 2).

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While analyzing the nationalities of the divers during the time period of this study, it was found that the highest number of divers came from Italy, with 306 divers. This was followed by divers coming from Jordan and Spain, with 231 and 218 divers, respectively. On the other hand, there were many countries from Europe that were represented by low number of divers such as Sweden, Belgium, Hungary, Portugal, Cyprus, Greece, Denmark among others. Also, countries from the Arabian Peninsula were represented by very few divers where only two Gulf countries were represented.

Although, the countries represented by lowest number of divers are considered rich countries, though they are major source of tourism around the world due to their high-income rates. This might suggest that those countries are not targeted by the advertisement for diving industry in Jordan. Therefore, it is highly recommended to target those countries to increase the number of visitors from such valuable countries.

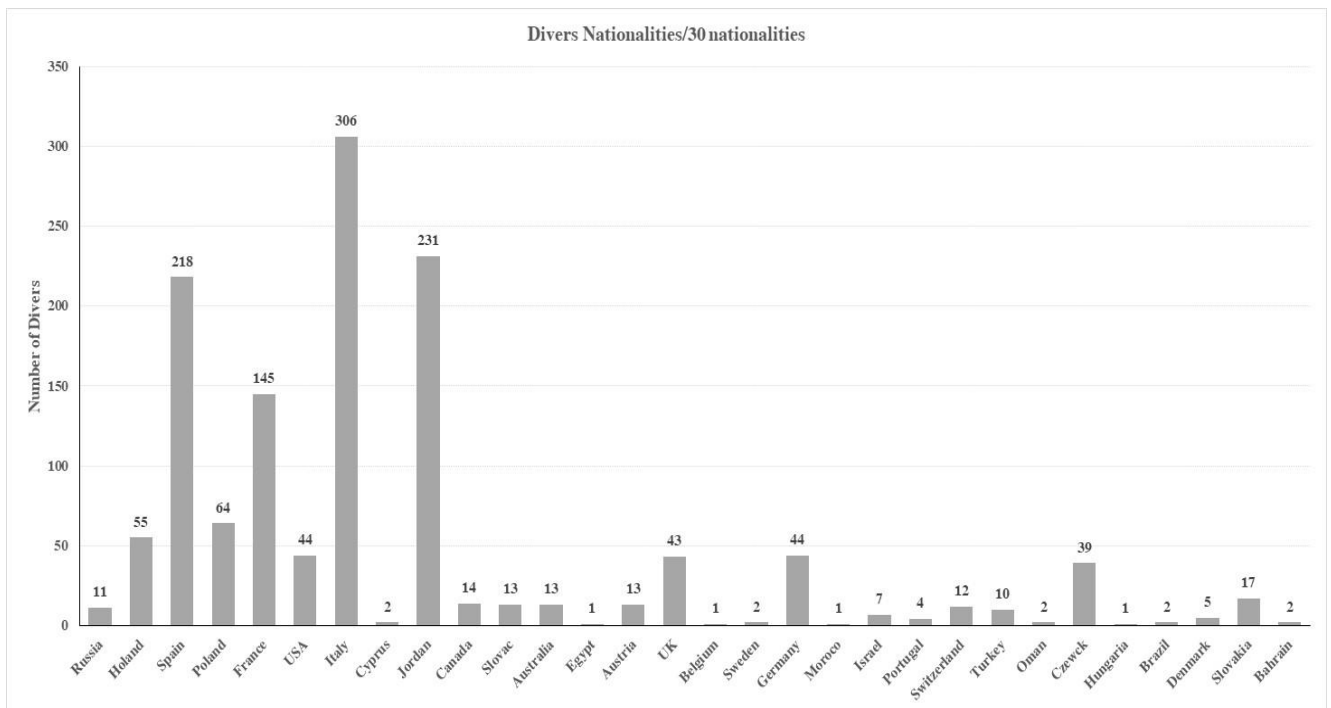


Fig. 5: Nationalities of the divers who have visited Aqaba during August and September.

Table 2: The number of divers coming from the source countries during the study period

Country	No. of Divers
Russia	11
Holland	55
Spain	218
Poland	64
France	145
USA	44
Italy	306
Cyprus	2
Jordan	231
Canada	14
Slovak	13
Australia	13
Egypt	1
Austria	13
UK	43
Belgium	1
Sweden	2
Germany	44
Morocco	1
Israel	7
Portugal	4
Switzerland	12
Turkey	10
Oman	2
Czewck	39
Hungaria	1
Brazil	2
Denmark	5
Slovakia	17
Bahrain	2

The age categories of the divers were also analyzed in order to identify the age group that are most interesting in diving. Five age categories were included in the survey. Those include the following age categories; 1. Below 15 years old, 2. 16-25 years old, 3. 26-35 years old, 4. 36-50 years old, and 5. Above 50 years old. The data obtained have shown high variation among the different age categories (Fig. 6). The highest number of



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divers were from age category 3 (i.e. between 26 and 35 years old). The next age category was category 4 (i.e. between 36 and 50 years old), which was followed by the age category 2 (16-25 years old). Ages below 15 years and above 50 years, were least represented. This analysis indicates that the most interesting age categories are the ones in the middle ages (i.e. between 16-50 years old). While, it might be important to target the other two age categories by special programs designed for those groups. Further discussions might be needed to study the needs of the age categories and then develop special programs to attract the young and old possible divers.

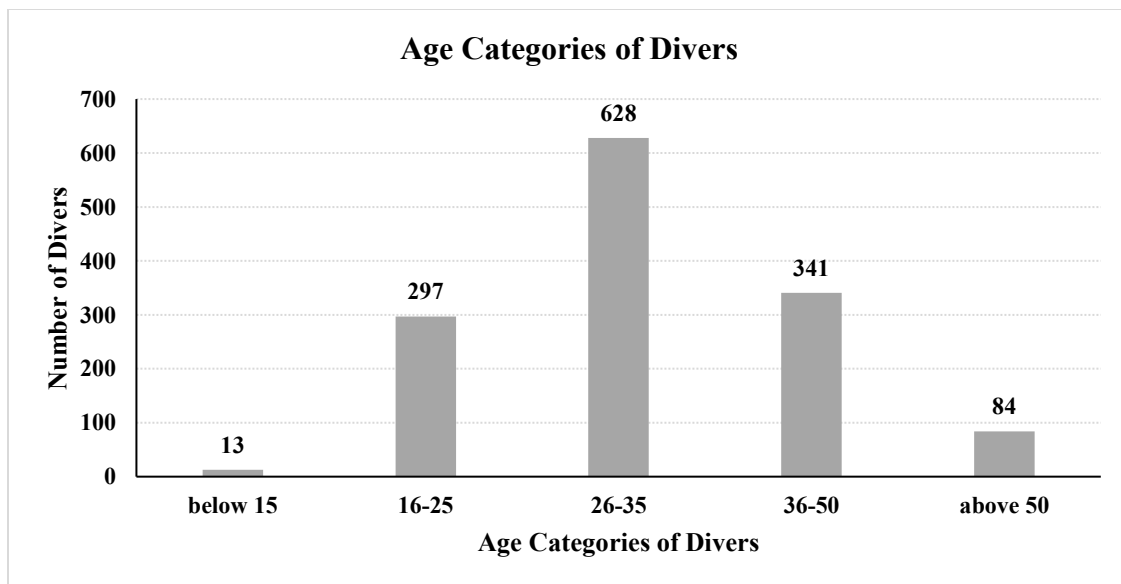


Fig. 6: Number of divers from the different age categories.

In addition to the above-mentioned criteria, the divers' diving experiences were analyzed. In this case, the divers were categorized into two main categories; the first one is the non-certified divers, which include all divers who do not hold a diving certificate, while the second one includes all other divers who are qualified divers and have diving certificates. The results obtained have shown that there diving sites that are preferred for non-certified divers, while other diving sites are more attractive for certified more



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experienced divers. For example, the Rainbow site, First Bay site, Tank site, and Japanese Garden site received more visitation by non-certified divers, while Plane C130 site, Cedar Pride Shipwreck site, Power station site, Tri star site, Military Museum, and Gorgon 1 received much higher number of certified divers in comparison with the non-certified divers (Fig. 7). The reason behind this difference among the two categories, might be due to easy access and shallow depths site that are feasible for beginner divers, while the more deep, offshore or long-distance diving sites are more attractive for more experienced divers. It is also possible that this distinction is due to the diving clubs preferences, where they prefer to take beginner divers to certain diving sites that are more suitable for beginners, where they can start and end the dive within the time limit of the capabilities of beginner divers. It might also be safer for them and can cause least environmental damages.

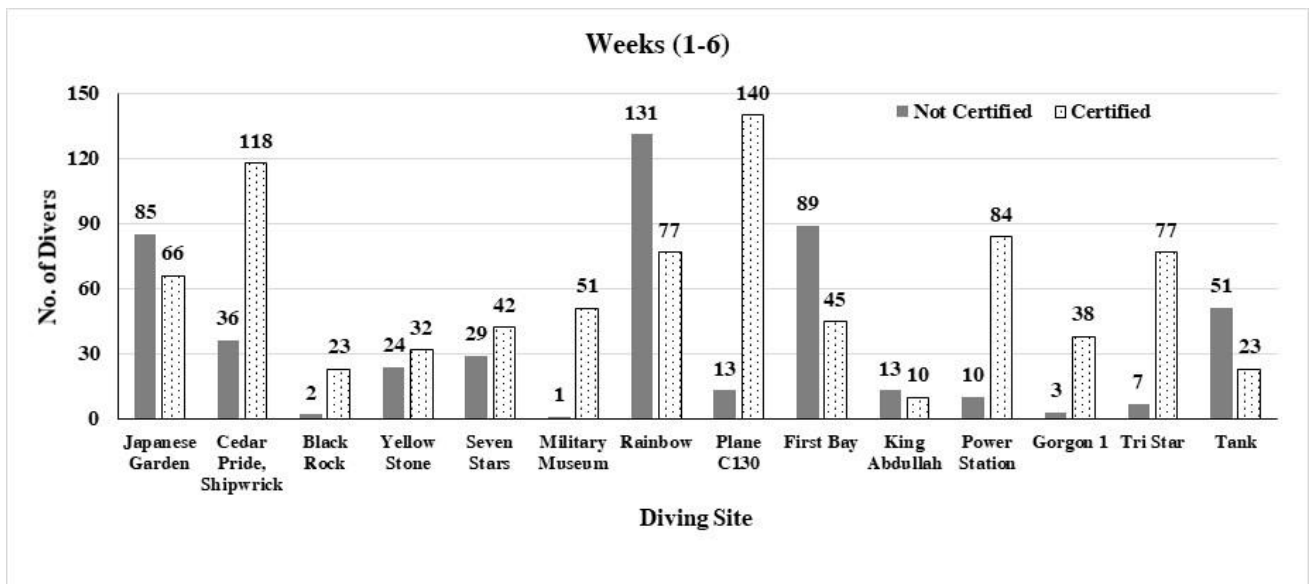


Fig. 7: Number of certified and non-certified divers visiting the different diving sites.

From the above, the following points can be concluded;

1. There are diving sites that are more attractive than others. This variation needs to be analyzed in terms of the site nature attraction, or facilities and access points present in each site. It might be wise to develop the sites that are not very attractive,



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or may be close them and start special development plan to make them more attractive.

2. There is a big gap between number of divers among the different source countries. This is a very important parameter that might reflect the weak programs presented to the least represented countries. It should be noted that such countries are known for their high tourists' sources in many countries around the world.
3. Special programs might be important to target divers from the Arabian Peninsula, especially that high number of tourists are visiting Jordan from those countries.
4. The age categories of the divers were highly variant among the different age groups. In this regard, it might be important to develop special programs for the age categories that are least represented among the divers.
5. There are diving sites that are more suitable for beginner divers, while others are more attractive for experienced divers. Criteria might depend on easiness of the dive for the beginners.

2. Reef Check Survey

Introduction

As part of a more comprehensive survey, the Aqaba Diving Association (ADA) was to conduct reef check survey in five selected sites. The sites were selected based on the interest of the client and because they represent major diving attraction for recreational divers. In the report, the reef check results will be presented for the substrate bottom habitat components as well as the indicator fish species that were identified in the manual of the reef check international for the Red Sea living biota.

Methods

Reef Check survey was carried out in five sites, according to the methods used internationally. The sites subjected to reef check survey were selected based on their importance as diving sites, which normally have high visitation rates by recreational divers. The sites are also more affected by diving stress and show some weaknesses of their coral



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reefs, some of which have more coral damage than others. The selected sites include the following diving sites; the Underwater Military Museum (C1, Fig.1), Rainbow Reef (D1, Fig.1), Cedar Pride Shipwreck (D2, Fig.1), Black Rock (C5, Fig.1), and Japanese Gardens (D3, Fig.1). The sites are continuously subjected to high pressure loads as a result of the intense diving activities.



Fig. 1: Diving sites of the Jordanian coast of the Gulf of Aqaba showing the five selected sites subjected to Reef Check survey.

In the reef check, a 100m line is laid down on the bottom substrate and the line is divided into four 20m segments with 5m gaps between them. points are sampled at each 0.5 m interval along the measuring tape to determine the substrate types on the reef (Fig. 2). The reef components included in the reef check include items that are most significant in terms of the coral reef ecosystem health and that help evaluate the status of each coral reef ecosystem surveyed. Those include ten items such as corals and other reef components (table 2).

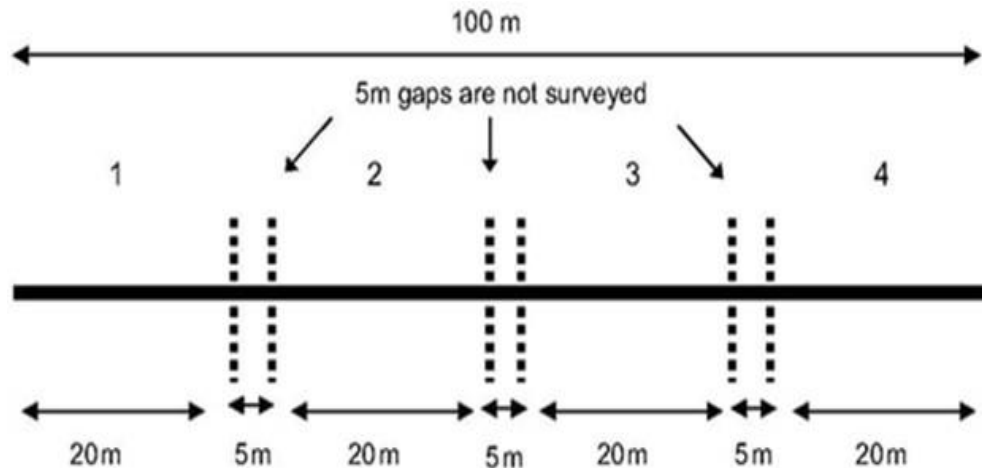


Fig. 1: Diagram of the substrate line transect to be used in reef check survey.

Table 2: Benthic Habitat Components included in the Reef Check survey

Benthic Habitat component	Abbreviation
Hard Coral	HC
Soft Coral	SC
Recently Killed Corals	RKC
Algae	AG
Sponge	SP
Rock	RC
Rubble	RB
Sand	SD
Man Made Object	MM
Others (invertebrates)	OT

The reef check was also applied to study the fish community in the five selected sites, where eight fish species (listed in the Reef Check official site for the monitoring of the red Sea area) were surveyed (Table 2).

Table 2: Fish species included in the Reef Check survey in the study sites.

Butterflyfish
Haemulidae
Broomtail wrasse
Humphead wrasse
Bumphead parrot
Parrotfish
Snapper
Moray eel

The line transects used for the study of the bottom substrates were used to conduct the survey study of the fish species.



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The study team who conducted the reef check field survey included the following personnel; Omar Al-Momany, Al-Waed AlMaaytah, Fares Abu Mahfouz, Amwaj Hamada, and Mohammad Awartani. All of them are certified reef check monitoring individuals.

Results and Discussion

The results obtained for the reef check survey conducted in the Black Rock diving site are presented below. The line transect was laid at 12m depth parallel to the shoreline. The data for the bottom substrate showed that this site has 13% hard coral cover and 18% of the bottom was covered by soft corals. In total, the corals (both types) constituted 31% of the bottom substrate (Fig. 2). The remaining of the bottom habitat was occupied by Rocks and Sand components, which had 33% cover percentage for each. The results obtained indicate that this site is a coral reef site, although the cover percentage is relatively moderate in comparison with other common reef sites. The results may change if more reef check surveys are conducted in the site since this is a one-transect line in one spot that was conducted.

Regarding the fish survey, the most common fish that was recorded in the site was the Butterfly fish, which had an average of 30 fishes. The fish species reported Broomtail wrasse, Parrotfish and snapper with average of 0.5, 1 and 1 for each fish, respectively (Fig. 3).

Mean Percent Cover Of Substrate for Black Rock site

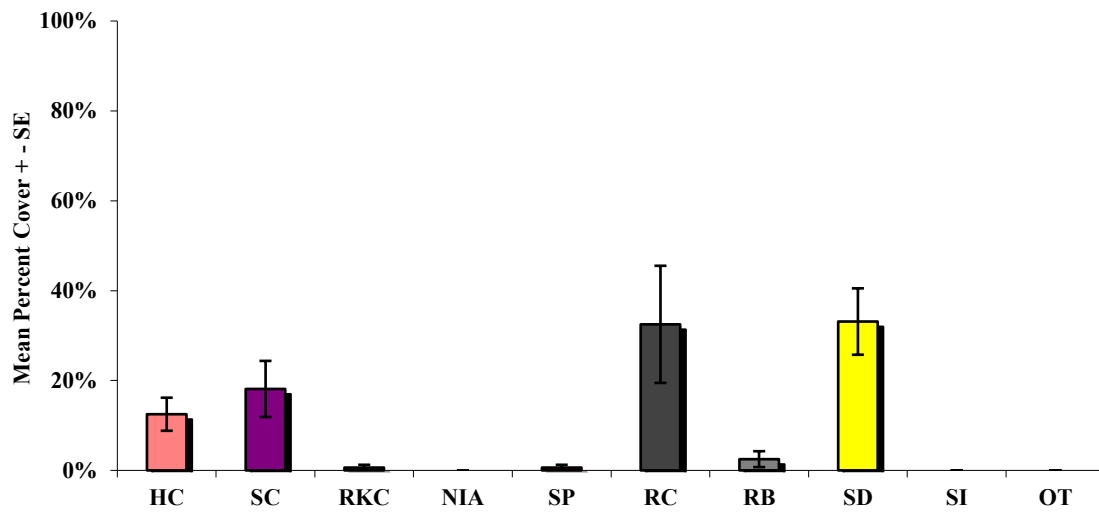


Fig. 2: Bottom habitat components in the black rock site.

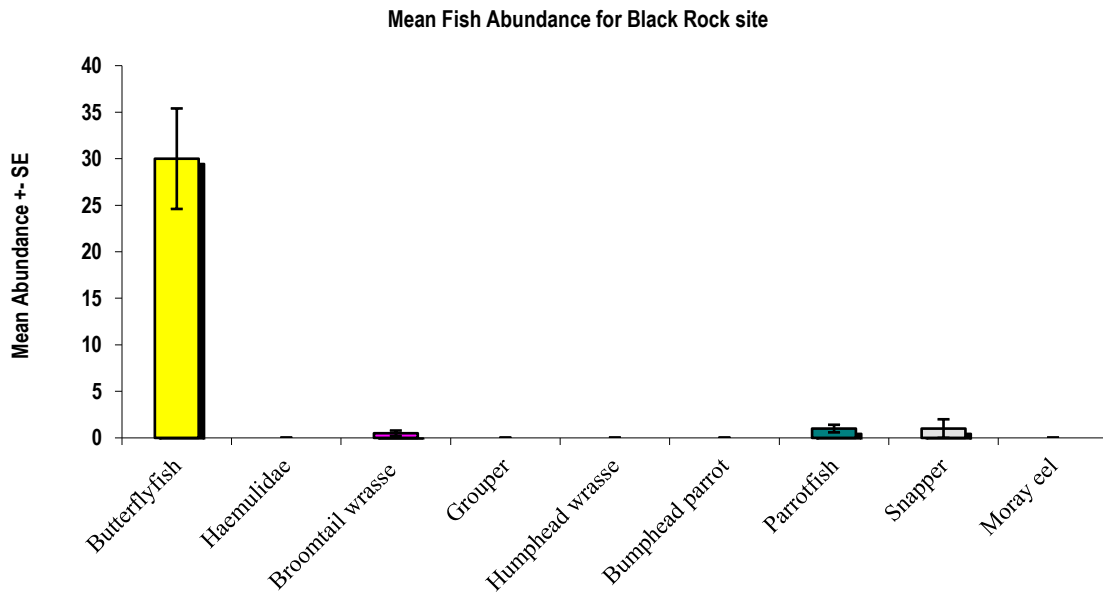


Fig. 3: Average fish species in the black rock site for the indicator fish species surveyed.

The results obtained for the reef check survey conducted in the Cedar Pride Shipwreck diving site are presented below. The line transect was laid at 9.5m depth parallel



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to the shoreline. The data for the bottom substrate in the site showed that the hard corals constituted 13% of the bottom habitat, with the soft corals covered only 3% of the bottom (Fig. 4). In this site, the component named NIA, which represents algae had high percent cover with 44%. This component indicates a high algae cover, which might be due to high percentages of nutrients in the water. Further water analysis is needed to verify this notion.

The most abundant fish species reported in this site was also Butterfly fish, which had a mean of 15.75 fishes. Other species reported include Broomtail wrasse, Grouper, Parrotfish and Moray Eel, which all had a mean value of less than 1 (Fig. 5).

Mean Percent Cover of Substrate for Cedar Pride site

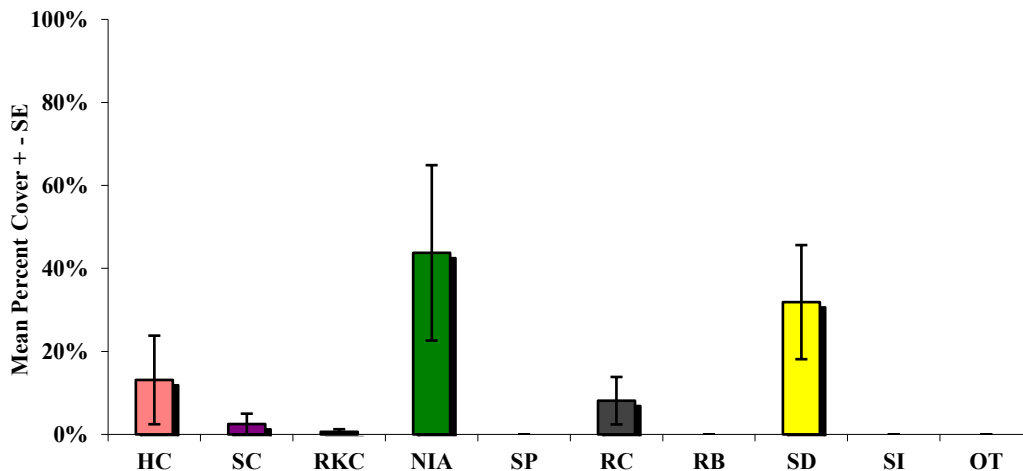


Fig. 4: Bottom habitat components in Cedar Pride Shipwreck site.

Mean Fish Abundance for Cedar Pride site

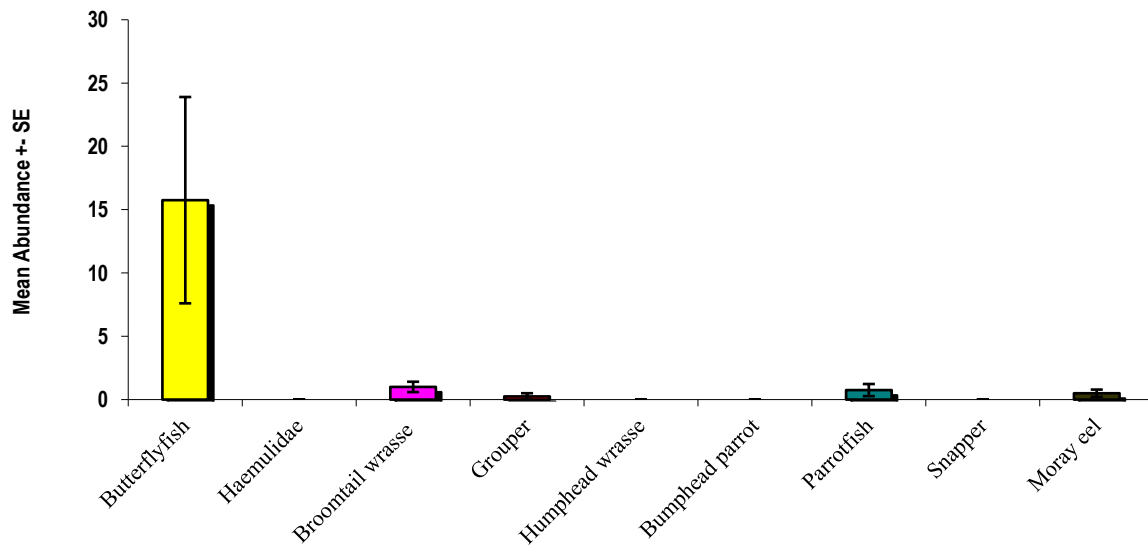


Fig. 5: Average fish species in the Cedar Pride Shipwreck site of the indicator fish species surveyed.

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The results obtained for the reef check survey conducted in the Japanese Garden diving site are presented below. The line transect was laid at 7m depth parallel to the shoreline. The data for the bottom substrate in the site showed that there is relatively high percent cover of hard corals in this site with an average of 28% cover with only 15 covered by soft corals (Fig. 6). This result indicates that this site is a rich coral reef site. The rock and rubble components, which represent corals that have died long time ago covered about 41% of the bottom habitat. This indicates that there were some impacts that have affected this site in the past and cause death of plenty of coral colonies. The recently killed corals did not have high percent cover, which indicates that there no recent negative impact in the past months.

The most abundant fish species reported in this site was Butterfly fish, with high mean value close to 40 fishes. The other fish species reported include Broomtail wrasse, Grouper, Parrotfish, Snapper and Moray Eel had a mean value of less than 2 (Fig. 7).

Mean Percent Cover of Substrate for Japanese garden site

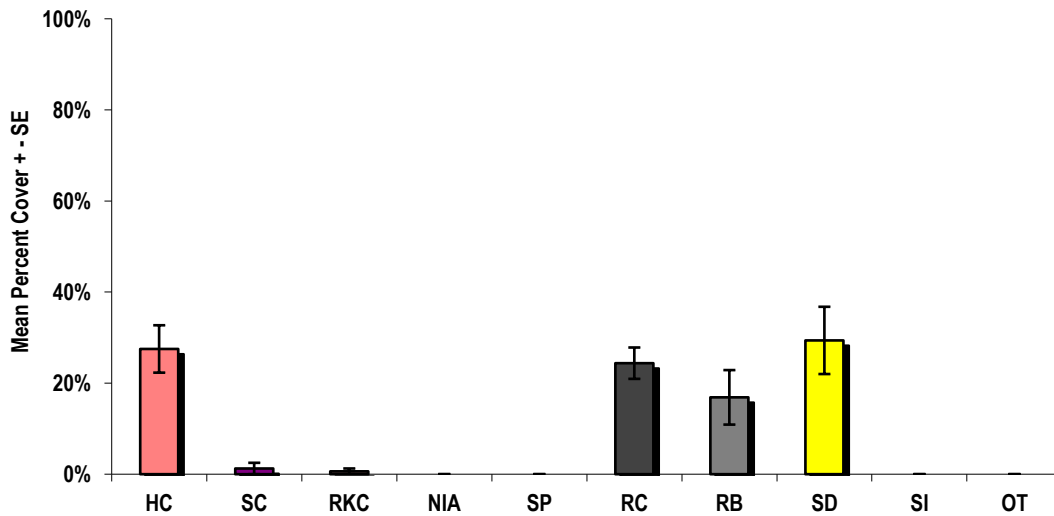


Fig. 6: Bottom habitat components in Japanese Garden site.

Mean Fish Abundance for Japanese Garden site

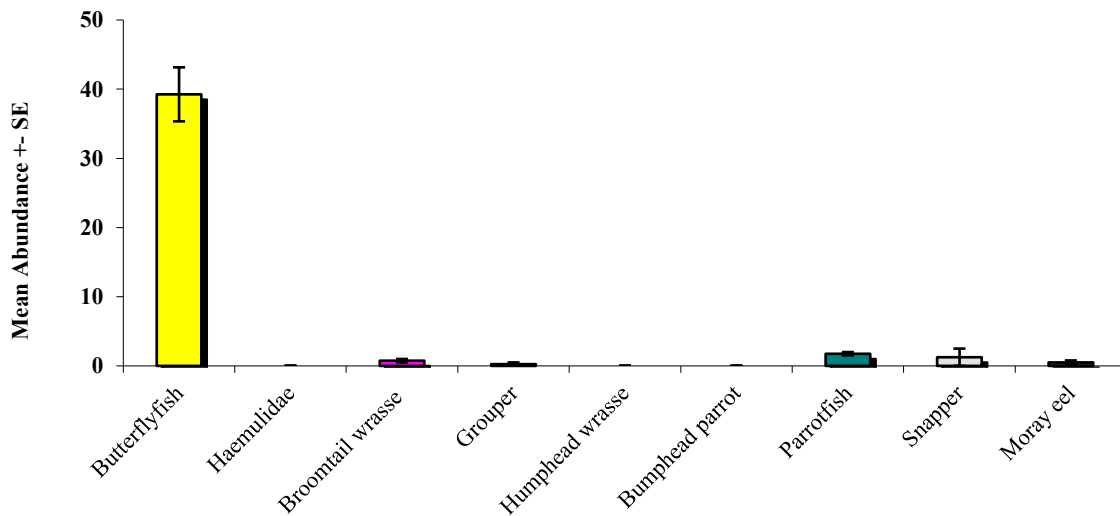


Fig. 7: Average fish species in the Japanese Garden site of the indicator fish species surveyed.

The results obtained for the reef check survey conducted in the Underwater Military Museum diving site are presented below. The line transect was laid at 14m depth parallel to the shoreline. In this site, the hard corals covered an average of 13% of the bottom surface, while the soft corals covered 11% of the bottom, with a total of 24% of the bottom



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habitat covered by corals (Fig. 8). This percent cover of corals, qualify this site to be a relatively good coral reef site, though it has moderate amount of coral cover. Apart from this, the site seems to be suffering from impacts that lead to death of corals. This is indicated from the relatively high percent cover of recently killed corals, which had about 6% cover. This is high percent in comparison with the other studied sites. This result indicates that this site is a rich coral reef site. The rock and rubble components, which represent corals that have died long time ago covered about 21% of the bottom habitat indicating high turnover of the corals in the site. The algae had 4% cover, which could be the reason for the high percent cover of recently killed corals. The site has also relatively high percent cover of sponges, with an average of 11% cover. This component is a healthy indicator for the site, because sponges are responsible for the filtering the seawater from suspended particles. This also explains the reason for the high percentage of algae in th site as nutrients encourage algal growth.

The most abundant fish species reported in this site was Butterfly fish, with a value 6 fishes. The other fish species reported include Haemulidae, Broomtail Wrasse, Grouper, Parrotfish, and Moray Eel (Fig. 7). The diversity in the site is slightly higher than the other sites included in this study. This is well known for sites with artificial substrates deployed in it.

