

## MARINE AND DIVING CENTER

Lujain Saad Al-Umran<sup>1</sup>, Mohammed Fekry<sup>2</sup>, Marwa Abuhassan<sup>3</sup>

<sup>1,2,3</sup>College of Architecture and Design, Effat University, Qasr Khuzam St., Kilo.2, Old Mecca Road. P.O.BOX 34689, Jeddah 21478, Saudi Arabia

E-mail: [lalumran@effatuniversity.edu.sa](mailto:lalumran@effatuniversity.edu.sa), [mfekry@effatuniversity.edu.sa](mailto:mfekry@effatuniversity.edu.sa)

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### Abstract

The marine and diving center consider as a new product for the community that can bring a new approach which aims to conserve the marine environment, conduct research, encouraged to develop the knowledge of marine sciences and underwater ecosystems and make diving activities possible, easier, safer and more comfortable where the whole family can go and enjoy a whole day or even a weekend. Several case studies were conducted for idea development and design consideration. The defined zones of the proposed project are marine research center, diving center, yacht club and fishing marina, administration, and services. The criteria used for site evaluation are site location, sea accessibility, shape/proportional, topography, noise level, visual quality, visibility, surrounding, view, and future development. The chosen site is located at north Obhur - Alzomord districts. This project provides space for various types of resources and references and makes them easily accessible to the public and space users and marine ecosystems for research and education.

**Keywords**--Marine, Diving Center, Environment, Underwater Ecosystems, Knowledge

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### INTRODUCTION

In the 1970s, environmental research into the life of the sea was attempted at institutions set up particularly to study marine science [1, 2]. Notable was the Woods Hole Oceanographic Institution in America, which built up a model for other marine research laboratories subsequently set up far and wide the world [3, 4]. Previously, the investigation of sea life science has been limited by an absence of technology as researchers could only dive so deep to analyse life in the ocean. Before the mid-twentieth century, the deep-sea base couldn't be seen unless one dug a bit of it and brought it to the surface. This has changed significantly because of the development of new technologies in both the laboratory and the vast ocean.

These new technological advancements have enabled researchers to investigate parts of the sea they didn't even know existed. The improvement of scuba outfit enabled researchers to visually investigate the seas as it contains an independent underwater breathing apparatus enabling a person to inhale while being submerged 100 to 200 feet into the sea [5, 6]. Remotely operated underwater vehicles (ROV) are currently used with and without submersibles to see the deepest zones of the sea that would be excessively hazardous for people [7]. ROVs are completely equipped with cameras and sampling equipment which enables specialists to see and control everything the vehicle does. ROVs have turned into the predominant sort of technology used to see the deepest parts of the sea [8].

The southern Red Sea is among the wealthiest and most copious of marine environments, due in substantial part to the more than 250km of coastal fringing reef [9]. Underwater Tropical Forest is what the Red Sea is referred to; with its magnificent marine life and splendid unique coral reefs. The underwater eco-system of the Red Sea is home to over 300 species, 1200 species of fish, marvellous vegetation, and coral reefs of hundreds of years old that lies along the Saudi shores and coastlines, 10% of which are found nowhere else in the world [9]. Therefore the Red Sea in Jeddah has enhanced its tourism, also have been able to preserve aquatic life and coral reefs which are a must see and not to be missed. Because of the wonderful rich underwater life, Jeddah present the best scuba diving and marine sites in Saudi Arabia.

### CASE STUDIES

The case studies analysing the similar project that related to marine and diving center. The case studies cover the scopes of marina research center, yacht club and aquarium, which will helps finding the project's requirements. The case studies are:

- Ocean Discovery Centre, Nanaimo, BC
- Marine Research Centre, Bali
- Dubai Maritime Museum & Research Center, UAE
- Yas Island Yacht Club, Abu Dhabi
- Antalya Aquarium, Antalya, Turkey

#### Ocean Discovery Centre, Nanaimo, BC

The designer of the Ocean Discovery Centre is Checkwithch Poiron Architects Inc. (Figure 1). The Ocean Discovery Center will empower a positively affect people's understanding and become aware of how to use our seas and more connection with earth's environment. The facility will be an inspiring collection of interactive displays, submersibles and IMAX experiences displaying the history, the present, and revealing the future of sea environment and sustainable technologies [10].

The Ocean Discovery Center is a community gathering place that tells the story of the evolution of deep-ocean exploration and innovation that has been developed in British Columbia and how it has changed the world. The Ocean Discovery Center is an educational and entertaining destination for local residents and tourists alike where each visit is guaranteed to provide a new and extreme discovery of what is under the ocean.

#### Marine Research Centre, Bali

Marine Research Centre is designed by solus4 (Figure 2). A 2500-square-meter Marine Research Center is one hundred meters away from the shore of Kuta Beach, Bali, Indonesia. The center is made out of three fundamental segments: private, semi-public and public [11]. The spaces vary from researcher rooms, underwater labs and an aquatic garden to a sea water pool, swimming pool terrace, auditorium and bar. The spaces are situated above and beneath water to enable researchers and visitors to take full advantage of the stunning scene that surrounds the project.

The design utilizes the underlying elliptical manner and cross section graph of the tsunami wave, one concentration of the centre's research and prevention efforts, as the morphology generators and guides of programmatic organization. The design is both aesthetically imposing and seamlessly adapts into its aquatic natural habitat [11]. Therefore, the structure is a fluid structure with a direct and immediate visual connection with the outside. The research center will serve not only as an architectural icon for Bali but also international model of on-site renewable energy resources for modern sustainable design.

#### Dubai Maritime Museum & Research Center, UAE

Dubai Maritime Museum & Research Center is designed by Niko Kapa (Figure 3). The building is an extension of the city to the sea and vice-versa, relating to both the ocean and the city and in a constant dialogue between them. Considered as a continuation and a transition via the wide public area, the building dives into the sea and integrate with it. It develops as a triangular sharp shape, which concentrates the public routes to the museum, through an inviting form that attracts visitors to the welcoming area and distributes them to the indoors [12].

The building itself is an artifact, an artificial underwater environment organized under an huge glass roof that has been designed to be able to give the maximum view of the sea and intensify the feeling of diving into the seabed [12]. The building is simultaneously a vessel that shores the concept of the adventure. Indoors space is organized through cascading platforms that develop in a successive and non-stop manner, allowing visitors to have a wide view and clear overview of the whole interior, under a "water roof". Generous inner height allows the perception of large interior views and the display of artifacts of significant scale [12]. Since seawater temperature is at all-time lower than the ambient temperature, placement of the building underwater allows reducing energy strain on the mechanical systems used for cooling. Overall organization act according to a triangular grid, which defines the functional and the main morphological aspects of both landscape and building.

#### Yas Island Yacht Club, Abu Dhabi

Yas Island Yacht Club is designed by Omiros One Architecture (Figure 4). The project includes various Five-star club uses within high quality modern interiors containing lounges, restaurants, function rooms, bars, outdoor deck space and associated administration, retail store and car parking lots. The architect Mr. Omiros Emmanouilides characterizes the design concept as "a composition of dynamic and fluid forms that link the buildings to the nautical theme" [13]. The two main buildings sculpted shapes are reflected in a combination of surrounding water features set into a lush garden landscape. A matrix of crystal LED façade lights merged into the exterior shells enable their transformation into giant pixelated viewing screens against the night sky.

#### Antalya Aquarium, Antalya, Turkey

Antalya Aquarium is designed by BKA / Bahadır Kul Architects (Figure 5). The main objects of Antalya Aquarium project are specified with desire of creating harmony with topography. The aim of the client of the aquarium project is one of the recreational places of Antalya cost. So that, they drive Project design phases as building has the multi-functional interior and exterior volumes and the quality of longer tunnels. Antalya Aquarium offers inspiration, entertainment and education all at once [14].

The main concept of aquarium design is turning upside down the relationship of ground and underwater level [14]. Besides, topography led to create underground volumes. A shaded public area is formed by pulling back of the ground floor. This shaded public area is the point of gathering approach and diffusion of the aquarium project. Also the shell of this area defines the

information and fast-food spaces, amphitheatre and the box office with its curves and waves. The entrance area is the most characteristic part of the project; it has the feature of wave.

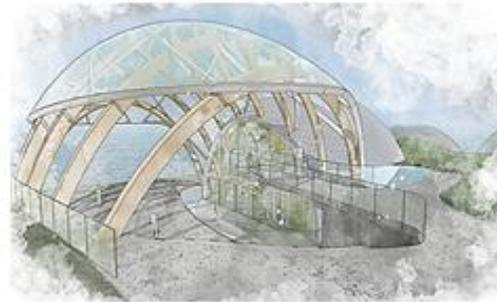


Figure 1. Ocean Discovery Centre, Nanaimo, BC [10]



Figure 2. Marine Research Centre, Bali [11]

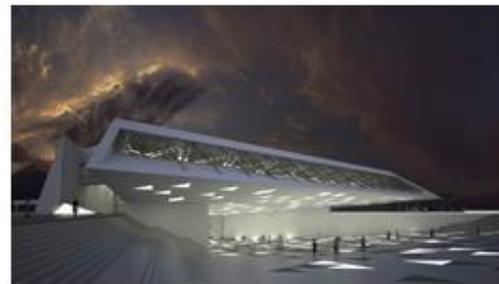


Figure 3. Dubai Maritime Museum & Research Center, UAE [12]



Figure 4. Yas Island Yacht Club, Abu Dhabi [13]



Figure 5. Antalya Aquarium, Antalya, Turkey [14]

**SPACE PROGRAM**

Figure 6 demonstrates the bubble diagram of the program. There are five main zones namely marine zone, diving zone, yacht club and fishing marina, administration and services zone. Each of the zones consists of its own facilities and services. The marine zone consists of library, laboratory, classroom, researcher bedroom, and lecture hall. The diving zone consists of aquarium, filling station, rental equipment, clinic, and equipment trial. The yacht club and fishing marina consists of VIP area, restaurant, rental office, fishing equipment shop. The administration zone consists of offices, trader office, event organizer, and meeting room. The services zone consists of maintenance, shops, and prayer hall.



**Figure 6.** Bubble diagram

Table 1 and Table 2 tabulated the space program and occupancy load calculations respectively. The overall project area is based on the project's area calculations, were the buildable area in total is 8,692 m<sup>2</sup>, 40% of the entire project's area, and it contains the marine research center, diving center, yacht club and fishing marina, administration and other services and facilities, while the unbuildable area contains both parking spaces and outdoor recreational areas, with a total space of 13,308 m<sup>2</sup>, which is 60% of the entire project's area. The expected users are approximately 3231 users. The parking calculation is demonstrated in Table 3 and it's occupied about 4687.5m<sup>2</sup>.

**Table 1.** Space program

Types	Zones	Percentage (%)	No. of Floors	Net Area (m <sup>2</sup> )	GF A (m <sup>2</sup> )	Footprint (m <sup>2</sup> )
Buildable	Marine research center	21.7		2274	2615	1307
	Diving center	37		3880	4500	2250
	Yacht club and fishing marina	33.6		3532	4200	4200
	Administration	4.4		466	536	536
	Services	3.3		347	399	399
<b>Subtotal</b>		<b>100</b>		<b>10499</b>	<b>12250</b>	<b>8692</b>
Unbuildable	Parking					4687.5
						5

Outdoor or recreational area	8620.5
<b>Subtotal</b>	<b>13308</b>
<b>Total project area</b>	<b>22000</b>

**Table 2.** Occupancy load calculations

Space program	Expected users
Marina research center	
Researchers	136
Students	80
Visitors	332
Diving center	500
Aquarium	953
Yacht club and finishing marina	793
Restaurant	222
Employees	215
<b>Total (Approximate)</b>	<b>3231</b>

**Table 3.** Parking calculations

Facility	Standards	No. of Parking Lots	Area (m <sup>2</sup> )
Parking for researchers	1/3 researchers	45	562.5
Parking for students	1/3 students	26	325
Parking for visitors	1/40 m <sup>2</sup>	233	2912.5
Parking for employees	1/3 employees	71	887.5
<b>Total</b>		<b>375</b>	<b>4687.5</b>

**SITE SELECTION AND ANALYSIS**

There are two sites from Jeddah were proposed for site selection. Figure 7 shows site 1 located in north Obhur - Alzomord districts, along with Prince Abdullah AlFaisal Street. The site located close to fisheries research center and thahban fishing. Figure 8 shows site 2 located in Northern Cornish, Alshatea districts along AlCornish road. The site located near to the red sea mall and Atallah happy land.



**Figure 7.** Site 1 [15]



Figure 8. Site 2 [16]

There are several criteria that considered for this project, namely accessibility, site location, sea accessibility, shape/proportional, topography, noise level, visual quality, visibility, surrounding view, and future development. Each criterion is rated with the weighting factor from 1 to 3, where 1 is less important, 2 is average and 3 is very important. The site evaluation result is shown in Table 4.

Table 4. Site Evaluation

Criteria	Weighting factor	Site 1	Site 2
Accessibility	3	12	15
Site location	3	15	12
Sea accessibility	3	15	15
Shape/proportional	3	15	12
Topography	1	5	5
Noise level	2	10	10
Visual quality	2	8	8
Visibility	3	15	15
Surrounding	2	10	8
View	3	12	15
Future development	2	10	8
<b>Total</b>		<b>127</b>	<b>123</b>

According to the site comparison evaluation shown in Table 4, site 1 appeared to have the highest total scored which make it the best adequate site for the project. The selected site is located in the continent of Asia, Saudi Arabia. Western Region, Jeddah. It is located in north Obhur - Alzomord districts, overlooking the open sea, with latitude of 21°48'11.46"N, and longitude 39°1'46.77"E. The total area of the selected site is 22,000 m<sup>2</sup>.

Regarding the site's regulations, multiple uses are allowed in these areas such as residential, commercial, administrative, and tourist. Secondly, the gradation of elevation from the main road down to the sea should take into consideration. Next, about 50% of the waterfront is connected visually and directly to the main road (not built). About 30% of the depth of the land shall be left in an open area not exceeding 15 m. A pedestrian walkway shall be established on either side of the project at least 10 m from the main street and up to the open area to the public by the sea. Public parking is provided at the side of the pedestrian walkway. The major roads that connected to the site are King Saud Road and Prince Abdullah AlFaisal Road, while the secondary road is Prince Abdulmajeed Road. The site landmarks are Lack City, Indigo Beach Resort and La Fontaine Resort which located along the corniche.

Regarding the climate analysis of the site, July is the hottest month in Jeddah with an average temperature of 39°C (102°F). The coldest is February at 17°C (63°F). The average temperature throughout the year typically varies from 23°C to 39°C. The

clearer part of the year in Jeddah begins around mid-October and ending around early July. On end of September, the cloudiest day of the year, the sky is overcast or mostly cloudy 48% of the time, and clear, mostly clear, or partly cloudy 52% of the time. The earliest sunrise is at 5:39 AM on early June, and the latest sunrise is 1 hour, 24 minutes later at 7:03 AM on mid-January. The earliest sunset is at 5:39 PM on end of November, and the latest sunset is 1 hour, 30 minutes later at 7:09 PM on early July. The muggier period of the year lasts for 8.2 months, from early April to mid-December, during which time the comfort level is muggy, oppressive, or miserable at least 38% of the time.

The muggiest day of the year is early September, with muggy conditions 91% of the time. The least muggy day of the year is end of January, with muggy conditions 21% of the time. The windiest day of the year is mid-June, with an average hourly wind speed of 10.6 miles per hour. The calmest day of the year is mid-October, with an average hourly wind speed of 7.7 miles per hour. The time of year with warmer water lasts for 4 months, from early July to early November, with an average temperature above 86°F. The day of the year with the warmest water is mid-August, with an average temperature of 88°F. The time of year with cooler water lasts for 3 months, from mid-January to mid-April, with an average temperature below 80°F. The day of the year with the coolest water is mid-February, with an average temperature of 78°F.

**ZONING AND PROJECT DESIGN**

Figure 9 and Figure 10 demonstrate the site zoning and site master plan. The design concept is shown in Figure 11. The Philosophy behind designing the marine and diving center is to create a new approach relates to people's search for new experiences to discover the underwater and see the greatest variety and diversity of the red sea marine life. It will be both educational and entertainment building. Therefore, it will attract scientists, researchers, student, elders and teenagers. The underwater part consists of research lab, classroom and lecture hall, gallery and aquarium, to let people enjoy viewing marine life from a safe distance. All the adventure start at the water level part that consists of the diving zone which will serve all what you are looking for and more to begin you unforgettable experiences trip to the underwater, also have the fishing area and yacht club. Figure 12 shows the main perspective view of the project.

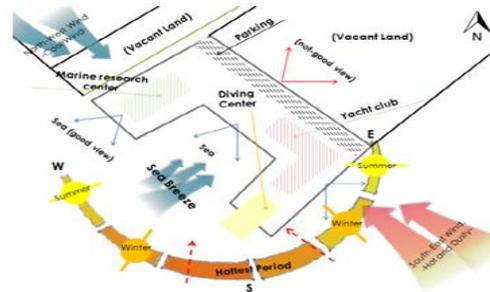


Figure 9. Site zoning



Figure 10. Site master plan

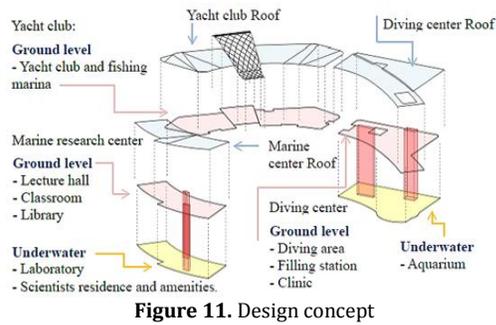


Figure 11. Design concept



Figure 12. Main perspective view

## CONCLUSION

This project aims to be the world leader and the best option in marine sciences, research, recreational scuba diving, fishing and boat trips. The main zones that considered in the project are marine research center, diving center, yacht club and fishing marina, administration, and services. The selected site for the project is located at north Obhur - Alzomord districts based on the evaluation criteria of accessibility, site location, sea accessibility, shape/proportional, topography, noise level, visual quality, visibility, surrounding, view, and future development. The proposed project provides activity and exploring the underwater world with passion through research in all aspects of marine sciences, diving, fishing and boat trips with the highest possible world class standard of training, safety, and customer service for interesting enjoyable experience.

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