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Distribution and status of seagrass beds around Hurghada area, Red sea, Egypt

Eslam Osama, Abdel Kader M. Hassan and Mohamed M. Abou Zaid

Marine Biology & Ichthyology Section, Zoology Department, Faculty of Science, Al-Azhar University, Cairo, Egypt.
Email: *eslam_16884@hotmail.com*

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Abstract

The present work includes the results of a field survey conducted to investigate the distribution and status of the seagrass beds on the coastal area facing Hurghada city along the Egyptian Red Sea coast during the period from April to May 2007. The surveyed area was about 40 km^2 and located between 27° 30̀ 482̋ E 33° 75̀ 4839º N and 27° 08̀ 8756̋ E 33° 85̀ 5422̋ N. The results of the survey indicated that seagrass beds in this area were in a form of monospecific (3 Locations) or mixed beds (9 Locations) ranged between 0.5 to about 15 m deep. In addition, only seven species of seagrasses were recorded in the area. Seagrass coverage also showed wide range between 50% at South Hurghada to 85% in most studied locations. The average biomass of seagrasses in the studied locations ranged between 9.1 $gdwm^{-2}$ at Northern shoreline site to 458.6 $gdwm^{-2}$ at the offshore islands sites. Results of mechanical soil analysis indicated that, seagrasses grow preferably in bottom sediment containing high amount of sand and also sometimes silt with low gravels and clay percentages in soil structure. A comparison has made between using the supervised and unsupervised classification of the satellite images for the determination of the distribution of seagrasses beds in the area. The matching of the data obtained from the survey to the image analysis indicated that unsupervised classification was the most accurate method especially during high number of shades to predict the seagrass beds around Hurghada. Unsupervised classification indicates that the seagrass bed sizes valuated by about 1.96 km^2 mainly located offshore around Abo Monkar and Gifton islands.

1-Introduction

Seagrasses are marine flowering plants, which exist their entire life submerged in seawater including underwater flowering, pollination, distribution of seeds and germination into new plants (Hemminga and Duarte, 2000). The 60 known species of seagrasses worldwide are divided into 12 genera belonging to five families Hydrocharitaceae, Cymodoceaceae, Posidoniaceae, Zosteraceae and Ruppiaceae (Short *et al*., 2007).

Seagrass community is among the most productive autotrophic communities on the planet (Hillman *et al*., 1989; Duarte and Chiscano, 1999). The ecological functions associated with seagrasses include nutrient recycling, detritus production and export, sediment stabilization and providing of optimal habitat for growth, survival and reproduction of a diverse array of vertebrate and invertebrate taxa (Heck *et al*., 2003). It was also evident that seagrass high biomass and production are directly linked with their important role in the ecosystem (Klumpp *et al*., 1992)

Recently, among the scientific community, attention has been paid to the coastal ecosystems which provide services and are adversely affected by a wide variety of human activities. Among those ecosystems are the seagrass meadows that are negatively affected by anthropogenic impacts. Global assessment of seagrass meadows lost during the last two decades indicated 29% loss in total coverage (Hughes *et al.,* 2009**).** This loss will cost the world important ecosystem services, including an estimated 1.9 trillion $ per year in the form of nutrient cycling; an order of magnitude enhancement of coral reef fish productivity; a habitat for thousands of fish, birds, and invertebrate species and a major food source for endangered dugong, manatee, and green turtle (Waycott *et al*., 2009).

The systematic lists of the seagrass species of the Red Sea over the last decade included twelve species recorded from different areas on the coast. These records differ according to the area not only from eastern to western coasts but also from north to south (Aleem, 1979 and 1984). The most common species appeared in all lists were *Halophila stipulacea, Thalassodendron ciliatum, Halodule uninervis, Syringodium isoetifolium* and *Halophila ovalis*. Both *Halophila stipulacea* and *Thalassodendron ciliatum* have the greatest vertical distribution extending from the lower shoreline to at least 70 m depth, while *Halodule uninervis* from extreme low-water level to at least 40 m depth (Lipkin, 1979). The remaining species are restricted to seabed under lesser than 10 m deep. Recently, six species belonging to five genera of seagrasses were identified by Geneid, (2009) along Egyptian Red Sea coast (*Halodule uninervis, Halophila* *stipulacea, Halophila ovalis, Thalassia hemprichii, Thalassodendron ciliatum and Syringodium isoetifolium*).

Despite the extensive growth of seagrass beds in the Egyptian Red Sea coast and their importance as productive ecosystem, rather limited information are available about their distribution (Price *et al*., 1988 and Sheppard *et al*., 1995).

The present work aims to study the distribution and the status of seagrass beds around Hurghada area which considered one of the fastest developing areas of the Egyptian coast of the Red Sea. Also it aims to test the ability of the satellite image analysis in mapping seagrass beds using high resolution satellite image combined with field data.

2-Material and Methods

2.1. Study area

The study area is located in the Egyptian coast of the Red Sea at Hurghada area and the near shore islands. The area is marked on the coast between Latitude. 27° 30` 1482´´ and Longitude.33° 75̀ 4839́ in the north and to Lat. 27° 08̀ 8756″ & Long.33° 85̀ 5422″ in the south (Figure. 1).

The conducted survey included several boat trips to the localities of seagrass beds depending on information collected from the local fishermen community. During conducting the field survey more than 12 locations with 40 stations were visited. After determination of seagrass species, samples were collected from 2 or more stations within each site. The co-ordinates of each sample was determined by Geographical Positioning System (GPS) and plotted in the Map (Figure 1).

Figure 1. Map indicating the surveyed locations during current study.

2.2. Sampling

In each of the visited 40 stations, three replicates core samples (10 cm diameter x 10 cm high) were collected using snorkeling and SCUBA diving when needed. Samples were selected to represent the middle and the edges of the meadow. Each core includes sediment and seagrass shoots, rhizomes and roots. Samples were transferred to the laboratory in labeled plastic bags. Seagrass coverage was measured using visual observation of three random quadrates (25 x 25 cm) according to the manual provided by SeagrassNet for monitoring of seagrass beds (Short, 2006).

In the laboratory, seagrass samples were washed under tap water and epiphytes were smoothly scratched using sharp plate. Above and below ground tissue biomasses were determined by drying plant materials at 70 ^{0}C for 72 hrs. Sediment samples were dried at 65 ^{0}C for 96 hrs. The grain size analysis was conducting according to (Budick and Kendick, 2001) from lesser than 0.106 to about 2 mm attached to automatic shaker and the content of each sieve was weighed and its percentage was determined. For determination of clay and silt, the pipette analysis was applied according to Carver (1971). The soil texture analysis was done by determining the percentage of sand, silt and clay in each sample. Those findings are plugged into a texture analysis triangle (FAO, 1977).

2.3. Satellite images Analysis (Remote sensing)

Geographical Information System was performed on Quick Bird Satellite images (60 cm resolution) obtained from Red Sea Protected Area Sector (Hurghada). ERDAS imagine software (Ver. 8.1) was used to classify the seagrasses localities according to signature obtained from sea truthing (supervised classification) to show distribution of seagrasses around Hurghada. In addition, also unsupervised classification was used for determination of the seagrass meadows based on 20 and 30 different color shades (classes). The accuracy of the method in predicting the exact localities was verified by field visits to the locations.

The data tabulation, plotting and statistical analysis was performed using Statistica Ver. 5.1, Primer Ver.5.2.2 and Surfer Ver. 8.5 computer soft wares.

3. Results

Seven seagrass species were recorded on the coast of Hurghada and the adjacent islands. These were *Halophila stipulacea* (Forsskål) Ascherson; *Halophila ovalis* (R. Brown) J.D.Hooker; *Halodule uninervis* (Forsskål) Ascherson; *Thalassodendron ciliatum* (Forsskål) den Hartog; *Thalassia hemprichii* (Ehrenberg) Ascherson; *Cymodocea rotundata* Ehrenberg & Hemprich ex Ascherson and *Cymodocea serrulata* (R. Brown) Ascherson & Magnus. The results in Table (1) represent the data obtained during the survey in the 12 visited locations around Hurghada coast. The seagrass beds around Hurghada coast consist of one to five species of seagrass with dominance of *H. stipulacea* and *H. uninervis* in all studied locations. The results indicated that only three locations are mono specific beds (North Ahyaa, El-Minah and South Gifton). Both North Ahyaa and South Gifton locations have *H. stipulacea* and El-Minah location has *H. uninervis.* Data also indicated that four of the examined locations (West and East Abo Monkar, El-Nasraniah Bay and North Gifton) have three seagrass species, two locations (El-Dahar, El-Fanous and South Hurghada) contained three species, Marine station location have four species and North of Abo Monkar has five species of seagrasses in mixed bed. The seagrass coverage within the beds in the study area showed a range between 50 % at South Hurghada to about 85% at Abo Monkar, El-Nasraniah Bay and El-Minah location. The data also indicated that seagrass meadows are found in depth ranged from 0.5 to 15 m with an average of about 6 m in most locations. Only three of the examined locations showed a signs of pollution with heavy algal growth covering seagrasses blades.

3.1. Total Biomass

The total seagrass biomasses at the 12 studied locations during the study period are presented in Figure (2). Seagrass biomass values ranged from 41.13 ± 6.2 gdwm^{-2} at south Hurghada location to 391.0 ± 92.5 gdwm^{-2} at El Fanous location. The data in Figure (2) showed also that seagrass biomass differs significantly from one locality to anther around Hurghada area. This fluctuation in the biomass of the different localities could be resulted from the number of species.

3.2. Grain size analysis

The results of grain size analysis performed on the samples collected from different seagrass locations around Hurghada during the survey is presented in Figure (3). The results indicated that the highest percentage of gravels and coarse sand recorded at Abo Monkar North being 2.42%, while the highest percentage of silt content has been recorded at North Ahyaa and Marine locations being 47.6% and 54.9% respectively.

According to the classification triangle provided by FAO (1977), the data showed that out of the 12 examined locations, five were sandy in nature (North Gifon, El-Dahar, El-Fanous, Abu Monkar North and East). Meanwhile, three locations were of sandy loam in nature (North Ahyaa, El-Nasraniah Bay and South Gifton) and three were loamy sand (El-Minah, West Abu Monkar and South Hurghada). On the other hand, only one location (Marine Station) was silty loam in nature.

The similarity between the different locations using the data obtained from the grain size analysis is presented in the dendrogram (Figure 4).The analysis of data showed that the examined site is separated to two major clusters, the first included one site (El-Dahar) which characterized by the presence of high percentages of coarse and medium size sand grains. This site showed very low similarity (44.8%) to the other stations (Figure 4). The second cluster included two major sub-clusters, the first comprising four locations namely; El-Fanous, El-Minah in group and Abu Monkar North, North Gifton in another group. The similarity between the two groups was about 70.2% while in the first group it was 84% and the second group 81%. The second sub cluster included seven locations separated to two groups. The first group included three locations namely; Abu Monkar East, Abu Monkar West and South Hurghada with similarity between them about 89%. However, the last two locations are more closed to each other with similarity up to 93%. The second group included four locations namely; NorthAhyaa, Marine station with similarity about 81% and El-Nasraniah Bay with south Gifton (79%). The degree of similarity between the locations in this group was about 74%.

Table 1. Collective summary of the data collected during the survey from the 12 visited locations

Location	Type	*Seagrass* sp.	Coverage (%)	Depth (m)	Status	Samples No.	Epi-flora
North Ahyaa	Mono sp.	*Ha. stipulacea*	80	3 -15	Healthy	3	Heavy
Marine Station	Multi	*Ha. stipulacea* *Hd. uninervis* *Ha. ovalis* *Thn. ciliatum*	75	3-10	Healthy	4	Medium
North Gifton	Multi	*Ha. stipulacea* *Ha. ovalis*	50-60	2-2.5	Healthy	2	Rare
El-Dahar	Multi	*Ha. stipulacea* *Hd. uninervis* *Tha. hemprichii*	70-80	0.5 - 3	Healthy	4	Medium
El-Minah	Mono sp.	*Hd. uninervis*	85	0.5 -1.5	Polluted	3	Heavy
El-Fanous	Multi	*Ha. stipulacea* *Hd. uninervis* *Tha. hemprichii*	70-80	0.5 - 7	Healthy	3	Rare
Abo Monkar North	Multi	*Ha. stipulacea* *Tha. hemprichii* *C. serrulata* *C. rotundata* *Thn. ciliatum*	70-75	2-4	Healthy	2	Rare
Abo Monkar West	Multi.	*Ha. stipulacea* *Hd. uninervis*	75- 85	0.5 -2	Healthy	4	Medium
Abo Mokar East	Multi	*Ha. stipulacea* *Hd. uninervis*	75	0.5 - 5	Healthy	5	Rare
El-Nasraniah Bay	Multi	*Ha. stipulacea* *Hd. uninervis*	75-85	1 - 4	Healthy	3	Rare
South Gifton	Mono sp.	*Ha. stipulacea*	60 -70	4-6	Polluted	4	Heavy
South Hurghada	Multi	*Ha. stipulacea* *Ha. ovalis* *Hd. uninervis*	50	0.5 - 2.5	Polluted	3	Medium

Ha=Halophila *Hd=Halodule* *Thn=Thalassodendron* *Tha=Thalassia* *C=Cymodocea*

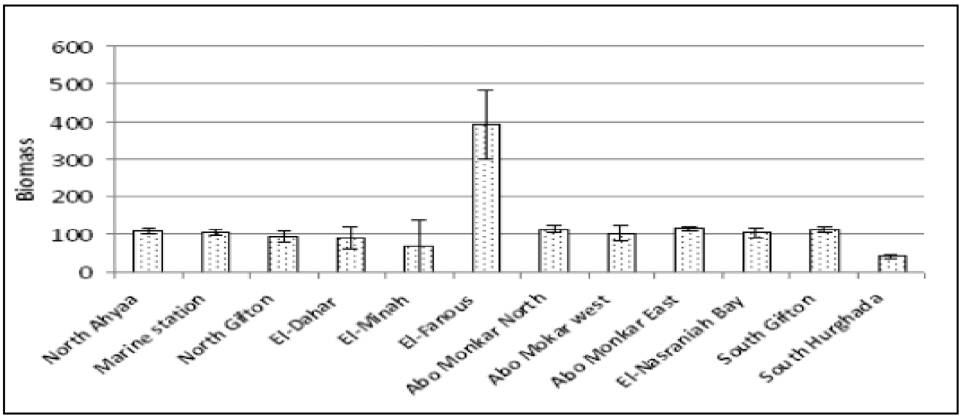

Figure 2. Mean biomass (gdwm^{-2}) of seagrasses from 12 surveyed locations

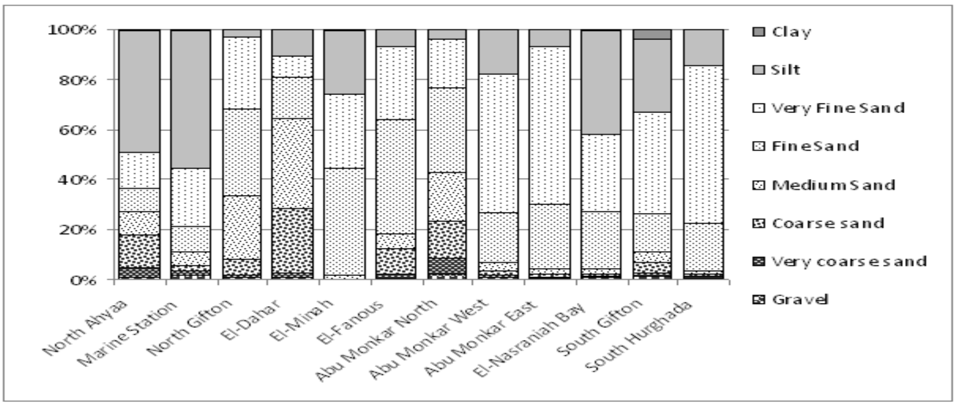

Figure 3. The percentage of grain size components recorded from surveyed locations around Hurghada

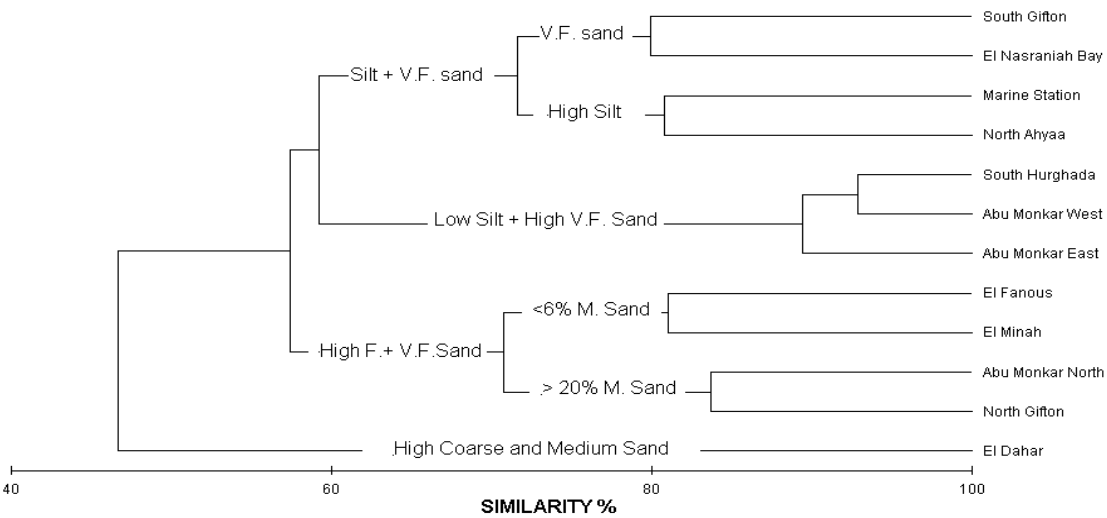

Figure 4. Dendrogram showing the similarity between the surveyed locations based on the grain size data collected from area around Hurghada

3.3. Satellite image analysis

3.3.1. Supervised Classification

The supervised classification performed on segment of the Quick Bird image covering Hurghada coast using coordinates were obtained from 40 signature localities. The result presented in Figure (5) indicated that the seagrass areas around Abo Monkar Island concentrated in the northern and north east side of the island close to west Gifton Island. In addition, the presences of a considerable sized bed in the south eastern side of the Island and inside the Mangrove channel, also some spots within seagrass areas were recognized with the mangrove color pattern.

However, the sea truthing proved that there are many errors in the results of supervised classification (Figure 6). For example, the area in the south east of the island is mainly an aggregation of seaweeds and no seagrass present. Also, mangrove Chanel has no seagrasses and most of the area in the outer rocky edge of the island is mainly sea weeds, and the area between the islands is mixed bed of seagrass species with a considerable algal growth over rocky surfaces. According to the previously mentioned findings, it was decided to make comparison with the results of the unsupervised classification results.

3.3.2. Unsupervised Classification

The unsupervised classification was performed in the same image but in this case we used the whole image in the analysis to get the over all picture of the distribution. In order to carry out the analysis, two methods were used. These methods depend on classifying the image using 20 and 30 different shade of gray in order to compare the two methods and detect the effect of increasing the number of shades in separating seagrass from seaweeds. After performing the classification, a test for the recognition of the seagrass signature was performed by changing the color of each shade to light green and verify the obtained data against the GPS readings recorded from seagrass beds site recorded during the survey.

The results of the unsupervised classification of the Quick Bird image performed using 20 (classes) shades on the gray scale are presented in Figure (7). Examination of the resulted image revealed that the shade number 11 is the closest shade to the seagrass localities in the area around Hurghada. The area recognized as seagrass in this image using this type of classification was found to be vast comparing to the data collected from the field. It seems to include areas of the reefs and seaweeds within the seagrass signature pattern, that was clear from designated area around El-Gifton El-Keber Island especially from the eastern coast where no seagrass was seen in this area on the narrow reef flat which instead it was almost covered with seaweeds. Also, the areas examined such as the south west of the El-Gifton Island which linked to Abu Monkar Island and the southern part of Sheraton Reef were not showed all these coverage of seagrasses.

The close examination of the results indicated that the depth of the seagrass bed may be affecting factor leading to miss identification of the meadows (Dangon *et al.,* 2008). According to this remark and according to the suggestion of some of the authors performed the unsupervised classification that the increase of the number of shades may increase the sensitivity of the classification and recognize the seagrass with minimum interference with the seaweeds.

The resulted image of the classification conducted using 30 shades (Classes) of gray scale applied using the same system of classification is presented in Figure (8). After performing the classification, a test for the recognition of the seagrass signature was performed by changing the color of each shade to light green and verify the obtained data against the GPS readings recorded from seagrass beds site recorded during the survey. The results showed that class number 15 was the most probable choice of the 30 classes to represent the seagrass meadows localities around Hurghada.

The examination of the image Figure (8) revealed that the area of seagrasses around Hurghada was different completely as result of using this class of gray scale. Where all the incorrect areas recognized in the previous image analysis (classification) around Gifton and Abo Monkar Islands was not recognized in this class. In addition, the coverage of seagrass meadows in the southern and northern areas of the coast was more close to reality. Meanwhile, some recognized areas in the image need further confirmation. Accordingly, it was safe to say that this type of classification is relatively more accurate than the previous one.

Estimation of seagrass area obtained from unsupervised classification of satellite image into 30 classes was done by calculating the total number of pixels occupied by the effective class number 15. Number of pixels of class number 15 was 724015 pixels in the whole image, and the area of each pixel is multiplied by 2.7 m^2 which is the area of each pixel on this image. So, the size estimated for the seagrass meadows around Hurghada area was valuated by about 1.96 k m^2.

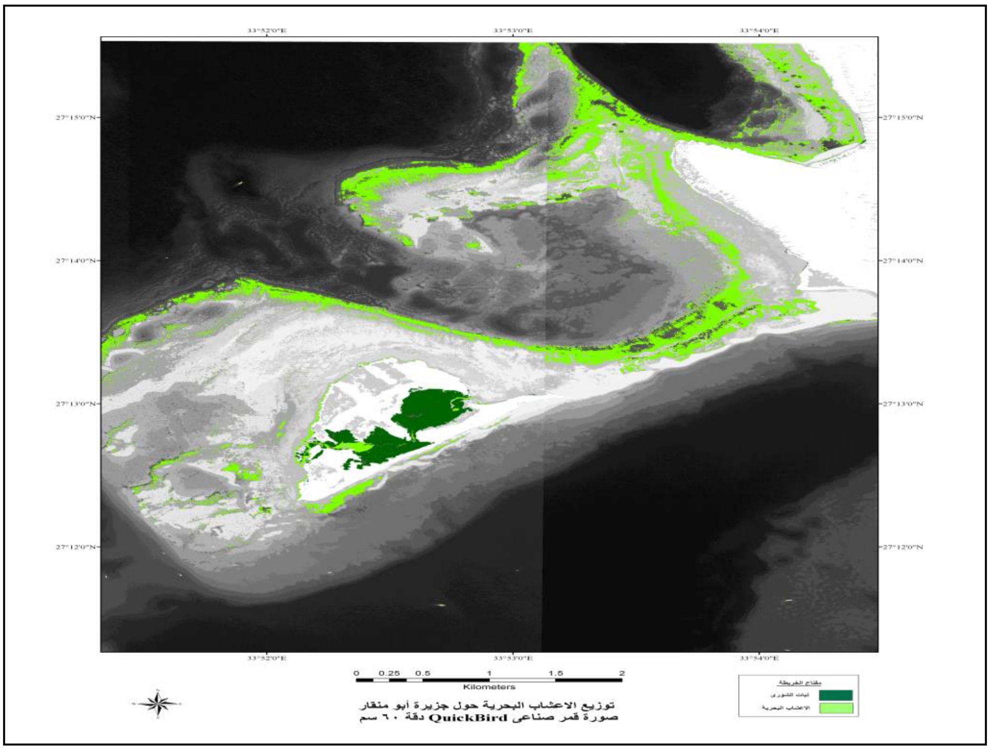

Figure 5. Image resulted from applying the supervised classification on segment of the Quick Bird images (60 cm resolution)

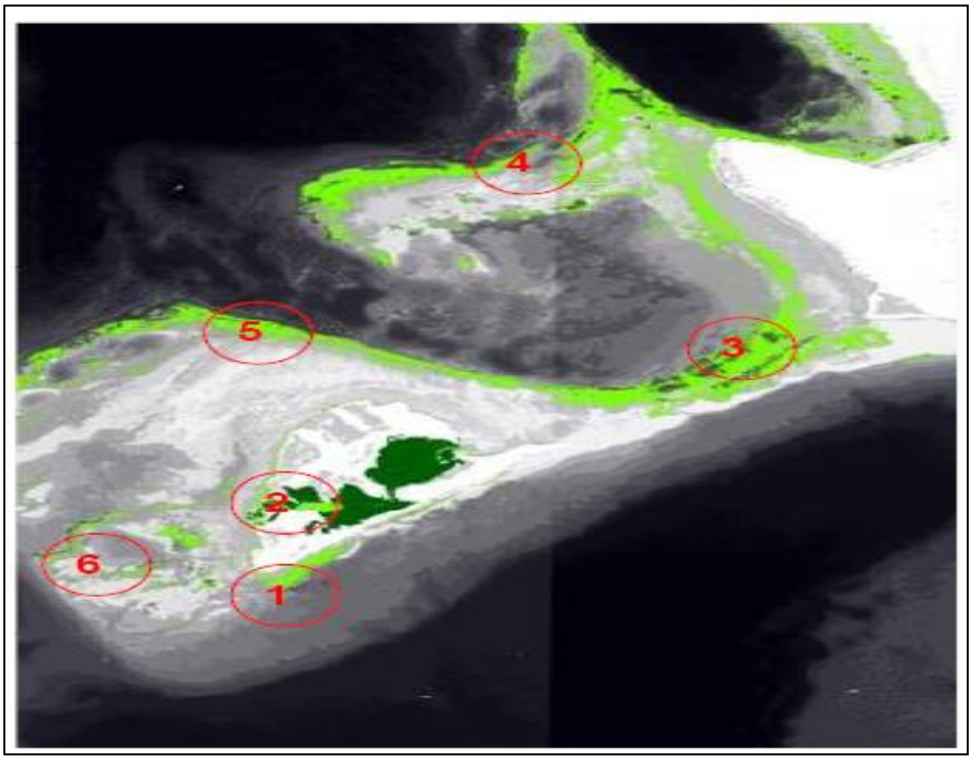

Figure 6. Verification of the obtained results a quick visit to the island

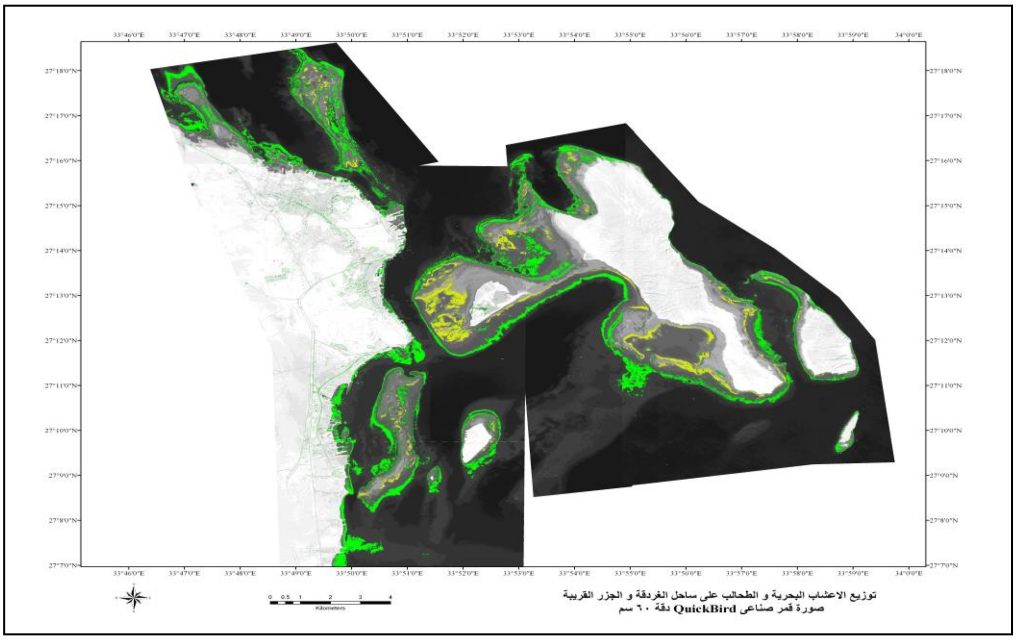

Figure 7. The results of unsupervised classification of Quick Bird image of Hurghada using 20 shades on the gray scale

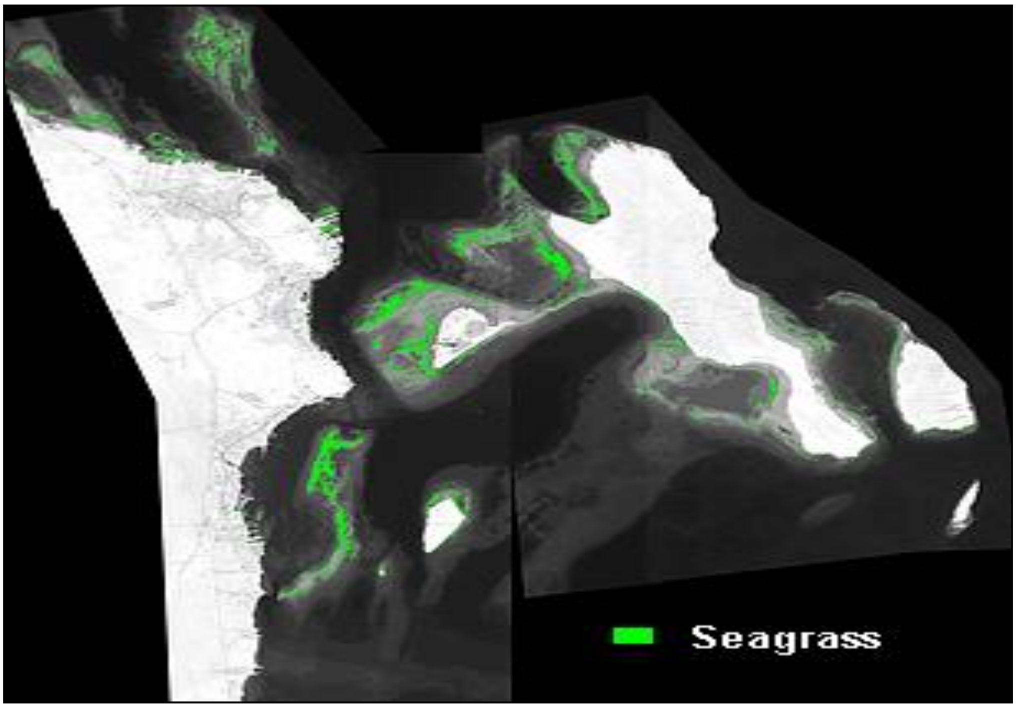

Figure 8. The results of unsupervised classification of Quick Bird image of Hurghada using 30 shades on the gray scale

4. Discussion

Important ecological and economic functions of seagrass beds have been widely acknowledged, notably their importance to fisheries (Jackson *et al*., 2001) and their role in preventing coastal erosion and siltation of coral reefs (Duarte, 2002). Despite the globally recognized fact that Seagrasses are among the most productive autotrophic communities on the plant which fulfill a key role in the coastal zone (Duarte and Chiscano, 1999) a rather very limited information are available on the seagrass beds in the Egyptian Red Sea coast.

The present work indicated that out of the twelve visited locations around Hurghada area only 3 locations contain mono-specific beds of seagrass. In addition, the examination of the species composition in the remaining nine locations revealed that *Halophila stipulacea* was the most dominant species in the area where it found in almost all the locations. The dominance of *Halophila stipulacea* was also confirming the work of Wahbeh (1981) in which he stated that for the northern part of the Red Sea *Halophila stipulacea* was the most dominant species. Different combinations were found to form the other beds in the area where two or more species.

In case of the mixed beds, it was cleared that there are some factors that may affect the distribution of these species in the present pattern. Among those factors and the one most stressed by many researchers is the sediment type. This was cleared in the current study from the presence of species like *Halophila stipulacea* alone in areas with high percentage of silt and very fine sand. *Halodule uninervis* also may share part of the same characteristic habitat with *Halophila stipulacea*. However, when the percentage of coarse sand increases in the sediment, the probability of finding both *Thalassia hemprichii* and *Thalassodendron ciliatum* increased, especially the former species.

The attempt to find links for the combinations of seagrass species using grain size analysis proved to be insignificant where locations far from each other have the same sediment grain size. This suggested that seagrass areas have been exposed to certain changes in the last decade causing disturbance in seagrass distribution. The major changes in the habitat in Hurghada area were resulted from the land filling performed on the coast, which generated large amounts of sediments trapped by the seagrass beds causing changes in sediment grain size. The same results were also recorded by De Falco *et al*. (2006). In agreement with Halun *et al*. (2002) and Short *et al*. (2007), the author also suggested that, the differences in grain size fractionation and the silt: clay ratio is an indicator of high-energy conditions in the area. The same results were reported in the present study where El-Minah site had affected by anthropogenic impact due to fine sediment deposition following the dredging and building of the new Hurghada Marina, resulted in the presence of single species (*Halodule uninervis).*

The human activities or the coastal development (land filling) may have played a major role not only in the seagrass species distribution within the study area but also affected the seagrass bed species composition, it is supported by the others (Hemminga and Duarte, 2000; Daby, 2003; Ruiz and Romero, 2003; Burfeind and Stunz, 2006).

In addition to the sedimentation as a major factor affecting the status of the seagrass beds in the Hurghada, several other factors related directly or indirectly to human activities may also be involved. Among those factors, is the increase in number of motorized boats in the area which supported by Burfeind and Stunz (2006) which proved that boats have negative impact on seagrass beds. Also, the increasing number of boats in Hurghada area has indirect effect through the usage of anchors. Giuliaa *et. el.* (2007) provided evidence that anchoring may cause damage to seagrass beds which difficult to recover due to slow growth rate of the seagrasses.

Over fishing of the herbivorous species from the surrounding reefs may have an effect on the seagrass beds through allowing algae to spread over, the same results were reported by Armitage and Fourqurean (2006). They reported that the impacts of grazing on *Halodule wrightii* and *Thalassia testudinum* which indicate that herbivory may be an important regulator of the distribution of multiple algal species near herbivore refuges like patch reefs in the Caribbean.

The exposure of seagrass beds to certain environmental stresses could be expressed also as reduction in its biomass and productivity. The present results demonstrated that the average biomass in the overall beds around Hurghada was about 237 gdwm^{-2}. This average comes close to that reported by Wahbeh (1981**)** and Gaballah (1996). However, the average recorded in the Gulf of Aqaba at the northern tip of the Red Sea reached 400 gdwm^{-2} (Gaballah, 1996). Our estimates in the present study indicated that the wide differences in the biomass between the different localities are most probably resulted from the presence of the mixed beds, where the dominant species such as *Halophila stipulacea* could play a role in the bed productivity, in agreement with the findings of Hulings (1979) for the Arabian Gulf.

The use of remote sensing, particularly high resolution satellite images, has been an important tool in the study of seagrass distribution (Green *et al*., 1996). In the present study, the trails conducted on the Quick Bird images for detection of seagrass beds of Hurghada showed that the use of such tool in studying seagrass not only need a lot of experience but also training on the use of the sophisticated software's. However, further efforts need to be directed to this area especially, on the field of using indices of quantification. There are several indices available to quantify habitat fragmentation. Sleeman *et al.* (2005) concluded that the use of different information sources in addition to the image analysis is best to detect significant differences between seagrass fragmentation categories.

According to literature in this field several factors may affect the process of detection including the reflectance of plankton (Mayo *et al.,* 1995) and depth (Mazlan *et al*., 1997). However, it seems appropriate to mention that the mapping of seagrass using satellite images is a target for the current and future research team at Marine Biology and Fish Science section. Also, it is important to emphasis that the analysis of the images became a very good tool in management of the seagrass areas. The capacity of remote sensing to detect change over large spatial and temporal scales has also made a great improvement during the last five years to a level where you can detect changes up to 8% of the bed area. (Pasqualini *et al*., 2001 and Meehan *et al*., 2005).

Historical studies using remote sensing have been able to correlate change in seagrass distribution with natural and anthropogenic effects (Ward *et al*., 2003, Williams and Meehan, 2004), as well as document the recovery of seagrass following the cessation of these effects (Kendrick *et al*., 2000). The present results could also be considered as a baseline study for monitoring of the changes in the area of seagrass habitat in Hurghada area which could help the conservation Authority (EEAA) to form a data base for the Egyptian coast using the same technique.

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توزيع وحالة مروج الحشائش البحرية بمنطقة الغردقة بالبحر الأحمر – مصر

إسلام أسامة ، عبدالقادر محمد حسن ، محمد محمود على ابوزيد
شعبة علوم البحار والأسماك, كلية العلوم, جامعة الأزهـــر-القاهرة

تم عمل مسح حقلى لساحل مدينة الغردقة بطول 40 كم والجزر المجاورة لها لمعرفة أماكن توزيع مروج الحشائش البحرية بالمنطقة فى الفترة ما بين إبريل الى مايو 2007. تم تجميع عينات تشمل الحشائش البحرية والتربة من 12 موقع وتسجيل مجموعة البيانات داخل كل موقع وتم تسجيل سبعة أنواع من الحشائش البحرية موزعة على الساحل والجزر القريبة فى عمق يتراوح من 0.5 الى 15 متر بنسبة غطاء تتراوح من 50% كما فى جنوب الغردقة الى 85% كما فى معظم مواقع الدراسة. وجد أن هناك ثلاثة مواقع بها نوع واحد من الحشائش البحرية وتسعة مواقع بها أكثر من نوع فى نفس الموقع. تراوحت نسبة الكتلة الحيوية للحشائش البحرية بين 9.1 جم/متر مربع فى المواقع الساحلية الى 458.6 جم/متر مربع فى المواقع القريبة من الجزر. اثبتت التحاليل أن الحشائش البحرية تميل للنمو فى التربة ذات طبيعة رملية حيث تأقلم نوع واحد وهو *Halophila stipulacea* للنمو فى جميع أنواع التربة سواء كانت خشنة او غرينية حيث كانت له السيادة فى جميع المواقع بينما كان نوع واحد (*Thalassodendron ciliatum*) يميل للنمو فى التربة ذات الملمس الخشن. تم إستخدام صور الأقمار الصناعية وتقنية الاستشعار عن بعد لمعرفة وإنتاج خريطة توضح توزيع مروج الحشائش البحرية بساحل مدينة الغردقة والجزر المحيطة وتشير إلى الأماكن المتوقع وجود المروج بها وأيضا حساب المساحة الكلية لمروج الحشائش البحرية. أوضحت النتائج أن استخدام اسلوب التقسيم الذاتى للصورة مستخدما فى ذلك 30 قيمة لونية أكثر دقة من استخدام التقسيم الذاتى مستخدما 20 قيمة لونية فقط، بينما التقسيم الغير ذاتى والذى يتم التدخل فية عن طريق إعطاء قيمة لونية مستخدما فى ذلك قراءات GPS للبرنامج لم يعطى النتائج بشكل صحيح. وتم تقدير مساحة الحشائش البحرية على ساحل مدينة الغردقة والجزر القريبة بحوالى 1.96 كم مربع تركزت بالقرب من الجزر.