REPORT ON A SURVEY OF THE MARINE INFRALITTORAL BENTHIC HABITATS IN THE DWEJRA/QAWRA AREA (GOZO, MALTESE ISLANDS), MADE IN AUGUST – SEPTEMBER 2004

SURVEY COMMISSIONED BY NATURE TRUST

AND

THE MALTA ENVIRONMENT AND PLANNING AUTHORITY

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1. INTRODUCTION

1. The Dwejra/Qawra coastal area in Gozo (Figures 1 & 2) has been identified as an area of "*potential international scientific importance because of the complex of features of geological, geomorphological, ecological, archaeological, historical and aesthetic interest*" (Malta Structure Plan, 1990). The importance of the area has also been emphasised by Anderson *et al.* (1992), who have made the following overall evaluation:

   (i) The coastline deserves to be recognised as one of 'international importance', mostly due to its geomorphological characteristics.
   (ii) The area provides a spectacular underwater scenery which includes a wide variety of habitats: seagrass meadows, sheer drop-offs, extensive boulder grounds, marine caves, sea stacks, archways and an enclosed lagoon.
   (iii) Building development has been limited to a number of boathouses at Qawra Bay, but proposed tourist development projects place the area under considerable pressure.
   (iv) The site is ideal for designation as a National Park/Marine National Park (World Conservation Union Definition), while Fungus Rock itself deserves protection as a scientific reserve.

Figure 1: Aerial photograph showing the Dwejra/Qawra area.

2. Although the marine area off the Dwejra/Qawra coast has, to date, not been designated as a protected area, parts of the terrestrial area are legally protected. The island of Fungus Rock in Dwejra Bay, Gozo was established as a Nature Reserve by Legal Notice Nº22 of 1992, while the same island and

the coastline extending from Il-Ponta tad-Dwejra to the mouth of the wied at Tal-Port in Il-Bajja tad-Dwejra and the 'Inland Sea', were originally declared a 'Nature Reserve' by virtue of Legal Notice 144 of 1993 issued in terms of the Environment Protection Act N$^{o.}$ V of 1991[1]; this designation was later changed to 'Bird Sanctuary' by the Protection of Birds and Wild Rabbit (Amendment) Regulations, 2003 (Legal Notice 41 of 2003; Schedule V). The Flora, Fauna and Natural Habitats Protection Regulations, 2003 (LN 257 of 2003) designate the Dwejra/Qawra area with Fungus Rock, as a Candidate Special Area of Conservation of International Importance. Dwejra is designated a candidate Marine Conservation Area by Malta Structure Plan policy MCO1(1).

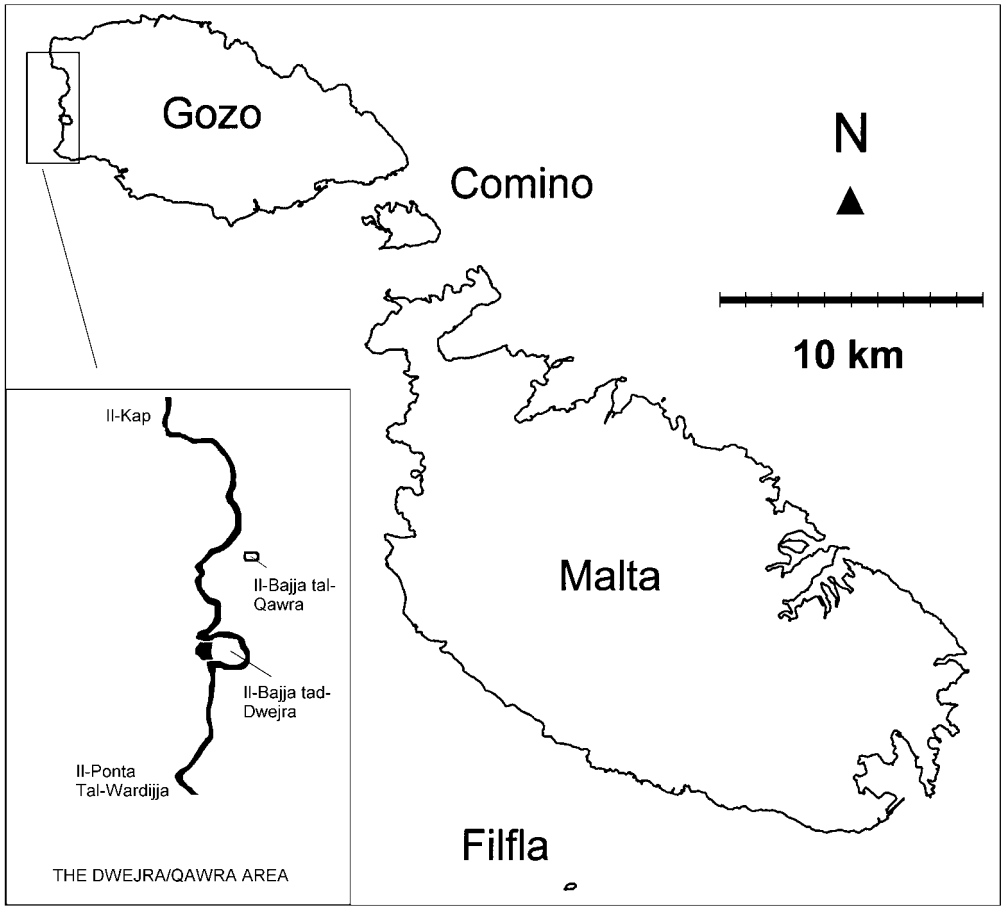

Figure 2: Map of the Maltese islands showing the location of the study area (inset).

3. Few scientific studies have been carried out at the Dwejra/Qawra area. However, a transect study (Rolè, 1991; Anderson *et al*., 1992) indicated that the marine benthic assemblages and habitats present in the area were typical of ones that characterise the cliff dominated south-western coast of the Maltese Islands. In these areas, the infralittoral bottom consists of bedrock forming vertical drop-offs, with boulder fields occurring at their base. The infralittoral biotopes that characterise the steep sloping and vertical submarine cliff faces, horizontal rocky platforms (where present) and boulders, mainly

[1] The original Environment Protection Act 1991 [Act V of 1991] was repealed and replaced by the Environment Protection Act 2001 [Act XX of 2001].

support assemblages of photophilic algae on hard substrata (bedrock and boulders) at depths of 0m to 25 m and assemblages of sciaphilic algae at depths exceeding 25m (Pirotta & Schembri, 1997). However, assemblages of caves and tunnels are also present where the sciaphilic assemblages of algae (in the lighted regions) and sessile invertebrates (in the less lighted and dark regions) dominate. Seagrasses rarely occur in such biotopes, except where shallow embayments are present, and, where present, the plants tend to form only small patches growing on bedrock. At depths greater than 40m, where the lower limit of occurrence of bedrock and boulder fields forms a boundary with a soft sediment bottom, extensive areas with bare sand occur, the latter extending down into the circalittoral and deeper.

4. The first general marine benthic survey of the Dwejra/Qawra area was commissioned by the Malta Environment and Planning Authority[2] and was carried out in 1997 (Borg *et al*., 1997). The area surveyed by Borg *et al*. (1997) was defined by the shore and a line drawn between the two points identified by the two headlands known as: 'Il-Kap*'* and *'*Il-Ponta tal-Wardija', in the 0-40m depth range. The area surveyed also included *'*Il-Bajja tal-Qawra*'* and *'*Il-Bajja tad-Dwejra*'*. In summary, the main findings of Borg *et al*.'s (1997) survey were as follows:

(i) A number of features of particular geomorphological interest were recorded from the study area. These comprised:
   (a) A series of drop-offs[3] running along the coast below the cliffs, along the shoal lying off *'*Iz-Zerqa*'* and below the rocky platform extending between the shore below *'*It-Torri tal-Qawra*'* and *'*Il-Baqra'.
   (b) Two rocky shoals[4], both of which are closely associated with drop-offs. These are: the shoal lying off *'*Iz-Zerqa*'* and another lying between the shore below *'*It-Torri tal-Qawra*'* and *'*Il-Baqra'.
   (c) Extensive boulder fields, usually occurring below the drop-offs, present at the base of the cliffs, where the latter are present in the study area.
   (d) Three arches: one submerged (forming part of the so called 'Blue Hole' = Il-Hofra tal-Birwin) and two emergent: one forming part of *'*It-Tieqa*'* and the other forming part of the promontory in the *'*Ta' Slima*'* area.
   (e) Five submerged caves and six emergent caves.
   (f) Two tunnels: a small submerged tunnel forming part of the shoal lying off *'*Iz-Zerqa*'* and an emergent tunnel (L-Ghar tal-Qawra) which connects *'*Il-Bajja tal-Qawra*'* to the open sea.

(ii) Only small amounts of anthropogenic material and litter were encountered on the seabed in the study area; these mainly consisted of empty glass bottles, aluminium beer-cans and plastic bottles, and car tyres (the latter used as boat fenders), and were mainly recorded from *'*Il-Bajja tal-Qawra*'* and *'*Il-Bajja tad-Dwejra'. In addition to this material, a small number of concrete blocks used as moorings, were present in *'*Il-Bajja tal-Qawra'.

[2] Then known as the Malta Planning Authority
[3] Submarine rock faces equivalent to escarpments on land.
[4] Know as '*sikek'* in Maltese and popularly referred to as 'reefs'.

(iii) Five major infralittoral benthic community types were recorded from the study area, as follows (using the nomenclature of Pérès & Picard, 1964 and Pérès, 1967):
    (a) assemblages of photophilic algae on hard substrata;
    (b) assemblages of semi-obscure caves and tunnels;
    (c) assemblages of *Posidonia oceanica* meadows;
    (d) assemblages of bare sand;
    (e) assemblages of accumulations of small boulders, cobbles and pebbles.

    In addition, stands of the alga *Caulerpa racemosa*, which is an alien species, were recorded from a depth of 20-40m off the Ta' Slima area. This was the first time that this species was recorded from the Maltese Islands.

(iv) Several caves in the study area were found to support very diverse assemblages characteristic of semi-obscure caves[5]. The macrofaunal component of this assemblage type consisted of a large number of bryozoans, sponges and serpulid polychaetes. While some of the species recorded from this assemblage are considered to be rare, the overall species richness and abundance appeared to be higher than that recorded from elsewhere in the Maltese Islands.

(v) Meadows of the seagrass *Posidonia oceanica* were only recorded from *'*Il-Bajja tad-Dwejra*'*, where their distribution was overall patchy. However, small sparse stands of this seagrass also occurred in some places amongst the boulder fields below the drop-offs.

(vi) A census of fish species encountered during the survey indicated that the richest fish fauna occurred in the *'*It-Tieqa*'* area and in the vicinity of the shoal lying off *'*Iz-Zerqa'. Furthermore, the fish fauna recorded from the study area included some species, such as large groupers *Epinephelus guaza*, that have become rare elsewhere in the Maltese islands.

(vii) The caves and *P. oceanica* meadows in *'*Il-Bajja tad-Dwejra*'* were being negatively affected by human activities. The biota living inside the submerged caves situated below *'*Il-Hofra tal-Birwin*'* and *'*Iz-Zerqa*'* had suffered extensive damage through frequent visits by SCUBA divers, while the *P. oceanica* meadows in *'*Il-Bajja tad-Dwejra*'* appeared stressed as a result of physical damage caused by the anchoring of pleasure boats. Uncontrolled fishing activities, including spearfishing and net casting, were witnessed in the study area.

[5] Those with dim light conditions but not complete darkness.

5. In view of the unique physical and biological characteristics, namely: (i) the variety of striking geomorphological features; (ii) the diversity of habitats present and the species they support, including a rich fish fauna, and (iii) the presence of species of international conservation importance, Borg *et al*. (1997) proposed that the entire area be declared a marine conservation area. Furthermore, the authors recommended the formulation of a management plan and a monitoring programme for the area. In particular, the *'*It-Tieqa*'* and *'*Iz-Zerqa*'* areas deserved special attention since they are the best sites within the study area and were also under considerable pressure from human activities.

6. The present survey of the marine ecological resources of the Dwejra/Qawra area, has been commissioned by Nature Trust (Malta) as part of a LIFE poject being undertaken by this NGO in conjunction with the Malta Environment and Planning Authority, with partial funding from the European Union. This project concerns the formulation of a management plan for the Dwejra/Qawra area, comprising both terrestrial and marine components. The present report, concerned with the marine area describes the marine environment within an area from sealevel to a boundary defined by the 40m depth contour and evaluates the ecological and conservation significance of the biotic assemblages present within this area.

7. The main objectives of the present survey, which covered the same area that was surveyed by Borg *et al*. in 1997, were as follows:

   (i) To determine whether there have been any changes in the boundaries delineating the main benthic habitat types and assemblages (hence their spatial extent), from those indicated by Borg *et al*. in 1997, and if so, to map the location of the new boundaries.
   (ii) To determine whether there have been any changes in the species composition and abundance of the main indicator species for the various marine benthic assemblages in the study area, from those indicated by Borg *et al*. (1997), and to describe such changes, if present.
   (iii) To assess and describe the overall state of health of the marine benthic assemblages and habitats in the study area by comparing the findings of the present survey with those of Borg *et al*. (1997).
   (iv) To assess any changes in the main physical features of the study area since Borg et al.'s (1997) survey, for example those resulting from anthropogenic activities, which may have an adverse impact of the physical and biological characteristics of the study area.
   (v) To confirm or otherwise the recommendations made by Borg *et al*. (1997) regarding the importance of the infralittoral physical features and habitats (that is, submarine geomorphological and biological features) present in the study area, in terms of outstanding aesthetic value and ecological value, and the conservation value of these features.

2. METHODOLOGY

8. The area surveyed in the present study is identical to the one surveyed by Borg *et al.* (1997), i.e. that enclosed between the shore and a line drawn between the two points identified by the following Universal Transverse Mercator (UTM) co-ordinates: 426610/3991700 ('Il-Kap') and 426730/3988510 ('Il-Ponta tal-Wardija'), excluding those parts where the depth exceeded 40m (see Figures 2 & 3). The area surveyed also includes 'Il-Bajja tal-Qawra' (the so called 'Inland Sea' and 'Il-Bajja tad-Dwejra' (see Figure 1).

9. The same survey techniques adopted by Borg *et al*. (1997) were again used in the present survey, namely collection of data underwater by direct observation along transects laid on the bottom by SCUBA divers. To facilitate comparison with the results obtained by Borg et al. (1997), transects were laid during the present survey in the same locations used in the former study. During fieldwork, transects were laid underwater along fixed bearings starting from the shoreline and extending seawards into deeper waters, down to the 40m depth contour. The length of these transects varied between 50m and 300m, and the distance between adjacent transects was from 50m to 100m. During fieldwork, SCUBA divers laid transect lines, graduated at 5m intervals, along the bottom at compass bearings perpendicular to the shore. In most cases, transects were situated close to prominent landmarks on the shore or at the base of cliff faces, for ease of location. Divers then swam along these transects and recorded the occurrence, type, and area of bottom covered by the different benthic assemblages. Random dives were also made to explore the area lying between the transects. Where the transect starting points were not accessible from the shore, the SCUBA divers were transported to the respective site using a 5m Rigid Inflatable Boat (RIB).

10. Where extensive beds of seagrass were encountered, *in situ* shoot density estimates were made using a 35cm x 35cm quadrat. However, to avoid destructive sampling, no samples of the seagrass were collected for morphometric studies.

11. Video footage[6] of the marine benthic assemblages and habitats was also collected underwater in various parts of the study area using a Sony 3 CCD digital professional video camera enclosed in an Amphibico Navigator housing. Images of some of the species and main assemblage types mentioned in the present report were captured from the video footage and presented as photographs (see plates in Appendix 1), to illustrate features present.

12. The classification scheme of Borg & Schembri (2002) for marine benthic assemblages was used in the present survey. This scheme differs from the one used by Borg *et al.* (1997), since it is primarily based on the classification of benthic biocoenoses adopted by the Regional Activity Centre for Specially Protected Areas (RAC/SPA) of the United Nations' Mediterranean Action Plan (UNEP-MAP). The Borg & Schembri (2002) classification is a modified version of the RAC/SPA scheme adapted for local use and has also been recently

[6] Video (on DVD) entitled '*Video footage of the Dwejra/Qawra coastal area (Gozo, Maltese Archipelago)*'. Produced by Ecoserv Ltd and Deep5 Underwater Productions.

adopted by MEPA as the local 'standard' classification scheme for benthic biotic assemblages.

13. Fieldwork in relation to the present survey was carried out between 1st August 2004 and 30th September 2004

3. RESULTS

3.1. Physical characteristics

14. The study area is mainly exposed to the north-westerly, westerly and south-westerly winds (see Figure 1). San Dimitri Point, which is located close by (round the headland known as 'Il-Kap') is the most exposed site in the Maltese Islands. Strong currents were not encountered by the divers during the survey, however, this is to be expected considering that fieldwork sessions were deliberately held on days that had relatively calm weather conditions[7]. Throughout the survey area, except inside 'Il-Bajja tal-Qawra', the underwater visibility was very good (20-30m).

15. Overall, when comparing the results of the present survey with those recorded by Borg *et al*. (1997), no major changes in bathymetry were noted. As noted by Borg *et al*. (1997), a depth of 20m to 40m was recorded close to the shoreline (between 5m to 300m horizontal distance from the shore) in most of the study area. Shallow depths (less than 10m) were recorded inside 'Il-Bajja tal-Qawra' and 'Il-Bajja tad-Dwejra', in the area lying off 'Iz-Zerqa', and above the rocky platform lying between the shore below 'It-Torri tal-Qawra' and 'Il-Baqra'. In many places, the depth increased (sometimes by up to 20m) over a very small horizontal distance (*circa* 5m). Very shallow depths of 1-2m were recorded above the outer parts of the shoal which extends seawards from 'Iz-Zerqa', close to 'Il-Blajta' and inside 'Il-Bajja tal-Qawra'.

16. The same main submarine geomorphological features recorded by Borg *et al*. (1997) were again noted during the present survey; no additional ones were encountered. Overall, the study area supports an impressive variety of underwater geomorphological features, including rocky platforms, drop-offs, shoals, boulder fields, arches, caves and tunnels. A brief description of the main geomorphological features recorded from the present survey follows. Where mentioned, reference to different types of mobile substrata (boulders, cobbles, pebbles, sand etc.) is based on the Wentworth scale as used in Holme & McIntyre (1984) and in Pirotta & Schembri (1997). For a more detailed description the reader is referred to Borg *et al.* (1997).

    (i) **Drop-offs** (taken in the present study to have a vertical extent greater than 10m) were the most abundant geomorphological feature in the study area, except inside 'Il-Bajja tal-Qawra' and 'Il-Bajja tad-Dwejra'. The height of these drop-offs varied with location, but most had a very

[7] Sea currents around the Maltese Islands are mainly generated following strong winds and related climatic factors.

steep inclination. Furthermore, both 'continuous' (drop-offs that extend from the surface to the seabed without any major topographical variations down the cliff face) and 'non-continuous' (drop-offs that are characterised by ledges and platforms running across the vertical face) (Pirotta & Schembri, 1997) were present, but the latter were predominant. Furthermore, most of the drop-offs recorded from the study area had a number of submarine terraces present on their faces. In most of the study area, a steep rocky slope extends from the base of the drop-offs down to the part where the hard substratum abuts the soft sediment bottom. Accumulations of boulders are often present on the lower parts of these steep rocky slopes.

(ii) **Bedrock platforms and shoals.** A wide bedrock platform is present between the shore lying below 'It-Torri tal-Qawra' and 'Il-Baqra'. Patches of sand are present in many places on this rocky platform. The marine area off 'Iz-Zerqa' supports a shoal that extends seawards for around 80m and has shallow (1-2m) waters above it in various places.

(iii) **Boulder fields**. Extensive boulder fields are present at the base of drop-offs throughout the study area. Extensive boulders fields are present below the cliffs lying between 'Il-Kap' and 'Iz-Zerqa' and those lying between Fungus Rock and 'Il-Ponta tal-Wardija'. A dense boulder field is also present in the area surrounding 'It-Tieqa'. In places, small patches of sand are interspersed amongst the boulders.

(iv) **Arches.** One submerged arch and two emergent arches are present in the study area. The submerged arch is located just below the so called 'Blue Hole' (present on the shoreward side of 'Iz-Zerqa'), of which it forms a part, and leads to a submerged cave lying below 'Il-Hofra tal-Birwin'. One of the two emergent arches is located below the cliffs in the 'Ta' Slima' area and forms part of the promontory which extends out from the cliff. The roof of this emergent arch lies high up in the cliff itself. The other emergent arch is 'It-Tieqa', and also has its roof high up in a cliff.

(v) **Caves.** Five large submerged caves and six large emergent caves are present in the study area (Figure 3). Several other minor caves and clefts are also present in the study area. The five submerged caves, all of which are located in the northern half of the survey area, have a very complex physiognomy (Borg *et al*., 1997), and a bottom characterised by fine sediment. The largest of these appear to be the two caves lying below the shore of the 'Il-Hofra tal-Birwin' and 'Iz-Zerqa' area. The six emergent caves, which are distributed throughout the study area, also have a very complex physiognomy, both underwater and above sea level (Borg *et al*., 1997). The bottom inside the emergent caves consists of bedrock, with small boulders, cobbles and pebbles present in some places.

(vi) **Tunnels.** Two tunnels are present in the study area; a long (circa 100m) emergent tunnel that connects 'Il-Bajja tal-Qawra' to the open sea, and a smaller tunnel (circa 6m long) that is fully submerged and located below 'iz-Zerqa' (Figure 3).

17. Overall, the various geomorphological features recorded from the study area were in a good state and appeared unchanged when comparing present observations to Borg *et al*.'s (1997) descriptions. An exception to this are the two caves lying below the shore of 'Il-Hofra tal-Birwin' and 'Iz-Zerqa' area. Frequent visits by large numbers of divers in these two caves appears to have caused detachment of fragile bryozoan colonies, sponges and other sessile fauna from the cave walls, as evidenced by the large amounts of dead remains of these animals present on the soft sediment bottom inside the caves.

18. Anthropogenic litter was rarely encountered in the study area. However, there was an apparent small increase in the amount of anthropogenic litter present in 'Il-Bajja tal-Qawra' and 'Il-Bajja tad-Dwejra', which mainly consisted of plastic bags, and empty plastic and glass bottles. Intensive boating activities and visits by bathers and divers in 'Il-Bajja tal-Qawra' (where a number of boat moorings are also present; see Borg *et al*., 1997) and 'Il-Bajja tad-Dwejra', and continuous visits by SCUBA divers in the vicinity of the two submerged caves situated below 'Il-Hofra tal-' and 'Iz-Zerqa'), together with fishing activities ranging from spearfishing to laying of trammel nets and fish traps in various parts of the study area appear to constitute the main anthropogenic activities in the area. Several large abandoned fish traps, together with others that had been freshly baited and deployed by fishermen, were encountered at depths of around 30–40m in the northern parts of the study area.

3.2. Biological characteristics

19. The spatial distribution of the main marine benthic assemblages and habitats recorded from the study area are shown in Figure 3. The same major marine benthic assemblage types that were recorded by Borg *et al*. (1997) were again recorded from the study area during the present survey. These were:

    (i) **Biocoenosis of infralittoral algae** (equivalent to the 'community of photophilic algae on hard substrata' and the 'community of semi-obscure caves and tunnels' of Borg *et al*., 1997) (Figure 4). This bioceonosis was characterised by several different associations, characterised by different dominant species that occurred interspersed with each other. In the 0–20 m depth range, the main associations forming this biocoenosis were the following:
        (a) Association with *Cystoseira ercegovicii*
        (b) Association with *Cystoseira barbata*
        (c) Association with *Cystosira tenuior*
        (d) Association with *Cystosira brachycarpa* (= *balearica*);
        (e) Association with *Cystoseira stricta*
        (f) Association with *Halopteris scoparia*
        (g) Association with *Halopteris filicina*
        (h) Association with *Sargassum vulgare*
        (i) Association with *Padina pavonica*
        (j) Association with *Corallina elongata*

(k) Association with *Dictyopteris polypodioides*
(l) Association with *Caulerpa racemosa*

Several algal species that did not form distinct associations, but were present as small clumps or single plants, were also recorded from this biocoenosis in the 0–20m depth range. These included *Cladostephus spongiosus*, *Amphiroa rigida, Jania corniculata*, (occurring mostly as an epiphyte on *Cystoseira* spp.), *Dictyota fasciola, Dictyota linearis* and *Codium bursa.* Each of the associations listed above had a particular coverage, which however, varied depending on location. Overall, the associations of *Cystoseira* spp. (collectively) and the association of *Dictyopteris polypodiodes* had the highest spatial coverage (Figures 5 & 6). These findings are similar to those recorded by Borg *et al*. (1997), however, small differences in coverage of the less dominant associations were evident during the present survey.

In the 21–40 m, the main associations forming this biocoenosis were the following:

(a) Association with *Flabellia petiolata* and *Peysonnelia squamaria*
(b) Association with *Halimeda tuna*
(c) Association with *Lithophyllum fronduosum*
(d) Association with *Caulerpa racemosa*

Several algal species that did not form distinct associations but were present as small clumps or single plants were also recorded from this biocoenosis in the 21–40 m depth range. These included *Polisiphonia* sp. and *Codium bursa* (which was much more abundant in the 21–40m depth range than at depths of 0–20m). As recorded by Borg *et al*. (1997), the dominant associations were the association with *Flabellia petiolata* and *Peysonnelia squamaria*, and the association with *Halimeda tuna* (Figure 7). However, at depths of around 30–40 m, the dominant association was that with *Caulerpa racemosa* (Figure 8). At the mouth of caves, the algae *Lithophyllum fronduosum* (Figure 9) and *Zonaria tournefortii* were very abundant, while the innermost parts of the caves had their rocky substratum practically devoid of any plants (Figure 10).

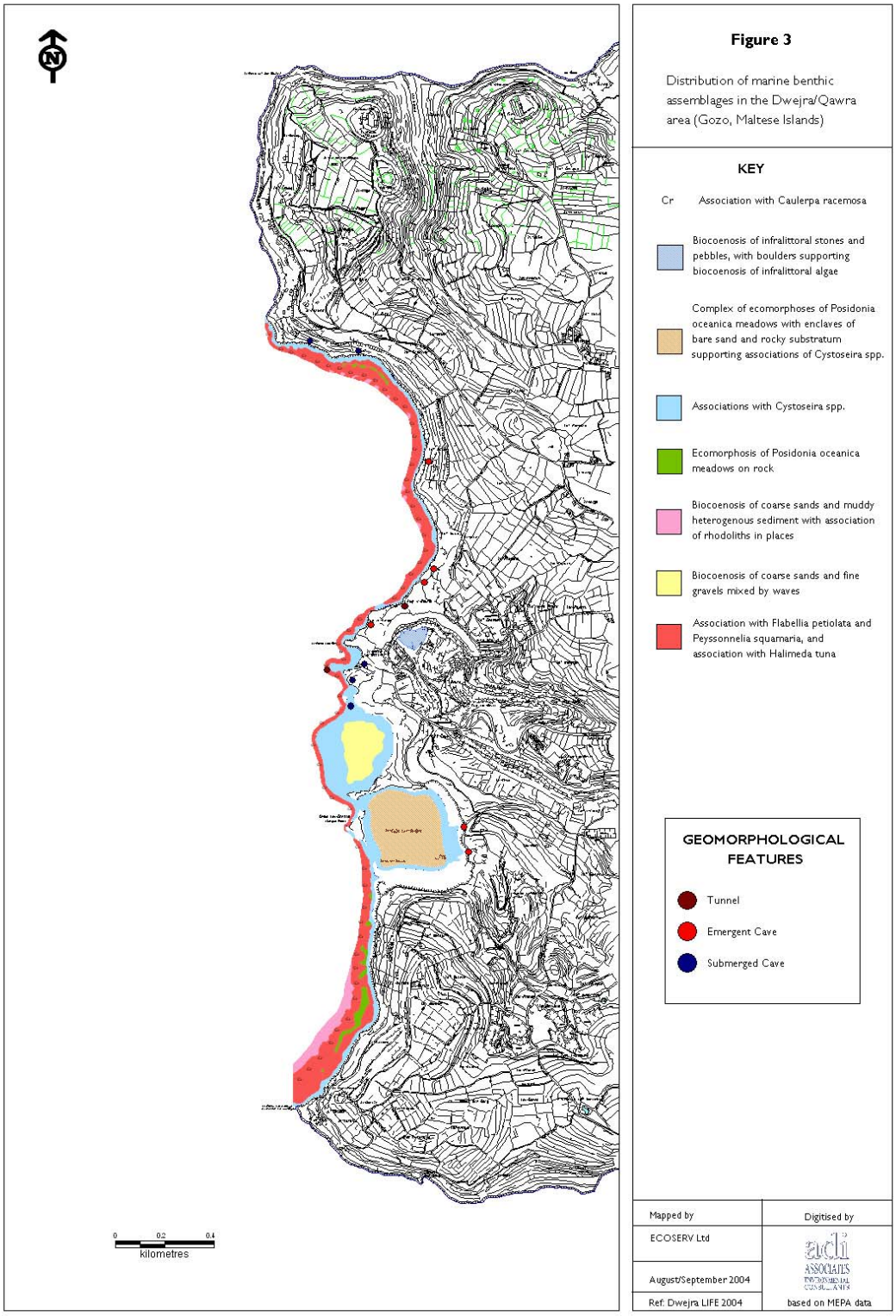
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Figure 3
Distribution of marine benthic assemblages in the Dwejra/Qawra area (Gozo, Maltese Islands)
KEY
Cr Association with Caulerpa racemosa
Biocoenosis of infralittoral stones and pebbles, with boulders supporting biocoenosis of infralittoral algae
Complex of ecomorphoses of Posidonia oceanica meadows with enclaves of bare sand and rocky substratum supporting associations of Cystoseira spp.
Associations with Cystoseira spp.
Ecomorphosis of Posidonia oceanica meadows on rock
Biocoenosis of coarse sands and muddy heterogenous sediment with association of rhodoliths in places
Biocoenosis of coarse sands and fine gravels mixed by waves
Association with Flabellia petiolata and Peyssonnelia squamaria, and association with Halimeda tuna
GEOMORPHOLOGICAL FEATURES
Tunnel
Emergent Cave
Submerged Cave
Mapped by
ECOSERV Ltd
August/September 2004
Ref: Dwejra LIFE 2004
Digitised by
ASSOCIATES
based on MEPA data

Figure 4: **Photograph showing a general view of the biocoenosis of infralittoral algae.**

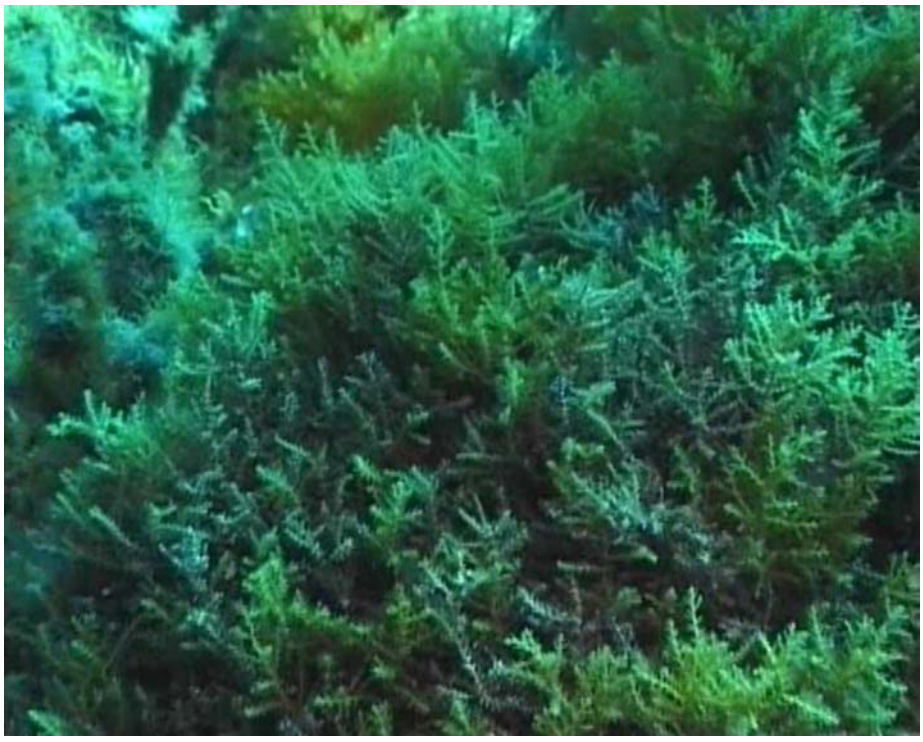

Figure 5: **Photograph showing the biocoenosis of infralittoral algae – Association with *Cystoseira* spp.**

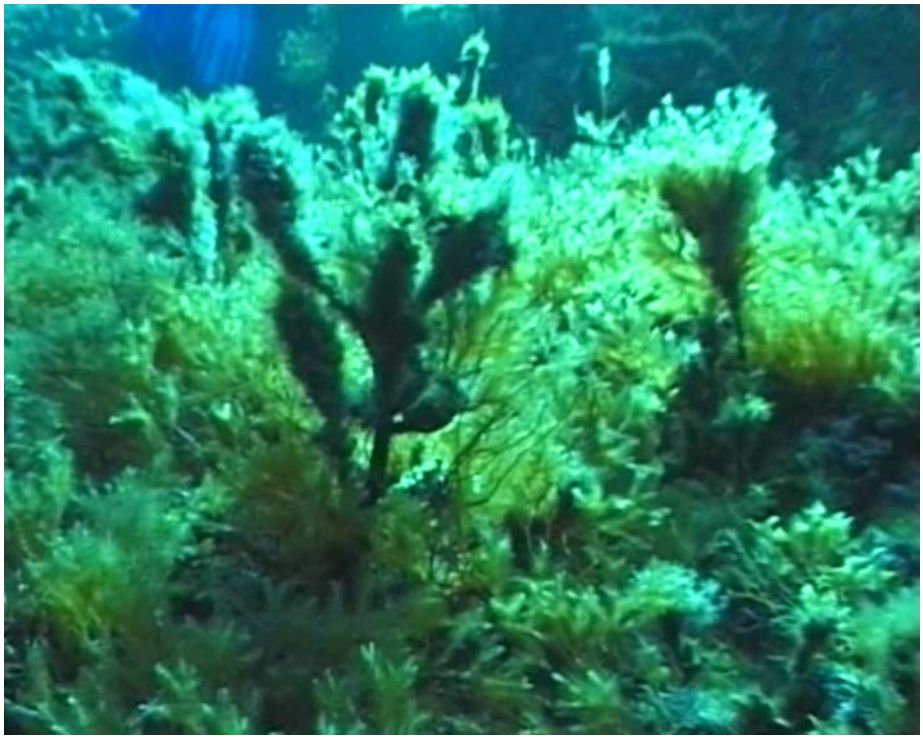

Figure 6: Photograph showing the biocoenosis of infralittoral algae – Association with *Cystoseira* sp. interspersed with an Association of *Dictyopteris polypodiodes*.

In the 0–20 m depth range, the most conspicuous fauna associated with this biocoenosis included the sponges *Ircinia spinosula, Chonrosia reniformis* and *Ircinia variabilis;* the hydroid *Aglaophenia* sp; the corals *Astroides calycularis*; *Balanophyllia europaea*, *Cladocora caespitosa* and (?) *Polycyathus muellerae*; the sea urchins *Paracentrotus lividus* and *Arbacia lixula*; the sea stars *Echinaster sepositus* and *Marthasterias glacialis*; the errant polychaete *Hermodice carunculata*; several spider crabs (Majidae spp.); the hermit crabs *Clibanarius erythropus* (very abundant in ‘Il-Bajja tal-Qawra’), *Calcinus ornatus* and *Pagurus anachoretus*; the gastropods *Columbella rustica*, *Cerithium rupestre, Hexaplex trunculus* and *Fasciolaria lignaria;* and the echiuran *Bonellia viridis*. In shaded places, for example below overhangs, inside crevices and at the mouth of caves, the fauna mainly comprised sciaphilic species, for example the bryozoans *Reptadeonella violacea* and *Myriapora truncata,* and the seastar *Ophidiaster ophidianus* (Figure 11).

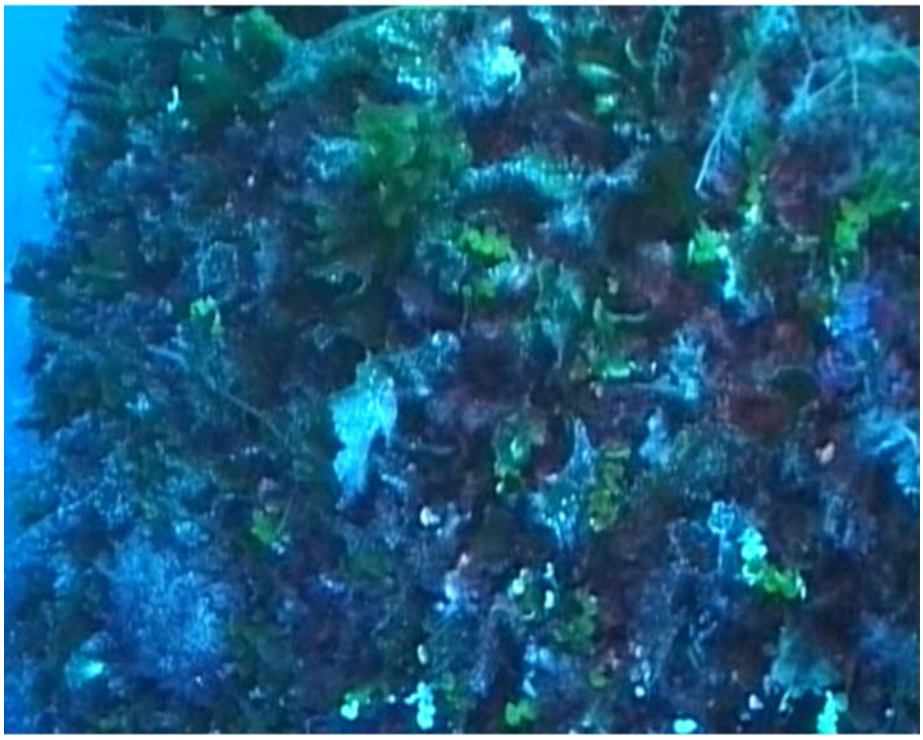

Figure 7: **Photograph showing the biocoenosis of infralittoral algae – Association with *Flabellia petiolata* and Peyssonelia squamaria interspersed with the Association of *Halimeda tuna*.**

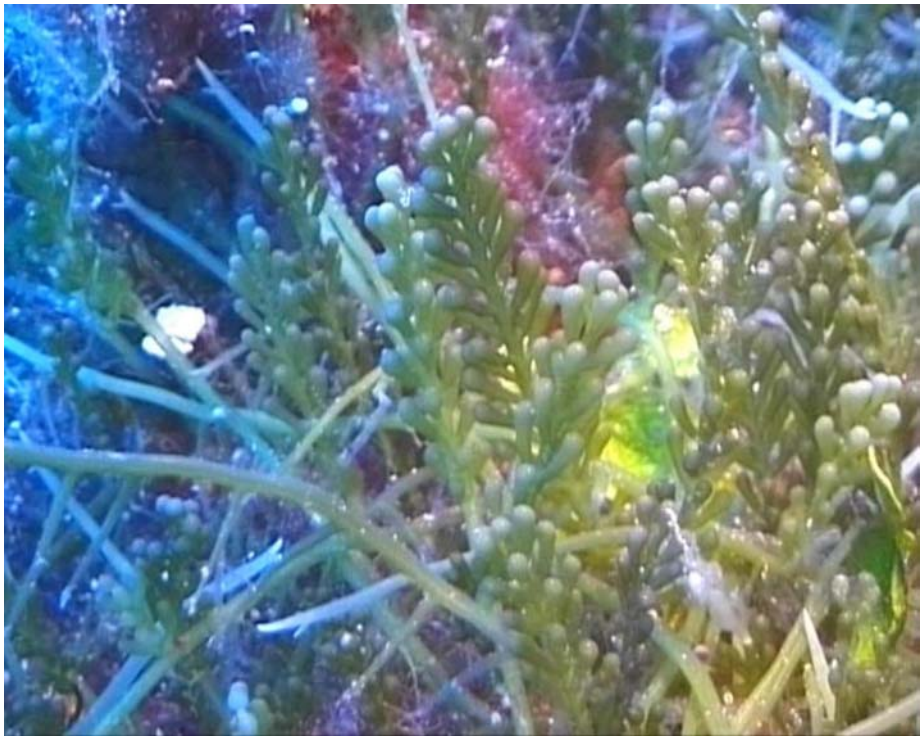

Figure 8: **Photograph showing the Association of *Caulerpa racemosa*.**

In the 21–40 m depth range, especially below overhangs and at the entrance to caves (Figure 12), the most conspicuous fauna associated

with this biocoenosis included the following sciaphilic species: the sponges *Agelas oroides, Petrosia ficiformis, Chondrosia reniformis, Crambe crambe* and *Anchinoe* sp.; sabellid polychaetes (including *Spirographis spallenzani*) and the errant polychaete *Hermodice carunculata*; the seastars *Ophidiaster ophidianus* and *Hacelia attenuata*; the bryozoan *Myriapora truncata*, the tunicate *Halocynthia papillosa;* the hermit crabs *Calcinus tubularis* and *Dardanus callidus* (Figure 13)*;* the Mediterranean locust lobster *Scyllarides latus* and the crawfish *Palinurus elephas* (Figure 14) and the long spined seaurchin *Centrostephanus longispinus* (Figure 15). Inside caves (Figure 16), the sponges *Oscarella lobularis*, *Fasciospongia cavernosa* and *Petrobiona massiliana*, the bryozoans *Myriapora truncata*, *Sertella* spp., *Smittina cervicornis, Reptadeonella* sp.*, Adeonella calveti, Schizoporella* spp. and *Buskea* dichotoma; the shrimps *Palaemon* sp. and *Stenopus spinosus,* and the anemone *Cerianthus membranacea*, were abundant.

The species mentioned above constitute the more conspicuous flora and fauna associated with this biocoenosis. Undoubtedly, a much higher associated biodiversity is to be found since many of the associated animals fall within the 'macrofauna' (0.5mm – 4cm) and 'meiofauna' (< 0.5 mm) categories, and include numerous species of molluscs, polychaetes, crustaceans and echinoderms that are less conspicuous and were not spotted in the transect surveys. Nevertheless, except for small differences (for example an increase in the abundance of the errant polychaete *Hermodice carunculata*), the faunal species mentioned above are the same as those recorded by Borg *et al*. (1997).

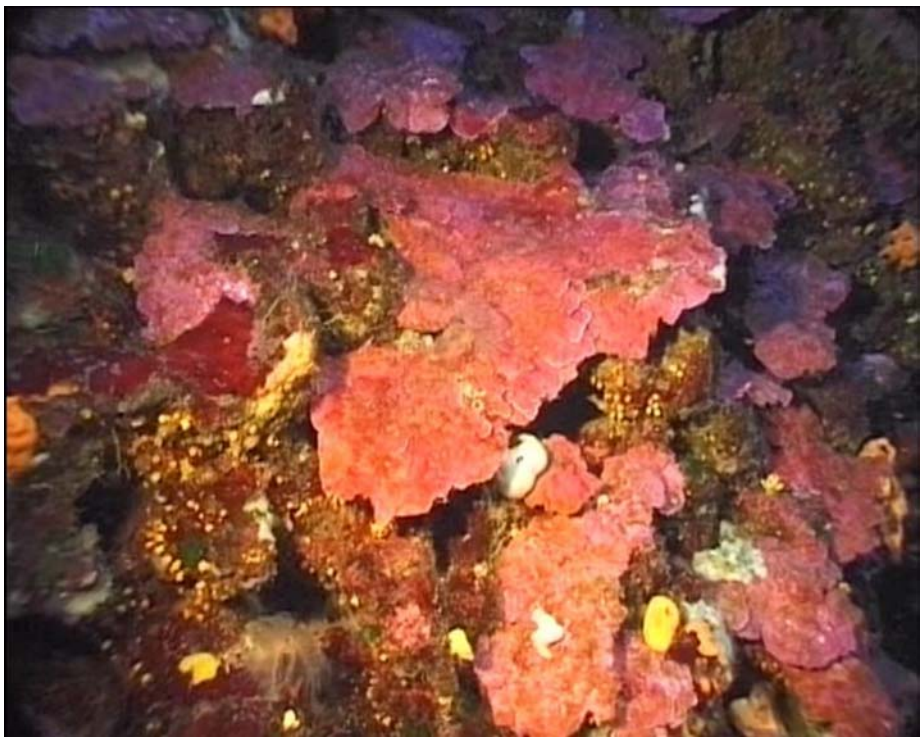

Figure 9: Photograph of the association with *Lithophyllum fronduosum* (red-pink alga).

Figure 10: Photograph of the inner parts of one of the caves present in the study area, showing the walls devoid of any algae.

(ii) **Ecomorphoses of *Posidonia oceanica* meadows** (equivalent to the 'community of *Posidonia oceanica* meadows' of Borg *et al*., 1997). This bioceonosis was mainly present in 'Il-Bajja tad-Dwejra'. Two main ecomorphoses were encountered, as follows:

(a) Ecomorphosis of continuous *Posidonia oceanica* meadows on sand with enclaves of bare sand

(b) Ecomorphosis of reticulate *Posidonia oceanica* meadows on sand with enclaves of bare sand

Small patches of the seagrass were also present in the shallower parts of the inlet, growing on the rocky substratum or on the sandy bottom present therein. Furthermore, the two ecomorphoses of *P. oceanica* meadows, together with patches of the seagrass, were frequently interrupted by areas of bare sand and/or gravel/shingle, by bedrock, by boulders and by clay. Overall, the total coverage of *P. oceanica* meadows inside 'Il-Bajja tad-Dwejra' was similar to that recorded by Borg *et al*. (1997). However, a small increase in coverage of bare sand assemblages [see (iii) below] was evident inside the bay, which coincided with a small decrease in spatial coverage of the seagrass. In places, a thick layer of *Posidonia* leaf litter was present on the bare sandy bottom inside. Large chunks of freshly detached *Posidonia* matte (bearing living shoots) were present in several places inside the inlet. The number of chunks of detached *Posidonia* matte encountered during the present survey appeared to be higher than that encountered in the previous survey (Borg *et al*., 1997). The seagrass shoots appeared to support a heavier epiphytic growth than that recorded in the previous (1997) survey. On the other hand, shoot

density estimates of this seagrass inside 'Il-Bajja tad-Dwejra' indicated similar values [250–800 shoots/m^2 to those recorded previously by Borg *et al*. (1997)].

The fauna associated with the *Posidona* meadows included numerous species of molluscs, polychaetes, crustaceans and echinoderms that seek refuge in the leaf canopy and root-rhizome layers, and are hence less conspicuous.

(iii) **Biocoenosis of coarse sands and fine gravels mixed by waves** (included within the 'community of bare sand' of Borg *et al*., 1997). This biocoenosis was characterised by an impoverished epibiota, mainly characterised by holothurians *Holothuria* spp., but a rich infauna (as evidenced by the presence of numerous openings to burrows of infaunal species), and was mainly recorded as discrete patches from inside 'Il-Bajja tad-Dwejra' and on the wide platform of bedrock extending from the shore lying below 'It-Torri tal Qawra' and 'Il-Baqra'*;* and (ii) on the floor of the submerged caves. Observations from the present survey on this assemblage type were similar to those made by Borg *et al*. (1997) during the previous survey.

(iv) **Biocoenosis of well sorted fine sands** (included within the 'community of bare sand' of Borg *et al*., 1997). This bioceonosis was mainly recorded from the bottom of the submerged caves present in the study area, and was characterised by the absence of algae and an impoverished epifauna, but a rich infauna (as evidenced by the presence of openings to burrows of infaunal species). Individuals of the anemone *Cerianthus membranacea* (Figure 17) were occasionally recorded from this biocoenosis, on the sediment surface.

Figure 11: **Photograph showing the seastar *Ophidiaster ophidianus* foraging within an Association of *Dictyopteris polypodiodes* and an Association of *Sargassum vulgare*.**

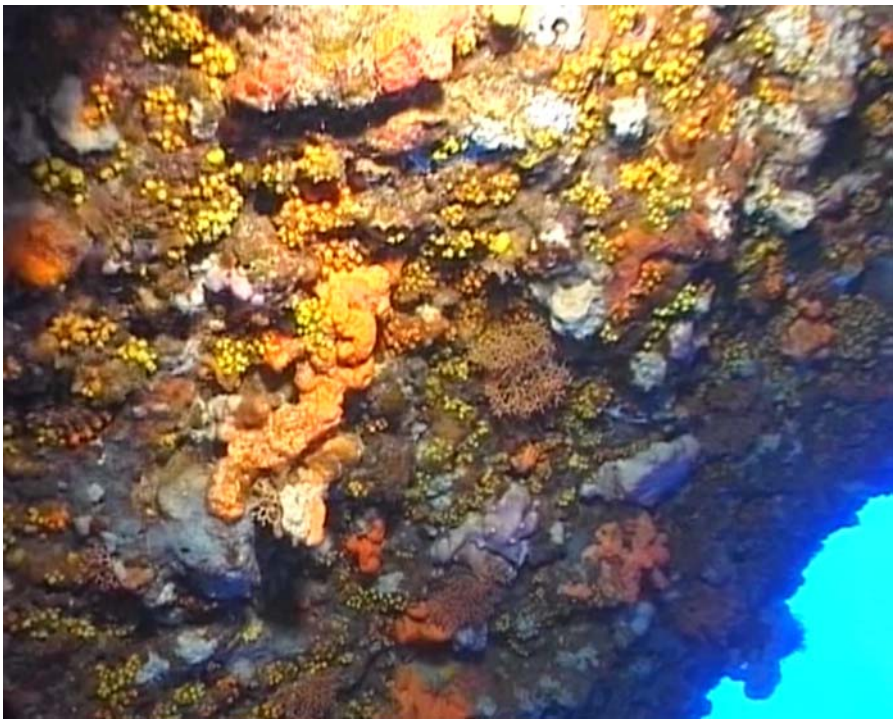

Figure 12: **Photograph showing sciaphilic biota from the assemblages forming part of the biocoenosis of infralittoral algae on the walls of a cave, close to the entrance. The brightly coloured fauna includes several species of sponges, bryozoans and corals.**

(v) **Biocoenosis of coarse sands and muddy heterogeneous sediment** (included within the 'community of bare sand' in deeper waters of Borg *et al*., 1997). This biocoenosis was mainly recorded from the lower infralittoral at depths greater than 40m, namely where the boulder fields and drop-offs form a boundary with the soft sediment. As for (iii) above, this biocoenosis was characterised by an impoverished epibiota, but a rich infauna (as evidenced by the presence of openings to burrows of infaunal species). In places, namely in the vicinity of 'Il-Ponta tal-Wardija' areas this biocoenosis had an association of rhodolliths and was characterised by stones of different sizes encrusted by the calcareous red alga (?) *Neogonolithon* sp.. Observations from the present survey on this assemblage type were similar to those made by Borg *et al*. (1997) during the previous survey.

(vi) **Biocoenosis of infralittoral stones and pebbles** (equivalent to the 'community of accumulations of small boulders, cobbles and pebbles' in deeper waters of Borg *et al*., 1997. This biocoenosis was mainly present in 'Il-Bajja tal-Qawra'. Although the small boulders, cobbles and pebbles on the bottom of this bay mostly supported a thin algal felt, a rich and abundant macrofauna lived beneath them. The most abundant macrofauna included the gastropods *Gibbula* spp. and *Osilinus articulatus*; the hermit crab *Clibanarius erythropus*; the Crabs *Xantho poressa* and *Xantho incisus;* and the porcelain crab *Pisidia* sp. Observations from the present survey on this assemblage type were similar to those made by Borg *et al*. (1997) during the previous survey, however, there was an apparent decrease in coverage of photophilic algae growing on the small boulders and larger stones present in the inlet.

Figure 13: Photograph of the hermit crab *Dardanus callidus*.

Figure 14: Photograph showing the crawfish (or spiny lobster) *Palinurus elephas*, seeking refuge in a rock crevice.

3.3. Demersal and pelagic fauna

A rich demersal and pelagic fish fauna was recorded from the study area. The demersal species encountered during the survey included the cephalopods *Sepia officinalis* and *Octopus vulgaris*, together with many fish species, of which the most abundant were combers *Serranus scriba* and *Serranus cabrilla*, ornate wrasse *Thalassoma pavo*, rainbow wrasse *Coris julis*, wrasses *Crenilabrus* spp. and *Labrus* sp., damselfish *Chromis chromis,* the red mullet *Mullus surmuletus* and *Gobius* spp. (the latter two being mainly recorded from inside *'*Il-Bajja tal-Qawra*')*, black scorpionfish *Scorpaena porcus,* and parrotfish *Sparisoma cretense.* Other less abundant demersal fish species included the red scorpion fish *Scorpaena scrofa*, grouper *Epinephelus guaza*, cardinalfish *Apogon imberbis* (usually recorded inside crevices, clefts and below overhangs), swallowtail seaperch *Anthias anthias*, brown meagre *Sciaena umbra,* eagle ray Myliobatis aquila, moray eel *Muraena helena*, conger eel *Conger conger,* and forkbeard *Phycis phycis* (the latter two species being mainly recorded inside caves). The pelagic fish fauna mainly comprised shoals of saupe *Sarpa salpa,* bogue *Boops boops*, picarel *Spicara smaris,* amberjack *Seriola dumerilii,* barracuda *Sphyraena sphyraena* and saddled bream *Oblada melanura*.

Figure 15: Photograph showing the long spined sea urchin *Centrostephanus longispinus*.

Figure 16: **Photograph showing colonies of the bryozoan *Sertella* sp., together with other sciaphilic biota growing on the roof of one of the submerged caves in the study area.**

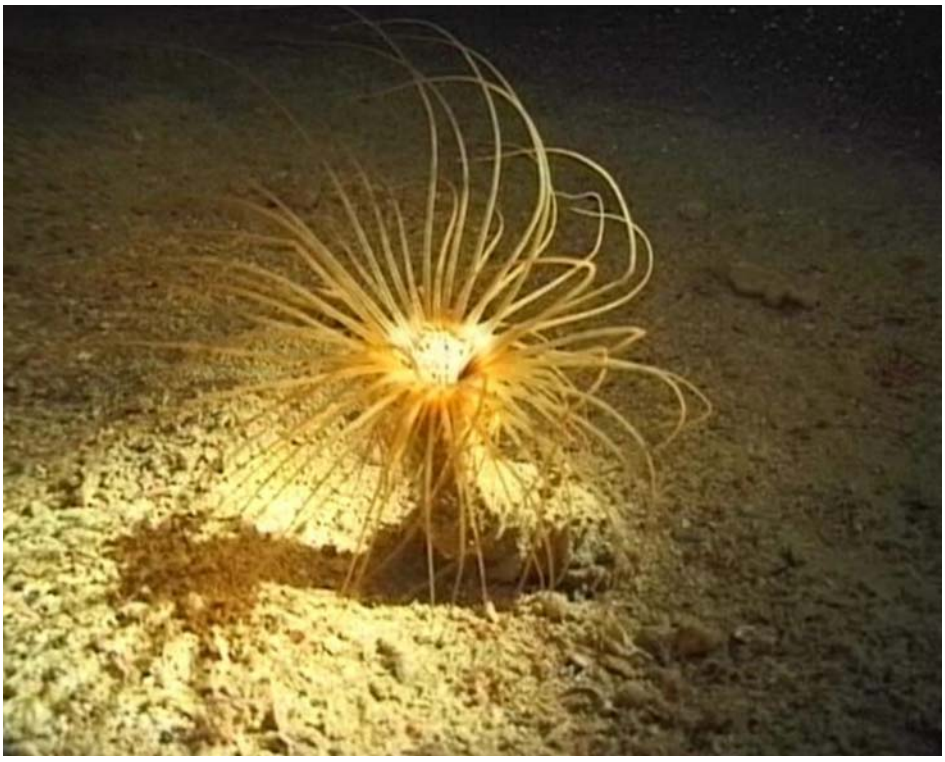

Figure 17: **Photograph showing an individual of the tube anemone *Cerianthus membranacea* present on the soft sediment bottom inside one of the submerged caves in the study area.**

4. DISCUSSION

20. Overall, observations on the species composition and distribution of marine benthic assemblages recorded during the present survey corroborate the findings of Borg et al. (1997); no large differences in type, species composition and spatial extent of the assemblages present in the Dwejra/Qawra area were recorded in the present study. Furthermore, the overall state of the benthic habitats present in the study area was very good and similar to that recorded by Borg *et al*. (1997). The minor differences noted when comparing the findings of the present survey with those of the previous (1997) survey are as follows:

    (i) A small decrease in spatial coverage of seagrass (*Posidonia oceanica*) meadows in 'Il-Bajja tad-Dwejra', and a corresponding increase in the area occupied by bare sand.

    (ii) Small changes in the species composition and abundance of algae constituting the main associations of photophilic algae on hard substrata, and an increase in the abundance of the errant polychaete *Hermodice carunculata.*

    (iii) An increase in the abundance and spatial coverage of the alien alga *Caulerpa racemosa*, particularly in the 21–40 m depth range, and a corresponding decrease in abundance and cover of algae (namely the association with *Flabellia petiolata* and *Peysonnelia squamaria*) where dense mats of the former occurred.

    (iv) A decrease in the abundance and coverage of sessile biota (namely bryozoans and anthozoans) present in the two submerged caves situated below 'Il-Hofra tal-' and 'Iz-Zerqa'), which are frequented by SCUBA divers.

    (v) A deterioration in the state of health of assemblages of photophilic algae on boulders and large stones present in 'Il-Bajja tal-Qawra'.

21. Small changes in coverage of some of the associations constituting the biocoenosis of infralittoral algae were recorded, while the errant polychaete *Hermodice carunculata* was much more abundant during the present survey. However, these changes may have resulted from seasonal differences and/or natural temporal variation in biotic characteristics, since while Borg *et al*. (1997) made their survey during winter-spring, the present survey was made in summer-autumn.

22. The considerable increase in abundance and coverage of the alien alga *Caulerpa racemosa* appears to constitute a massive invasion of the alga and possible displacement of other algal species, particularly those of the sciaphilic Association of *Flabellia petiolata* and *Peysssonellia squamaria,* and the Association of *Halimeda tuna*. *C. racemosa* was recorded for the first time from the Maltese Islands during Borg *et al*.'s (1997) survey. Since then, this alga has spread to many coastal areas in the Maltese islands, where it has formed dense forests on infralittoral hard substrata, and has also been recorded as sparse stands from infralittoral soft substrata (authors, unpublished data).

23. The small decrease in spatial coverage of *P. oceanica* seagrass beds and the corresponding increase in coverage of bare sand indicates possible further damage may have occurred to the seagrass beds, resulting from anchoring of pleasure craft in the area.

24. Intensive boating activities and visits by bathers in *'*Il-Bajja tal-Qawra*'* (where a number of boat moorings are also present) and *'*Il-Bajja tad-Dwejra', anchoring by pleasure craft in the latter inlet, and continuous visits by SCUBA divers in the vicinity of the two submerged caves situated below *'*Il-Hofra tal-' and 'Iz-Zerqa'), together with fishing activities ranging from spearfishing to laying of fish traps in various parts of the study area, appear to constitute the main anthropogenic activities that are impacting the marine benthic habitats and biota present in the study area. Apart from an increase in the amount of anthropogenic litter present mainly in *'*Il-Bajja tal-Qawra' and *'*Il-Bajja tad-Dwejra', the results of the surveys made to date did not indicate any adverse alterations of the physical characteristics (geomorphological features) of the area. However, the observed deterioration of sessile biotic assemblages present in the two caves located below *'*Iz-Zerqa', which is apparently due to frequent visits by SCUBA divers (see Borg *et al*., 1997) is worrying, since continued stress on the cave habitats may lead to increasing loss of biodiversity. Equally worrying are (i) the practice of spearfishing, particularly with aqualungs and (ii) deployment of fish traps in the area, since the former targets groupers and other large territorial fish, leading to a slow demise in their population, and the latter collect a significant by-catch comprising decapods and other large scavenging invertebrates. When the fish trap lines get snagged against rocks, these are left on the seabed[8], where they continue 'fishing' - attracting fishes and large invertebrates, which eventually die in a repeated cycle.

25. The present findings confirm the recommendations made by Borg *et al*. (1997) regarding the importance of the infralittoral physical features and habitats present in the study area, in terms of outstanding aesthetic beauty and ecological value, and the high conservation value of the physical and biological features present.

26. The European Union's **Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora**[9]**,** known as the 'Habitats Directive' establishes a framework for the conservation of animals, plants and natural habitats of interest to Union Member States, and provides for the creation of a network of "**Special Areas of Conservation**" called "**NATURA 2000**"

27. As it now stands following the accession of 10 new member states (including Malta) on 1st May 2004, the Directive includes six annexes of which the following are relevant to the present discussion. Annex I lists natural habitat types of Community interest whose conservation requires the designation of Special Areas Of Conservation. Some 200 different types of habitat are listed, some of which are further designated as "**priority habitat types**"[10]. The

[8] Abandoned traps are popularly known as 'ghost traps'.
[9] *Official Journal of the European Communities* L 206, 22.7.1992, p. 7.
[10] Priority habitat types are defined in Article 1(d) of the Habitats Directive as natural habitat types in danger of disappearance, which are present the territory of Member States and for the conservation of which the EU has particular responsibility in view of the proportion of their natural range which falls within the territory of Member States.

NATURA 2000 network will include a representative sample of all habitats of Community interest, especially priority habitats.

28. Annex I marine habitats (excluding adlittoral habitats) are the following:

- **Sandbanks which are slightly covered by seawater all the time**
- ***Posidonia* beds***
- **Estuaries**
- **Mudflats and sandflats not covered by seawater at low tide**
- **Coastal lagoons***
- **Large shallow inlets and bays**
- **Reefs**
- **Submarine structures made by leaking gases**
- **Submerged or partially submerged sea caves**

The asterisk signifies a 'priority habitat'.

29. Annex II lists species of plants and animals whose habitats must be protected for their survival and therefore whose conservation requires the designation of Special Areas Of Conservation. Annex II marine species that are found or may potentially be found in the Maltese Islands are: the Bottle-nosed Dolphin (*Tursiops truncatus*), the Harbour Porpoise (*Phocoena phocoena*), the Mediterranean Monk Seal (*Monachus monachus*), the Loggerhead Turtle (*Caretta caretta*), the Killifish (*Aphanius fasciatus*) and the Maltese Top-shell *Gibbula nivosa*. The Mediterranean Monk Seal and the Loggerhead Turtle are designated 'priority species[11]'.

30. Annex IV lists animal and plant species of Community interest in need of strict protection. A number of marine species listed in this annex occur also in the Maltese Islands. These are: all species of whales and dolphins that occur in Maltese waters, the Mediterranean Monk Seal (*Monachus monachus*), all species of marine turtles that occur in Maltese waters, the Maltese Top-shell *Gibbula nivosa*, the Date Mussel (*Lithophaga lithophaga*), the Noble Pen-shell (*Pinna nobilis*), and the Long-spined Sea-urchin (*Centrostephanus longispinus*).

31. Annex V list species of plants and animals of EU interest whose taking from the wild and exploitation is subject to management, that is, their exploitation must be controlled such as to ensure their survival in the wild. Marine species of interest to Malta in this list are: the Twaite Shad (*Alosa fallax*), the Red Coral (*Corallium rubrum*), the Mediterranean Locust Lobster (*Scyllarides latus*) and the rhodolith-forming coralline algae *Lithothamnium coralloides* and *Phymatholithon calcareum*.

[11] Priority species are defined by Article 1(h) of the Habitats Directive as species of EU interest (as defined by Article 1(g), that is, species that are endangered, vulnerable, rare, endemic and requiring particular conservation measures) for the conservation of which the EU has particular responsibility in view of the proportion of their natural range which falls within the territory of Member States.

32. The Dwejra/Qawra area studied here includes a number of species and habitats that fall within the scope of the Habitats Directive. Annex I marine habitats present within the area are:

Sand Banks Which Are Slightly Covered By Seawater All The Time: Large patches of bare sand are present on the bedrock platforms and at the base of submarine cliffs in many parts of the area. However, these do not constitute extensive sand banks.

***Posidonia* Beds:** There is an extensive but non-continuous bed within Il-Bajja tad-Dwejra area where the stands are dense and healthy. Small patches of the seagrass also occur on bedrock in other parts of the area. The *P. oceanica* meadows in the Dwejra/Qawra area are considered to be isolated since there is little or no continuity with meadows present in other coastal areas due to the deep water present off most of the western coast of Gozo.

Coastal Lagoons: The 'Inland Sea' at Il-Qawra may be considered as a possible lagoon pending further studies on its ecology and hydrodynamics.

Large Shallow Inlets And Bays: Taking the interpretation of this habitat type as adapted for Malta (Borg & Schembri, 2003), the various inlets of the Dwejra/Qawra area qualify as such a habitat in terms of their biological characteristics, even if some of the inlets are physically of limited dimensions.

Reefs: Rocky reefs are present throughout the area and are of two types: (i) submarine continuations of emergent cliffs and (ii) reefs that rise vertically from a sandy bottom littered with large boulders to join submarine bedrock platforms (e.g. Il-Baqra). In places, the vertical face of these reefs is tens of metres high.

Submerged Or Partially Submerged Caves: A total of six fully submerged caves and seven semi-submerged caves are present in the area. Most of the caves are exposed to considerable disturbance from SCUBA divers.

33. A number of species listed in the annexes of the Habitats Directive are present in the study area as follows:

Annex II Species: Frequent sightings of Bottle-nosed Dolphins (*Tursiops truncatus*) and of Loggerhead Turtles (*Caretta caretta*) have been made (see (Borg & Schembri, 2003) and the records in Baldacchino & Schembri, 2002).

Annex IV Species: The *Posidonia oceanica* meadows present at Id-Dwejra support a small population of the Noble Pen-shell (*Pinna nobilis*). Populations and single individuals of the Long-spined Sea-urchin (*Centrostephanus longispinus*) occur below overhangs and in crevices present on the rocky substrata in the area. However, since no detailed population studies have been made, the exact extent and population density of these two species are not known.

Annex V Species: Small populations and occasional individuals of the Mediterranean Locust Lobster (*Scyllarides latus*) occur below overhangs and in crevices present on rock faces in the area. However, since no detailed population studies have been made, the exact extent and population density of this species are not known.

5. SUMMARY AND RECOMMENDATIONS FOR MANAGEMENT

34. The Dwejra/Qawra area studied here presents typical examples of a range of habitats occurring in the Maltese Islands, particularly those associated with is steeply sloping rock, submarine cliffs and submerged and emergent sea caves. The abundant rocky habitats and the range of depths available within a short distance make this a very important site for species of hard substrata, including photophilic algae and especially sciaphilic assemblages.

35. It is also a very popular diving site.

36. The so-called 'Inland Sea' at Il-Qawra is a unique feature.

37. With one exception, no large differences in type, species composition and spatial extent of the marine benthic assemblages present in the Dwejra/Qawra area were recorded in the present study as compared to a previous survey of the same area made in 1997 by the present consultants using the same methodology. The only significant difference was an increase in the abundance and spatial coverage of the alien alga *Caulerpa racemosa* (originally first recorded from Malta in these 1997 surveys), particularly in the 21-40m depth range, where it appears to have displaced stands of the native assemblages dominated by *Flabellia petiolata* and *Peysonnelia squamaria*).

38. More minor changes noted since 1997 include A small decrease in spatial coverage of seagrass (*Posidonia oceanica*) meadows in Il-Bajja tad-Dwejra and a decrease in the abundance and coverage of sessile biota (mostly bryozoans and anthozoans) in the two submerged caves situated below Il-Hofra tal-Berwin and Iz-Zerqa, which are frequented by SCUBA divers

39. The area surveyed includes a number of species and habitats that fall within the scope of the European Union's 'Habitats Directive'. Annex I marine habitats present within the area are Sand Banks Which Are Slightly Covered By Seawater All The Time, *Posidonia* Beds (a 'Priority Habitat), a Coastal Lagoon (the 'Inland Sea' at Il-Qawra). Large Shallow Inlets And Bays, Reefs, and Submerged Or Partially Submerged Caves. Annex II Species known to be present include Bottle-nosed Dolphins (*Tursiops truncatus*) and Loggerhead Turtles (*Caretta caretta*); Annex IV Species include the Noble Pen-shell (*Pinna nobilis*) and the Long-spined Sea-urchin (*Centrostephanus longispinus*); Annex V Species include the Mediterranean Locust Lobster (*Scyllarides latus*).

40. The marine area studied fulfils the criteria for a NATURA 2000 site as listed in Annex III of the 'Habitats Directives', and as such should be declared a marine candidate Special Area of Conservation for eventual designation as a NATURA 2000 site. The Dwejra/Qawra area has been proposed as a candidate Marine Conservation Area and the adjoining terrestrial area as a National Park while the Government of Malta has proposed the entire Qawra/Dwejra as a natural World Heritage Site (Malta Structure Plan, 1992).

41. The marine protected area zonation scheme proposed for Dwejra/Qawra in the 1997 report by Borg & Schembri is deemed to still be valid and can serve as a basis for zoning the area for protection and conservation purposes.

42. With the exception of the caves, some of which are heavily impacted, most of the marine area is relatively pristine and only subject to localized impacts that are more or less easily controlled and managed, especially by zoning and regulation of the activities within each zone. Habitat restoration is only deemed necessary for the caves.

43. The area is prone to heavy passage by marine craft (especially in the summer months), mostly pleasure craft and professional and amateur fishing boats. Amateur fishermen occasionally drop anchor in some places while fishing using hand-lines. Professional and amateur fishermen also lay small moorings for fish traps in several places in the area. A few boat moorings are present in Il-Bajja tal-Qawra. The area is also visited by large numbers of SCUBA divers, especially in summer. Anchoring of large craft within Il-Bajja tad-Dwejra is causing damage to the *Posidonia oceanica* meadows there.

44. Control measures necessary for the conservation of the habitats present at Dwejra/Qawra are the prohibition of anchoring by pleasure craft and amateur fishermen in all but designated areas, the strict control of access by divers to the caves and the formulation and enforcement of a code of practice for divers visiting these caves, the declaration of some caves as 'closed' to divers to allow regeneration, the prohibition of spear-fishing with aqualungs and the prohibition of all other types of spear-fishing except in designated areas, the control and regulation of fishing activities in the area particularly those that collect a significant by-catch and those that target large territorial fish, and the removal of 'ghost' traps and nets.

45. Consideration should also be given to restricting the number of mooring in Il-Bajja tal-Qawra and to reducing the number of concrete piers there in order to revert sections of the shore to the ecologically important shingle beach originally present. Traffic through Il-Ghar tal-Qawra needs to be controlled for both environmental and safety reasons since this tunnel is used by both divers and sea craft.

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