Biodiversity analysis of a rocky shore line in Newquay in support of a proposed marine conservation zone

Introduction

A marine conservation zone (MCZ) is one form of a protected area at sea that restricts human activity in an attempt to protect a range of nationally important marine wildlife and habitats. Since the passing of the Marine and Coastal Access Act 2009 the government are creating 27 potential MCZ's in the sea around England. One of these is Newquay and the Gannel, a potential tranche 2. The proposed boundary for this site includes the Gannel estuary, stretching along its seaward boundary from Porth to Polly Joke covering around 4 miles of coastline and spreading 1 kilometre out to sea. This pMCZ encompasses a number of different habitats including intertidal rocky habitat, coarse and fine intertidal sediment, coastal saltmarsh, saline reed beds and subtidal habitats ranging from sands and gravel to rocky reef. This vast wealth of habitat types supports an array of important foci species such as pink sea fans, giant goby, stalked jellyfish, European eel and salmon.

The efforts of surveying focused mainly on the upper and middle level of the rocky shore. This can be defined as an intertidal area of the coastline where solid rock predominates. The lower levels of the rocky shore are those that are very rarely exposed expect during spring tides. On the flip reverse the upper shore may only briefly be immersed and thus can only be occupied by species able to withstand desiccation, strong light and variable changes in temperature and salinity. When the tide recedes bodies of water form and create microhabitats along the rocky coastline. In the lower shore conditions are more favourable, and there is intense competition among species that are able to live there. The lower shore is predominated by soft bodied organisms such as sponges, brittle stars and sea cucumbers and macroalage such as kelp. In contrast the upper shore is inhabited by shelled organisms such as limpets, topshells, mussels and barnacles plus hardy macroalage such as the wracks.

To support the pMCZ ecological surveys were conducted in order to determine key habitat types, marine life and topography of the Newquay coastline. This is fundamental to outline existing biodiversity, population fluctuations and species responses to climate change. This then allows any key species to be identified that will assist with the designation of a marine conservation zone to the area.

Methods

In order to gain a representative measure of biodiversity for the MCZ it was firstly important to survey as much of the site as possible and as often as possible due to changing biotic variables such as weather and tides. This involved conducting shore surveys along key points of the Newquay coastline within the MCZ. Key survey areas included Fistral beach, Towan beach, Porth beach and Lusty glaze beach. These where areas in the MCZ that where easy to access.

There are multiple survey types for the rocky shore depending on topography, number of surveyors and type of rocky shore. The four key survey types include: line transects, quadrats, timed species search and a walk-over survey. Given the nature of the main survey areas timed species search and walk-over surveys where more practical and efficient. The uneven gradient of the coastline made line transects and quadrats in practical. Furthermore, the low number of surveyors also made timed species search difficult, therefore walk-over surveys where the preferred type.

Timed species search is a survey involving searching for a limited number of species of particular interest usually climate change indicators, and invasive species in a fixed amount of time usually 20 minutes to cover 70 metres of the survey area. This survey uses cards to help find key species on the rocky shore. Surveyors are given up to 4 cards each; these contain photographs and details of single species, and then surveyors search the shore for 20 minutes recording occurrences of species on the cards.

A walk-over survey is the most important aspect of the survey as it provides data directly to governing bodies. The walk-over survey is a broad-scale survey to establish basic habitat types and species diversity present at a site which can identify gross changes since previous surveys. It allows for a broad sweep in search of key species that may often be missed in line transects and quadrats. With all survey types the site name, date, name of surveyors and the GPS position of the start and centre points of the survey are to be undertaken. The rocky shore is surveyed looking for foci, dominant, rare and unusual species. The zone the species occurs in and the abundance are also recorded using the SACFORN scale. A minimum of 10 photographs are required for each survey and to be significant the foci species must be found within 5 different areas on the same site.

Results

All surveys where undertaken during the summer of 2014 between May and September before the consultation of MCZ early in 2015. Surveying began to help aid in the designation of a potential MCZ at Newquay by show casing the vast array of species found in the area. The identification of key foci species such as pink sea fans, European eel, giant goby and stalked jellyfish would aid in supporting the need for a protected area within Newquay. The pMCZ covers around 4 mile of coastline and includes the gannel which is currently listed as a Special Site of Scientific Interest (SSSI), this is due to the importance of estuaries for over wintering birds, acting as a nursery for small fish and access to breeding grounds for salmon and the European eel. Along this 4 mile boundary different stretches of the rocky shore where selected to survey.

<u>Shore search number 1: South Fistral 28.5.14</u>

First Newquay marine group (NMG) rocky shore ramble of the year, respectable turn out of volunteers from NMG members and also volunteers from the Cornwall wildlife trust. At this site a timed species search was conducted for 20 minutes aimed at key species. These include climate change indicators, invasive species and typical rocky shore inhabitants. From the timed species it was evident that the invasive sargassum muticum was common at this site. No other invasive sea weeds where discovered or any of the foci species. Other typical rocky shore inhabitants where either frequent or common at this site.

In addition a walk-over survey was also done, this involved a broad sweep of the survey area and aims to pick up on species that are potentially missed during a timed species search. The area consisted of a number of different zone types including green algae and the wracks on the upper shore and mussel beds, rocky overhangs, exposed and sheltered rock pools on the middle shore. The walk-over survey found a key species for the site such as the scarlet and gold cup coral which is a rare solitary small coral with a hard skeleton and a single anemone like polyp. This species can be found on the extreme lower shore or subtidally attached to rocks.

An unusual find on the rocky shore was a conger eel elver found on the upper shore amongst brown seaweeds. The conger eel is the largest eel species in the world and is usually grey in colour. Adult conger eels travel to the warmer Atlantic waters to reproduce and the elvers travel back to European waters to mature. Also found at this site was the hedgehog sponge a widespread and locally common on the coasts of Britain and Ireland, however at this site was listed as rare. Abundant species listed for this site include beadlet anemone, common blenny, common limpet, barnacles, flat wrack, breadcrumb sponge, green leaf worms and celtic sea slugs.

Phylum	Common name	Number of species
Algae	Sea weeds	8
Annelida	Segmented worms	1
Bryozoa	Sea mats and sea firs	0
Cnidaria	Anemones, corals, jellyfish and hydroids	7
Crustacea	Crabs, lobsters, prawns and barnacles	7
Echinoderms	Starfish, brittlestars, urchins and sea cucumbers	3
Mollusca	Shells, sea slugs and cuttlefish	6
Pisces	Fishes	3
Platyhelminthes	Flat worms	0
Porifera	Sponges	2
Tunicata	Sea squirts	1
Total		**38**

Figure 1. South Fistral, survey area

Figure 2. Dahlia anemone

Figure 3. Light bulb sea squirts

Figure 4.Srawberry anemone, beadlet anemone, topshells and dog whelk

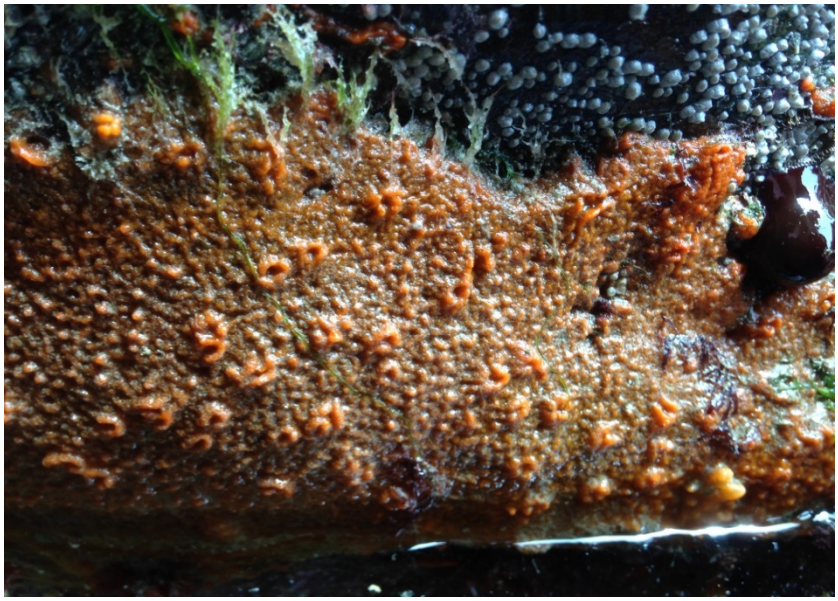

Figure 5. Breadcrumb sponge

Figure 6. Conger eel elver

Shore search number 2: Towan beach 05.06.14

Second shore search of the year, quite a poor turnout only 2 NMG members. Due to low numbers a timed species search was not appropriate for this site. A broad sweep walk-over survey was conducted identifying any inhabitants of the rocky shore with particular interest for foci species and also climate change indicators and invasive species. Key note for this survey was that the invasive seaweed sargassum muticum was only listed as occasional, this may be due to lack of suitable rock pools for it to inhabit. The area consisted of green algae and wracks, mussel beds and sheltered rock pools. No key species where found at this site and other typical rocky shore inhabitants were listed as frequent and abundant.

Abundant species included: mussels, barnacles, limpets and frequent species included: beadlet anemone, snakelocks anemone, strawberry anemone, common prawn, bladder and egg wrack, dog whelk, common blenny and shore crabs.

Phylum	Common name	Number of species
Algae	Sea weeds	7
Annelida	Segmented worms	1
Bryozoa	Sea mats and sea firs	1
Cnidaria	Anemones, corals, jellyfish and hydroids	4
Crustacea	Crabs, lobsters, prawns and barnacles	3
Echinoderms	Starfish, brittlestars, urchins and sea cucumbers	0
Mollusca	Shells, sea slugs and cuttlefish	5
Pisces	Fishes	2
Platyhelminthes	Flat worms	0
Porifera	Sponges	1
Tunicata	Sea squirts	0
Total		**24**

Figure 7. Beadlet anemone, green leaf worm and green algae.

Figure 8. Snakelocks anemone and enteromorpha lynza

Shore search number 3: South Fistral 15.06/14

The third shore search in support of the potential MCZ. A turn out of just 4 NMG members meant that a timed species search was not deemed appropriate and a full broad sweep walk-over survey would be sufficient. With a super low tide and extremely high ambient temperature enabled access to extreme lower shore which is otherwise usually submerged. Due to the extreme low tide meant that on this particular survey a lot of the soft bodied organisms and species usually not found on a rocky shore survey where able to be recorded. The survey area as previously been described in the first shore search however the extreme lower shore was exposed on this occasion. This encompassed steep rocky outcrops and kelp fringes.

Key species where not found at this site except the presence of the scarlet and gold cup coral, the only invasive species was sargassum muticum already described for this site. Abundant species included: mussels, barnacles and beadlet anemone. Frequent species included: shore crab, edible crab, sea hare, breadcrumb sponge, celtic sea slug, limpets, dog whelks, common prawn, dahlia anemone, gem anemone and snakelocks anemone.

Phylum	Common name	Number of species
Algae	Sea weeds	7
Annelida	Segmented worms	0
Bryozoa	Sea mats and sea firs	0
Cnidaria	Anemones, corals, jellyfish and hydroids	8
Crustacea	Crabs, lobsters, prawns and barnacles	8
Echinoderms	Starfish, brittlestars, urchins and sea cucumbers	1
Mollusca	Shells, sea slugs and cuttlefish	6
Pisces	Fishes	1
Platyhelminthes	Flat worms	0
Porifera	Sponges	2
Tunicata	Sea squirts	2
Total		**35**

Figure 9. Velvet swimming crab

Figure 10. Sea hare

Figure 11. Beadlet anemone

Figure 12. Star ascidian

Shore search number 4: South Fistral 20.06.14

Fourth NMG shore search and the third one for this site. High tide was late in the evening and the tide was coming in during this survey limiting the area covered and survey time. Again a low turnout of just 2 NMG members meant that a timed species search was not appropriate. The lower shore was not accessible on this survey. A walk-over survey was conducted at this site aimed at recording all rocky shore inhabitants. On this survey none of the key species where identified with sargassum muticum being the only invasive species. Three of the climate change indicators where recorded including celtic sea slugs, snakelocks anemone and the flat top shell. The usual rocky shore inhabitants where recorded. Abundant species at this survey included: blue mussels, beadlet anemone and barnacles. Common species included: Japanese wire weed, strawberry anemone, common blenny, limpets, enteromorpha lynza, egg wrack, and common prawn.

Occasional and frequent species include: snakelocks anemone, daisy anemone, flat top shell, breadcrumb sponge, sea lettuce, kelp, sea hare, sand shrimp, ballan wrasse, edible crab, shore crab, gem and dahlia anemone, dog whelk and long-spined sea scorpion.

Phylum	Common name	Number of species
Algae	Sea weeds	8
Annelida	Segmented worms	0
Bryozoa	Sea mats and sea firs	0
Cnidaria	Anemones, corals, jellyfish and hydroids	8
Crustacea	Crabs, lobsters, prawns and barnacles	8
Echinoderms	Starfish, brittlestars, urchins and sea cucumbers	0
Mollusca	Shells, sea slugs and cuttlefish	6
Pisces	Fishes	7
Platyhelminthes	Flat worms	0
Porifera	Sponges	2
Tunicata	Sea squirts	2
Total		**42**

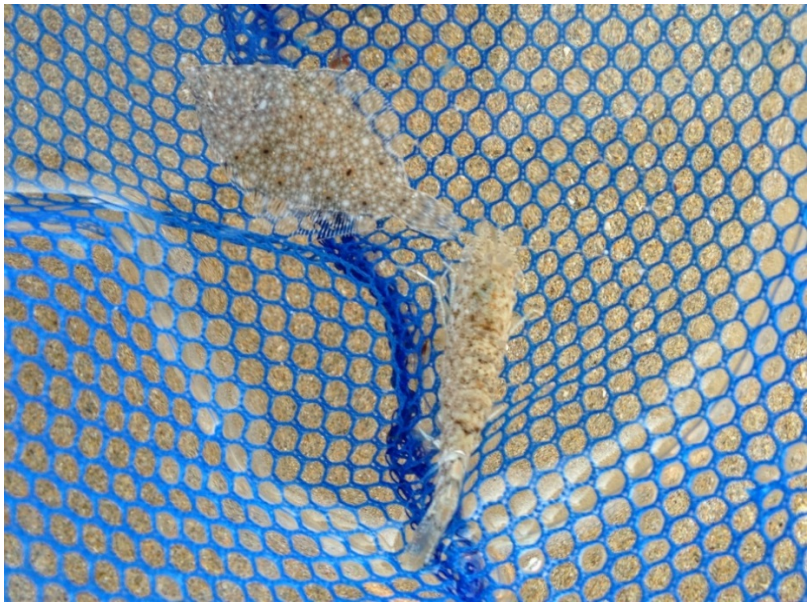

Figure 13. Flatfish and sand shrimp

Figure 14. Long spined sea scorpion

Figure 15. Unknown goby spp.

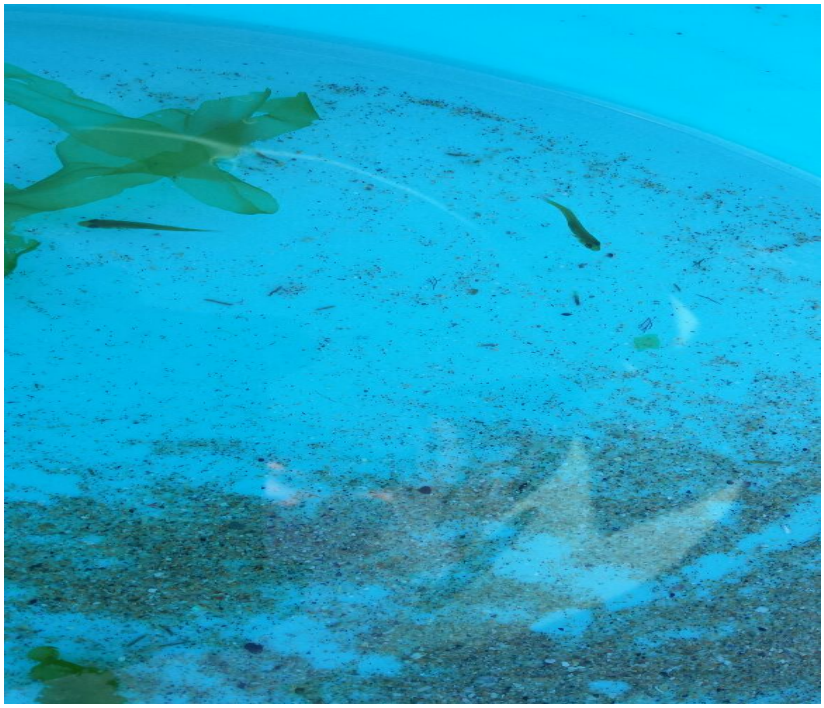

Figure 16. Ballan wrasse fry

Figure 17. Unknown goby spp.

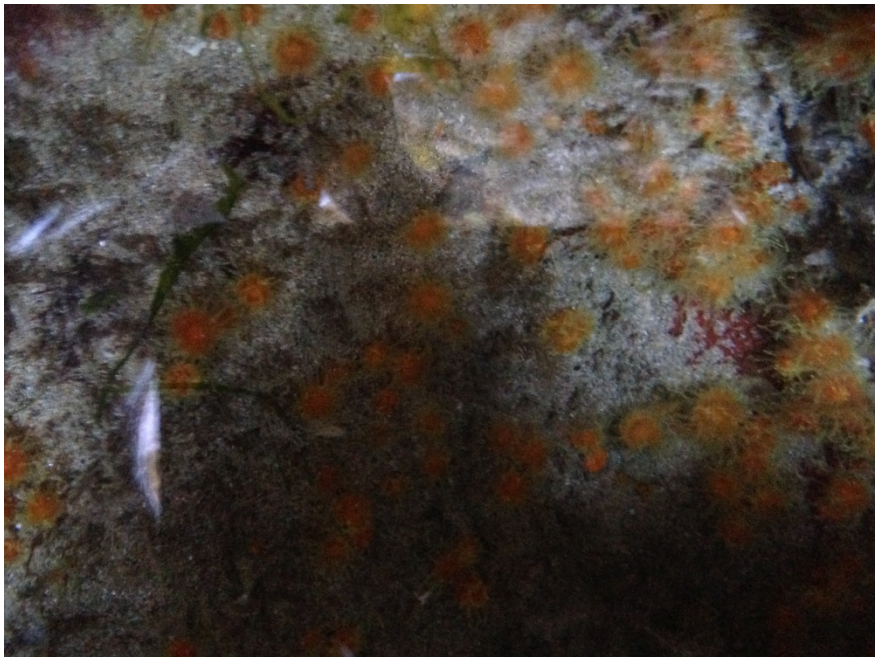

Figure 18. Scarlet and gold cup coral

Shore search number 5: Porth beach 12.08.14

Fifth NMG shore search of the year this survey focused on the perimeter of the proposed MCZ. The turnout for this survey was low with just 2 MNG members present. This was a very low tide exposing the lower shore however with strong winds causing surges the lower shore line was inaccessible. The survey site was largely sandy with a freshwater stream running along the northern edge home to a vast array of brackish fish. The north and south edges are flanked with steep rocks and cliff edges. The upper shore is barren consisting of little life, with the middle shore home to wracks, limpets and barnacles found on small rocky areas flanking the freshwater stream.

The lower shore is dominated by sheer rock edges and cliff faces exposing kelp fringes at low tide and exposed rock pools both on ground and elevated levels. Due to low surveyor numbers a walk-over survey was appropriate for this site. None of the foci species where recorded for this site and the invasive sargassum muticum was recorded as occasional. Two of the climate change indicator species where also present at this site. Although a common species in the Northern hemisphere quite an unusual sight for a high energy coast line was the sand mason worm. This is a species of burrowing marine polychaete worm, it builds a characteristic tube which extends from the sea bed. This worm can be found as a few scattered individuals or in populations of several thousand per kilometre square. Abundant species at this site included: blue mussel, beadlet anemone and barnacles. Common species included: Grey thick-lip mullet, common blenny, shore crab, strawberry anemone, celtic sea slug and egg wrack. Occasional and frequent species include: Japanese wire weed, snakelocks anemone, hydroid spp, springtails, common prawn, keel worm, dog whelk, enteromorpha lynza, sea lettuce, edible crab, sand goby, limpets, breadcrumb sponge and kelp.

Phylum	Common name	Number of species
Algae	Sea weeds	8
Annelida	Segmented worms	3
Bryozoa	Sea mats and sea firs	0
Cnidaria	Anemones, corals, jellyfish and hydroids	7
Crustacea	Crabs, lobsters, prawns and barnacles	5
Echinoderms	Starfish, brittlestars, urchins and sea cucumbers	0
Mollusca	Shells, sea slugs and cuttlefish	5
Pisces	Fishes	3
Platyhelminthes	Flat worms	0
Porifera	Sponges	1
Tunicata	Sea squirts	0
Total		**32**

Figure 19. Breadcrumb sponge

Figure 20. Edible crab

Figure 21. Gem anemone

Shore search number 6: Lusty Glaze 20/08/14

Final official NMG shore search of the year with two NMG members present. Another low tide exposing some of the middle shore. Survey site was sheer cliff sides and large sporadic rocky formations. Very little macroalage at this site, largely dominated by anemones and marine teleost's. None of the foci species were identified at this site and a simple yet effective broad sweep walk-over survey was conducted. One of the climate change indicators where found and interestingly nor was the invasive sargassum muticum. Abundant species at this site include: barnacles, limpets and mussels. Frequent species include beadlet anemone, snakelocks anemone and the common blenny.

Phylum	Common name	Number of species
Algae	Sea weeds	4
Annelida	Segmented worms	1
Bryozoa	Sea mats and sea firs	0
Cnidaria	Anemones, corals, jellyfish and hydroids	3
Crustacea	Crabs, lobsters, prawns and barnacles	2
Echinoderms	Starfish, brittlestars, urchins and sea cucumbers	0
Mollusca	Shells, sea slugs and cuttlefish	2
Pisces	Fishes	3
Platyhelminthes	Flat worms	0
Porifera	Sponges	1
Tunicata	Sea squirts	0
Total		**16**

Figure 22. Barnacles

Figure 23. Snakelocks anemone

Figure 24. Green leaf worm, beadlet anemone, breadcrumb sponge and barnacles

Discussion

Evident from the results is the diversity of species found within the proposed marine conservation zone boundary and how similar but yet different each survey area is within this boundary. Although none of the foci species where found during our surveys the giant goby and stalked jellyfish have been found within the pMCZ area. A limiting factor may likely have been the low number of surveyors at each survey to cover enough ground. However, scarlet and gold cup have been found on Fistral this is a rare, slow growing and solitary coral that is susceptible to changes in water quality. Usually found on the extreme lower shore or subtidally attached to rocks, often in caves or in exposed areas with good water movement suggests that Fistral is a suitable habitat for them. From figure 18 it is evident how densely populated they are within this location this suggests that there could be others at this site. Also evident from the results is the high species numbers found at Fistral. This may be attributed to the prevailing winds and exposed coastline meaning that most planktonic and other motile species are likely to be brought in with the incoming tide and are able to settle in a large area with sheltered habitats.

Fistral provides a rich variety of microhabitats including large rock pools home to a wealth of seaweeds and marine fish, large rocky pinnacles and deep ravines home to kelp on the extreme lower shore whilst providing sponges and filter feeders lots of flow. In contrast towan beach provides less possible habitats and is slightly sheltered yet the species numbers in a small location are equally as high. There are a high number of sea birds at towan and also disturbance from tourists not usually seen at Fistral as the sheer rocky areas are less accessible. This may impact on the type of species seen at towan. When compared to Porth beach the habitats available are affected by the topography of the beach. On the extreme lower shore this site is quite narrow and flanked by sheer cliff edges and being exposed means this is a high energy location. This site was predominantly occupied by filter feeders such as mussels, any sheltered areas where home to sessile organisms such as anemones.

In summary the pMCZ supports a vast array of species, although none of the foci species where found the diversity of life here was found to be exceptionally high. This pMCZ also incorporates the gannel estuary acting as a nursery for fish fry supplementing fish stocks out at sea and also provides access to freshwater for the European eel. More surveying needs to be done so we can also see how populations are changing compared to last year and how climate change may also be affecting our coastline. The MCZ would also support the local economy and fisherman would also benefit from increased fish stock spilling out of the protected area. With increased protection in the form of a MCZ numbers of foci species are likely to increase.