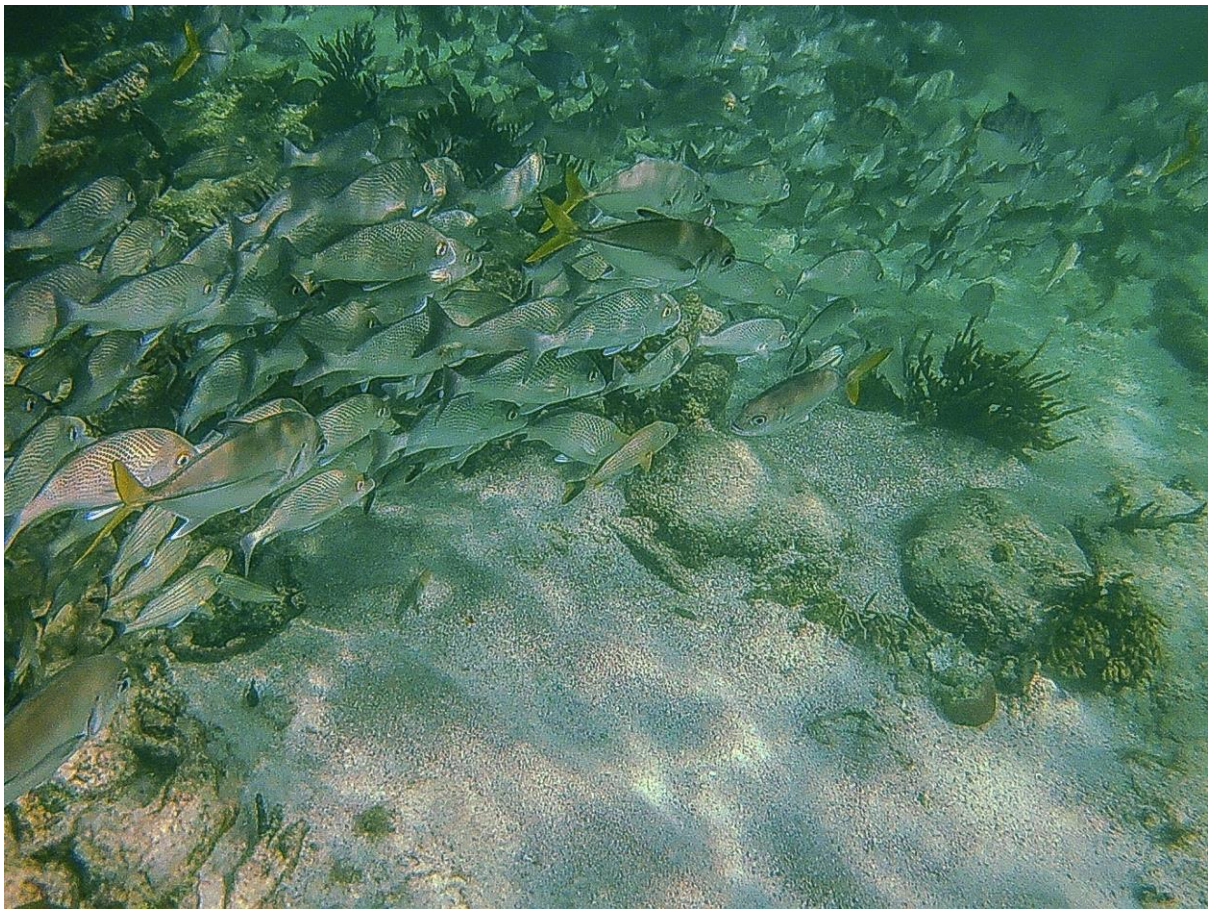
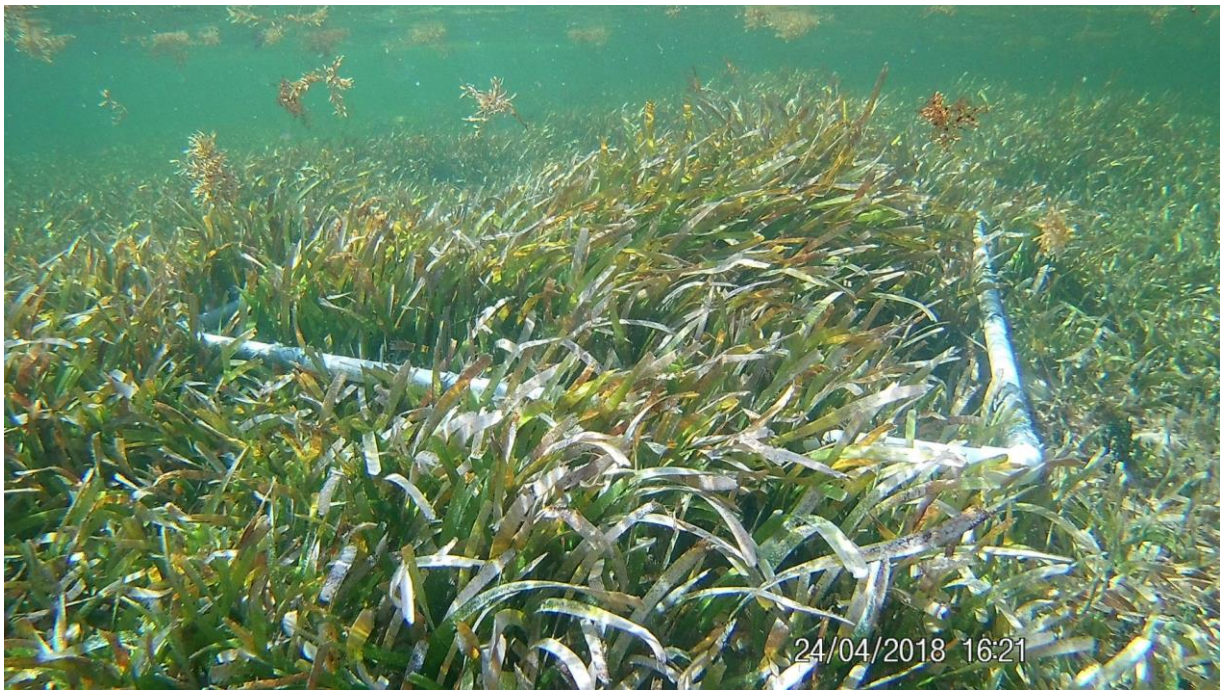
Fish community structure and habitat utilisation within Soliman Bay



Introduction

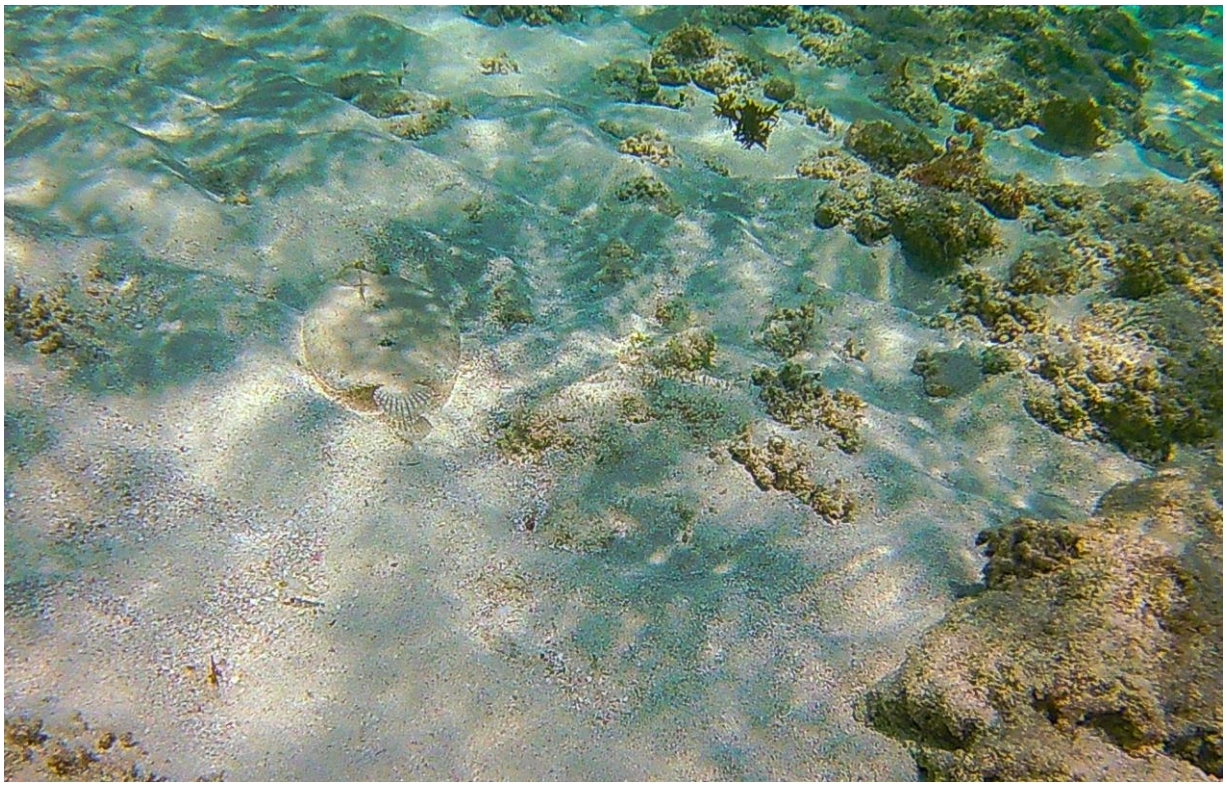
Understanding connectivity of marine habitats is essential for effective marine conservation. Indeed, the less human impact, the less habitat degradation will be incurred to the natural habitat. A thriving ecosystem will have a high habitat complexity, which will support great biodiversity due to the high availability of niches. Thus, it is important to maintain intact ecosystems without impacting the connected key habitats, such as the seagrass, intermediate zone, and fringing reefs within the Soliman Bay. The three zones are vital to fish at different life stages and functional guilds. The seagrass beds can be found close to shore, as soon as the seagrass ends, an 'intermediate' zone will appear, which will then lead onto the fringing corals before the reef starts.

Seagrass is mostly used by fish as nurseries due to a high abundance of food and shelter.



Thalassia testudinum, turtle grass.

The intermediate zone (below) is the migratory zone for fish communities. *Note* the flounder in the centre of the image.



The complexity of the corals provides many ecological niches and shelter, supporting a wide diversity of fauna.

Methodology

Within Soliman Bay, twenty 1-meter by 1-meter quadrats were used in each of the three zones, (1) seagrass, (2) intermediate zone, and (3) corals. *See below*.

Within each quadrat, for a time of five minutes all species were recorded, identified and counted. Each quadrat was recorded using a digital camera.

Results

The greatest abundance of fish was found in the fringing coral habitats, with the Soliman Bay, and difference of fish abundance was found between the seagrass and intermediate areas (fig. 1).

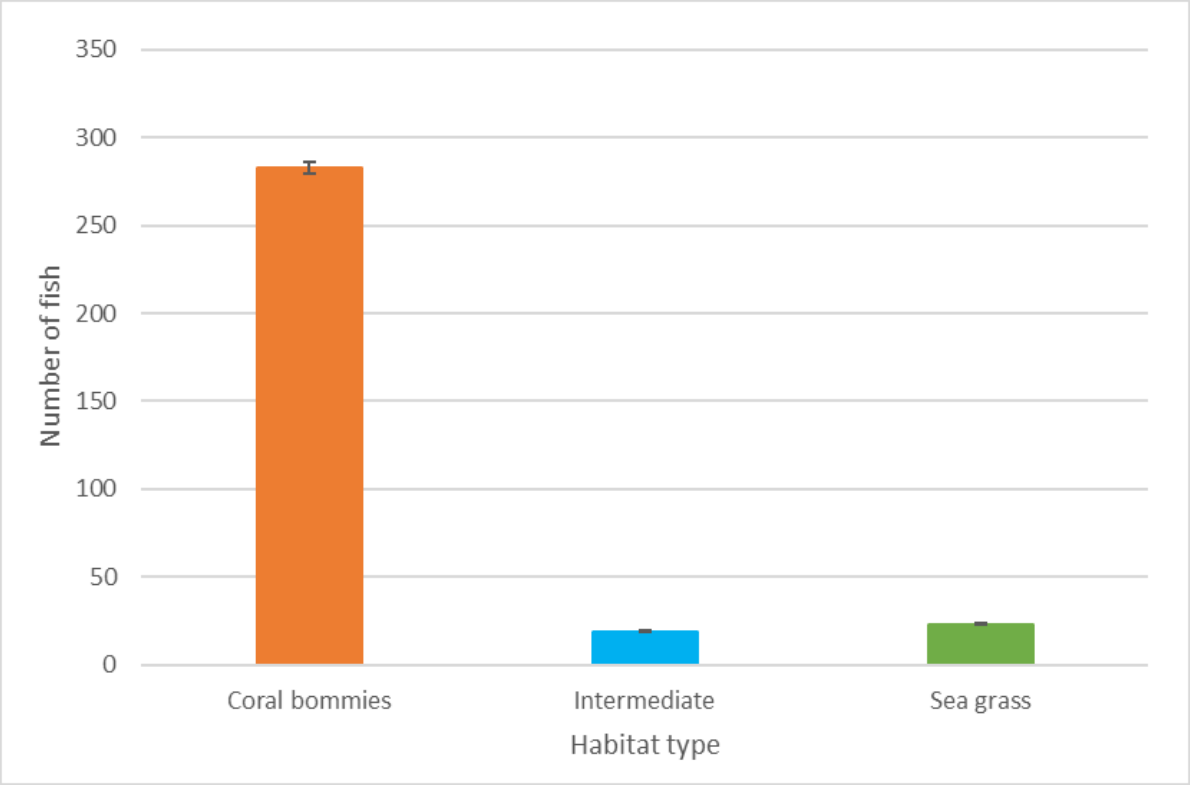


Figure 1. The abundance of fish counted in twenty 1-meter x 1-meter quadrats within three different habitats in Soliman Bay.

All fish were identified and categorised into their functional guild e.g. herbivores, omnivores and predators. The coral zone in Soliman Bay had a very high abundance of herbivores, omnivores and carnivores (fig. 2). The seagrass and intermediate zones had omnivores and carnivores in very low abundance compared with the coral zones. Surprisingly, no herbivores were found in the seagrass or intermediate zones.

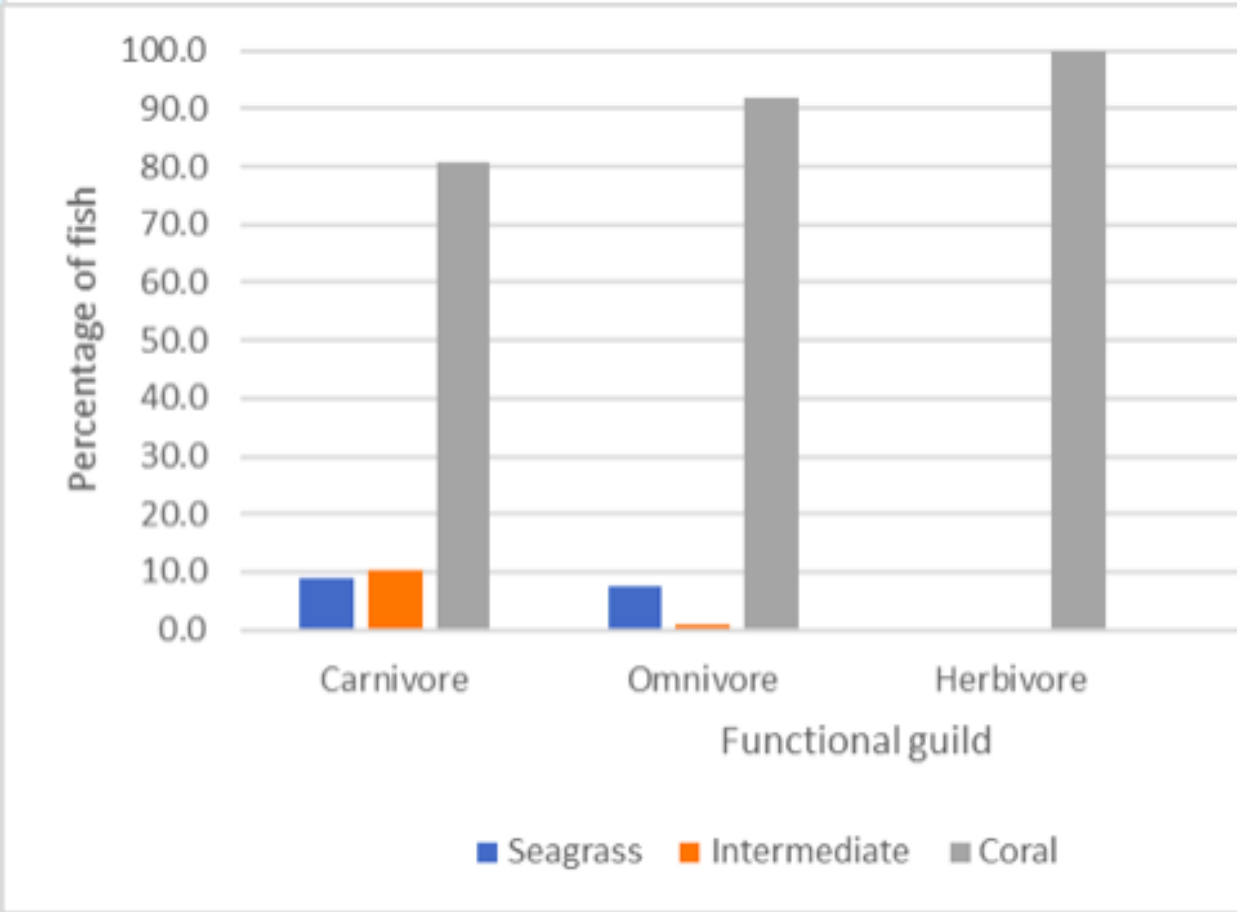


Figure 2. All fish were identified and separated into their functional feeding groups.

In the seagrass habitats, *Halichoeres bivitatus* and *Haemulon carbonarium* made up more than 90 per cent of the fish community structure. Only one species, *Haemulon carbonarium* were found in the intermediate zone making 100 per cent of the fish community structure in the zone. However, *Abudefduf saxatilis, Halichoeres bivitatus* and *Stegastes adustius* made up more than 90 per cent of the fish community structure found within the coral zones in Soliman Bay (*see* Table 1 and fig. 3).

Table 1. The accumulative composition of fish species found in the three zones within the Soliman Bay. Corals had the greatest diversity of fish species. The seagrass areas share similar fish communities to the corals, but more juveniles were found in the seagrass areas.

Coral	**Intermediate**	**Seagrass**
Abudefduf saxatilis 41.5% *Halichoeres bivitatus* *68.9%* *Stegastes adustius* *92.4%*	*Haemulon carbonarium* *100%*	*Halichoeres bivitatus* *77%* *Haemulon carbonarium* *91.8%*

Figure 3. Common fish found in all areas of the Soliman Bay. A, *Halichoeres bivitatus* (slippery dick), B, *Abudefduf saxatilis* (sergeant major), C, *Stegastes adustius* (dusky damselfish), and, D, *Haemulon carbonarium* (Caesar grunt).

Some of the fish communities between the three different habitats within the Soliman Bay were mutually distinct from each other. No difference was found between the fish communities using the seagrass beds and intermediate zones (fig 4, samples grouped within the green circle). However, fish communities within the seagrass and intermediate zones were significantly different compared to the fish communities found with the corals (samples grouped in the red circle, fig 4).

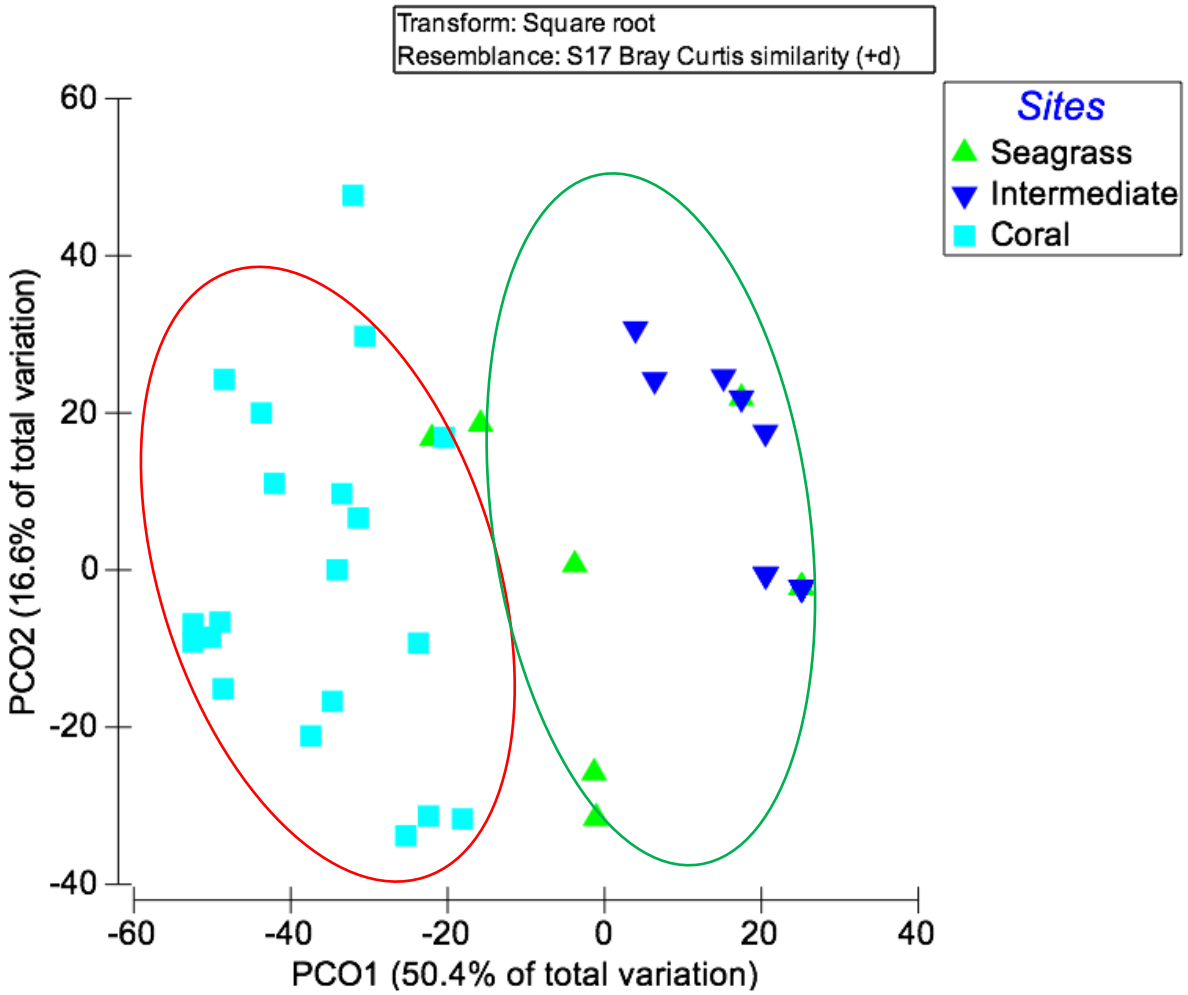


Figure 4. A principle component analysis (PCO), illustrating the similarities of fish communities recorded within twenty quadrats in each zone within the Soliman Bay. The fish communities, highlighted within the red circle are significantly different from the fish communities found within the seagrass beds and intermediate zones (green circle).

Conclusions

From the data, it is clear to determine that each of the three habitats (zones) within the Soliman Bay are vital for the fish community structure and ecology of the bay. The seagrass beds act as a nursery for the adjacent coral reefs in the Soliman Bay. The intermediate zones

help provide a stepping stone for the fish communities between the seagrass beds and the coral reefs in the Soliman Bay. Each of the habitats are essential for the biodiversity, and it is important to note that without the structural complexity, the nursery function of the seagrass beds, and the transitional function of the intermediate zones would be lost. Without the structural complexity, juvenile and vulnerable fish species would have a greater mortality, and this would lead to a huge loss of biodiversity, biomass and productivity within the Soliman Bay. Thus, it is essential that human impacts are minimised, and where possible, habitat restoration, at the whole ecosystem-level must be maintained to ensure that the habitat structural complexity, and ecosystem structure and function remains intact. Without the nursery function provided by the seagrass beds, and habitat complexity provided by the corals, the fish communities within the Soliman Bay would be non-existent.