INTERVIEW WITH A RESEARCHER – June 2013

RESEARCH FUNDED BY NATURE FOUNDATION SA

RESEARCHER: RYAN BARING, FLINDERS UNIVERSITY PHD STUDENT
RESEARCH PROJECT: "AN INVESTIGATION OF THE ROLE THAT FLOATING MACROPHYTES (SEAGRASSES & ALGAE) PLAY AS HABITAT & FOOD RESOURCE FOR INVERTEBRATES AND FISH FAUNA IN THE SURF ZONE OF SANDY BEACHES".
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Piles of seaweed along Normanville beach after a storm in 2012.
Photo: Ryan Baring

What was the aim and purpose of your project?

Drifting seaweed that accumulates along sandy beaches can be unsightly and have a foul odour as it decomposes over time. Yet, the role that drifting seaweed plays as a habitat for many species of young fish and their invertebrate prey is very important but often overlooked. Previously it was suggested that regular storms force the drifting seaweed into the surf zone but to date no research has investigated how this actually works. The main aim of this project was to investigate seaweed accumulations in the surf zone of sandy beaches during storm versus calm weather events to identify the seaweed, fish and invertebrate prey within.

Summarise the results of your project [tells us about]

So far, the types of drifting seaweed that I have found in the surf zone of sandy beaches is very different along Metropolitan Adelaide, Fleurieu Peninsula and the South-East of South Australia. The amounts and types of drifting seaweed found in the surf zone of sandy beaches during storm and calm weather events is similar, indicating that the arrival and movement of drifting seaweed is very complex and unpredictable. The species and abundance of young fish that are using the drifting seaweed as habitat is different in the Metropolitan Adelaide and South-East region. Fleurieu Peninsula tends to have the most number of fish species that hang around drifting seaweed which is made up of a mixture of seagrass and algae.

Seine-net being brought into shore after capturing drifting seaweed at Semaphore Beach during the pilot study Aug 2011.
Photo: Ryan Baring

Interesting points about this work

- The movement of seaweed into the surf zone of sandy beaches is not as predictable as previously thought.
- Three different regions of the SA coastline have very different drifting seaweed composition in the surf zone of sandy beaches
- Surf zones along Fleurieu Peninsula beaches have a very diverse number of fish species that use drifting seaweed as habitat
- Many species of young fish that are found hanging around drifting seaweed are important for recreational and commercial fisheries.

What was the most exciting thing about this work?

"drifting seaweed in the surf zone of sandy beaches plays a very important habitat role for many species of young fish"

Large seaweed deposits at Large Bay April 2011
Photo: Ryan Baring

FINAL REPORT TO NATURE FOUNDATION SA – 2012 SCHOLARSHIP FUNDING

NAME: RYAN BARING

PROJECT NAME: ***"AN INVESTIGATION OF THE ROLE THAT FLOATING MACROPHYTES (SEAGRASSES & ALGAE) PLAY AS HABITAT & FOOD RESOURCE FOR INVERTEBRATES AND FISH FAUNA IN THE SURF ZONE OF SANDY BEACHES"***

Abstract

Drifting macrophytes (seagrasses and algae) in the nearshore surf zones of sandy beaches were sampled during stormy versus calm weather surveys in 2012. The main aim of this study was to investigate the fish and invertebrate fauna associated with macrophyte accumulations along beaches in three coastal regions between storm and calm events. The sampling events in 2012 provided new understanding of the variability in fish and invertebrate numbers and macrophyte volume encountered with macrophyte accumulations in surf zones with regular oscillations of storm and calm weather events. In total, 39 species of fish were identified in the 2012 surveys, which included 11 species of recreational and commercial importance and nine species of pipefish from a family that is important from a conservation perspective. So far it appears that the macrophyte composition and fish abundances and species numbers do not differ between storm and calm events. The movement of drifting macrophytes into the surf zone of sandy beaches is very complex and not easy to predict.

Young Leatherjacket captured around drifting seaweed in the surf zone at Basham Beach, Fleurieu Peninsula
Photo: Ryan Baring

Introduction

A walk along most local beaches particularly after storms one can see that there are normally large piles of what is commonly called 'wrack'. The wrack piles consist of many species of seagrass and algae ('macrophytes'), some animal carcasses and human-sourced litter (e.g. plastics, cans, bottles). During storms, seagrass and algae are ripped up from the seafloor and either float to the surface or tumble along the seafloor where they end up stranded on beaches or are buried in the sand, where they begin to decompose, usually over long time periods. The wrack that is stranded on beaches may re-enter the surf zone of sandy beaches with subsequent high tides and is constantly moving and changing in composition due to wave turbulence and tidal action.

Previous studies elsewhere have identified that multiple fish species (both fished and nonfished species) aggregate around wrack accumulations in the surf zone of sandy beaches (Lenanton and Caputi 1989; Crawley et al. 2006). The presence of many young fish around wrack accumulations suggests that wrack may be an important temporary habitat that serves as a nursery for young fish. The question of why young fish are attracted to drifting wrack is still not totally resolved but it appears that they may be using wrack as a refuge from larger

predators and/or for better food resources due to larger abundances of invertebrate prey than in surrounding clear waters.

In eastern South Australia we have three bioregions along our coastline that represent very different coastal marine habitats: Gulf St. Vincent consists of dense seagrass meadows (Loo and Drabsch 2008); the Coorong bioregion has a mixture of patchy to dense seagrass meadows and patchy sub-tidal rocky reefs; and the Otway bioregion consists of mainly low to medium continuous sub-tidal rocky reefs (DENR 2010). Consequently, the three regions also have distinct macrophyte accumulations; the seagrass-dominated metropolitan Adelaide, the seagrass-and macroalgae-dominated Fleurieu Peninsula and the macroalgae-dominated South-East region of South Australia (McKechnie and Fairweather 2003; Duong 2008). This provides a good model for investigating drifting macrophytes and their associated fish and macroinvertebrate assemblages between very different regions.

In Australia, the soon to be implemented South Australian Representative System of Marine Protected Areas (SARSMPA) aims to ensure the future conservation and sustainable use of ecosystems in coastal waters in order to meet Australia's obligation under the International Convention on Biological Diversity (DSEWPC 2010). With this in mind, my study focuses on the wrack accumulation in surf zones of sandy beaches and the potential habitat and food resources provided for young fish within nearshore ecosystems. For example, previous research on drifting macrophytes suggests that they play an important role in secondary production due to the breakdown of plant matter providing carbon and nutrients to lower levels of the food web, particularly in nearshore areas such as the surf zones of sandy beaches (Christie et al. 2009).

The study undertaken in 2012 aimed to provide an understanding of the variability in fish and invertebrate abundances and macrophyte volumes associated with drifting macrophytes in surf zones of sandy beaches immediately after storms and during calm periods between three separate coastal regions in South Australia (Adelaide Metropolitan, Fleurieu Peninsula and South-East). This ongoing work will be valuable for understanding marine ecosystem function, enabling the protection of critical life stages of fish, the future conservation of coastal habitats and fish biodiversity, and aid in fisheries management decisions.

The recreationally and commercially important flathead (*Platycephalus speculator)* captured during sein-net sampling at Semaphore Aug 2011 Photo: Ryan Baring

Methods:

Sampling events were undertaken from January - August 2012 in the surf zone of sandy beach sites (3 sites per region) across 3 regions (Metropolitan Adelaide, Fleurieu Peninsula, South-East South Australia) to compare conditions after storm activity to those during calm weather. Immediately after storm activity there are large amounts of drifting wrack while during calm weather periods less wrack is typically found. So far three storm and two calm events have been surveyed to identify the drifting macrophyte, fish and invertebrate

composition between weather events and regions (1 calm weather survey pending). The last sampling event was undertaken in August 2012 and there has been some delay in the final calm weather sampling event taking place due to the large fluctuations in weather (no ideal calm events), particularly in the South-East region. For the five sampling events undertaken so far, the data for macrophytes and fish have been obtained and analysed while the invertebrate samples are still being sorted and identified in the lab. The storm and calm weather events surveyed involved the deployment of seine nets from the beach at nine sites (3 sites per region) to capture wrack in order to determine the composition and volume of macrophytes, and the abundance, species number and composition of fish and invertebrates between weather events and regions. A large number of environmental variables were also measured in the field to determine whether any of these had an influence on fish and invertebrate numbers and species richness.

Results and Discussion

So far during this study, I have sampled 270 wrack accumulations across all nine sites from the three regions. I have also identified 39 species of fish that include 11 species of recreational and/or commercial value and 9 species of pipefish (the Syngnathidae family of fishes, which are protected in South Australia). Based on the five sampling events undertaken so far, it appears that the fish that are using the drifting wrack as a habitat and/or food resource are mainly quite young immature fish. The volume of the wrack samples taken during the five sampling events mainly consisted of the Posidonia species of seagrasses or seagrass rhizomes in the case of the Adelaide metropolitan region, a mixture of seagrass and algae throughout Fleurieu Peninsula and predominantly algae in the South-East region (Figure 1). There does not appear to be a distinct difference in the wrack composition between storm and calm events from the events sampled so far. However, there is large variability in the data which provides evidence that the mechanism of wrack movement into the nearshore zone of sandy beaches is not straight forward and very complex. There were no differences in fish abundances and species numbers between storm and calm events in any of the three regions. Fish abundances and species numbers were largest along the Fleurieu Peninsula and lowest along Adelaide metropolitan beaches (Figures 2 and 3).

Macroinvertebrate samples are currently being processed in the laboratory but so far they mainly consist of amphipods and isopods, which are small crustaceans that are a common food source for fish.

During September to November 2012, some research and development was conducted for the macrophyte tagging study. Radio tags were placed along Brighton Beach in metropolitan Adelaide under different environmental scenarios in order to gain a full understanding of the signal detection range of tags (e.g. floating on water surface, buried in sand). Scenarios of tags buried in sand and under wrack piles along the beach could be detected by the receiver unit to the exact position of tags or worst case to within 1 square metre. This provided enough information of the potential accuracy of tag positions for the tagging study. Cages for the tag units were also designed and tested with a maximum of 0.5 L volume of wrack attached to the base of cages for floatability on the water surface and natural drift patterns. The next stages of the tagging study will include a deployment of tag/cage units with seagrass and algae attached at different distances from shore to identify the drift patterns over the short term and a deployment of tag/cage units from the largest distance over the longer term.

Future research for 2013

An investigation of wrack drift patterns will be conducted during mid-2013 as a two-stage experiment with a short-term tracking of wrack at multiple distances from shore during a single day (100 m, 250 m, 500 m, 1 km, 2.5 km and 5 km) and a longer-term deployment of tagged wrack at the largest distance from shore over > 2 weeks (2-5 km). Both tagged wrack experiments will provide a better understanding of the drift pathway at various distances from shore and over the long term from when macrophytes are detached from the seafloor until

they end up on shore. Dietary analysis of fish and stable isotope processing of fish, invertebrates, epiphytes and macrophytes was planned for mid-2012 but will now be undertaken as a one-off sampling event during April 2013 encompassing the most abundant (in terms of macrophytes, fishes and macroinvertebrates) Fleurieu Peninsula and South-East regions.

Preliminary results from the storm and calm weather study were presented at the Australian Society for Fish Biology Conference in Adelaide, July 2012. I sincerely acknowledge and thank the Nature Foundation of SA for partially funding this study.