INTRODUCTION

The idea of ''ecosystem'' for the most part infers a system with a high level of internal control and constraining. No biological system, however, is completely without interaction with, or impact from, adjacent natural surroundings or species assemblages (Orr et al 2005). Sandy shorelines frame a dynamic interface between marine and terrestrial ecosystems, and a large number of studies focussing on the connectivity between various segments of a beach and their neighbouring coastal environments have been led over the recent years (Mellbrand et al 2011). One of the principle linkages comprises of allochthonous contributions of organic material, which sandy beaches obtain in the form of beach-cast wrack, i.e. primarily macroalgae and higher plants/seagrasses (Rossi and Underwood 2002). This wrack material, transferred from surrounding ecosystems such as rocky shores or seagrass beds, may strand all through the whole intertidal range. Algal wrack deposits are documented on various kinds of beaches over the world, and with extremely variable values (i.e. sandy shorelines and estuarine shorelines: Gómez et al 2013). These external contributions of detrital macroalgae can greatly impact ecological features and operation of the receiver ecosystems by providing food and living space, regularly boosting richness and biodiversity of primary and secondary consumers (e.g. Wilson and Wolkovich 2011). Impact of algal wrack is more important where an exceedingly productive coastal environment, (i.e. subtidal rocky shores) interfaces with and sends out materials to the moderately less productive exposed sedimentary shores, such as rocky or sandy beaches, regularly without aquatic macrophytes (Lastra 2014).

The richness of stranded macrophytes on shorelines is extremely variable and relies upon the vicinity to rocky shores and reefs or to seagrass fields. Marsden (1991a) working on a sandy beach in New Zealand calculated an average monthly wet weight of organic material of 11.25 kg 5m-1 (SE mean = 3.78 kg) demonstrating a low organic input. On different events inputs can be very high. An approximation of 2179 kgm-1 yr-1 of kelp wrack was calculated for a beach on the western coast of South Africa (Stenton-Dozey and Griffiths 1983) a value very similar to that established for a nearby rocky shore, namely 1200–1800 kgm-1 yr-1 (Koop & Field 1980). On another South African shoreline close Port Elisabeth, the aggregate wrack input assessed was 2920 kgm-1 yr-1 (McLachlan and McGwynne 1986) though on beaches close Perth, western Australia 240 tdwkm-1 coastline yr-1 of segregated plants were processed through the sandy beach system (Hansen 1983).

Together with other factors, accumulations of stranded macrophytes along shorelines have the significant role of inducing dune formation. Wracks are mainly significant on exposed shorelines where they balance out the foreshore by enhancing the organic and moisture contents, permitting pioneer plants to establish (Llewellyn and Shackley 1996). Moreover, Kelp is utilized as a dirt amendment in agriculture in numerous parts of the world (Chapman and Chapman 1980), and is an economical local resource in coastal agricultural zones. In the External Hebrides of northwest Scotland, mostly corrupted kelp has generally been spread on fields of fixed dune grassland known 'machair' (Angus 2001), to expand soil organic matter, bind soil particles and provide plant nutrients. In recent decades, however, the labour intensive collection and spreading of kelp is being partly substituted with NPK compost (Thorse et al 2010).

Float kelp (for the most part, Ecklonia maxima with some Laminaria pallida and small measures of other seaweeds) that appears on shorelines along the Cape Peninsula is routinely removed for both commercial and aesthetic reasons. Two separate administrative bodies manage this procedure which are; The Department of Agriculture, Forestry and Fisheries (DAFF) and the Cape Town Municipality (Yoshikawa 2013). DAFF Issues grants permitting rights holders to gather kelp for commercial reasons such as alginate production within specific concession areas, which is their way of monitoring the collection of beach-cast kelp along the entire South African coast. There are areas designated as Marine Protected Areas by South African National Parks within these concession regions, where collection of any material which includes kelp is prohibited. On the other hand, The Cape Town Municipality cleans the Cape Peninsula beaches by removing all kelps with the drive of enhancing beach aesthetics (Yoshikawa 2013). Since the deterioration of kelp on the surface of a beach shows an assortment of unsatisfactory conditions for beachgoers such as the scent of spoiling seaweed and kelp flies being present as well as other invertebrates, this beach-cast seaweed is therefore removed by workers employed by the Municipality with the sole purpose of making Cape Town’s beaches tourist-friendly. None of the float kelp gathered by the Municipality is utilized commercially, however is fairly discarded. Despite the fact that the two organisations work within their different limits and by their own methods, these two agencies are frequently in conflict with respect to how kelp collection should be managed on the Cape Peninsula (Yoshikawa 2013).

One of a kind occurrence of kelp administration by the Cape Town Municipality is the situation of Clifton's 4th beach, where the gathered kelp is covered-up onsite as opposed to remove to landfills as it regularly seems to be. While waste from other beaches subject to kelp cleansing by the Municipality is taken to landfills, absence of a road adjacent to Clifton’s 4th beach keeps trucks from getting to the area (Yoshikawa 2013). Keeping in mind the end goal to discard the beach-cast kelp, therefore, the seaweed is being buried everyday along the top of the beach by workers. The areas and timing of these burials, however, are construct absolutely on practicality and the implications of this practice on both long-term aesthetics and the health and dynamics of the beach ecosystem are unknown. In spite of the fact that little is known about the implications of covering kelp in sandy shore surroundings, there is much information of the roles of beach-cast seaweed in sandy shore ecosystems, coastal decay of kelp, and the administration of kelp accumulation and use along the Cape Peninsula (Yoshikawa 2013).

Along the south-west shoreline of South Africa, kelp wrack is the essential source of energy for sandy shore ecosystems (Griffiths et al 1983). The main types of kelps available in this area are Ecklonia maxima and Laminaria pallida, and it has been assessed that more than 2 metric tons of these kelps are deposited on each meter of beach every year (Griffiths et al, 1983). Beach-cast kelp has been observed to be imperative to coastal environments around the world as it supports intertidal herbivore and decomposer communities (Revell et al 2011) contributes to primary production (Koop et al 1982). It was additionally proposed that kelp wrack may assist in beach shaping; through a study of beaches in California, it was demonstrated that seaweed debris may help in steadying beaches against disintegration caused by elements such as wave exposure (Revell et al, 2011). On beaches in Ireland, this kelp wrack that amasses above the high water mark is vital to the improvement and support of dunes by facilitating the accumulation of sand (McKenna et al 2000). This kelp also greatly impacts different biological communities, conveying with it the seeds of numerous seashore plants and providing nutrients and moisture to these environments (McKenna et al 2000). Kelp collection in South Australia have also been revealed to play a role in dune formation by trapping sand (Kirkman and Kendrick 1997). But then what will happen if the Kelp is removed from the beaches?

Extreme removal of kelp from beaches can have important implications for the integrity of beach and dune ecology. The CCT has set up a Beach Cleaning Practice which advises the operational administration and removal of kelp from Cape Town’s beaches. This arrangement aims to strike a delicate balance between leaving kelp on beaches due to the environmental and indirect social benefits, while limiting the negative social effects related with kelp, that being smell, flies and obstruction. Outside of kelp cleaning zones beach cast kelp will be left in its natural configuration along Cape Town’s beaches as opposed to physically placing kelp on dune systems. The regular distribution of kelp on beaches plays an important role in elevating beach profiles. Elevated beach profiles in turn mitigate exposure of dunes to coastal erosion (ERMD 2015).

Recently, the expanding utilization of beaches as recreational zones has pressed regional authorities of numerous nations to remove all natural flotsam, such as detached macrophytes, driftwood and carrion, together with sanitary refuse and other litter of human origin such as glass, metal, plastic and their derivatives (Ryan and Swanepoel 1996). Mechanical removal has been viewed as a cheap method for removing unwanted debris and has been utilized by numerous coastal specialists without considering the long-term detrimental outcomes on coastal environments. There is developing worry with the issue and few studies have been done to assess the effect of mechanical beach cleaning on shores. Davidson et al. (1991) concluded that beach-cleaning machines damagingly affected invertebrate populations and that in regions of high recreational weight the steadiness of the dunes would also be affected. Kirby (1992) strengthened this worry, expressing that the removal of driftwood and particularly vast jetsam could damagingly affect certain isopods and ground insects that utilize this debris for housing. Llewellyn and Shackley (1996) compared four mechanically cleaned areas of Swansea Narrows, UK, with a control zone with no mechanical cleaning or hand-picking. The review showed that mechanical beach-cleaning had a genuine malicious impact on the general strandline-related species diversity and richness. Recently, Dugan & Hubbard (in press) arrived at similar conclusions when contrasting groomed and ungroomed beaches during a survey of 15 southern Californian beaches.

With Cape Town’s coastline extending for 307 kilometres along the West Coast, around the Cape Peninsula, and beyond False Bay to the Kogelberg coast in the east. Our research aims to see if the routine of removing kelp for both commercial and aesthetic reasons that is managed by both DAFF and the Cape Town Municipality has any effect on the beach sand. By doing so, we analysed the Particulate organic matter of sand acquired from both cleared and none-cleared sites from 5 different sites with the following objectives; 1. Is POM content higher in uncleaned areas than in cleared areas? 2. Is POM content different over time? 3. Does POM differ between sites? Hypothesising that, there is no significant difference in POM content between the cleared and the no-cleared sites.

References Used

1. Angus S (2001) The Outer Hebrides. Moor and Machair. The WhiteHorse, Cambridge and Isle of Harris, pp 195–243.
2. Author: Minna Yoshikawa... Advisor: Professor John Bolton… University of Cape Town... May 2013…Removing Drift Kelp from Cape Peninsula Beaches: Rationales, Conflicts and Ecological Effects…21 pages Hounours thesis.
3. Orr, M., Zimmer, M., Jelinski, DE., and Mew, M. 2005. Wrack deposition on different beach types: spatial and temporal variation in the pattern of subsidy. Ecology, 86(6): 1496-1507.
4. Mellbrand, K., Lavery, P.S., Hyndes, G., Hambäck, P.A., 2011. Linking land and sea: different pathways for marine subsidies. Ecosystems 14, 732–744.
5. Rossi, F., Underwood, A., 2002. Small-scale disturbance and increased nutrients as influences on intertidal macrobenthic assemblages: experimental burial of wrack in different intertidal environments. Mar. Ecol. Prog. Ser. 241, 29–39.
6. Stenton-Dozey, J.M.E. & Griffiths, C. L. 1983. The fauna associated with kelp stranded on a sandy beach. In Sandy beaches as ecosystems, A. McLachlan & T. Erasmus (eds). The Hague: Junk, 557–568.
7. Wilson, E.E., Wolkovich, E.M., 2011. Scavenging, how carnivores and carrion structure communities. Trends Ecol. Evol. 26 (3), 129–135.
8. Revell, DL., Dugan, JE., and Hubbard, DM. 2011. Physical and Ecological Responses of Sandy Beaches to the 1997-98 El Nino. SO Journal of Coastal Research, 27(4): 718-730.
9. Ryan, P. G. & Swanepoel, D. 1996. Cleaning beaches: sweeping the rubbish under the carpet. South African Journal of Science 92, 275–276.
10. McKenna, J. MacLeod, M., Power, J., Cooper, A. 2000. Rural Beach Management: A Good Practice Guide. Donegal County Council.
11. Marsden, I. D. 1991a. Kelp-sandhopper interactions on a sand beach in New Zealand. I. Drift composition and distribution. Journal of Experimental Marine Biology and Ecology 152, 61–74.
12. Chapman VJ, Chapman DJ (1980) Seaweeds and their uses, 3rd edn. Chapman and Hall Ltd, London, pp 30–43
13. Lastra M, Rodil IF, Sánchez-Mata A, García-Gallego M, Mora J. 2014. Fate and processing of macroalgal wrack subsidies in beaches of Deception Island, Antarctic Peninsula. Journal of Sea Research 88: 1–10.
14. Llewellyn, P. J. & Shackley, S. E. 1996 The effects of mechanical beach-cleaning on invertebrate populations. British Wildlife 7, 147–155.
15. Maja K. Thorsen & Stephen Woodward & Blair M. McKenzie. 2010. Kelp (Laminaria digitata) increases germination and affects rooting and plant vigour in crops and native plants from an arable grassland in the Outer Hebrides, Scotland. J Coast Conserv 14:239–247.
16. Griffiths, CL., Stenton-Dozey, JME., Koop, K. 1983. Kelp Wrack and the Flow of Energy Through a Sandy Beach Ecosystem. The Fauna Associated with Kelp Stranded on a Sandy Beach. Ed. Erasmus, T. & McLachlan, A. Sandy Beaches as Ecosystems (Developments in Hydrobiology). Springer: 547-556. Print.
17. Koop, K., Newell, RC., Lucas, MI. 1982. Microbial Regeneration of Nutrients from the Decomposition of Macrophyte Debris on the Shore. Marine Ecology Progress Series, 9: 91-96.
18. Kirkman, H. & Kendrick, G. A. 1997. Ecological significance and commercial harvesting of drifting and beach-cast macro-algae and seagrasses in Australia: a review. Journal of Applied Phycology 9, 311–326.
19. 21.Kirby, P. 1992. Habitat management for invertebrates: a practical handbook. Joint Nature Conservation Committee. Publication of the Royal Society for the Protection of Birds, London
20. Maintenance Management Plan: Dunes and Beaches. Maintenance Management Plan: Dunes and Beaches. COASTAL CLEANING PROTOCOAL FOR THE CITY OF CAPE TOWN MAY 2015. Prepared by the Environmental Resource Management Department.