




Applying the theory of planned behaviour (TPB) towards understanding tourism-related waste behaviour in the Aliwal Shoal Marine Protected Area

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Dissertation accepted in fulfilment of the requirements for the degree *Master of Science in Geography and Environmental Management* at the North-West University

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Graduation May 2022

28539982

PREFACE AND ACKNOWLEDGMENTS

“Often the most attractive destinations are the most vulnerable”.

Given the limited research on waste-related behaviour in protected areas, internationally, this research aimed to understand waste-related behaviour in the Aliwal Shoal Marine Protected Area, in South Africa. The Theory of Planned Behaviour (TPB) framed the research design.

I would like to thank my supervisor, Dr. Claudine Roos, for her unending and continuous support throughout the duration of my study. Your patience, guidance, and advice towards the completion of this study will always be appreciated.

I will forever remain indebted to my parents Hetta Harper and Desmond Harper for their love and support throughout my university career. I am grateful to all the opportunities you have allowed me. Thank you to my friends and support system, Tiana Koen, Sherise Celliers, Nicole Nel, and Stefan Smit for always being willing to provide assistance and offer words of encouragement when I needed it.

I wish to express my gratitude to the CSIR and North West University for providing me with a bursary to fund my studies. The experience and opportunities I have received would not have been possible without this bursary.

Lastly, I would like to thank all the participants for allowing me to conduct the data collection, and for their assistance in the study.

ABSTRACT

An increasing population, urbanisation, as well as unsustainable anthropogenic activities have resulted in the degradation of the natural environment. This is especially true in vulnerable environments, such as protected areas (PAs). South Africa is home to many PAs, which generates a considerable number of tourism activities. Tourism-related activities generate different types and quantities of waste, which may cause negative impacts to PAs if not managed correctly. In order to ensure that the PA environment is conserved and protected, sustainable waste management should be practiced. This research aims to apply the Theory of Planned Behaviour (TPB) to understand the factors influencing waste behaviour related to tourism activities within the Aliwal Shoal Marine Protected Area (MPA). The TPB suggests that an individual's intention to engage in a behaviour is dependent on their attitude, subjective norms, as well as perceived behavioural control. To this extent, the waste management behaviour of selected diving charters and accommodation facilities were considered in this research. The research specifically focuses on waste separation at source behaviour.

Observed- and self-reported elements of waste separation at source behaviours were determined during this research, since literature suggests that there may be inconsistencies between reported- and actual waste-related behaviour. On-site observations and a waste characterisation study were performed to understand observed (or actual) behaviour. Survey questionnaires, based on the TPB, were administered to determine self-reported behaviour. Associations between TPB statements could not be determined because of the low variability of data points, mainly due to the relatively small sample size. Finally, interviews were conducted to understand the opportunities and challenges related to waste separation at source within the Aliwal Shoal MPA.

Waste observations and waste characterisation studies of five diving charters and four accommodation facilities indicated that there was a significant percentage of recyclable waste (>70%) found within the disposable waste, with no source separation currently taking place. It was also determined that no waste separation infrastructure was present at any of the participants investigated. Responses from nine participants indicated a positive attitude towards waste separation, with a social drive towards participating. Respondents also indicated that they generally participated in waste separation at source. This contradicted the observation data, which indicated that no waste separation at source is currently being practiced. Results of interviews indicated that a lack of waste separation infrastructure, a lack of collection and transportation services, convenience, time constraints, and the willingness of customers to participate in waste separation were the main challenges of source separation in the Aliwal Shoal. The provision of waste separation resources and municipal services, as well as improved waste management behaviour were opportunities identified by the participants.

Keywords: *Theory of Planned Behaviour (TPB), waste behaviour, tourism, Aliwal Shoal, Marine Protected Area (MPA)*

ABBREVIATIONS AND ACRONYMS

DSW	Durban Solid Waste
ERB	Environmentally Responsible Behaviour
EU	European Union
HDPE	High Density Polyethylene
IUCN	International Union for Conservation of Nature
LOC	Locus of Control
MPA	Marine Protected Area
MSW	Municipal Solid Waste
NEMA	National Environmental Management Act (107 of 1998)
NEM: PAA	National Environmental Management Protected Areas Act (57 of 2003)
NEM: WA	National Environmental Management Waste Act (59 of 2008)
NWMS	National Waste Management strategy
PA	Protected Area
PET	Polyethylene Terephthalate
REC	Research Ethics Committee
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action

KEY DEFINITIONS

Attitude: *The way that you think and feel about somebody/something; the way that you behave towards somebody/something that shows how you think and feel* (Oxford Dictionary, 2021). In the context of the theory of planned behaviour (TPB), attitude refers to an individual's complete evaluations regarding the performance of a specific behaviour (Connor & Armitage, 1998).

Awareness: According to the Oxford Dictionary (2021), awareness is defined as *knowing something; knowing something that exists and is important*.

Behaviour: *the way that somebody behaves, especially toward other people* (Oxford Dictionary, 2021).

Environment: *“environment” means the surroundings within which humans exist and that are made up of (i) the land, water and atmosphere of the earth; (ii) micro-organisms, plant and animal life; (iii) any part or combination of (i) and (ii) and the interrelationships among or between them; and (iv) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being* (National Environmental Management Act, 107 of 1998).

Ecotourism: *Organised holidays that are designed so that the tourists damage the environment as little as possible, especially when some of the money they pay is used to protect the local environment* (Oxford Dictionary, 2021).

Intention: *What you intend or plan to do; your aim* (Oxford Dictionary, 2021).

Marine Protected Area: *An area declared as a marine protected area in terms of section 22A of the National Environmental Management Protected Areas Act (57 of 2003) as amended. IUCN has defined an MPA as “any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment”* (IUCN, 1999).

Perceived behavioural control: *Within the context of the Theory of Planned Behaviour, this is concerned with how much effort an individual will have to exert in order to perform a behaviour under specific conditions* (Fishbein & Ajzen, 1980).

Protected area: *Any of the protected areas referred to in section 9 of the National Environmental Management Protected Areas Act (57 of 2003) as amended. It includes: (a) special nature reserves, national parks, nature reserves (including wilderness areas) and protected*

environments; (b) world heritage sites; (c) marine protected areas; (d) specially protected forest areas, forest nature reserves and forest wilderness areas declared in terms of the National Forests Act, 1998 (Act No. 84 of 1998) and (e) mountain catchment areas declared in terms of the Mountain Catchment Areas Act, 1970 (Act No. 63 of 1970).

Separation at source: Separation at source consists of separating waste into similar waste streams or categories for separate collection (National Waste Management Strategy; DFFE, 2020).

Subjective norm: *Subjective norm is defined as the pressure placed on an individual by society to perform a certain behaviour (Yadav & Pathak, 2017).*

Theory of Planned Behaviour: *The Theory of Planned Behaviour is used to explain and predict human social behaviour through the evaluation of an individual's attitude, social norms, and perceived behavioural control (Ajzen, 2011; Ajzen, 2020).*

Tourism-related activities: *These refer to any activities that meet the needs of individuals who travel for business or pleasure and that contributes to the provision of accommodation, catering and other tourism related ventures (Law Insider, 2021).*

Waste management hierarchy: *The waste hierarchy is a systematic and hierarchical approach to integrated waste management, addressing in turn waste avoidance, reduction, re-use, recycling, recovery, treatment safe and disposal of waste as a last resort (National Waste Management Strategy; DEA, 2011).*

TABLE OF CONTENTS

PREFACE AND ACKNOWLEDGMENTS	I
ABSTRACT	II
ABBREVIATIONS AND ACRONYMS	III
KEY DEFINITIONS	IV
CHAPTER 1 INTRODUCTION	1
1.1 Background	1
1.2 Problem statement and rationale for the study	3
1.3 Research aim and objectives.....	4
1.4 Scope of the research	5
1.5 Limitations of the research	5
1.6 Contribution of the research.....	6
1.7 Structure and outline of the dissertation	6
1.8 Chapter conclusion	7
CHAPTER 2 LITERATURE REVIEW	8
2.1 Introduction	8
2.2 Background to waste generation and management in the global, African and South African contexts	8
2.3 Waste generated from tourism-related activities	10
2.4 The impacts of waste on protected areas (PAs).....	11
2.5 The National Environmental Management Protected Areas Act (57 of 2003) and managing impacts on protected areas	12
2.6 The National Environmental Management Waste Act (59 of 2008) and managing impacts of waste in protected areas.....	13

2.7	Towards implementing the waste management hierarchy: The importance of separation of waste at source	15
2.7.1	Separation of waste at source in the international and African contexts.....	15
2.7.2	Separation of waste at source in the South African context	17
2.7.3	Understanding waste separation at source behaviour.....	18
2.7.3.1	Theories applied to understand and predict behaviour.....	18
2.7.3.2	The Theory of Planned Behaviour (TPB) towards understanding waste-related behaviour.....	19
2.7.3.2.1	External variables	20
2.7.3.2.2	Attitude	21
2.7.3.2.3	Subjective norm.....	22
2.7.3.2.4	Perceived behavioural control.....	22
2.8	Behaviour and separation of waste at source	22
2.9	Understanding waste behaviour in protected areas	23
2.10	Chapter summary	25
CHAPTER 3 METHODOLOGY		26
3.1	Introduction	26
3.2	Research design.....	26
3.2.1	The quantitative research approach.....	27
3.2.2	The qualitative research approach.....	28
3.2.3	The mixed-methods research approach.....	28
3.3	Case study selection.....	29
3.4	Description of study area.....	30

3.5	Participant selection.....	32
3.6	Data collection.....	34
3.6.1	Data collection to determine actual (observed) waste separation at source behaviour (RO1).....	34
3.6.1.1	On-site observations.....	34
3.6.1.2	Waste composition characterisation	35
3.6.2	Data collection to determine (self-reported) waste separation at source behaviour.....	38
3.6.2.1	Structured survey questionnaires.....	38
3.6.2.2	Semi-structured interviews.....	41
3.7	Data analysis.....	41
3.7.1	Analysis of on-site observations and interviews	42
3.7.2	Analysis of waste characterisation study.....	43
3.7.3	Analysis of responses to survey questionnaires.....	43
3.8	Methodological assumptions and limitations.....	43
3.9	Ethical considerations	44
3.10	Chapter summary	45
CHAPTER 4 RESULTS/DATA ANALYSIS AND DISCUSSION		46
4.1	Results related to RO1: Determine the actual (observed) waste behaviour related to accommodation and diving activities within the MPA	46
4.1.1	Waste characterisation results.....	46
4.1.1.1	Waste generation rates.....	46
4.1.1.1.1	Waste intended for disposal.....	47

4.1.1.1.2	Waste intended for recycling (source separated waste).....	47
4.1.1.2	Waste composition results	48
4.1.1.2.1	Composition of waste intended for disposal.....	48
4.1.1.2.2	Composition of waste intended for recycling (separated at source)	51
4.1.2	Results from observations	52
4.2	Results related to RO2: Determine the self-reported waste behaviour related to accommodation facilities and diving activities within the MPA	54
4.2.1	TPB survey questionnaire results	54
4.2.1.1	Socio-demographic profile of respondents.....	54
4.2.1.2	Survey responses related to the TPB and source separation of waste	55
4.2.1.2.1	Waste separation at source practice/behaviour (B).....	63
4.2.1.2.2	Attitudes (A) related to the separation of waste at source	63
4.2.1.2.3	The role of subjective norms (SN) in waste separation at source.....	64
4.2.1.2.4	The role of perceived behavioural control (PBC) in waste separation at source	64
4.2.1.3	Associations between TPB constructs	65
4.3	Results related to RO3: Evaluate the underlying factors influencing waste separation behaviour through the application of the TPB.....	66
4.3.1	Evaluation of observed versus reported behaviour	66
4.3.2	Results of interviews.....	67
4.3.2.1	Barriers/challenges to separation at source at Aliwal Shoal MPA	68
4.3.2.1.1	Lack of waste separation resources (infrastructure).....	68
4.3.2.1.2	Collection and transportation of waste	69

4.3.2.1.3	Convenience, time constraints and unwillingness of guests to participate.....	69
4.3.2.2	Opportunities for source separation at Aliwal Shoal MPA	70
4.3.2.2.1	Provision of source separation resources	70
4.3.2.2.2	Provision of municipal collection services	71
4.3.2.2.3	Improved waste management behaviour	71
4.4	Chapter summary	72
CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS		74
5.1	Introduction	74
5.2	Conclusions.....	74
5.2.1	Conclusions related to RO1: Actual (observed) behaviour	74
5.2.2	Conclusions related to RO2: Self-reported behaviour	75
5.2.3	Conclusions related to RO3: Evaluating the underlying factors influencing waste separation behaviour through application of the TPB.....	76
5.3	Recommendations.....	77
5.3.1	Practical recommendations towards waste separation at source at Aliwal Shoal MPA	77
5.3.2	Recommendations for further research.....	78
BIBLIOGRAPHY		80

LIST OF TABLES

Table 2-1: Summary of findings related to external variables 21

Table 3-1: Summary of the research design..... 27

Table 3-2: Profile of diving charters (DC) and accommodation (A) selected for inclusion of the study..... 33

Table 3-3: General waste categories used for sorting (Adapted from: ASTM, 2016) 37

Table 3-4: Statements included in the survey questionnaire based on the TPB constructs 39

Table 4-1: Breakdown of the waste composition of diving charters (based on the combined weight collected per diving charter during one week) 49

Table 4-2: Breakdown of the waste composition of accommodation facilities (based on the combined weight collected per diving charter during one week) 50

Table 4-3: Waste composition of recyclables for diving charters and accommodation facilities 52

Table 4-4: Socio-demographic profile of participants..... 55

Table 4-5: Frequency table of Likert scale responses 57

LIST OF FIGURES

Figure 1-1: Number of protected areas per designation in South Africa (adapted from UNEP-WCMC & IUCN, 2021) 2

Figure 1-2: Outline of chapters of this dissertation..... 7

Figure 2-1: The Waste Management Hierarchy (adapted from: DEA, 2011)..... 14

Figure 2-2: A Schematic representation of The Theory of Planned Behaviour (adapted from: Ajzen, 1991) 20

Figure 3-1: A map of the larger Aliwal Shoal MPA (sourced from: NEM: PAA, 2019) 31

Figure 3-2: Data collection aimed at determining (actual- and self-reported) waste separation at source behaviour 34

Figure 3-3: Schematic representation of steps used in qualitative analysis 42

Figure 4-1: Example of waste composition and waste sorting procedure 48

Figure 4-2: Disposable waste destined for municipal collection by an accommodation..... 53

Figure 4-3: Disposable waste destined for municipal collection by a diving charter 53

CHAPTER 1 INTRODUCTION

1.1 Background

The majority of the world's ecosystems have been impacted by anthropogenic activities, leading to an increasing interest in the conservation of these areas (He *et al.*, 2018; Mahmoud & Gan, 2018). Biodiversity has especially been impacted, with extinction rates accelerating up to a thousand times higher than it has ever been in the past (Diaz *et al.*, 2019; Palfrey *et al.*, 2020). In order to conserve vulnerable areas, certain areas are declared as protected areas (PAs) in terms of legislation. PAs are defined by the International Union for the Conservation of Nature (IUCN) as “*A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values*” (Dudley, 2008:2; IUCN 2016). There are currently over 200 000 PAs, covering approximately 15% of the Earth's land surface (Alberts *et al.*, 2021; IUCN, 2016). The IUCN identifies six management categories (of which the first category has two sub-divisions) of PAs. These are (ia) strict nature reserves, (ib) wilderness areas, (ii) national parks, (iii) national monuments or features, (iv) habitat/species management areas, (v) protected landscapes/seascapes, and (vi) protected areas with sustainable use of natural resources (Dudley, 2008). These management categories provide global standards towards facilitating the planning of PAs and PA systems; improving information management; and helping to regulate activities in PAs (IUCN, 2016) (according to PA category).

PAs are regarded as having tourism value (Leung *et al.*, 2018; Reinius & Fredman, 2007) and are often considered as popular tourism destinations because of their biodiversity, unique natural features and high-quality tourism-related resources (Reinius & Fredman, 2007). The primary appeal of tourism in protected areas is that it can, in theory, provide local economic benefits while maintaining ecological integrity through low-impact, non-consumptive use of local resources (Stem *et al.*, 2003). Although tourism has economic, environmental and social benefits, commercial tourism may have several negative impacts on protected environments (Amusan & Olutola, 2017; Whitelaw *et al.*, 2014). According to Eagles *et al.* (2002:33), the negative environmental impacts of, especially commercial tourism, include: changing water courses, damage to archaeological sites, increased fire risk, soil erosion, damage to reefs, impacts on vegetation, overfishing, increased waste generation, pollution, and habitat loss.

Tourism has been heralded as the fastest growing industry worldwide, with ecotourism becoming the fastest growing sector within tourism (Gumede & Nzama, 2019). In 2016, tourism accounted for approximately 2.9% of the country's GDP in South Africa (StatsSA, 2019). South Africa is,

globally, regarded as a top ecotourism destination (Chiutsi *et al.*, 2011) because of its abundant diversity in wildlife species and habitats, and relatively large number of PAs and other biodiversity areas (Lindsey *et al.*, 2007). South Africa’s PAs cover approximately 6% of the country, encompassing 1,692 terrestrial and marine protected areas, and other effective area-based conservation measures (Hoveka *et al.*, 2020; UNEP-WCMC & IUCN, 2021) (Figure 1-1).

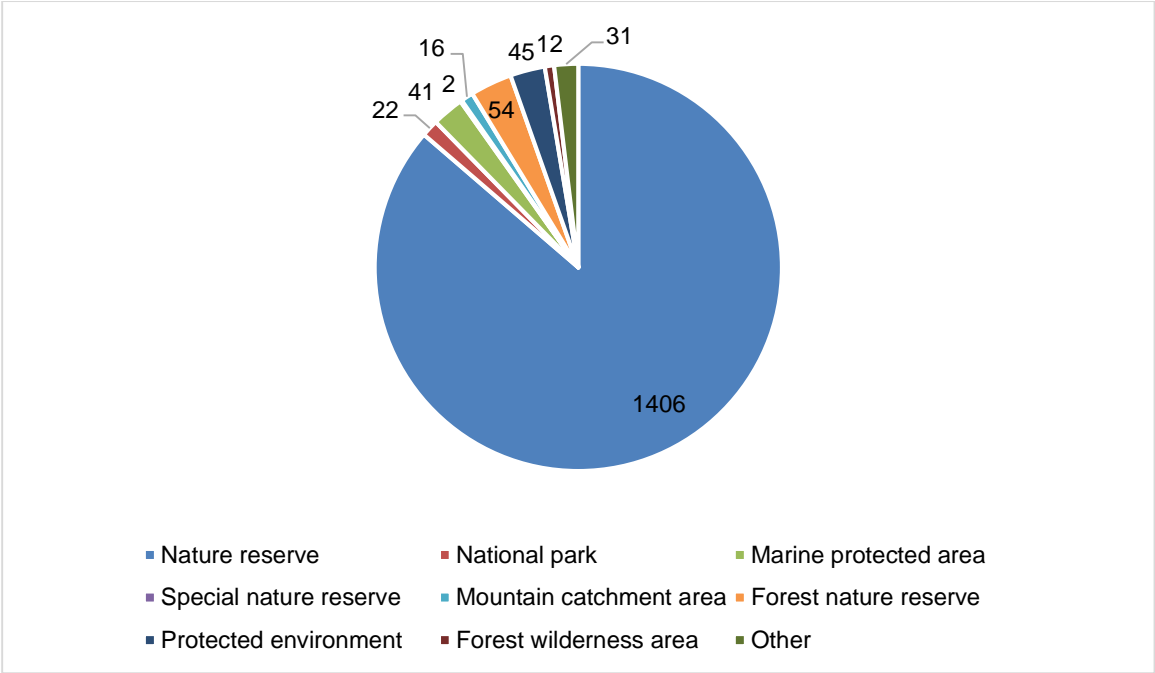


Figure 1-1: Number of protected areas per designation in South Africa (adapted from UNEP-WCMC & IUCN, 2021)

There are currently 41 Marine Protected Areas (MPAs) declared through the National Environmental Management: Protected Areas Act (NEM: PAA) in South Africa (Findlay, 2020; UNEP-WCMC & IUCN, 2021). MPAs are used as an instrument for habitat protection, the promotion of sustainable resource management, biodiversity conservation, as well as managing fisheries (Ban *et al.*, 2017; Sowman & Sunde, 2018). These areas are particularly popular tourist destinations as a result of their biodiversity, culture, and history; and they provide for numerous tourism activities, such as fishing, scuba diving, snorkelling, and marine fish-, mammal- and bird watching (Sink, 2016).

However, as mentioned earlier, tourism-related activities within coastal-marine zones may have negative impacts on these protected environments, which include the removal of, or physical damage to species or organisms, including species on land and on the ocean floor (Milazzo *et al.*, 2002). Additionally, these activities may result in a loss of local identity and traditional culture, and the degradation of the environment by tourism infrastructure (Laffoley *et al.*, 2019). One specific concern with increased development within protected areas is effective waste management (Steg & Vlek, 2009; Belsoy *et al.*, 2012; Rodríguez-Rodríguez, 2012; Lawhon *et al.*, 2018; Sandham *et al.*, 2020).

Leung *et al.* (2018:5) and Przydatek (2019:14) have found that soil and water pollution, increased fire hazards, odours, impacts on animal health and behaviour and visual and aesthetic intrusions are just some of the negative effects that waste can have on PAs. These effects do not only negatively impact PAs and adjacent communities, but also impacts on visitor experience, where responsible waste management has been cited as one of the top ranked visitor expectations for ecotourism areas (Lawhon *et al.*, 2018; Mateer, 2020; Morrison-Saunders *et al.*, 2015).

1.2 Problem statement and rationale for the study

There is significant pressure placed on MPA ecosystems as a result of tourism-related activities (Li & Yang, 2007). According to Manomaivibool (2015:69), Mateu-Sbert *et al.* (2013:2589) and Li & Yang (2007:2955), tourists visiting developing countries, such as South Africa, tend to leave a greater ecological footprint than the local community. One major area of concern, as far as contributing to the ecological footprint is concerned, is *waste management* in protected areas. This concern is mainly associated with the rapid growth and increase in tourist volumes, as well as their irresponsible and unsustainable waste behaviours (Capochi *et al.*, 2019).

Tourism-related activities generate mostly municipal solid waste (MSW), with food waste being the most common (Diaz-Farina *et al.*, 2019), which usually needs to be managed and disposed of by the tourist operator (Hoang *et al.*, 2017). These wastes can have a negative impact on sensitive environments, such as MPAs due to its pollution potential and resultant degradation of the natural environment (Przydatek, 2019; Wang *et al.*, 2019).

Some research has been conducted that focus on the efforts made by the tourism industry in reducing pollution, as well as contributing towards zero waste initiatives (del Mar Alonso-Almeida, 2012; Hsiao *et al.*, 2014; Wyngaard & de Lange, 2013; Yusof & Jamuludin, 2013). However, *waste behaviour* related to *tourism-related activities* within protected areas, especially *Marine Protected Areas*, have not yet been extensively researched.

The aim of this study is, therefore, to apply the theory of planned behaviour (TPB) to understand tourism-related waste behaviour within a South African MPA. The study followed a case study approach where the Aliwal Shoal MPA was selected. The research specifically focused on waste separation at source behaviour.

The separation of waste at source is the first step towards diverting waste away from landfill by means of improving the re-use, recycling and recovery potential of waste (Padilla & Trujillo, 2018). The National Waste Management Strategy (NWMS) focuses strongly on achieving waste separation at source, as part of “Pillar 1” focusing on *waste minimization and the implementation of the waste management hierarchy* (DFFE, 2020).

The separation of waste at source requires specific waste management practices and behaviours (Bernstad, 2014; Boonrod *et al.*, 2015). The TPB provides a theoretical framework for understanding how psychological- and other factors influence the decision to engage in specific practice – in this instance: *waste separation at source* (Ghani *et al.*, 2013). This theory, introduced in 1985, is used as one of the most influential models to predict human social behaviour (Ajzen, 2011) and is frequently applied in waste-related research (for instance: Tonglet *et al.*, 2004; Ghani *et al.*, 2013; Pakpour *et al.*, 2014; Gilli *et al.*, 2018). In this theory there are three elements, namely attitude, subjective norm, and perceived behavioural control, that may predict and understand an individual's intention to engage in a specific behaviour (Ajzen, 2011; Razali *et al.*, 2020; Strydom, 2018). These three elements are positively related to waste behaviour, and by understanding these three elements, one may be able to increase an individual's intention to engage in a specific behaviour (Ajzen, 2011; Ghani *et al.*, 2013; Huffman *et al.*, 2014; Razali *et al.*, 2020). This intention, however, does not always reflect their actual or observed behaviour (Huffman *et al.*, 2014).

According to Huffman *et al.* (2014:263) and Steg and Vlek (2009:310), the most efficient way of measuring behaviour is through observation. It is, therefore, necessary to evaluate actual (observed) behaviour, in addition to predicted (self-reported) behaviour in order to obtain a holistic view of waste management.

1.3 Research aim and objectives

The aim of this research is to apply the Theory of Planned Behaviour (TPB) to understand the factors influencing tourism-related waste behaviour within the Aliwal Shoal Marine Protected Area (MPA). The TPB mainly relies on self-reported information on waste behaviour, however, research has shown that self-reported behaviour may differ from actual waste management

practices. Therefore, the research was designed to supplement self-reported waste-related behaviour, by investigating actual (observed) waste-related behaviour.

The research specifically focuses on *waste separation at source behaviour* and aims to address the following research objectives:

1. To determine the actual (observed) waste behaviour related to diving activities and accommodation facilities within the MPA;
2. To determine self-reported waste behaviour related to diving activities and accommodation facilities within the MPA; and
3. To evaluate the underlying factors influencing waste-related behaviour through the application of the TPB.

1.4 Scope of the research

The scope of the study is concerned with *waste related* behaviour and practices related to *tourism activities* in the *Aliwal Shoal MPA*. The research specifically focuses on a sample of *tourism-related activities* (mainly diving and accommodation) and did not focus on all households and all sectors located within the MPA. Specifically, behaviour related to the *separation of general waste at source* was considered within the context provided by the *Theory of Planned Behaviour*. Hazardous waste was excluded from the scope of the research.

Both *actual (observed) behaviour* and *self-reported behaviour* related to the separation of waste at source were determined. By understanding which factors influence these behaviours, one will be able to guide future planning and decision-making with regards to encouraging separation at source behaviours. Self-reported behaviour (through surveys and interviews) indicates *perceived* behaviour and the *perceived* waste separation at source challenges of respondents.

The research was conducted in 2021, with data collection being undertaken between June 2021 and September 2021.

1.5 Limitations of the research

This research was conducted in one MPA in South Africa, mainly focusing on waste generated from tourism activities related to diving and tourist accommodation. Other sources of waste generation, such as MSW and other industry waste, were not considered.

The impact of COVID-19 on the results of the research should be taken into consideration. The restrictions related to the COVID-19 pandemic could have influenced the quantities and types of

waste generated (when compared to a pre-COVID-19 scenario). Three of the diving charters identified for inclusion in the research, for instance, closed their operations during the period of the research being conducted. It must, therefore, be kept in mind that the results of this research are indicative of a post-COVID-19 scenario, which may not necessarily be comparable to pre-COVID-19 scenarios. Furthermore, as a result of the period of unrest in KwaZulu-Natal during the data collection stage of the study, waste generation rates may have also been affected.

1.6 Contribution of the research

The study will contribute to research related to waste behaviour, and the impact thereof, in protected areas, by specifically focusing on MPAs. Research on waste management in protected areas in South Africa (and the developing world in general) is scant. It is anticipated that this research may inform waste management decision-making in protected areas and possibly call attention to interventions that may promote separation at source behaviours.

The research also highlights an important aspect, which has not been researched extensively, which is the difference in self-reported and observed waste-related behaviour.

1.7 Structure and outline of the dissertation

This dissertation contains five chapters. This chapter presented a brief background on the importance of waste-related research in protected areas, specifically MPAs. First, the rationale, problem statement, aims and objectives, and the potential contribution of the research were discussed to provide an understanding of the reasons behind the chosen research topic. Chapter two reviews key literature regarding the TPB and its elements. Additionally, any literature regarding waste management or waste-related behaviours in protected areas (PA's) are discussed. The research methodology used in this study is discussed in the third chapter. The fourth chapter presents the results obtained in the study, as well as the discussion of these results. Finally, chapter five contains the conclusions drawn from the results and includes any recommendations made based on the results. An outline of these chapters can be found in Figure 1-2 below:

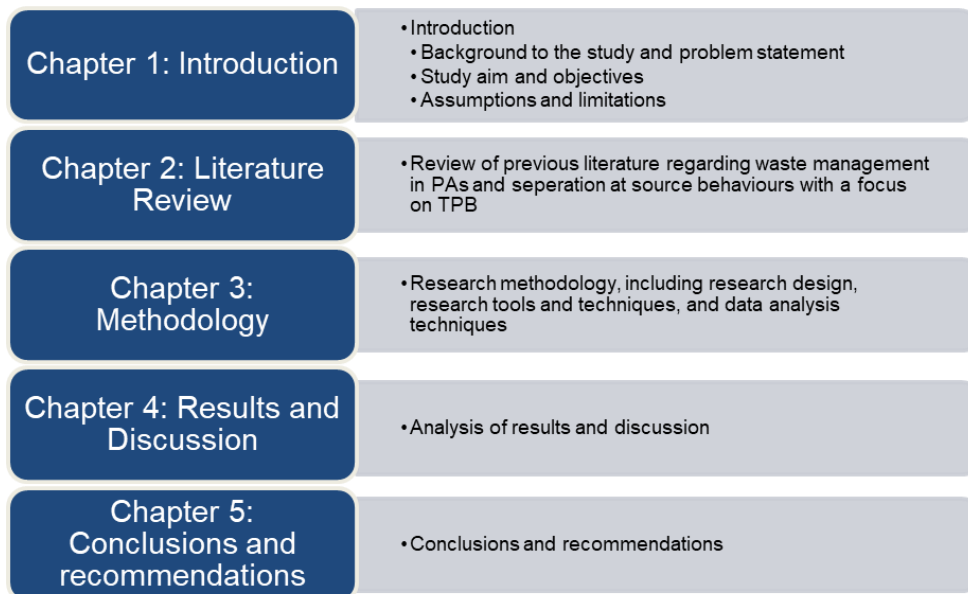


Figure 1-2: Outline of chapters of this dissertation

1.8 Chapter conclusion

Chapter 1 has contextualised the background of this research, and provided the problem statement, research aim, related objectives and research scope. The next chapter presents the literature review applicable to applying the Theory of Planned Behaviour (TPB) towards understanding tourism-related waste behaviour in the Aliwal Shoal Marine Protected Area.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

Academic writing is informed by what is already known, models that have already been developed, and work that has been done before (Randolph, 2009). Referencing the work of other authors is, therefore, a distinguishable feature of academic writing. The aim of this chapter is to give context to the study by examining existing literature on the research topic, which focuses on applying the Theory of Planned Behaviour (TPB) towards understanding tourism-related waste behaviour in the Aliwal Shoal Marine Protected Area. In particular, the literature review focuses on waste generation and management in an international and national context, followed by a review of South Africa's separation at source practices. Various theories which could be applied to understand waste-related behaviour are discussed, with an emphasis on the Theory of Planned Behaviour. Lastly, the importance of sound waste management within Marine Protected Areas (MPAs) is highlighted.

The literature review was conducted by examining the literature that could be accessed on Google Scholar, as well as the North West University's (NWU) library website. Official government and other organisation documents were also considered. Search words related to the study were used to find the relevant literature. These included keywords/phrases such as "*waste*", "*waste management*", "*separation at source*", "*waste behaviour*", and "*Theory of Planned Behaviour*" in different combinations. Although the application of the TPB within the waste management context yielded several sources of literature, the application of the TPB to waste behaviour in MPAs did not yield any literature results.

2.2 Background to waste generation and management in the global, African and South African contexts

Waste management is a global issue that, if not properly dealt with, will become a major threat to the environment (Kaza *et al.*, 2018). Understanding waste generation in a global context is often impossible as there are limitations in the availability of data. As provided by UNEP (2015:54), construction and demolition waste (36%), commercial and industrial waste (32%), and municipal solid waste (24%) are the three major waste streams produced globally. These figures are, however, based on the Organisation for Economic Co-operation and Development (OECD) member countries. This is as a result of the lack of waste data in lower-income and developing countries. Additionally, where there is data available, it is mainly focussed on Municipal Solid Waste (MSW) generation (UNEP, 2015). From the available data, it was estimated that 7 to 10

billion tonnes of 'urban waste' (including commercial, industrial, municipal, and construction and demolition wastes) is generated annually in OECD countries (UNEP, 2015).

Although many developed countries have made progress in improving their waste management, many low- and middle-income countries are still facing sustainable waste management challenges. Some of these challenges, identified by UNEP (2015:7) are inadequate waste services, uncontrolled dumping and waste burning. These challenges may lead to the contamination of oceans, the transmission of diseases, health problems, and a diminished economy (Kaza *et al.*, 2018). African countries are expected to double their waste generation (especially MSW) in the next 15 to 20 years, resulting in an urgent need to improve waste management (Bello *et al.*, 2016; Wilson & Velis, 2015).

According to UNEP (2018:6), the increase in waste generation in Africa is attributed to population growth, urbanisation, a change in consumption habits, and economic development. Approximately 174 million tonnes of waste were generated in the Sub-Saharan region of Africa in 2016 (Kaza *et al.*, 2018). This equates to approximately 0.46 kg/capita/day, which is lower than the global average of 0.74kg/capita/day. This is generally due to higher rates of income and tourism in urban areas. Unlike global trends in waste generation, Africa's largest waste stream is organic waste (62.8%) (UNEP, 2018). Compared to more developed regions, Africa's waste generation rates are relatively small. Although this is true, the mismanagement of this waste creates a greater problem (Godfrey *et al.*, 2019). According to Mohammed *et al.* (2013:261) and UNEP (2018:9), Africa's waste management system is characterised by open burning and uncontrolled dumping. Factors such as poor legislation, low levels of enforcement, absence of waste management services, and political instability are often cited as the reasons for inadequate waste management systems in Africa (UNEP, 2018). South Africa, in particular, has similarly followed the trends of other developing countries.

Sustainable waste management is becoming more of a challenge in South Africa as a result of a growing population, an increase in urbanisation, as well as a lack of resources (Godfrey *et al.*, 2017). As a consequence of these factors, waste generation has also increased. 55,7 million tonnes of general waste were generated in South Africa in 2017, more than 50% of which consisted of organic waste and biomass (DFFE, 2020). Of this waste, only 11% was recycled (DEA, 2018). Furthermore, 67 million tonnes of hazardous waste were generated, bringing South Africa's total waste generation to 122.7 million tonnes/annum (DFFE, 2020). The per capita waste generation is higher than the global and regional average at 0.98kg/day (Kaza *et al.*, 2018). According to Godfrey and Oelofse (2017:2), South Africa is approximately 30 years behind many developed countries when it comes to waste management. The diversion of waste from landfills, in particular, is a challenge. In South Africa, landfilling is the most common form of waste

management, although these landfills are often not managed correctly. Further challenges to waste management are highlighted below (DFFE, 2020):

- Illegal dumping and littering,
- A lack of separation at source,
- Minimal recycling infrastructure,
- Low levels of awareness and education,
- Backlogs in the delivery of waste services, and
- Waste burning

As stated previously, areas with higher tourist populations generally generate greater volumes of waste. This has been found to be true in South Africa, where there is a relatively high number of tourist destinations.

2.3 Waste generated from tourism-related activities

Waste generated by tourists places significant pressure on the waste management facilities and services of tourist destinations. It has been found that tourists can generate up to 1kg/capita/day of waste, sometimes doubling that of a local resident (Diaz-Farina, 2019; Pirani and Arafat, 2014). Tourism-related activities have historically been cited as the leading cause of pollution in many countries (Abdulredha *et al.*, 2018). The increase in waste in these areas is, however, seasonal.

Tourism-related waste is generally characterised as municipal solid waste (MSW). Food waste is generally identified as the largest contributor to tourism-related waste, followed by cardboard (Bhat *et al.*, 2014; Mateu-Sbert, 2013). Tourist events and festivals (including business, sport, cultural and entertainment events and festivals) have especially received attention in the past (Abdulredha *et al.*, 2018; Barber *et al.*, 2014; Getz and Page, 2016; Kruger and Saayman, 2012; Mair, 2012). Waste generated by the hospitality (accommodation) and sport (diving) tourism sector was specifically focussed on in this study.

As stated by Diaz-Farina *et al.* (2019:587), Pirani and Arafat (2014:320) and Sealey and Smith (2014:30), the hospitality industry, which includes tourist accommodation, generates the greatest volumes of tourist waste, with food waste being the largest contributor. According to Frleta and Zupan (2020:157), the waste generated by tourists is similar to that of household waste. The weight of each waste category will, however, differ between locations, and types of accommodation facilities (Pirani & Arafat, 2016). Diving tourism, on the other hand, generally has a positive effect on the conservation of the environment (Lucrezi & Saayman, 2017). The nature of the diving tourism sector, is however, resource intensive. Most of the waste produced by diving charters is generated by tourists that make use of this service. Examples of some of this waste

includes plastic (plastic bags, food wrappers, plastic bottles), damaged diving equipment, and fishing gear (Mota, 2015). This waste is then removed from the boat and disposed of (Mota, 2015).

According to Kaza *et al.* (2018:1), mismanaged waste can have a significant impact on marine resources, causes flooding through blocked drains, transmits diseases, increases the occurrence of respiratory diseases, and diminishes tourism. In addition to this, waste is often generated by tourists in sensitive areas that have a high level of vulnerability (Frleta & Zupan, 2020).

2.4 The impacts of waste on protected areas (PAs)

Understanding waste generation and management in protected areas (PAs) can be a challenge as a result of the wide dispersion and types of waste producers (Caputo *et al.*, 2002). In addition to this, an increase in public use may overwhelm an area's waste management infrastructure and resources. Research done by Brown *et al.* (2010), Hammit and Cole (1998) and Liddle (1997) have shown that any type of recreational activity, even at low levels, can cause environmental degradation. Further impacts include land degradation, littering, biodiversity loss, surface and groundwater pollution, and can be a breeding ground for pathogens, insects and rodents (Dunjic *et al.*, 2017; Rodriguez-Rodriguez, 2012). Littering has been found to not only impact PAs visually, but is also a source of pollution that impacts the water, soil, humans, and wildlife of an area (Rodriguez-Rodriguez, 2012). As solid waste is comprised of various organic and inorganic substances, over time the chemical and physical composition of the waste changes, resulting in leachate (Canteiro *et al.*, 2018). This leachate can be toxic to the receiving environment, especially the marine/coastal environment.

Coastal or marine areas are especially vulnerable to the effects of waste, especially in areas where tourism is prominent. Tourists visiting these areas generate significant quantities of solid waste, of which marine debris is of particular concern (Hayati *et al.*, 2020). Marine debris is described as “*any persistent, manufactured or processed solid material, discarded, disposed or abandoned in the marine and coastal environments*” (UNEP, 2003). Marine debris does not only affect the natural environment, resources, and marine life, but also human health, food safety and security, as well as tourism (Barboza *et al.*, 2018; Hayati *et al.*, 2020).

A study done by Krelling *et al.* (2017:95), reported that the income generated by tourism could decrease between 15% and 39.1% with an increase in marine litter. Further economic costs, including beach clean-up operations, have also been identified (Kiessling *et al.*, 2017). Furthermore, sewage runoff and wastewater can cause damage to coral reefs and other fauna and flora, as well as change the siltation and salination of the water (Belsoy *et al.*, 2012). Of particular concern in South Africa, identified by the DFFE (2020:11), is micro-plastic debris. As a

result of the small size of micro-plastics, they have the potential to cause adverse effects to marine life, and humans alike (Barboza *et al.*, 2018).

Various pieces of legislation and regulations are put in place that attempt to reduce the impacts of waste on PAs in South Africa. Of note to this study, is the waste management hierarchy advocated in terms of the National Environmental Management Waste Act (59 of 2008) and the National Environmental Management Protected Areas Act (57 of 2003).

2.5 The National Environmental Management Protected Areas Act (57 of 2003) and managing impacts on protected areas

The National Environmental Protected Areas Act (57 of 2003) (NEM: PAA) has the ultimate aim to protect certain landscapes and seascapes in South Africa through the declaration of PAs. These include areas of ecological and biological diversity. The National Minister of Environmental Affairs and Tourism (now the Department of Forestry, Fisheries and Environment, DFFE) or the Provincial Ministers of the Executive Council (MEC) who are responsible for national environmental management in protected areas, may declare an area as a PA under certain conditions. In particular, section 22A (2) of the NEM: PAA states that an MPA status may only be issued (DEA, 2003) under the following conditions:

- To conserve and protect marine and coastal ecosystems, biodiversity, species, population, or habitat,
- In the presence of scenic areas or cultural heritage,
- For the protection or migratory routes and breeding, nursing, and feeding areas,
- To protect environments used for research and monitoring, and
- To restrict and prohibit certain activities that could cause harm to MPAs.

The NEM: PAA provides regulations for the declaration of all kinds of PAs in South Africa including special nature reserves, national parks, MPAs, nature reserves, and other protected environments (DEA, 2003). Several provisions are set out in this Act that regulate access to and activities that take place in PAs. Some of these restrictions include (Paterson, 2009):

- The prohibition of aircrafts flying at certain altitudes in special nature reserves, national parks, and world heritage sites,
- The prohibition of mining and commercial prospecting in special nature reserves, national parks, and nature reserves (these activities are allowed in protected environments), and
- Strict regulation of community and commercial activities in national parks, nature reserves, and world heritage sites.

With the regulation of activities, the management authority aims to decrease the negative impacts of these activities on PAs. A thorough breakdown of activities that are allowed and prohibited in PAs can be found in the *Regulations for the Proper Administration of Special Nature Reserves, National Parks and World Heritage sites* (DEAT, 2005). These also contain the mechanisms that attempt to protect PAs against negative impacts, such as waste. Control of access to PAs and the prohibition of littering and other waste discharge and depositing are just some of the examples of the restrictions placed on activities in PAs (DEAT, 2005).

2.6 The National Environmental Management Waste Act (59 of 2008) and managing impacts of waste in protected areas

The National Environmental Management Waste Act (59 of 2008) (NEM: WA) aims to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development. The NEM: WA has provided the legal framework to work towards the movement away from landfilling towards the prevention of waste, as well as re-use and recycling (Godfrey *et al.*, 2017). This is achieved through various sections in the Act that promote the re-use, recycling, or recovery of waste, over its disposal (i.e., Section 16 and 17 of NEM: WA, 2008). In addition to this, the Act required the establishment of the National Waste Management Strategy (NWMS), in which certain sustainable environmental goals were identified.

The National Waste Management Strategy (NWMS) aims to address the challenges of waste management in South Africa, of which the separation of waste at source is one (DEA, 2011). The first goal of the NWMS aims to implement and integrate the waste management hierarchy. This hierarchy is related to the notion of a circular economy, whereby waste management is seen as a closed loop that may protect and conserve resources (Goyal *et al.*, 2018). In Figure 2-1 below, one can see that this hierarchy ranks the different waste management options from least to most desirable.

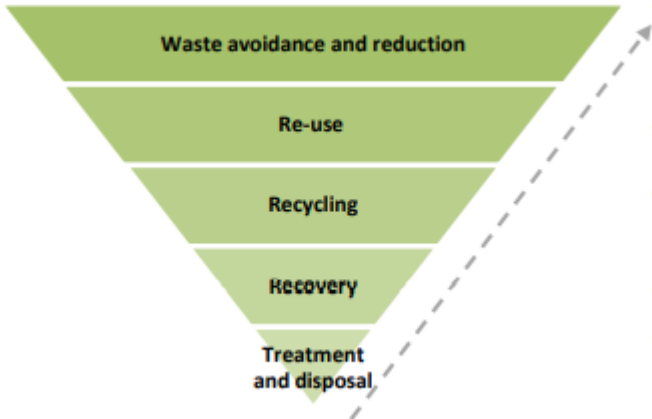


Figure 2-1: The Waste Management Hierarchy (adapted from: DEA, 2011)

The most favourable option for waste management is waste avoidance and reduction, with treatment and disposal being least favourable. This study focuses on the recycling element of the waste hierarchy, specifically waste separation at source. With the ultimate aim of diverting waste from landfills, the NWMS aims to investigate possible interventions or incentives to motivate residential areas to participate in waste reduction programmes (DEA, 2011).

While behaviour change on the part of the consumer plays a major role in increasing recycling rates, the backlog on waste service delivery greatly impedes the initiation of any waste reduction programmes. Other obstacles to the successful implementation are highlighted below (DFFE, 2020):

- There is a limited number of recycling facilities in certain areas in South Africa,
- In the short-term, landfilling is the cheaper option,
- There is minimal reliable data on waste streams, and
- There is a lack of policy implementation by the local government and industries.

Goal 2 of this strategy aims to promote “*access to at least a basic level of waste services for all and integrates the waste management hierarchy into waste services, including separation at source*” (DEA, 2011:16). Some efforts have been made to increase participation in separation at source programmes, although a backlog in service delivery and the willingness of individuals remain a challenge (DEA, 2011).

As stated by the DFFE (2020:15), source separation is the key to a successful waste reduction programme. In the NWMS, separation at source behaviours are promoted through nationally coordinated awareness campaigns aimed at households, organisations, as well as businesses (DEA, 2011). Unfortunately, there is an absence of participation in waste separation at source programmes in South Africa (Godfrey and Oelofse, 2017). With regards to South African regulations on separation at source, these focus on providing an enabling environment for households. This is done by increasing public awareness and motivating private sectors to invest in services and infrastructure, encouraging separation at source. The willingness of households to partake in these programmes influences their successful implementation. Some efforts have also been made that focus on the packaging and design of products. This encourages producers to support markets for source separated materials.

2.7 Towards implementing the waste management hierarchy: The importance of separation of waste at source

Numerous studies have been conducted related to sustainable MSW management, although there is a lack of research that investigates holistic approaches that monitors and manages MSW on a global scale (Das *et al.*, 2019). The priority of sustainable waste management solutions is to shift from traditional approaches, i.e., landfilling, which are hazardous to the environment, towards waste management approaches which retain valuable resources. One such approach is waste separation at source.

With the move towards a more integrated waste management system, waste separation at source has been considered an essential component in the appropriate treatment of MSW (Zhuang *et al.*, 2008). Separation at source behaviour involves separating one's waste at its generated source in order to remove these items from the waste stream. These behaviours are an essential part of sustainable waste management. There are many benefits to these behaviours. As identified by Zhuang *et al.* (2008:2022), waste separation optimises incineration, produces compost of greater quality, and enhances the quality of recyclables. Furthermore, it decreases the labour and energy needed in waste management processes. Various awareness schemes have been implemented in many countries. The success of these schemes, however, rely heavily on the cooperation of the public. Without public participation, the efficiency of waste separation programmes decreases drastically (Bernstad, 2014).

2.7.1 Separation of waste at source in the international and African contexts

Waste separation at source has been cited as one of the most crucial aspects of recycling, and ultimately the promotion of a circular economy (Kato *et al.*, 2019; Odura-Kwarteng *et al.*, 2016; Phu *et al.*, 2019). Separation at source has been beneficial to waste management on both the macro scale (MSW) and the micro scale (electronic waste, household waste, university campus waste, etc.). The move towards a circular economy, however, does not only require the reduction and prevention of waste, but the adjustment of existing waste services and policies (Knickmeyer, 2020). Studies conducted by the United Nations Department of Economic and Social Affairs (UN DESA, 2013), state that investments in separation at source programmes are essential in the reduction of waste generation. Many of the existing programmes are focussed on household waste separation.

The majority of municipalities in developed countries have developed and implemented various waste management schemes or programmes. The European Union (EU) are among the global leaders in the development of sustainable waste management policies. In 2018, new measures

were approved by the EU targeting the recycling of municipal waste and developing a circular economy (Nainggolan *et al.*, 2019). This new waste legislation aims to recycle 55% of MSW by 2025, and 65% by 2035. Separate waste collection is currently being practiced in the EU for paper and cardboard, plastic, metals, and glass (European Union, 2018). Oxford City in the United Kingdom, in particular, has implemented various waste collection and management strategies that aim to increase recycling. These include weekly recycling collections offered for various categories of MSW, including food waste and green waste (Al Seadi *et al.*, 2013). With the new legislation, the separate collection of waste extends to hazardous and bio-waste. Both households and producers are incentivised to support the waste hierarchy through the use of economic instruments and other measures. The success of these schemes is attributed to legally binding targets, as well as the treatment of waste as a valuable resource (European Union, 2018).

The Japanese government has also achieved high recycling rates through the implementation of various waste laws. The Containers and Recycling Act, in which the producers or users of containers or packaging materials in Japan are held responsible for the recycling of these materials, has achieved great success in recycling efforts (Chifari *et al.*, 2017). The responsibility of separating these materials from their solid waste, are households. Designated collection locations and collection days are then specified for each household. According to Leeabai *et al.* (2019:58), there are currently twenty-five waste separation categories in Japan. Collected MSW is then further separated at processing facilities to reduce the quantities of waste disposed (Chifari *et al.*, 2017). Developing countries, however, might not have the same finances, resources, or governance to accomplish what developed countries have.

A study conducted in Ghana found that the residents rarely separated their solid waste, regardless of their economic situation (Gyimah *et al.*, 2019). With ineffective waste management systems, the lifespan of Ghana's landfills is significantly shortened. Only 10% of Ghana's waste is collected and disposed of at landfills (Douti *et al.*, 2017; Lissah *et al.*, 2021). A large majority of the waste ends up in the streets, drains, or water sources. Waste minimisation, recycling and re-use are promoted through their Environmental Sanitation Policy, although effective waste separation is required. These regulations are however, not enforced and public awareness of sustainable waste management practices are low (Lissah *et al.*, 2021). Specific regulations regarding waste separation are not present in Ghana.

In Namibia, open dumpsites and uncontrolled dumpsites are the most common forms of waste disposal (Kadhila, 2019). Waste scavenging in these dumpsites is, however, an important part of Namibia's waste management system. Unemployed and underprivileged individuals scavenge for waste in dumpsites for their own use, sale, or recycling. This form of recycling, as is in many other developing countries, is considered illegal (Asim *et al.*, 2012; Nambuli *et al.*, 2021). As is the case

with Ghana, no formal recycling systems are in place. This includes waste separation at source. As can be seen, the methods of waste management differ between developed and developing countries, where developed countries adopt more sustainable methods.

2.7.2 Separation of waste at source in the South African context

There is potential to increase recycling and separation at source in South Africa. The regulatory environment of South Africa is ideal when it comes to supporting a circular economy through the implementation of the waste management hierarchy (Strydom, 2018). In recent years recycling has improved in the paper and packaging sectors, although this is largely due to private companies and the informal waste sector (Godfrey, 2016). Households have, however, continued to show poor participation in recycling efforts, with Strydom and Godfrey (2016:5) stating that only 7.2% of households actively recycled their waste in 2015. The ability of households to recycle may, however, be impeded by inadequate municipal refuse removal services, as well as a lack of awareness. According to the General Household survey of 2002-2016, only 66.9% of South African households had access to solid waste management services in 2016 (StatsSA, 2018). Strydom (2018:1) states that waste collection varies between 25% and 70% depending on the municipality. Waste separation at source has fared even worse with only 0.5% to 6.1% of households separating their waste in 2019 (StatsSA, 2019). Waste separation at source is, however, not required from households in South Africa (Roos *et al.*, 2021a). There are a number of challenges to waste separation outlined in the South African State of Waste Report (DEA, 2018), namely, financial constraints, a lack of knowledge and willingness of households to participate, and not integrating informal waste pickers into source separation programmes.

With the majority of studies around separation at source practices focussing on household source separation and recycling (Oyekale, 2018; Roos *et al.*, 2021a; Strydom & Godfrey, 2016; Strydom, 2018), it has been found that there is limited research focussing on waste separation in PAs. This is especially true for MPAs. One of the few studies conducted on source separation in PAs was authored by Hatton (2002). In this study the researcher evaluated the waste management practices of various PAs in KwaZulu-Natal. It was found that waste from these PAs were more often than not burned or buried (after being removed from the PA), with source separation (in 2002) being practiced by the Hilltop camp in Hluhluwe iMfolozi Game Reserve in KwaZulu-Natal; and Skukuza camp in the Kruger National Park only (Hatton, 2002). Although some separation of waste at source took place at these camps, it was often not done correctly (with the exception of the Skukuza waste disposal site) and typically still ended up being disposed to landfill, which leaves room for improvement.

2.7.3 Understanding waste separation at source behaviour

Due to the rapid increase in waste generation and its subsequent impact on the natural environment, the importance of understanding waste separation behaviour has become apparent. Separation at source programmes have been found to be an effective measure against environmental degradation (Xu *et al.*, 2017).

According to Zhang *et al.* (2017:445), the success of MSW source separation does not only depend on streamlining technology, but on the involvement of people. Understanding an individual's waste separation behaviour and its related factors are therefore, essential. There are certain influential factors that affect an individual's intention to engage in a behaviour. By evaluating these factors, one will be able to determine the drivers and barriers behind these individuals' waste separation behaviours (Xu *et al.*, 2017). Once these are determined, steps can be taken to improve waste management systems and programmes. These systems and programmes, however, are situational and will depend on the context and characteristics of an area.

Multiple studies have been conducted on the factors that affect an individual's behaviour towards waste separation at source. By understanding these factors, sustainable programmes may be developed. The most common predictor of these behaviours, identified by Nomura *et al.* (2017:1052), is demographics and attitude. Individuals who do not have a great concern for the environment are more likely to participate in these schemes if there is some type of incentive. Those individuals who are concerned for the environment tend to find their own reasons for participating in separation at source behaviours (Boonrod *et al.*, 2015). External triggers, or incentives are, therefore, not of concern. Situational factors, such as the convenience of participation, as well as an individual's skill or resources should also be mentioned. When it comes to household recycling, access to a curb-side recycling scheme is of utmost importance (Barr & Gilg, 2005). Moreover, mandatory schemes and the active enforcement of these programmes have proven to have a greater success rate (Boonrod *et al.*, 2015). According to Boonrod *et al.* (2015:77) there have been a few successful cases where separation at source programmes had been implemented in cities, namely in Korea, the United Kingdom and in Sweden. There are numerous theories that attempt to understand or predict an individual's behaviour - three of which will be discussed in the following sections.

2.7.3.1 Theories applied to understand and predict behaviour

There have been various theoretical frameworks and models that have attempted to explain and predict human behaviour. One such model, is the *Model of Environmentally Responsible*

Behaviour (ERB). Proposed by Hines, Hungerford and Tomera (1987), this theory stresses the importance of forming environmentally responsible habits that are persistent and consistent (Osbaldiston *et al.*, 2003). By adopting ERB's, environmental concerns may be remediated. Variables, such as the intention to act and other personal and situational factors (attitudes, locus of control (LOC), knowledge, and sense of personal responsibility) are said to interact, influencing the adoption of a behaviour (Akintunde, 2017; Hines *et al.*, 1987). This intention to act, however, must work in combination with the factors mentioned above before a behaviour can be adopted (Hines *et al.*, 1987). Attitude, in particular, has been found to be an important precedent of behaviour (Lee *et al.*, 2013). With regards to tourism behaviour, attitude-behaviour models have received considerable attention. Various alternative models were, however, proposed as the ERB model was found to be too simplistic (Pan *et al.*, 2018).

Among others, certain concepts, such as personality traits, social attitude, and general dispositions have also been studied. These concepts, however, have proven to be untenable, especially in situations with specific circumstances (Ajzen, 1991). This finding resulted in the formulation of the *Theory of Reasoned Action (TRA)*, which was derived from the following equation (1) (Forward, 1997):

$$\text{Attitude} = \sum \text{Expectancy} \times \text{Value} \quad (1)$$

The idea behind this formula is that attitude is the sum total of an individual's beliefs regarding the preconceived consequences of their actions multiplied by the expected value of these actions (Sarver, 1983). This relates to a person's attitude towards a behaviour as well as their subjective norm. It should be added that this theory only deals with volitional behaviours (Connor, 2020; Forward, 1997). Limitations to this theory are, therefore, that behaviours not fully under one's control are not considered. The Theory of Planned Behaviour (TPB) attempts to address this problem.

2.7.3.2 The Theory of Planned Behaviour (TPB) towards understanding waste-related behaviour

In addition to attitude and subjective norm, this theory considered perceived behavioural control to be one of the constructs related to predicting human behaviour (Ajzen, 1991; Forward, 1997). The following linear regression function (equation 2) can, therefore, be depicted by this theory (Connor, 2020):

$$B = w_1BI + w_2PBC \quad (2)$$

where B is behaviour, BI behavioural intention, PBC perceived behavioural control, and where w_1 and w_2 are regression weights (the value of these weights will vary depending on the situation, behaviour, as well as the specific population being studied). Therefore, this theory posits the idea that an individual's attitude toward an action (behavioural beliefs), their subjective norm (normative beliefs), as well as their perceived behavioural control (control beliefs) will determine their behaviour (Forward, 1997; Godin & Kok, 1996). These three factors form an individual's behavioural intention. Intention is described by Ajzen (1991), as the motivational factors influencing a certain behaviour, although this is only applicable in those behaviours that are under volitional control. Furthermore, it can be said that the stronger an individual's intention to engage in a specific behaviour, the more likely that the behaviour will be performed (Ajzen, 1991). A schematic representation of Ajzen's (1989) theory can be found in Figure 2-2 below:

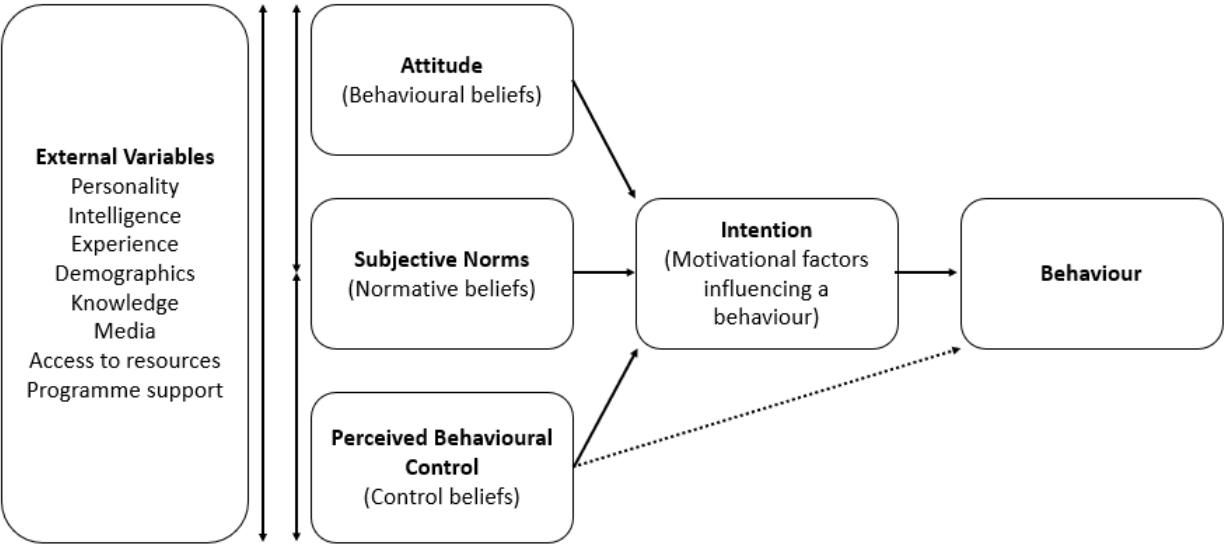


Figure 2-2: A Schematic representation of The Theory of Planned Behaviour (adapted from: Ajzen, 1991)

2.7.3.2.1 External variables

External variables, such as situational factors (including convenience and access to information) and socio-economic characteristics (i.e., age, gender, income, and education) are some of the external variables that can be used to evaluate an individual's intention to engage in separation of waste at source (Alhassan, 2017). The results of previous studies concerning external variables are highlighted in Table 2-1 below.

Table 2-1: Summary of findings related to external variables

External variable	Researcher(s)/author(s)	Findings
Information	Gamba and Oskamp (1994); Hornik <i>et al.</i> (1995); Vining and Ebreo (1992)	The findings from these studies have found information to be a positive indicator of recycling behaviour.
Gender	do Valle <i>et al.</i> (2004); Ekere <i>et al.</i> (2009); Saphores <i>et al.</i> (2006); Vicente and Resi (2008) Hage <i>et al.</i> (2009); Knussen and Yule (2008).	Women are generally found to be responsible for recycling or waste separation activities, and are more willing to do so than men. In contrast, other studies have found that gender does not affect recycling behaviour.
Education	Barre <i>et al.</i> (2003); Hage and Söderholm (2008); Saphores <i>et al.</i> (2006)	Individuals who have a higher level of education are more aware of environmental issues, leading to an increase in the intention to engage in separation at source behaviours.
Age	Martin <i>et al.</i> (2006); Saphores <i>et al.</i> (2006)	These studies found that older people are more willing to recycle as they have more time.
Income	Martin <i>et al.</i> (2006); Williams and Kelly (2003).	It was observed that individuals with a higher income are more likely to recycle than those with a lower income.
Household size	Hage and Söderholm (2008); Hage <i>et al.</i> (2009)	Single-family dwellings have been found to recycle more than multiple-family dwellings due to the availability of space.
Convenience	Domina and Koch (2002); Gonzalez-Torre <i>et al.</i> (2003); Ghani <i>et al.</i> (2013) Saphores <i>et al.</i> (2006)	The more convenient it is to recycle or separate waste, the more likely individuals are to engage in that behaviour. Some factors include proximity and access to waste management facilities, and time and effort.

Conner and Armitage (1998:1429), further suggest that factors such as belief salience, self-efficacy, past behaviour, affective beliefs, and self-identity also effect behaviour. These factors are, however, not covered in the TPB and were not be considered in this study.

2.7.3.2.2 Attitude

The first predictor of behavioural intention is attitude. Attitude can be described as an individual's complete evaluations regarding the performance of a specific behaviour (Connor & Armitage, 1998). It can, therefore, be said that the formation of an attitude depends on an expectancy-value formulation, whereby an attitude toward a behaviour is assumed to be affected by an individual's beliefs about the expected consequences of performing that behaviour (Ajzen, 2020). These behavioural beliefs are subjective. An individual's belief that a behaviour will result in a certain experience or outcome, will either produce a positive or negative evaluation of that behaviour (Fishbein & Ajzen, 1980; Forward, 1997; Yadav & Pathak, 2017). Equation (3) demonstrates this expectancy-value model (Ajzen, 2020):

$$ATT \propto \sum b_i e_i (3)$$

where an individual's attitude is directly proportional to their belief (*b*), multiplied by their subjective evaluation (*e*) of a behaviour, of which the resulting products are summed.

2.7.3.2.3 Subjective norm

Subjective norm is defined as the pressure placed on an individual by society to perform a certain behaviour (Yadav & Pathak, 2017). This factor is, therefore, a normative belief. Furthermore, there are two types of normative beliefs that can be distinguished, namely injunctive and descriptive normative beliefs (Ajzen, 2020). Injunctive beliefs refer whether an individual believes that a certain group or individual will approve or disapprove of a behaviour, whereas descriptive beliefs are beliefs as to whether significant others will perform the behaviour themselves (Ajzen, 2020; Connor & Armitage, 1998). This can be seen in Equation (4) below (Ajzen, 2020):

$$SN \propto \sum n_i s_i \quad (4)$$

where the subjective norm (*SN*) of an individual is directly proportional to the sum of each normative belief (*n*) multiplied by the behaviour's significance (*s*) to the individual.

2.7.3.2.4 Perceived behavioural control

Perceived behavioural control is associated with accessible control beliefs. This is concerned with how much effort an individual will have to exert in order to perform a behaviour under specific conditions (Fishbein & Ajzen, 1980). These conditions include the availability or lack of resources, finances, time, skills, etc. These conditions, in interaction with their perceived power to facilitate or impede a behaviour, will form an individual's control beliefs (Ajzen, 2020). As can be seen in Equation (5) below, perceived behavioural control (*PBC*) is directly proportional to the sum of the products of control belief strength (*c*) and power (*p*) (Ajzen, 2020).

$$PBC \propto \sum c_i p_i \quad (5)$$

A positive attitude, as well as a positive subjective norm, in conjunction with a favourable perceived behavioural control, will support the formation of advantageous behavioural intentions (Ajzen, 2020).

Although the TPB has successfully been used to explain/predict behaviour in a variety of behavioural fields, its application to waste-related behaviours is relatively new.

2.8 Behaviour and separation of waste at source

The relation between TPB and household recycling has been extensively researched. Studies by Echegaray and Hansstein (2016), Pakpour *et al.* (2014), Ghani *et al.* (2013), and Nigbur *et al.*

(2010) have utilised this theory to predict the determinants of household recycling behaviour. In these studies, several determinants were found to have a positive relationship with recycling behaviours. Perceived behavioural control was found to be the strongest predictor of recycling behaviour. Additionally, attitude was a significant predictor, although subjective norms reported mixed findings. Tonglet *et al.* (2004:208) argued that the influence of societal norms did not have a significant impact on recycling behaviour. Compared to recycling behaviours, waste separation at source has received less attention (Alhassan *et al.*, 2017). Additionally, minimal research regarding these practices is found in Africa, especially using TPB.

Identifying the determinants of source separation behaviour, according to Alhassan *et al.* (2017:708), is essential in moving towards complete individual participation. Unlike recycling behaviours, societal norms were found to play a critical role in waste separation practices (Alhassan *et al.*, 2017; Xu *et al.*, 2017; Ghani *et al.*, 2013). Furthermore, attitude was the strongest predictor of these behaviours. It was found that situational, as well as demographic factors heavily influenced an individual's participation intentions (Alhassan *et al.*, 2017). For example, if there are no campaigns or resources available to households, they were less motivated to separate their waste. Once again, there has been very little research conducted on these practices in the South African context. There have also been minimal studies focussed on applying this theory to a business or organisational context. This study attempts to apply TPB to separation at source practices in a business context, with a focus on the Aliwal Shoal MPA.

2.9 Understanding waste behaviour in protected areas

There have been various studies conducted on environmental management in PAs, both internationally and nationally. PAs play a vital role in preserving the biodiversity of vulnerable natural environments, however, there is significant pressure placed on these areas due to anthropogenic activities (Kolahi *et al.*, 2013; Przydatek, 2019). Despite this pressure, sustainable waste management must be achieved in order to ensure that natural resources in PAs remain undamaged. In addition to this, tourism has also been found to impact sustainable development in these areas (Wei *et al.*, 2013). Limited research has been done on *waste management* in PAs.

A study done by Przydatek (2019) reviewed waste management in selected PAs worldwide. These selected areas included North America (Canada and the United States), Africa (Tanzania), Asia (China, Iran, Nepal, Mongolia, Turkey), and Europe (England, France, Germany, Poland, Slovakia, Sweden) (Przydatek, 2019). It was determined that waste management in PAs are subject to the legislation and regulations of the area in which the PA operates. The study specifically focussed on the diversion of waste from landfill. It was found that the majority of countries studied banned landfilling within PAs, although only five countries complied with these

bans. The diversion from landfills in these areas is generally attributed to the re-use and recycling of waste. Some other techniques include composting, diverting waste from PAs to landfills in other areas, and encouraging tourists to take their waste with them. The main threats to PAs, and MPAs especially, are related to tourist flows. These include the increase in the number of tourists that visit PAs and the subsequent development of tourist infrastructure (Przydatek, 2019). As stated by de Witt and van der Merwe (2015:2), unless tourists take an active interest in the sustainability of PAs, the efforts made by governments or industries will not succeed.

When it comes to environmental issues, Kamino *et al.* (2020:2) state that awareness, participation, and social control should form a part of the decision-making process. By understanding waste management in PAs, as well as the waste behaviour of individuals who visit PAs, efficient decision-making may be made regarding sustainable waste management plans.

One way in which PAs attempt to promote sustainable waste management, is through ecotourism. There are four main purposes of ecotourism identified by de Witt and van der Merwe (2017:3), namely to conserve and enhance the natural environment, to increase the knowledge of tourists, to sustainably manage PAs, and to provide tourists with an enlightened experience of the natural environment. This allows tourists who visit PAs to be made aware of- and increase their knowledge of the natural environment in the hope that they partake in these sustainable practices, including waste minimisation (Lee & Moscardo, 2005). Knowledge influences attitude, which in turn influences behaviour (Strydom, 2018). According to Hatton (2002:28), a tourist's positive attitude towards waste management, and in particular waste separation, will positively influence the effectiveness of a PA's waste management programme. Ecotourism is important as it generates income that is used to maintain and manage PAs. One other way in which PAs attempt to achieve sustainable management, is through legislation.

In South Africa, the National Environmental Protected Areas Act (57 of 2003) intends to protect and conserve MPAs through Section 22A (2) of the Act. The ultimate goal of this section is to protect and conserve marine and coastal ecosystems, biodiversity, species, specific populations and its habitats. Furthermore, areas that hold scenic or cultural importance should also be protected. If PAs are not managed correctly, however, sustainable waste management practices cannot be achieved despite conservation attempts. Some challenges identified by He and Cliquet (2020:9) include incomplete legislation, institutional barriers, a lack of funding, and insufficient public participation.

2.10 Chapter summary

With an increase in urbanisation and population, waste has become a global problem in need of improved waste management techniques. In this chapter, the issues of waste and waste management in South Africa were discussed in order to identify the current MSW practices. At present, landfilling is the most common form of waste management. Additionally, South African waste legislation and regulations are also highlighted. TPB and its constructs were then discussed to orientate the research methodology and the questionnaire design. Lastly, existing literature regarding the application of TPB to waste behaviours was discussed. It was found that little research has been conducted on waste separation practices in the business or organisational context.

Chapter 3 outlines the methods followed in pursuit of the research objectives.

CHAPTER 3 METHODOLOGY

3.1 Introduction

This chapter describes the research design applied to this study, including the data collection and analysis methods. Furthermore, the sampling method, ethical considerations, as well as the assumptions and limitations of the methodology are presented. The following section provides an in-depth review of the three research designs, in addition to the justification for the research design chosen for this study.

3.2 Research design

The two most recognised approaches to research are quantitative and qualitative research designs. These designs have clear differences between them, with the selection of an appropriate design depending on the research problem and aims of a study (Petty *et al.*, 2012). The research design for this study employed a mixture of quantitative and qualitative approaches. To gain an understanding of waste separation at source behaviour related to tourism activities within the Aliwal Shoal MPA, the research design was centred around the Theory of Planned Behaviour (TPB). The TPB relies on self-reported responses to questions based on waste-related attitude, behaviour and practice, amongst others. However, according to Huffman *et al.* (2014:263), self-reported behaviour may differ from actual waste-related behaviour. Therefore, the research design provided for the observation of actual waste-related behaviour, supported by waste composition characterisation to determine actual waste practices and the actual quantities and types of waste separated at source (RO1). Actual behaviour and practice were observed *before* self-reported behaviour was determined, to limit the potential of the expectations presented by the TPB framework influencing or changing respondents' actual separation at source behaviour.

As indicated in Table 3-1, the first research objective (RO1) focused on determining actual (observed) waste separation at source behaviour, which employed descriptive observations as well as waste composition characterisation. The second research objective aimed at determining (self-reported) waste separation at source behaviour, by applying the TPB framework. As stated previously, an individual's behavioural beliefs (attitude), normative beliefs (social norms), and control beliefs (perceived behavioural control) influence their intentions to engage in a behaviour (Armitage & Christian, 2003; Ajzen, 2020). The TPB framework allows one to understand the psychological determinants of behaviours such as waste separation, although these self-reported behaviours alone are not sufficient (as mentioned earlier).

Table 3-1: Summary of the research design

Research Objective	Methods	Justification for method
<p>Research objective 1 (RO1): Determine the actual (observed) waste behaviour related to accommodation and diving activities within the MPA</p>	<p>Waste characterisation and observations</p>	<p>Waste characterisation studies are found to be an appropriate method used for the measurement of the observed waste behaviour of individuals as they determine the actual composition and volume of the sample of waste collected (Dahlén & Lagerkvist, 2008; Oelofse <i>et al.</i>, 2016).</p> <p>A more reliable measurement of the participants' actual waste behaviour could also be measured using observations (Noor, 2008). On-site observations were used to determine the waste management facilities available to each participant, as well as their actual waste separation at source practices. This was used in combination with the self-reported behaviour to gain a more comprehensive understanding of waste separation at source behaviour (Jamshed, 2014).</p>
<p>Research objective 2 (RO2): Determine the self-reported waste behaviour related to accommodation facilities and diving activities within the MPA</p>	<p>Questionnaires based on the TPB</p>	<p>Questionnaires based on the TPB were used to determine the self-reported behaviour. Questionnaires were designed to address attitude, social norms, perceived behavioural control, and intention related to waste separation at source (Ajzen, 1991).</p>
<p>Research objective 3 (RO3): To evaluate the underlying factors influencing waste-related behaviour through the application of the TPB</p>	<p>Interviews and analysis of the results of RO1 and RO2</p>	<p>Additional information regarding the underlying factors (opportunities and challenges) of waste separation at source, that could not be obtained from the questionnaires, could be determined through interviews with participants. Their unique perceptions could, therefore, be determined (de Vos <i>et al.</i>, 2011).</p> <p>As stated by Steg and Vlek (2009:310) and Huffman <i>et al.</i> (2014:263), self-reported behaviour alone may not yield accurate results as they are often biased. The self-reported behaviour should, therefore be compared to the observed behaviour to get an accurate representation of the participant's waste separation at source behaviour.</p>

3.2.1 The quantitative research approach

The quantitative research design originates from the natural or physical sciences and is positivistic in nature (de Vos *et al.*, 2011; Tuli, 2010). The positivistic paradigm states that reality can be measured and is independent from the researcher who observes it (Weber, 2004). The knowledge obtained is, therefore, objective. This design aims to predict, explain, and control phenomena by answering certain questions (*who, what, when, where, how, how much, and how many*).

Furthermore, the quantitative approach is deductive, where observations are applied to reliable theories and conclusions are drawn. The relationships between variables can be quantified and analysed to obtain results (trends and behaviours) (de Vos *et al.*, 2011). Generalisations are then developed from these relationships. Lee (1992:87) states that the research method of this approach is based on numerical data, which is then analysed using statistical methods. This approach is most appropriate when used to determine the degree and scope of a phenomenon.

The quantitative element used in this study was a **waste characterisation** study. Numerical data, in the form of waste percentages, were analysed to determine trends in the waste behaviour of the participants. Goertzen (2017:12) notes that this approach does, however, not aim to understand the motivation behind an individual's behaviour. The qualitative approach will, therefore, compliment the limitations of the quantitative approach.

3.2.2 The qualitative research approach

In comparison to the quantitative research design, the qualitative approach is based on the phenomenological paradigm which originated from the social sciences. Phenomenology relates to deriving knowledge from the first-hand experiences of an individual and exploring human behaviour in its entirety (Lee, 1992). The purpose of quantitative research is to understand and interpret complex phenomena, such as an individual's experiences, behaviours and perceptions of social interactions (de Vos *et al.*, 2011). The knowledge obtained from this research is, therefore, highly subjective with multiple realities. The researcher will collect data, whereafter a new theory or hypothesis will be generated. This is known as inductive research. Unlike quantitative research, the qualitative approach assumes that social phenomena are too complex to be reduced to variables. From the analysis of data, patterns, themes, and features can be identified (Apuke, 2017).

Questionnaires, observations and interviews were used as the qualitative component of this study. These research techniques provided for the subjective evaluation of the participant's waste behaviour. A criticism of this research design, identified by Choy (2014:101), is that the results obtained from this research cannot be objectively verified. The mixed-methods research design aims to explore complex phenomena in greater detail by combining the strengths of both the qualitative and quantitative approaches (Kumar, 2019; Schoonenboom & Johnson, 2017).

3.2.3 The mixed-methods research approach

According to Ponce and Pagán-Maldonado (2015:114), the complexity of environmental concerns can only be understood by incorporating multiple methods. For this study, which aimed to understand tourism-related waste separation behaviours in the Aliwal Shoal MPA, it was assumed

that there are multiple dimensions, which could not be understood by applying one design alone. It was, therefore, necessary to include a quantitative element (waste characterisation) to understand waste characteristics and composition, and a qualitative element (observations, questionnaires and interviews) to understand the reasons, challenges, barriers, and opportunities of waste separation at source practices. The qualitative and quantitative methods mentioned earlier were used to measure different aspects of the same research questions (Ponce & Pagán-Maldonado, 2014).

Studies that use a mixed-methods approach will obtain a broader and deeper understanding of the phenomena being studied. McKim (2017:203) states that this approach adds value by supporting the creation of knowledge, informing the collection of the data source, and increasing the validity of the results. Furthermore, both numeric and written data are collected either concurrently or sequentially (Maree, 2007). These two types of data were collected and analysed separately, but within the same time period. Once the data had been analysed, the results were then combined and compared (O’Cathain *et al.*, 2007). It was then determined whether these two datasets were convergent, complementary, or contradictory. Across-method triangulation (as suggested by Adami & Kiger, 2005; Bekhet & Zauszniewski, 2012), where results are compared and contrasted in order to produce well-validated findings that adds rigour and depth to the study (Denzin, 1994; Maree, 2007), was applied.

3.3 Case study selection

For the purpose of this research, a case study approach was favoured. Yin (2018:3) states that a case study approach is most appropriate when an in-depth and extensive understanding of a certain phenomenon is needed. The aim of this research was to apply the TPB to understand the factors influencing tourism-related waste behaviour within the Aliwal Shoal MPA.

In order to achieve this aim, a study of the actual versus self-reported separation at source behaviours was performed (as discussed in Sections 3.2.1 to 3.2.3 above). Multiple sources of evidence were gathered, which is common for a case study approach (Noor, 2008).

The Aliwal Shoal MPA in KwaZulu-Natal, South Africa was ultimately chosen as a case study for this research. Non-probability sampling (*a sampling technique in which the researcher selects samples based on the subjective judgment of the researcher rather than random selection*), based on the following criteria, was used to identify this case study area (Teddlie & Yu, 2007).

- **Diverse tourism-related activities, infrastructure and services:** The Aliwal Shoal MPA was selected due to its diversity in tourism-related activities, consisting of diving, fishing, bird watching, and other tourism-related activities, supported by accommodation activities

and infrastructure, as well as other services. Diving and accommodation activities were purposively selected, since these activities are known generators of diverse waste streams, and because there are a number of these facilities located in the Aliwal Shoal MPA.

- An MPA with **sufficient participants** were needed to participate in data collection. As mentioned above, Aliwal Shoal has a diversity of accommodation facilities and diving charters, which were expected to provide a representative sample to determine waste-related behaviour within an MPA.
- **Willingness to participate in research and consent and permission to conduct research:** The diving charters and accommodation facilities had to agree to participate in the research and provide permission to conduct waste characterisation studies, interviews, observations, or questionnaires.

The Aliwal Shoal complied to the above characteristics and was, therefore, selected as an appropriate case study.

3.4 Description of study area

Identified as a MPA in 2004, the Aliwal Shoal is found on the South Coast of Kwa-Zulu Natal in Umkomaas (Cele & Ndlovu, 2018). This area is located within a transition zone, covering approximately 234 km² of ocean and 670 km of coastline (Lagabrielle *et al.*, 2018). A map of the larger MPA area is illustrated in Figure 3-1.

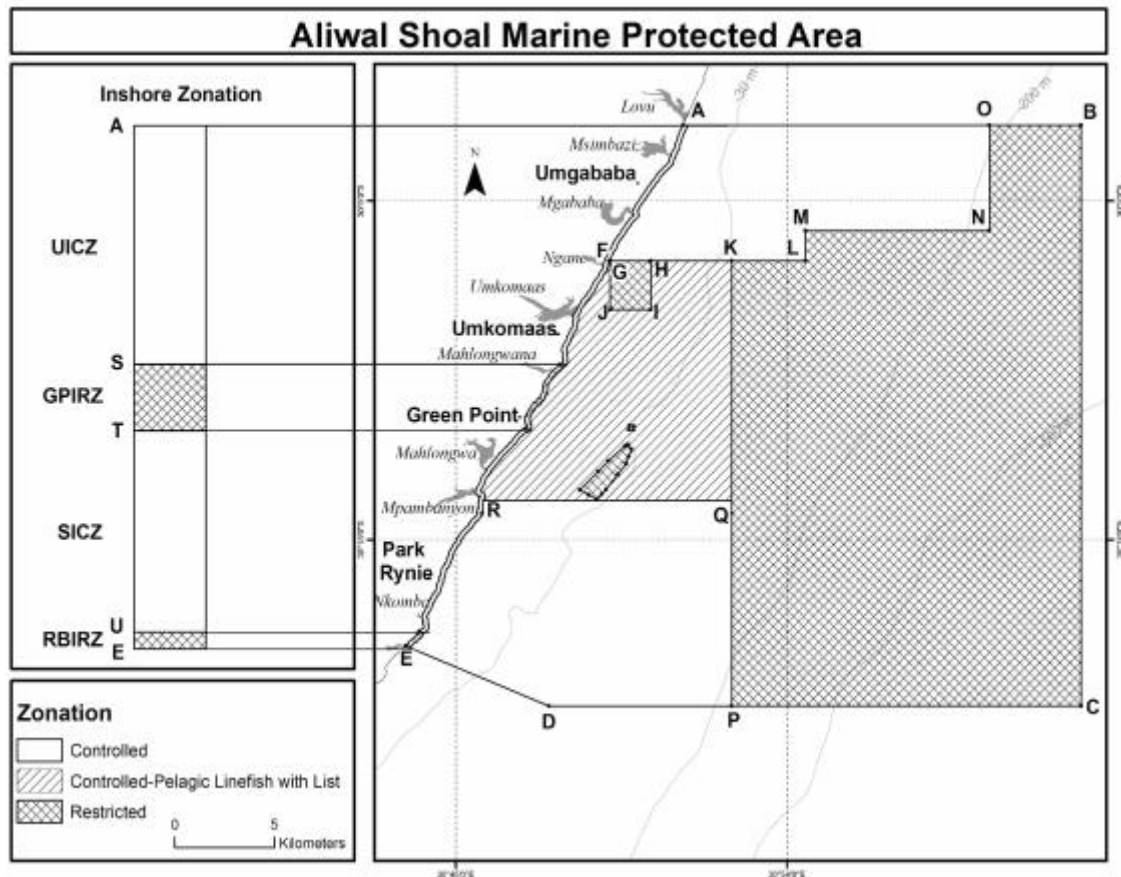


Figure 3-1: A map of the larger Aliwal Shoal MPA (sourced from: NEM: PAA, 2019)

This subtidal, subtropical reef is found between the Maputaland and Pondoland reefs (Olbers *et al.*, 2009). The MPA is divided into inshore areas and offshore areas, where certain activities are either controlled or restricted (NEM: PAA, 2019). Regarding the fauna and flora of the area, the benthic zone of the Aliwal Shoal is dominated by sponges and algae, with the total living cover of the area being approximately 86.9% (Olbers, 2017; Olbers *et al.*, 2009). Furthermore, a variety of echinoderms, ascidians, as well as various hard and soft corals can be found. This forms a habitat for the various warm-temperate, tropical, and subtropical fish communities (Daly, 2018). For a few months of the year, humpback whales, bottlenose and humpback dolphins, as well as various shark species pass through this area. Effective waste management is an important aspect of ensuring the preservation of this area.

The Aliwal Shoal falls under the jurisdiction of the eThekweni, Ugu, and Umdoni Municipalities, with the majority of research participants falling within the jurisdiction of the eThekweni Municipality. According to the Integrated Waste Management Plan (IWMP) of this municipality, the domestic waste generation rates vary from 0.2 kg/person/day for low-income groups to 3.0 kg/person/day for high income groups (eThekweni Municipality, 2016). Durban Solid Waste (DSW)

is responsible for waste management in the eThekweni Municipality. DSW offers collection services for 945 911 households (formal and informal) and 33 616 industrial and commercial customers (eThekweni Municipality, undated). There are currently four landfill sites, of which only three are active, and 23 recycling plants in this municipality. These recycling plants are, however, not well maintained. The Aliwal Shoal's waste is disposed to the Lovu landfill site. Additionally, the waste from Bisasar landfill is diverted to Lovu landfill and other sites. Lovu landfill has a lifespan of approximately 25 years, which may be significantly reduced by this diversion. In 2015, a total of 89 579 tonnes of waste was disposed of at the Lovu landfill (eThekweni Municipality, 2016). It is, therefore, essential to consider other forms of waste management in the eThekweni municipality. This municipality runs separation at source programmes, with 800 000 households participating in these projects (eThekweni Municipality, undated). Programmes aimed at industries and businesses are, however, scarce. Research is therefore, needed to determine the source separation practices of these sectors.

3.5 Participant selection

As stated in Section 1.4 of this dissertation, to address the research aim, the scope of the research specifically focused on a sample of tourism-related activities and *did not* focus on all households and all sectors located within the MPA. Diving activities and accommodation facilities within the Aliwal Shoal MPA were purposively selected to represent "tourism-related" activities, because of their proximity and daily interactions with the Aliwal Shoal MPA, as well as their generation of diverse general waste.

There are a total of fourteen (14) diving charters and nineteen (19) accommodation facilities that can be found in the Aliwal Shoal MPA. Accommodation facilities that were located inland from the Aliwal Shoal were not considered as they do not directly influence the MPA. For the purpose of this research ten (71.4%) diving charters and eleven (57.9%) accommodation facilities were selected for inclusion. The diving charters selected included different types and sizes of operators (Table 3-2). Accommodation facilities were also selected to include a range of accommodation types, such as lodges, hotels and guest houses (Table 3-2), since the waste types and waste-related behaviour of these facilities may differ (based on accommodation type).

Table 3-2 shows a profile of the nine diving charters, and ten accommodation facilities that were selected as possible participants in the study. The names of the chosen diving charters and accommodation facilities were kept confidential (anonymous) and abbreviations were assigned (i.e., DCA or AA) as identifiers for the research participants (Table 3-2).

Table 3-2: Profile of diving charters (DC) and accommodation (A) selected for inclusion of the study

Selected participants	Description
DCA	Diving charter A (DCA) operates in the Umkomaas area. They provide reef, wreck and shark dive charters, scuba training, shark cage snorkelling, as well as accommodation. They are located near the 'Produce' and 'Nebo' shipwrecks, and offer daily dives.
DCB	Diving charter B (DCB) is located in Umkomaas and provides daily wreck dives, shark dives, free diving and snorkelling. In addition, they have a fully operational hotel and restaurant.
DCC	Diving charter C (DCC), a relatively new dive centre, is located in Widenham, Umkomaas. A range of recreational scuba diving and technical diving courses, as well as a bed and breakfast are available to customers.
DCD	Diving charter D (DCD) offers adventure diving, with large predator interactions with baited shark diving being a focus of their business. Training and accommodation are also available.
DCE	Diving charter E (DCE) have been operating in the Aliwal Shoal MPA for the last 20 years and were the first diving charter to offer Tiger shark diving in the area. They offer both shark and wreck diving in twelve locations.
DCF	Diving charter F (DCF) not only operates in the Aliwal Shoal, but in Sodwana Bay and Ponta do Ouro as well. In contrast to the other dive charters, only package deals are offered at this establishment, which includes eight dives and two baited shark dives in five days.
DCG	Diving charter G (DCG) is situated in Scottburgh. They provide daily trips to the Aliwal Shoal, with services ranging from open water diving to dive training and equipment sales.
DCH	Diving charter H (DCH) operates in the Umkomaas area. Reef dives, baited shark dives, and accommodation is available.
DCI	Diving charter I (DCI) is situated in Freeland Park. They offer daily shark cage diving, cageless snorkelling, and baited shark dives. Shark and marine conservation are important aspects of this establishments policy.
AA	Accommodation A (AA) (lodge) is located within 850 m from Widenham beach. The lodge has eight rooms that sleeps two people each and provides for bed and breakfast options.
AB	Accommodation B (AB) (lodge) is situated on the south rocky ledges of Umkomaas beach. Six rooms are available that sleep either two or three people. Self-catering and B&B options are provided.
AC	Accommodation C (AC) (hotel) is located on the Scottburgh main beach and has fifty-six rooms that overlook the ocean. Furthermore, a restaurant is available. Diving charter G is based at this hotel.
AD	Accommodation D (AD) (hotel) is situated on the Scottburgh beachfront and is a 3-star accommodation. They provide 122 rooms with ocean views.
AE	Accommodation E (AE) (lodge) is a self-catering lodge located in Clansthal walking distance from Clansthal beach (Green Point). Each chalet can sleep two to eight people.
AF	Accommodation F (AF) (hotel) is a 3-star hotel located on the Illovo beachfront in Amanzimtoti. There are a total of eighty-one rooms that are either sea facing or facing the blue lagoon.
AG	Accommodation G (AG) (guest house) is located on Clansthal beach directly overlooking the Aliwal Shoal. Green point, a popular surf spot, is just 500m away from the guest house.
AH	Accommodation H (AH) (guest house) is located in Freeland Park, approximately 500m from the main beach in Scottburgh. The guest house has two bedrooms that can sleep up to eight people.
AL	Accommodation I (AI) (lodge) is located 200m from Widenham Beach and has a 3-star rating. This is a self-catering lodge with nine units with a total of twenty-five beds.
AJ	Accommodation J (AJ) (beach house) is a five-bedroom house in Clansthal and is self-catering. It is located approximately 200m from the beach.

3.6 Data collection

Data was collected in a phased-approach by means of observations, waste characterisation studies, questionnaires, and interviews (as outlined in Table 3-1, Figure 3-2).

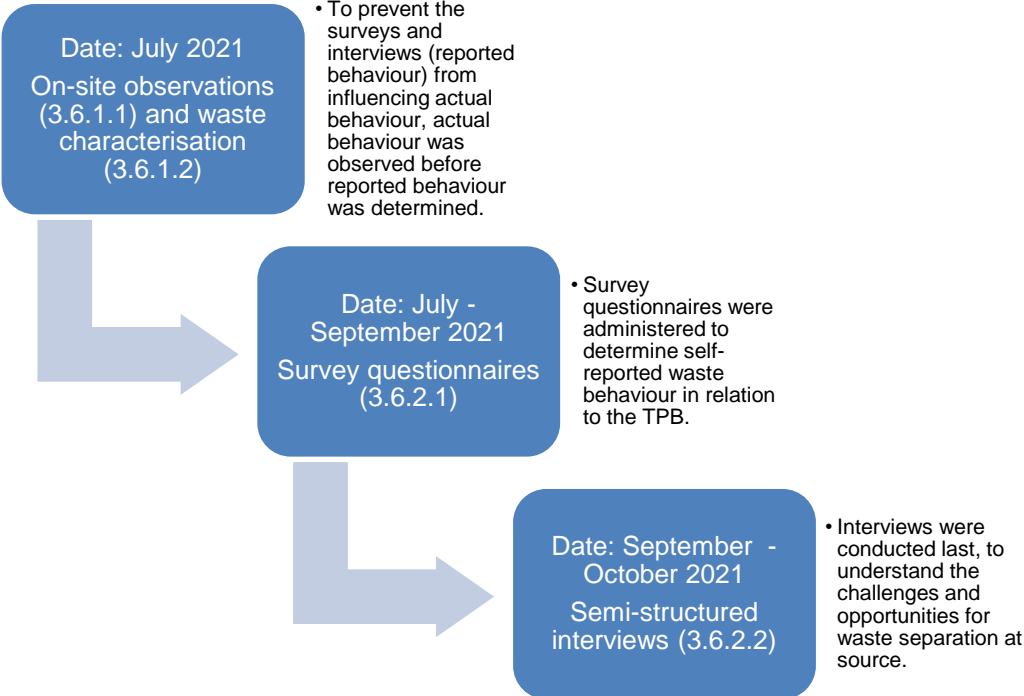


Figure 3-2: Data collection aimed at determining (actual- and self-reported) waste separation at source behaviour

3.6.1 Data collection to determine actual (observed) waste separation at source behaviour (RO1)

A waste characterisation study and on-site observations were conducted to determine the actual (observed) behaviour of the participants.

3.6.1.1 On-site observations

According to Steg and Vlek (2009:310) and Huffman *et al.* (2014:263), the most reliable way of determining separation at source behaviours is to measure the occurrence of the observed behaviour. By measuring the observed behaviour, one will be able to provide a direct and objective measurement of the behaviour of these individuals (Corral-Verdugo, 1997). The observed behaviour was measured prior to the commencement of the questionnaires and interviews, as the nature of the questions may have influenced the actual behaviour of the participants (Huffman *et al.*, 2014).

Observations, which are concerned with the researcher observing a specific phenomenon of interest, were used in this study (Noor, 2008). Two types of observations are identified by Yin (2018:150), namely participant observation and direct observation. Participant observation allows the researcher to take part in the phenomenon being studied and interact with participants. Direct observation, in contrast, allows the researcher to capture and observe the phenomenon being studied without being involved.

Direct observation was employed in this study. This was done to gain a better understanding of the resources and infrastructure that the participants had that may benefit or hinder waste separation at source. In particular, the following were considered:

- The availability of waste separation at source infrastructure,
- The location and number of waste storage facilities, and
- The actual separation at source practices and activities.

Since this research was primarily concerned with determining the participants' perceptions towards separation at source practices, with the actual behaviour providing a complementary role, the study *did not* provide for in-depth observational research, but merely included observations as a screening exercise. Thus, observations provided additional evidence, with the view of supplementing the results obtained from the interviews (Yin, 2018).

It must be noted, however, that the data collected during observations (especially participant observations) may be inaccurate as the participant may change their behaviour if they have prior knowledge of the observations (Petty *et al.*, 2012). A total of nine facilities, which included five diving charters (83.3%) and four accommodation facilities (50%) agreed to participate in these observations. Field notes were captured of the observations made.

3.6.1.2 Waste composition characterisation

As identified by Oelofse *et al.* (2016:345), there are a number of reasons for conducting waste composition characterisation studies, which may include: generating plans regarding solid waste, informing the design of waste management facilities, informing alternative waste treatment technologies, as well as for use as a baseline for monitoring waste recycling and diversion targets. The purpose of performing waste composition characterisation during this research was to:

- Determine the composition of waste generated by selected participants to understand the recycling potential of the waste streams;
- Determine the composition of any source separated waste;
- Determine the quantity and composition of recyclable waste ending up with the disposable waste stream; and

- Support the self-reported data collected during surveys and interviews to understand waste separation at source behaviour.

A waste characterisation study includes the collection and sorting of waste in order to determine the quantity of waste generated, as well as its composition (Martinho *et al.*, 2008). The American Society for Testing and Materials (ASTM) standard for characterising unprocessed MSW was used as a reference in this study. This standard allows for the manual sorting of MSW into waste categories (ASTM, 2016). By using this standard, this study may produce results that are replicable, accurate and reliable. According to Oelofse *et al.* (2016:345), the following should be considered before samples are collected:

- Sample size and number of samples,
- The location where the sampling took place,
- The type and number of waste components that were investigated, and
- The number and types of strata.

General waste samples were collected from five diving charters and four accommodation facilities (including hotels, guest houses, and lodges). One combined sample was taken from each participant/place of operation, with a total of nine samples. The participants were asked to set aside a weeks' worth of waste from the Tuesday to the Monday (from the previous waste collection day). The samples were collected in July 2021, during the "sardine run", since it was expected that tourism activities would be more active during this time of year. The samples collected were marked according to the facility from which it was collected for easy identification.

The waste characterisation represented the entire quantity of waste generated in one week (seven days) of each participant. Each participant's waste characterisation was conducted separately and then combined in order to be interpreted.

The contents of each bag were then deposited onto a tarp surface for sorting. Equipment that was needed for the sorting of waste included: a digital scale, a tarp, waste containers for each category, wash water facilities with soap and PPE (overalls, latex gloves, disposable face masks). Waste was then sorted into nine (9) general waste categories as outlined in Table 3-3 (ASTM, 2016) as proposed by Oelofse *et al.*, 2016.

Table 3-3: General waste categories used for sorting (Adapted from: ASTM, 2016)

General waste categories	Sub-category
Paper and paperboard	Newspaper Cardboard/boxboard Magazines Office paper Other/Miscellaneous paper
Glass	Clear, green and amber glass bottles Remainder/composite glass
Metal	Tin/steel containers Aluminium containers Ferrous metal Non-ferrous containers Major appliances
Plastics	Polyethylene Terephthalate (PET) containers High Density Polyethylene (HDPE) containers Film Plastics Other plastics
Textiles	Textiles
Organics	Food waste Garden waste Agricultural waste Abattoir waste Reminder/composite waste
Construction and demolition (C&D) materials	Concrete Lumbar Remainder/composite C&D
Special care waste	Paint Hazardous materials Biomedical Batteries Oil filters Remainder/composite waste
Other waste	Waste electrical products Tyres Furniture Ceramics Rubber/leather/other

Once the waste was sorted into the general waste categories, it was transferred to plastic bags and weighed (with a digital scale). Finally, the quantities of each waste category were recorded into a waste spreadsheet. The quantity and type of wastes sorted was then determined. In addition to this, the quantity and types of recyclable waste that ends up in the disposable waste stream were also determined. This was done by identifying the waste categories in the sampled waste that were able to be recycled (but because of contamination with other waste is now non-recyclable). By doing this, the possible potential of source separation could be determined.

3.6.2 Data collection to determine (self-reported) waste separation at source behaviour

Structured questionnaires and interviews were used to determine self-reported waste behaviour through the application of the Theory of Planned Behaviour (TPB) framework.

3.6.2.1 Structured survey questionnaires

Kormos and Gifford (2014:360) state that questionnaires allow the researcher to investigate behaviours that cannot always be observed. A survey questionnaire was used to determine the factors influencing the behaviour regarding waste separation at source in the Aliwal Shoal MPA. The TPB framework was the fundamental behaviour model around which the survey questionnaire was developed. The three main constructs, namely attitude, subjective norms, and perceived behavioural control, informed the questionnaire design. Additionally, questions related to socio-demographic factors (including gender, age, highest education level, and occupation) and behavioural factors were included.

Studies from Alhassan *et al.* (2018); Ghani *et al.* (2013); Mak *et al.* (2018); Nomura *et al.* (2017); Stoeva and Alriksson (2017); Xu *et al.* (2017); and Yadav and Pathak (2017) were consulted to decide on the statements to be included in the questionnaire. These studies, however, focussed mainly on waste management behaviours on a household level. The statements were, therefore, adapted to suit the needs of the research, which focused on waste in a marine protected area (MPA). These statements were used to determine behavioural practice (B1-3), attitude (A1-9), subjective norms (SN1-11), and perceived behavioural control (PBC1-15), as outlined in Table 3-4.

Table 3-4: Statements included in the survey questionnaire based on the TPB constructs

	Statements	Reference
B1	I regularly separate waste into recyclables	Mak, 2018; Razali <i>et al.</i> 2020; Stoeva & Alriksson, 2017
B2	I often dispose sorted waste on time	Nomura, 2017; Razali <i>et al.</i> 2020; Stoeva & Alriksson, 2017
B3	I often dispose sorted waste in the appropriate recycle bins	Mak, 2018; Razali <i>et al.</i> 2020; Stoeva & Alriksson, 2017
A1	In my opinion, source separation of waste is a useful practice in the Aliwal Shoal MPA	Alhassan, 2017; Issock, 2020; Razali <i>et al.</i> 2020; Stoeva & Alriksson, 2017
A2	I believe waste separation would enable me to be a responsible member of the Aliwal Shoal community	Razali <i>et al.</i> 2020; Yadav & Pathak, 2017
A3	In my opinion, source separation of waste would enable me to live in a clean and better environment	Issock, 2020; Razali <i>et al.</i> 2020; Yadav & Pathak, 2017
A4	Waste separation aids in environmental protection and the conservation of resources in the Aliwal Shoal MPA	Issock, 2020; Razali <i>et al.</i> 2020
A5	I think waste separation at my workplace is an interesting and fulfilling task	Razali <i>et al.</i> 2020; Ghani <i>et al.</i> 2013
A6	I can set an example for my colleagues by participating in waste separation	Mak, 2018
A7	Waste separation should be promoted in the Aliwal Shoal MPA	Nomura, 2017; Alhassan, 2017
A8	Waste separation should be formalised in the Aliwal Shoal MPA	Alhassan, 2017
A9	I believe that the waste management of my workplace are sufficient	Issock, 2020; Mak, 2018
SN1	My family thinks I should participate in waste separation at my workplace	Alhassan, 2017; Issock, 2020; Razali <i>et al.</i> 2020; Stoeva & Alriksson, 2017; Ghani <i>et al.</i> 2013
SN2	If my family encourages me to participate in waste separation, I am willing to listen to their advice	Alhassan, 2017; Xu <i>et al.</i> , 2017
SN3	My friends think I should participate in waste separation at my workplace	Alhassan, 2017; Issock, 2020; Razali <i>et al.</i> 2020; Stoeva & Alriksson, 2017; Ghani <i>et al.</i> 2013
SN4	If my friends encourage me to participate in waste separation, I am willing to listen to their advice	Alhassan, 2017; Xu <i>et al.</i> , 2017
SN5	The Aliwal Shoal community thinks I should participate in waste separation at my workplace	Alhassan, 2017; Issock, 2020; Razali <i>et al.</i> 2020; Stoeva & Alriksson, 2017; Ghani <i>et al.</i> 2013
SN6	If my community encourages me to participate in waste separation, I am willing to listen to their advice	Alhassan, 2017; Xu <i>et al.</i> , 2017
SN7	My colleagues think I should participate in waste separation at my workplace	Alhassan, 2017; Issock, 2020; Mak, 2018; Razali <i>et al.</i> 2020; Stoeva & Alriksson, 2017; Ghani <i>et al.</i> 2013
SN8	If my colleagues encourage me to participate in waste separation, I am willing to listen to their advice	Alhassan, 2017; Mak, 2018; Xu <i>et al.</i> , 2017
SN9	My municipality (Ethekwini/ Ugu/ Umdoni Municipality)	Issock, 2020, Strydom, 2018

	Statements	Reference
	encourages me to participate in waste separation at my workplace	
SN10	If my municipality encourages me to participate in waste separation, I am willing to listen to their advice	Xu <i>et al.</i> , 2017
SN11	Waste separation practices are expected from our customers/guests	Strydom, 2018
PBC1	I have complete control in deciding whether or not to separate waste at my workplace	Mak, 2018; Ghani <i>et al.</i> 2013
PBC2	A lack of cooperation from colleagues would complicate waste separation at my workplace	Issock, 2020; Mak, 2018
PBC3	Waste separation requires time and effort	Nomura, 2017; Razali <i>et al.</i> 2020; Stoeva & Alriksson, 2017; Ghani <i>et al.</i> 2013
PBC4	Even if waste separation requires time and effort, I will still participate	Xu <i>et al.</i> , 2017
PBC5	A lack of separation facilities at my workplace would make waste separation difficult	Strydom, 2018; Yadav & Pathak, 2017
PBC6	My workplace has enough space to store separated waste	Nomura, 2017; Mak, 2018; Stoeva & Alriksson, 2017; Ghani <i>et al.</i> 2013
PBC7	Even if my workplace does not have enough space to store separated waste, I will still participate	Xu <i>et al.</i> , 2017
PBC8	My municipality (Ethekwini/ Ugu/ Umdoni Municipality) provides me with complete facilities for waste separation at my workplace	Alhassan, 2017; Issock, 2020; Stoeva & Alriksson, 2017
PBC9	Even if my municipality does not provide me with complete facilities for waste separation, I will still participate	Xu <i>et al.</i> , 2017
PBC10	I know how waste should be separated at my workplace	Razali <i>et al.</i> 2020; Stoeva & Alriksson, 2017
PBC11	If I do not know how to separate wastes, I will still participate	Xu <i>et al.</i> , 2017
PBC12	I know which recycling bins sorted waste should be put into	Razali <i>et al.</i> 2020; Stoeva & Alriksson, 2017
PBC13	If I do not know which recycling bins sorted waste should be put into, I will still participate	Xu <i>et al.</i> , 2017
PBC14	My workplace is convenient to carry out waste separation (e.g., recycling bins are close to my workplace)	Issock, 2020; Mak, 2018; Stoeva & Alriksson, 2017; Ghani <i>et al.</i> 2013
PBC15	If my workplace is inconvenient to carry out waste separation, I will still participate	Xu <i>et al.</i> , 2017

Similar to other studies, a 5-point Likert Scale (where 1 indicated a high level of disagreement/ no agreement and 5 indicated a high level of agreement) was adopted to quantify the predicted behaviour of the participants regarding statements addressed in the questionnaire (Strydom, 2018).

The questionnaire was piloted by three students, with knowledge of waste management. Changes were made, where necessary. The responses of the pilot survey were not included in the

research.

The survey questionnaires were distributed electronically to selected research participants, which included nine diving charters and ten accommodation facilities (Table 3-2). A response window of four weeks, from July to August 2021, was allowed.

Responses on surveys were received from nine participants, which four diving charters (66.6%) and five accommodation facilities (62.5%) (one hotel, three lodges, and one guest house). The survey participants were different from the waste characterisation participants. There were a few reasons for participants electing not to participate in the survey questionnaires, namely time constraints and disinterest in the study.

3.6.2.2 Semi-structured interviews

Semi-structured interviews are used when a researcher wishes to obtain specific information on an individual's perceptions concerning a topic. This is a suitable interview style to use when a process or event is complex or personal in nature (de Vos *et al.*, 2011). Various disciplines have used this interview method to understand the behaviour, attitudes, beliefs and perceptions of participants. The interviewee is thus the expert on the subject being discussed. Semi-structured interviews were preferred over structured interviews as it offers flexibility when approaching different participants while still covering the same topic of interest (Horton *et al.*, 2004).

In this case, interviews were used to gather data concerning the *challenges and barriers* of the participant's waste separation at source behaviours, as well as the *potential opportunities*. Thus, the participant's perceptions of reality were determined, generating rich and in-depth data. With permission from the participants, the interviews were recorded and transcribed for the purpose of data analysis. The nine survey participants (four from diving charters and five from the accommodation facilities) agreed to participate in further interviews.

3.7 Data analysis

During data analysis, the data collected during a study is organised and classified in order to make sense out of a large volume of raw data. This is done to calculate results and draw conclusions. Qualitative and quantitative data was analysed separately. According to the aims and design of the study, thematic analysis was deemed to be appropriate for the analysis of qualitative data (especially observations and interviews).

3.7.1 Analysis of on-site observations and interviews

The analysis of the interview data and observational data began with data immersion. This entailed the thorough examination of interview responses and observations to generate ideas about how the data may be analysed (Green *et al.*, 2007) (Figure 3-3). Furthermore, disjointed elements within the data could be identified to provide a greater insight into the problem under investigation.

By using thematic analysis, the qualitative data gathered from the interviews and observations could be reduced and grouped into categories/codes to provide understanding (Neuendorf, 2018). Codes are defined by Auerbach and Silverstein (2003:144), as “*tags or labels for allocating units of meaning to the descriptive or inferential information compiled during a study*”. These codes allowed themes and relationships to emerge inductively from the data, denoting the unique viewpoints of the participants (Williams & Moser, 2019). Specifically, manual emergent coding was used, as codes were determined from the data, instead of using predetermined codes (Blair, 2015). Descriptive labels in the form of codes are applied to sections of the text, whereafter they are linked to form categories. This is done to determine the relationships between codes. The final step is the identification of themes, whereby there is an explanation and interpretation of the problem being investigated (Green *et al.*, 2007).

A schematic representation of these steps is outlined below:

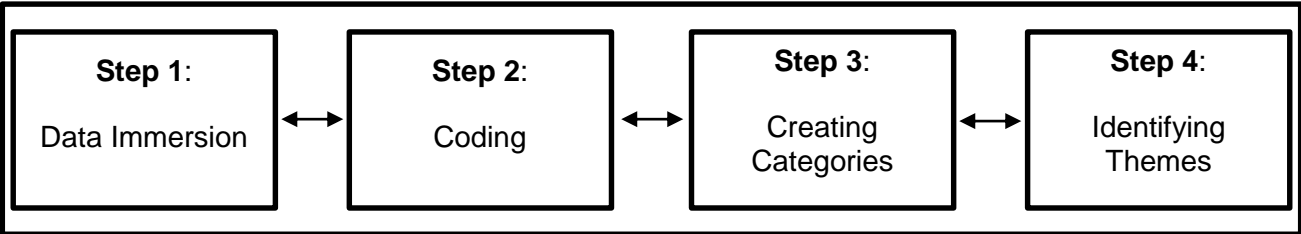


Figure 3-3: Schematic representation of steps used in qualitative analysis

3.7.2 Analysis of waste characterisation study

Quantitative data was collected through a waste characterisation study. The purpose of collecting this type of data was to determine the composition, characteristics, and quantity of waste generated by diving charters and accommodation facilities in the Aliwal Shoal. This was done to identify the recycling potential of waste.

Each waste category was analysed by weight in percentages, then captured in Microsoft Excel where various graphs and charts were generated. A comparative analysis between the actual behaviour (waste characterisation study and observations) and the self-reported behaviour (questionnaires and interviews) of the participants was then conducted.

3.7.3 Analysis of responses to survey questionnaires

A frequency table was compiled to record the number of responses falling in each interval. A frequency table was found to be useful when analysing categorical data. In particular, the level of agreement or disagreement each participant had with a certain statement could be determined through a frequency table.

It was not possible to perform any analysis related to determining associations between statements, due to the relatively small sample size.

Cross-tabulations (or contingency tables) display the frequency distribution of the variables being studied. Associations between attitude (A) and social norms (SN), attitude (A) and perceived behavioural control (PBC), and social norms (SN) and perceived behavioural control (PBC) were attempted, with SPSS. The results of the cross-tabulation, however, indicated that variability in data is too low to perform the Pearson's Chi-Square test. Unfortunately, no statistical significance tests could be conducted as a result of the small sample size.

3.8 Methodological assumptions and limitations

Methodological assumptions are defined by Simon and Goes (2013:1) as *beliefs that cannot be proven, but are necessary to conduct research*. In this study, it was assumed that all participants would respond to the questionnaire and interview questions factually and honestly. Assuring these participants that their responses would be kept confidential and their identities concealed was assumed to provide honest responses. In addition to this, the questions posed were not of a sensitive nature, which may have led the responses to be more factual. It was also assumed that the samples taken for the waste characterisation study were not tampered with by the participants.

Throughout the duration of the study, a few limitations were identified. This study encountered slight delays with the data collection. In July of 2021 when the data collection was scheduled to take place, South Africa experienced a period of political unrest. This resulted in some businesses temporarily shutting down their operations. The commencement of data collection was, therefore, delayed by a few weeks.

Some of the participants also declined to participate in the study as a result of this. Furthermore, some of the participants who were initially identified were discovered to have permanently closed due to financial difficulties after the lockdown in 2020/21. As the success of the study heavily relied on the participation of diving charters and accommodation facilities, the willingness of these businesses to participate in the study was also found to be a constraint. The accommodation facilities were especially hesitant to participate fully, with only a few agreeing to respond to the survey questionnaires. Due to the relatively low response rate, with related low variability in data points, it was not possible to determine associations between TPB statements in a statistically reliable way.

Another limitation discovered in this study was the time period in which the waste characterisation study was undertaken. Ideally this type of study should consider the seasonal variation in waste generation (Oelofse *et al.*, 2016). This study's data collection, however, only took place in the winter of 2021 (during the sardine run, which is traditionally a period of high tourism activity). Furthermore, only one sample (which contained one weeks' worth of MSW) was taken from each participant due to time constraints.

As a result of these limitations mentioned above, certain associations between TPB statements could not be determined. The research is, however, still considered to be relevant and to make a positive contribution towards understanding waste behaviour in protected areas, specifically MPAs, since existing research is limited.

The research also highlights an important aspect, which has not been researched extensively, which is the difference in self-reported and observed waste-related behaviour.

3.9 Ethical considerations

When dealing with human participants, ethical consideration is of utmost importance. Ethical norms require a researcher to conduct themselves and their research in a specific way. These norms are essential when conducting research as they promote the aims of research, namely, truth knowledge, and avoiding errors (Gajjar, 2013). The Faculty of Natural and Agricultural Science Research Ethics Committee (FNAS REC) provided ethical clearance for this study (ethics number: NWU – 00492 – 21 – A90). The ethical guidelines provided by the North West University

FNAS REC were followed to ensure that the study was conducted in an ethical manner and to protect the confidentiality of the participants. Furthermore, permission to conduct the research (including all data collection) was obtained from all participants. All participants were provided with an information sheet prior to conducting the research explaining what was expected of them. Additionally, their confidentiality was guaranteed. This ensures that all participants are aware of the risks and benefits of participating in the research. The participants were informed that their participation was voluntary and that they could withdraw from the study at any time. A consent form was signed by all participants.

3.10 Chapter summary

A mixed-methods research design, specifically triangulation, was used for this study. It was determined that multiple data collection methods were needed to obtain a comprehensive understanding of the source separation behaviours of the selected participants in the Aliwal Shoal MPA. A waste characterisation study, observations, questionnaires, and interviews were conducted. Qualitative data collection methods were used to gain an in-depth understanding of the participants' separation at source behaviours, as well as their insights into why they believe these behaviours are feasible or not, in the context of their establishment. Quantitative data collection methods were then used to quantify the participants waste separation in order to compare their actual versus self-reported behaviours.

CHAPTER 4 RESULTS/DATA ANALYSIS AND DISCUSSION

This chapter of the research dissertation contains the results and discussion of the study. The results of the data collection are analysed and interpreted, whereafter, the significance of these results is discussed. The results of the waste characterisation study, including the rates of generation and composition of the waste, can be found in the first section of this study. Thereafter, the results of the TPB questionnaires are evaluated. Finally, the results from both the waste characterisation study and the questionnaires are compared to determine the actual separation at source behaviour of the participants. Through these comparisons, as well as the interview and observation results, the separation at source potential of the participants can be determined.

4.1 Results related to RO1: Determine the actual (observed) waste behaviour related to accommodation and diving activities within the MPA

To determine the actual (observed) behaviour of the respondents, a waste characterisation study, as well as direct observations were performed (as explained in Section 3.6.1 of this dissertation).

4.1.1 Waste characterisation results

This section discusses the results from the waste characterisation study, which includes the waste generation rates, as well as the waste composition of each participant.

Five diving charters and four accommodation facilities participated in the waste characterisation study. The aim of the waste characterisation was to:

- Determine the waste generation rates of diving charters and accommodation facilities;
- Determine the composition of waste generated by the respondents, and
- Determine the percentage of sorted waste versus the percentage of recyclable waste found in the disposable waste.

The waste characterisation study had the ultimate aim of supporting the self-reported data to understand the respondent's waste separation at source behaviour.

4.1.1.1 Waste generation rates

In this section, the waste generation rates of the diving charters and accommodation facilities will be discussed, with an emphasis on waste intended for disposal and source separated waste.

4.1.1.1.1 Waste intended for disposal

One combined sample, containing one week's worth of waste (Tuesday to Monday) was collected from each participant for sorting and further analysis. In total, 31.17 kg of waste was collected from the five diving charters and four accommodation facilities (15.4 kg from diving charters, and 15.80 kg from accommodation facilities) (Table 4-1). Each diving charter, on average, generated 3.0 kg of waste per week, whereas each accommodation facility generated an average of 3.9 kg of waste per week (Table 4-1). It was found that the average waste generated by the diving charters were less than for the accommodation facilities, however, not significantly. The average waste generated by the participants was calculated instead of per capita waste generation, as the number of customers who contributed to the waste generation could not be determined.

Household waste generation rates typically vary between 0.11 kg/capita/day in developing countries to 4.54 kg/capita/day in developed countries, with an average of 0.74 kg/capita/day (Zorpas, 2020). South Africa's household waste generation rates are found to be similar. These generation rates vary between 0.6 and 2.1 kg/capita/day (Rodseth *et al.*, 2020). In comparison to South Africa's average waste generation rates, the results from this study were found to be significantly lower. These calculated quantities of waste are, however, based on only one week of sampling during the month of July 2021. The quantities of waste generated per week may differ, based on changes to the number of customers on a given week, peak and off-peak seasons, as well as seasonality. Although the data was collected during peak season, as a result of COVID-19 and the social unrest that occurred during the data collection period, the participants were not operating at full capacity, which may explain the relatively low quantities of waste generated during the sampling week.

There is little to no research conducted on the waste generation rates of smaller tourist accommodation facilities, as well as diving charters. Research on accommodation waste generation rates is typically focussed on larger hotels or guesthouses (Azarmi *et al.*, 2018; Saito, 2013; Wani *et al.*, 2020), which cannot be compared to the results of this study. Studies conducted on waste from diving charters, on the other hand, focus on waste management and not waste generation rates (Lucrezi *et al.*, 2017).

4.1.1.1.2 Waste intended for recycling (source separated waste)

The waste characterisation study aimed to also quantify and characterise source separated waste. Eight of the nine participants did not participate in any source separation of waste. All of the waste that was generated, was destined for landfill disposal. This was unexpected, given the relatively high recycling potential of the waste that was generated (refer to Section 4.1.1.2). One

lodge did, however, separate their garden waste from their domestic waste, which consisted of three blue bags with a combined weight of 6.90 kg.

4.1.1.2 Waste composition results

In this section, the composition of the collected waste is discussed. This includes the composition of the disposed waste, as well as the composition of the separated waste, if any. Furthermore, the quantity of recyclable waste is also considered.

4.1.1.2.1 Composition of waste intended for disposal

A total of 31.17 kg of waste was collected from the participants, which was then sorted according to the ASTM's standard for characterising MSW. The weight of each category was then recorded to give an indication of the composition of waste generated from tourism activities in the Aliwal Shoal. The waste collected from the diving charters were analysed separately from the accommodation facilities. The waste was either sorted on the day of collection or the day thereafter. This was done as per the recommended sorting procedure of Dahlén and Lagerkvist (2008:1107), which states that waste should be sorted within two days of collection, so as to avoid changes (both physical and chemical) to the sampled waste. Figure 4-1 below shows an example of how the waste was sorted.

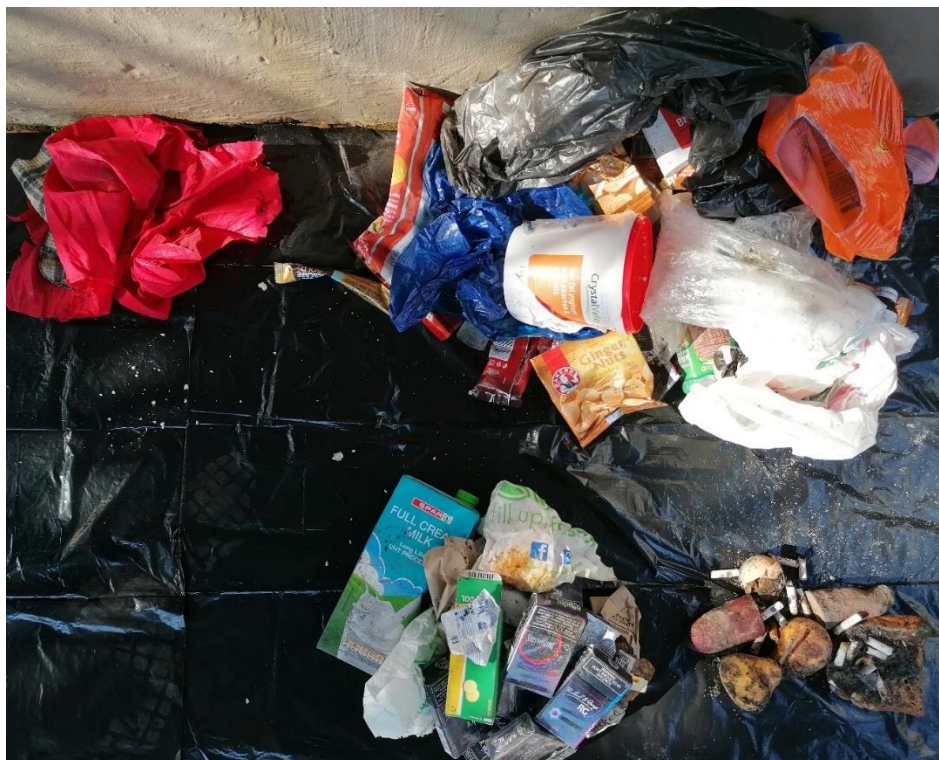


Figure 4-1: Example of waste composition and waste sorting procedure

As a result of the small sample size, all waste collected from the diving charters and all waste collected from the accommodation facilities were combined to avoid grouping and segregation errors. These errors often occur with small scale waste characterisation studies (Dahlén and Lagerkvist, 2008).

A breakdown of the diving charter's waste composition can be found in Table 4-1 below, which indicates that the greatest contributor to waste by diving charters is paper and paperboard (25.89%), followed by plastics (23.7%).

Table 4-1: Breakdown of the waste composition of diving charters (based on the combined weight collected per diving charter during one week)

General waste categories	Weight of waste collected per diving charter (kg)					Average weight (kg)	Total weight (kg)	Percentage of total (%)
	1	2	3	4	5			
Paper and paperboard	0.4	0.7	0.7	1.3	0.9	0.7	3.9	25.89
Glass	1.0	0.5	0.3	0.5	0.0	0.7	2.3	14.97
Metal	0.2	0.4	0.2	0.2	1.1	0.4	2.1	13.72
Plastics	0.6	0.3	0.5	1.5	0.8	0.7	3.7	23.70
Textiles	0.2	0.0	0.2	0.0	0.0	0.08	0.5	2.89
Organics	0.1	0.9	1.1	0.4	0.2	0.5	2.8	17.91
C&D materials	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Special care waste	0.0	0.0	0.0	0.0	0.2	0.04	0.1	1.08
Other waste	0.0	0.04	0.0	0.0	0.0	0.0	0.04	0.23
Total	2.1	2.9	2.9	3.9	3.2	3.0	15.4	100

Unfortunately, no previous studies could be found on the specific waste composition of diving charters that this study's results could be compared to. The source of waste can, however, be attributed to waste disposal on the vessels, as well as at the dive centres. A study by Lucrezi and Saayman (2017), which researched the waste disposal techniques of diving charters in Ponta do Ouro and Portofino (Mozambique), briefly discussed the types of waste generated by these participants. These mainly included paper, plastic, metal, food waste, toxic waste (engine oil and batteries) and diving equipment. No toxic waste or diving equipment was found in the waste produced by the diving charters in this study. Of particular interest in these participants' waste were fishing line and bait.

The quantity of recyclable waste, which was not separated at source and was destined for disposal, of diving charters included in this research amounted to 12 kg, consisting of paper and paperboard, glass, metal, and plastics, which is 77.9% of the total waste composition (Table 4-1). All waste streams, excluding textiles, organics, C&D materials, special care wastes, and other wastes, were therefore excluded. This is a significant percentage of waste, with high a potential recycling value, which currently ends up at landfill sites.

In Table 4-2 below, a breakdown of waste from the accommodation facilities studied can be found. In contrast to the diving charters, plastic (22.97%) was found to be the main contributor of general waste from accommodation facilities, followed by glass (20.32%) and organic waste (18.74%).

Table 4-2: Breakdown of the waste composition of accommodation facilities (based on the combined weight collected per diving charter during one week)

General waste categories	Weight of waste collected per accommodation facility (kg)				Average weight (kg)	Total weight (kg)	Percentage of total (%)
	1 ¹	2 ²	3 ¹	4 ³			
Paper and paperboard	0.4	1.3	0.4	0.7	0.7	2.8	17.69
Glass	0.3	0.0	0.2	2.7	0.8	3.2	20.32
Metal	0.95	0.0	0.05	1.1	0.5	2.1	13.49
Plastics	0.3	0.6	1.7	1.1	0.9	3.6	22.97
Textiles	0.0	0.2	0.0	0.0	0.05	0.2	1.24
Organics	0.3	0.6	0.4	1.5	0.7	2.95	18.74
C&D materials	0.0	0.0	0.0	0.0	0.0	0.0	0
Special care waste	0.0	0.0	0.2	0.0	0.05	0.2	0.99
Other waste	0.0	0.0	0.0	0.7	0.2	0.7	4.55
Total	2.3	2.7	2.9	7.8	3.9	15.8	100

The quantity of recyclable waste, which was not separated at source and was destined for disposal, of accommodation facilities included in this research amounted to 11.7 kg, consisting of

¹ These accommodation facilities serve as self-catering lodges, with a bed and breakfast option.

² This accommodation facility serves as a fully self-catering lodge.

³ This accommodation facility serves as a fully self-catering guest house

paper and paperboard, glass, metal, and plastics which is 74.1 % of the total waste composition (Table 4-2). The wastes excluded from the recyclable waste is mentioned above.

In contrast to this research, a study conducted by Wani *et al.* (2018) found that the majority of waste generated by accommodation facilities (hotels and guest houses) in the Himalayas was food waste (34.2%). Organic waste (18.74%) in this research included not only food waste, but other organic waste, such as garden waste, agricultural waste, abattoir waste and reminder/composite waste. From the organic waste collected, small garden waste and food waste were prominent. Similar to the study conducted by Wani *et al.* (2018), a study of the waste management practices of the Hoi An, Vietnam hotel industry found that 35.5% of the total waste was food waste (Phu *et al.*, 2018). The high percentage of food waste in these studies compared to this research may be attributed to the type of accommodation facilities. Accommodation facilities (hotels, bed and breakfast, and guest houses) that offer meals or have restaurants available will produce more organic waste than the predominantly self-catering accommodation facilities investigated in this study. Two of the lodges were self-catering with bed and breakfast options, one lodge was fully self-catering, and one guest house was also fully self-catering. This feature may be the cause of the high percentage in plastic waste, and low percentage of food waste, found in the accommodation facilities' waste. Furthermore, this low percentage of food waste could also be attributed to the number of guests present during the time of data collection. As previously stated, these establishments were not operating at full capacity, which may have resulted in less food waste being produced.

4.1.1.2.2 Composition of waste intended for recycling (separated at source)

As stated previously, only one accommodation facility separated their garden waste (6.90 kg) from their waste intended for disposal. No other evidence of waste separation was found.

A considerable quantity of recyclable waste was, however, found in the disposed waste (refer to Tables 4-1 and 4-2). Recyclable waste accounted for approximately 77.9 % and 74.1 % of the waste (for diving charters and accommodation facilities respectively), which included paper and paperboard, glass, metal and plastics. Table 4-3 below details the recyclable waste composition for both the role-players.

Table 4-3: Waste composition of recyclables for diving charters and accommodation facilities

Recyclable waste	Diving charters percentage (%)	Accommodation facilities percentage (%)
Paper and paperboard	25.89	17.69
Glass	14.97	20.32
Metal	13.72	13.49
Plastics	23.70	22.97

The majority of the paper and paperboard was, however, contaminated by other waste, such as food waste, making it unrecyclable. Non-recyclable waste was in the minority (less than 30%), with wastes such as single-use plastics (disposable cutlery and plastic cups), disposable diapers, and ceramics being present.

4.1.2 Results from observations

The waste management practices of nine participants (all of which participated in the waste characterisation study) were observed. All of the business premises are located in residential areas, with waste being collected once a week by the municipality. Recycled waste is not collected by the municipality (DSW) in the Aliwal Shoal area. The collection of garden refuse takes place on the same day as the domestic waste collection (provided that this waste is put in the blue bags supplied by the municipality). Independent businesses generally collect larger garden waste, as well as other large domestic waste, for a fee. It was observed that none of the participants had any waste separation facilities (i.e., different bins or bags for different recyclables) or related infrastructure.

For all the accommodation facilities observed, waste from each room and communal area (from waste bins) is collected periodically and deposited into larger bins. These bins were, however, not dedicated to specific waste categories, but contained all disposable waste. Once these larger bins are filled, they are taken to a waste storage area (one small room) until the day of collection. These waste storage areas were generally located in an area far from the guest's rooms and communal areas. All waste is then placed on the curbside, where the municipality would then collect it. All waste was, therefore, disposed of with no source separation taking place.

Figure 4-2 and 4-3 below shows an example of the waste deposited on the curb-side for collection by an accommodation, as well as a diving charter.



Figure 4-2: Disposable waste destined for municipal collection by an accommodation



Figure 4-3: Disposable waste destined for municipal collection by a diving charter

Although many participants were willing to separate their waste, they did not participate in waste separation at source. This was partly due to the municipality not providing any waste collection services, specifically focusing on separated waste. The participants also mentioned that they did not have the time to transport separated waste to recycling stations. It was, therefore, determined that no separation at source behaviours or activities were practised by the participants. Diving charters managed their waste similarly – with all of the waste being consolidated for collection by the municipality and, ultimately, landfill disposal.

4.2 Results related to RO2: Determine the self-reported waste behaviour related to accommodation facilities and diving activities within the MPA

To determine the self-reported waste behaviour, structured survey questionnaires were administered and analysed.

4.2.1 TPB survey questionnaire results

A total of nine responses were received from the fourteen establishments requested to participate in the study, which indicated a 64% response rate. Particularly five accommodation facilities and four diving charters responded to the questionnaires.

4.2.1.1 Socio-demographic profile of respondents

The socio-demographic information of the respondents is illustrated in Table 4-4. The majority of respondents (67%) were female, while 33% were male. This corresponded with a study done by Issock *et al.* (2020:537), which showed that females are generally more willing to participate in questionnaires. Most respondents were between the ages of 41 and 50 (n=4), with three respondents between the ages of 51 and 60, and only one respondent between the ages of 20 and 30, and 31 and 40, respectively. Lastly, with regards to level of education, the majority of respondents either had their matric certificate (n=4) or a tertiary education (n=4). Only one participant had a postgraduate qualification.

Table 4-4: Socio-demographic profile of participants

Variables	Frequency (n)	Percentage (%)
Gender		
<i>Female</i>	6	66.67
<i>Male</i>	3	33.33
<i>Other</i>	0	0
Age		
<i><20</i>	0	0
<i>20-30</i>	1	11.11
<i>31-40</i>	1	11.11
<i>41-50</i>	4	44.44
<i>51-60</i>	3	33.33
<i>60+</i>	0	0
Level of education		
<i>No education</i>	0	0
<i>Primary school</i>	0	0
<i>High school</i>	4	44.44
<i>Tertiary</i>	4	44.44
<i>Postgraduate</i>	1	11.11

The occupations of the respondents were as follows:

- Two owners of accommodation facilities,
- Two managers of accommodation facilities
- One secretary at an accommodation facility,
- One diving charter owner,
- One diving charter manager,
- One diving instructor, and
- One personal assistant at a diving charter.

The socio-demographic characteristics of the respondents were not taken into consideration during the analysis of the TPB elements as it does not relate to waste separation behaviour in the context of the theory. It is merely indicated here to provide information on the representative nature of survey respondents.

4.2.1.2 Survey responses related to the TPB and source separation of waste

In this section, the frequency of responses (expressed as a percentage according to the Likert Scale rating) will be discussed. This was done for each TPB element, namely behaviour/practice (B), attitude (A), subjective norm (SN), and perceived behavioural control (PBC). Statements

related to behaviour (B) were also considered. These results can be found in Table 4-5 below and are discussed in sub-sections 4.2.1.2.1 to 4.2.1.2.4.

Table 4-5: Frequency table of Likert scale responses

Statements	Frequency of Likert scale responses (% of responses)					
	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)	Mean
Behaviour/practice statements						
B1: I regularly separate waste into recyclables						
Diving charters	0	0	0	100	0	4,00
Accommodation facilities	20	20	0	20	40	3,40
B2: I often dispose sorted waste on time						
Diving charters	0	0	25	75	0	3,75
Accommodation facilities	20	20	0	20	40	3,40
B3: I often dispose sorted waste in the appropriate recycle bins						
Diving charters	0	0	0	100	0	4,00
Accommodation facilities	20	20	0	20	40	3,40
Attitude statements						
A1: In my opinion, source separation of waste is a useful practice in the Aliwal Shoal MPA						
Diving charters	0	0	0	25	75	4,75
Accommodation facilities	0	0	0	40	60	4,60
A2: I believe waste separation would enable me to be a responsible member of the Aliwal Shoal community						
Diving charters	0	0	0	25	75	4,75
Accommodation facilities	0	0	0	40	60	4,60
A3: In my opinion, source separation of waste would enable me to live in a clean and better environment						
Diving charters	0	0	0	25	75	4,75
Accommodation facilities	0	0	0	40	60	4,60
A4: Waste separation aids in environmental protection and the conservation of resources in the Aliwal Shoal MPA						

Statements	Frequency of Likert scale responses (% of responses)					
	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)	Mean
Diving charters	0	0	0	25	75	4,75
Accommodation facilities	0	0	0	20	80	4,80
A5: I think waste separation at my workplace is an interesting and fulfilling task						
Diving charters	0	0	25	25	50	4,25
Accommodation facilities	0	20	0	40	40	4,00
A6: I can set an example for my colleagues by participating in waste separation						
Diving charters	0	0	0	25	75	4,75
Accommodation facilities	0	0	20	20	60	4,40
A7: Waste separation should be promoted in the Aliwal Shoal MPA						
Diving charters	0	0	0	25	75	4,75
Accommodation facilities	0	0	0	40	60	4,60
A8: Waste separation should be formalised in the Aliwal Shoal MPA						
Diving charters	0	0	0	25	75	4,75
Accommodation facilities	0	0	0	40	60	4,60
A9: I believe that the waste management of my workplace are sufficient						
Diving charters	0	25	0	50	25	3,75
Accommodation facilities	60	0	20	0	20	2,20
Subjective norm statements						
SN1: My family thinks I should participate in waste separation at my workplace						
Diving charters	0	0	0	50	50	4,50
Accommodation facilities	0	0	20	20	60	4,40
SN2: If my family encourages me to participate in waste separation, I am willing to listen to their advice						
Diving charters	0	0	0	50	50	4,50
Accommodation facilities	0	40	0	20	40	3,60

Statements	Frequency of Likert scale responses (% of responses)					
	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)	Mean
SN3: My friends think I should participate in waste separation at my workplace						
Diving charters	0	0	25	50	25	4,00
Accommodation facilities	0	20	20	20	40	3,80
SN4: If my friends encourage me to participate in waste separation, I am willing to listen to their advice						
Diving charters	0	0	0	75	25	4,25
Accommodation facilities	0	20	20	20	40	3,80
SN5: The Aliwal Shoal community thinks I should participate in waste separation at my workplace						
Diving charters	0	0	0	75	25	4,25
Accommodation facilities	0	0	0	60	40	4,40
SN6: If my community encourages me to participate in waste separation, I am willing to listen to their advice						
Diving charters	0	0	0	75	25	4,25
Accommodation facilities	0	40	0	20	40	3,60
SN7: My colleagues think I should participate in waste separation at my workplace						
Diving charters	0	0	0	75	25	4,75
Accommodation facilities	20	0	20	20	40	3,60
SN8: If my colleagues encourage me to participate in waste separation, I am willing to listen to their advice						
Diving charters	0	0	0	75	25	4,25
Accommodation facilities	0	20	0	40	40	4,00
SN9: My municipality (Ethekwini/ Ugu/ Umdoni Municipality) encourages me to participate in waste separation at my workplace						
Diving charters	0	50	0	25	25	3,25
Accommodation facilities	40	20	20	0	20	2,40

Statements	Frequency of Likert scale responses (% of responses)					
	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)	Mean
SN10: <i>If my municipality encourages me to participate in waste separation, I am willing to listen to their advice</i>						
Diving charters	0	0	0	75	25	4,25
Accommodation facilities	0	0	20	40	40	4,20
SN11: <i>Waste separation practices are expected from our customers/ guests</i>						
Diving charters	0	0	0	50	50	4,50
Accommodation facilities	60	0	20	0	20	2,20
Perceived behavioural control statements						
PBC1: <i>I have complete control in deciding whether or not to separate waste at my workplace</i>						
Diving charters	0	0	0	25	75	4,75
Accommodation facilities	0	0	0	40	60	4,60
PBC2: <i>A lack of cooperation from colleagues would complicate waste separation at my workplace</i>						
Diving charters	0	0	0	25	75	4,75
Accommodation facilities	0	40	0	0	60	3,80
PBC3: <i>Waste separation requires time and effort</i>						
Diving charters	0	25	0	75	0	3,50
Accommodation facilities	0	0	0	60	40	4,40
PBC4: <i>Even if waste separation requires time and effort, I will still participate</i>						
Diving charters	0	0	0	75	25	4,25
Accommodation facilities	0	40	0	20	40	3,60
PBC5: <i>A lack of separation facilities at my workplace would make waste separation difficult</i>						
Diving charters	0	0	0	50	50	4,50
Accommodation facilities	0	0	0	20	80	4,80
PBC6: <i>My workplace has enough space to store separated waste</i>						

Statements	Frequency of Likert scale responses (% of responses)					
	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)	Mean
Diving charters	0	0	25	50	25	4,00
Accommodation facilities	40	0	0	20	40	3,20
PBC7: Even if my workplace does not have enough space to store separated waste, I will still participate						
Diving charters	0	0	0	75	25	4,25
Accommodation facilities	0	40	0	20	40	3,60
PBC8: My municipality (Ethekwini/ Ugu/ Umdoni Municipality) provides me with complete facilities for waste separation at my workplace						
Diving charters	25	75	0	0	0	1,75
Accommodation facilities	40	40	0	0	20	2,20
PBC9: Even if my municipality does not provide me with complete facilities for waste separation, I will still participate						
Diving charters	0	25	0	75	0	3,50
Accommodation facilities	0	40	0	20	40	3,60
PBC10: I know how waste should be separated at my workplace						
Diving charters	0	0	0	75	25	4,25
Accommodation facilities	0	0	20	40	40	4,20
PBC11: If I do not know how to separate wastes, I will still participate						
Diving charters	0	0	0	100	0	4,00
Accommodation facilities	0	40	0	20	40	3,60
PBC12: I know which recycling bins sorted waste should be put into						
Diving charters	0	0	0	50	50	4,50
Accommodation facilities	0	0	0	60	40	4,40
PBC13: If I do not know which recycling bins sorted waste should be put into, I will still participate						

Statements	Frequency of Likert scale responses (% of responses)					
	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)	Mean
Diving charters	0	0	0	75	25	4,25
Accommodation facilities	0	40	0	20	40	3,60
PBC14: My workplace is convenient to carry out waste separation (e.g., recycling bins are close to my workplace)						
Diving charters	0	25	0	75	0	3,50
Accommodation facilities	20	20	20	0	40	3,20
PBC15: If my workplace is inconvenient to carry out waste separation, I will still participate						
Diving charters	0	0	0	25	75	4,75
Accommodation facilities	0	40	0	20	40	3,60

4.2.1.2.1 Waste separation at source practice/behaviour (B)

Statements related to behaviour (i.e., actual waste separation at source practices) scored well for diving charters with all respondents either agreeing or strongly agreeing to separating their waste (B1), on time (B2), and in the appropriate recycling bins (B3) (percentage of 100%, 75%, and 100%, respectively) (Table 4-5). These self-reported behaviours, however, contradict the findings of the waste characterisation study, where it was determined that no source separation practices were in place. Tonglet *et al.* (2004) reported that self-reported behaviour often exaggerates observed behaviour (these authors found that approximately 80% of individuals stated that they often recycled their waste, with only 40% actually doing so), with the MORI Social Research Institute (2002) finding that more than 60% of individuals claim to recycle their waste, but that the actual proportion was much lower.

Accommodation facilities, on the other hand, mostly disagreed with the above statements, with 100% either disagreeing or strongly disagreeing with all three statements. Two respondents (one from a diving charter and one from an accommodation facility) did state that they have source separation programmes in place, but opted not to participate in the waste characterisation study or observations to confirm.

4.2.1.2.2 Attitudes (A) related to the separation of waste at source

Accommodation facilities generally disagreed that the waste management of their workplace was sufficient (A9; mean on 2.2), with 60% of respondents strongly disagreeing with the statement (Table 4-5). Diving charters, however, generally believed that their practices were sufficient (75% either agreeing or strongly agreeing). When asked if they agree that source separation is a useful practice that conserves and protects the environment (Table 4-5, A1 to A4), all respondents either agreed or strongly agreed to the statements (100%). A similar result was obtained from Issock *et al.* (2020), which indicated a strong agreement related to the importance of source separation and protection of the environment (for South African households). This indicates that both role-players recognise the importance of source separation, but may, for reasons determined by the interviews, not be able to participate. Further, all respondents generally agreed that source separation is an interesting and fulfilling task (A5; mean of 75% and 80% respectively), and generally believed that they could set an example for their colleagues by participating in waste separation (A6; mean of 100% and 80%, respectively) (Table 4-5). All role players either agreed or strongly agreed that waste separation should be formalised and promoted in the Aliwal Shoal MPA (A7 and A8; 100%). From these results it can be said that both diving charters and accommodation facilities generally have a positive attitude towards source separation.

4.2.1.2.3 The role of subjective norms (SN) in waste separation at source

When it came to subjective norms (SN), both role players stated that society (their family, friends, colleagues and community) expects them to participate in source separation at their workplace (SN1, SN3, SN5, SN7; ranging between 60% and 100%) (Table 4-5). Overall, if respondents were to be encouraged by society to separate their waste, they would (SN2, SN4, SN6, SN8; ranging between 60% and 100%). Stoeva and Ariksson (2017) agreed that encouragement and expectations from society would motivate individuals to participate in recycling. Social and peer pressure also plays a role. It was, however, determined that the local municipality (SN9) usually does not encourage separation at source (with 50% of diving charters and 60% of accommodation facilities agreeing), but respondents would be likely to participate if they were (SN10, 80% and 100% respectively). It can, therefore, be said that the community of the Aliwal Shoal approves of waste separation at source, and that individuals would participate in these behaviours if the community placed pressure on them. Of particular interest is that diving charters either agreed or strongly agreed that their customers are expected to participate in waste separation practices (A11; 100%), whereas this was not the case for accommodation facilities, with 60% strongly disagreeing with this statement (Table 4-5). This divide can be explained by the emphasis that is placed on environmental protection by diving charters.

4.2.1.2.4 The role of perceived behavioural control (PBC) in waste separation at source

The last element investigated, namely PBC, was used to determine the control beliefs of the participants. Both role players indicated that they have complete control in deciding whether or not to separate waste at their workplace (PBC1). Specifically, 75% of diving charters and 60% of accommodation facilities agreed to the statement (Table 4-5). Although participants had control over whether they wanted to participate in source separation, there are other factors that influence whether PBC is favourable.

These factors include time and effort (PBC3), with most diving charters and accommodation facilities agreeing that waste separation does require time and effort (mean of 75% and 100%, respectively) (Table 4-5). Although this is true, these role players also stated that they would still participate regardless (PBC4; 100% and 60% respectively). Strydom (2018:7) found that time was the main reason for individuals not participating in recycling, with 28.1% of the respondents agreeing that time is a factor which influenced their non-participation in separation at source.

It was further indicated that a lack of separation facilities would hinder source separation (PBC5; 100% of role-players agreed), but that most establishments did have enough space to store separated waste (PBC6; agreement of 75% and 60% respectively) and would still be willing to participate (PBC7; agreement of 100% and 60% respectively) (Table 4-5).

Convenience (PBC14) was, however, found to be a challenge, with only three diving charters (75%) and two accommodation facilities (40%) stating that they had recycling bins close to their workplace (Table 4-5). The majority of respondents indicated that they would still participate in spite of the inconvenience (PBC15; agreement of 100% and 60% respectively). A low level of convenience was similarly found to have a negative influence on recycling behaviour by Strydom (2018:10). A study by Stoeva and Alriksson (2017) agreed with these findings.

Despite the respondent's willingness to participate, it was found that the local municipalities (PBC8) do not provide them with the adequate facilities for waste separation. 100% of diving charters and 80% of accommodation facilities agreed with this statement (Table 4-5). This factor discouraged some respondents from separating their waste (PBC9; 25% of diving charters and 40% of accommodation facilities), which is in accordance with the results from Stoeva and Alriksson (2017), who noted a lack of facilities to be a hindrance to recycling in Bulgaria.

Education was found to be favourable with the majority of respondents stating that they know how to separate their waste (PBC10, agreement of 100% and 80% respectively), and which recycling bins the waste should be sorted into (PBC12; agreement of 100% for both role-players). Their lack of knowledge would also not discourage them from participating (PBC11; 100% and 60% respectively, PBC13; mean of 100% and 60% respectively) (Table 4-5). This result was found to be similar to the research by Strydom (2018:7), who determined that only 14% of their participants had a lack of knowledge on recycling techniques, and those participants generally had the rudimentary knowledge necessary for the separation of waste into basic categories.

4.2.1.3 Associations between TPB constructs

Associations between TPB statements could not be determined in a statistically sound manner because of the low variability in data due to the relatively small sample size (only nine participants responding to the survey questionnaire).

4.3 Results related to RO3: Evaluate the underlying factors influencing waste separation behaviour through the application of the TPB

This section of the dissertation (related to RO3) aims to evaluate and understand the main underlying factors influencing waste separation at source. The discussions are based on a comparison of the observed (RO1) versus the reported (RO2) behaviour, as well as results of semi-structured interviews.

4.3.1 Evaluation of observed versus reported behaviour

Research suggests that self-reported and observed waste-related behaviour are not strongly correlated (Huffman *et al.*, 2014) and reported behaviour may, therefore, not be an accurate reflection of actual separation at source practices. To evaluate the factors influencing waste separation at source behaviour, observed (RO1) and reported (RO2) waste separation at source behaviour and practice were, therefore, determined.

The self-reported behaviour of some of the accommodation facilities complemented their observed waste behaviour. The observations determined that no separation at source activities were taking place, which was confirmed by the majority of participants also reporting no to low participation in waste separation at source. It was clear that gaps exist between the observed and self-reported waste behaviour of the majority of respondents representing diving charters. When questioned on their waste separation practices (B1 to B3), the majority of diving charters stated that they regularly separated their domestic waste. This was, however, proven to contradict the results from the waste characterisation study and the observations, that showed no evidence of separation.

Research by Ee and Ze (2018), that studied the environmental attitudes of individuals visiting a sporting event (The South East Asia Games), complemented the findings of this research. In their study, it was determined that 48.7% of the individuals stated that they separated their waste, although the actual recycling rate in Malaysia was only 17.5% (Ee & Ze, 2018).

Social pressure could be a reason for this contradiction. It was evident from these results that individuals felt a social pressure to engage in waste separation behaviours (based on subjective norm (SN) statements), with the majority of the respondents stating that if those around them encouraged them to participate, they would. This notion is highlighted in a study done by Flagg and Bates (2016:492), stating that *“as a social norm, recycling has a coercive aspect; people believe it is something they should do, regardless of their personal commitment to waste reduction or other pro-environmental values.”* Therefore, many individuals may state that they participate in

pro-environmental behaviours if others around them do, but may not actively participate, as can be seen in these results.

It was determined (from the responses to survey questionnaires) that the majority of respondents have the appropriate space and infrastructure to separate their waste and that their workplace is convenient to carry out this separation. The on-site observations contradicted this, especially when it came to their waste storage facilities. These were found to be inadequate for waste separation. Resources, such as dedicated waste bins and bags were not present, contradicting the responses on availability of infrastructure, space and convenience that were reported.

Inaccuracies in the self-reported data can have various negative implications. By reporting that source separation is being practiced in the Aliwal Shoal MPA, when in reality it is not, could invalidate the efforts of waste separation recycling programmes in the area. These programmes require appropriate planning and cooperation in order to effectively aid in environmental conservation. Additionally, the respondents stated that they know how to separate their waste and in which bins they should be deposited (PBC10; PBC12). If this is found not to be true, it could affirm the need for educational programmes.

All respondents agreed that waste separation at source is an important practice that aids in environmental protection and resource conservation, but none actively participated. Although attitude is the TPB factor which generally has the least impact on waste behaviour (Razali *et al.*, 2020), it is still a crucial element in influencing separation at source behaviour. Many studies have found that attitude generally has a positive influence on recycling behaviour (Martinho *et al.*, 2015; Razali *et al.*, 2020; Stoeva & Alriksson, 2017; Tonglet *et al.*, 2004), however, other factors, such as convenience, access to infrastructure, and municipal support generally seem to play a determining role in waste-related behaviour.

Although reported behaviour towards waste separation at source was, generally, positive, certain barriers or challenges prevented these individuals from partaking in waste separation at source. The barriers and challenges to source separation of waste were further explored by means of interviews (Section 4.3.2).

4.3.2 Results of interviews

Interviews, which were conducted with all respondents who participated in the survey, were primarily done to determine the challenges (barriers) and opportunities for source separation of waste in the Aliwal Shoal MPA. From the analysis of the interview responses, certain themes were identified, which are discussed in the sub-sections to follow.

4.3.2.1 Barriers/challenges to separation at source at Aliwal Shoal MPA

In this section, the barriers and challenges to waste separation at source will be discussed.

4.3.2.1.1 Lack of waste separation resources (infrastructure)

A lack of necessary *resources*, mostly related to collection services and infrastructure, were identified as one of the greatest barriers towards separating waste at source (this was confirmed during research observations). This situational factor, identified by Ghani *et al.*, (2013), may influence behaviour, in addition to the TPB factors discussed previously. Most of the facilities did not have any dedicated infrastructure (i.e., recycling bins) available for the separation of waste at source. It was also reported that no collection services for recyclable wastes were available. It seems as if the respondents expected the municipality to coordinate or fulfil this role. Both the diving charter and accommodation facility respondents explicitly mentioned that the municipalities (Ethekwini/ Ugu/ Umdoni Municipality) did not provide the necessary *resources* required for source separation. The municipalities did not render any specific waste collection services for source separated waste, and no additional infrastructure (bins or bags) were issued – also refer to Section 4.3.2.1.3.

Businesses are issued the standard waste disposal bins, but do not have access to dedicated recycling bins. Those that wish to recycle (separate at source) are required to purchase additional bins themselves. A study by Roos *et al.* (2021a) found the availability of waste bins to be one of the main reasons for the lack of separation at source participation in households. The respondents also mentioned that they would not be sure how and where to seek for private waste collection services (and were reluctant to spend time and effort towards it), if the municipality did not support waste separation at source.

A diving centre owner stated that: *“Our municipality only supplies us with black plastic bags for our refuse. Even if we wanted to separate the refuse, we cannot afford to buy other equipment. The municipality should look at addressing these services. I know of other municipalities in KZN who give recycling bags”*.

The Ethekwini, Ugu, and Umdoni municipalities provide black bags to the residences, mainly for domestic waste, blue bags for garden refuse (this service is optional), orange bags for recyclables (including cardboard, paper, and plastic), and clear bags for glass bottles and cans. Orange and clear bags are, however, only provided in some residential areas. These challenges are regarded as an inconvenience to waste separation, which is cited by Roos *et al.* (2021a:9) as one of the greatest impediments to waste separation.

4.3.2.1.2 Collection and transportation of waste

Two accommodation facilities stated that they had different bins to separate their waste, but that the municipality does not collect this waste separately. They stated that *“the community and businesses within the MPA are eager to recycle, but the local municipality does not offer assistance”*. Irregular waste collection services are one of the challenges of waste management in South Africa highlighted in the Africa Waste Management Outlook (UNEP:2018).

A lodge and dive centre manager stated that: *“Within our workplace we have all the necessary recycle bins and do separate accordingly – and our clients/guests follow our example. The municipality does not collect recycled goods at all. It is the responsibility of an individual or business to make arrangements to dispose of the separated waste themselves”*. She elaborated that this has proven to be a challenge as there are no recycling facilities nearby.

There are twenty-three recycling facilities in the Ethekewini municipality. These include seven buyback centres (Redhill, Westmead, Durban, New Germany, Queensmead, and Kwa-Mashu), three community drop off centres (Kloof, Hillcrest, and Westville), and eleven DSW garden refuse sites (Amanzimtoti, Bellair, Bluff, Chatsworth, Durban North, Merewent, Mount Edgecombe, Newlands West, Phoenix, Redhill, and Woodlands/Montclair). The majority of these recycling facilities are, however, a considerable distance from the participants of this study. The closest recycling facility is found in Amanzimtoti (Naturesway Recovery Centre) which is approximately within a 25km radius from the diving charters and accommodation facilities studied. There is also, a paper recycling bin located at a Primary School in Umkomaas, which is within a 5 km radius from the respondents.

The transportation of waste to recycling facilities was stated as an impediment to source separation in the Aliwal Shoal. One participant (lodge and dive centre manager) stated that a local recycling company has attempted to assist the community in the past, however, due to financial constraints they were unable to continue. The funding of similar programmes is cited as a particular problem in South Africa (DEA, 2018).

The transportation of waste was also found to be a barrier towards household recycling initiatives by Roos *et al.* (2021a) and Strydom (2018) in the South African context.

4.3.2.1.3 Convenience, time constraints and unwillingness of guests to participate

One other challenge found by the participants is the willingness of guests or customers to participate. Willingness has been found to be a key challenge influencing waste separation at source in South Africa. An individual's awareness and attitudes towards waste separation have

been found to play an important role in household waste separation (Roos *et al.*, 2021a). Studies by Babaei *et al.* (2015), Gilli *et al.* (2018), Meng *et al.* (2019), Razali *et al.* (2020) and Wang *et al.* (2019) agree with this statement, where they highlight that people who are willing to participate in waste separation at source, will normally do so – if they have access to facilities.

It was determined from the questionnaire results that all of the role-players indicated willingness to separate waste at source. However, the success of separation at source would be reliant on visitor/guest interventions, where guests may be requested to avoid or minimize certain wastes, or separate certain waste streams from others. The waste-related attitudes, willingness and behaviour of the tourists were, however, not considered in this study. One diving charter owner did, however state that: *“We do try to encourage our customers to either not bring any rubbish with them on the boats or to take the waste back with them, although they generally do not comply with our requests”*.

Additionally, convenience also plays a role. As previously stated, the provision of waste separation resources in the Aliwal Shoal MPA has been found to be lacking. A study by Omotayo *et al.* (2020:11) identified that individuals would be more willing to participate in waste separation programmes if the current waste management practices were improved.

As stated by one lodge owner *“there is no recycling in our area that I am aware of, however I would recycle for free to make our area a better place, if facilities were available”*.

The last challenge identified were time constraints. Ghani *et al.* (2013), Omotayo *et al.* (2020), Roos *et al.* (2021a) and Strydom (2018) identified time as a situational factor that creates a barrier towards waste separation participation. As stated earlier, 75% of diving charters, and 100% of accommodation facilities agreed that waste separation requires time and effort. A secretary at a guest house stated that *“We are too busy to recycle our waste and have other priorities that take precedence over this”*.

4.3.2.2 Opportunities for source separation at Aliwal Shoal MPA

The opportunities for source separation in the Aliwal Shoal, highlighted by the respondents, are be discussed in this section.

4.3.2.2.1 Provision of source separation resources

When asked to offer possible opportunities for waste separation in the Aliwal Shoal, six of the nine participants stated that if the municipality provided recycling bins to businesses, they would be willing to separate their waste.

A lodge owner stated that: “*Ethekwini can definitely supply appropriate waste disposal bins to all the lodges and B&Bs and outlets throughout Umkomaas as we are a very small town*”.

Besides the paper recycling bin at the primary school, it was suggested that the municipality or private recycling businesses could place recycling bins in a centrally accessible area to encourage waste separation.

One participant, an owner of a lodge in Umkomaas, suggested that a separate waste drop-off centre could be established, stating that “*We have a local garage up the street that would work well, it’s very central for everyone*”. This could solve the costs that the participants would have to pay for transportation costs, and would be a relatively convenient option.

From the literature, it was established that the availability of appropriate waste infrastructure generally encourages source separation. The success of a separation at source programme, according to Babazadeh *et al.* (2018:10), can be attributed to the development of suitable infrastructure, and that the provision of waste facilities and infrastructure should be prioritized.

4.3.2.2.2 Provision of municipal collection services

Many of the participants were eager to separate their waste, provided that the local municipality collects the separated waste. Therefore, the greatest opportunity for improvement was found to be municipality involvement. The participants were of the opinion that, without cooperation with the municipality, all recycling efforts made by the tourism industry in the Aliwal Shoal MPA would be futile.

Formalising municipal waste separation programmes, such as educating the community on proper waste separation techniques, as well as the provision of waste services, could be able to improve waste separation in an area. The participants from a study conducted by Babazadeh *et al.* (2018:9) attributed the low level of source separation participation to a lack of awareness of programmes, as well as education. This could cause problems with the implementation of source separation programmes. The formalisation of municipal programmes is also cited by Issock *et al.* (2020:543) as an important aspect that could facilitate the adoption of a waste separation programme.

4.3.2.2.3 Improved waste management behaviour

Lastly, a waste minimisation strategy is currently being implemented by one of the diving charters. Some of their progress involves moving away from single use plastics and instead using reusable glass water bottles, as well as providing fruit on the boats instead of other snacks that are wrapped in paper or plastic wrapping.

The owner of this diving charter stated “*We try to move away from snacks and refreshments on the boats that could generate plastic waste, such as lollipop wrappers and plastic bottles*”.

A further opportunity mentioned for waste reduction was the composting of separated organic waste, in particular food waste. Food waste can be composted locally at a low cost, and used as agricultural fertiliser. A similar strategy, mentioned in the research by Wani *et al.* (2018) in a tourist town in the Himalayas, was found to be effective towards changing waste behaviour, and reducing the quantities of waste generated.

4.4 Chapter summary

When determining the actual (or observed) waste separation at source behaviour of selected diving charters and accommodation facilities within the Aliwal Shoal MPA (RO1), it was found that:

- Paper and paperboard were found to be the main contributors to domestic waste by the diving charters, and plastic was the main contributor to domestic waste for the accommodation facilities;
- The waste (composition) characterization indicated that the majority of the waste generated (74% and 77%, respectively) by participants had the potential to be recycled;
- However, limited separation at source was observed. Only one of the participants separated garden waste from other waste streams;
- Most of the generated waste was stored in bins or black bags for municipal collection and landfill disposal;
- This means that the recycling potential of waste (by separating it at source) may be decreased or lost (if not reclaimed elsewhere in the waste life cycle).

The results from the questionnaires were used to determine the self-reported behaviour of the tourism industry (RO2) based on the TPB. The following main findings were noted:

- The majority of diving charter (100%) and accommodation facility (60%) respondents indicated that they regularly participated in waste separation at source.
- The self-reported waste practices did not correspond to on-site observations.
- Generally, a positive attitude towards source separation was identified by all respondents, with societal norms and expectations also positively contributing to the adoption of these behaviours.
- Situational variables and behavioural control factors were, however, found to cause a hindrance towards waste separation. Factors such as time, effort, a lack of resources and municipal involvement were found to negatively influence these behaviours.

- Associations between TPB statements could not be determined, due to the low data variability based on the relatively small sample size.

Interviews were conducted to determine the opportunities and challenges for waste separation at source, to contribute towards understanding the main factors influencing separation at source behaviour (RO3). The following main findings were made:

- The results from surveys, indicating that behavioural control plays an important role towards waste separation at source, were confirmed by interview responses, which also identified a lack of infrastructure, the collection and transportation of waste, convenience, and the willingness of guests to participate to be challenges of waste separation in the Aliwal Shoal MPA.
- It was suggested that participation in waste separation could be improved by providing participants with the appropriate resources and services, as well as improving their current waste management behaviours.
- There was a gap identified in the observed versus the reported behaviour, which was more pronounced under the diving charters than the accommodation facilities. This could be attributed to social pressure and may lead to negative consequences, such as invalidating existing separation at source programmes, as well as providing inaccurate information towards the development of new programmes.

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter draws conclusions on the findings of the study and provides recommendations. This study aimed to apply the Theory of Planned Behaviour (TPB) to understand the factors influencing tourism-related waste behaviour within a Marine Protected Area (MPA), with a specific focus on waste separation at source. The Aliwal Shoal MPA was selected as a case study to investigate this research aim.

5.2 Conclusions

The research focused on establishing waste-related behaviour through the application of the TPB to determine attitudes, subjective norms, situational factors and perceived behavioural control factors influencing behaviour. The framework provided by the TPB relies strongly on self-reported waste-related behaviour. However, research has found that self-reported behaviour may vary from observed behaviour. Therefore, data on self-reported behaviour (RO2) was supplemented by observed behaviour (RO1). Observed behaviour (RO1) was determined before self-reported behaviour was investigated, to minimize the potential of the survey questionnaire influencing waste-related practices.

5.2.1 Conclusions related to RO1: Actual (observed) behaviour

To determine the actual (observed) behaviour of the respondents, a waste characterisation study, as well as direct observations were performed. A total of 31.17 kg of waste was collected from the participants. It was determined that the accommodation facilities, on a weekly average, generated more waste than the diving charters. This was, however, only a moderate difference. These waste generation rates were found to not be comparable with, and lower than, South Africa's daily average waste generation rates (Rodseth *et al.*, 2020). The effects of the COVID-19 restrictions, social unrest, the number of customers at the time, and the season the samples were collected are some of the possible reasons for this difference. Furthermore, when determining the extent of waste separation by the participants, it was discovered that no such practices took place. This was seen from the waste composition results.

Compared to previous studies (Phu *et al.*, 2018; Wani *et al.*, 2018), where the majority of waste was found to be food waste, this study identified paper and paperboard, and plastic were the main contributors to domestic waste by the diving charters and accommodation facilities respectively.

These studies were, however, focussed on larger accommodation facilities that were fully catered. The accommodation facilities investigated in this study operated on a smaller scale, and were generally self-catering. No studies could be found related to the waste composition of diving charters.

This waste composition characterisation revealed that the majority of waste generated had the potential to be separated and recycled. Specifically, 77.9% (diving charters) and 74.1% (accommodation facilities) of the waste generated had recycling potential, however, these wastes were mixed with non-recyclable waste and destined for landfill disposal. As a result of the contamination of recyclable waste with food waste and other wastes, the recycling potential of waste was low. Direct observations confirmed that no source separation took place. The lack of source separation is common in South African households and businesses, with the majority of waste still being disposed to landfill, despite the fact that approximately 90% of waste that is generated could be diverted from landfill (Godfrey & Oelofse, 2017).

Waste generated by diving charters and accommodation facilities were managed in a similar way. There were no waste separation resources, or related infrastructure, found on the premises of the participants. Waste was discovered to be stored in black bags or bins, which were then deposited on the curb-side for collection by the municipality (Durban Solid Waste - DSW) on a weekly basis. In addition to the collection of domestic waste, garden waste is also collected on the same day. Even if participants separated their waste or were willing to participate, DSW does not collect separated waste. This is a challenge in other South African municipalities as well (DEA, 2008).

5.2.2 Conclusions related to RO2: Self-reported behaviour

Self-reported behaviour regarding waste separation practices scored well for both diving charters and accommodation facilities, with 100% of diving charter and 60% of accommodation facility respondents indicating (agreeing) that they separate waste at source. This result was discovered not to correspond with the waste characterisation study and on-site observations. Tonglet *et al.* (2004) and the MORI Social Research Institute (2002) state that self-reported behaviour generally overestimates observed behaviour. The attitudes of the respondents on waste separation at source were, however, found to be generally positive.

The importance of sound waste management towards environmental protection and conservation is highlighted by Issock *et al.* (2020). The majority of respondents agreed that by participating in waste separation, the environment may be conserved and protected. It was also believed that waste separation should be formalised and promoted in South Africa. Furthermore, 75% of diving charters agreed that their current waste management practices were sufficient, while 60% of

accommodation facilities disagreed. The high level of agreement by the diving charters could be due to perceived societal pressure (Thomas & Sharp, 2013).

Results indicate that social expectations by family, friends, colleagues, and the Aliwal Shoal community may play an important role in encouraging the respondents to participate in waste separation. This is in agreement with Stoeva and Alriksson (2017), stating that the encouragement and expectations of a society greatly influences an individual's motivation to recycle. The municipality did, however, neither encourage nor support residents in the Aliwal Shoal MPA to separate their waste, leading to a few respondents being discouraged from participating. This factor, as well as other behavioural control beliefs, had an effect on actual source separation.

These perceived behavioural control factors, including time, effort, a lack of separation facilities and space, as well as convenience, were identified as reasons for these respondents electing not to participate in waste separation at source. Studies by Stoeva and Alriksson (2017) and Strydom (2018) also found these control beliefs to have a negative impact. Education was, nevertheless, found to have a positive influence.

Associations between TPB statements could not be determined in a statistically reliable way, because of the low data variability, due to the relatively small sample size of responses.

5.2.3 Conclusions related to RO3: Evaluating the underlying factors influencing waste separation behaviour through application of the TPB

Self-reported behaviour may differ from actual (observed) behaviour (Ee & Ze, 2018; Huffman *et al.*, 2014). The self-reported behaviour of the respondents, therefore had to be supplemented by evaluating observed behaviours.

The differences in the self-reported versus observed behaviours was more pronounced under the diving charter respondents. All of the diving charter respondents and 60% of accommodation facility respondents reported regular source separation, however, source separation was not evident from the waste characterisation study or observations. This gap between reported and actual behaviour could be attributed to perceived social pressure to report waste separation behaviour as part of the survey questionnaire. Flagg and Bates (2016) identified social pressure as a reason for individuals agreeing to a behaviour, but in reality, not participating in that behaviour.

A lack of space and source separation infrastructure was observed, which was contradicted by the self-reported questionnaires by which the participants stated that they had these facilities.

The inconsistencies between the self-reported and observed behaviours may have negative consequences, such as invalidating existing separation at source programmes, as well as providing inaccurate information towards the development of new programmes.

With all the respondents agreeing that source separation is an important practice, certain challenges were identified that may hinder active participation. Interview results indicated that a lack of waste separation facilities and a lack of municipal support were the main perceived challenges for waste separation at source. Further challenges include the collection and transportation of waste, convenience, and the willingness of guests to participate. Similar challenges are identified by Ghani *et al.* (2013), Gilli *et al.* (2018), Omotayo *et al.* (2020), Razali *et al.* (2020), Roos *et al.* (2021a), and Strydom (2018).

Although positive attitudes have the potential to positively influence source separation of waste, attitude alone is not the only driving factor, with additional factors, such as perceived behavioural control playing a determining role. With participants perceiving waste separation at source as inconvenient and time consuming, mainly due to the lack of waste separation at source facilities and limited municipal support, it is unlikely that respondents would participate in source separation (as indicated by observed results) despite their positive attitudes and willingness to participate.

5.3 Recommendations

In this section, the practical recommendations towards waste separation that can be followed by the diving charters and accommodation facilities in the Aliwal Shoal MPA will be outlined. Furthermore, recommendations for future research will also be discussed.

5.3.1 Practical recommendations towards waste separation at source at Aliwal Shoal MPA

Practical recommendations towards waste separation were determined by evaluating the opportunities identified by the interviews. The development of suitable waste separation infrastructure and the provision of waste resources have been identified by Babazadeh *et al.* (2018) as one of the most important factors in encouraging source separation. This was also found to be true in this research, with approximately 67% of respondents stating that they would participate in waste separation if the municipality provided them with dedicated waste bins and other facilities. It was suggested that waste separation bins be placed in a central area to encourage participation. In this way, transportation costs may be minimised and convenience increased.

Related to the provision of source separation infrastructure, the collection of waste by the local municipality was also deemed important. Respondents stated that if the municipality did not cooperate with source separation programmes, all efforts by the community would be ineffective.

By formalising municipal waste management programmes, such as educating the community on source separation techniques and the provision of waste services, Issock *et al.* (2020) state that this could facilitate the adoption of a waste separation programme. Babazadeh *et al.* (2018) also agreed that the lack of education negatively influences participation.

Lastly, changes in the current waste management practices were highlighted by the respondents as a way to reduce waste. One diving charter is currently moving away from single-use plastics and using reusable glass water bottles on their vessels. Composting separated organic waste was also identified as a viable option, as food waste can be composted at a low-cost and used as agricultural fertiliser.

These practices could positively contribute to reducing the quantity of waste disposed to landfill, towards limiting the impacts of waste to the Aliwal Shoal MPA.

5.3.2 Recommendations for further research

The limitations and conclusions drawn from this study indicated the following areas as recommendations for future research:

- This research was influenced by the impacts of COVID-19 restrictions, where national and international travel were restricted during July 2021. It is recommended that the research be repeated in a post-COVID scenario, when tourism-related activities have normalised in the Aliwal Shoal MPA, which may provide a more accurate reflection of waste quantities and types.
- This study reported the results from nine respondents in the Aliwal Shoal MPA. For future research, it is recommended that a representative sample of tourism facilities be investigated.
- Time limitations coupled with limited willingness to participate in the research, when it came to data collection, negatively influenced the number of respondents who participated in the study. It is recommended that the respondents have a longer time period to consider their participation.
- The type of tourism facilities investigated could be broadened, with the inclusion of other tourism-related activities, such as fishing charters, water parks, hiking trails, etc.
- It was discovered that tourists were generally unwilling to participate in waste separation at the diving charters and accommodation facilities. Investigating the behaviour of these tourists could be included in future research to determine their reasoning for not opting to participate.

- Lastly, since limited research has been done on waste-related behaviour in protected areas (Roos *et al.*, 2021b), it is recommended that this research is duplicated for other MPAs and other types of protected areas.

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