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My Coast NSW Study

New South Wales Community Perceptions of Coastal Erosion and Inundation

(May 2019)

Proudly funded by

SYDNEY COASTAL COUNCILS GROUP

SURF LIFE SAVING NEW SOUTH WALES

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Glossary of Key Terms*

Term	Definition and Description
Beach	A coastal deposit of sediment, generally of sand or pebble size, that extends landward from the lowest astronomical tide level to the line of vegetation/bedrock/structure.
Beach nourishment	The practice of adding large quantities of sand or sediment to beaches to combat erosion and/or increase beach width and volume.
Coastal Accommodation Business (CAB)	An accommodation-oriented business (e.g. caravan park, tourist park, motel) located proximally to coastal waters.
Coastal community	A group of people who share an interest in the coast regardless of their geographic location and type of coastal usage.
Coastal environment	An environment, or set of environments, where marine and terrestrial areas influence each other – these include (but are not limited to) beaches, estuaries, and rock platforms.
Coastal erosion	The loss of sand and/or sediment from coastal shorelines (e.g. beaches, dunes, cliffs) in the form of a reduction in volume and/or width. It may be episodic or long-term.
Coastal 'Frontline' resident	Members of the public who reside on beachfront and/or shoreline residential properties along known coastal erosion 'hot spot' locations.
Coastal Indigenous community	An Indigenous community that identifies the coast as part of their cultural identity.
Coastal Management Professional (CMP)	A person who works in the area of coastal management – this may include coastal Council environment managers, consultants, engineers or coastal environment researchers.
Coastal storm	A low-pressure cyclonic weather system generating strong winds, large waves and significant precipitation that impacts the coastal environment.
Community engagement	A two-way process of dialogue whereby aspirations, concerns, needs and values of the community are incorporated into policy development, planning, decision-making, education, service delivery and assessment.
Community of interest	Communities of people linked by a shared interest (e.g. teachers, coastal management professionals).
Community of place	Communities of people intrinsically linked to a defined place (e.g. Surf Life Saving Club members, coastal 'Frontline' residents).
Developed beaches	Beaches characterised by building and/or engineered infrastructure, situated either behind the beach and/or on the beach.

Developed estuaries	Estuaries characterised by building and/or engineered infrastructure, situated along, or behind, the coastline.
Dune maintenance and/or management	Maintaining, stabilising and/or reinforcing (e.g. through planting vegetation) a coastal sand dune system.
East Coast Low (ECL)	An intense low-pressure cyclonic system that typically occurs several times a year off the east coast of Australia and can generate strong winds, widespread rainfall and large ocean waves.
Erosion hotspot	Defined areas where houses or public assets at risk of, or experiencing erosion, are identified in an immediate coastal hazard area. https://www.environment.nsw.gov.au/coasts/coasthotspots.htm
Estuary	Any part of a river, lake, lagoon, or coastal creek whose level is periodically or intermittently affected by coastal tides, up to the highest astronomical tide.
General Coastal User (GCU)	A person who utilises the coastal environment in any way (both active or passive), at any time for any length of time.
Groyne	A long, narrow structure (often made of rocks) built perpendicular to the coast, out into a body of water.
Hard management solution	Construction of an intended permanent structure at a fixed location to manage the effects and risks of coastal hazards (see seawall, groyne).
Hazard (Coastal)	Caused by dynamic processes such as weather, waves, tides, currents and rock weathering that expose a coastal area to risk of property damage, loss of life and environment degradation.
Inundation (Coastal)	Flooding of normally dry land by sea water, often caused by storms surges or king tides.
King tide	An especially astronomical high tide event occurring twice a year where there is greatest vertical difference between high and low water (tide range).
Less developed beaches	Beaches with little or no buildings or anthropogenic infrastructure along the coastline.
Local government area	An area governed in NSW under a local Council, i.e. the Northern Beaches Council in Sydney.
Mental model	An existing knowledge structure relevant to a subject that helps make sense of the problem at hand (Morgan, 1997).
Natural environment	An environment that has not been developed or built upon – left in its' natural state.
NSW	The Australian state of New South Wales.
Perception	The way in which something is interpreted; the organisation, identification and interpretation of sensory information in order to understand the presented information or environment.

Retreat (management solution)	Planned relocation of residential housing and infrastructure away from a receding coastline.
Risk	A situation, exposure to, or effect of a dangerous situation.
SCCG	Sydney Coastal Councils Group.
Sea Level Rise (SLR)	Change in global average sea level caused by increased volume of the ocean (caused by a variety of factors).
Seawall	A wall built along the back of a beach or estuary shoreline to stabilise the shoreline and offer protection from waves.
SLS NSW	Surf Life Saving New South Wales.
Soft management solution	Managing the effects or risks of coastal hazards through the replacement or prevention of land or sediment lost (see *Dune maintenance, Beach nourishment*).
Storm surge	A phenomenon of localised rising ocean water level caused by a coastal storm or low-pressure weather system.
Teacher	A primary or high school teacher.
Understanding	The comprehension of information provided by an external source.

* For more information on terms used in this report, refer to the NSW Government Coastal Management Glossary (2018) https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Water/Coasts/coastal-management-glossary-180195.pdf

1. Executive Summary

Various locations along the coast of New South Wales (NSW) are presently subject to amenity loss and infrastructure damage associated with erosion and inundation resulting from severe coastal storms. The continued occurrence of these storm events, as well as anticipated sea level rise, will only enhance the extent and cost of erosion and inundation damage of coastal zones throughout NSW in the future, particularly in low-lying estuarine areas.

An important aspect of building community resiliency and preparedness to coastal erosion and inundation is understanding what NSW coastal communities presently understand and perceive about both of these hazards and how these will affect their interaction(s) with, and use of, the coast in the future. However, many knowledge gaps exist regarding community understanding of the nature, driving forces, potential magnitude and frequency, and coastal management solutions in relation to both coastal storms and sea level rise. There are also significant differences in community expectations regarding the future use of the NSW coast, both between different coastal communities and between coastal management professionals, general coastal users and coastal accommodation businesses.

This study involved developing and disseminating a series of survey questionnaires designed to gain a greater understanding of the values, attitudes and perceptions of the NSW community in relation to 'their coast' as well as key themes related to coastal erosion, inundation and associated management issues and strategies. The surveys involved questions regarding future expectations of the frequency and magnitude of these coastal hazards, what is considered the 'best' way to manage their impacts, and who should be expected to pay for any associated damages.

The purpose of this study was to provide an evidence-based platform that will assist local governments and coastal management professionals in the future development of suitable and effective educational strategies and programs to help improve the ability of NSW coastal communities to adapt sustainably to the risk of coastal erosion and inundation. Additionally, a number of resources, including this Final Report, Fact Sheets, and a study guide for teachers to educate high school students, have been made available to assist in improving general community awareness of these coastal hazards. These resources are all available at www.bees.unsw.edu.au/nsw-my-coast-study.

The findings outlined in this report are representative of the views and perceptions (both qualitative and quantitative) of three selected 'communities' within the overall NSW coastal community: 1. Coastal Management Professionals (CMPs), who represent members of the coastal management community including government (State and Local), academics, researchers and engineers; 2. General Coastal Users (GCUs), who represent a cross section

of people who use the NSW coast and consisted of 6 sub-communities that were surveyed individually: i) NSW primary and secondary school teachers; ii) NSW Surf Lifesaving Club members; iii) coastal accommodation tourists; iv) Indigenous coastal community members; v) coastal Council employees; and vi) NSW 'Frontline' residents (those located directly on coastlines identified as at risk of coastal erosion; and 3. Coastal Accommodation Businesses (CABs), who were owners, managers or employees of accommodation businesses (e.g. caravan parks) situated close to the coast.

1.1 Key Findings

The surveys conducted in this project generated a considerable amount of data describing how respondents perceive coastal hazards, coastal risks, various aspects of coastal management, and how these will impact on their interactions with the coast in the future. Data is available upon request. Key findings from these surveys are summarised in Table 1.1.

Table 1.1 Key findings from the surveys conducted during the project. Primary themes are colour coded and findings are presented based on the three target groups where applicable - Coastal Management Professionals, General Coastal Users, and Coastal Accommodation Businesses.

Coastal Usage and Risk Perception	
Coastal usage	**General Coastal Users** • 34% visit the coast every day with an additional 30% visiting at least once a week. Fewer than 5% stated they visit the coast only about once a year; • Regional beaches were identified as the coastline most utilised (42%), followed by urban beaches (36%), regional estuaries (7%) and urban estuaries (3%); • 10% indicated they use the coastal environment solely for land-based activities. **Coastal Accommodation Businesses** • 92% were located within 1 km of coastal waters, with 55% located within 100m; • 42% had been affected by coastal inundation or erosion; of those, 31% indicated it occurs once a year or more.
Natural hazard risk perception	**General Coastal Users** • Erosion and coastal storms (63% and 55% respectively) are perceived as the natural hazards representing the highest risk to this group over the next 20 years; • 49% perceive sea level rise as a significant risk (high or extremely high) while 38% perceive flooding as a high or extremely high risk over the next 20 years. **Coastal Accommodation Businesses** • 55% perceived severe coastal storms as the natural hazard representing the highest risk over the next 20 years, followed by flooding (42%) and sea level rise (42%).
Living on the coast	**General Coastal Users** • Given the option to live in a beachfront property, 52% stated they would not, 32% stated they would and 16% were unsure; • For those that would live at a beachfront, location, reward outweighing the risk and beach access were the most common justifications; • For those who would not, the possibility of damage caused by coastal hazards and risk to house and family were the most common justifications; • 80% think that people who choose to live in hazardous areas should accept the risk and cost of living there; • Only 25% think that people will voluntarily move out of harms' way if given appropriate information about coastal hazards.

Coastal Hazards	
Sea level rise	**Coastal Management Professionals** • Approximately 23% think the NSW community has a good understanding of sea level rise, while 38% think that the NSW community has 'little' to 'no' understanding of sea level rise. **General Coastal Users** • 85% think sea level rise is occurring, 10% are unsure and 5% do not think it's occurring; • 19% are unsure of how much sea level will change, 5% think it won't change, 30% think it will rise more than 25cm, but the majority (45%) think it will rise somewhere between 1-25cm in the next 20-50 years, which is lower than IPCC projections; • 80% think sea level rise will affect the NSW coast, 68% think it will affect the coast closest to them and roughly 50% think it will impact them directly. **Coastal Accommodation Businesses** • 75% think sea level rise is happening; 5% do not, and 20% are unsure; • 33% think sea level will rise between 25cm-1m over the next 20-50 years, 23% think it will rise between 1-25cm, 31% are unsure; • 73% think the NSW coast will be affected by sea level rise, 62% think it will affect the coast closest to their business and 38% think it's a direct threat to the future of their business.
Erosion	**Coastal Management Professionals** • 80% rated erosion as a high risk in their area; • 93% believe risk of erosion will increase over the next 20 years; • Identified beaches as being at highest risk, followed by dunes and estuaries; cliffs were ranked far lower; • 23% think the NSW community has a good understanding of erosion. **General Coastal Users** • Identified developed beaches as the type of coast most at risk, followed by estuaries, dunes and cliffs; • 80% think occurrence of erosion will increase over next 20 years; • 22% think erosion will significantly impact their future use of the coast. **Coastal Accommodation Businesses** • Identified developed beaches as the type of coast most at risk, followed by dunes, estuaries and cliffs; • 75% think occurrence of erosion will increase over next 20 years; • Approximately 40% indicated their business had been affected by erosion and/or coastal inundation, and 32% of this group stated that these events occur at least once a year.

Coastal storms	**Coastal Management Professionals** • 25% think the NSW community has a good understanding of sea level rise, while approximately 40% rated community understanding as 'little' to 'none'. **General Coastal Users** • 35% think severe coastal storms occur about once every five years, 15% think they occur more frequently than every five years and 45% think they occur about once every 20 years or more; • 75% think severe coastal storms will occur more often and 67% think they will be more damaging; • Pollution, damage to flora and fauna, and loss of life or injury were rated as consequences of most concern. **Coastal Accommodation Businesses** • Approximately 50% think severe coastal storms occur about every 5 years, 30% think they occur about once every 20 years or less; • 60% think severe coastal storms in the future will occur more often while 27% think occurrence will stay the same; • 65% think storms will be more damaging and 30% think they will be about the same; • Pollution, loss of sand from the beach and interruption to utilities rated as consequences of most concern.
Inundation	**Coastal Management Professionals** • Only 17% think the NSW coastal community have a good understanding of coastal inundation, with 55% assuming the community have 'little' to 'no' understanding; • Approximately 60% identified the area in which they work to be at high risk of coastal inundation; • Identified estuaries, followed by beaches, then tidal flats/wetlands as most at risk of damage from coastal inundation. **General Coastal Users** • Approximately 30% do not associate storm surges as a contributing factor of coastal inundation and 50% do not identify tidal influences (king tide/spring high tide) as contributing factors; • 77% think the occurrence of coastal inundation will increase over the next 20 years, while 14% think that it will stay the same; • Identified developed beaches, followed by developed estuaries and mangroves/tidal flats, as the coastal environments most at risk of coastal inundation. **Coastal Accommodation Businesses** • Approximately 20% do not associate storm surges as a contributing factor of coastal inundation and 30% do not associate king tides as a contributing factor;

	• 67% think the occurrence of coastal inundation will increase over the next 20 years, with 20% stating it will stay the same and 13% unsure of how, or if, it will change; • Developed beaches, followed by developed estuaries and sand dunes, were identified as the coastal environments most at risk of coastal inundation.
Coastal Management	
Solutions	**General Coastal Users** • 48% have little or no confidence in their local Council in terms of managing the coastal environment; • 48% think that not enough action is being taken to manage the effects of coastal inundation; 23% think enough action is being taken and 29% don't know; • 59% do not think enough action is being taken to manage the effects of erosion; 13% think present action is adequate and 28% are unsure; • Maintaining sand dunes, relocating buildings at risk and government buyback ranked as the three best management options to manage damage by inundation; • Maintaining dunes, relocating buildings at risk and seawalls ranked as the best management options to manage damage by erosion. **Coastal Accommodation Businesses** • 49% of respondents have little or no confidence in their local Council's management of the coastal environment; • 39% of surveyed businesses are presently protected by coastal protection initiatives. Of these, 59% stated that they are satisfied with the protection in place; • Maintaining dunes, building a seawall and relocating buildings at risk ranked as the best options to manage coastal inundation; • Maintaining dunes, beach nourishment and constructing a seawall were ranked as the best options to manage coastal erosion.
Who should pay?	**General Coastal Users** • 66% stated insurance companies should pay for the clean-up and repair after a damaging coastal storm, followed by state government (65%) and local Council (55%); **Coastal Accommodation Businesses** • 60% stated insurance companies should pay for the clean-up and repair after a damaging coastal storm, followed by the local Council (58%) and the State government (58%).

Community Engagement	
Coastal Management Professionals *('Developers')*	• 70% indicated they (or the organisation they represent) have conducted community engagement related to coastal hazards at some time; • 32% think that previous attempts at community engagement were either 'a little' or 'not at all' effective; • 32% consider community forums to be the most effective way to conduct community engagement, with social media (28%) and tv news (22%) also considered as effective mediums; • Significant difference between what is considered the best communication mediums to engage with the community and mediums previously used; • Coastal communities need more information about direct personal and public risks associated with coastal hazards, general information about coastal hazards and processes, and their impacts on the greater NSW community.
Accommodation Businesses *('Distributors')*	• Less than 20% presently provide information about coastal hazards such as erosion, coastal inundation and coastal storms to their clientele; • 75% would be willing to provide information about coastal hazards to their clientele, with over 95% willing to provide information about general beach safety; • Favoured form of information distribution about coastal hazards is via a brochure (80%) followed by providing information on their website (or links to other websites; 25%) and displaying a poster on site with relevant information (23%).
General Coastal Users *('Audience')*	• News media and documentaries were the most common sources of learned information about coastal erosion; • 15% stated they had never had any information about coastal erosion, while 24% indicated that they had never had any information about coastal inundation; • 29% said they had received information about coastal erosion from their local Council, while only 3% had received information about coastal inundation; • Approximately 50% indicated their preferred mode of learning about coastal hazards is via 'documentary', followed by dedicated websites/YouTube channel (42%); • Government publications and local Council (60% respectively) are the most trusted sources of information, with social media (24%) and insurance companies (23%) trusted by less than 25% of respondents; • Would like to know more about how climate change will impact their immediate coast, what the possible solutions are and who are the 'key players' of coastal management.

1.2 Recommendations

The results of this study have identified areas of differing understandings and perceptions across diverse members of the NSW 'coastal community'. By design, this study was broad in nature, both in terms of geographic data collection (NSW coast-wide) and subject matter: hazard understanding, risk perception, understanding and preference of coastal management options and sources of learned information. The results presented in this study are therefore statistically descriptive and while this provides an overall picture of the sample group, it does not identify significant causality between variables or how variables may be related. Data from this study are therefore freely available for others to use (upon request) for further examination. Furthermore, as summarised in Table 1.2, there are a number of ways in which this study can be expanded in future to build upon knowledge of coastal communities' understandings and perceptions, both in NSW and elsewhere.

Table 1.2 Recommendations for future studies extending from this Project.

Possible future studies	Aspects and benefits
Regional replications	• Perform a similar survey within a smaller sample area in NSW (e.g. North Coast, South Coast, Central Coast); • Perform similar surveys external to NSW.
Local Council area replications	• Perform a similar survey within local Council areas; • Gain insight into understanding and perspectives of local residents and coastal users.
Understanding terminology	• Examine how coastal communities understand the language used to describe hazards and risks; • Examine understanding of coastal management options (What is a seawall/groyne?); • Useful for future communications campaigns, are people gaining the information you think you are communicating?
Sub-category focus surveys	• Focus on one sub-category in depth; i.e. hazard/risk perception, understanding of coastal management, information sources/trust etc.; • Possibility to perform statistical analysis, rather than descriptive counts between variables.
Follow-up interviews	• Gain more qualitatively rich data; • Allows for more thorough exploration of individuals' perceptions and understandings; • Provide common misunderstandings of concepts and how/why these perceptions are gained and proliferated; • Can be used to construct a more targeted follow up survey tool.

1.3 Structure of this Report

This study involved targeting different types of 'coastal communities' in NSW. A number of different survey questionnaires were developed to a gain a range of information from these communities in relation to various issues related to coastal erosion and inundation caused by coastal storms and sea level rise. Given the multi-faceted nature of the study and the varied audience that may be interested in accessing the content, the report is divided into 5 thematic sections, each containing multiple chapters that are colour coded so that users can more easily access particular sections of interest (Table 1.3).

The findings of the study are presented as chapters grouped by theme. Each theme is colour coded and each chapter represents a 'Fact File'. The Fact Files follow their own structure and may be read as a stand-alone piece or as a segment of the report, detailing the key findings, qualitative data and supporting literature for that particular topic. Modified versions of some of the fact files are available online along with the Appendices, which provide the survey questions presented to each of the 8 surveyed groups, at www.bees.unsw.edu.au/nsw-my-coast-study.

Table 1.3 Guide to report structure showing chapters and 'Fact Files' colour coded by theme and a general description of chapter content.

Chapter	Description
2. Introduction	• Motivation of study; • Aims and objectives; • Location of study.
3. Background	• Literature review; • Definition of coastal communities; • Research of survey designs; • Identified knowledge gaps.
4. Methods	• Design and dissemination of survey tools; • Challenges and limitations.
5. Fact Files	
5.1. Survey 1: Coastal Management Professionals (CMPs)	• Who they are; • Where they work; • Perceptions of coastal risk.
5.2 Survey 2: General Coastal Users (GCUs)	• Who they are; • Where they live; • Perceptions of coastal risk.
5.3 Snapshot: Coastal 'Frontline' Residents	• Who they are; • Where they live; • Perceptions of coastal risk.
5.4. Snapshot: Coastal Indigenous Communities	• Who they are; • Where they live; • Perceptions of coastal risk.
5.5. Survey 3: Coastal Accommodation Businesses (CABs)	• Who they are; • Where they conduct business; • Perceptions of coastal risk.
5.6 Coastal Values and Usage	• How GCU group uses and values the NSW Coast.
5.7 Sea Level Rise	• Perceptions of rate / magnitude of sea level rise; • Perception of risks posed by sea level rise on different aspects of society.
5.8 Severe Coastal Storms	• Coastal management professionals' perceptions of community awareness and preparedness; • General coastal user/accommodation businesses understanding of coastal storms; • Perceptions of future rate and magnitude.
5.9 Coastal Inundation	• Coastal management professionals' perceptions of community awareness; • General coastal user/accommodation businesses understanding of coastal inundation; • Perceptions of rate of change and impact.

5.10 Coastal Erosion	• Coastal management professionals' perceptions of community awareness; • General coastal user/accommodation businesses understanding of coastal erosion; • Perceptions of rate of change and impact.
5.11 Coastal Management	• General coastal users' confidence in local Council; • Satisfaction levels of actions taken to manage erosion and inundation; • Accommodation business respondent's; satisfaction of coastal protection initiatives; • perceptions of which management strategies (soft/hard/retreat) are best for each hazard.
5.12 Who Wants to Live in a Beachfront Property?	• Qualitative answers to '*would you buy and live in this house?*' and '*how would you protect your property*'; • Perceptions of the risks of living in waterfront properties.
5.13 Who Should Pay for the Damage from Coastal Erosion and Inundation?	• GCUs and CABs perceptions of who should pay for damages.
5.14 Community Engagement	• Mediums previously used by coastal management professionals (CMP); • 'Best' mediums perceived by CMPs; • Mediums general coastal users (GCU) have seen; • Mediums GCU prefer; • Mediums accommodation businesses provide.
5.15 What Do People Need to Know?	• CMP - information the community needs; • GCU preferences of information they would like.
6.Reference List	• List of other works referred to in this report.

2. Introduction

In June 2016, large storm waves and inundation associated with an East Coast Low cyclonic system caused extreme beach erosion and significant infrastructure damage along many parts of the New South Wales (NSW) coast (Hannam & Kembrey, 2016). Media reports of the event, particularly at Collaroy/Narrabeen beach in Sydney, captured affected homeowners casting blame on coastal Councils for not having prepared the coastline (or them) for the damage that ultimately occurred (Houghton, 2016). Yet these homeowners chose to live in a location in close proximity to an ocean beach that was well established as being a coastal erosion hotspot (Smith & O'Rourke, 2002; OEH, 2011). Immediate attention on the impacts of such extreme storm events often tends to involve blame and who is at fault. After an event, the focus then shifts to the economic impact and damage the storms have caused (SMH, 1974a;b; O'Rourke, 2015; Patterson & Swain, 2016; Houghton, 2016). This generally leads to questions of '*who pays for the damage*', '*why weren't we prepared?*' and '*who is responsible for preventing this type of damage in the future*?'. These questions are particularly relevant for coastal Councils (as primary caretakers of the coastal environment) as more often than not, the expectations regarding the hazards, preventative actions and adaptation strategies vary considerably among their constituents.

What the public knows and thinks about coastal hazards has a range of implications for coastal management adaptation efforts (Morgan, 1997; Thomsen *et al.* 2009; Fairfull *et al.* 2014). In particular, the way in which the public perceives the associated risks of these hazards, and how these risks will affect their personal values, identity and social space, can significantly influence the way in which they may engage in adaptation actions (Grant *et al.* 2015), often determining the success, or failure, of these actions (Leitch & Inman, 2012). Knowledge of this type of public perception is therefore of significant interest to those involved in managing the coast from coastal hazards, such as coastal Councils. While there is an abundance of literature that analyses natural disaster risk perception (Kates, 1962; Slovic, 2000a;b; NOAA, 2016a), climate change risk perception (Eden, 1996; Buckley, 2008; Barnett *et al.* 2013; Akerlof *et al.* 2016; Buckley *et al.* 2017) and perceptions of adaptation efforts (Barnett *et al.* 2013), few studies have specifically investigated how the public understand coastal hazards such as coastal erosion and inundation, and their associated risks, both temporally and spatially, within New South Wales (Bulkeley, 2000; Fairfull *et al.* 2014).

2.1 Aims and Objectives

The primary aims of this report are to explore how NSW coastal communities: i) understand the hazards of coastal erosion and coastal inundation, particularly in relation to how they may be exacerbated by climate change, coastal storms and sea level rise; and ii) perceive various management options available to adapt to and mitigate the impacts of these hazards. A particular objective of the report is to compare existing community understanding with scientific understanding of the projected impacts of climate change on coastal hazards, risk, and risk management and to compare understanding and opinions of the community with those directly involved in coastal management decision making. By highlighting areas of commonality and differences, this report aims to identify knowledge gaps that will assist future community engagement and communication efforts to better educate NSW coastal communities about these coastal hazards. It is hoped that these collective efforts will help improve the resiliency and preparedness of NSW coastal communities and assist coastal management decision makers in creating successful adaptation schemes for the future sustainability of the NSW coast.

2.2 Location of Study

This project was conducted between April 2017 and December 2018 with surveys distributed both online and face to face across the NSW coastal region (Figure 2.1). For a full list of survey sites and response rates, see *Research Design and Methods* (Section 4).

a) **b)**

Figure 2.1 a) Australia with Sydney identified with blue circle; **b)** The NSW coast divided into four regions; South East, Greater Sydney, Hunter, North Coast (NSW Local Land Services, 2018).

3. Background

An abundance of literature exists about the projected impacts and possible solutions related to sea level rise, coastal erosion and coastal inundation on the NSW coast. However, very little attention has focussed on how the public understands these hazards and how they perceive they will affect their future use of their coast. Here we provide a review of various literature related to these coastal hazards and their management solutions with an emphasis on highlighting knowledge gaps related to public understanding.

3.1 Coastal hazards, solutions and people

Many studies have been conducted, both internationally and within Australia, to describe various scenarios of sea level rise (DCCEE 2009; Leitch & Inman, 2012; O'Donnell & Gates, 2013; Church *et al.* 2016) and how this will exacerbate corresponding coastal hazards, such as coastal erosion and inundation (Mulrennan & Woodroffe, 1998; Tomlinson, 2001; Watson, 2001; Church & White 2006; Aboudha & Woodroffe, 2006; Ablain *et al.* 2009; Leitch & Inman, 2012; Graham *et al.* 2013; Church *et al.* 2016). Other areas of academia have attempted to define how to plan for the future impacts of these hazards, and the pros and cons of management solutions such as the construction of seawalls (Kraus, 1988; Pilkey & Wright III, 1988; US Army Corps of Engineers, 1991; Hume & Blackett, 2007; Friesinger & Bernatchez, 2010; SCCG, 2013b; Betzold & Mohamed, 2016), groynes (Phillips *et al.* 2005; Brown *et al.* 2016), beach nourishment (Lord *et al.* 1995; Thom, 2003; Cameron & Corbett, 2005; Withycombe *et al.* 2009; Nielsen *et al.* 2011; Watson, 2011; Cooke *et al.* 2012; Kirkpatrick 2012; Dhakal *et al.* 2015; Blumberg, 2017), dune restoration (De Lillis *et al.* 2004; Rozé & Lemauviel, 2004; Gómez-Pina *et al.* 2002; Beardsmore *et al.* 2014; Khan 2015) or retreat (Thom, 2003; Helman *et al.* 2007; Ryan *et al.* 2011; Leitch 2009; Alexander *et al.* 2011; Svikis & Lofthouse, 2011).

Many coastal areas in NSW are already experiencing damaging effects of coastal erosion and coastal inundation and many of the above measures are already implemented, or being trialled, at various locations. For example, seawalls along Collaroy/Narrabeen beach have been implemented to reduce coastal erosion, along with ongoing dune management and periodic episodes of beach nourishment in the form of sand replacement from the entrance of Narrabeen Lagoon (Northern Beaches Council, 2016; 2017). After the June 2016 storm event, there has been a call to implement further and more robust seawalls along this coast by many local residents, with Northern Beaches Council granting approval in late 2017 (Houghton, 2016; Patterson & Swain, 2016; Patterson, 2018).

Areas such as Collaroy/Narrabeen are particularly exposed and differentially vulnerable to coastal hazards. As part of the reforms to coastal management, culminating in the NSW *Coastal Management Act 2016*, a new definition of coastal zone was established. One of the specific coastal management areas that make up the new coastal zone is the *'coastal vulnerability area'* (OEH, 2017a). When mapped, a coastal vulnerability area, as defined in the *Coastal Management Act 2016 (*NSW), will encompass coastal areas at risk from coastal hazards, taking into account specific coastal hazard studies conducted by various NSW coastal councils. In addition, 15 coastal erosion 'hot spots' have been identified by the Office of Environment and Heritage (formerly the Department of Environment Climate Change and Water) (Table 3.1; OEH, 2011) as legacy risk areas that are required to have coastal erosion emergency action plans prepared. These locations have been defined as areas where five or more houses and/or a public road are located in a current (or immediate) coastal hazard area, as identified in a coastal hazard study. There are also other locations along the coastline where either a smaller number of houses, or only residential land (i.e. no houses), are in a coastal hazard area (OEH, 2011; Kinsela & Hanslow, 2013).

Table 3.1 Erosion hotspots adapted from OEH (2011).

Local NSW Council area	Erosion Hotspot Locations
Byron Shire Council	Belongil Beach
Ballina Shire Council	Lennox Head
Clarence Valley Council	Brooms Head Wooli Beach
Port Macquarie-Hastings Council	Lake Cathie
Mid Coast Council	Old Bar Beach Winda Woppa - Jimmys Beach
Central Coast Council	The Entrance North Noraville Beach Norah Head Wamberal/Terrigal Beach
Northern Beaches Council	Bilgola Beach Mona Vale Beach Collaroy/Narrabeen Beach
Eurobodalla Shire Council	Batemans Bay

While this information is well known to coastal management professionals and is written into NSW State legislation, there is no formal record of what the NSW coastal community understands and perceives about these hazards, hazard 'hot spots' and how erosion and inundation will affect their use of the NSW coast in the foreseeable future.

3.2 Living on the NSW Coast

As of December 2015, NSW's coastal resident population (residents within 50 km of the coast) numbered 7.5 million people (NSW DPE, 2016). Under recent projections, the state of NSW is anticipated to grow from 7.2 million people in 2011 to 9.9 million in 2036, an increase of 2.7 million (Table 3.2; NSW DPE, 2016). This projection also indicates that approximately 63% of the state's population is expected to live in the Sydney region, with 15% of the population estimated to be living in 'other metropolitan' areas (comprised of Lower Hunter, Central Coast and Illawarra regions).

Table 3.2 NSW Government population projections – Sydney and regional 2011-2036 (NSW DPE, 2016).

Region	2011	2016	2021	2026	2031	2036	Growth 2011-2036 (#)	Growth 2011-2036 (%)
Sydney	4,286,350	4,681,800	5,106,450	5,537,800	5,975,700	6,421,950	2,135,650	**49.8%**
Other Metropolitan *	1,153,650	1,220,400	1,286,200	1,350,200	1,411,250	1,468,950	315,300	**27.3%**
Regional NSW	1,778,550	1,845,000	1,904,900	1,956,650	2,000,300	2,034,650	256,300	**14.4%**
NSW TOTAL	7,218,550	7,747,200	8,297,550	8,844,650	9,387,250	9,925,550	2,707,250	**37.5%**

'Other Metropolitan' includes the following Local Government Areas: Central Coast, Lower Hunter (Cessnock, Lake Macquarie, Maitland, Newcastle and Port Stephens) and Illawarra (Kiama, Shellharbour and Wollongong)

Almost 80% of the state's population is projected to live within the Wollongong-Newcastle conurbation by 2036. With such an increase of population, greater numbers of people will utilise the coastal zone, adding extra strain on present infrastructure. The increase in population will also impact the coastal environment in the form of increased public accessibility and human usage, compounded by the stresses of natural hazards, which are predicted to become more frequent and more intense due to the effects of climate change (Smith & Doherty, 2006; Helman *et al.* 2010).

The Intergovernmental Panel for Climate Change (IPCC) proposes two active responses to climate change: mitigation of greenhouse gas emissions to slow or stabilise the warming trajectory, and adaptation to address the effects of a changing climate (IPCC, 2014). Some see mitigation and adaptation as two distinctly separate options but developing and adopting both mitigation and adaptation strategies will be necessary to ensure safe human habitation along the NSW coast in the future (ACECRC, 2008; Maiback *et al.* 2008; Pelling 2011;

Thomsen *et al.* 2012). While mitigation measures are highly unlikely to significantly reduce the risks of sea-level rise and extreme events in the short to medium-term, efforts to adapt sustainably to coastal hazards driven by climate change (such as erosion and inundation) are already the primary policy option for many coastal planners and coastal Council decision-makers (ACECRC, 2008; Leitch & Inman, 2012; Smith *et al.* 2016).

In 2007, the Australian Greenhouse Office (AGO, 2007) published a report outlining the potential impacts of climate change in six areas of local government (Council) responsibility: infrastructure and property services; health services; planning and development approvals; natural resource management; water and sewage services; and recreational facilities (ACECRC, 2008; Productivity Commission, 2012; OEH, 2017c). It was noted that where coastal development is permitted in areas vulnerable to sea-level rise, the coastal Council is likely to have to cover costs, legal liability and possible compensation for previous 'legacy' decisions that allowed developments to go ahead (AGO, 2007; ACECRC, 2008, Productivity Commission, 2012). These legacies of inappropriate coastal development continue to pose a significant problem for NSW coastal Councils, and closely align with the State's 15 identified coastal erosion 'hotspot' areas (Table 3.1).

With predicted growth in the NSW population, combined with 'legacy' decisions and the predicted implications of climate change, there is an urgent need to prepare the NSW coastal community to changes in the way they use their coast. In doing so, it is imperative to gain an understanding about what the coastal community knows and perceives about these hazards in order to communicate adaptation strategies clearly and effectively.

3.3 Legislative actions to accommodate climate change

In an effort to accommodate both demographic pressures and a changing coastal environment, the NSW Government recently passed the Coastal Management Act (2016). This replaces the Coastal Protection Act (1979) and seeks to make more effective linkages between land use planning, environmental considerations and coastal Council decision-making. The new legislation has incorporated objectives to conserve and enhance the scenic, social and cultural values of the NSW coastal zone while supporting sustainable coastal economies and ecologically sustainable development (OEH, 2017a). The NSW coastal zone is divided into four coastal management areas each with a specific focus: (1) coastal wetlands and littoral rainforest area; (2) coastal vulnerability area; (3) coastal use area; and (4) coastal environment area. The new Act establishes management objectives for each coastal management area to ensure coastal Councils apply appropriate management tools and development controls (OEH, 2017a). Of particular note, in the new Act is a focus on social and

cultural values, maintaining access to amenities and considering potential climate change induced impacts in land use planning.

Under the new Act, the Coastal Management State Environmental Planning Policy (the Coastal SEPP) acknowledges the dynamic nature of coastal environments and requires this to be taken into consideration in any future planning within the coastal zone. The new legislation provides a framework for reflecting the needs and values of NSW coastal communities and allows for public involvement in decision-making (OEH, 2017a; OEH 2017b). As with existing policy, this is achieved by undertaking 'community engagement' activities, the concept of which is widely accepted as underpinning successful climate change adaptation efforts (Morgan, 1997; Leitch & Inman, 2012; Barnett *et al.* 2013; Hine *et al.* 2013; Smith *et al.* 2016), land use planning and acceptable natural resource management decisions globally.

3.4 Community engagement

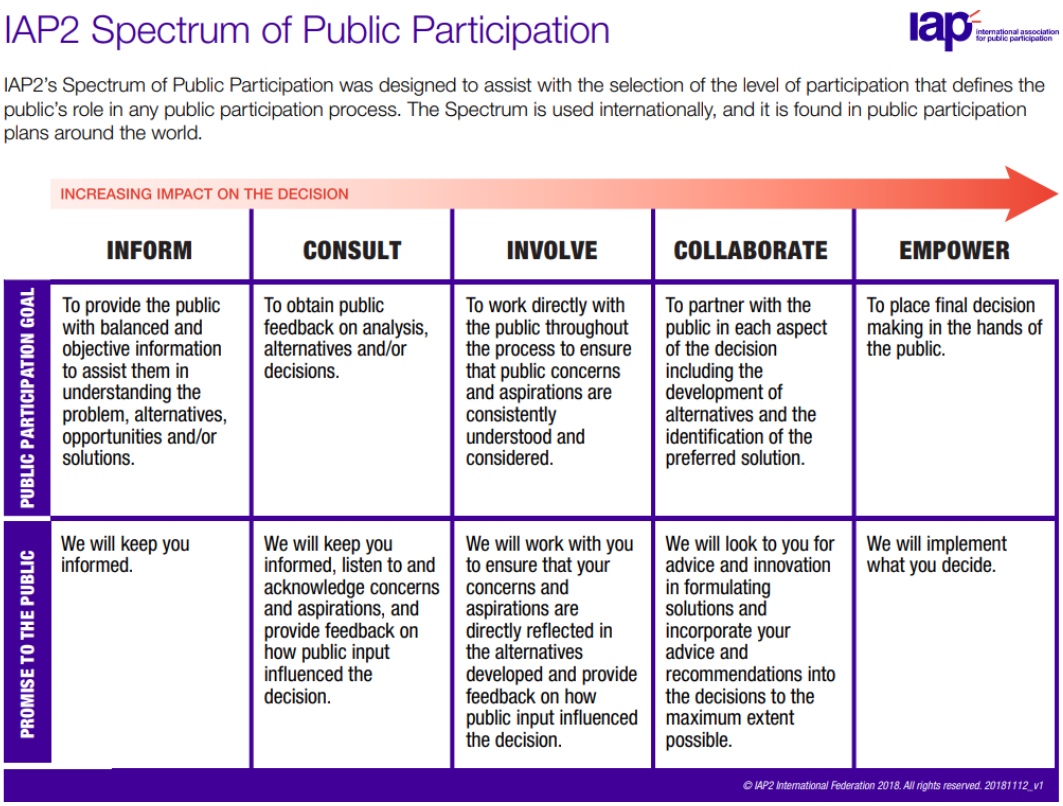
Community engagement is defined by the Australian Centre for Excellence in Local Government (ACELG) as;

> *'a two- way process of dialogue by which the aspirations, concerns, needs and values of the community are incorporated into policy development, planning, decision-making, service delivery and assessment'* (Smith *et al.* 2016).

Community engagement is a fundamental component of successful policy implementation and is undertaken by state and local governments in NSW across a broad range of topics. In terms of coastal management, there is not one definitive process of stakeholder engagement utilised by all Councils, but rather guidelines of various techniques that can be implemented (NSW OLG, 2002; Smith *et al.* 2016; Leitch 2017; NSW Adapt, 2018).

Of note, the National Climate Change Adaptation Research Facility (NCCARF) has launched a template for effective community engagement including skeleton structures, case studies, informative YouTube videos and an Information Manual (Smith *et al.* 2016). It provides decision makers with tools to conduct meaningful and successful community engagement actions, as well as highlighting areas of difficulties and ways to navigate through a 'wicked problem' (APS, 2012; see Section 3.6). The IAP2's Public Participation Spectrum can be found in almost all community engagement manuals relating to coastal hazards (Figure 3.1). The spectrum illustrates the level of public participation with corresponding goals and promises to the public. It shows that a higher level of community participation can increase the capacity for conflict resolution, innovation and problem solving. However, it is important to match the issue with the right level of engagement; not every issue will require 'collaboration' or 'empowerment' (Smith *et al.* 2016). The theory behind community engagement in natural

resources management suggests that by involving stakeholders in decision-making, decision makers are better able to make more informed decisions with stronger public support (Buckeley, 2000; Serrao-Neumann *et al.* 2015; NOAA, 2016b).



IAP2 Spectrum of Public Participation

IAP2's Spectrum of Public Participation was designed to assist with the selection of the level of participation that defines the public's role in any public participation process. The Spectrum is used internationally, and it is found in public participation plans around the world.

INCREASING IMPACT ON THE DECISION

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

Figure 3.1 International Association for Public Participation (IAP2) Public Participation Spectrum (2018).

Barnett *et al.* (2013) discussed barriers to climate change adaptation, as identified by a variety of community stakeholders. Their findings highlighted that most of the barriers identified revolved around the inability to comprehend climate science and the relative risk of impacts, as well as feelings of fear and apathy through uncertainty, and the tendency for short-term thinking rather than long-term, strategic planning. This suggests that initial confusion regarding the science of coastal hazards may lead to a skewed perception of the eventual risks.

As promoted in the Information Deficit Model (Bulkeley, 2000), ignorance is often seen as a barrier to effective public involvement in policy processes. However, studies by Eden (1996), Leiserowitz (2005) and Luis *et al*. (2016) point to socio-cultural factors as the key frames for risk perception. Lorenzoni *et al.* (2007) discussed the limitations of public participation that focuses on providing scientifically sound information but ignores the potential subjectivism of public interpretation (Serrao-Neumann *et al.* 2015). In light of this, there is a need to move from the idea of just providing people with information in order to create behavioural change, but rather recognise that public understanding is complex, fluid and often contradictory in nature and that it is buoyed by social relations and lived experience (Leitch & Inman, 2012), and founded upon lived values (Graham *et al.* 2013).

Community engagement needs to be a two-way exchange of information, between policy or decision makers, and the public (Eden, 1996; Leitch & Inman, 2012; Smith *et al.* 2016). However, in practice, evidence suggests that in many contexts engagement remains driven by external agencies, with pre-formulated agendas so that the results of a two-way communication engagement, representing a successful learning partnership, is the exception rather than the norm (Meppem, 2000; Smith *et al.* 2005; Thompson *et al*. 2009). This line of reasoning strengthens the need to adequately understand how much different communities know about coastal hazards and associated risks and will provide critical insights into how risk communication efforts can be tailored appropriately (Tofa & Gissing, 2017).

3.5 Community engagement and the 'coastal community'

Many NSW coastal Councils undertake a variety of community engagement practices. However, often the public they engage with are either people directly exposed to coastal hazards or members of the community who are actively concerned about the future of their coast (Barnett *et al.* 2014; Smith *et al.* 2016). As a result, a consistent problem has arisen in coastal management; '*how to engage the wider community*?' (Thomsen *et al.* 2009). It must be noted that one, homogenous 'wider community' does not exist. Rather, multiple communities that overlap and are constantly changing make up specific groups, tribes or what we will call 'coastal communities'. Two umbrella categories are commonly used to describe communities: communities of place (e.g. residents) and communities of interest (e.g. tourists, shareholders of companies etc.; Thomsen *et al.* 2009). However, the real challenge in defining coastal communities is considering how each type of community impacts and interacts with the coastal environment and how this may change both temporally and spatially (Thomsen *et al.* 2009).

Engaging with a community defined by their residential proximity to hazardous coasts, or with an active concern about the coast, produces significant difficulties for holistic engagement. It may be that a considerable number of people with an interest in the coast (a community of interest) may reside outside that narrow area (or even that local government area), perhaps only having a short-term or passing interest in the area, such as holiday home owners, caravan park users, tourists etc. (Thomsen *et al*. 2009) – but still a valid interest. Also, there may be members of a community that don't have an active concern in the present, but may do in the future. Additionally, the person or entity framing the issue to be addressed often does not consider themselves to be part of the community, effectively externalising the issue and distancing themselves from the 'community' (Thomsen *et al.* 2009; NOAA, 2016b; 2017). This method perpetuates a top-down public engagement approach and emphasises the hierarchy of knowledge with scientific understanding given pre-eminence.

3.6 The issues with community engagement and 'wicked problems'

As noted in Section 3.4, it is critical to the eventual success of an adaptation effort for Governments to effectively engage a broad range of stakeholders when making decisions that will affect the whole community, not just those directly affected (Smith *et al.* 2016). While some stakeholders will come with a deep understanding of specific aspects of an issue, it is unlikely that anyone will have a thorough understanding of the overall issue, taking into consideration the needs and wants of all other stakeholders (NOAA, 2016b), including scientists, coastal management professionals and decision makers. An ambiguity of knowledge among different stakeholders, underlying complexity around problem definition and uncertainty of impact make adapting to coastal risks a truly 'wicked problem' or risk conundrum (Kasperson *et al*. 2017).

A wicked problem, as described by Rittel and Webber (1973), is;

> *'…a complex, interacting issue that is not easy to define, has no clear solution and involves many stakeholders with conflicting interests and opinions. How a wicked problem is understood will frame any potential solution, which means that tackling a wicked problem is essentially a social process.'*

As already stated, the complexities of sea level rise, its' influence on coastal hazards, the complexity of impacts, a wide array of perspectives and values, and an uncertain timeframe provides a prime example of a wicked problem. It is important to engage coastal communities in the initial scoping of the problem, to develop a shared understanding of the issue and in turn, find a solution that meets in expectations of the differing stakeholders (Serrao-Neumann *et al.* 2015; Smith *et al.* 2016).

3.7 Identifying public understanding and 'knowledge gaps'

By seeking to elicit community views around coastal hazards and risk, this project is placed firmly within the field of risk communication (Sterman, 2011). One method to improve risk communication, without influencing answers through indications in the question, is based on the 'mental model' approach. This approach takes into account what people might already know about an issue, prior to a formal communication strategy (Morgan *et al.* 2002; Helgeson *et al.* 2012; Bostrom, 2017). People generally have some kind of existing 'mental model', a knowledge structure relevant to the subject (Morgan, 1997) that helps make sense of the problem at hand. Mental models have three major functions: i) to serve as a framework to which people 'filter' new information; ii) define how individuals' approach and solve problems and; iii) help shape actions and behaviours in response to the new information (Helgeson *et al.* 2012). As any new information imparted to them will pass through and be filtered by this existing 'mental model', it is crucial to know what those mental models are before designing a

communication campaign (Morgan, 1997; Morgan *et al.* 2002; Sterman, 2008; Bostrom, 2017).

In conjunction with this model, Eden (1996) challenged the notion that public confusion arises from a deficit in public knowledge and understanding of environmental issue which needs to be filled by expert knowledge' – also known as the 'deficit model'. Eden (1996) suggests an alternative framework, where public understanding is tied to larger questions of the relations between society and nature; public understandings are not just based on scientific information, but also local knowledge, values and moral responsibilities for the future (Eden, 1996). This suggests that a lack of information may not necessarily be the most significant barrier to public understanding, but rather the way that information is formed, presented and, in turn, interpreted (Eden, 1996).

Although not directly investigating public understanding of coastal hazards, Bulkeley (2000) conducted a study that aimed to assess public understanding of climate change in Newcastle, NSW, Australia. She found that there was confusion over some key 'climate change' messages. While a majority of survey respondents felt that climate change was '*happening now and would continue to do so in the future*', 35% of the surveyed participants agreed with the statement '*global warming is caused by a hole in the atmosphere*', which was concurrent with market research findings at the time (Bulkeley, 2000). Bulkeley noted that this confusion shouldn't necessarily be interpreted as a misunderstanding of an issue, but rather as a different understanding of it, in which multiple scientifically defined issues are seen as part of the same problem (Bulkeley, 2000). In terms of personal understanding of information about climate change, respondents expressed doubt and scepticism about the climate change knowledge they had received, but they also recognised their dependence on expert knowledge and placed faith in science and education as the most reliable sources of information (Bulkeley, 2000). Although this study investigated public understanding of climate change concepts, it showed a clear disconnect between understanding of an overall concept and the workings behind it, which may be applied to public understanding of coastal hazards.

The Barnett *et al.* (2013) study touched upon people's understandings of coastal adaptation initiatives, but focussed on public perceptions of adaptation options. It was noted that there is some confusion in understanding terminology and the processes of certain coastal hazards. For example, the term '1-in-100 year flood' is particularly misleading. Rather than representing a flood that will happen once within 100 years, it represents a statistical average: a particular level of flooding has a 1% chance of happening in any given year. Extreme flood events may occur more frequently within 100 years, and the term is often a source of confusion rather than explanation (Barnett *et al.* 2013).

Barnett *et al*. (2013) also noted that many of the study's respondents mentioned a '*gap in information*' as a barrier to adaptation to sea level rise. Local government responders highlighted a lack of information tailored to local contexts and all respondent groups indicated a lack of relevant, reliable, consistent and easily comprehensible climate projections, to assist with acceptance to adaption efforts (Barnett *et al.* 2013). Some respondents noted a lack of ability to judge the reliability of information, as information is often available through a myriad of sources, both locally and internationally. In line with these findings, Serrao-Neumann *et al.* (2015) identified three critical factors that can influence public participation as: i) technocratic approach to decision making; ii) absent high order government support and; iii) a lack of evaluation methods for public participation.

Further abroad, Buckley *et al.* (2017) conducted an international study of 10,000 European citizens to establish levels of awareness, concern about and trust regarding impacts of climate change to the marine environment. The study found that citizens of different countries exhibited varying levels of 'informedness' and concern, with respondents who lived in coastal areas claiming to be more informed and more concerned than respondents who lived further inland (Buckley *et al.* 2017). This study is particularly relevant as it also assessed the level of trust respondents have in sources of information, such as news media, professional scientists or policy makers. As public engagement is key to successful adaptation to the impacts of climate change, the use of a variety of communication mediums that reach different demographic groups may be necessary (Buckley *et al.* 2017). By noting which information sources different demographics trust, communication and engagement efforts can be better tailored for specific social groups.

An Australia-wide exploratory survey by Ryan *et al.* (2011) further examined the issue of public misperceptions; interviews with sea level rise rejectionists revealed an inherent distrust of *'[the] CSIRO or the government to be honest in matters of climate change*', with respondents believing in a degree of '*deliberate fraud*' or other scheme designed to *'[waste] taxpayers money'*. This indicates a clear resistance to publicly available (and generally accepted) information, or a mental model that rejects new, contradictory information.

3.8 Key knowledge gaps

While there is literature available which measures public perceptions of coastal adaptation options (Barnett *et al.* 2013) and understanding(s) of climate change (Bulkeley 2000; Ryan *et al.* 2011; Moser and Dilling, 2011; Buckley *et al*. 2017), to date, there have been no studies in NSW that seek to define coastal communities' understanding of coastal erosion, coastal inundation and how these hazards interact with severe coastal storms and rising sea levels. This suggests that past community engagement efforts relating to these specific hazards may have been flawed from the start, as the information communicated may not have been the same information received. By assessing the 'mental models', or differing understandings of coastal hazards, of NSW Coastal Communities, this study aims to provide information about differences and 'gaps' in community knowledge, which can be used to help NSW coastal management professionals to better prepare NSW coastal users to adapt to coastal changes influenced by climate change.

4. Research Design and Methods

This project progressed over six key research stages (Figure 4.1), each integral to the final outcomes and products created: this final report and the online resources at www.bees.unsw.edu.au/nsw-my-coast-study.

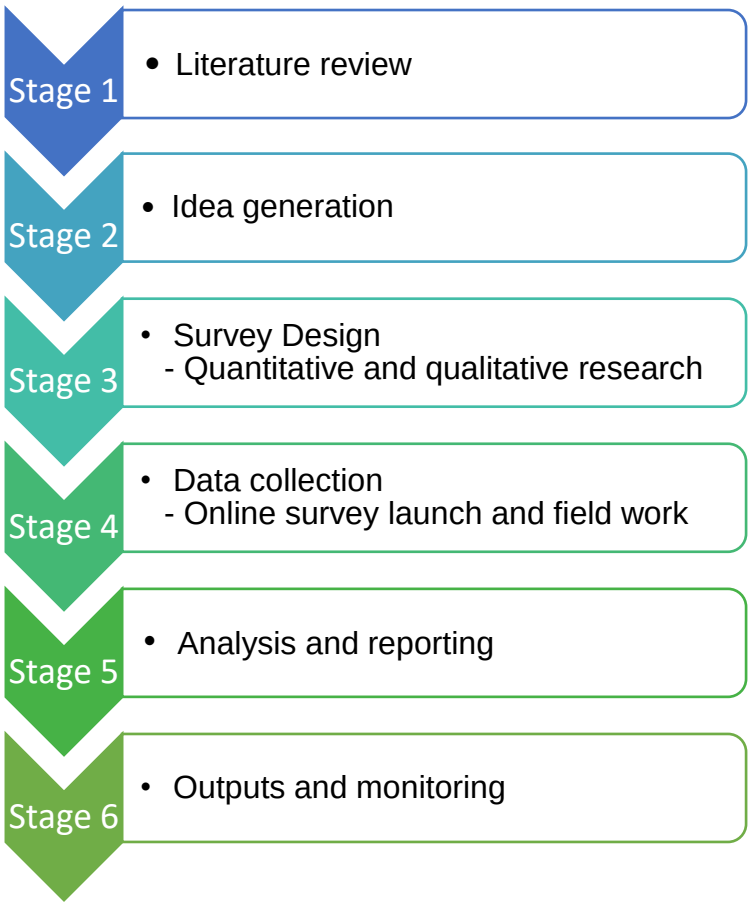


Figure 4.1 Flow chart illustrating the main stages of the project.

4.1 Stage 1: Literature review

A literature review was conducted between May and August 2017 to help define knowledge gaps and the scope of this study. Topics explored included: coastal geography of New South Wales; projected demographic changes in NSW; social and economic value of the NSW coast; current legislation and adaptation strategies in NSW; projected impacts of climate change and subsequent hazards; risk perception of natural hazards; public understanding of coastal erosion, inundation and climate change; community engagement and exploring the differences between understanding, knowledge and perception. These are summarised in Chapter 3.

4.2 Stage 2: Idea generation

Upon completion of the literature review, it became apparent there were a vast number of possibilities in terms of direction that this study could take and there were several ways that the research questions could be addressed. Consultation with the Steering Committee made up of representatives from UNSW Sydney, local Council bodies (Sydney Coastal Councils Group, Sydney Northern Beaches Council), State Government (Office of Environment and Heritage) and community groups (Surf Life Saving NSW) highlighted the different expectations of end users and possibilities to generate useful output materials, as well as generating discussion regarding the best way to address the research questions. The *idea generation* stage of the research design was vital, as it ensured that the expectations of end users was taken into consideration in the survey design.

4.3 Stage 3: Survey design

4.3.1 Survey groups

To answer the research questions and follow the recommendations of the Steering Committee, a decision was made to target three distinct groups within NSW to be surveyed:

Survey Group 1: Coastal Management Professionals (CMPs) – this group consists of those working in a coastal related field (in government, consulting, academia etc.) and provided an opportunity to explore 'expert' opinions related to coastal hazards and management as well as their perceptions of the knowledge of their coastal communities to coastal hazards and management.

Survey Group 2: General Coastal Users (GCUs) – this group consisted of 6 different sub-groups (Table 4.1), each representing a different 'coastal community' to allow for a broad range of knowledge, perspectives and opinions about coastal erosion and inundation from different coastal users.

Survey Group 3: Coastal Accommodation Businesses (CABs) – this group consisted of those working in coastal tourist accommodations situated close to coastal waters that derived their business largely from their coastal location. These respondents ranged from owners, managers to full time employees and casual staff and encompassed different accommodation types such as caravan parks, coastal tourist parks and motels. This group provided an opportunity to assess the understanding, needs and expectations of businesses in relation to coastal erosion and inundation.

Table 4.1 Rationale for selection of the six General Coastal User sub-groups (communities).

Survey Group	Rationale
Teachers (Primary and High school)	• Varying levels of interaction with the coast • Highly accessible • Demographically diverse
Surf Life Savers	• High level of interaction with the coast • Highly accessible • Demographically diverse
Coastal Tourists	• Varying levels of interaction with the coast • Accessible • Demographically diverse
Coastal Council Employees	• Varying perspectives of value of the NSW coast • Highly accessible • Directly linked to management of coastal areas
Coastal Indigenous Communities	• Varying levels of interaction with the coast • Represent the Indigenous members of the NSW coastal community
Coastal Hazard 'Frontline' Residents	• High level of interaction with the coast • Vested interest in the management of the NSW coast

4.3.2 Survey Structure

Each of the three primary survey groups were administered surveys that differed somewhat in design but maintained core questions that were similar across the surveys for comparison purposes. The Coastal Management Professional (CMP) survey consisted of 20 questions involving a mixture of tick box, Likert scale and short open-ended questions (Appendix A1). The General Coastal User (GCU) survey was longer, consisting of 38 generic questions, also of mixed type that were organised into four thematic sections (Table 4.2). The generic GCU survey was administered to each of the 6 sub-groups (Table 4.1) with an initial section of tailored questions added to gain tailored insight into the perceptions, coastal usage and understandings pertaining to each particular group (Appendix A2). The Coastal Accommodation Business (CAB) survey consisted of the same generic survey questions as the GCU survey, but questions were addressed in terms of how the hazards affected the business rather than the individual. The CAB survey consisted of 42 questions of mixed tick box, open ended and Likert scale style questions (Appendix A3).

Table 4.2 Generic survey questions presented to the General Coastal User (GCU) and Coastal Accommodation (CAB) groups by thematic section, example questions and objectives. Full versions of all surveys used in the study can be found in the Appendices on the My Coast Study website; at www.bees.unsw.edu.au/nsw-my-coast-study.

Thematic Section	Example Questions	Objectives
Your coast	'*Approximately how far do you live from the coast?*' *'In a typical year, how often do you spend time at the coast?'* *'What do you think is the biggest threat to your future use of your coast?'*	Segmentation for analysis through: • Age • Gender • Geographic variables • Coastal usage
Hazards and climate	*'Which statement best describes what you think about climate change and sea level rise?'* *'In NSW, which type of coast do you think is most susceptible to damage caused by coastal erosion/coastal inundation*' *'How often do you think damaging coastal storms occur?'*	Assess understanding/ and perceptions of coastal hazards: • Temporal • Spatial • Magnitude • Frequency • Impact
Coastal Management	*'Which coastal management options do you think are the best way to manage damage caused by coastal inundation/coastal erosion?'* *'Do you think enough action is currently being taken to manage the effects of coastal inundation/erosion at your most visited coast?'*	Gain understanding of public perceptions of: • Solutions (protect, accommodate, adapt) • Acceptability • Measure expectations
Hazard / risk communication	*'Where have you previously received information about coastal erosion/ inundation?'* *'How much do you trust the following sources of information'* *'Of the following, which topics would you like to know more about?'*	Defining accepted sources of information and level of trust

4.4 Stage 4: Data dissemination and collection

A range of dissemination techniques for the different surveys were utilised during the study as outlined in Table 4.3.

Coastal Management Professionals (CMPs): Data collection commenced on the 7th of November 2017, at the NSW Coastal Conference in Port Stephens where a hardcopy version of the survey was distributed to all attendees in the conference pack. A reminder to complete the survey and a link to an online version of the survey was sent out in a post conference email (15th November 2017).

Table 4.3 Distribution timeline of surveys by group and distribution method.

Surveyed Group	Distribution Method	Dates
1. Coastal Management Professionals (CMPs)	Online; direct email	07/01/17 – 01/01/18
2. General Coastal Users (GCUs)		
Teachers	Online; direct email to schools and social media	15/11/17 – 31/01/18
Surf Life Saving Club members	Online; direct email to clubs and social media	21/11/17 – 20/04/18
Coastal tourists (Table 1.3)	Face to face, hardcopy	07/01/18 – 15/04/18
Coastal Indigenous groups	Online; social media	15/03/18 – 14/06/18
Coastal Council employees	Online, direct email mail out	15/03/18 – 30/04/18
Coastal hazard 'Frontline' residents	Mail drop; Narrabeen and Kingscliff	26/03/18 – 18/06/18
3. Coastal Accommodation Businesses (CABs)	Face to face, hardcopy Online; direct email to accommodation businesses	07/01/18 – 30/04/18

General Coastal Users (GCUs): As this survey group was comprised of six different sub-groups, the survey distribution was staggered and consisted of both online and hardcopy field work collection dissemination (Table 4.3). Table 4.4 details the geographic locations for the hardcopy dissemination of the 'Coastal Tourists' general coastal user group survey, with a brief rationale of why each location was selected.

Coastal Accommodation Businesses (CABs): Survey distribution to this survey group was launched at the same time as the 'Coastal Tourists' survey and was disseminated in hardcopy form in conjunction with the tourist survey. Due to the poor return of surveys during the initial phase of data collection, a second phase of online direct email targeting caravan parks, campgrounds, hotels, motels and resorts was implemented in March 2018. The contact information for these accommodation businesses was accessed via Google Maps and various websites, such as www.visitnsw.com and www.caravanandcampingnsw.com.au, and collated into a contact database.

Table 4.4 Distribution locations for the 'coastal tourist' sub-group of the General Coastal Users (GCUs) with brief rationale of choice of targeted location.

NSW Region	Accommodation Locations	Rationale
Far North Coast	Lennox Head Belongil Pottsville Kingscliff Tweed Heads	Highly populated coast Less populated coast Ocean beaches Estuaries Erosion hotspot
Mid-North Coast	Forster Hawks Nest Smiths Lake Blueys Beach Nambucca Heads	Highly populated Ocean beaches Estuaries Erosion hotspot
Central Coast/Sydney	Terrigal Beach Narrabeen The Basin	Highly populated Ocean beaches Estuaries Erosion hotspot National Park Council/private parks
South Coast	Shellharbour Sussex Inlet Swan Lake Gerroa/Gerringong Batemans Bay/Batehaven Kiama Jervis Bay (Greenpatch) Ulladulla	Highly populated Less populated Ocean beaches Estuaries Erosion hotspot National Park Council/private parks

4.5 Stage 5: Analysis and reporting

Data cleaning and analysis commenced in April 2018. Data cleaning was done using Microsoft Excel and involved removing partially completed surveys, with the minimum requirement to have answered Sections 1, 2 and 3 for both the GCU and CAB surveys (Appendices A1, A2 and A3). The CMP surveys were sorted by completion rate, with a minimum requirement of 16 of the 20 questions as the long answer responses were optional. The data was then divided into sections, coded and analysed within each of the three focus group sets. Given the overall number of survey groups and sub-groups, it was a lengthy process to ensure that data was collated correctly. Table 4.5 details final survey collection counts for each group both pre- and post-cleaning. Qualitative, long answer data was manually coded by content analysis and answers were collated and presented in themes (Bryman, 2012). Once survey data cleaning was completed, 'quick look' plots of the three primary survey groups were created using the statistical analysis program 'R'©. This information was presented to the Steering Committee where final decisions regarding presentation of project outputs were made. Each survey is presented in the Appendices found on the My Coast Study website at www.bees.unsw.edu.au/nsw-my-coast-study.

Table 4.5 Summary of surveys received and used in final analysis by survey group and dissemination method. Survey counts are indicated.

	1. Coastal Management Professionals	2. General Coastal Users	3. Coastal Accommodation Businesses
Online	Coastal Conference (n = 71)	• Teachers (n = 449) • SLS members (n = 451) • Coastal Indigenous communities (n = 24) • Coastal Council employees (n = 73)	n = 72
Hardcopy	Coastal Conference (n = 23)	• Coastal tourists (n = 252) • Coastal Frontline residents (n = 27)	n = 4
Total Count Received	n = 94	n= 1276	n = 76
Total Used in Analysis	**n = 62**	**n = 993**	**n = 62**

4.6 Stage 6: Outputs and monitoring

The key outputs of this study can be found on the project website www.bees.unsw.edu.au/nsw-my-coast-study and include the Final Report, Appendices detailing the surveys used in this study, summary Fact Sheets and an educational learning guide for high school teachers. There are also links on the website to an ongoing survey related to the project and a quick survey for evaluating and providing feedback on the project. Within this final report, the 'Fact Files' in Chapter 5 provide information about the focus groups and specific communities and their perceptions of coastal erosion and inundation, understanding of coastal management efforts, and preferences for future engagement. This information can be used for general public information guides, school teaching purposes, and guidance for local Council community engagement plans.

4.7 Challenges to the Study

The design and implementation of this study presented a variety of challenges, largely stemming from the broad scope, both geographically and academically, given its' multi-disciplinary nature. Examination of these challenges may be of use to similar studies in the future.

4.7.1 Defining the 'NSW coastal community'

The original aim of this project was to explore the New South Wales coastal community understanding of coastal erosion and inundation. While the question itself seemed fairly straight forward, actually defining 'the coastal community' proved difficult. The coastal

community is not simply people who live within a certain distance of the coast, but rather encompasses a large number of communities of place and communities of interest, made up of people who utilise the coastal zone in different ways, both temporally and spatially (see Section 3.5). As it was logistically impossible to survey every community along the NSW coastline, a selection of different communities of place and of interest were ultimately chosen that collectively would represent a broad range of NSW coastal users (Table 4.1).

In this way, we were also able to gather information from coastal users who may not otherwise had their opinions and perceptions recorded. By changing from a geographic focus to one of usage and values-based factors, we were able to maintain a NSW-wide spread using discrete and representative samples. Of note, the selection process was conducted through considerable discussion with the project Steering Committee, experts in the field (both coastal and social science based), academics and members of the public.

However, the focus on usage and value-based factors did not address the issue of the vast geomorphological variation along the NSW coast. Different experiences of respondents based on which part and physical environment of the NSW coastline they most frequently visit, and how often they visit, would ultimately influence the way they perceive threats to their coastal usage and the appropriateness of various coastal management strategies. For example, a respondent from Collaroy/Narrabeen may think implementing a seawall is the best way to reduce erosion based on their local experience, while a respondent from Batemans Bay may think beach nourishment is more effective. Both may be right, as these issues are often location specific and influenced by a range of factors. In order to address this issue, a number of open-ended questions in the survey allowed respondents to provide answers for a specific location or situation, in order to gauge their understanding of the hazards themselves and appropriate coastal management options.

4.7.2 Study scope - spanning several academic disciplines

In trying to identify public perceptions about coastal erosion and coastal inundation, this study touches upon concepts that are embedded in the psychology of risk perception, the economics of ‘who should pay’ for damage, and the social science of mental models and theories of communication, all under the twin physical umbrellas of climate change and coastal science. In order to gain meaningful insights into community understanding of these coastal hazards, it was not possible to separate the interdisciplinary aspects, but rather the focus was on finding ways to address each aspect without losing data integrity and to fulfil the objectives of the project. This was particularly difficult to do through the medium of survey data collection, specifically in terms of the length and time it would take to complete the survey to ensure a suitable number of responses. Survey length for a study of this nature is therefore a limiting

factor for response rate and number of completions and should not be underestimated in this regard.

4.7.3 Focussing the study and addressing the aims

Ultimately, the main challenge in designing the project and survey(s) was maintaining a strict focus on what this study originally aimed to achieve. There are multiple avenues that could have been explored under the broad title of this project. However, the above challenges added a layer of logistical difficulty that impacted on the timeline of the project, which in turn stretched resources – designing, disseminating and analysing multiple survey data takes a considerable time investment.

5. Fact Files

The key findings of this study have been grouped into a total of 15 'Fact Files' that provide snapshots of key elements of the study. The purpose of structuring the findings this way is to allow different users of the report to access information that is of specific interest, or use, to them. The Fact Files have been divided into 3 sections: i) Focus Groups – which provides an overview of the findings in regards to the target groups of our surveys; ii) Coastal Hazards – which provides information based on elements of the study specifically in relation to community knowledge of coastal hazards; and iii) Coastal Management – which provides information based on elements of the study relating to community knowledge of coastal management actions associated with these coastal hazards

Focus Groups

This project examined the perceptions, understandings and opinions of different members of New South Wales (NSW) ‘coastal communities’. Three primary focus groups were chosen for this study and are referred to as Coastal Management Professionals (CMPs), General Coastal Users (GCUs), which is made up of 6 sub-groups (Table 4.1), and Coastal Accommodation Businesses (CABs). The following Fact Files provide details of each focus group including who is represented within each group, how they use the coast and what they perceive are the biggest threats to their future use of the NSW coastal environment.

Playground at Freshwater Beach, NSW, July 2018 (Photo by A. Attard).

Fact File 1: Coastal Management Professionals (CMPs)

The Coastal Management Professionals (CMPs) survey was launched at the 2017 New South Wales Coastal Conference in Port Stephens, NSW on the 7th of November 2017. The survey was distributed in the welcome packs for the conference delegates and via a link to the online survey in a post conference email sent to all delegates. The return rate for this survey was 97 in total, with 63 surveys used for final analysis. The survey comprised 20 questions, targeting coastal management professionals about their opinions and perceptions of coastal community understandings of coastal hazards (Appendix A1). The results of this survey provide insights into the differences between understandings and expectations of coastal users, businesses and those who manage the coastal environment in relation to coastal hazards and management.

Who are they?

The CMP respondents represented a cross section of the professional community in terms of gender (males=45%, females=37%, n/a=18%) and age (Figure 5.1a). The survey group comprised a range of coastal professionals from governments, private sector and academic communities working in nationwide, state-wide and regional areas (Figure 5.1b). The majority of this group had been working in the coastal management field for more than 5 years, with 52% having over 10 years' experience (Figure 5.1c).

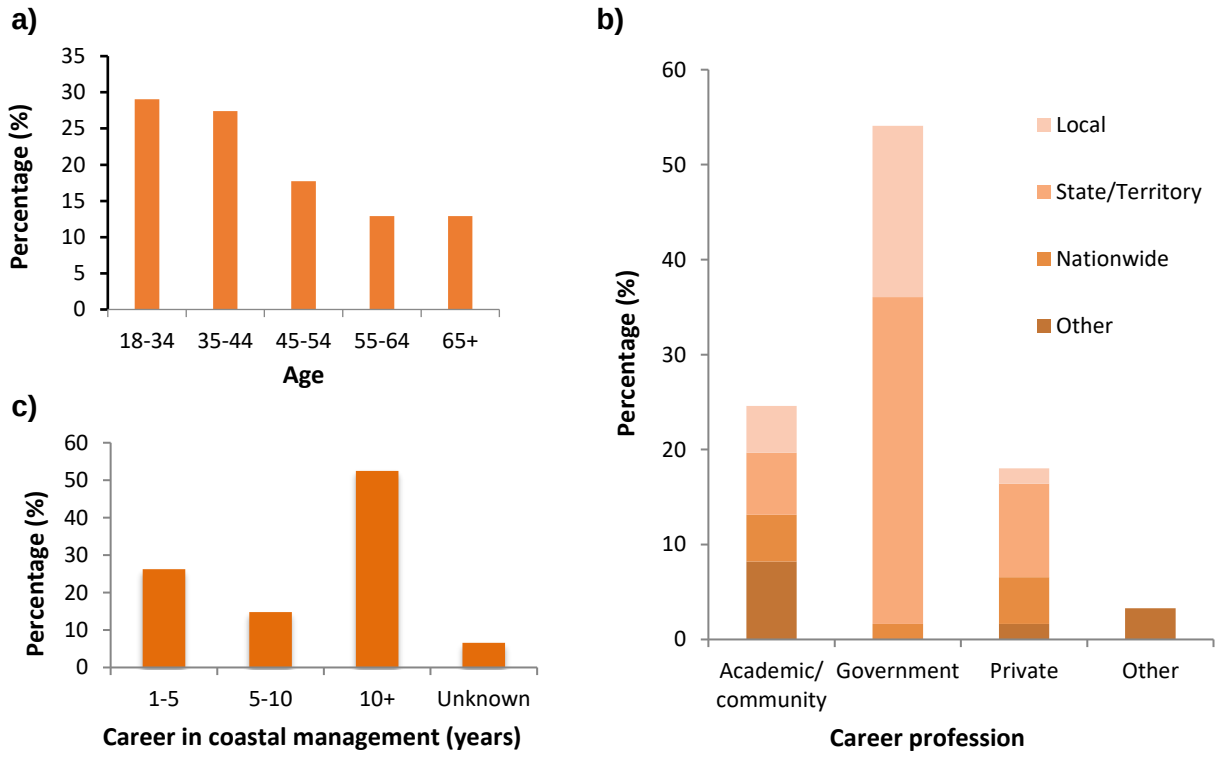


Figure 5.1 A profile summary of the Coastal Management Professionals (CMPs) surveyed in this study: **a)** age distribution; **b)** professions; and **c)** length of career in a coastal related field.

Coastal risk

Most (87%) CMPs indicated that some of the area in which they work is at risk of coastal erosion or coastal inundation. Only 10% did not know if there was an area at risk within the region of their work. When asked to elaborate about the level of risk posed to the coast in which they work, more than half of CMPs indicated it was either 'high' or 'extreme' (Figure 5.2). In conjunction, 70% of CMPs did not think enough priority was given to reducing the risk of coastal inundation and erosion along the NSW coast in general, and 63% thought not enough was given to reducing these risks within their local government area (Box 5.1).

Perceptions

One of the main objectives of this survey was to measure Coastal Management Professionals' assumptions regarding the coastal community's knowledge and perceptions of coastal hazards and risks, or 'mental models'. People generally have some kind of existing mental model; a knowledge structure relevant to the subject in which all new information is filtered through (Morgan, 1997). Because any new information imparted to them will pass through this existing 'mental model', it is crucial to know what that mental model is before designing a communication campaign (Morgan, 1997). Figure 5.3 illustrates what CMPs perceive about public understanding of coastal storms, sea level rise, coastal inundation and coastal erosion and how well the community is prepared to

Box 5.1 CMP perceptions of present-day actions to reduce the risk of coastal hazards in NSW.

Q19. Do you think sufficient priority is given to reducing the risk of coastal inundation and erosion along the NSW coast in general?	
Yes	9 %
No	**70 %**
Don't know	21 %
Q20. Do you think sufficient priority is given to reducing the risk of coastal inundation and erosion in the local NSW government area you are involved with?	
Yes	15 %
No	**63 %**
Don't know	22%

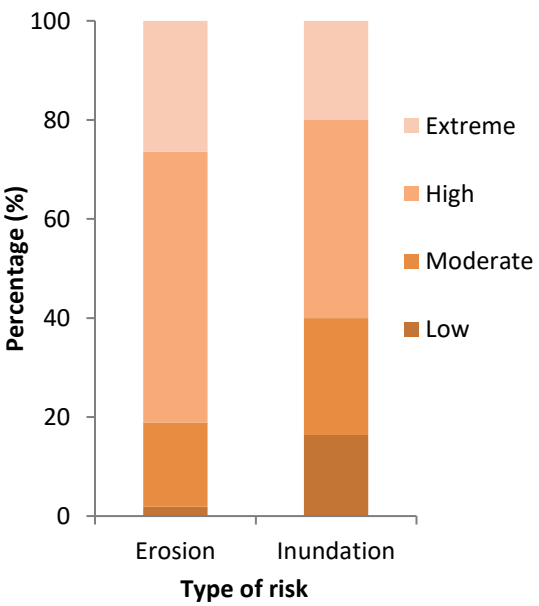


Figure 5.2 Coastal Management Professionals (CMPs) perceived risk of coastal erosion and inundation in the coastal region where they work.

cope with these hazards. Fewer than 30% of CMPs think coastal communities have a good understanding of the hazards and fewer than 5% think that the community has even a good level of preparedness (Figure 5.3).

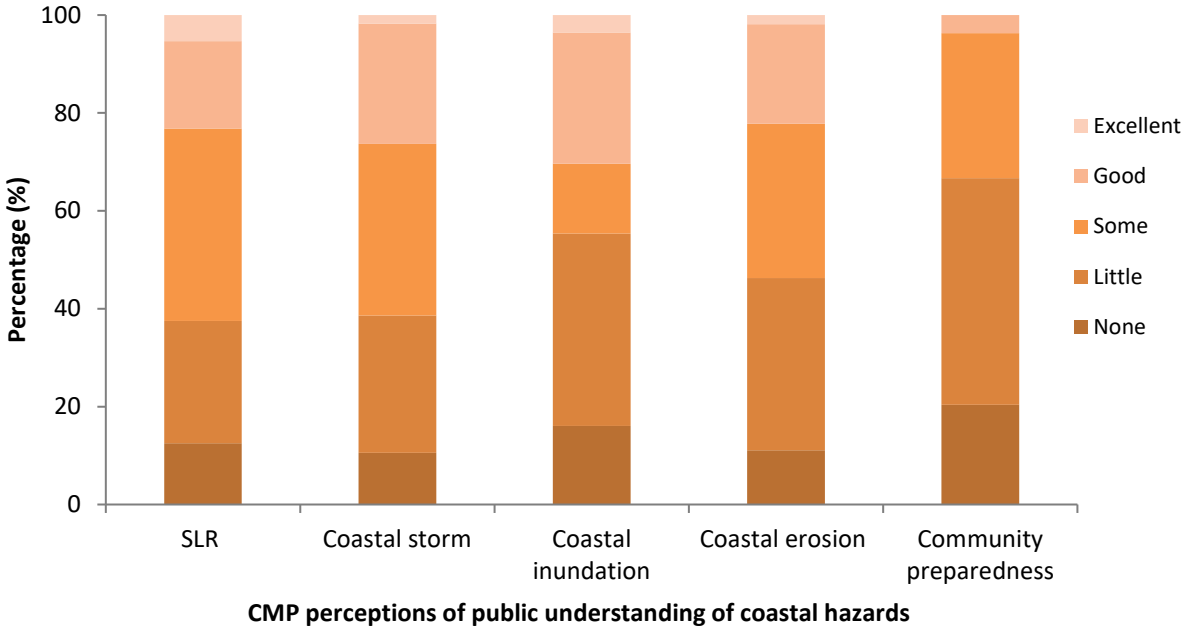


Figure 5.3 Coastal Management Professionals (CMPs) perceptions of community understanding in relation to various types and aspects of coastal hazards.

Perceived Coastal Management Issues

Another objective of this survey was to give CMP respondents a platform to articulate their views about issues facing coastal management in New South Wales. This was achieved through two short answer questions focussing on challenges surrounding physical and environmental issues (Box 5. 2) and risk communication and obstacles to implementing coastal management practices (Box 5.3). As evident from Box 5.2, a range of themes emerged, with loss of habitat/change to natural environments, protecting physical assets and the actual occurrence of these hazards being considered as the most pressing challenges in regard to coastal erosion and inundation. As evident from Box 5.3, there was also a range of opinions regarding the types of challenges involving communicating the risk of coastal hazards. The main themes to emerge were: improving public understanding of risk; understanding the hazards and processes themselves; and the long-term nature of some of these impacts.

Box 5.2 Examples of Coastal Management Professionals (CMPs) responses regarding the physical and environmental challenges of managing coastal erosion and coastal inundation. Percentages refer to the relative occurrence of those themes within the survey sample size.

Q9. In your opinion, what are the most pressing PHYSICAL and/or ENVIRONMENTAL challenges/concerns involving coastal erosion and inundation in your coastal area(s)?	
Themes	**Examples**
Loss of habitat/change of natural environments (29%)	• '*Saltmarshes, water quality, weeds, biodiversity, habitats (including underwater), marine debris, erosion, sediment/catchment inputs, threatened species'* (CMP05) • '*Greatest concern is the degradation of other natural environments, loss of biodiversity through habitat loss, loss of wildlife corridor'* (CMP22)
Protecting physical assets (23%)	• *'Loss of amenities e.g. steps and showers, impact on sewage and electricity infrastructure, loss of dunes and inundation of low set houses'* (CMP05) • *'Resilience building, to prepare for extreme events'* (CMP27) • *'To identify which sections of coast with public infrastructure that some form of protection is warranted'* (CMP38) • *'Relocating built assets out of areas vulnerable to coastal hazards'* (CMP61)
Climate change/physical hazards (21%)	• '*Impacts of climate change/sea level rise'* (CMP20) • *'Significant east coast low events'* (CMP27) • *'Global warming sea level rise and storm pattern disruption'* (CMP60) • *'Sea level rise, increasing high intensity storm surges'* (CMP58) • *'Extreme floods and high tides'* (CMP53)
Population, development and planning (19%)	• '*Inappropriate existing and future development'* (CMP27) • *'Removing development from inappropriate sites'* (CMP40)
Managing protection vs environmental impact (17%)	• *'How to manage the risk to property via erosion and inundation protection measures whilst managing adverse environmental impacts of these protection works'* (CMP07) • *'Dealing with legacy developments approved in vulnerability areas*' (CMP25)
Political (8%)	• '*Coastal squeeze due to legacy issues will be a high cost, who pays?'* (CMP43) • *'The political will to make the tough decisions on 'retreat' and mechanisms to address the consequence of mass migration'* (CMP30)
Problem too big/Delaying inevitable (2%)	• '*Much of the work that is being done does not have environmental benefit and the physical structures are delaying the inevitable'* (CMP04)

Box 5.3 CMP short answers regarding perceived challenges of risk communication in relation to coastal erosion and coastal inundation.

Q10. In your opinion, what are the main RISK COMMUNICATION challenges you face when dealing with the general coastal community in relation to coastal hazards such as erosion and inundation?	
Themes	**Examples**
Understanding of risks (24%)	• *'Public understanding and appreciation of risk and its likely increase over time'* (CMP61) • *'Lack of comprehension of terms, little awareness of risks* (CMP23) • *'Appreciation of the full range of risk to the more severe, but less probable events'*(CMP26)
Understanding of hazards/processes (22%)	• *'Lack of urgency or understanding of scale. e.g. "it looks fine today so I don't see the problem" type of attitudes'* (CMP29) • *'Sceptical community members regarding climate change or sea level rise'* (CMP36) • *'Overall coastal process understanding especially beach building response times'* (CMP38)
Temporal issues (long term nature; 19%)	• *'Long term nature of the problem. Communities universally support emergency management but oppose long term strategies to address future issues'* (CMP63) • *'People find long term problems and associated risk hard to grasp'* (CMP53) • *'The non-instantaneous effect of climate change meaning people don't directly see the risk at all times'* (CMP52)
Lack of/difficulty of consistent messaging (15%)	• *'Technical language and inability of community members to understand the importance of the risks'* (CMP22) • *'Basically, you have trouble conveying risk on a fine sunny day....particularly months, if not years, after a major event'* (CMP33)
Number of stakeholders (11%)	• *'Different parties have different outcomes in mind (money, houses, recreation) the health of the natural coast is mostly put last when it need to remain priority no matter which party is in house'* (CMP15)
Politics/policy (11%)	• *'Politicians do not know the background to coastal management and really do not help when they want fixes now, they give the community false time lines which are impossible to manage'* (CMP43) • *'Ignorance, lack of official intervention, credibility, lack of leadership, political agendas, misinformation'* (CMP18)
Economic implications (7%)	• *'The assumption that government or 'someone else' will pay'* (CMP18) • *'Insurance related matters'* (CMP41) • *'Property value decrease'* (CMP45)
Un-relatable to the individual (6%)	• *'People are unfamiliar with a) the common effects of humans and climate on coastal health and b) the impacts of their own actions on coast and erosion. How is it relatable?'* (CMP51)
Denial of problem (4%)	• '*Denial of problem or fear response'* (CMP56) • *'Ignorance, denial of sea level rise. Coast is always changing, it will come back ideas'* (CMP58)

Utilising public perceptions

In light of these opinions, 93% of CMPs acknowledged that having a better knowledge of how New South Wales coastal communities understand hazards would assist them in making better decisions about the future management of the coast. The reasons for this often touched upon ideas such as '*better understanding leads to better more informed decisions*' (CMP03) and *'changing the way that coastal managers engage the community'* (CMP26) by identifying *'knowledge gaps'*, which will *'help to implement education programs'* (CMP54). One respondent highlighted that *'changes require political will and political will is only driven by community awareness and pressure'* (CMP33). Another suggested that a better understanding of community perceptions would help with communicating why certain actions were being taken; *'unless people understand the issues, they resent their taxes being 'wasted'* as the *'beach always comes back…they spend all this money on moving sand and the first big storm it's all gone again!'* (CMP60).

'The message needs to contain a story about coastal hazards, how we manage them and why we need beaches and coastal environments to buffer us from the impacts' (CMP28)

However, a small minority of CMPs were not sure that having a better knowledge of coastal community understanding of hazards would assist coastal managers due to emotional and political aspects of the problem: '*it's more up to the decision makers to decide what is the best action to take, doesn't matter if the community understands or not*' (CMP22).

Fact File 2: General Coastal Users (GCUs)

As the coastal community is not just one homogenous group, but rather a collection of smaller, overlapping groups that change over time and fluctuate in size (Thomsen *et al*. 2009*)*, six different 'sub-communities' within NSW were chosen to represent a General Coastal Users (GCUs) group who utilise the coast in a variety of ways. As shown in Box 5.4, surveys administered to the GCUs attempted to gain perspectives and opinions of coastal communities of both 'place' and 'interest' (see Section 3; Thomsen *et al.* 2009).

Box 5.4 The six surveyed sub-communities that make up the 'General Coastal Users' group (GCU) divided into communities of place and communities of interest.

Communities of Place	Communities of Interest
Surf Life Saving Club Members	Teachers (Primary and High school)
Coastal Tourists	Coastal Council Management Professionals
Coastal 'Frontline' Residents	
Coastal Indigenous Communities	

Many people, from all walks of life, utilise the NSW coast. In addition to those who live close to the coast and interact with the coastal environment regularly, some people with an interest in the coast (a community of interest) reside outside the narrow 'coastal' area, such as members of a surf lifesaving club that travel to take part in the community. Others may only have a short-term or passing interest, such as caravan park users, or tourists (Thomsen *et al.* 2009). Other members of a community may not actively interact or have a concern for their coast at present, but may do in the future (e.g. teachers). People who are actively involved in the management of the coastal environment, such as members of the Local Council, are also part of the overall General Coastal Users' group. It is important to include this community as often people or entities involved in management of an issue don't consider themselves to be part of the 'community', effectively externalising the issue and distancing themselves (Thomsen *et al.* 2009; NOAA, 2016b) from the overall community of which that they are intrinsic members.

Demographics

The General Coastal Users group was made up of 993 respondents from the six different sub-communities described in Table 4.5. The largest cohort were teachers (36%, n=355; both high school and primary), followed by members of NSW surf lifesaving clubs (31%, n= 307), coastal tourists (24%, n=237), coastal Council management professionals (6%, n=57), coastal

'Frontline' residents (2%, n=23) and coastal Indigenous communities (1%, n=16). The overall GCU cohort was characterised by a normal age group distribution (Figure 5.4a) with more female (56%) than male (42%) respondents. In terms of residence location with respect to the coast, approximately 33% of GCUs lived within 1 km, 35% between 1km and 10km and 32% more than 10km away from the coast (Figure 5.4b). The majority of GCUs indicated they visit the coast either every day or at least once a week (Figure 5.4c) with beaches being the most common type of coastline utilised (Figure 5.4d).

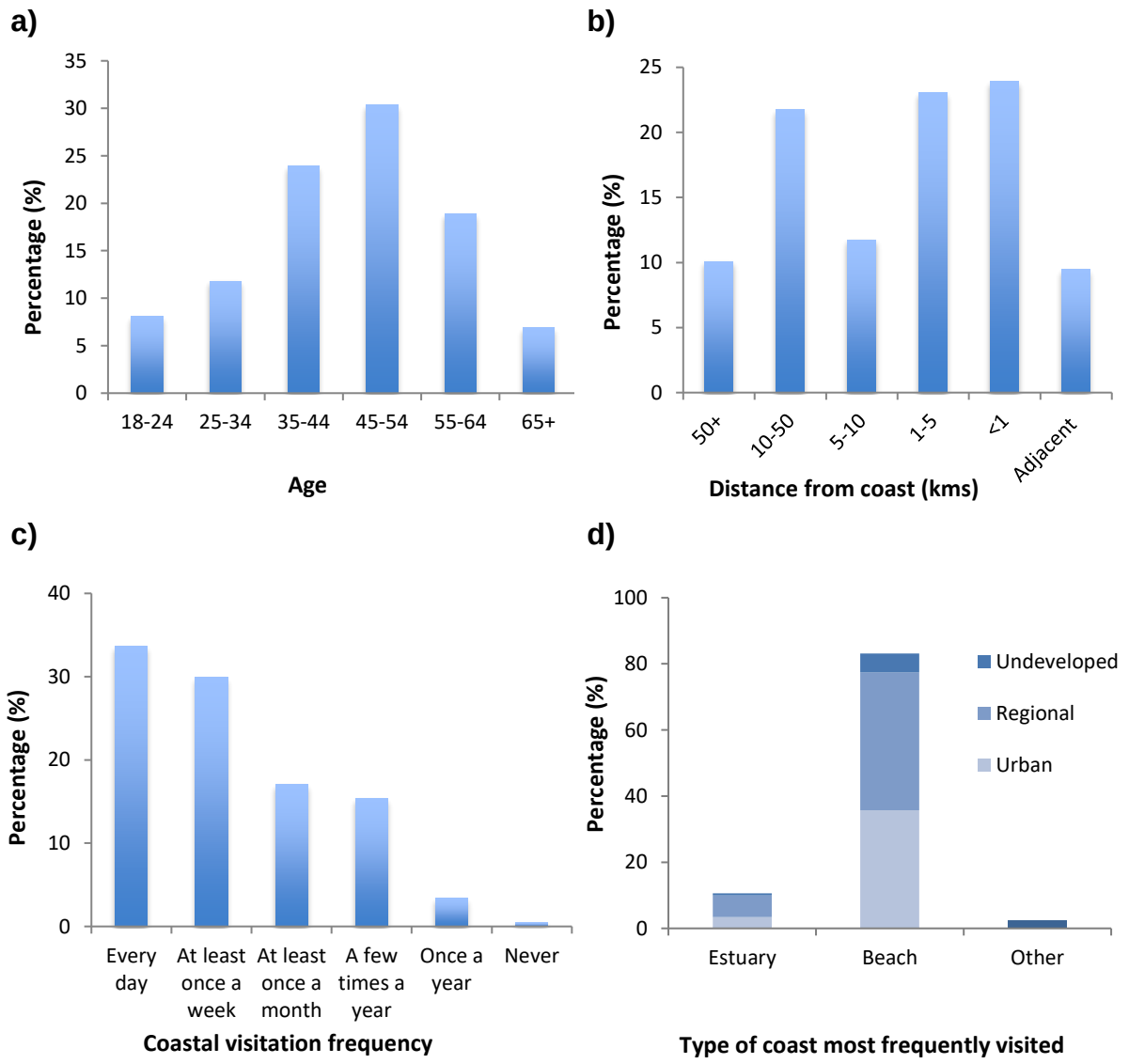


Figure 5.4 Demographics and coastal usage of the General Coastal Users (GCU): **a)** age distribution; **b)** residential distance from coast; **c)** frequency of coastal usage; and **d)** type of coast visited.

Future Expectations

The survey included a question that provided a range of different types of natural hazards (Figure 5.5) and asked, '*how much of a risk do you think the following hazards will pose to you within the next 20 years*?'. More than 60% of the GCUs ranked erosion as being either a high or extremely high risk (Figure 5.5). Coastal storms and heatwaves were considered as the next greatest risks. Approximately 55% of respondents ranked sea level rise as either a high or extremely high risk. Although coastal cliff collapse was ranked as representing the lowest risk respectively, 30% of respondents still ranked it as either a high or extremely high risk (Figure 5.5).

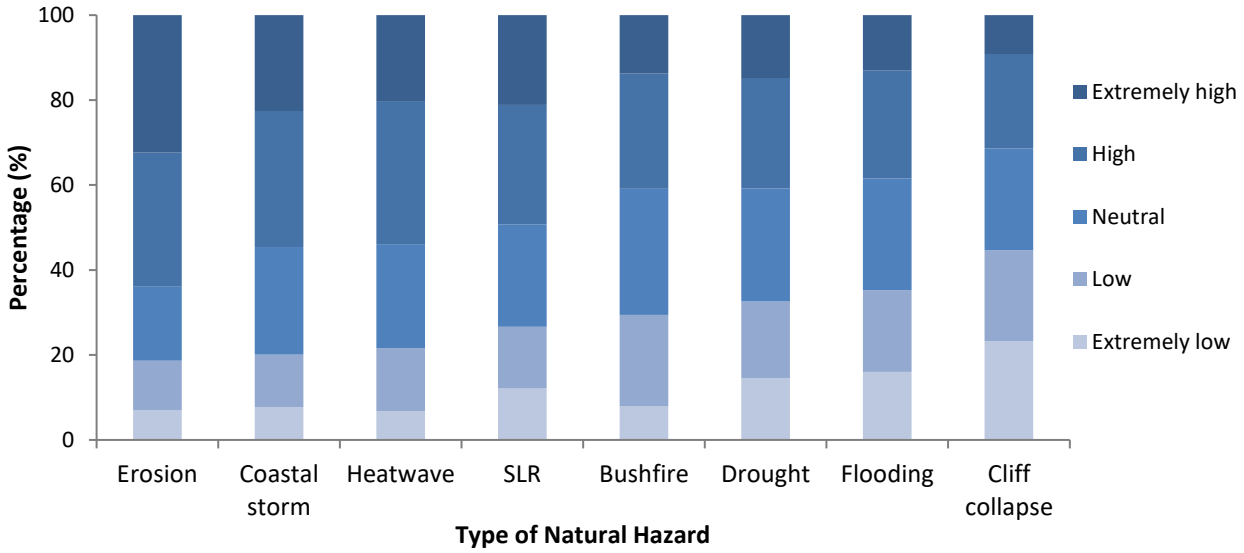


Figure 5.5 Ranked perceptions by the General Coastal Users (GCUs) of risks posed by different natural hazards over the next 20 years. SLR refers to 'Sea Level Rise'.

Future Issues

The survey also asked General Coastal Users to describe what they thought was the biggest threat to their future use of their coast. The word cloud in Figure 5.6 demonstrates the most common answers with '*development*', '*erosion*' and '*climate change*' standing out as the biggest threats in that order. These themes were often mentioned in conjunction with each other, either as independent issues or as factors part of a larger issue. For example, '*development*' was often linked with '*population growth*' and '*poor management'*; '*climate change*' with '*increased storm severity and erosion*'.

It is interesting to note that *'tidal changes'*, or '*rising tides*' were mentioned semi-frequently as something that will affect future use of the NSW coast. It is unclear whether these respondents were referring to sea level rise or if there is concern about changes to tidal patterns, such as

the extent of king tides. It may suggest a lack of understanding, or confusion of terms, attributing long term changes in sea level to tidal fluctuations.

Figure 5.6 Word cloud of the most common responses by the General Coastal Users (GCUs) to the question: '*What do you think is the biggest threat to your future use of the coast*?'.

While responses to this question were categorised into themes, there were a number of ways people expressed their concerns. For example, most people articulated their concern about erosion by using the term '*erosion*', while others referred to it more descriptively '*it (the beach) being washed away*' (GCU 587). Similarly, sea level rise was referred to as *'higher water levels'* (GCU132) and changes in '*weather patterns*' were also mentioned (GCU 761, GCU 995), but it is not clear if respondents were referring to climate change, or just changes in day to day weather. This corroborates other studies that have employed a 'mental model' approach about climate change (Bostrom. *et al.* 1994a; Read *et al.* 1994), which highlighted areas of public confusion such as confusing stratospheric ozone depletion with the greenhouse effect and confusing the terms '*climate*' and '*weather*'.

Some GCUs also mentioned *mining*, *plastics* and *bushfires* as possible risks to their future use of the NSW coast, which may suggest cognitive connections of these general environmental issues with understandings of coastal risks. This could be due to current media focus of these environmental problems, such as the single-use plastic bag removal by major supermarket chains and the ABC television mini-series 'War on Waste'. While this represents positive community recognition of an environmental problem, it shows there may be some level of confusion about issues specifically related to the management of the NSW coast, such

as coastal erosion and inundation, which may have more of a direct impact on the future use of the NSW coast than pollution or plastics.

Development

'*Development*' was the most common theme chosen by GCUs in terms of what they perceived as the biggest threat to their future use of the coast (Figure 5.6). Many respondents stated that '*mismanagement and overdevelopment*' (GCU 668) of coastal areas, combined with an increase in population, would affect coastal access and have negative effects on general coastal usage. Examples included '*human development altering accessibility and beauty'* (GCU 824) and issues with '*managing coastal development to ensure public access along the coast'* (GCU 376), *'increased population growth and future building or expanding of heavily built up areas'* (GCU 733) and '*relaxation on current development restrictions, and an increase in population*' (GCU 831). Within this theme was the perception that there is '*unregulated development*' (GCU 410) occurring or '*uniformed regulations'* (GCU 635) leading to poor or '*unsustainable development'* (GCU 880) decisions and '*self-interested Council development approvals influenced by money and business'* (GCU 816).

'Inappropriate development in conjunction with predicted sea level rise' (GCU 448)

Population growth and Overuse

'*Population growth*' and '*overuse*' were strong themes highlighted by many General Coastal Users. As mentioned above, many respondents made a link between *coastal development* and a *growing population*, stating that these factors will likely result in crowding, coastal '*overuse*' and '*misuse*' leading to a loss of coastal appeal, for example '*getting too busy, need to travel further for quieter beaches*' (GCU 208), '*crowding due to increasing population size near the coast'* (GCU 13) and '*traffic, the amount of time it takes to get to a beach and the amount of parking'* (GCU 960). There were also concerns of exacerbation of coastal hazards due to human usage such as '*erosion because of inappropriate use*' (GCU 72).

'Loving it to death' (GCU 239)

Under the latest projections, the state of NSW is anticipated to grow from 7.2 million people in 2011 to 9.92 million in 2036, an increase of 2.7 million (NSW DPE, 2016). Approximately 63% of the state's population is expected to be living in the Sydney region by 2036, with 15% of the population estimated to be living in 'other metropolitan' areas (comprised of Lower Hunter, Central Coast and Illawarra regions). Almost 80% of the state's population is projected to live within this Wollongong - Newcastle conurbation by 2036. With such an increase of population along a short distance of the NSW coastline, this will equate to larger numbers of people utilising the coastal zone, adding extra strain on current infrastructure and coastal

environments. The results of the GCU survey show that a growth in population is something that already concerns NSW coastal users, with strong negative perceptions of development and overpopulation in coastal areas.

Policy and economics

Connected to the themes of '*development*' and '*population growth*' were concerns surrounding policy and economically driven motives. Some respondents linked development to monetarily motivated decision-making; '*mismanagement/destruction resulting from ill informed decisions by people who put short term gain and financial benefits ahead of looking after the environment*' (GCU 785). Others considered large organisations and their presence on the coast to be a detriment, i.e. '*large organisations with no concern for the general public and full interest in money'* (GCU 737), while others linked tourism with crowded beaches '*oversaturation of the tourist market, where the sole focus of local governing bodies is mainly on maximising profits instead of providing adequate funding to coastal protection'* (GCU 980).

'Short-sighted decisions by governments' (GCU 347)

Climate Change, sea level rise and coastal hazards

Climate change was a central theme to most respondents' answers. This was often in conjunction with sea level rise, erosion, an increase in storm frequency or intensity and flooding; *'sea erosion due to climate change'* (GCU 158), '*increased storm events as a result of climate change'* (GCU 269) and *'climate change resulting from the enhanced greenhouse effect'* (GCU 913). However, some respondents saw climate change, sea level rise and coastal hazards as mutually exclusive issues; *'not sea level rise; (but) erosion due to storm surges*' (GCU 855). This suggests there may be some gaps in knowledge regarding how sea level rise may affect erosion, inundation, coastal storms and associated hazards.

'Climate change leading to storms and … beach erosion' (GCU 534)

Reduced Quality

Another theme highlighted by the GCUs was a concern for future 'quality' of the coastline. This theme was often linked to ancillary concerns of population growth, such as '*excess rubbish and pollution due to increased population' (*GCU 365). The theme 'reduced quality' includes concerns about pollution, people '*not caring*' (GCU 31) or having a *'lack of respect*' (GCU 105) for the coastal environment as well as concerns for water quality and coastal access (GCU361). Pollution and water quality were often linked, with topics such as *'stormwater runoff'* (GCU360), 'd*umping rubbish*' and '*proliferation of plastic in the environment*' representing risks to the future use of the coast (GCU 31; GCU 926).

'...mangroves are being replaced by housing (leading to) higher pollution, less fish and decreased clarity of water' (GCU 361)

Fact File 3: Snapshot: Coastal 'Frontline' Residents

The coastal 'Frontline' resident group is a sub-community of the General Coastal Users' group who live directly along 'at risk' shorelines. They were targeted to gain insights into the perceptions of people who may have been directly affected by coastal storm erosion and inundation by residing on a coastline identified as a coastal erosion 'hotspot'. This focus group comprised 25 respondents living at Narrabeen Beach (Figure 5.7a), both on estuarine and ocean beach frontage properties, and Kingscliff Beach on the far north NSW coast (Figure 5.7b). Both Collaroy/Narrabeen and Kingscliff are identified as coastal erosion hotspots by the NSW Office of Environment and Heritage, which are defined as having '*five or more houses and/or a public road located in a current (or immediate) coastal hazard area*'.

The damage to both public and private property at Collaroy/Narrabeen caused by the East Coast Low system that hit NSW in June 2016 gained significant media attention, reignited local debates about how to address immediate risks of coastal erosion and inundation and acted as a catalyst for this project. Kingscliff Beach has been subject to continued severe erosion since a large storm in 2009 (Tweed Shire Council, 2017). The Kingscliff Foreshore Revitalisation project has recently been undertaken, which includes the construction of a permanent seawall to protect the Surf Life Saving Club, Kingscliff Beach Holiday Park and Kingscliff Beach Bowls club from erosion and projected sea level rise (Tweed Shire Council, 2017). Approximately 120 surveys were distributed across both sites through letter box drops with postage paid return envelopes. Thirty-two surveys were returned with 25 surveys used for analysis based on completion rates.

a)

b)

Figure 5.7 Location of surveyed areas (red shading) at: **a)** Collaroy/Narrabeen Beach NSW; and **b)** Kingscliff Beach NSW.

Demographics

The majority of the 'Frontline' residents owned their property (owned = 72%; rent = 28%) and were located on ocean beach frontage (Figure 5.8a). Over half of the respondents had lived at the same location for over five years (Figure 5.8b). When asked why they chose to live at their current location, all respondents identified 'location' and 'proximity to the coast' as key reasons, with many noting 'lifestyle' and 'access (to the coast)' as factors supporting their choice. When asked to identify how they use the coastal environment, swimming, enjoying the view/connect with nature and exercise were each identified by approximately 80% of respondents.

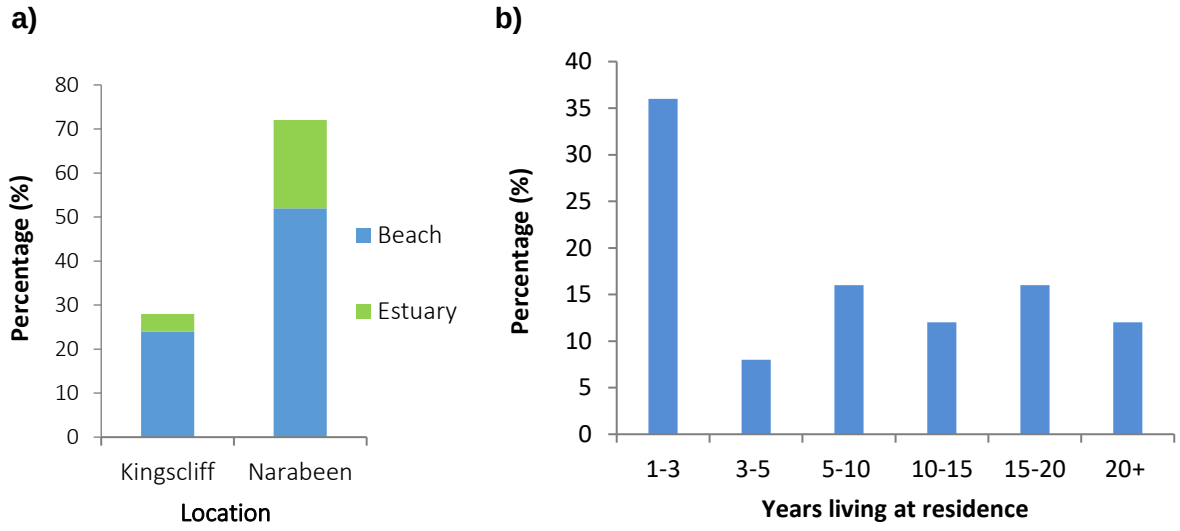


Figure 5.8 a) Type of coastal environment that the 'Frontline' resident group presently reside adjacent to; **b)** Length of time this group has lived at their current address (waterfront property).

Hazard Experience

The two locations were targeted primarily due to ongoing issues related to erosion resulting from damaging coastal storm events. When asked to detail their experience of erosion and coastal inundation, approximately 50% of the residents from Narrabeen indicated their property had previously been damaged by either erosion and/or coastal inundation (Figure 5.9a), with the majority identifying the 2016 East Coast Low as the most recent damaging event. When asked how often they thought this type of damage occurs, approximately 30% of Narrabeen residents indicated they didn't know, 20% stated it occurs less than once every ten years and 12% indicated it occurs more than once a year (Figure 5.9b). In contrast, almost 100% of the Kingscliff residents indicated their property had not been subject to damage caused by these hazards whilst they had resided there. Only 15% stated they had experienced erosion caused by daily waves and tides with no noted experience of damage caused by the other hazard categories.

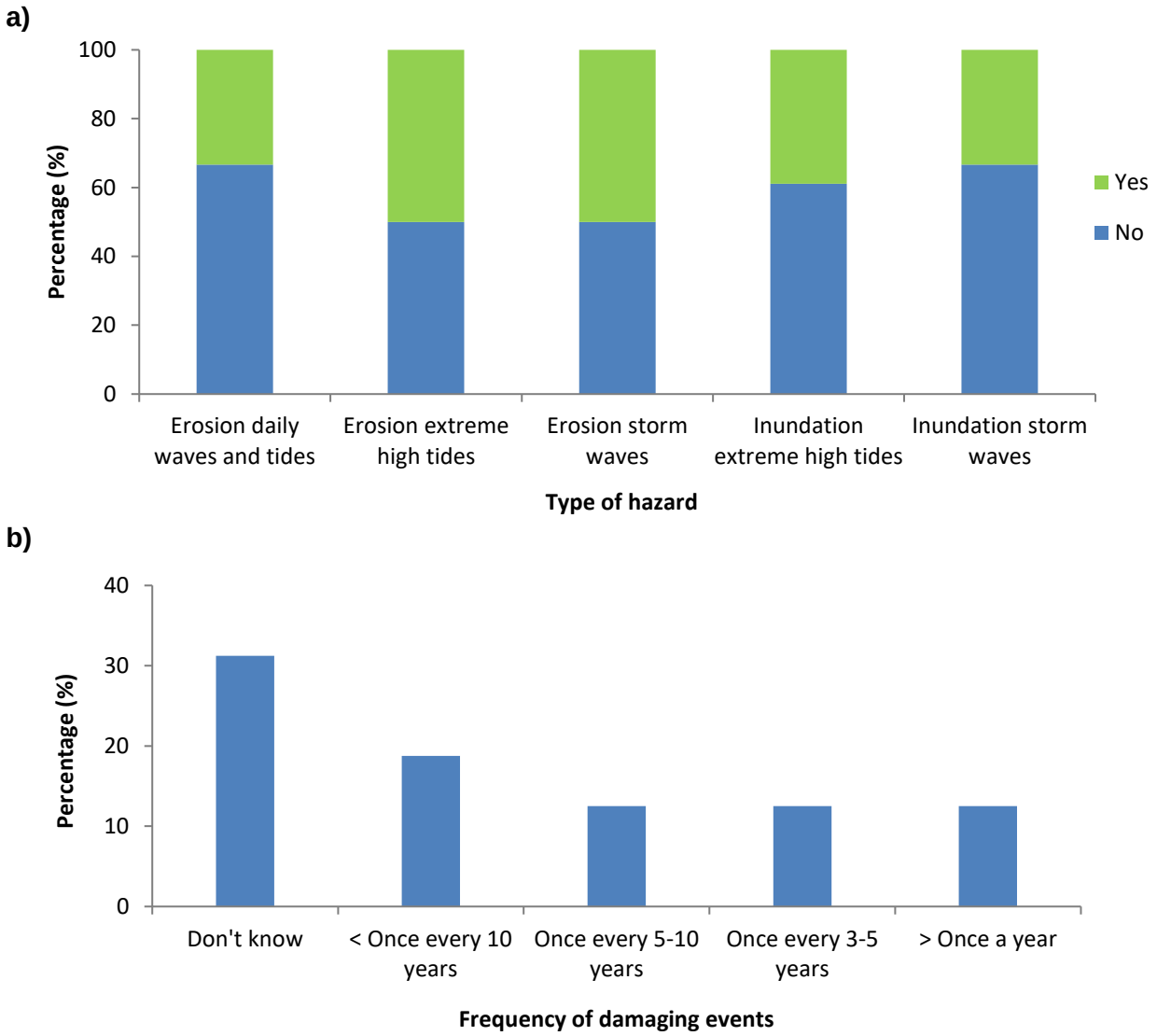


Figure 5.9 a) Coastal hazard experience of Collaroy/Narrabeen 'Frontline' residents'; **b)** Frequency of previous damaging events as experienced by this group.

Risk perception and understanding of hazards

When asked '*How much of a risk do you think the following hazards will pose to you within the next 20 years?*', more than 60% of the respondents ranked erosion as either a high or extremely high risk, followed by drought (60%), sea level rise (55%) and flooding (42%; Figure 5.10). Interestingly, erosion, flooding and sea level rise were perceived as representing a higher risk than coastal storms, even though most of the residents surveyed had experienced an East Coast Low event while residing at their current property. These results vary from the GCU group, who ranked coastal storms as the second most 'high risk' hazard, followed by heatwaves and sea level rise (Figure 5.5).

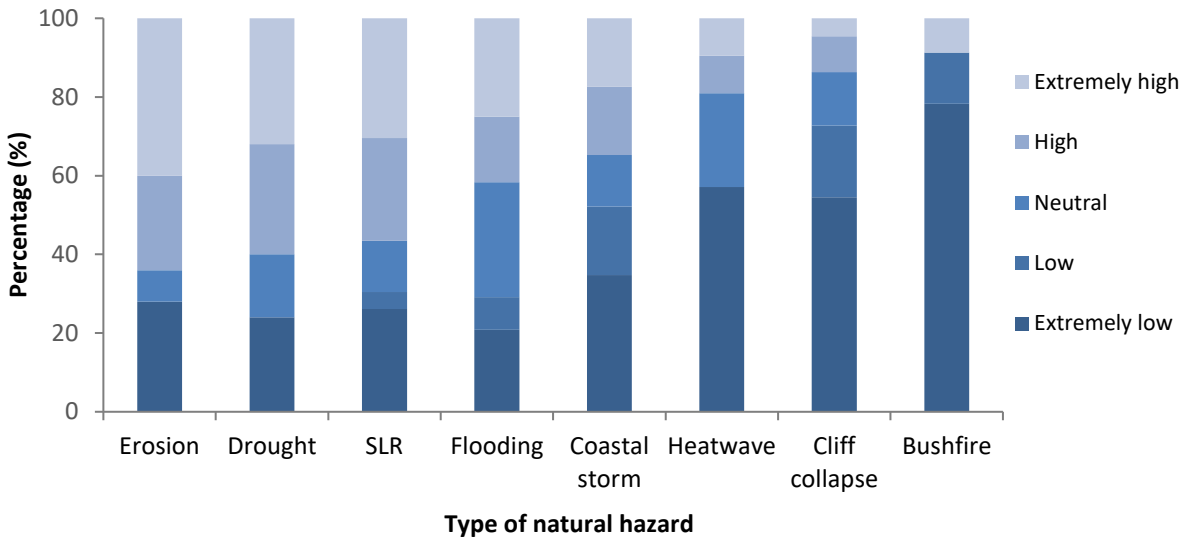


Figure 5.10 'Frontline' coastal residents ranked perceptions of risks posed by different natural hazards over the next 20 years.

Sea Level Rise

Although sea level rise represented a high to extremely high risk to almost 60% of the 'Frontline' residents, 16% believed it was not occurring and 24% said they 'don't know'. With adaptation strategies in place within New South Wales policy to accommodate for changes in sea level (OEH, 2017c), it is interesting to note that 40% of coastal frontage property residents remain either unsure, or in disbelief, of sea level rise. When asked to indicate how much they agree with statements relating to the local effects of sea level rise, it is evident that while most believe it is an issue for the NSW coast, 30% of residents do not think it will have an impact on people like themselves (Figure 5.11).

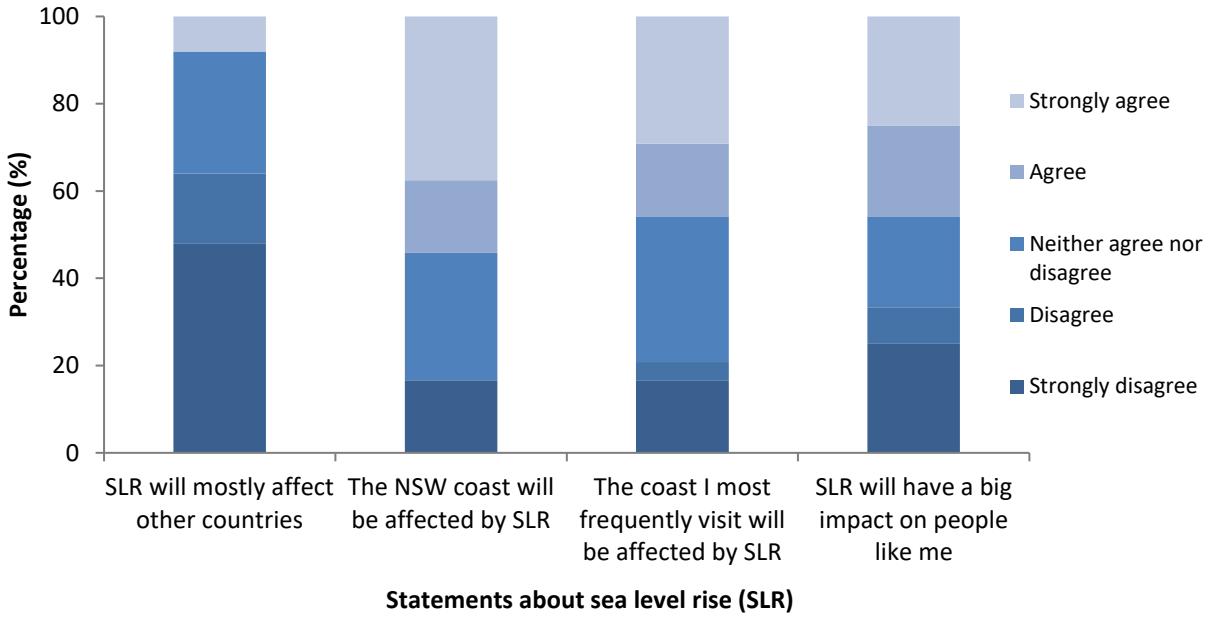


Figure 5.11 Coastal 'Frontline' resident opinions of the consequences of future sea level rise.

Coastal Storms

When asked about the perceived frequency of damaging coastal storms, more than 70% of the 'Frontline' residents think these events occur roughly once every 20 years or less (Figure 5.12). When compared to responses regarding how frequently their property is damaged, approximately 40% indicated at least once every ten years, which suggests that some don't attribute storms to damage caused. Just over half (52%) of the residents think coastal storms will occur at the same rate as they always have over the next 20 years and 56% think they will cause the same amount of damage as they do presently. Combined with the perception that coastal storms pose less of a risk than other coastal hazards (Figure 5.10), this suggests that some of the 'Frontline' respondents may underestimate the potential effects of East Coast Lows on their coastline.

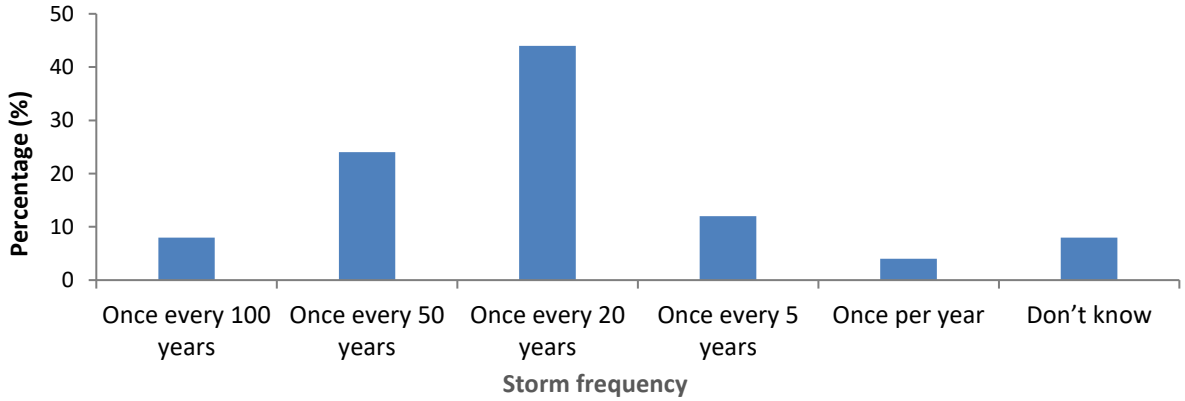


Figure 5.12 Coastal 'Frontline' resident respondents' perceptions of present-day rate of occurrence of severe coastal storms.

When asked to rank damage caused by coastal storms in terms of what concerns them the most, damage to private land and property, interruption to utilities and road closure were overwhelmingly selected as factors that the 'Frontline' residents are most concerned about (Figure 5.13).

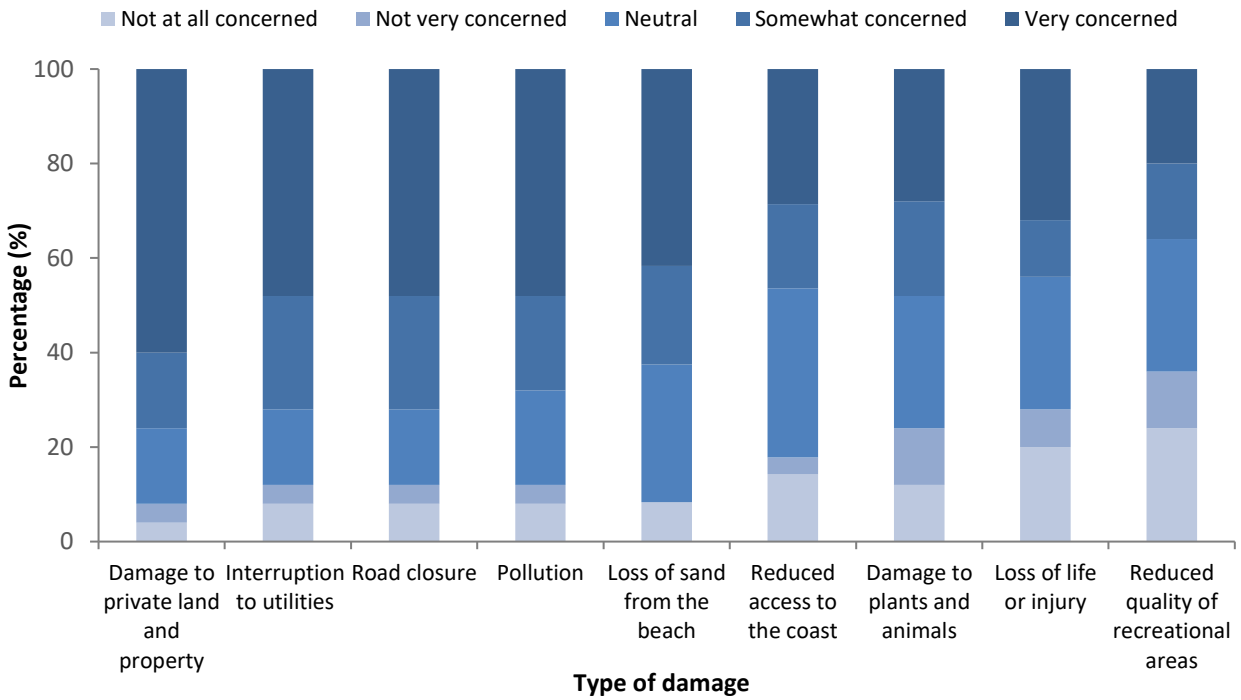


Figure 5.13 Level of concern amongst 'Frontline' coastal residents in terms of damage caused by severe coastal storms.

Inundation and Erosion

When asked to identify what they considered to be main causes of coastal inundation, 'heavy rain' followed by 'king tides' were selected by more than 60% of the residents respectively (Figure 5.14). Storms surges were selected by 56% of respondents, meaning that 44% do not consider storm surges to be a main contributing factor.

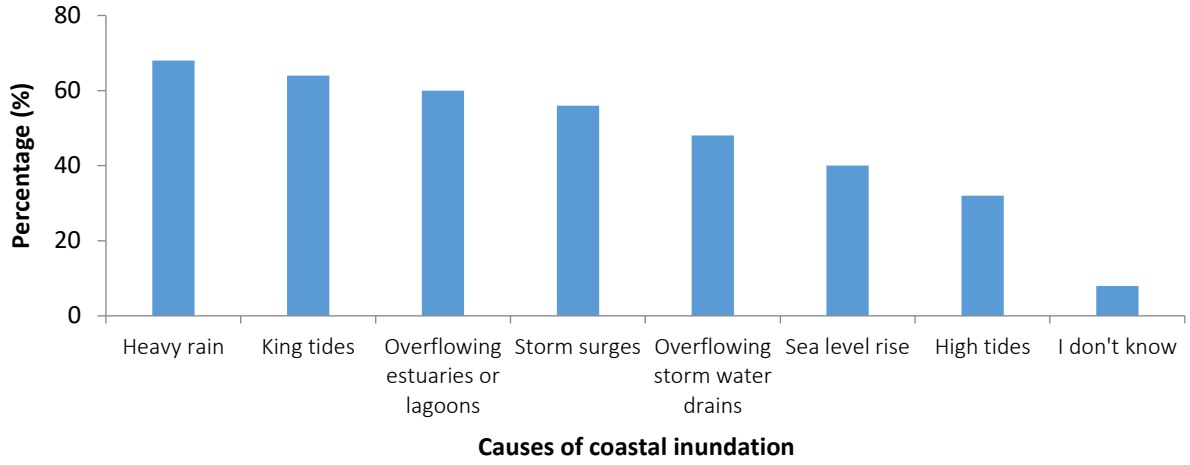


Figure 5.14 'Frontline' coastal residents understanding of contributing factors of coastal inundation.

Developed beaches and estuaries were the coastal environments identified by the 'Frontline' residents as being most at risk of damage caused by coastal inundation, followed by lagoons (Figure 5.15a). Similarly, developed beaches and estuaries were identified as the coastal environments most at risk of coastal erosion (Figure 5.15b).

The majority of 'Frontline' residents believed the occurrence of coastal inundation will stay about the same over the next 20 years. In contrast, the majority of respondents believed the occurrence of coastal erosion will increase over the same time period.

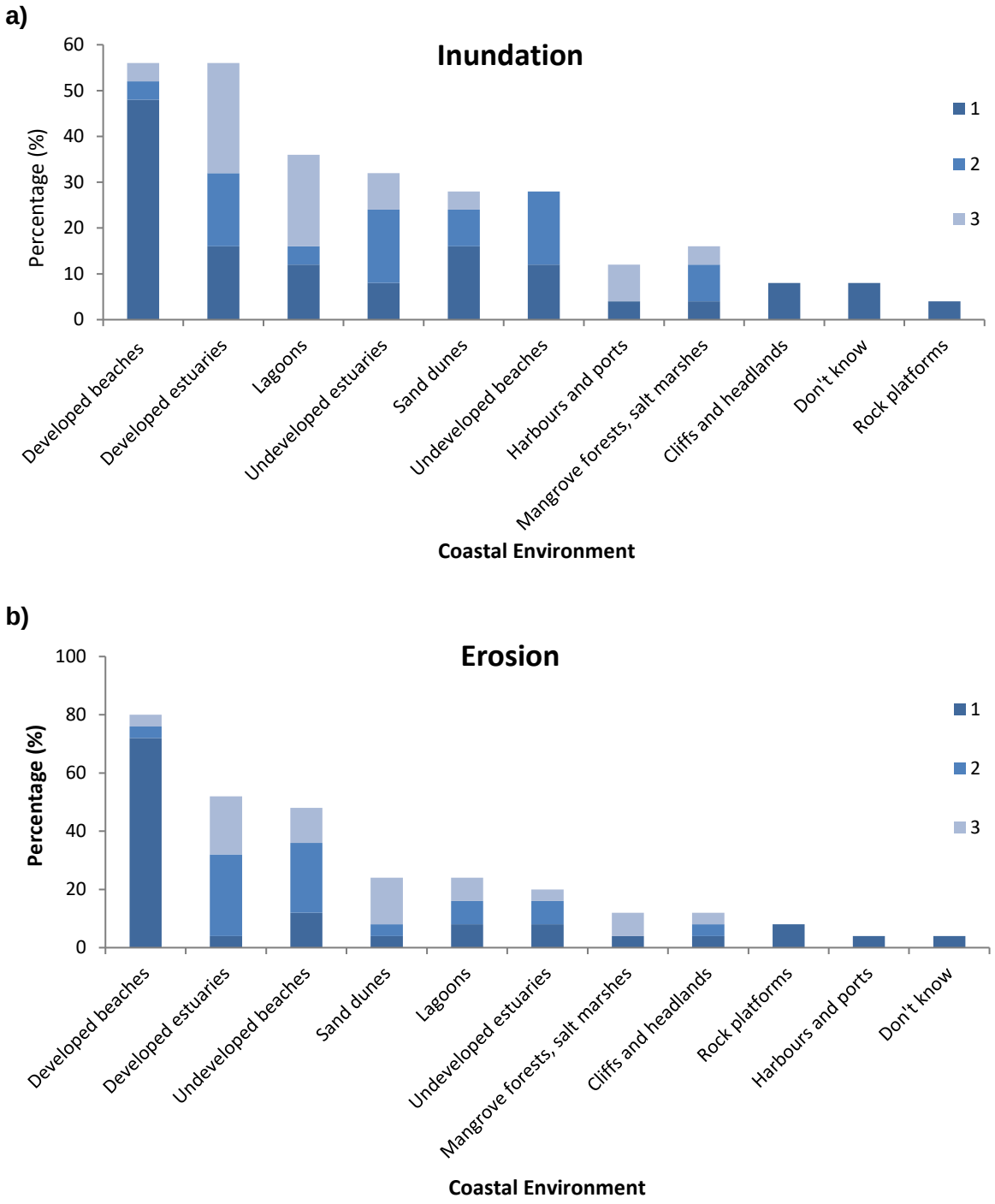


Figure 5.15 'Frontline' coastal residents perceptions of environments most at risk of: **a)** coastal inundation; and **b)** coastal erosion. Choices were ranked from 1-3 in terms of order of importance.

Fact File 4: Snapshot: Coastal Indigenous Communities

Who are they?

The Coastal Indigenous Communities group is a sub-community of the General Coastal Users' group and was targeted to gain insights into the perceptions of coastal Indigenous communities residing within NSW. Nura Gili, the centre for Indigenous programs at UNSW Sydney, assisted in the distribution of this survey through social media notifications to students and word of mouth to friends and family. The survey received 24 responses, 15 of which were used for analysis.

Demographics

As the survey was promoted through UNSW Sydney, respondents were of typical student age with 80% aged 18-24 and 20% aged 24-34. The majority (67%) lived within 5km of a coastal environment and over 50% stated they visit the coast at least once a week (Figure 5.16) with ocean beaches being the most frequently visited (85%) coastal environment.

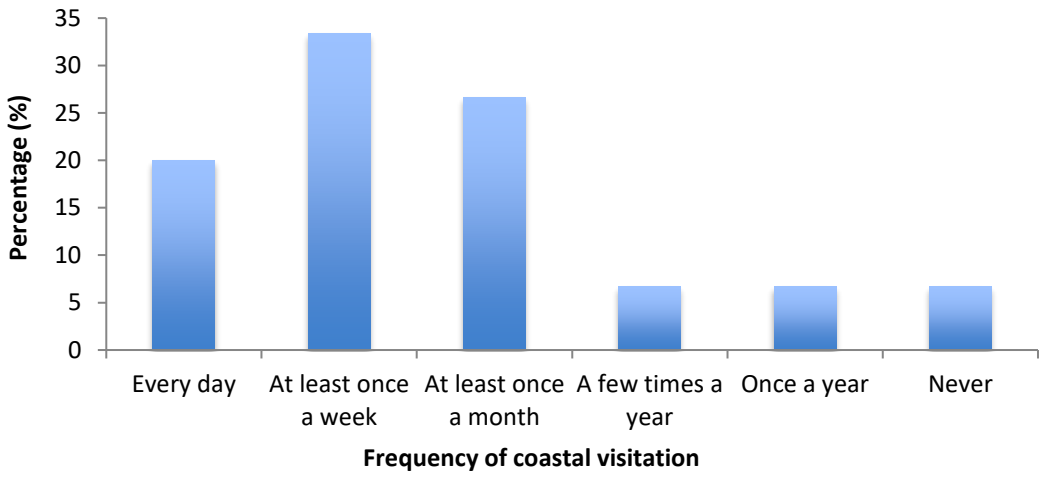


Figure 5.16 Frequency of coastal visitations by the surveyed NSW Coastal Indigenous Community.

Eighty percent of the Coastal Indigenous Community group indicated they utilise the coast for swimming, 60% for enjoying the view and connecting with nature, with sunbathing, exercise and fishing identified as other popular activities (Figure 5.17).

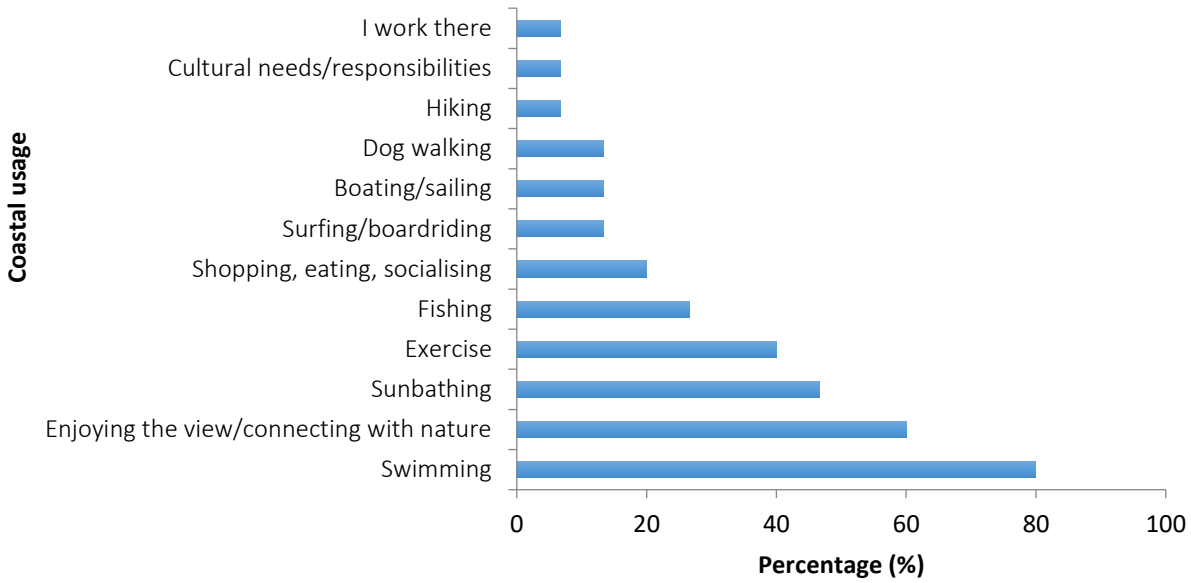


Figure 5.17 Most common coastal activities undertaken by the surveyed NSW Coastal Indigenous Community.

Risk perception and understanding of hazards

Coastal erosion, heat waves and sea level rise were perceived as natural hazards posing the greatest risk to this group over the next 20 years (Figure 5.18), which is similar to the results of the overall GCU group (5.5).

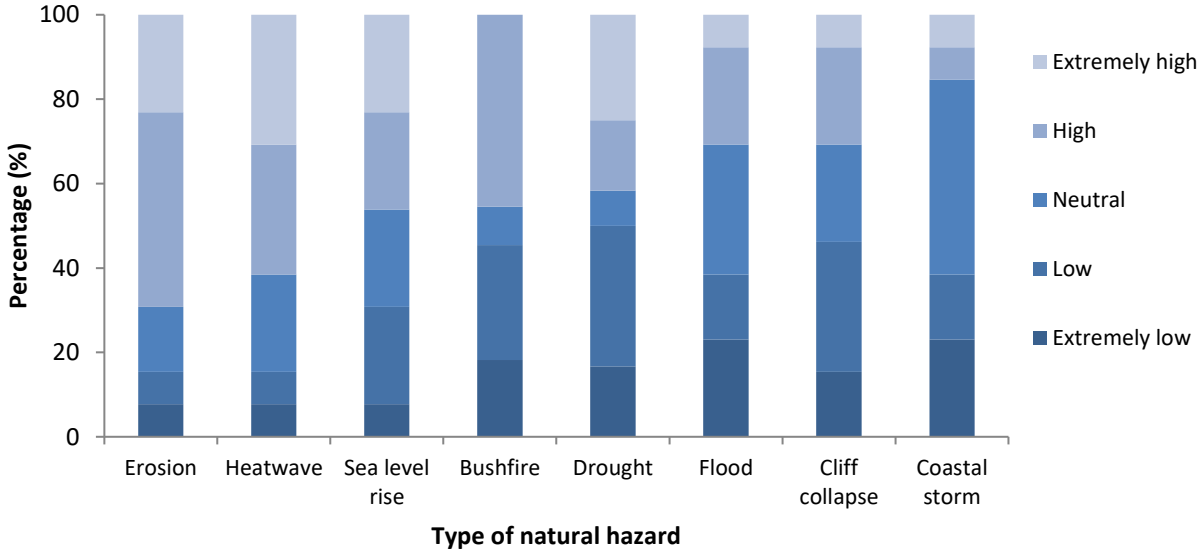


Figure 5.18 Perceptions of future risk of different natural hazards by the NSW Coastal Indigenous Community.

Over 75% thought sea level rise was occurring, with 7% stating it was not and 15% being unsure. The majority of respondents thought sea level will rise somewhere between 50 cm and 1 m over the next 20 to 50 years (Figure 5.19a), which is higher than results of the GCU group (Figure 5.34). While not as prevalent in this small sample group, there is still evidence of a trend that sea level rise will affect other coastal areas more than coastal areas utilised by this focus group (Figure 5.19b).

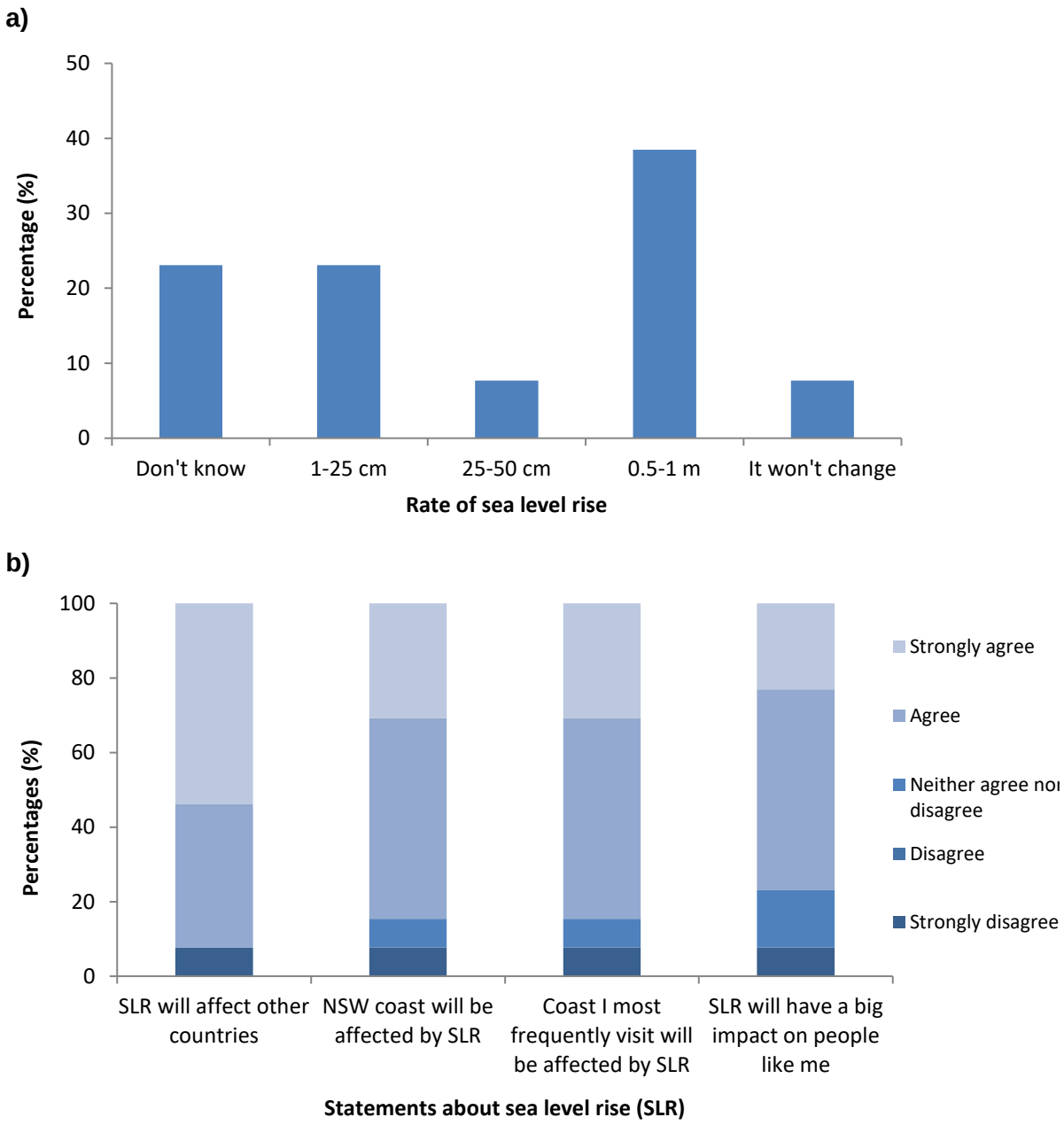


Figure 5.19 NSW Coastal Indigenous groups' perceptions of: **a)** the rate of sea level rise over the next 20 -50 years; and **b)** the impacts of sea level rise.

Coastal storms were the hazard ranked as posing the least risk by the Coastal Indigenous Community (Figure 5.18). When asked to identify how often severe coastal storms occur, over 50% of respondents indicated they occur at least once every 5 years (Figure 5.20a). Approximately 80% thought severe coastal storms will occur more often over the next 20 years and 75% think they will be more damaging. When asked to rank their opinion about the type of damage caused by severe coastal storms that concerns them the most, this group indicated interruption to utilities, pollution and damage to plants and animals to be of most concern (Figure 5.20b).

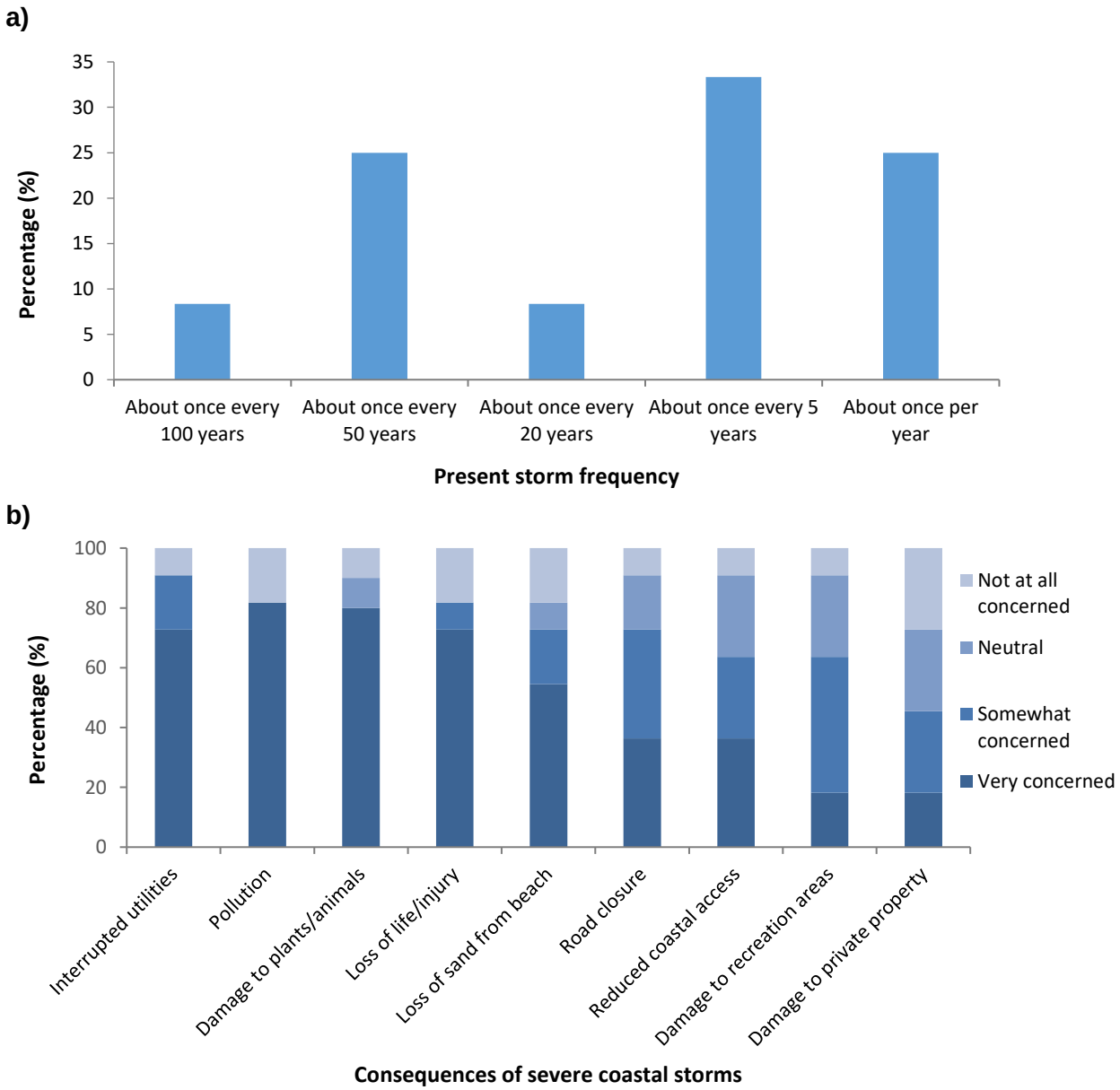


Figure 5.20 NSW Coastal Indigenous group: **a)** perceptions of the present rate of occurrence of severe coastal storms on the NSW coast; and **b)** concerns in relation to different types of damage caused by severe coastal storms.

When asked to identify what they consider to be the main causes of coastal inundation, heavy rain, storm surges and king tides were the three most selected responses by the Coastal Indigenous group (Figure 5.21). Developed estuaries, developed beaches and cliffs/headlands were ranked as the top three environments at risk of coastal inundation (Figure 5.22). In contrast to the results of the GCU group (5.42a), cliffs/headlands were ranked as the environment most at risk of coastal erosion, followed by developed estuaries and beaches (Figure 5.22). 83% and 92% of the surveyed Coastal Indigenous Community think that coastal inundation and erosion, respectively, will increase over the next 20 years.

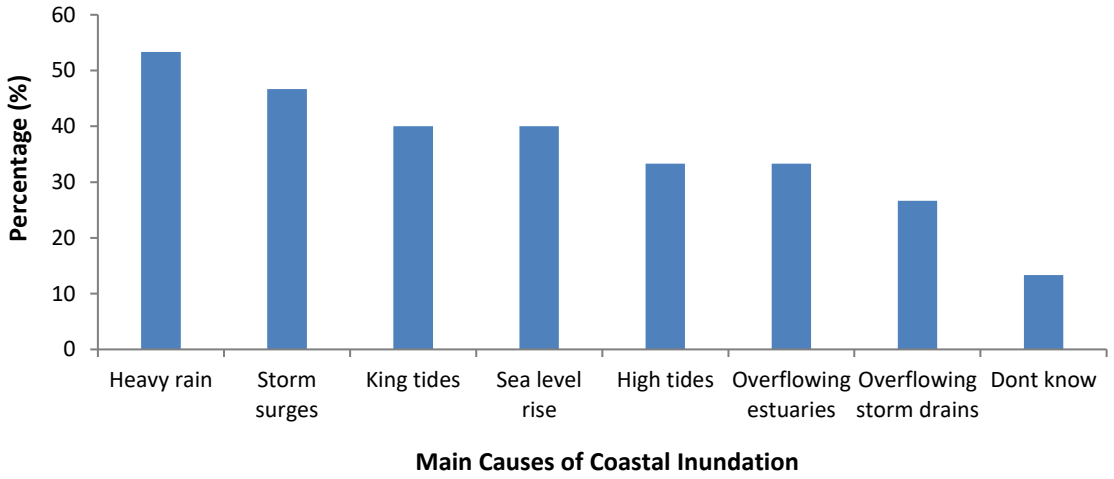


Figure 5.21 Perceived main causes of coastal inundation by the surveyed NSW Coastal Indigenous group. Respondents were able to select more than one answer.

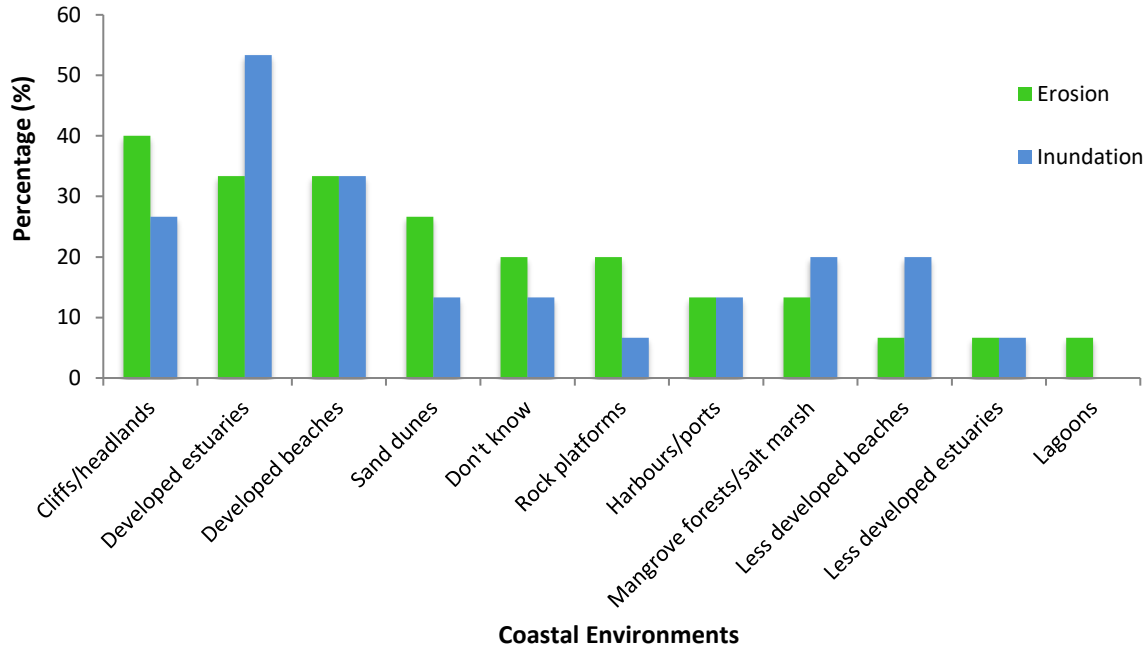


Figure 5.22 Coastal environments considered to be most at risk of coastal erosion and inundation by the surveyed NSW Coastal Indigenous Community.

Fact File 5: Coastal Accommodation Businesses (CABs)

Tourism provides substantial revenue to the New South Wales economy. In the 2016-2017 financial year, NSW received more than $90.8 million from overnight and day trip visitors, with total expenditure amounting to more than $33.2 billion. These values factor in both domestic and international tourists and although they represent NSW in its' entirety, NSW coastal areas generated the majority of this expenditure (Figure 5.23a), with Sydney alone contributing over $25 billion (Figure 5.23b).

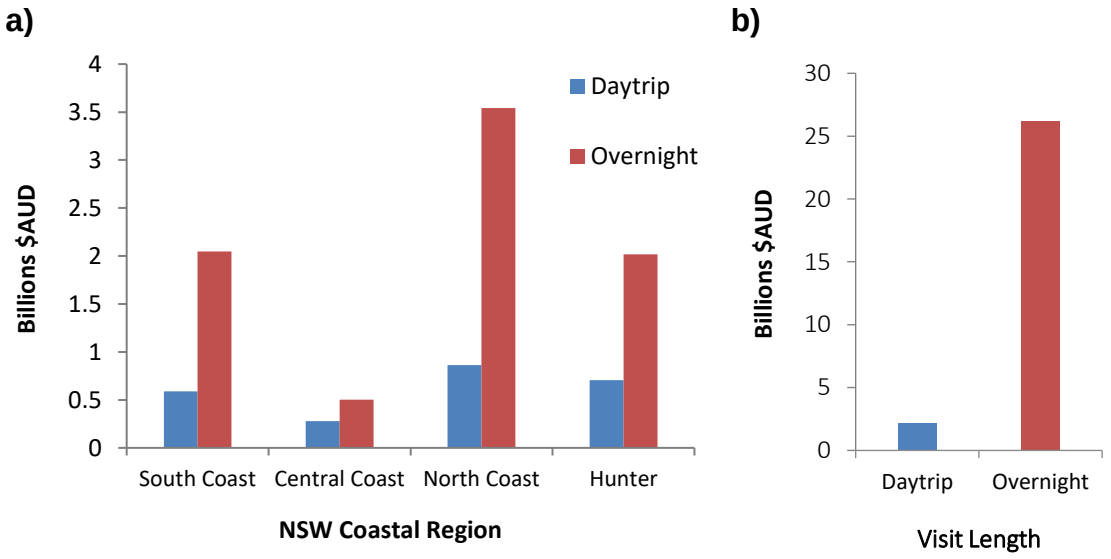


Figure 5.23 Tourism expenditure in: **a)** NSW coastal regions, including airfares and transport costs; and **b)** Sydney, including airfares and transport costs (Destination NSW, 2017).

The Destination NSW Annual Report (2017) detailed accommodation preferences of both domestic and international visitors (Figure 5.24) and while staying with 'friends or relatives' is the overwhelming first choice for both groups, domestic tourists are the group that predominantly utilises caravan and camping grounds as well as staying in hotels, motels or resorts.

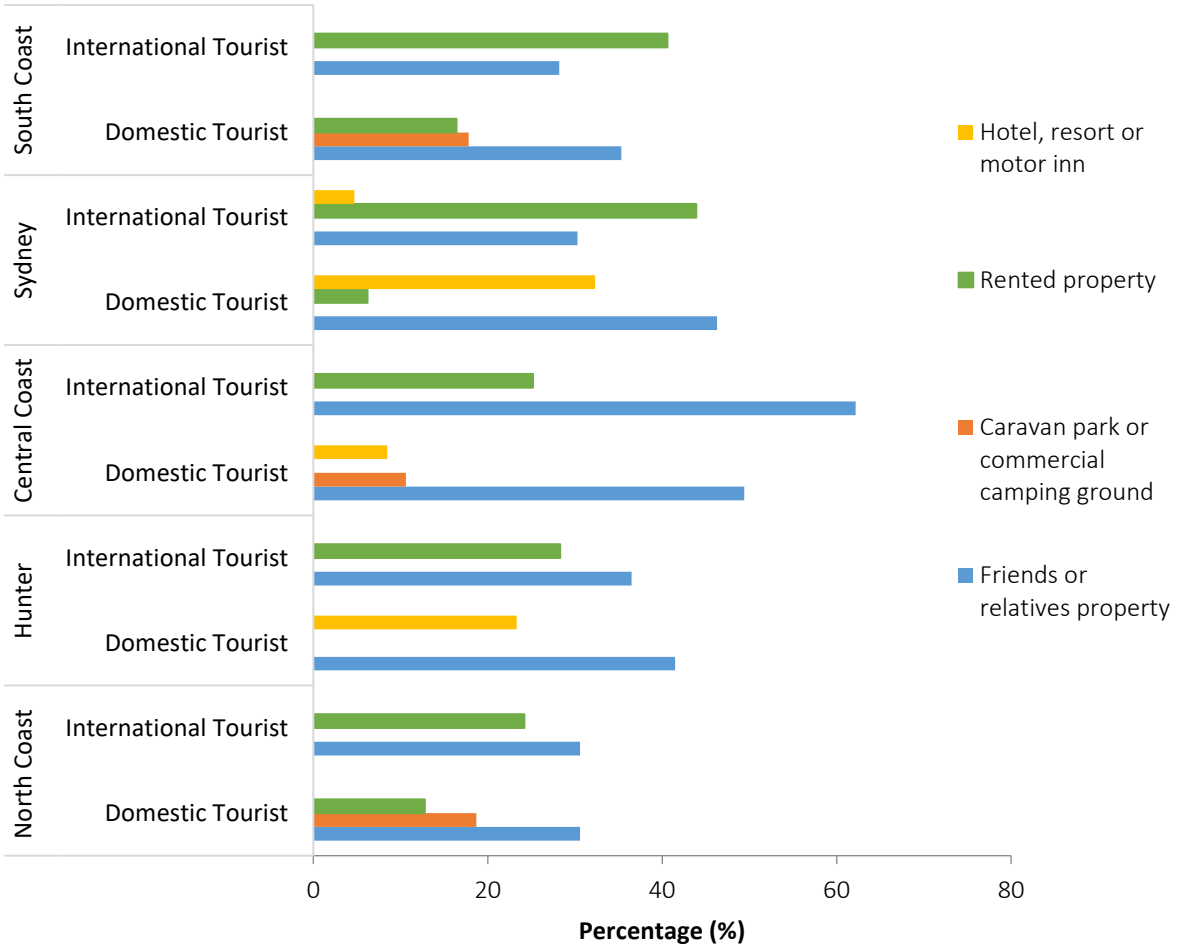


Figure 5.24 Tourist accommodation preference statistics by NSW region between July 2016 and June 2017 (Destination NSW, 2017).

Survey Results

The third survey focus group of this study involved different types of Coastal Accommodation Businesses (CABs), such as coastal caravan and camping parks, hotels, motels and resorts. Accommodation businesses were contacted directly by email and provided with a URL link to the online 'My Coast' Accommodation Business survey and 76 responses were collected (62 used for analysis). Respondents consisted of accommodation owners, managers and employees and encompassed a normal age distribution centred around the 45-54 age group with most respondents being female (61%). Surveyed businesses were largely holiday caravan parks on ocean beach coastlines (Figures 5.25a; b). Approximately 55% of the businesses surveyed indicated their business is located either adjacent to or less than 100 m from the coast with roughly 92% of all respondents located within 1 km of the coast. For ease of analysis, businesses were sub-categorised into permanent structures (motels, resorts, other) and temporary structures (holiday caravan parks and campgrounds; Figure 5.25c).

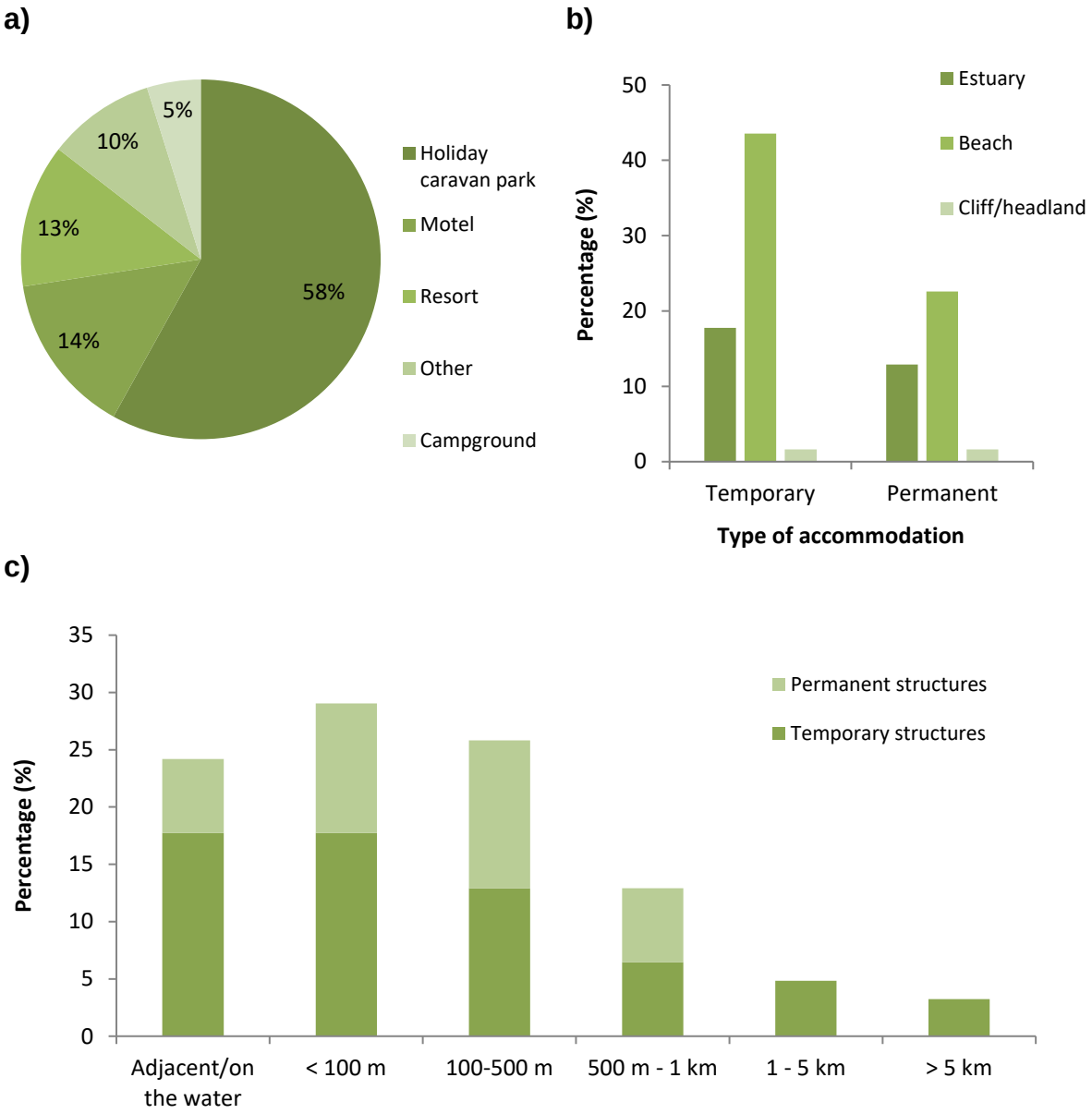


Figure 5.25 Characteristics of NSW Coastal Accommodation Businesses (CABs) surveyed in terms of: **a)** accommodation type; **b)** coastal environment by type of accommodation; and **c)** distance from coast.

Of the businesses surveyed, 42% indicated that they had previously been directly affected by coastal erosion and/or inundation, 52% indicated that they had not and 6% didn't know. Of those that had been affected, 31% indicated these events occur once a year or more (Figure 5.26).

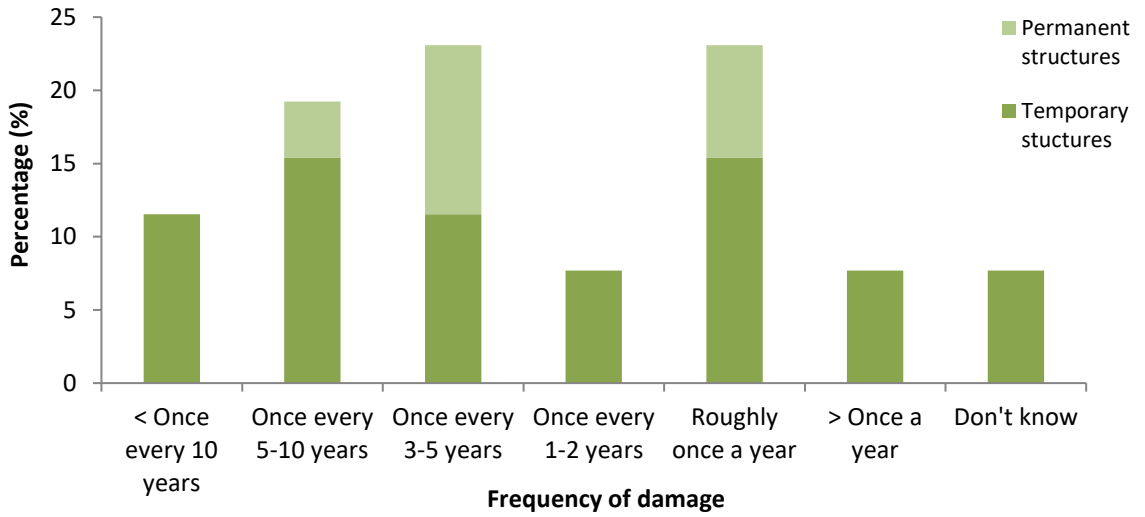


Figure 5.26 Frequency of damage to coastal accommodation businesses caused by coastal hazards.

Previous Damage

Businesses that had experienced damage caused by coastal hazards were asked to provide details of the extent of the damage and the majority identified flood damage caused by a combination of storm driven heavy rains and high tides. For example, one respondent described a '*1 in 100 year flood – all caravans onsite are in flood-level (of inlet) so all vans flooded, several had to be replaced, damage to camping area*' (CAB55). Others described damage to '*guest's property*' (CAB29) and loss of revenue experienced after a period of heavy rain - '(a) *king tide, high tide and severe rain led to the creek that runs through the park to break banks and flood our holiday park (with) lots of debris left behind once water levels fell, (we suffered a) loss of business as campers/caravaners couldn't stay*' (CAB11). Erosion was also mentioned by a number of respondents; '*due to erosion, (the) site had to be redeveloped for tourists*' (CAB24) and '*…in places foredune erosion impacted as much as 20 to 30 meters inland of the preceding high-water line*' (CAB60). This suggests there are significant costs to accommodation businesses, both in terms of lost revenue as well as constructing and maintaining preventative measures to protect their business from future damage.

Present day protection

Of the businesses surveyed, slightly over half (53%) indicated their business did not have any coastal protection measures in place and 8% were unsure. The accommodation types were divided into temporary (camp sites, caravan parks) and permanent (hotels, motels, resorts etc.) for comparison of types of accommodations most at risk. Of the 39% who did have protection measures, the most common was managed sand dunes (43%), followed by seawalls (26%) and green areas (13%; Figure 5.27). While 59% of the surveyed businesses indicated they were satisfied with the coastal protection in place, 23% indicated they were not.

Of these, beach nourishment and groyne/jetty were identified as the protection measures with the least satisfaction levels (0%).

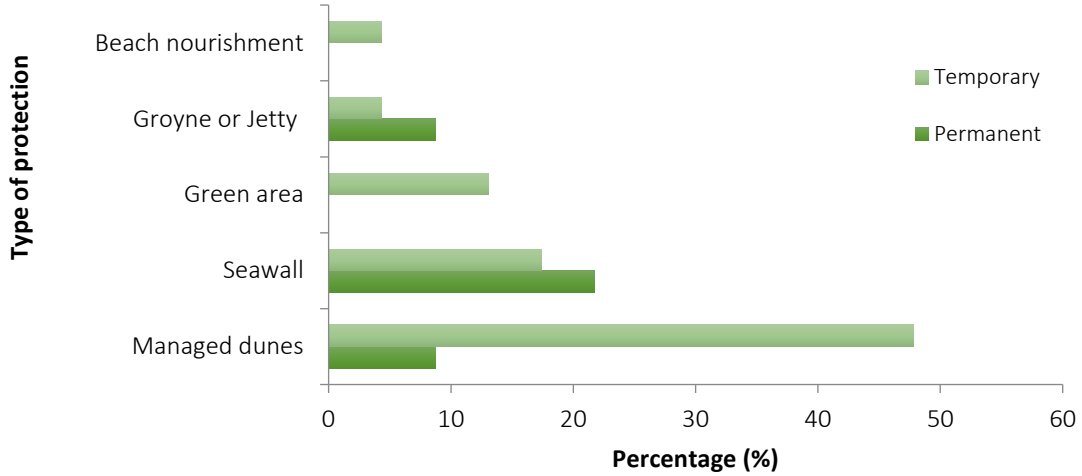


Figure 5.27 Type of protection in place at surveyed NSW Coastal Accommodation Businesses.

When the CABs were asked '*How much of a risk do you think the following hazards will pose to your business/the business you work at within the next 20 years*', coastal storms were identified as representing the highest risk, followed by flooding and sea level rise (Figure 5.28). As over 50% of the businesses surveyed indicated they were located 'less than 100m' from the shoreline (Figure 5.25c), this suggests that many businesses are well aware of the risks of having their business situated close to the shoreline.

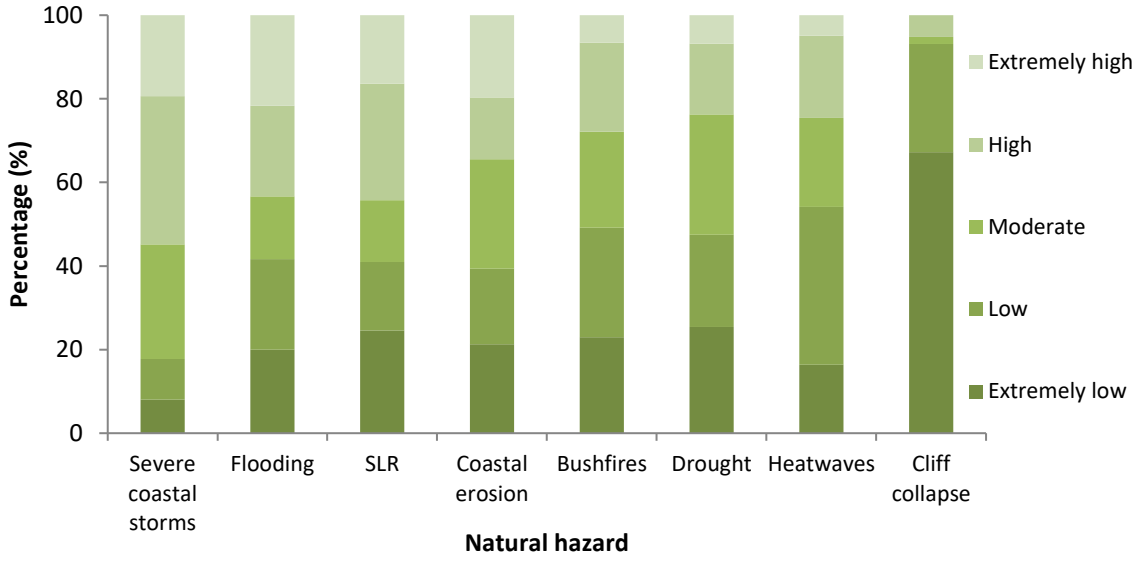


Figure 5.28 Ranked perceptions of risks posed by different natural hazards over the next 20 years by NSW Coastal Accommodation Businesses.

Future Concerns

The CABs were asked to identify the 'biggest threat' to their business in relation to the future use of the coast. This qualitative data was then collated into themes and generated into a word cloud to demonstrate what coastal businesses are most concerned about (Figure 5.29). Similar to the General Coastal Users group (Figure 5.6), erosion, overdevelopment and population growth were mentioned frequently. In contrast, '*unsafe beaches*' was a concern expressed by Coastal Accommodation Businesses, but not by General Coastal Users.

Similar to the GCUs (Figure 5.6), '*increased tides*' and '*rising water tables*' were mentioned by the CABs as threats but were not generally expressed alongside '*sea level rise*', suggesting a potential conceptual confusion regarding the causes of water level fluctuations and how it may affect them. Flooding was mentioned more frequently by the CABs compared to the GCUs, likely due to many of the Coastal Accommodation Businesses being located proximally to estuarine environments (30%) and having previously experienced damage caused by flooding.

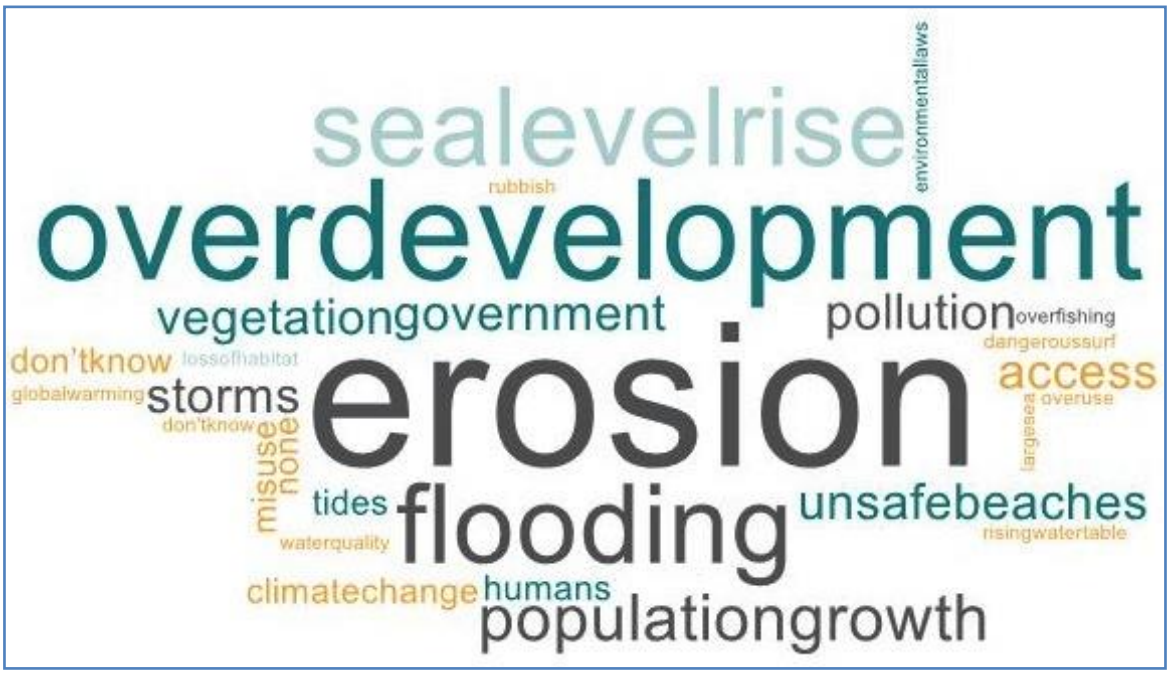


Figure 5.29 Word cloud based on responses by NSW Coastal Accommodation Businesses in regard to their perceived 'biggest threat' to coastal usage over the next 20 years.

Hazards

In general, coastal hazards were mentioned more frequently by CABs (compared to GCUs) as being threats to the future use of their coast (Figure 29). Erosion was cited by the majority of respondents, with '*beach, dune and shoreline erosion…(because of) being loved to death by too many people*' (CAB60) and '*bank erosion*' mentioned as threats to future coastal usage, particularly in '*areas which road and services lie and (reducing) access*' (CAB37). '*Increasing storm frequency and severity*' (CAB23) was also a concern shared by many. As described previously, beach safety was a concern of the CABs with the theme of beaches being '*unsuitable for swimming*' (CAB14) or '*unsafe*' (CAB47) due to '*dangerous surf*' (CAB14), being mentioned by roughly 10% of the respondents.

Policy

Policy and government management of the coastal zone was also mentioned as a threat to future use. This was expressed as '*changes in government priorities and re-zoning of national parks*' (CAB34). The concepts of '*over-governing*' (CAB46) and general '*environmental laws*' (CAB36) were also expressed as threats to the future use of the coast (Figure 5.29).

Vegetation

While the General Coastal Users mentioned 'lack of vegetation' as a future threat, the Coastal Accommodation Businesses were more concerned about the existence of *'noxious weeds*' (CAB38) and '*non-indigenous, detrimental vines*' (CAB28). Another respondent mentioned the '*planted tree line that cannot be maintained due to national parks request…causing a decline in animal population and prime coastal views*' (CAB6). So rather than concern about lack of coastal vegetation, the CAB group felt that existing vegetation is often the wrong kind and not well managed.

Fact File 6: Coastal Values and Usage

Cultural value

For Australians, the coast is deeply woven into our national identity and public psyche (Skinner *et al.* 2003). It is more than just a connection between the land and sea, it represents an intrinsic value both as part of the quintessential Australian lifestyle and as an economic asset (Anning *et al.* 2009; Kirkpatrick, 2012). Australia has more beaches per capita than any other large land mass (Spearritt, 2003) and our beaches are spectacular natural assets that few other countries possess. Residents and visitors utilise the coastal environment - both actively and passively – with each individual holding a different value for the same space. Figure 5.30 provides examples of the ways in which people may value a beach resource through both use and non-use. The resource can still hold a value to those who do not actively utilise the beach, such as knowing that the resource exists without an intention to visit it, knowing that the resource will be available for potential future use and for future generations (Anning *et al.* 2009).

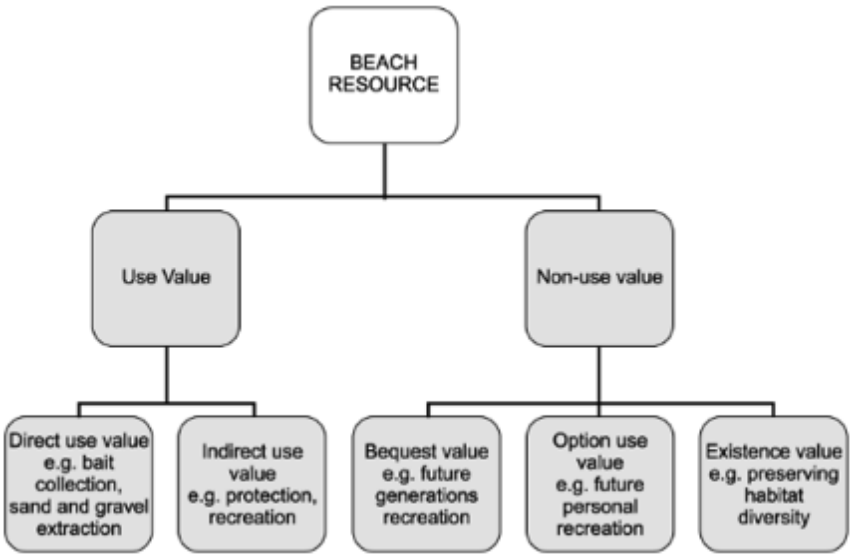


Figure 5.30 Use and non-use values of the beach resource (Anning *et al*. 2009).

The coastal environment offers a multitude of social and cultural benefits, from recreational sports such as surfing, ocean swimming and jogging to more organised sporting activities provided by organisations such as Surf Life Saving clubs, outdoor gyms and other fitness clubs. It also provides a variety of habitats for marine and terrestrial animals (Anning *et al.* 2009), which can contribute to tourism appeal such as bird watching, diving the numerous NSW reef systems and watching the bi-annual migration of whales (Kirkpatrick, 2012). The NSW coast has a unique aesthetic beauty, which draws tourists from all over the country as well as the world (Anning *et al*. 2009; Destination NSW, 2017). However, there is a gap in

understanding of how the NSW coastal community perceives how coastal hazards, exacerbated by climate change and sea level rise, will affect their future use of the NSW coast.

While many survey respondents note '*development*' and '*overuse*' as the biggest perceived threat to their future use of the coast (see Fact Files 2 and 5), many fail to make the connections between natural hazards and impacts to their coastal usage. As noted by a Coastal Management Professional respondent (CMP 5): '*I think we need to link (coastal hazards) with people's values of the coast to make them really understand and care. If it's not in your backyard and not affecting you directly then people don't tend to spend much time thinking on the issue'*. By assessing how people use and value the coast and understand and perceive coastal hazards, this project aimed to identify ways in which NSW coastal users can be better educated and prepared in order to adapt to future coastal change.

Coastal usage

The General Coastal Users group was asked to identify how often they use the coastal environment (Figure 5.31) and what activities they engage in whilst at the coast (Figure 5.32). Over 60% indicated they visit the coast at least once a week, with more than half of those visiting approximately every day. The GCUs were provided with a list of common coastal activities, of which they were asked to select all that were applicable in terms of their usage. The majority 80% indicated they use the coast for 'swimming/bathing', with 'exercise' and 'enjoying the view' selected as the second and third most popular activities. Of those surveyed, 10% indicated they use the coastal environment solely for land-based activities (Figure 5.32).

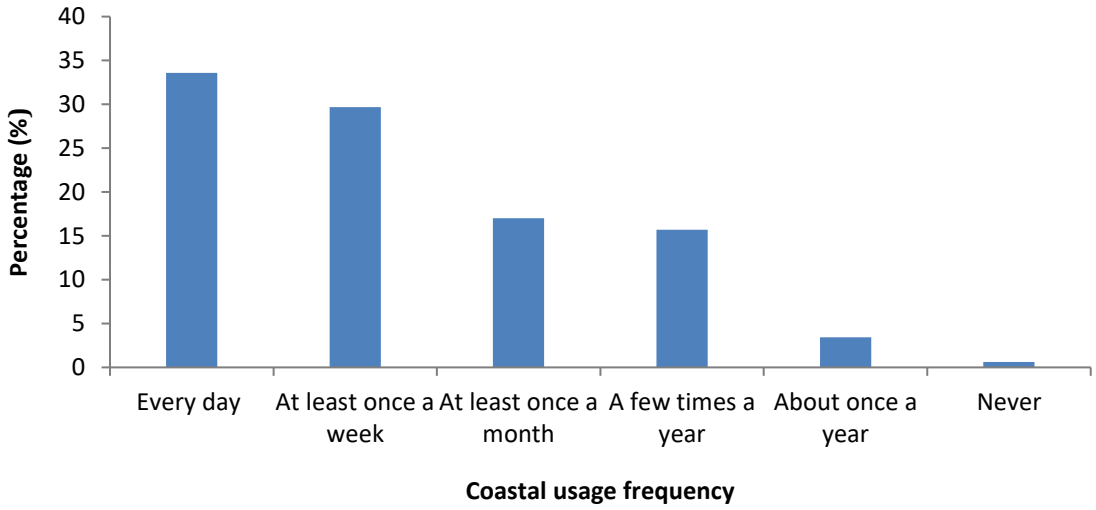


Figure 5.31 Frequency of coastal usage by the General Coastal Users (GCUs).

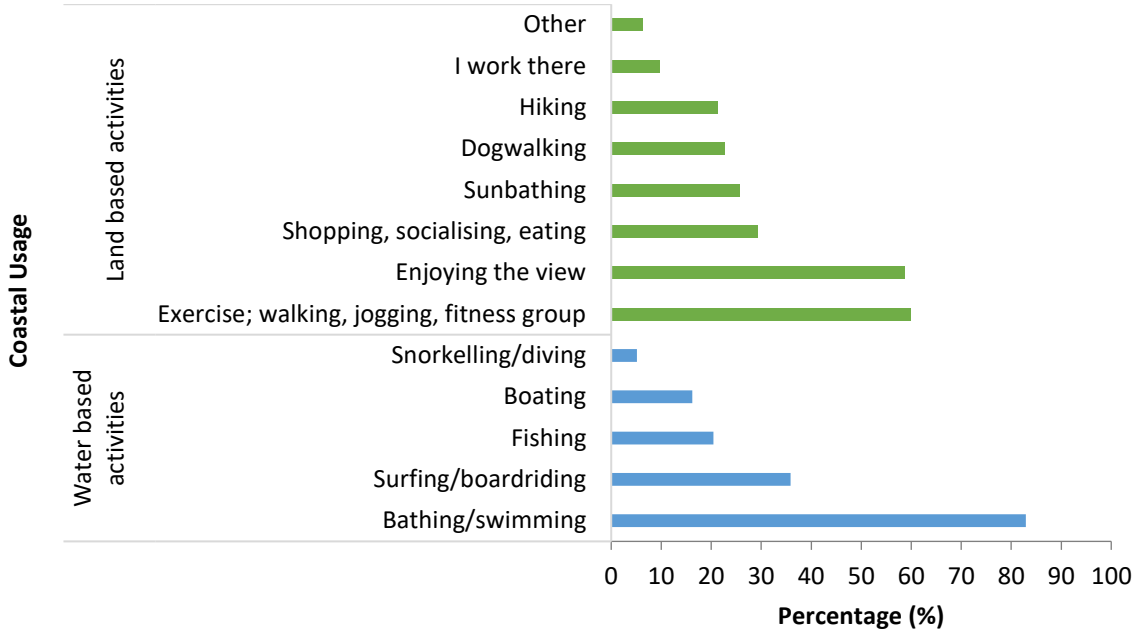


Figure 5.32 Primary coastal activities by General Coastal Users (GCUs). Respondents could select more than one answer.

A recent study conducted by the Sydney Coastal Councils Group (SCCG) investigated the economic value of Sydney beaches, focussing on the economic impacts of sea level rise and subsequent hazards (SCCG, 2013a). The study found that as few as 40% of people actually go onto the sand, or into the water, when visiting the beach, and roughly 60% feel they would not be substantially affected by short term loss of sand – or not enough so they would leave the beach (SCCG, 2013a). This could represent a desire for nature enhanced cultural activities, such as eating fish and chips on a beach or walking down a coastal promenade (SCCG, 2013a).

The results of our study support this view, suggesting that the beach is not just an environment for surfers, swimmers or sunbakers, but also acts as a backdrop to other dominant activities – such as eating or retail therapy; beachfront property owners and holidaymakers consume the view, but may never actually set foot on the sand (Spearritt, 2003). In this case, the aesthetic quality of the picturesque Australian beach has just as much value for passive beacher users as the physical usage of the beach for active ones.

Hazards

The Fact Files in this section describe perceptions and understanding of each of the three primary survey groups in relation to the hazards of coastal erosion and inundation. This includes the driving forces that influence the dynamic nature of these hazards, which are severe coastal storms (e.g. East Coast Lows) and sea level rise, and how the magnitude and frequency of each may change in the future.

Cargo ship Pasha Bulker run aground at Nobby's Beach, Newcastle, NSW on June 8, 2007 (Photo by R. Brander).

Fact File 7: Sea Level Rise

Sea level rise is described by the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO) as:

> *...a response to increasing concentrations of greenhouse gases in the atmosphere and the consequent changes in the global climate. Sea-level rise contributes to coastal erosion and inundation of low-lying coastal regions, particularly during extreme sea level events. It also leads to saltwater intrusion into aquifers, deltas and estuaries* (Legresy, 2014).

While not categorised as a hazard itself, sea level rise is a significant driving force of the two hazards explored within this study; coastal erosion and coastal inundation. Although mean sea level has changed in the past, fluctuating within an amplitude of more than 100m largely due to the growth and melt of polar ice sheets (Aboudha & Woodroffe 2006), the concept that sea levels are rising at an accelerating rate has reached almost global consensus within the scientific community (Leuliette *et al*. 2004; Church & White 2006; Ablain *et al*. 2009, Legresy, 2014; OEH 2017c; IPCC 2018).

In 2009, a sea level rise of 0.4 m by 2050 and 0.9 m by 2100, relative to 1990 mean sea levels, was set as a NSW-wide planning benchmark by the NSW government (Gibbs and Hill, 2011; O'Donnell and Gates 2013). More recently, the NSW Government announced that Councils would have the flexibility to determine their own sea level rise projections to suit their local conditions (OEH, 2017c). Factoring in the predicted global sea level rise, the effect of the East Australian Current, and the increased melting of glaciers and ice sheets, this benchmark represents a scenario where emission outputs remain consistent with today's levels until 2100 (Siebentritt, 2016; OEH, 2017c). This projection has potentially dire effects for much of the NSW coastline and demonstrates a pressing need for adaptation efforts and solutions to the imminent effects of sea level rise.

Spring high tide at Fairy Bower pool, Manly NSW (Photo by A. Attard).

The results of this study show that contrary to the perceptions of Coastal Management Professionals (Figure 5.33), General Coastal Users and Coastal Accommodation Businesses have a reasonable understanding of the occurrence of sea level rise. However, there are some discrepancies regarding the details of how much and when sea level rise will happen, and how it will affect the respondents individually.

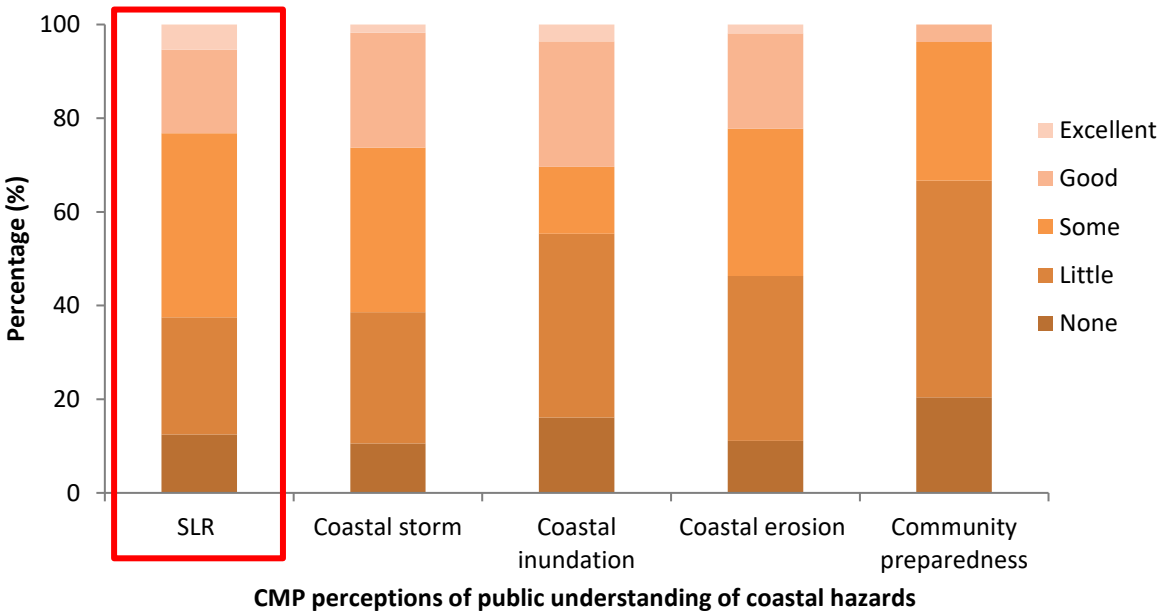


Figure 5.33 Coastal Management Professionals (CMPs) perceptions of public understanding in relation to different aspects of climate change driven coastal hazards. Red box highlights sea level rise (SLR) in relation to other hazards.

Occurrence

The majority of respondents from both the General Coastal Users group and the Coastal Accommodation Business group believe that sea level rise is occurring (Box 5.5). However, approximately 25% of surveyed CABs indicated that sea level rise was either not happening, or that they were unsure, while 15% of the GCUs expressed the same views. This suggests a lack of understanding regarding the occurrence of sea level rise amongst a significant cohort of the NSW coastal community. However, there was no correlation between age and understanding of sea level rise, nor between residential distance from the coast and understanding of sea level rise.

Box 5.5 Perceptions of the occurrence of sea level rise by General Coastal Users and Coastal Accommodation Businesses in NSW.

Survey group	It is happening	It isn't happening	Don't know
General Coastal Users	85%	**5%**	**10%**
Coastal Accommodation Businesses	75%	**5%**	**20%**

Rate and Magnitude

When asked *'How much do you think sea level will change over the next 20 -50 years?*', there was a clear under-estimation of the projected rate and magnitude of sea level rise by General Coastal Users with almost half (45%) predicting a rise between 1-25 cm compared to the estimate of 40 cm by the IPCC (2018). A number of both General Coastal Users (24%) and Coastal Accommodation Businesses (36%) also indicated they were either 'unsure' or believed that sea level 'won't change' along the NSW coast (Figure 5.34). Clearly there is a disconnect between a large portion of the NSW coastal community and science based projections regarding the magnitude of sea level rise and the time period over which these changes will occur.

Some General Coastal Users respondents commented that there is no consensus about how and when sea level rise will occur; '*most of it is unknown or unpredictable* (GCU 341, 768) and '*predicted sea level rise is based on unsubstantiated hypothesis, and failed computer models, which don't match real data*' (GCU 293). Some respondents described why they don't believe that it will be an issue in the near future as it is '*part of a natural cycle*' (GCU 427, 477, 504); '*climate change has happened since the big bang*' (GCU 309) and '*I think that …in the next 100yrs we will be saying 'do you remember when everyone thought that we were going to end up living in the ocean*?' (GCU 776).

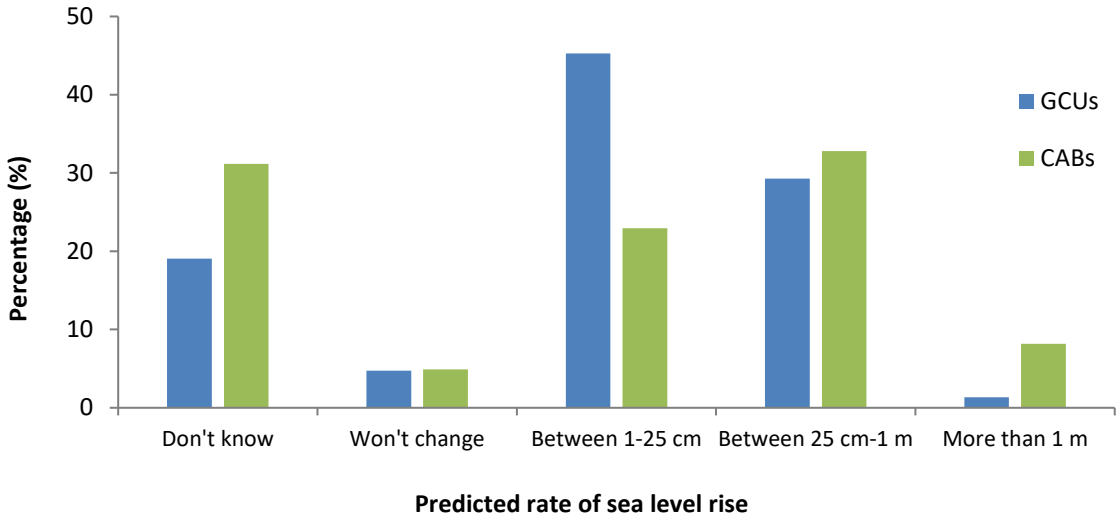


Figure 5.34 Opinions about the magnitude of sea level rise over the next 20-50 years by General Coastal Users (GCUs) and Coastal Accommodation Businesses (CABs) in NSW.

The findings of this study in relation to public perceptions of sea level rise are consistent with those of previous Australian studies. For example, the Victorian Coastal Council (2012) found that at least two thirds of interviewed residents in Victoria agreed that sea level rise is occurring and is a factor of global warming and that 40% of respondents believe sea level rise will have a tangible coastal impact within their lifetime. However, uncertainty existed over the specific timescale of these impacts, with responses ranging from within ten years to more than 100 years (SGC Economics & Planning, 2013).

Effects and Implications

When asked how sea level rise may affect people, there was a clear trend of respondents distancing themselves from the issue. While the majority of both the General Coastal Users (Figure 5.35a) and Coastal Accommodation Business groups (Figure 5.35b) either agreed or strongly agreed that the NSW coast will be affected by sea level rise, fewer respondents thought that the coast closest to them will be affected, and even fewer believed that sea level rise will have a direct impact on them. This supports previous research of risk perception of natural hazards, which shows that people are less concerned about hazards they don't perceive to be imminent or are perceived to be out of their control (Slovic *et al.* 2000, Slovic *et al.* 2002; Gurran *et al*. 2006; Wachinger & Renn, 2010). With the majority of GCUs living within 5 km of the coast and almost all of the CABs located within 1 km, this is a clear indication of a disconnect between awareness of sea level rise and the direct potential impacts to individuals. This finding is consistent with those of Buckley (2008), who found over 50% of respondents of a Byron Bay, NSW sample group perceived sea level rise to be a hazard that would not threaten them in their lifetime, or at all, despite scientific models indicating otherwise.

Barnett *et al.* (2013) found that the disjunction between public perception and science is formed by a combination of the perceived complexity of the mechanisms behind sea level rise, a lack of sufficient evidence of sea level rise in the form of observable, attributable effects at a local scale, and scepticism as to the validity of scientific data spanning what is perceived as a short time period.

This idea is also reflected in many responses from the surveyed Coastal Management Professionals, who indicated that one of the biggest issues facing coastal management professionals in terms of risk communication is communicating an actionable timeline and that sea level rise won't just '*happen to someone else*' (CMP 5).

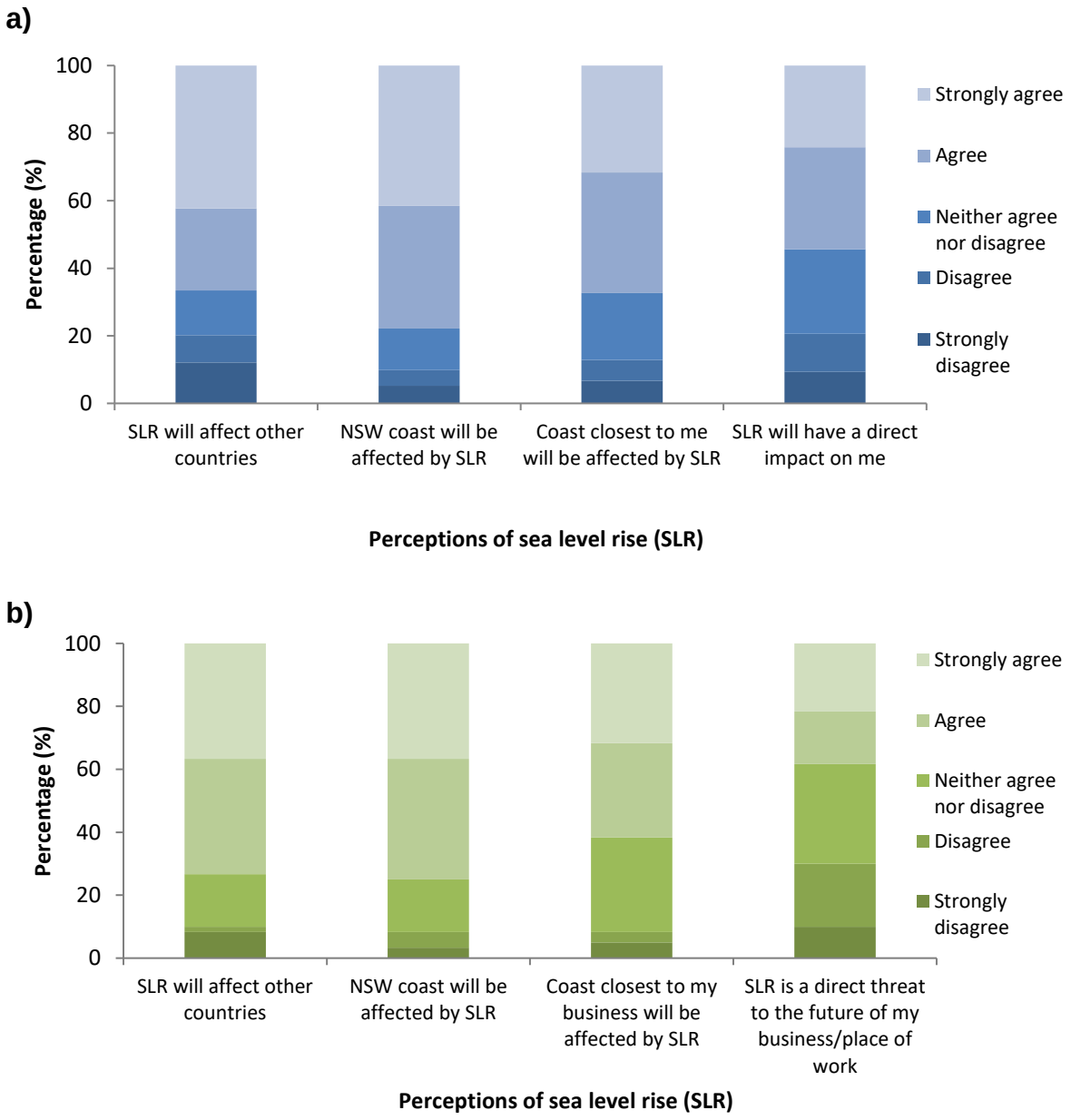


Figure 5.35 Spatial perceptions of the effects of sea level rise by: **a)** General Coastal Users (GCUs) in NSW; and **b)** Coastal Accommodation Businesses (CABs) in NSW.

Fact File 8: Coastal Storms

The New South Wales coast is susceptible to large coastal storm events, the most significant of which, in terms of magnitude, are East Coast Lows. East Coast Lows (ECL) are low pressure cyclones that generate gale force winds and heavy rainfall leading to large waves and flash flooding. While more prevalent in early to mid-winter, ECLs can occur at any time and on average NSW experiences 10 ECL events per year (BOM, 2007), although the number can vary considerably from year to year (Harley *et al.* 2016; NSW OEH 2017c). The combination of low atmospheric pressure and strong winds elevate sea levels, which can produce storm surges leading to coastal inundation and significant erosion along open coasts. These events can remove more than 50 m of beach width on an open coast beach and are often coupled with flooding due to associated rainfall (BOM, 2007; Leitch & Inman, 2012; SCCG, 2013a; Harley *et al.* 2016; NSW OEH, 2017c). Combined with the effects of a climate induced rise in the mean sea level, ECL have to potential to cause millions of dollars of damage along the NSW coast each year.

Over the last decade, there have been three particularly severe East Coast Lows that have caused significant damage to the NSW coastline. In June 8-9, 2007 an event generated significant wave heights (H_{sig}) of 6.9m offshore of Sydney (Harley *et al.* 2016) and caused the container ship 'Pasha Bulker' to run ashore at Nobby's Beach, Newcastle. Another significant ECL event hit NSW on the 20-22 April 2015, with a peak H_{sig} of 8.1m, causing multi-millions of dollars of damage across NSW (NSW Dept. Justice, 2016). Four deaths and a number of serious injuries were attributed to flash flooding caused by the 2015 storm event (Jarbour & Tan, 2015). More recently, the 3-7 June 2016 event caused major damage to the NSW coastline and was characterised by extreme hourly rainfall rates of between 100 - 150 mm at a number of locations along the coast (NSW Dept. Justice, 2016). Although H_{sig} of 6 - 7 m during the storm was smaller than previous events, the combination of an unusual North-Easterly direction of wind and waves and the occurrence of king tides resulted in significant damage to southern sections of beaches (NSW Dept. Justice, 2016; Harley *et al*. 2017). The Insurance Council of Australia estimated the cost of this disaster to be $304 million (NSW Dept. Justice, 2016).

With the prediction of more intense and more frequent cyclonic events due to climate change (DCCEE, 2009; Proudfoot & Peterson, 2011), adaptation efforts along the NSW coast are high on the agenda for coastal Councils state-wide (Serrao-Neumann *et al.* 2014). The 2007 ECL events, in particular the 'Pasha Bulker' storm, catalysed a reform in this literature, sparking the establishment of the Eastern Seaboard Climate Change Initiative – which aims to improve the understanding of ECLs and their impacts (Environment and Heritage n.d.a; Helman *et al*. 2010).

In this study, similar to their perceptions about public understanding of other coastal hazards, less than 30% of the surveyed Coastal Management Professionals think that the NSW coastal community has a good understanding of coastal storms (Figure 5.36).

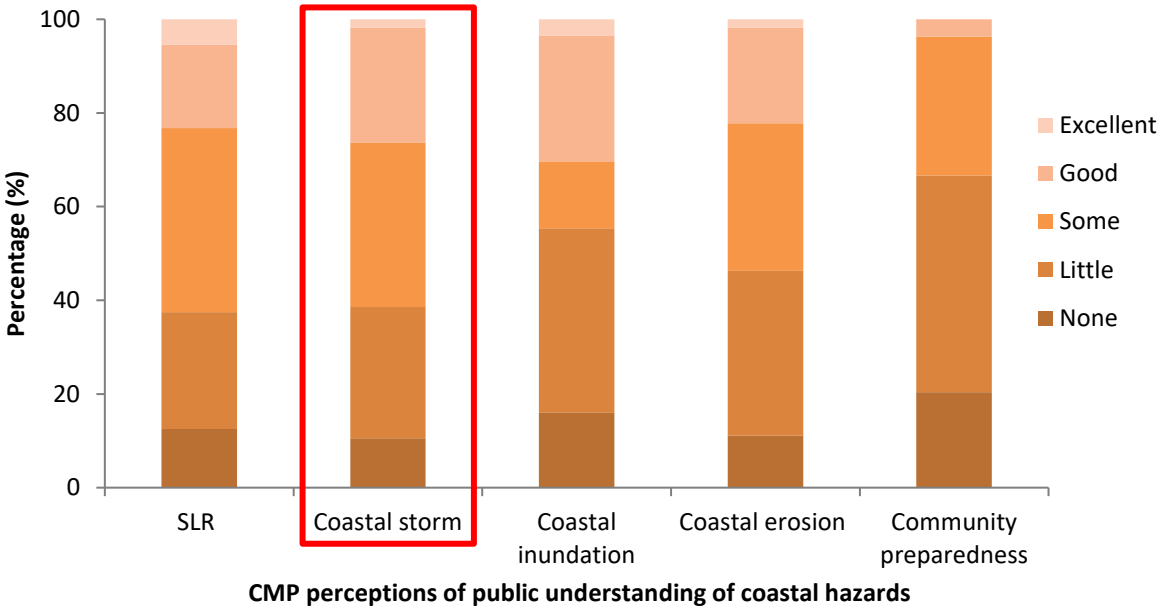


Figure 5.36 Coastal Management Professionals (CMPs) perceptions of the NSW community understanding of severe coastal storms in relation to other hazards.

Occurrence

The majority of General Coastal Users and Coastal Accommodation Businesses think that severe coastal storms in NSW, such as damaging ECL events, occur on average 'about once every 5 years' (35% and 48% respectively) followed by 'about once every 20 years' (26% and 18% respectively; Figure 5.37). While surveys are often prone to retrospective bias and recent events, these estimates are relatively correct given that the April 2015 storm was considered to be a '1 in 10' year event (NSW OEH, 2017c). This does not mean storms like this occur once every ten years, but rather the probability of a storm of that size occurring in any given year is 1 in 10. Presently, Australian ECL data does not cover the time period needed to account for the extreme temporal variability of Australia's climate. As a result, large ECL events (such as the 2007, 2015, 2016 events) are difficult to predict based on historical data (NSW OEH, 2017c).

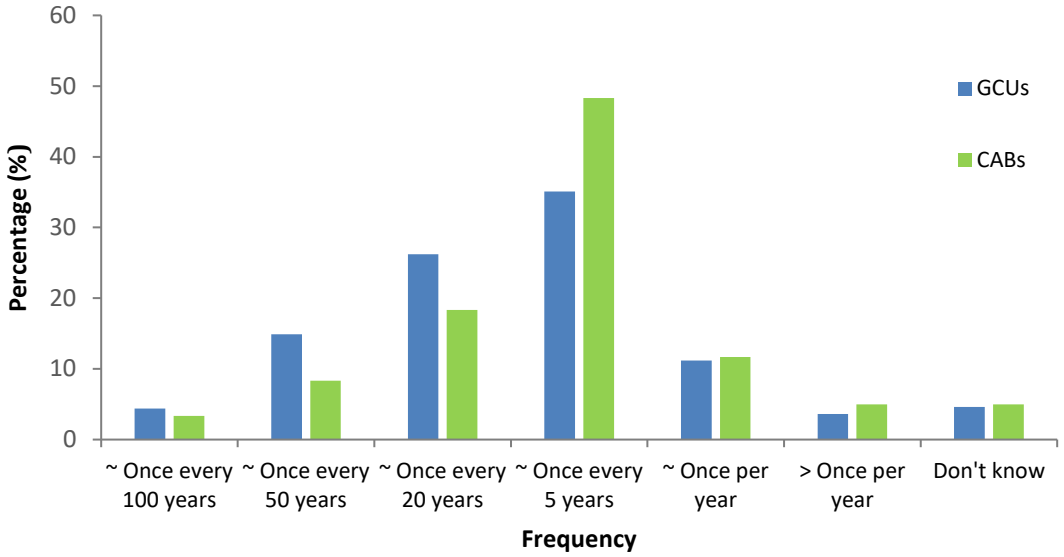


Figure 5.37 Comparison of surveyed NSW General Coastal Users (GCUs) and Coastal Accommodation Businesses (CABs) perceptions of the frequency of occurrence of severe coastal storms such as East Coast Lows.

As evident in Figure 5.37, there is a perception amongst both GCUs and CABs that severe coastal storms are relatively infrequent and therefore perhaps carry less risk. Of note, fewer Coastal Accommodation Businesses thought severe storms would occur less frequently in the future, which is likely a reflection of their direct experience with impacts of coastal storms due to their close proximity to the coast. When asked how often these types of storms are likely to occur in the future, 76% of General Coastal Users and 65% of Coastal Accommodation Businesses stated that they think severe storms will occur more often over the next 20 years (Box 5.6).

Box 5.6 Perceptions of the future rate and magnitude of severe coastal storms by NSW General Coastal Users and Coastal Accommodation Businesses.

Future coastal storm occurrence in 20 years	General Coastal Users	Coastal Accommodation Businesses
Occur more often	76%	65%
Occur less often	-	1%
Occur about the same as they always have	20%	27%
Don't know	4%	7%
Future coastal storm intensity in 20 years	**General Coastal Users**	**Coastal Accommodation Businesses**
More damaging	67%	65%
Less damaging	-	-
About the same	29%	30%
Don't know	4%	5%

Magnitude

In terms of the future magnitude and severity of coastal storms, approximately two-thirds of the General Coastal Users and Coastal Accommodation Businesses (67% and 65% respectively) think they will be more damaging (Box 5.6), while the remaining third think that potential damage will remain the same as present. The Australian Government Bureau of Meteorology (BOM) has a detailed database of ECLs from 1973 onwards. While there are roughly ten 'significant impact' East Coast Lows (ECL) per year, only about once per year do 'explosive' events occur (BOM, 2007; ESCCI, 2016) and very few cause the type of damage that occurred during the 2016 storm. Of note, it is presently difficult to predict how the severity of ECL events may change in the future (ESCCI, 2016).

Impacts and Concern

Respondents were provided with a description of the severe ECL event which hit NSW in June 2016, along with a photograph of a damaged swimming pool on Collaroy/Narrabeen beach caused by severe erosion (Figure 5.55). They were then asked '*specifically, how concerned would you be about the following impacts of a storm (like this)?'.* The most common concern of both the surveyed NSW General Coastal Users and Coastal Accommodation Businesses was 'pollution' (Figure 5.38). In the case of GCUs, this is very similar to Figure 5.6, which showed that pollution was also their main concern in regard to their future use of the coast. The GCUs were also more concerned for the safety of people and damage to plants and wildlife (Figure 5.38a), whereas the CABs tended to be more concerned about amenities (loss of sand from the beach and interruption to utilities'; Figure 5.38b). This is also likely a reflection of the direct experiences of CABs with damaging coastal storms and their proximity to the coast.

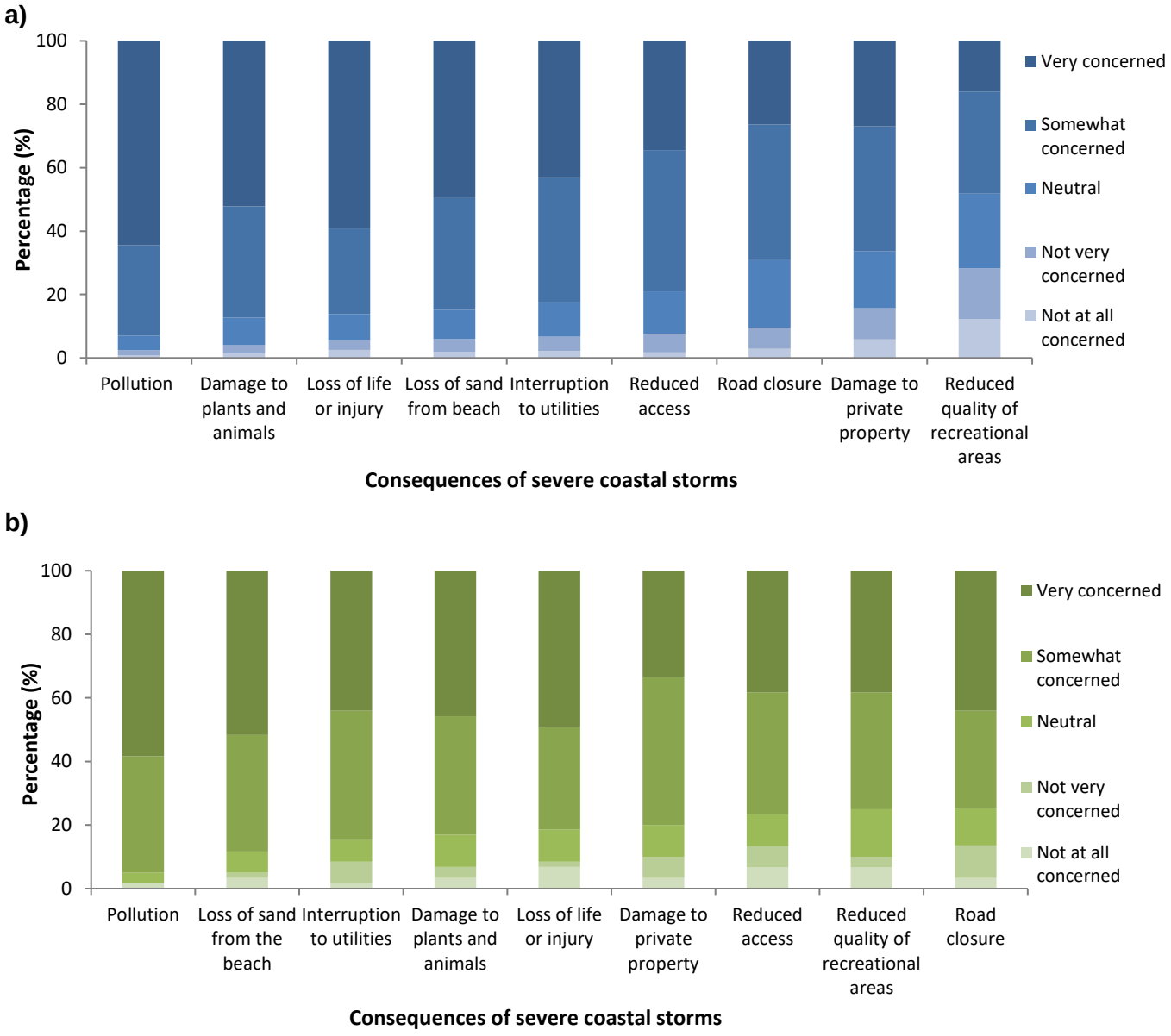


Figure 5.38 Consequences of severe storms ranked in terms of level of concern by: **a)** NSW General Coastal Users (GCUs); and **b)** NSW Coastal Accommodation Businesses (CABs).

Fact File 9: Coastal Inundation

Coastal inundation is the flooding of normally dry, low-lying coastal land. It is often caused by a combination of high tides (normally King tides), storm surges and large waves caused by extreme weather events, such as East Coast Lows in NSW (Leitch & Inman, 2012). The extent and occurrence of coastal inundation resulting from these processes will be exacerbated in the future by expected sea level rise (Leitch & Inman, 2012).

Inundation poses significant risks to NSW coastal communities through damage to, or destruction of, both public and private infrastructure. Economic costs associated with these impacts include those associated with repairs, the implementation and maintenance of mitigation efforts to reduce future damage, and higher premiums for insurance (Leitch & Inman, 2012; Kirkpatrick, 2012). The costs associated with pre-inundation mitigation and post-inundation repairs, rescues and relocations can be in the hundreds of millions of dollars (Kirkpatrick, 2012). This presents a particularly difficult problem for Councils; balancing the costs of preventative actions against the costs of social expectations and future repair costs as well as the 'knock-on' effects via damage of infrastructure like water supply, sewage, roads and power (Leitch and Inman, 2012; Kirkpatrick, 2012).

'As a retired marine biologist, I see inundation of our biologically rich intertidal rock platforms such as Long Reef a major loss' (CMP 56)

Public awareness and understanding of the causes and effects of coastal inundation is vital for adequate adaptation to the changing New South Wales climatic landscape. Along with damage to buildings and services and loss of habitable and usable land, coastal inundation presents a range of repercussions to the natural environment. Some of these effects, such as salt-water intrusion to coastal freshwater lakes and estuarine environments, could result in dramatic changes in delicate ecosystems and loss of biodiversity (Mulrennan and Woodroffe, 1998; Blackwell, 2005) as well as negative impacts to the usage of freshwater.

Perceptions of Coastal Management Professionals

Only 17% of the surveyed Coastal Management Professionals thought the NSW coastal community had a good or excellent understanding of coastal inundation (Figure 5.39). However, there was a strong belief that a better understanding of inundation would benefit future community engagement efforts: *'If they don't understand the hazard they can't buy into the solution - the more the community understands, the more they will support the issues which need to be prepared for now rather than wait until it's too late'* (CMP42).

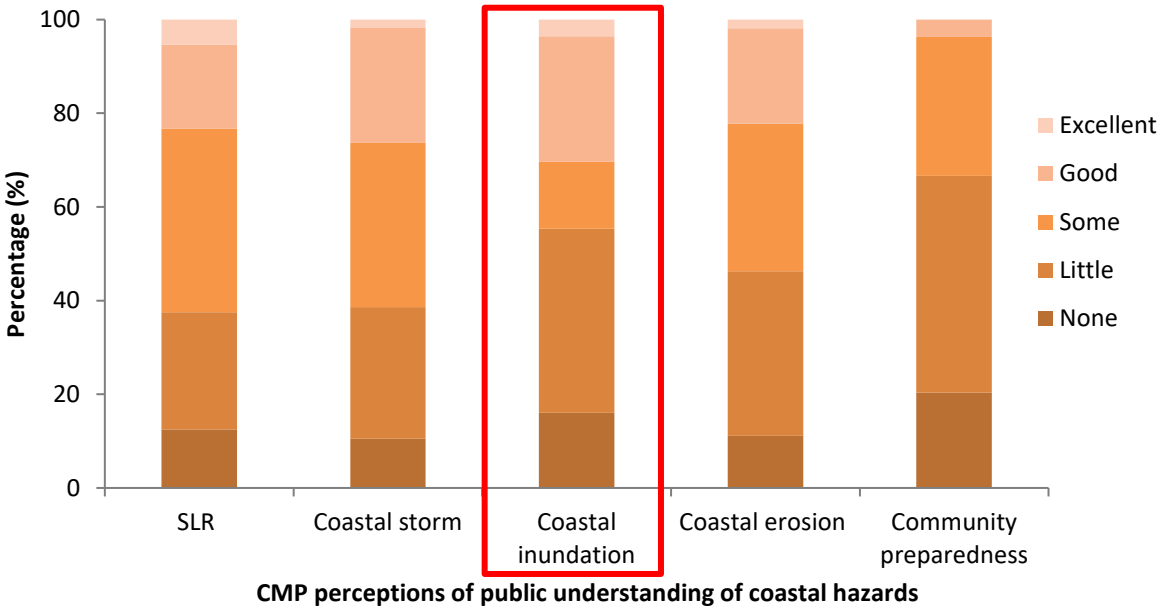


Figure 5.39 Coastal Management Professionals (CMPs) perceptions of the NSW community understanding of coastal inundation in relation to other hazards.

Figure 5.40a shows that 60% of the CMPs think the area in which they work is either at high or extreme risk of coastal inundation with estuaries identified as the coastal environment most at risk of damage (65%) followed by beaches (43%), tidal flats and wetlands (26%; Figure 5.40b). The EPA 2015 State of Environment report states that in NSW there are on average 200 people per km^2 residing in estuarine catchments, but this number is significantly variable across the state, particularly in coastal urban areas where the population density increases dramatically (EPA, 2015).

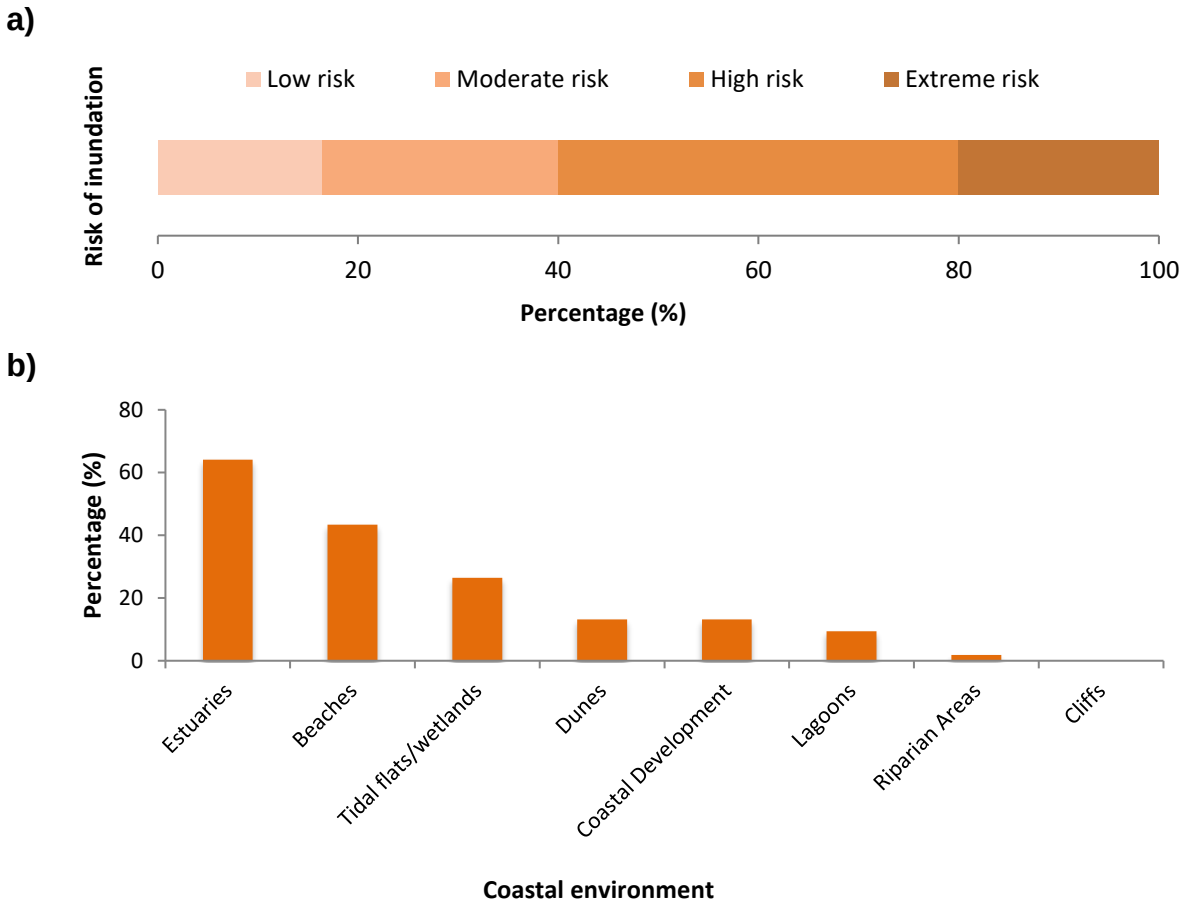


Figure 5.40 Coastal Management Professionals (CMPs) perceptions of**: a)** risk of coastal inundation at the coastline in which they frequently work; and **b)** coastal environments most at risk of damage caused by coastal inundation. Respondents were able to indicate more than one answer.

Community Understanding

Contrary to the perceptions of Coastal Management Professionals, the results of this study indicate that both General Coastal Users and Coastal Accommodation Businesses have a fairly good understanding of the causes of coastal inundation (Figure 5.41). While there is not one single correct cause, at least 70% of respondents from both surveyed groups acknowledged storm surges as a primary cause of coastal inundation. However, fewer GCUs than CABs indicated king tides/high tides as a primary cause, which is likely related to the direct experience of the latter (40% of respondents) with coastal inundation events in the past. While heavy rain is associated with East Coast Low events and undoubtedly contributes to flood damage, it is flooding caused by seawater that is unique to coastal inundation (Leitch & Inman 2012). However, the survey results suggest that approximately a third of the NSW General Coastal Users are unaware that storm surges contribute to coastal inundation and approximately half (45%) are unaware that tides are also a contributing factor.

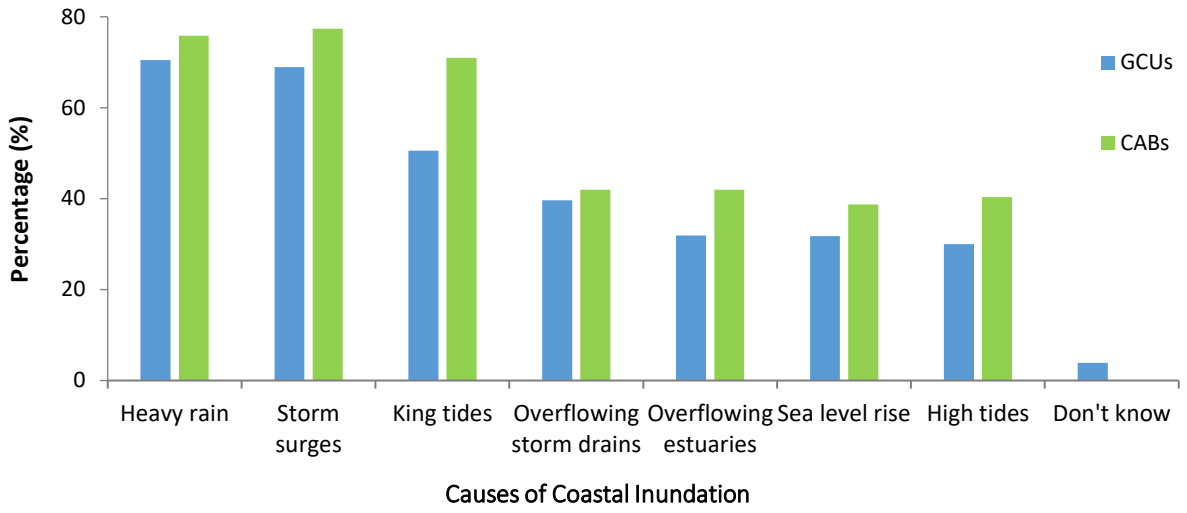


Figure 5.41 Responses by General Coastal Users (GCUs) and Coastal Accommodation Businesses (CABs) in response to the question '*What do you consider to be the main causes of coastal inundation?*' Respondents were able to select more than one answer.

In terms of the future occurrence of inundation, the majority of all three survey groups (CMPs, GCUs, CABs) think it will increase over the next 20 years (Box 5.7). All three groups were also asked '*which coastal environment do you think is most susceptible to damage caused by coastal inundation'*.

Box 5.7 Perceptions of survey respondents regarding future occurrence of coastal inundation in NSW.

	General Coastal Users	Coastal Accommodation Businesses	Coastal Management Professionals
Increase	77%	67%	95%
Decrease	1%	0%	0%
Stay about the same	14%	20%	5%
Don't know	8%	13%	0%

Whereas almost two-thirds of the CMPs identified 'estuaries', the majority of General Coastal Users and Coastal Accommodation Business groups indicated 'developed beaches' as being most vulnerable (Figure 5.42a, b). This disconnect may be due to the larger number of GCUs identifying beaches as their primary coastal usage (83%) compared to estuaries (10%) and that the public are more influenced by visible signs of damage to coastal infrastructure and loss of beach amenity due to coastal storm erosion. It also indicates that, unlike Coastal Management Professionals, the general public do not think in terms of future damage caused by inundation due to sea level rise.

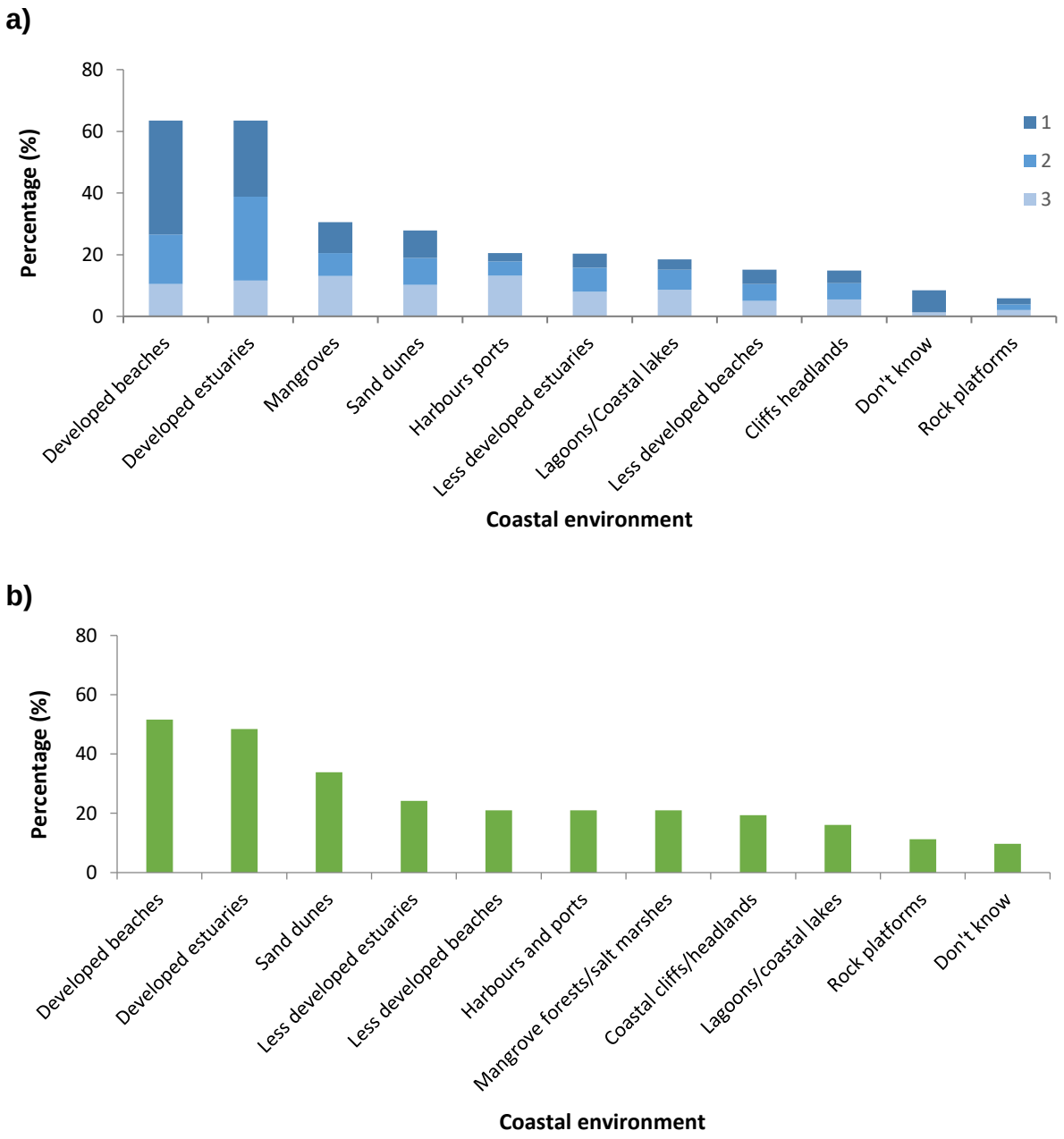


Figure 5.42 Perceptions of environments most at risk of coastal inundation by: **a)** General Coastal Users; and **b)** Coastal Accommodation Businesses. Both were asked to provide answers in rank order from 1-3, however the majority of the CABs did not rank their answers so only their primary choice is shown.

Fact File 10: Coastal Erosion

Coastal erosion is manifest as the recession of coastal land due to the removal and net loss of material, such as sand, rocks and other sediments, and refers to landward movement of the shoreline and/or a reduction in beach volume, usually associated with storm events or a series of events. Coastal (beach) erosion occurs due to one or more process drivers; wind, waves, tides, currents, ocean water level, and downslope movement of material due to gravity (OEH, 2018).

The most damaging of these driving forces are large coastal storms, which in NSW are dominated by East Coast Low cyclonic events. These powerful low-pressure systems generate gale force winds, heavy rain leading to flash flooding, rough seas and large coastal swell, all of which contribute to coastal erosion. There is also evidence that coastal erosion in NSW may be exacerbated by periods of *La Nina* climatic cycles, which are associated with a positive Southern Oscillation Index (SOI) and a negative Pacific Decadal Oscillation (PDO), both of which will likely be affected by climate change in the future (Helman *et al.* 2007; Helman *et al.* 2010; Proudfoot & Peterson, 2011; Barnard *et al.* 2015, Harley *et al*. 2017). The NSW government has identified 15 locations in NSW that are particularly at risk of coastal erosion and are considered to be 'erosion hotspots' (OEH, 2011), where 'five or more houses and/or a public road are located in a current (or immediate) coastal hazard area, as identified in a coastal hazard study' (OEH, 2011; Table 3.1).

A study conducted by Landry *et al.* (2003) on the east coast of the United States found that erosion of coastlines in front of residential property significantly affected the value of the property, while studies conducted in NSW found that severe coastal erosion has the potential to cost billions of dollars state-wide through damage to infrastructure (Kirkpatrick, 2012), recreational facilities (Elrick *et al.* 2011) and 'ecosystem goods and services' (Blackwell 2005). The Sydney Beaches Valuation Project (SCCG, 2013a) highlighted community awareness of erosion issues within their study areas and found that coastal users have a strong desire for action to be taken to limit projected erosion impacts (SCCG, 2013a). However, this study did not assess what people understand about coastal erosion and how they perceive the future changes of this hazard over time in terms of magnitude and frequency.

Perceptions of Coastal Management Professionals (CMPs)

Approximately 80% of the Coastal Management Professionals surveyed in this study think that the NSW coastline in which they work is at high or extreme risk of erosion (Figure 5.43a) and 93% believed that the chance of coastal erosion will increase over the next 20 years. These results show that CMPs view coastal erosion as a serious and growing issue with beaches, dunes and estuaries identified as the coastal environments most at risk. In comparison, less than 20% of the CMPs identified cliffs and coastal lagoons as being at risk (Figure 5.43b).

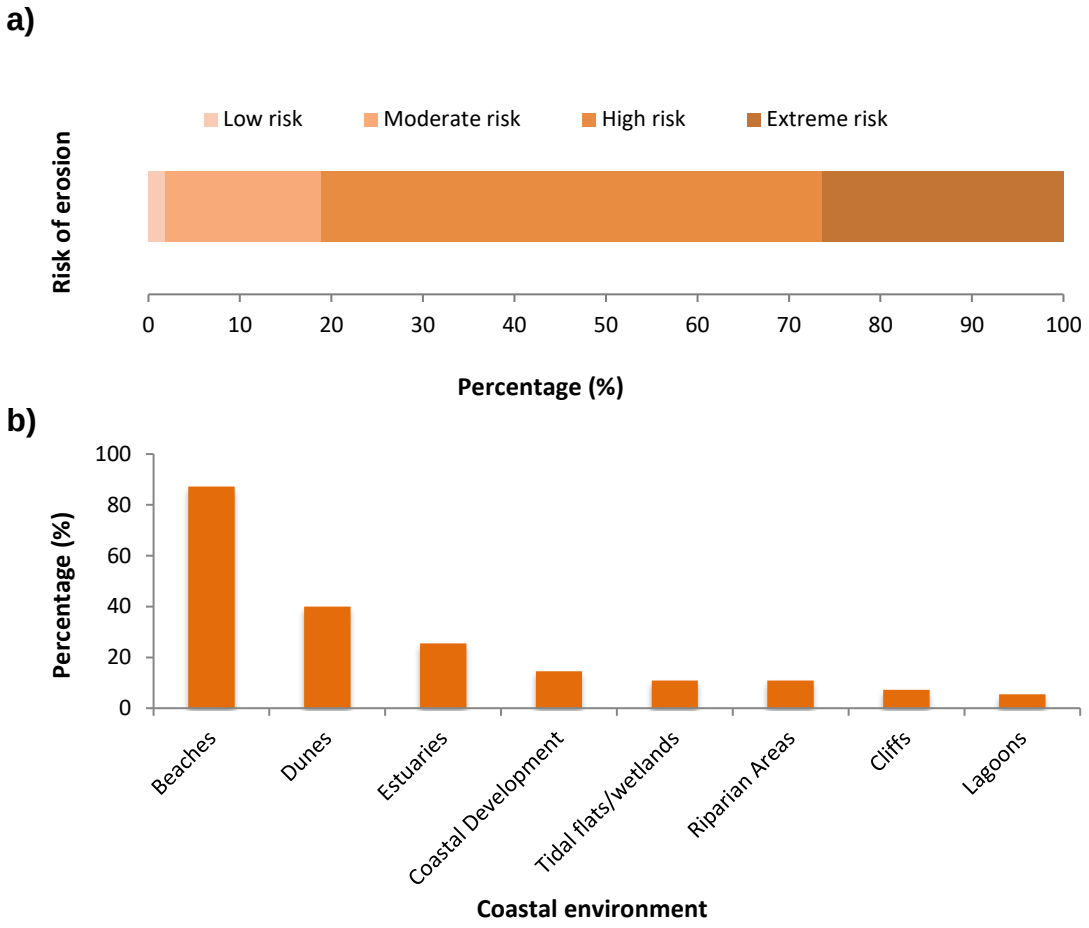


Figure 5.43 Coastal Management Professionals (CMPs): **a)** perceptions of present-day risk of coastal erosion in the area in which they work; and **b)** opinions of coastal environments most at risk of erosion.

While the CMPs recognised the clear risks posed by coastal erosion, they also had low expectations of public understanding of this hazard. Only 20% felt that the NSW coastal community had a good understanding of coastal erosion (Figure 5.44).

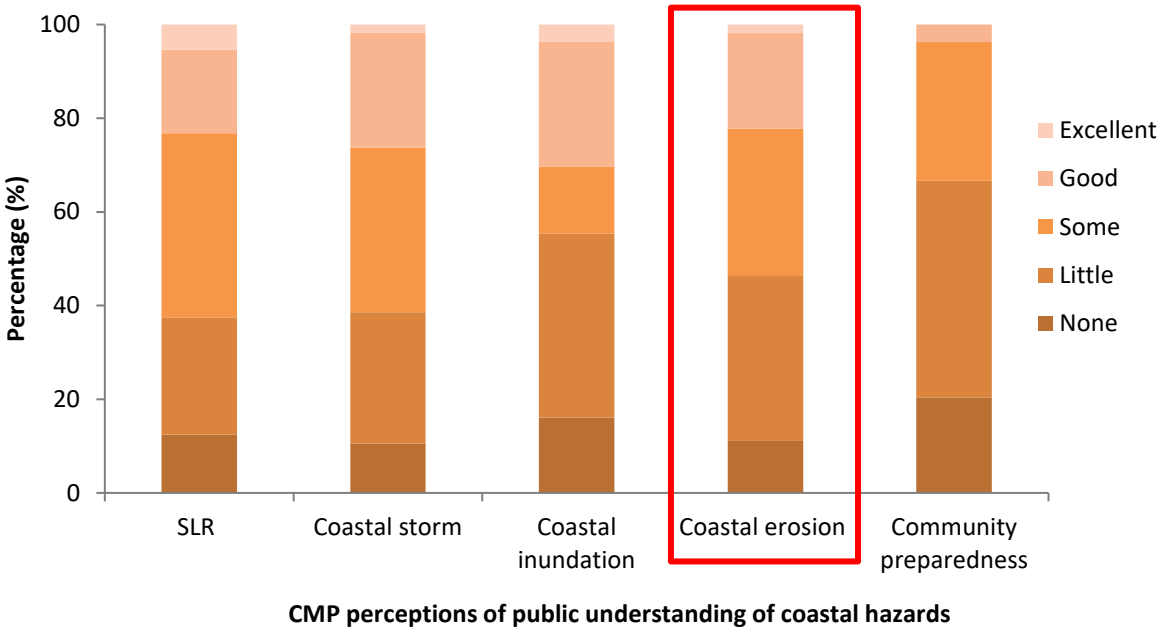


Figure 5.44 Coastal Management Professionals perceptions of public understanding of coastal erosion in relation to other hazards.

Community Understanding

Contrary to the perceptions of the Coastal Management Professionals, both General Coastal Users (Figure 5.45a) and Coastal Accommodation Businesses (Figure 5.45b) displayed a reasonably sound understanding of which environments are affected by coastal erosion, both at present and in the future. Both groups identified developed beaches, developed estuaries and sand dunes as coastal environments most at risk although CABs considered dunes to be more at risk, possibly due to the fact that many coastal accommodations are fronted by sand dunes. Overall the responses of the GCUs and CABs were similar to those identified by the Coastal Management Professionals. However, in contrast to the CMPs, the GCUs and CABs both considered cliffs and headlands to be at relatively high risk. This difference in perception represents a clear knowledge gap in relation to the erosion and hazards associated with rocky coast environments.

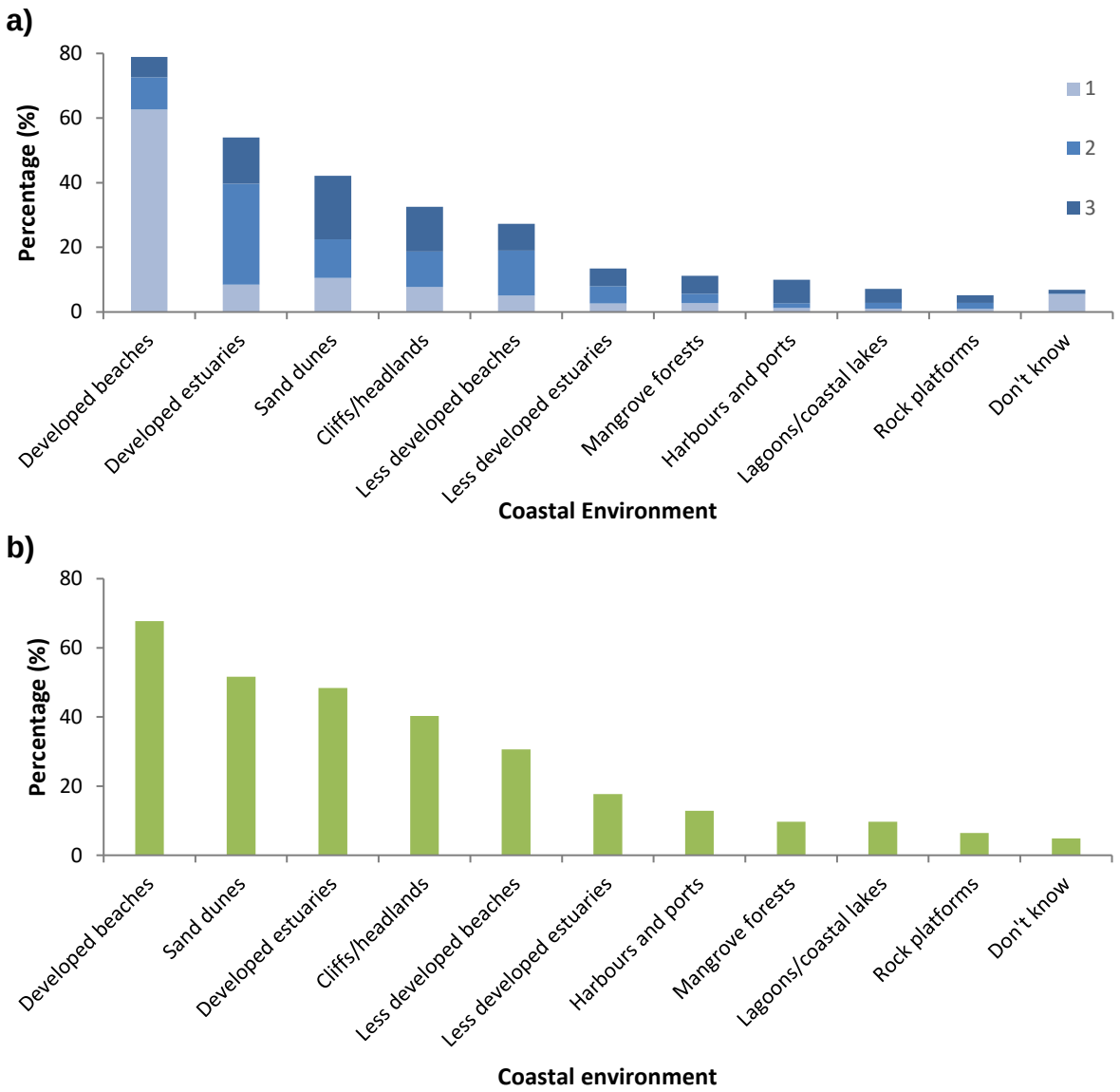


Figure 5.45 Coastal environments most at risk of damage caused by coastal erosion as perceived by: **a)** General Coastal Users (respondents were asked to rank top three choices); and **b)** Coastal Accommodation Businesses.

The majority of GCUs and CMPs thought the chance of erosion will increase over the next 20 years (Box 5.8). However, it is worth noting that 25% of the Coastal Accommodation Businesses were either unsure or thought the chance of erosion would stay about the same. This is of some concern, given the proximity of their businesses to coastal waters and the prevailing scientific view that with predicted changes in climate, episodes of severe coastal erosion along the NSW coast may increase in both frequency and magnitude (Abuodha & Woodroffe, 2006; Anning *et al.* 2009; Leitch & Inman, 2012).

Box 5.8 Perceptions of the future frequency of coastal erosion in the next 20 years by General Coastal Users, Coastal Accommodation Businesses and Coastal Management Professionals in NSW.

	General Coastal Users	Coastal Accommodation Businesses	Coastal Management Professionals
Increase	83%	75%	95%
Decrease	0%	0%	0%
Stay about the same	12%	20%	5%
Don't know	5%	5%	0%

When asked what they think is the biggest threat to the future use of their coast, the General Coastal Users identified coastal erosion as the third most prominent theme (following *development* and *climate change*) with opinions such as: '*lack of action by Council to repair erosion'* (GCU 44); *'erosion of banks from motorised watercrafts'* (GCU75); '*erosion because of inappropriate use*' (GCU82) and '*coastal erosion caused by sea level rise*' (GCU195). While it is clear there is public concern about coastal erosion and how it will affect NSW coastal users in the future, there is also a range of public perceptions regarding the different causes and damaging effects of erosion. This suggests that improved communication is needed to draw attention to what causes and exacerbates erosion events, both active and passive, and how this may affect all NSW coastal users in the future.

Coastal Management and Community Engagement

The Fact Files in this section describe the perceptions and understandings of each of the three survey groups regarding how the NSW coast is: i) managed in relation to coastal erosion and inundation; ii) where and how each group has previously received information about these coastal hazards; and iii) what they would like to know more about and how they would prefer to receive information in the future.

Freshwater Beach, NSW, in the height of summer January 2019 (Photo by A. Attard).

Fact File 11: The NSW Community and Coastal Management

New South Wales State policy regarding coastal management has recently undergone a period of review, resulting in the creation of a new framework. The new Coastal Management Act (2016) replaced the Coastal Protection Act 1979, and reflects the natural, social, cultural and economic values of NSW coastal areas, and promotes ecologically sustainable development in correspondence to these values (OEH, 2017a). Most notably, the new Act recognises the natural coastal processes and dynamic nature of the NSW coastline, both in local and regional perspectives, and legislates land use planning decisions to accommodate them. As the newly defined coastal zone forms part of the marine estate, the new Act also supports the aims of the *Marine Estate Act 2014* (OEH, 2017a).

Although there is a defined planning system in NSW which places the onus on local government bodies, a policy void exists in terms of statutory responsibility for climate change adaptation (Smith *et al.* 2016). This is reflected in the barriers against adaptation efforts across NSW (Barnett *et al.* 2013). One of the most significant barriers to adaptation is the lack of clarity of the roles and responsibilities of different government bodies communicated to the public (Productivity Commission 2012) regarding the implement of adaptation strategies. Many local governments do recognise the need to plan and facilitate community involved adaptation techniques, some of which have been supported by various state government programs (Smith *et al.* 2016). However, responsibilities are often a complex mix of formal and informal agreements for coastal management and they are often shared or duplicated across different levels of government, organisations and public and private sectors (Barrett *et al.* 2013).

In terms of actually implementing physical strategies to mitigate the impact of coastal erosion and inundation, existing management approaches typically fall into three categories: hard solutions, soft solutions and retreat. Hard solutions involve the construction of intended permanent structures in a fixed location, soft solutions involve replacing coastlines and beaches as they disappear, and retreat involves planned relocation of residential housing and infrastructure away from receding coastlines, often in the form of buyback programs controlled by the government (Hadwen *et al.* 2011).

In order for communities to support various types of coastal management strategies, public engagement prior to, during and after the implementation of the initiative(s) is vital for their success. Therefore, it is important to know what coastal communities know and understand about various physical strategies in order target future communications clearly and accurately.

What does the NSW Coastal Community think about coastal management?

When asked '*How much confidence do you have in your local Council for managing the coast appropriately*?' the surveyed General Coastal Users and Coastal Accommodation Businesses responded in relatively similar ways (Figure 5.46). While approximately 35% of both groups indicated they had '*some confidence*' in their local government Council, the majority indicated that they had either '*little*' or '*no*' confidence in their Council in terms of coastal management.

Figure 5.46 Confidence levels that surveyed NSW General Coastal Users and Coastal Accommodation Businesses have in their local government Councils to manage the coast appropriately.

Over 59% of the surveyed NSW General Coastal Users felt that '*not enough is being done*' to manage the effects of coastal erosion, and 48% believed that '*not enough is being done'* to manage the effects of coastal inundation (Figure 5.47).

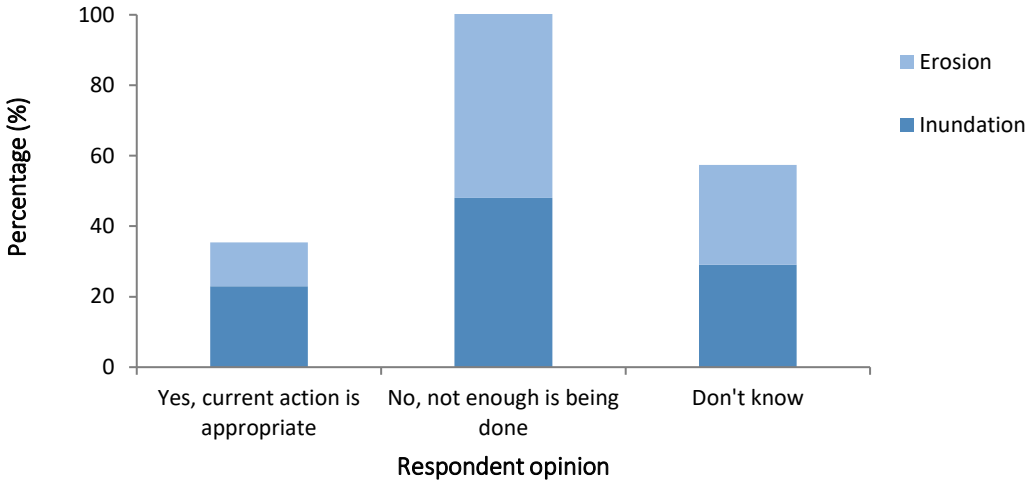


Figure 5.47 Opinions of NSW General Coastal Users regarding the present state of action being taken to prevent damage caused by coastal erosion and coastal inundation.

The NSW Coastal Accommodation Businesses surveyed in this study were asked if their business had any means of protection from coastal hazards. Only 39% of this group indicated that their business was presently protected by coastal protection initiatives and these respondents were asked if they were presently satisfied with the level of coastal protection at the coast closest to their business. While the majority (approximately 60%) indicated they were, 23% indicated they were not and 18% were unsure (Figure 5.48). Of those who indicated they were not satisfied, '*beach nourishment*' and '*groyne/jetty*' were identified by as protection measures with the least satisfaction levels.

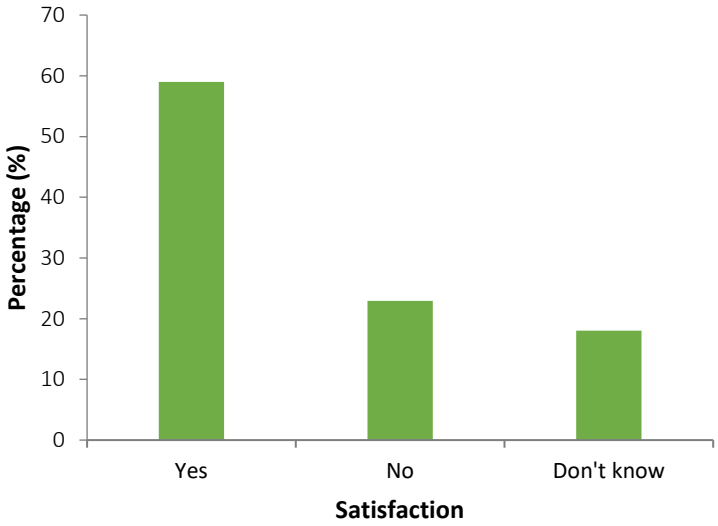


Figure 5.48 Satisfaction levels of NSW Coastal Accommodation Businesses in the type of coastal protection strategy presently used at the coastline nearest their business.

What does the NSW coastal community think about management strategies?

The NSW General Coastal Users surveyed in this study were asked to rank what they considered to be the best three ways to manage coastal erosion or coastal inundation on the coast. As shown in Figure 5.49 the clear preference for both hazards was '*maintaining sand dunes*' followed by '*relocating buildings at risk*'. The implementation of '*seawalls*' was more prevalent for erosion whereas more respondents chose '*government buyback*' to manage inundation. Of note, '*adding sand to the beach*', or beach nourishment, did not rank highly for either hazard. It is also interesting to note that many ranked '*relocating buildings at risk*' highly, when a significant proportion of respondents had also indicated that they would still purchase and live in a house located on a beach waterfront (see Fact File 12).

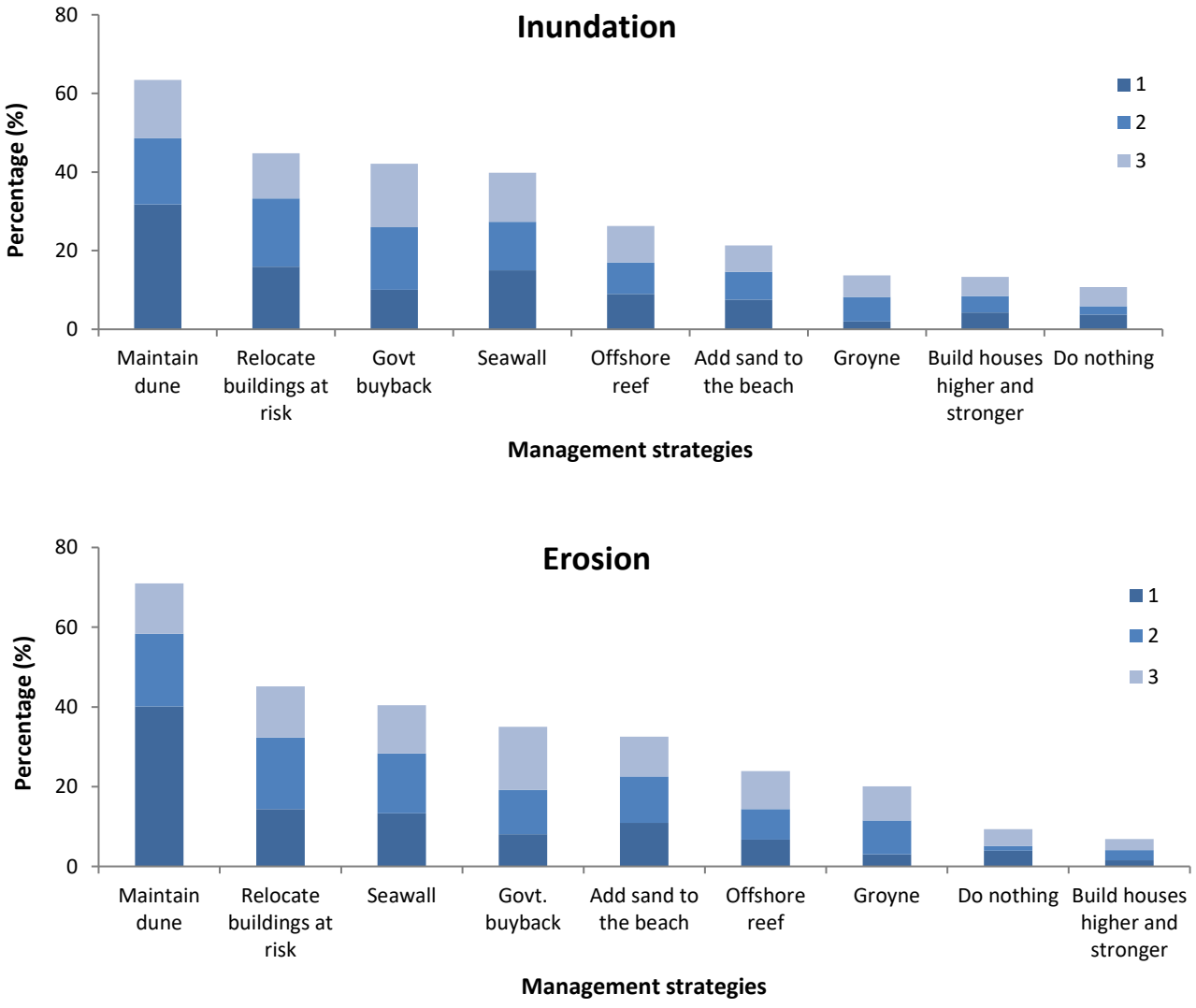


Figure 5.49 General Coastal Users perceptions of the 'best management option' for preventing damage caused by coastal inundation and erosion. Respondents were asked to rank their top three choices.

The NSW Coastal Accommodation Businesses surveyed in this study provided similar answers to the General Coastal Users, with the majority indicating that '*maintaining a sand dune*' was the best option for managing the effects of both coastal erosion and coastal inundation (Figure 5.50). However, the hard solution of constructing a seawall was considered the 'best' option for managing the effects of coastal inundation and erosion by 45% and 37% of the CABs respectively.

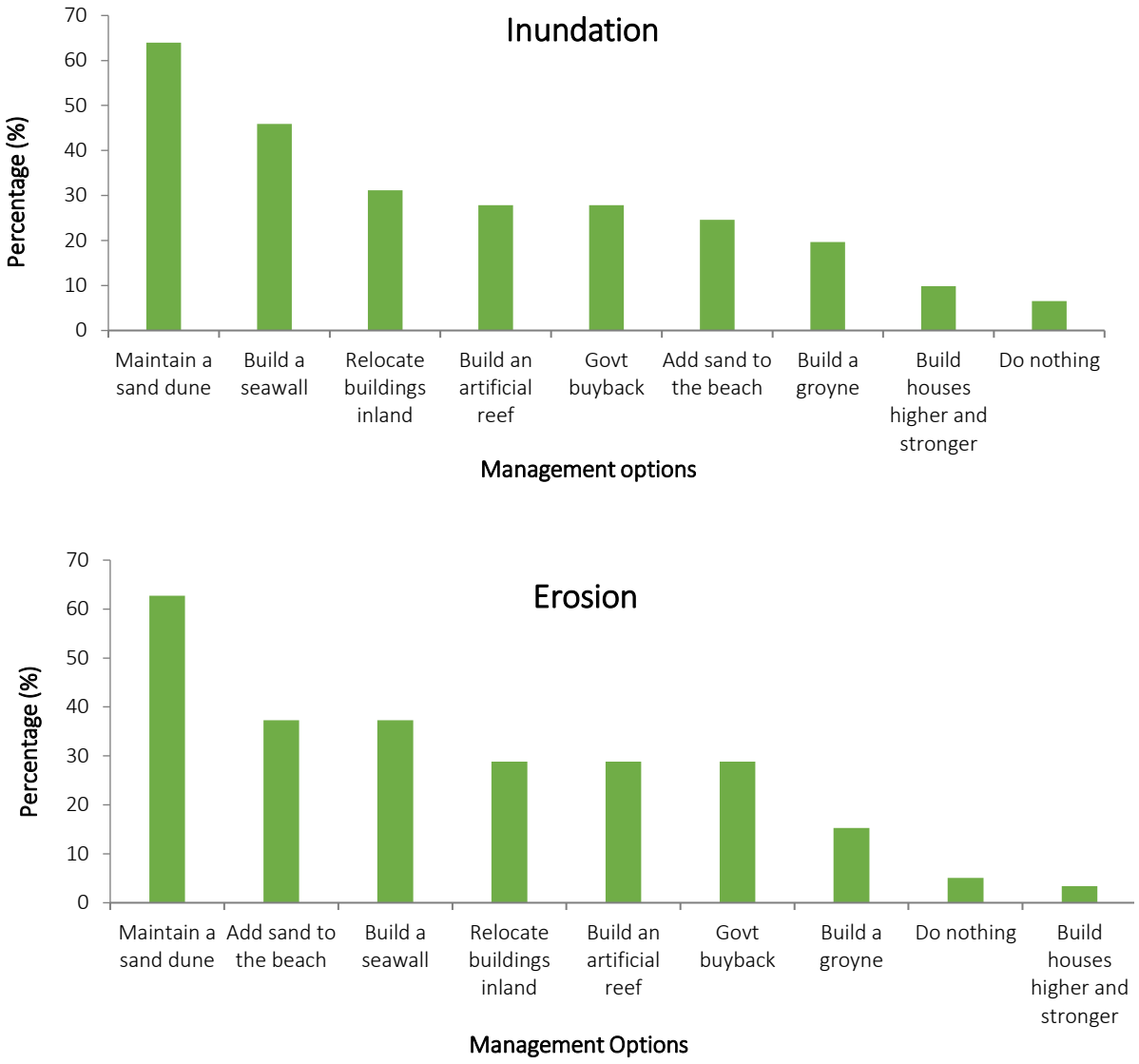


Figure 5.50 NSW Coastal Accommodation Businesses perceptions of the 'best management option' for preventing damage caused by coastal inundation and erosion. Respondents selected all that were applicable (not ranked).

Fact File 12: Who Wants to Live in a Beachfront Property?

Under the latest projections, the population of the state of NSW is anticipated to grow from 7.2 million people in 2011 to 9.9 million in 2036, an increase of 2.7million (NSW DPE, 2016). Past increases in population have resulted in a quick succession of coastal residential development, initiating management challenges in the form of social and economic pressure to protect existing assets while also implementing new, much needed infrastructure and supporting highly desired real estate (Anning *et al.* 2009).

Beachfront properties in NSW are extremely valuable in economic terms. For example, in 2012, beachfront properties on the Collaroy/Narrabeen stretch of Sydney's Northern Beaches were worth $1.93 AUD million on average, which is roughly 200% more than near identical properties within the same study area (SCCG, 2013a). Properties within the first block from the beach, but without direct beach access, were worth approximately $775k less than those that had direct access. The gross values of these properties have likely increased since these estimates were made, but it is probable that the difference in values based on location remain similar. Overall, in 2012, premiums paid to secure beachfront access came to approximately $110 million over the length of the beach (SCCG, 2013a). The loss of beach frontage through erosion may have potentially dire effects to the value of properties located on the NSW coastline. The SCCG Beach Valuation Project (2013) found that properties along the central section of Collaroy/Narrabeen had a lower value than those properties to the northern and southern end of the beach. This corresponds with the fact that the central section of the beach has a higher risk of erosion (SCCG, 2013a).

It is worth noting that the value of residential properties is dependent on the location, in terms of region, city or town, the characteristics of individual properties and the housing market (Kirkpatrick, 2012). However, there is no doubt that coastal properties are highly desirable and, as such, tend to have a higher price tag than properties located further inland (Spearrit, 2003). Many coastal properties are exposed to both inundation and shoreline recession associated with sea level rise, with a replacement value of $14-20 billion ($2008 AUD) for the estimated 44,000 – 68,000 buildings at risk in NSW (Kirkpatrick, 2012; DCCEE, 2009). These costs in 2018 are likely significantly higher.

With economic risks to private property and public shared space in mind, this study attempted to gain coastal communities' opinions regarding the desire to live in a coastal waterfront property. In doing so, this study gathered vital information about why people choose to live on the coast, what concerns them about living directly on the coast and how they would prepare, mitigate and adapt to the coastal hazards of sea level rise, severe coastal storms causing erosion and inundation.

Buyer Beware: Would you buy a house on the beach?

The NSW General Coastal Users surveyed in this study were shown a picture of a beachfront property (Figure 5.51) and asked the following question '*If you had both the opportunity and means, would you buy this house and live in it?*' Approximately half of the respondents (52%) indicated that they would not purchase the property, but 32% indicated they would and 16% were unsure. Respondents provided a range of reasons as to why they would or would not live in this location, with those unsure often commenting on both the pros and cons of living in such a location.

Figure 5.51 Image of a residential house and property that accompanied the survey question '*If you had both the opportunity and means to buy this house, would you buy it and live in it?'* (Image source Google Earth, 2018)

Yes: 'OMG Gorgeous location, maybe renovate and go up?' (GCU 815)

Approximately 50% of those who indicated that they would buy and live in this house stated that location was the primary factor. Roughly 35% indicated that the rewards of living in the beachfront location outweighed the risks, with approximately 25% indicating beach access and lifestyle as deciding factors (Figure 5.52a).

I would value the coastal lifestyle and the benefits of the location would outweigh the risks (GCU 858)

Some respondents acknowledged the risks, but felt that governments would advise them if needed '*I would accept the risk to personal property and expect a governing body to advise safety plans if we need to prepare for disaster*' (GCU 775). Insurance and government financial support were noted less frequently, although when mentioned there was an expectation that as the house was permitted to be built in that location, it presumably met safety regulations and therefore insurance agencies and the government had responsibility: '*the Council/government say it's ok to live there*' (GCU 710) and '*it is existing and approved by Council'* (GCU 712); '*Because if the govt deems it as purchasable land, then it should be 'safe' to do so*' (GCU 409). These views support opinions expressed by some of the surveyed NSW Coastal Management Professionals that '(*there is an…) expectation that someone else will look after them in an emergency*' (CMP 67) and '*people expect Council to defend their land'* (CMP 10).

'It won't happen to me; the government will bail me out' (CMP 10).

However, some of the General Coastal Users who indicated they would purchase and live in this beachfront location did acknowledge and accept the risk and responsibility of living so close to the shoreline; *'It is a wonderful location however (I) should be solely responsible for any damage which may occur and (I would) pay a pre-emptive insurance if (the house) needed to be covered'* (GCU 772) and '*I would ensure I could get appropriate insurance and have a plan to evacuate my family and precious belongings in emergency situations. We have this in place where we live now for bushfire risk*' (GCU 734).

No: 'It's built on sand next to an ocean. May as well build a house of cards next to a freeway' (GCU 352)

The General Coastal Users who indicated that they would not buy the house and live it also cited a number of reasons for this decision (Figure 5.52b) with the primary factor being that the house is too close to the shoreline; '*too close to the beach/sand and built on a sand dune. I think sand dunes should be…a natural defence for storms and tides*' (GCU 37). Potential damage was mentioned frequently, often just as general '*damage*', while others specified the cause of the damage; '*It is prone to flooding and coastal inundation from storm and wind... corrosion from salt spray and air*' (GCU 50) and '*…while it would be nice to live so close to the ocean, the risk of damage to the property is too high'* (GCU 185). Many respondents mentioned the lack of investment potential of house located so close to the shore; *'Too close to the coast. Resale value over time will diminish with increased risk of coastal erosion'* (GCU 139) and *'It is a poor investment. Not only in the near future with rust and storm damage, but also long term with sea level rise and increased likelihood of damaging storms'* (GCU 170).

'There is very little buffer between property and elements' (GCU 453).

'In 20 years time it would be worthless' (GCU 227).

Some negativity towards government and Council assistance was mentioned. '*The Council & state government will not let the residents protect their property at their own cost, yet they are still happy to collect rates'* (GCU 43).

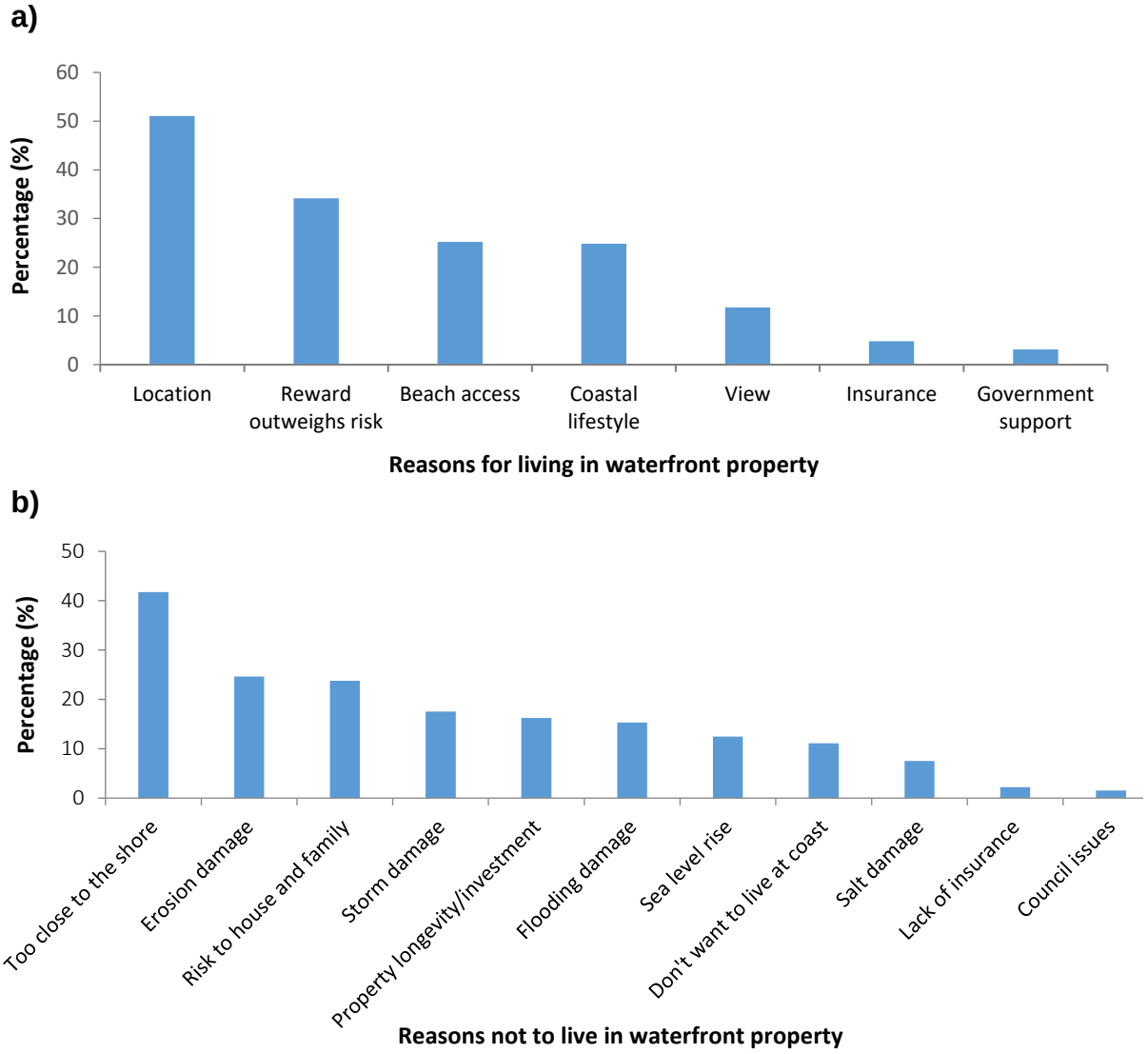


Figure 5.52 Most common reasons provided by General Coastal Users who indicated they would: **a)** purchase the beachfront property shown in Figure 5.51 if given the opportunity and means to do so; and **b)** not buy the property if given the opportunity and means to do so.

How would you protect your beachfront property?

The General Coastal Users were asked how they would protect the beachfront house and property if they did own it and responses varied between hard and soft management options. A majority (41%) said they would construct a seawall, with less than half of those indicating they would seek expert opinions or additional information from the local Council. When compared with answers given by the General Coastal Users in Fact File 13: Coastal Management Strategies, there is a clear contradiction between what people believe to be the

'best option' in general and the 'best option' when they actually own a property at risk of coastal erosion and/or inundation. While constructing a seawall was not considered a preferred option in general, it was the dominant response if living on the beachfront. However, many of those that preferred a seawall also indicated that it should be constructed in conjunction with sand dune management and planting vegetation on the ocean facing section of the property (Figure 5.53).

Figure 5.53 Word cloud of most common responses by General Coastal Users about how they would protect the waterfront property shown in Figure 5.51.

The General Coastal Users were asked to rate how much they agreed or disagreed with a number of statements regarding living by the coast (Figure 5.54) and there was a general trend towards respondents believing that people needed to take responsibility and accept the risks of living in hazardous areas. This was coupled with the general opinion that despite being given information about coastal hazards, people will still choose to live in hazardous areas as the location and reward outweighs the risk.

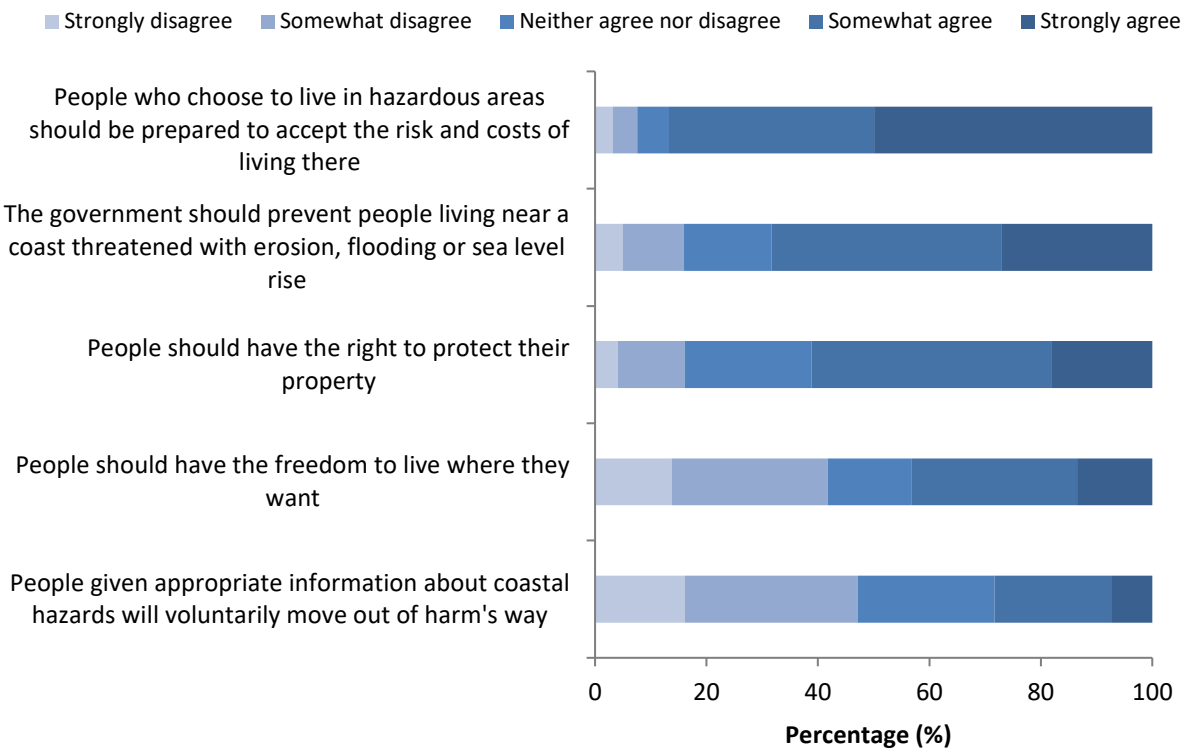


Figure 5.54 Opinions of NSW General Coastal Users in relation to different types of risk acceptance involved in living near the coast.

Fact File 13: Who should pay for damage caused by coastal erosion or coastal inundation?

In June 2016, large storm waves associated with an East Coast Low cyclonic system caused extreme beach erosion and significant infrastructure damage from coastal inundation along many parts of the NSW coast (Hannam & Kembrey, 2016). Collaroy/Narrabeen Beach on Sydney's Northern Beaches received significant media attention, with damage to residential buildings along this stretch of coast depicting the potential devastating power of coastal storms (Figure 5.55).

Figure 5.55 Image of damage caused at Collaroy Beach, Sydney, NSW during the June 2016 East Coast Low used in the survey. (Image: Peter Rae, 2016).

Subsequent media reports focussed on homeowners casting blame on local government Councils for not having prepared the coastline for the damage that occurred (Houghton, 2016). Immediate attention on the impacts of such extreme storm events often tends to involve blame and who is at fault. After the events, the focus then shifts to the economic impact and damage the storms have caused (SMH, 1974a;b; O'Rourke, 2015; Patterson & Swain, 2016; Houghton, 2016). This generally leads to questions of '*who pays for the damage*', '*why weren't we prepared?*' and '*who is responsible for preventing this type of damage in the future?*'.

Residential Compensation Costs

While coastal properties may be at risk of damage from coastal hazards, there are mixed perceptions about compensation awarded to home owners after a storm event. Barnett *et al.* (2013) found that a majority of the people interviewed in their study in Eurobodalla Shire, NSW and the Mornington Peninsula, Victoria were in favour of compensation, in conjunction with other adaptation options. Compensation was expressed largely as compensation for homeowners who are forced to move due to their property deemed to be 'at risk' of coastal hazards (Barnett *et al.* 2013). However, access to information regarding sea level rise and associated coastal risks was a significant factor in awarding compensation. All interviewees by Barnett *et al.* (2013) believed that future homeowners who were made aware of the risks to their property should not be compensated. For already established residents, the opinions of respondents were more divisive (Barnett *et al.* 2013), with some stating that sea level rise is beyond the control of residents, so they should be compensated, with others conveying a strong belief in individual responsibility of risk management, thus no compensation from the pockets of taxpayers. While the Barnett *et al.* (2013) study assessed public acceptance of compensation, it didn't touch upon the concept of who should pay, rather that compensation should be awarded to people whose property was, or will be, damaged.

This study asked General Coastal Users and Coastal Accommodation Businesses who they think should pay for damages caused by severe coastal storms. This information will provide insight into the expectations of NSW coastal users, including both residents and businesses, regarding how these issues should be addressed economically.

Who the NSW Coastal Community thinks should pay

Both the surveyed NSW General Coastal Users and Coastal Accommodation Businesses were shown a photograph, and provided with a description, of damage from the East Coast Low that hit NSW in June 2016 (Figure 5.55). They were then asked the question '*Who should pay for the costs of clean up and repair, after a coastal storm such as this*'. The overwhelming response from both groups was that insurance companies should pay for the damages, followed by local government Councils and the state government (Figures 5.56; 5.57). Less than half (40%) of respondents from both the General Coastal Users and Coastal Accommodation Businesses felt that the '*residents whose property was damaged*' should pay for damages.

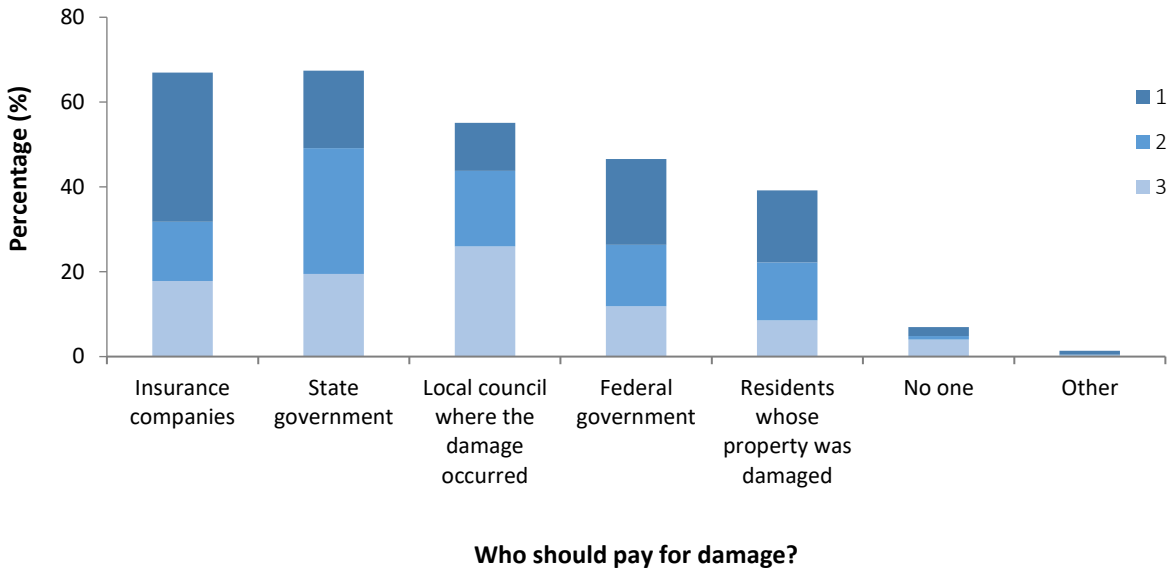


Figure 5.56 Opinions of surveyed General Coastal Users in regards to who should pay for damage after a severe coastal storm. Respondents were asked to rank their top three preferences.

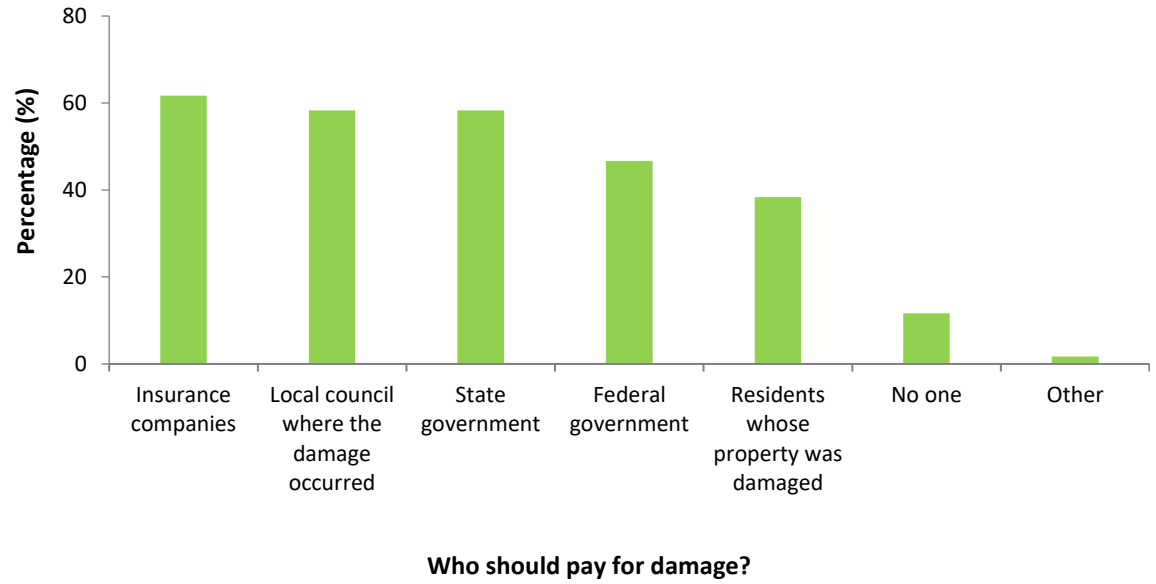


Figure 5.57 Opinions of NSW Coastal Accommodation Businesses in regards to who should pay for damage after a severe coastal storm. Respondents were asked to select one answer only.

Fact File 14: Community Engagement

Community engagement is defined by the Australian Centre for Excellence in Local Government as;

> *'a two- way process of dialogue by which the aspirations, concerns, needs and values of the community are incorporated into policy development, planning, decision-making, service delivery and assessment'* (Smith *et al.* 2016).

The theory behind community engagement in natural resource management suggests that by involving stakeholders in decision-making, decision makers are better able to make more informed decisions with stronger public support (Buckeley, 2000; NOAA, 2016b). Community engagement is a fundamental component of successful policy implementation and is undertaken by state and local governments in NSW across a broad range of policy matters. In terms of coastal management, there is no single definitive process of stakeholder engagement utilised by all local government Councils, but rather guidelines are available of various techniques that can be implemented. Of note, the National Climate Change Adaptation Research Facility (NCCARF) has launched a template for effective community engagement, including skeleton structures, case studies, informative YouTube videos and an Information Manual as part of the CoastAdapt scheme (Smith *et al.* 2016). It provides decision makers with tools to conduct meaningful and successful community engagement actions, as well as highlighting areas of difficulties and ways to navigate through a 'wicked problem' (APS, 2012), of which many can be found in coastal management initiatives.

While many NSW coastal Councils engage in a range of community engagement practices, there is often a lack of adequate analysis post engagement (Barnett *et al.* 2013; Barnett *et al*. 2014; OEH, 2017b). Individuals communicate and interpret things in different ways, and it is important to assess the effectiveness of an engagement process, in terms of what information was exchanged, the medium in which it was communicated, if it was exchanged clearly and understood correctly and if the information is retained (Morgan, 1997; Maibach e*t al.* 2008; Luís *et al.* 2016; NOAA, 2016b). A significant part of this study was to assess what respondents know and understand about coastal hazards, where they have previously received this information, and how they would prefer to receive information in the future.

Coastal Management Professionals

The NSW Coastal Management Professionals surveyed in this study were asked to outline if they (or the organisation they represent) had previously undertaken any form of community engagement and the majority (70%) indicated they had. These respondents were then asked to select the communication mediums they had utilised, allowing for more than one response (Figure 5.58). All of the Coastal Management Professionals were asked to select the communication medium they thought was the best way to engage with the community. For this question, respondents were asked to select only one answer.

As evident from Figure 5.58, the most common communication mediums previously used by CMPs were community forums, print media (including brochures, flyers and booklets) and online resources (e.g. dedicated websites and social media). Roughly 50% of the CMPs thought their previous efforts of community engagement were somewhat effective, with 32% thinking they were either '*a little*' effective or '*not at all*'. This suggests that the CMPs feel that while they do attempt to engage with the community, less than 17% feel it is done effectively. The majority of CMPs think that the best ways to engage with the community are through community forums and social media. Of note, despite having previously utilised print media and dedicated websites, these methods are not considered by the CMPs as the best methods for community engagement. In contrast, there was evidence for increased preference of engagement via tv news and documentaries (Figure 5.58).

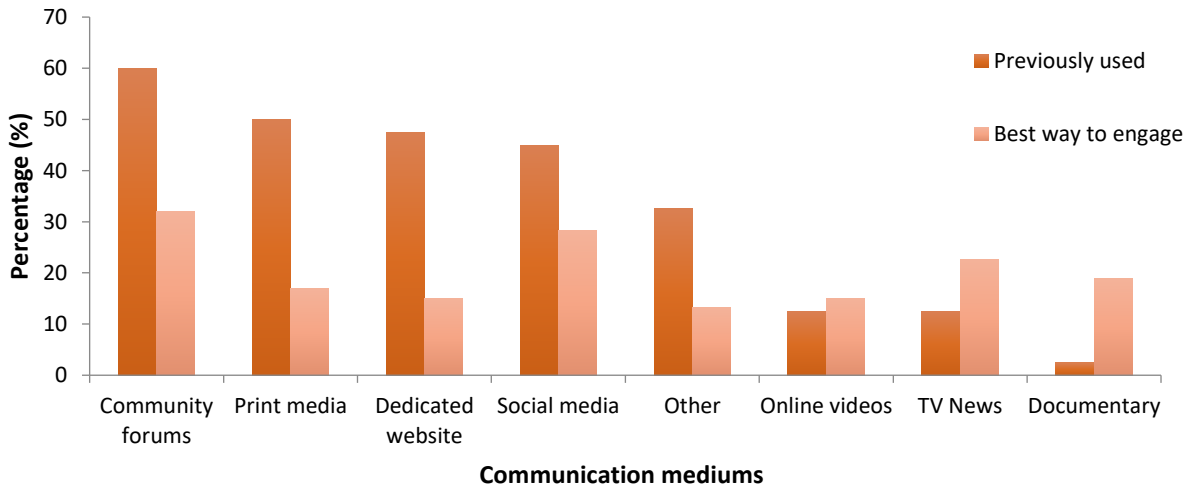


Figure 5.58 Communication mediums previously utilised by NSW Coastal Management Professionals about coastal hazards and their perceived best mediums for future communication.

Coastal Accommodation Businesses

NSW Coastal Accommodation Businesses surveyed in this study were asked questions about what kind of information they provide to their guests, how it is provided and if they would be willing to provide further information in the future. As evident from Figure 5.59a, the majority of CABs do not provide information about coastal erosion, coastal inundation (or tsunami). However, over 60% do provide information about beach safety, which is to be expected given the proximity of many of these businesses to surf beaches. When asked if they would be willing to provide information about coastal erosion and coastal inundation to their guests, approximately 70% of the CABs said they would and over 95% said they would be willing to provide information about general beach safety (Figure 5.59b).

However, while willingness to provide information is important, the accessibility, format and uptake of the information provided is critical for successful dissemination of the information. The majority of Coastal Accommodation Businesses (82%) indicated brochures or pamphlets would be the preferred method of communication of this information to their guests. This was followed by providing a link to a website with the relevant information (31%), displaying a poster on site (26%) and providing information through social media (23%; Figure 5.60). While print media is the most obvious method of disseminating this information directly at coastal accommodations, it is not the preferred method suggested by Coastal Management Professionals (Figure 5.60).

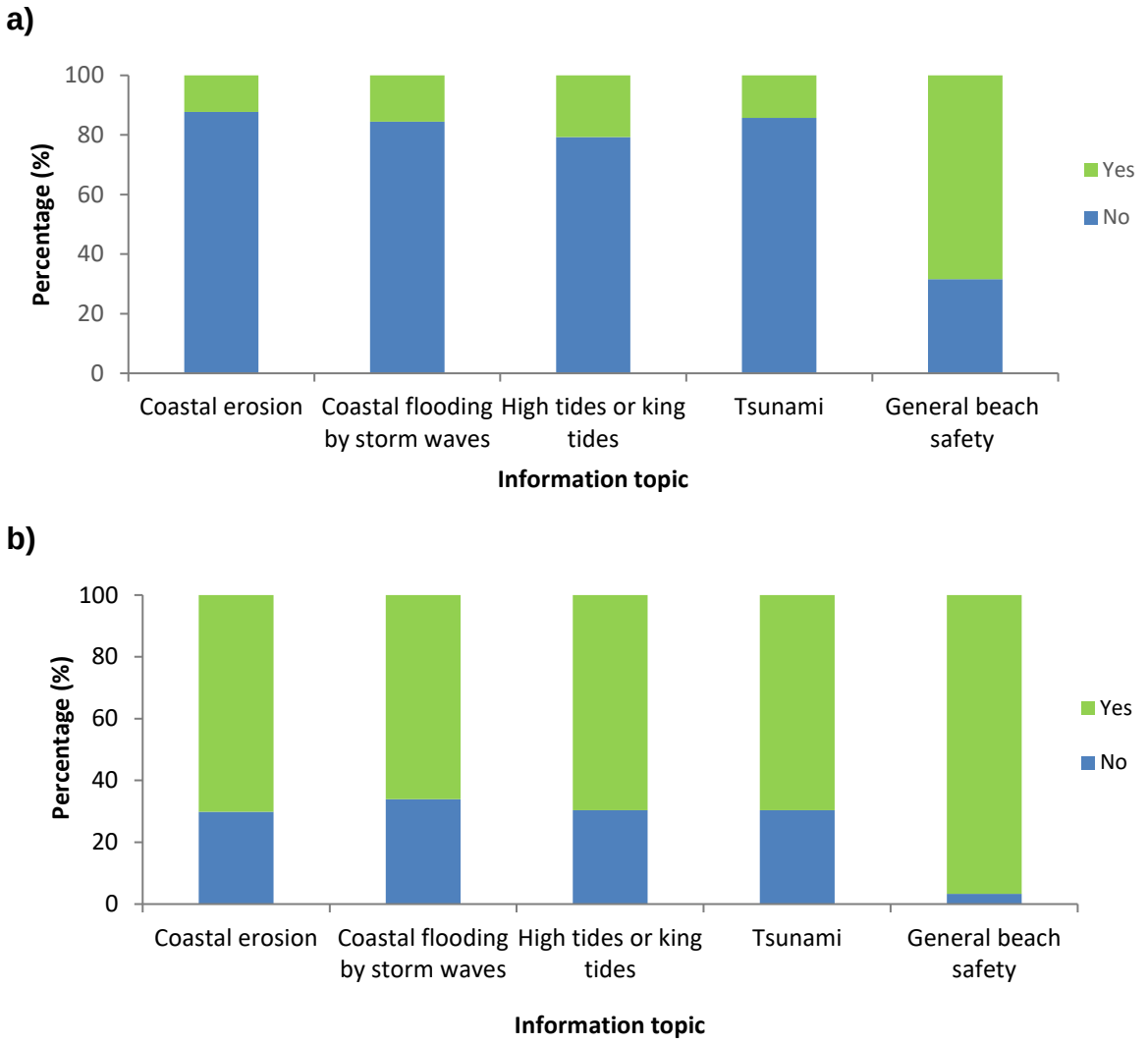


Figure 5.59 a) Percentage of surveyed NSW Coastal Accommodation Businesses who presently provide information to their guests about various coastal hazards; **b)** percentage of surveyed NSW Coastal Accommodation Businesses willing to provide information material to their guests about various coastal hazards.

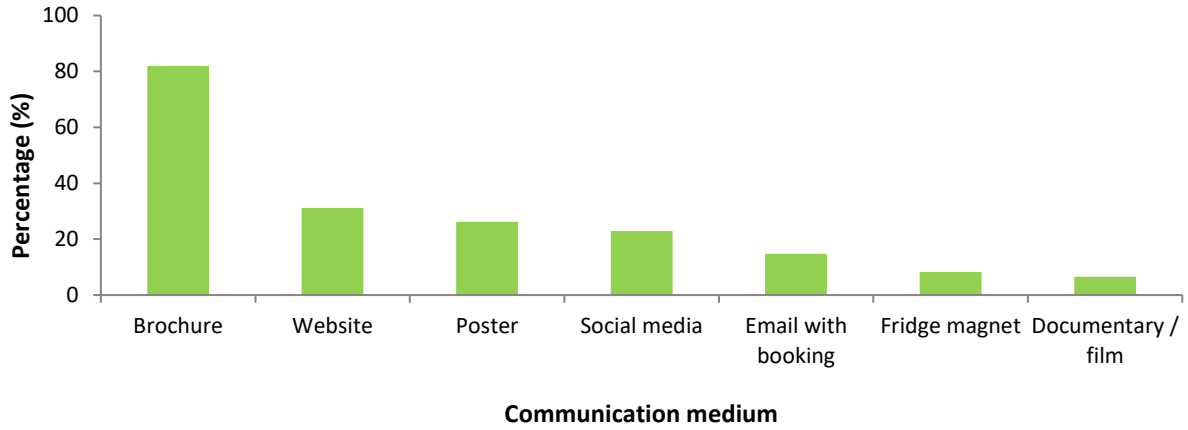


Figure 5.60 Preferences of surveyed NSW Coastal Accommodation Businesses of different types of communication mediums that could be used to provide guests with information about coastal hazards.

General Coast Users

The NSW General Coastal Users surveyed in this study were asked to identify if they had previously received any information about coastal erosion and/or coastal inundation, and if they had, where this information had come from. In general, more respondents indicated they had received information about coastal erosion (84%) compared to inundation (76%; Figure 5.61). News media and documentaries ranked highest for both hazards, with personal experience identified as a source of information by approximately 25% of respondents. Of note, while 29% of the GCUs stated they had received information about coastal erosion from their local Council, only 3% had received information about coastal inundation (Figure 5.62). This indicates the potential need for greater information provided to coastal communities about coastal inundation.

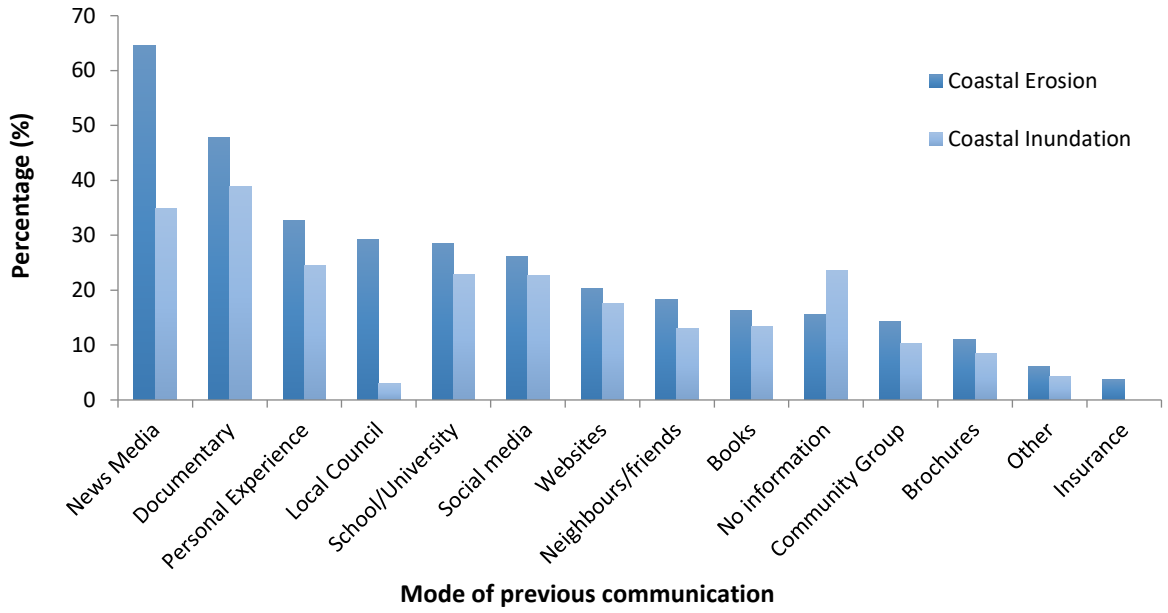


Figure 5.61 Different types of communication mediums where surveyed NSW General Coastal Users had previously gained information about coastal erosion and inundation.

In order to reach a target audience, a communicator needs to utilise an appropriate mode of communication. The surveyed General Coastal Users were asked how they would prefer to receive information about coastal hazards, particularly erosion, inundation, sea level rise and coastal storms. More than half of the respondents indicated that they would prefer to receive their information directly from government sources (Figure 5.62). With this in mind, it could be argued that people would prefer more visual modes of communication from the government – in the mode of short videos and websites, rather than print media, which is supported by the fact that documentaries and dedicated websites were the preferred engagement options.

While Coastal Management Professionals also have a preference for using documentaries in the future, they are not supportive of dedicated websites, and neither were rated highly (or as an option) for Coastal Accommodation Businesses.

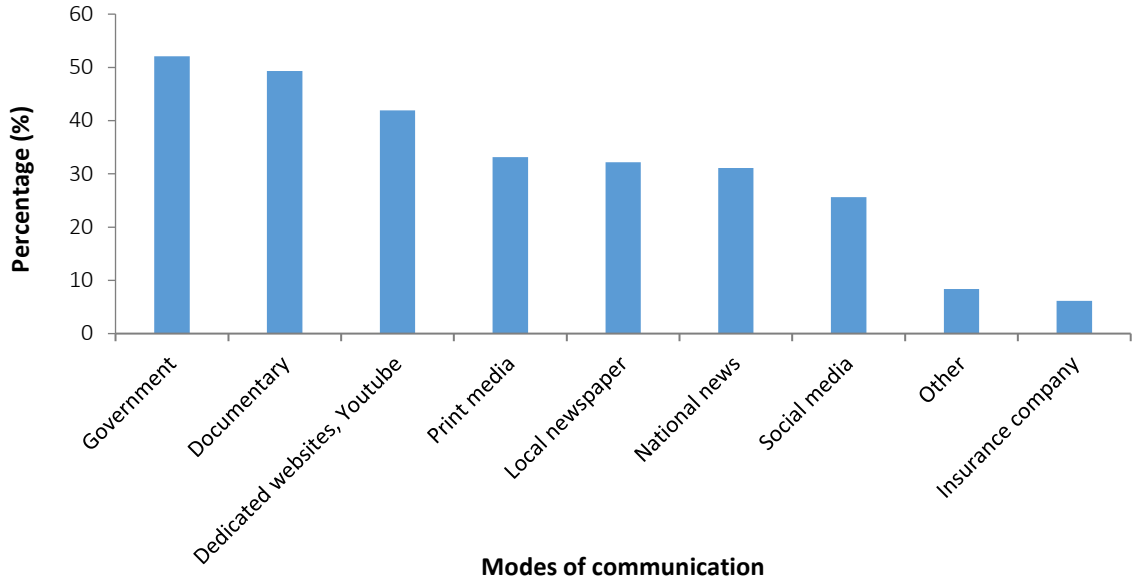


Figure 5.62 Preferred modes of communication by surveyed NSW General Coastal Users to receive future information on coastal hazards.

When asked to assess the level of trust respondents have in different sources of information (Figure 5.63), both government publications and local government Councils were the most trusted, with social media and insurance companies trusted the least (Figure 5.63). Today, social media can represent both a mode of communication and a source of information (Westerman *et al.* 2014), which can lead to questions of credibility of information provided.

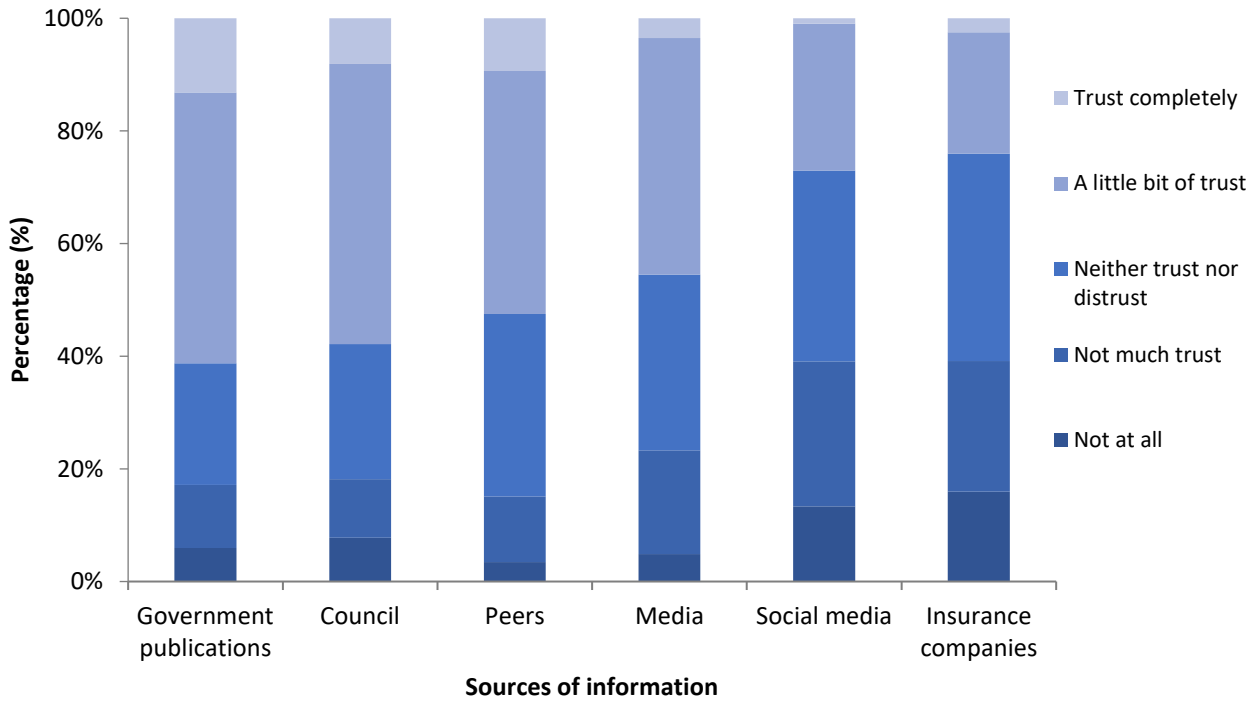


Figure 5.63. Levels of trust amongst surveyed NSW General Coastal Users in regard to different sources of information about coastal hazards.

Fact File 15: What Do People *Need* to Know?

Community engagement is a vital component of successful coastal management practice and is dependent upon mutual understanding of the topic of discussion. As such, the NSW Coastal Management Professionals surveyed in this study were asked what they think are the most important aspects about coastal erosion and inundation that the community should be educated about (Figure 5.64). The surveyed General Coastal Users were also asked what topics they would like to know more about (Figure 5.65). Results indicate that there is a distinct difference between what Coastal Management Professionals think the community *should* know and what the General Coastal Users *want* to know.

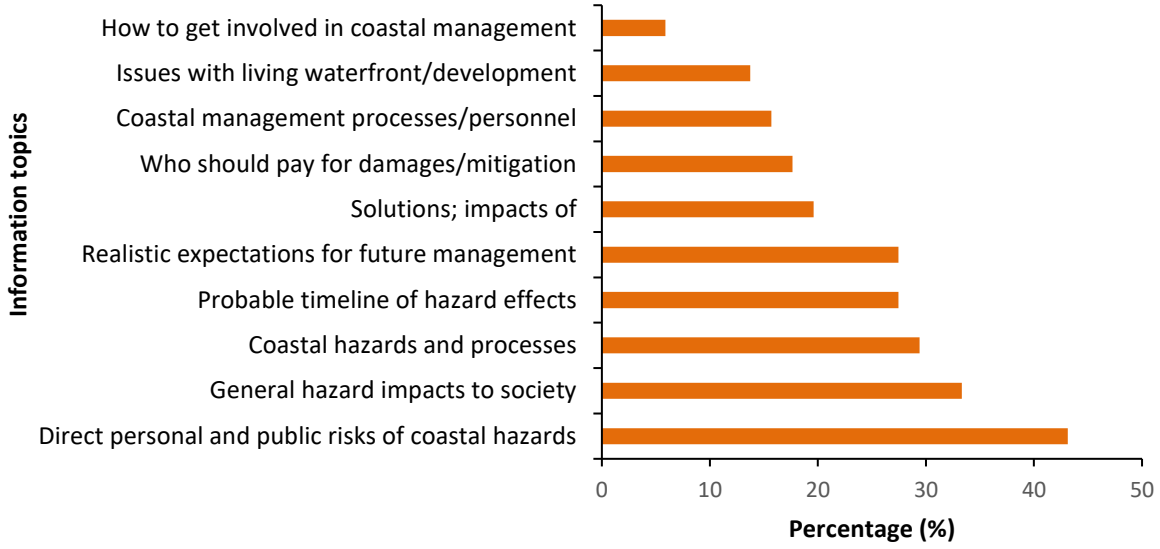


Figure 5.64 Opinions of surveyed NSW Coastal Management Professionals in regard to what topics relating to coastal hazards (related to erosion/inundation) that coastal communities need more information about.

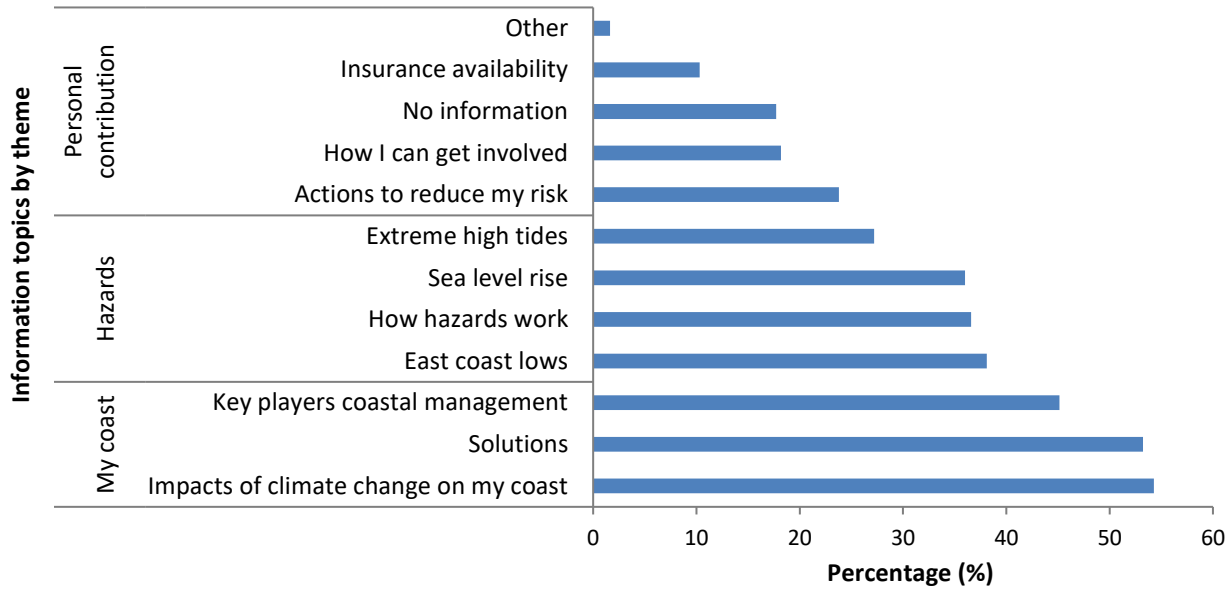


Figure 5.65 Preferences of surveyed NSW General Coastal Users in relation to what topics they would like to know more about in terms of coastal hazards and coastal management.

The majority of CMPs think the coastal community needs to know more about both the direct personal risk and public risks of coastal erosion and inundation. However, less than 25% of the GCUs wanted more information about actions they could take to reduce their own risk in relation to these coastal hazards. Instead, the majority of GCUs indicated they wanted more information about the impacts of, and solutions to, coastal hazards on their coast – not their personal risk. This suggests that many coastal users want to know more about how changes in the magnitude and frequency of coastal hazards may affect them and their usage of the coast personally. While it could be argued that these all feed into each other, knowing more about hazards will help people become more aware of the risk (Morgan, 1997). It is worth noting that the GCUs didn't identify the need for more information about the risks of coastal hazards, just the desire to know more about the possible impacts of coastal hazards and the potential solutions to these problems.

The General Coastal Users also wanted to know more about who is making decisions about the future of their coast (key players in coastal management; Figure 5.57). In contrast, this was not rated as important knowledge for the public by the Coastal Management Professionals (Figure 5.56). While there are discrepancies between the opinions of the two groups, there were also some similarities, including the need for more information about coastal hazards and processes in general.

6. References

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