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Beyond the Dikes: Unveiling Flood Risk Perceptions

“A Comparative Analysis of Flood Risk Perception: High-Risk Sea-Flood Areas vs. Low-Risk Sea-Flood Areas in the Netherlands"

by

Karlijn Hoogendoorn

S4648072

Supervised by

Dr. Tim Busscher

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Abstract

Flood risk perception is related to an individual's worry, awareness, and preparedness. Understanding flood risk perceptions is crucial for effective flood management and risk communication strategies. Especially in a country such as the Netherlands, with 70% of its inhabitants living in flood-prone areas. This research explores the relationship between location and flood risk perception by comparing two contrasting areas in the Netherlands: Zierikzee, a high-risk, and Zandvoort, a low-risk sea-flood area. The study provides insights into the interplay between different factors and the perception of sea-flood risk in the Netherlands, which could be used to improve sea-flood risk communication and potentially lower stress-caused healthcare expenses. The study is based on survey data. The results indicate that residents of Zierikzee exhibit higher levels of worry and preparedness compared to residents of Zandvoort, and with that perceive a higher level of sea-flood risk. The research shows that flood risk perception is influenced by an individual's experience with flooding as well as their trust in current measures. This research finds no misperception in risk perception. It therefore finds that flood risk communication in Zierikzee and Zandvoort is sufficient. For generalization purposes, it is recommended the research be repeated in multiple locations.

Keywords: sea-flood, perceived flood risk, high-risk, low-risk

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1. Introduction

Water safety is an issue in the Netherlands as approximately 59% of its surface is prone to flooding, including 26% which lies below sea level entirely (Planbureau voor de Leefomgeving, sd). This flood-prone land includes densely populated areas; 70% of Dutch inhabitants live in a flood-prone area and this number is expected to grow due to urbanization (Planbureau voor de Leefomgeving, sd). The Netherlands borders the North Sea and is a delta of Europe's three main rivers: the Rhine, the Meuse, and the Scheldt (Klijn, et al., 2011). The Netherlands faces the risk of flooding from both the sea, and from the aforementioned rivers (Prime, et al., 2015; Maddox, 2014).

People living in areas sensitive to flood have a perception regarding their flood safety (Mol, et al., 2020; Botzen, et al., 2009). Flood risk perception combines the expected probability of a flood with the expected consequences (Lechowska, 2018; Bubeck, et al., 2012; Becker, et al., 2013; Grothmann & Reusswig, 2006). People's perception is not always in line with the actual risk and misperceptions may occur (Mol, et al., 2020). When people perceive risk, e.g. a potential flood, it can cause stress (Atlas Leefomgeving, 2024), which can increase healthcare costs by up to 147% (Cryer, et al., 2003). Therefore, it is important to understand where people perceive a high risk to effectively target flood communication and address potential misperceptions (Paek & Hove, 2017).

Understanding flood risk perceptions is crucial for effective flood management and risk communication strategies to be tailored to the specific needs and perceptions of communities in different risk zones (Paek & Hove, 2017). Rising sea levels due to climate change, further establish the need for the research now (Pilkey, et al., 2016). By examining the interplay between different factors, this research aims to provide insights into the influence of location on sea-flood risk perception.

This study will compare sea-flood risk perception from people living in high-risk and low-risk sea-flood areas in the Netherlands, Zierikzee and Zandvoort have been selected for this respectively. This research's scientific value lies in its ability to reveal the difference in people's sea-flood risk perception in the Netherlands. The public's incentive for the research is to provide governmental and other institutions with data on sea-flood risk perception differences in the Netherlands. This data could be utilized to improve sea-flood risk communication, increase its effectiveness, and potentially lower stress-caused healthcare expenses.

There is a gap in existing research regarding the difference in perceived sea-flood risk between citizens in areas with a high risk of sea-flooding and areas with a low risk of sea-flooding in the Netherlands. Previous research has been done into, among others, the variables associated with both overestimation and underestimation of perceived flood risk (Mol, et al., 2020), perceived flood risk concerning knowledge of the causes of flooding (Botzen, et al., 2009), and perceived flood risk in relation to perceived flood zone distance (O'Neill, et al., 2016). There has not yet been research into the influence of the risk level of the location of the residence on an individual's level of flood risk perception. This research, therefore, aims to compare the perceived sea-flood risk of citizens living in high-risk sea-flood areas with citizens living in low-risk sea-flood areas. This comparison will indicate if there are possible misperceptions at play and will indicate which factors influence sea-flood risk perception.

The main research question is: How does the perception of sea-flood risk of citizens living in high-risk sea-flood areas compare to the perception of citizens living in low-risk sea-flood areas?

This research will, first, provide a theoretical framework regarding the key variables influencing flood risk perception as the dependent variable and the risk level of the location as the independent variables, in Chapter 2. The literature will comprise the possible relationship between the variables. After this, the research will introduce the locations of the research in Chapter 3. Subsequently, the research will dive into the way the data will be collected and analyzed, which can also be found in Chapter 3. After this, the research will present the main findings and compare these to past research in Chapter 4. Finally, the main research question will be answered and recommendations will be made for future research in Chapter 5.

2. Theoretical framework

This chapter explores the theoretical underpinnings that form the basis of this research, focusing on the variables that influence flood risk perception. Understanding the factors influencing perceived flood risk is essential since perceived flood risk does not necessarily reflect actual flood risk (Duží, et al., 2014; Heijmans, 2001). It is important to understand how society perceives flood risk to find a fitting method of spreading flood risk information (Bradford, et al., 2012).

2.1. Flood risk perception

Risk perception is a subjective assessment of risk (Kellens, et al., 2011). Risk perception combines the perceived likelihood of a hazard with the perceived consequences (Lechowska, 2018; Bubeck, et al., 2012; Becker, et al., 2013; Grothmann & Reusswig, 2006; Ministerie van Infrastructuur en Waterstaat, 2018). Flood risk perception depends on three factors: awareness, worry, and preparedness (Raaijmakers, et al., 2008).

2.1.1. Awareness, worry, and preparedness

Raaijmakers et al.(2008) use awareness as a measurement for the knowledge of risk and distinguish three levels: expert awareness, underestimation, and ignorance. When the public underestimates the risk or is ignorant to the risk, it is the government's responsibility to increase awareness, via e.g. flood risk communication (King, 2002; Raaijmakers, et al., 2008). Worry is closely linked to an individual's awareness level and the expected severity of the consequences of a flood (Tapsell, et al., 2002; Raaijmakers, et al., 2008). According to Raaijmakers et al.(2008), an increase in public worry increases the need to reduce the risk, which leads to a larger preparedness to deal with the risk and pay for protective measures. The preparedness of an individual can be described in three dimensions: technical, social, and economic (Raaijmakers, et al., 2008). Examples include the reduction of materialistic damage, knowledge of evacuation routes, and flood insurance, for the three dimensions respectively (Raaijmakers, et al., 2008). Raaijmakers et al.(2008) also distinguish an institutional dimension of preparedness, referring to the design and communication of evacuation schemes and training of emergency staff.

2.1.2. Experience with floods

Perceived flood risk is related to people's personal experience with floods, extending to the experience of immediate and extended family, or others within an individual's social circle (Lindell & Hwang, 2008). People who have experienced floods are, generally, better prepared and feel less threatened than people with no flood experience (Baan & Klijn, 2004). Other research also found that people without flood experience underestimate the consequences of flooding (Siegrist & Gutscher, 2008).

To deal with diverse flood risk perceptions it is necessary to know the factors influencing perceptions and their relationship with perceptions (Lechowska, 2018). Lechowska (2018) provides an overview of current knowledge on the factors that influence flood risk perception based on 50 empirical studies (see Table 1). This research will not take all the same factors into account.

Factors	Worry	Awareness	Preparedness	Perception (in general)
Location (hazard)			±	±
Hazard proximity			−	±
Living on ground floor			+	−
Length of residence			+	+
Direct experience	+	+	±	+
Age		−	±	±
Gender	±	−	+	±
Education	+	−	−	±
Incomes		−	±	-
Household size (children)			+	−
Home ownership			+	±
Cellar ownership			+	−
Knowledge		+	±	+
Indirect experience			+	+
Cultural-historical context			+	+
Religious context			+	+
Political context			+	+

Explanations: "+" clear relation, "±" unclear relation, "−" no relation

Table 1: Impact of potential factors on perception (Lechowska, 2018)

2.1.3. Demographic factors

Demographic factors like age, gender, and education might have an influence on risk perception (Macoby & Jacklin, 1974; Sjöberg, 1998; Sjöberg & Drottz-Sjöberg, 1993). Most often, women perceive risk to be higher than men (Macoby & Jacklin, 1974; Sjöberg, 1998). Research shows conflicting results regarding the influence of age and level of education with respect to flood risk perception. Research by Sjöberg (1998) and Sjöberg and Drottz-Sjöberg (1993), shows that risk perception increases with age for both genders and that a lower level of education increases the level of risk perception. Other research, however, does not find this relationship between age, education, and risk perception (Knocke & Kolviras, 2007).

2.1.4. Influence of risk perception on health

As mentioned in Chapter 1, when people perceive risk, it can cause stress (Atlas Leefomgeving, 2024). Stress can influence an individual both mentally and physically, with physical effects ranging from a simple headache to long-term memory loss and heart disease (Gijsen, et al., 2008). Physical and mental consequences of stress add up, for both the individual as well as society. Past research has revealed that for an individual who experiences long-term stress, healthcare costs are up to 147% higher than for an individual who does not experience stress (Cryer, et al., 2003).

2.2. Coastal flooding

Coastal floods, also called sea-floods, can be caused by storms, high tides, sea-level rise, and insufficient protection (Boudreau, et al., 2023). Areas prone to sea-floods experience a passive flood risk: passive flood risk relates to the intrinsic vulnerability of an area to flooding, irrespective of immediate external causes (Rossano, 2016). In the Netherlands, areas prone to sea-floods are protected by dikes (Rijksoverheid, sd). According to Planbureau voor de

Leefomgeving (sd) without the dikes the areas would be flooded often, this refers to the intrinsic vulnerability of the area.

2.2.1. Flood classification

Floods can be classified according to how likely they are to happen (Boudreau, et al., 2023; Mace, 2021). Most often, floods are classified as a 10-year flood, a 50-year flood, or a 100-year flood (Boudreau, et al., 2023). A 10-year flood is expected to happen once every 10 years, thus every year has a 10% chance of experiencing a 10-year flood (Boudreau, et al., 2023). Every year there is a 1% chance of a 100-year flood and a 0,2% chance of a 500-year flood and so on (Boudreau, et al., 2023; Mace, 2021; Lind, 2017). However, in recent years 100-year floods have happened more frequently, meaning that the chance of a 100-year flood happening is now more than 1%. This may be due to global warming and the current climate change (Boudreau, et al., 2023; Mace, 2021). Figure 1 (Ministerie van Infrastructuur en Waterstaat, 2018) shows the number of people affected in case of breakage of the primary defense systems along the main water system in case of a 100-year flood and a 1000-year flood. The term “x-year flood” has been found misleading, as it makes floods sound cyclical, which they are not (Mace, 2021). Moreover, people tend to underestimate the risk when the probability is small (Mace, 2021; Zagorsky, 2018). A further illustration of this risk misperception: during COVID-19, 50% of adults in the US were concerned with the 1% chance of dying from COVID-19, while hundreds were dying every day (Pew Research Center, 2020).

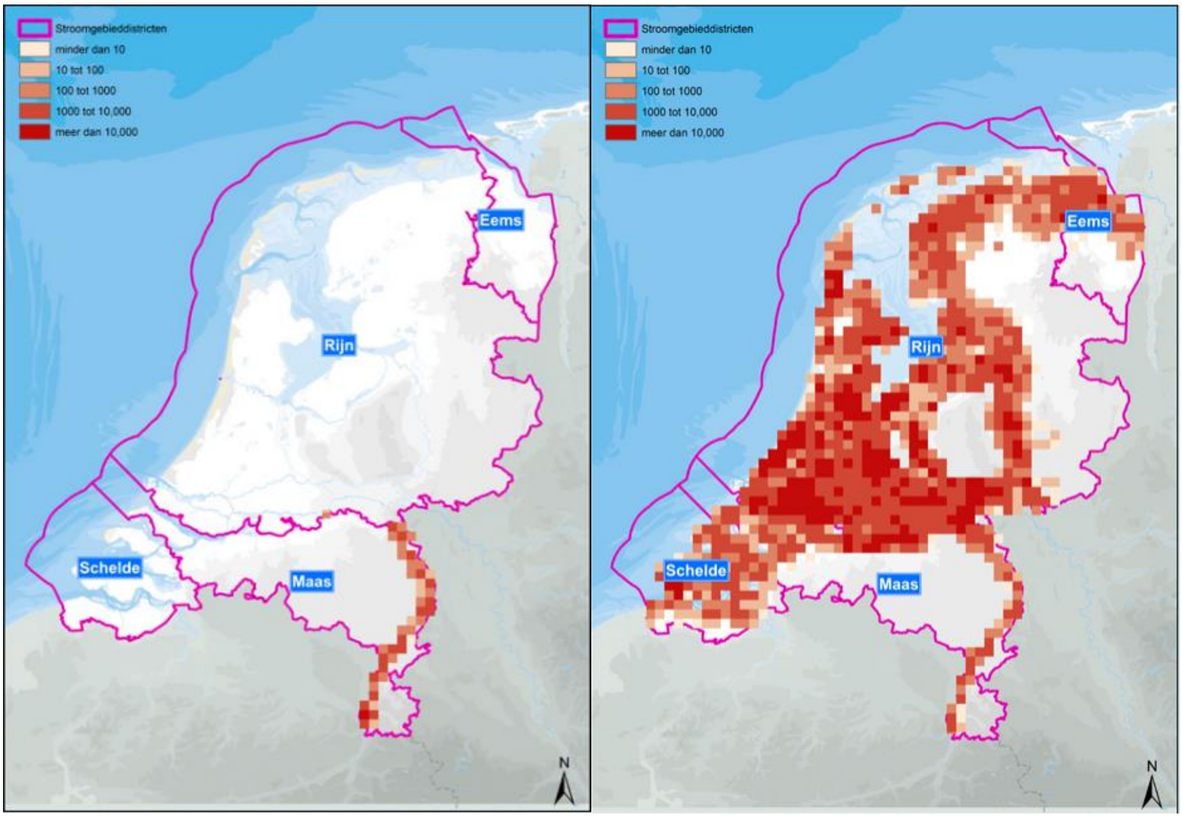

Figure 1: People affected by a 100-year flood in case of breakage of the primary defenses along the main water system (on the left), and people affected by a 1000-year flood in case of breakage of the primary defenses along the main water system (on the right) (Ministerie van Infrastructuur en Waterstaat, 2018)

2.3. Relation between perceived flood risk and the risk level of the location

According to Lechowska (2018), the risk level of a location has an unclear relation with the resident’s flood risk perception. This research aims to clarify this relationship. Kellens et al.(2011), researched risk perception in coastal flooding-prone areas and found that flood risk perception is directly influenced by age, gender, and flood experience, so these variables will be used as control variables as well as the level of education (see Fig. 2). As Raaijmakers et al.(2008) found awareness, worry, and preparedness to influence perception, these categories will be investigated as building blocks for the total flood risk perception (see Fig. 2).

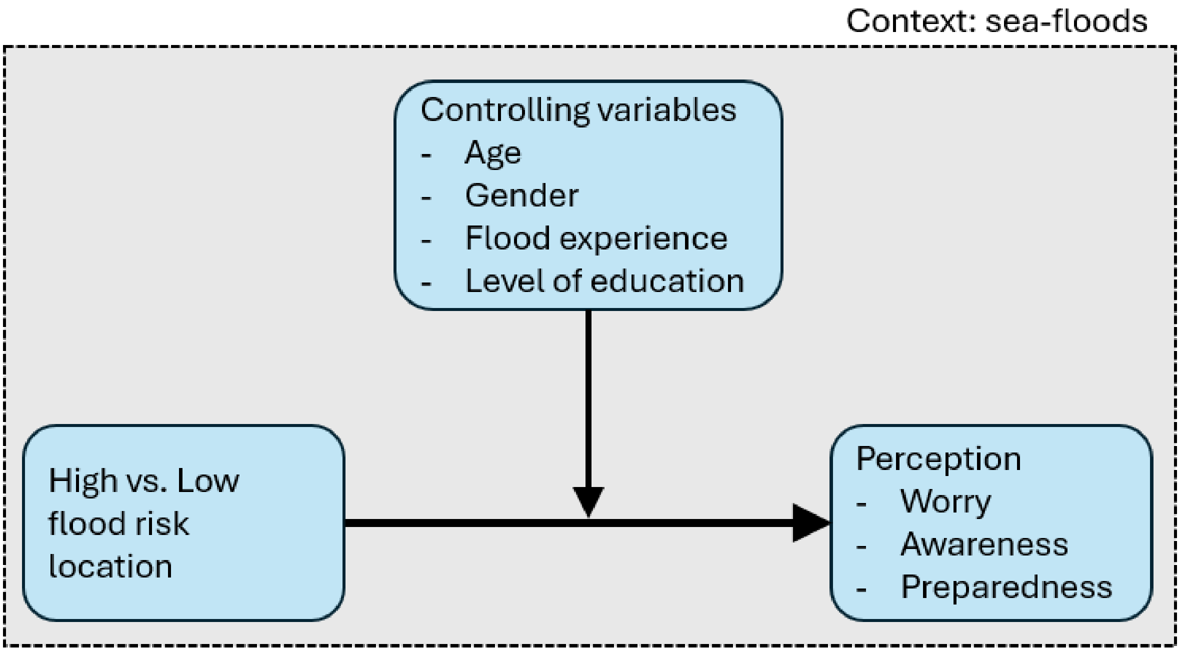

Figure 2: Conceptual model of the research

2.4. The hypothesis of the research

In comparing sea-flood risk perceptions between high-risk and low-risk areas, this research hypothesizes that individuals in the high-risk area (Zierikzee) will perceive a higher sea-flood risk compared to those in the low-risk area (Zandvoort). This hypothesis aligns with previous research on risk perception, which explains that risk perception is based on an individual's perception of the likelihood and the perceived consequences of a hazard.

In high-risk areas, where floods are relatively more common, residents are likely to have higher levels of all three key factors, compared to individuals in low-risk coastal areas, and therefore can result in a higher risk perception.

In low-risk areas, where floods are relatively less frequent or less severe, residents might have a lower awareness regarding the potential risks and consequently perceive lower levels of risk than individuals in a high-risk area. Furthermore, reduced worry and preparedness might contribute to a lower perceived risk, since individuals experience less urgency to take preventive measures than individuals in higher-risk coastal areas.

3. Methodology

This chapter outlines the approach adopted for the collection of data for this research. It describes the data collection method, encompassing surveys promoted online and through flyering, and the rationale behind selecting these methods. Furthermore, this chapter discusses the characteristics of the study population and the data analysis procedures. Through a transparent and systematic approach, this chapter aims to provide a clear roadmap of the research process.

3.1. Places of research

Zierikzee and Zandvoort have been selected as case studies for high-risk sea-flood areas and low-risk sea-flood areas respectively. Zierikzee is situated in the province of Zeeland and has a population of around 12.000 people (Gemeente Schouwen-Duiveland, 2023). Zierikzee lies below sea level, is prone to floods, and has been flooded before in the catastrophic flood of 1953 (Planbureau voor de Leefomgeving, sd). Figure 3 shows that Zierikzee lies below sea level indicated by the darker blue color, Zierikzee is indicated by the red circle in Zeeland. The low-risk sea-flood area Zandvoort lies in the province of North Holland and has a population of around 17.500 (Gemeente Zandvoort, 2024; Centraal Bureau voor de Statistiek, 2024). Zandvoort lies close to the sea but has not experienced sea-floods because Zandvoort lies above sea-level, as can be seen in Figure 3 (Planbureau voor de Leefomgeving, 2013) where Zierikzee is indicated as the upper red circle.

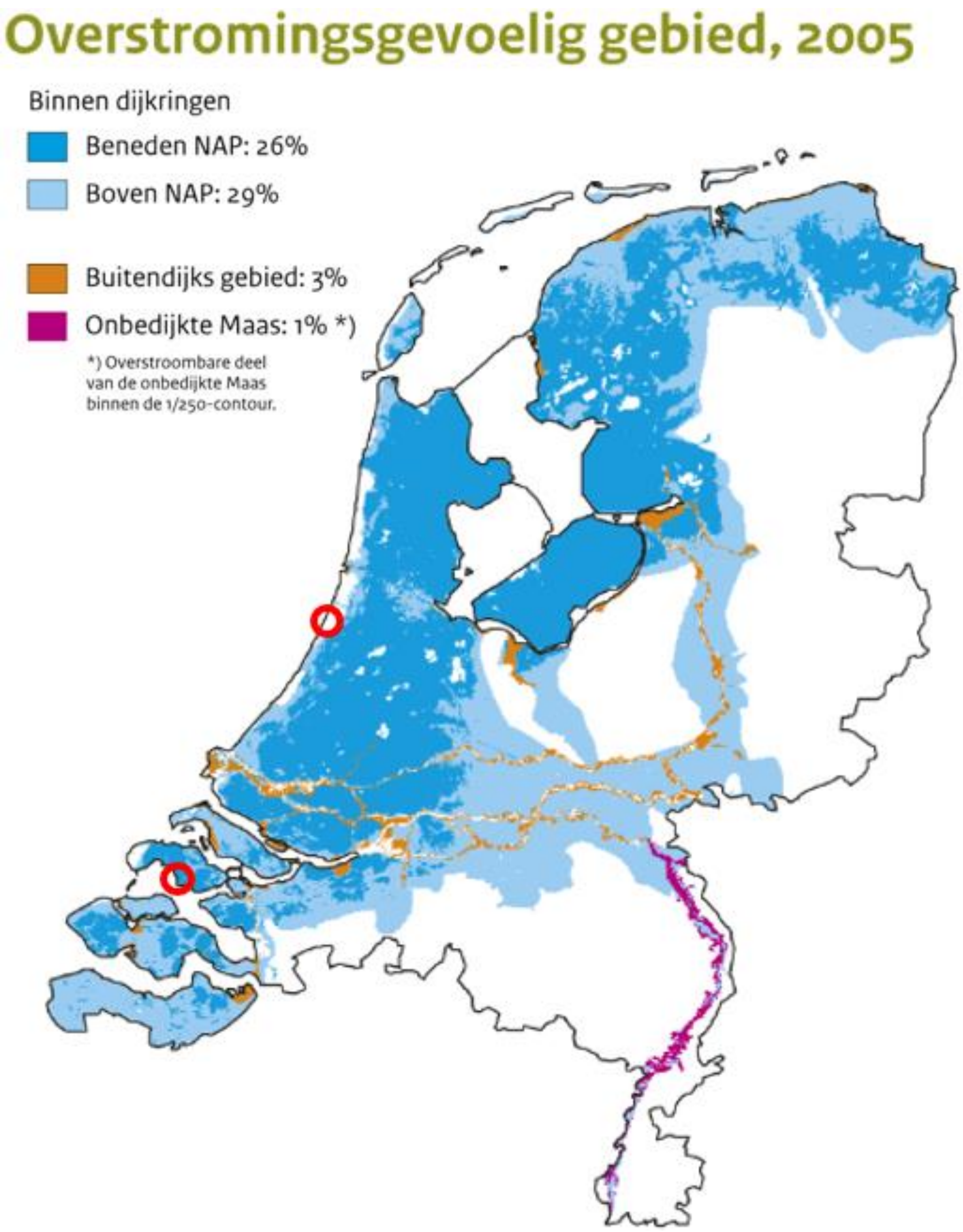

Figure 3: Flood-prone areas in the Netherlands (Planbureau voor de Leefomgeving, 2013) edited by the researcher. Dark blue indicates the land is below sea level, light blue indicates the land is above sea level, the white indicates that the land is not prone to flood.

3.2. Data collection via survey

To investigate the differences in perceived flood risk by residents living in relatively high or low-risk sea-flood areas, surveys have been selected as the data collection tool. In previous research, surveys have also been used as risk perception measurement tools (Bradford, et al., 2012; Raaijmakers, et al., 2008). The questionnaires that were used can be found in appendices 1 and 2, note that in the appendices the questionnaires are formulated in English whilst they were used in Dutch due to the local context. Part of the questions were built on the research done by Bradford et al.(2012). The surveys were differentiated per location; the survey of Zierikzee was focused on Oosterschelde-flooding and the survey for Zandvoort focused on North Sea flooding based on their location. Furthermore, both surveys contained space at the end for remarks and/or questions whilst being as concise as possible. The data collection was done in collaboration with Lisa Dijksterhuis; another student writing her bachelor thesis on the same topic. The data collection was done in two phases to ensure time efficiency and a wide outreach.

3.2.1. Phase 1: Reaching out via online platform Facebook.

The first phase of research was done through the online platform Facebook. An advantage of this phase was that it was time-efficient since it did not require visiting the locations. Phase one was most likely to reach a middle-aged demographic, so this was considered when the data was analyzed. The actual characteristics of the collected data will be explained in Chapter 4. The first phase required the respondent to have an online presence, although it is possible that the survey was shared with people without an online presence. Sharing the survey was encouraged in the introduction and outroduction of the survey. During the analysis of the data it was considered that the data might not be representative of the whole population, but rather of the part of the population which is active on the platforms used.

The surveys were shared in the following Facebook groups for Zierikzee: Prikbord Zierikzee, Zieriknieuws 2.0, and Zierikzee tijdens en na de ramp. For Zandvoort the surveys were shared in the following Facebook groups: De Zandvoorter, Je bent Zandvoorter als…, Bied je diensten aan in Zandvoort e.o., and Prikbord Zandvoort

Phase 1 provided sufficient data for Zierikzee, with 50 valid responses before April 13th. For Zandvoort, however, phase 1 provided insufficient data, with only 17 valid responses before April 13th. Due to time constraints, phase 2 commenced for Zandvoort only.

3.2.2 Phase 2: Flyering at the location.

For this second phase, flyering was done in the center and boardwalk of Zandvoort by approaching people with flyers with QR codes for the survey. Respondents were offered the possibility to fill out the survey in person if they did not feel comfortable with phones or laptops to ensure they'd have the ability to fill out the survey.

3.2.3. Quality of the data

It is important to note that through online promotion and in-person flyering, it is unlikely that the survey respondents represent the entire population accurately. Through promotion on Facebook, it is, for example, likely that only people with an online presence can be reached. It was expected that the respondents were likely middle-aged. Consider the case where the surveys had been promoted via other social media platforms, such as Instagram for example, the sample population would most likely have been younger. Nevertheless, it was chosen not to promote the survey through other social media channels, since these do not offer "common interest" groups in the way that Facebook does. However, by using an online platform like Facebook the outreach of the survey is relatively large whilst also being time efficient.

Additionally, the second phase of the investigation reached primarily an older demographic. This is because the moment of flyering was a Thursday morning and the beginning of the afternoon, during working hours. It is expected that this is the main reason behind the fact that most respondents reached through flyering were elderly people. This was a positive since this way a previously present gap was filled.

In short, the phases combined allowed for a large sample group with respondents of all ages whilst simultaneously being time-efficient and inclusive for both Facebook users and non-Facebook users.

3.3. Data analysis

The data was analyzed in SPSS. The data that was collected was either nominal, ordinal, or ratio/interval data. First, descriptive statistics have been created with visuals, e.g. histograms or bar charts. After this, a multiple linear regression was performed to investigate the influences of controlling and supporting variables on the key variables, as will be explained in Chapter 4.

In Table 2 (see below) the type of data gathered per question and how the question can be used to answer the main research question are elaborated upon. The numbers correspond to each question as can be found in Appendices 1 and 2.

Question	Type of data variable	What will be measured?	Past research
1 (Postal code)	Nominal	This question was used to exclude responses from people who live outside the area of research	
2 (Experience)	Nominal	The data from this question was compared between both locations and was used in a multiple linear regression to test if this variable influences any of the three key variables (awareness, worry, and preparedness)	Past research indicated that personal or social experience with flood influences an individual's level of worry and preparedness (Lindell & Hwang, 2008; Baan & Klijn, 2004; Lechowska, 2018). An individual with experience is expected to have a higher level of preparedness, whilst having a lower level of worry compared to an individual without experience (Baan & Klijn, 2004). Other research indicates that an individual without experience has a higher chance of underestimating flood risk compared to an individual with experience (Siegrist & Gutscher, 2008).
3 (Worry)	Ordinal	The data from this question was compared between both locations and was used in a multiple linear regression to test which variables influence an individual's level of worry.	
4 (Trust)	Ordinal	The data from this question was compared between both locations and was used in a multiple linear regression to test if this variable influences any of the three key variables	

		(awareness, worry, and preparedness)	
5 (Water level)	Ratio	The data from this question was compared between both locations and was used in a multiple linear regression to test if this variable influences any of the three key variables (awareness, worry, and preparedness)	
6 (Preparedness)	Nominal	The data from this question was compared between both locations and was used in a multiple linear regression to test which variables influence an individual's level of preparedness	
7 (Awareness)	Ordinal	The data from this question was compared between both locations and was used in a multiple linear regression to test which variables influence an individual's level of awareness	
8 (Age)	Ratio	The data from this question was used to test the representativeness of the sample with respect to the population. The data from this question was compared between both locations and was used in a multiple linear regression to test if this variable influences any of the three key variables (awareness, worry, and preparedness)	Previous research has shown that risk perception increases with age (Sjöberg, 1998; Sjöberg & Drottz-Sjöberg, 1993), whilst other research does not indicate this relation (Knocke & Kolviras, 2007).
9 (Gender)	Nominal	The data from this question was used to test the representativeness of the sample with respect to the population. The data from this question was compared between both locations and was used in a multiple linear regression to test if this variable influences any of the three key variables (awareness, worry, and preparedness)	Previous research has shown that women perceive a higher level of risk than men in similar situations (Macoby & Jacklin, 1974; Sjöberg, 1998).
10 (Education)	Ordinal	The data from this question was used to test the representativeness of the sample with respect to the population. The data from this question was compared between both locations and was	Previous research has shown conflicting results regarding the influence of the level of education on an individual's level of perceived risk (Sjöberg, 1998; Sjöberg & Drottz-

		used in a multiple linear regression to test if this variable influences any of the three key variables (awareness, worry, and preparedness)	Sjöberg, 1993; Knocke & Kolviras, 2007). On the one hand, research has indicated that an individual with a low level of education has a higher level of risk perception than an individual with a higher level of education (Sjöberg, 1998; Sjöberg & Drottz-Sjöberg, 1993). Other research does not find any relationship between an individual's level of education and their level of perceived risk (Knocke & Kolviras, 2007)
12	Open question	Possibly gives a deeper understanding of variables in the research	

Table 2: Overview of survey questions encompassing the type of data variable and how these questions will be used to answer the main research question (made by author)

3.4. Research ethics and privacy considerations

To ensure the privacy of the respondents some conditions were applied. The questionnaires started by explaining its purpose and how privacy has been ensured. It explained to the respondents that no identifiable information would be asked, meaning that all data was anonymous. The survey was held using Google Forms, under the license of the university. This decision was made because the university has a deal ensuring the privacy of the contents of Google Drive, which is very important. If the research were to be done on a personal Google Drive, privacy could not have been ensured. During the process, respondents were invited to contact us with questions or concerns by making use of the given contact information

The collected data was used confidentially, accessible to only six people: Lisa Dijksterhuis and I (Karlijn Hoogendoorn) as we are the researchers using the data, both our supervisors and primary graders: Tim Busscher and Bernadette Boumans, and both our secondary graders, which are anonymous to us.

After the finalization of the grading, all data will be deleted. This has been clarified in the introduction of the survey, as can be read in Appendices 1 and 2. The data will be deleted after the grading of the research since all graders need to have access to the data to ensure that it is real and has not been falsified by the researchers.

4. Results

This chapter presents the findings of the research by analyzing the collected data. The chapter begins with a summary of the controlling variables and describes the representability of the sample with respect to the population. After this, the chapter delves deeper into the main findings and the influence of the controlling and supporting variables on the key variables. Lastly, the chapter will discuss the results. This chapter aims to provide a comprehensive account of the research outcomes, setting the stage for the conclusion in Chapter 5.

4.1. Controlling variables

For this research, four controlling variables were used: age, gender, level of education, and experience with flooding. Past research has indicated that these variables might influence an individual's level of perceived risk (Lechowska, 2018; Lindell & Hwang, 2008; Baan & Klijn, 2004; Siegrist & Gutscher, 2008; Sjöberg, 1998; Sjöberg & Drottz-Sjöberg, 1993; Knocke & Kolviras, 2007; Macoby & Jacklin, 1974). This research aimed to find which variables indeed influence an individual's level of perceived risk.

4.1.1. Age, gender, level of education

It was found that within the samples, there is a slight difference in age distribution. For Zandvoort, the average age of the sample is 53, whilst for Zierikzee this is 54,5 (see Appendix 3). Regarding gender, there is a difference in gender distribution. Whilst for Zandvoort the gender distribution of the sample was 50% male and 50% female, the gender distribution for Zierikzee was 31% male and 69% female (see Appendix 4). Lastly, the samples indicate that citizens of Zierikzee, on average, have a lower level of education (see Appendix 5). As discussed in Chapter 2, research has indicated that risk perception increases with age for both genders (Sjöberg, 1998; Sjöberg & Drottz-Sjöberg, 1993), women generally perceive higher levels of risk (Macoby & Jacklin, 1974; Sjöberg, 1998), and that a lower level of education increases the level of risk perception (Sjöberg, 1998; Sjöberg & Drottz-Sjöberg, 1993). Whether these relationships are found in this research will be discussed in section 4.6.

Furthermore, the representativeness of the sample group was checked based on these three aspects: age, gender, and level of education. It was found that, although not perfect, the sample group represents the population of the two locations on a satisfactory level. It should be noted that in the sample of Zierikzee the female part of the population is overrepresented, although this was not found for the sample of Zandvoort (see Appendix 4)

4.1.2. Sea-flood experience

Within the samples, there is a difference in the distribution of experiences with sea-floods. Zandvoort shows a lower amount of experiences with floods, both in the personal and social experience categories (see Fig. 4.). This difference was expected, as Zandvoort has never experienced a sea-flood, while Zierikzee has (Planbureau voor de Leefomgeving, sd). As discussed in Chapter 2, past research has indicated that people without flood experience, both personal and social, often have a lower level of risk perception (Siegrist & Gutscher, 2008). Whether these relationships are found in this research will be discussed in section 4.6.

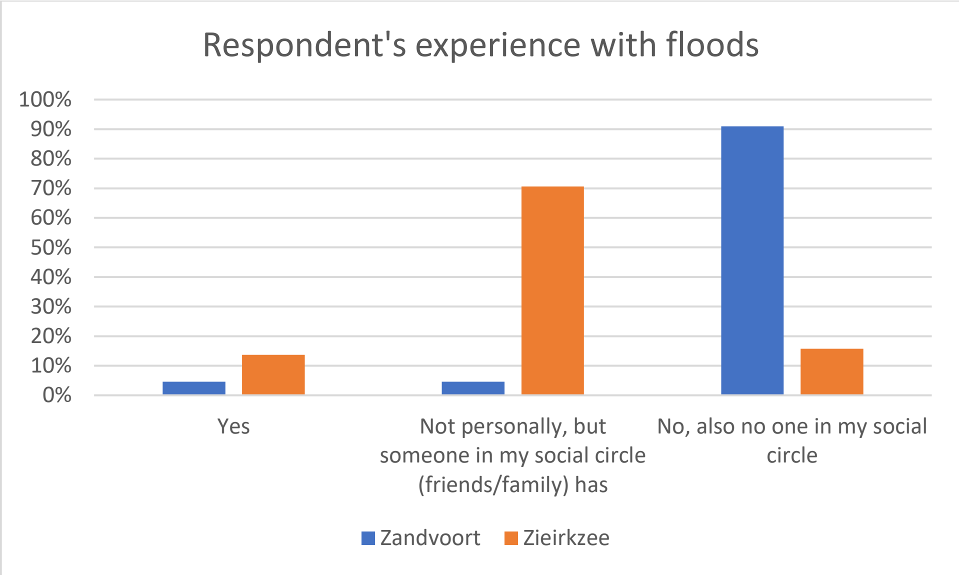

Figure 4: Experience with floods in the samples

4.3. Key variables

As discussed in Chapter 2, the key variables for researching the level of risk perception are awareness, worry, and preparedness (Raaijmakers, et al., 2008)(see Fig.2).

4.3.1. Awareness

Respondents were asked to indicate their level of knowledge on sea-floods and the current measures against sea-floods on a level of 1 to 10. The average indicated level for Zandvoort was a 5,1 and for Zierikzee this was a 5,3. The sample of Zandvoort indicated 2 respondents with a self-acclaimed perfect level of awareness (see Fig. 5.).

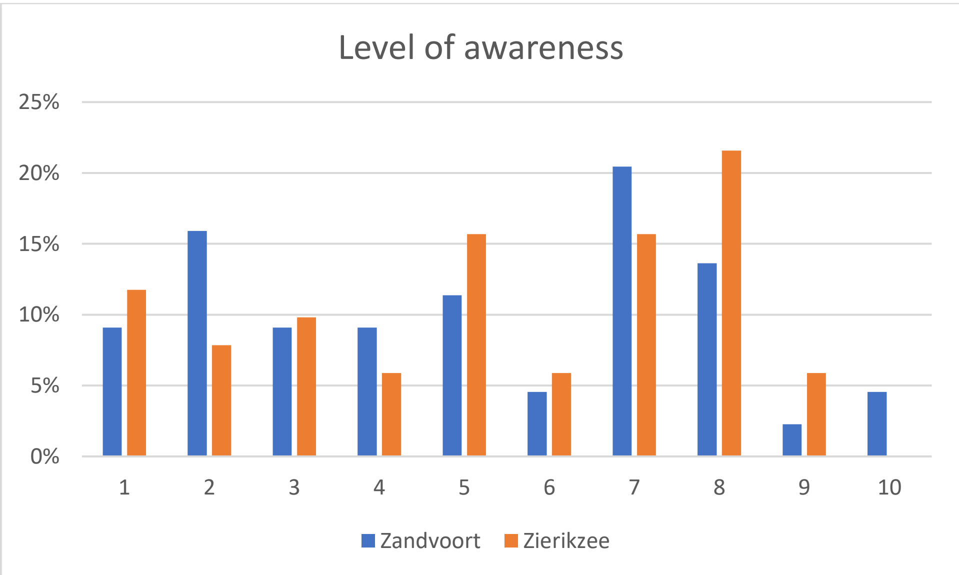

Figure 5: level of awareness in the samples

4.3.2. Worry

Respondents were asked to indicate their level of worriedness regarding the possibility of a sea-flood on a scale from 1 to 10 (see Fig. 6.). For Zierikzee the average level of worry was a 3,5 which is higher than Zandvoort's at 2,5.

Figure 6: Level of worry in the samples

4.3.3. Preparedness

Respondents were asked if they had taken steps to prepare for a sea-flood. Some respondents from Zierikzee had taken steps or were planning to, but none in Zandvoort (see Fig. 7.).

Figure 7: Level of preparedness in the samples

4.4. Supporting variables

The supporting variables for researching the level of risk perception are trust and suspected water height in case of a sea flood which will be elaborated upon in this section.

4.4.1. Trust

The respondents were asked to indicate their trust in the current measures against sea-floods, on a scale from 1 to 10 with 10 being complete trust and 1 being complete distrust. Zandvoort indicated a higher mean level of trust at 7,6 compared to Zierikzee's 7,1 (see Fig. 8.).

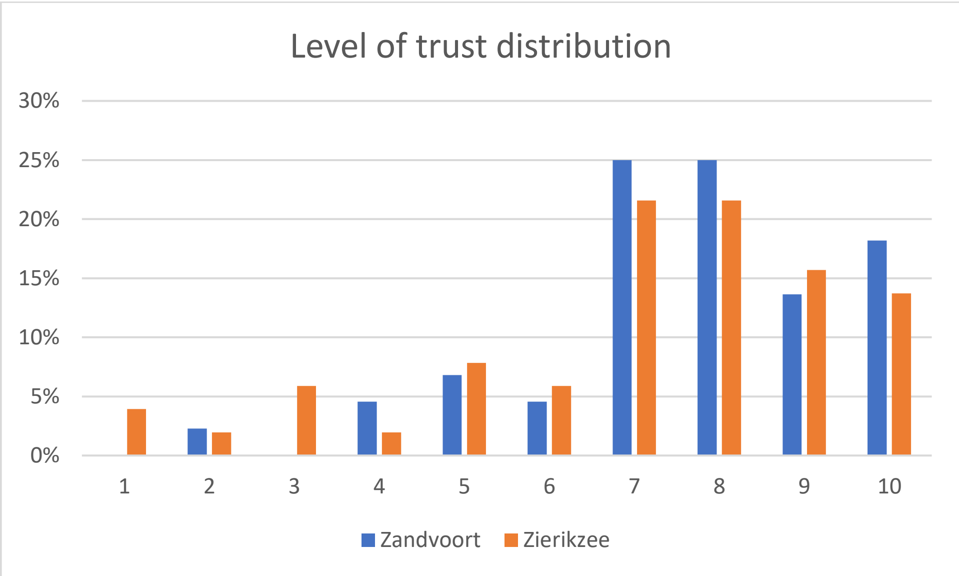

Figure 8: Distribution of the level of trust of the respondents

4.4.2 Water level

Respondents were asked to indicate what height they believed the water level would reach in their street in case of a sea-flood (see Table 3 and Appendix 6). This data can be used to indicate an individual's level of worry and awareness. As can be seen in Table 3, it is clear that respondents from Zierikzee believe the water would reach a higher level in their street, than the respondents from Zandvoort. This is in line with actual flood data that indicates a higher water level in Zierikzee compared to the water level in Zandvoort in case of a sea-flood (Planbureau voor de Leefomgeving, 2013). This indicates that the respondents are aware of the consequences of a possible flood.

	Zandvoort	**Zierikzee**
Minimum height	0 meters	0,1 meters
Maximum height	3 meters	8 meters
Average	0,65 meters	2,15 meters

Table 3: Overview of the expected water level in case of a sea-flood (made by author)

4.5. Preparing variables for multiple linear regression analyses

To use a multiple linear regression the variables preparedness, experience, gender, age, and level of education had to be changed to binary and ratio variables. To create the binary variables, categories had to be combined.

4.5.1. Translating preparedness and experience into binary variables

For the preparedness variable, two new variables were created with the following translations:

- "Prepared or planning to": this variable has both "Yes" and "No, but I am planning to" indicated by 1 and values "No" and "I have not thought about it" as 0.
- "Prepared": this variable only has "Yes" as 1, and all other categories as 0.

Using a chi-square test, both variables were tested and okay to use (see Appendix 7), after which it was chosen to continue with the "Prepared or planning to" as the preparedness variable. The test was only done for the data of Zierikzee because, within the sample of Zandvoort, no one indicated either "Yes" or "No, but I am planning to".

For the experience variable, two new variables were created with the following translations:

- "Personal or social experience": for this variable both "Yes" and "No, but someone in my social circle (family/friends) has" were put as 1, and "No, also no one in my social circle" was put as 0.
- "Personal experience": for this variable only the category "yes" was put as 1, the other categories were put as 0.

Again, the chi-square test proved that both new variables were okay to use for both Zierikzee and Zandvoort (see Appendices 8 and 9, respectively). It was chosen to continue with "Personal or social experience" as the experience variable

4.5.2. Translating gender into a binary variable

The data for gender was translated from a nominal to a binary variable by coding "male" as 0 and "female" as 1. This translation did not edit the categories.

4.5.3. Translating age and level of education into ratio variables

Since age and level of education are ordinal variables, they could not be taken into account in the multiple linear regressions which can only provide statistics for ratio and interval data. Age and level of education were translated into ratio variables by coding the answers on a scale.

- The following translation was made for age: "18-25" into "1", "26-40" into "2", "41-50" into "3", "51-65" into "4", "66-80" into "5", and "81+" into "6".
- The following translation was made for the level of education: "Primary education" into "1", "MBO" into "2", "HBO" into "3", "University" into "4", and "I prefer not to say" has not been translated as it will be kept out.

4.6. Relationship between the variables

To find if the controlling and supporting variables influenced the key variables, a multiple linear regression was done in SPSS 29. A multiple linear regression is the preferred test for this since it allows for the examination of multiple independent variables and a dependent variable (Weedberg, 2018). The test allows the analysis of the relative influence of each independent variable on the dependent variable (Weedberg, 2018). Before the multiple linear regression is performed, SPSS 29 performs an ANOVA which indicates how well the regression equation predicts the dependent variable. The ANOVA statistics can be found in Appendices 10 through 14. To identify which controlling and supporting variables have a significant influence on the key variables it is important to look at the "sig." column, which is the right column of the table. When the significance is indicated to be $p \leq 0.050$, it can be stated that the variable influences the key variable. To find the direction of the relationship, the column named Unstandardized B can be looked at. A positive value for B indicates a direct, positive relationship between the two variables.

4.6.1. Multiple linear regression Zierikzee

As can be seen in Table 4, the individual's level of preparedness (p=0,010; B= 3,621) and trust (p=0,014; B=0,440) both have a positive influence on the individual's level of awareness. All other variables do not influence the individual's level of awareness. This is in contradiction with previous research by Lechowska (2018), which found that awareness was influenced only by experience.

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	3,065	3,106		,987	,330
	Worry	-,209	,201	-,168	-1,041	,305
	Prepared_or_planning_to	3,621	1,333	,430	2,715	,010
	Personal_or_social_experience	1,481	1,112	,214	1,332	,191
	Trust	,440	,170	,359	2,593	,014
	Water_height	-,033	,219	-,021	-,153	,879
	Gender	-1,508	,798	-,274	-1,890	,067
	Age_categorical_scale	-,135	,334	-,062	-,404	,689
	Education_categrorical	-,130	,558	-,034	-,233	,817

a. Dependent Variable: Awareness

Table 4: The outcome of the multiple linear regression with Awareness as its dependent variable for Zierikzee

By looking at Table 5, it can be found that an individual's level of preparedness (p<0,001; B=2,942), and an individual's experience with floods (p=0.050; B=-1,771) are the variables influencing an individual's level of worry. The level of preparedness has a positive relationship to the individual's level of worry. Regarding an individual's level of flood experience, it has been found to have a negative relationship with an individual's level of worry. This means that an individual with flood experience will experience a lower level of worry compared to an individual without flood experience when all other variables are the same. This research simultaneously corroborates, adds to, and opposes past research by Lechowska (2018). Past research indicated that an individual's level of worry was influenced by experience and level of education, whilst this research corroborates the first it does not support Lechowska's (2018) finding of the latter. This research does add to Lechowska's (2018) research by finding the direct and positive relationship between the individual's level of preparedness and their level of worry.

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	8,711	2,098		4,151	<,001
	Prepared_or_planning_to	2,942	1,075	,434	2,736	,010
	Awareness	-,136	,131	-,169	-1,041	,305
	Personal_or_social_experience	-1,771	,872	-,318	-2,030	,050
	Trust	-,165	,147	-,167	-1,124	,268
	Water_height	,205	,173	,161	1,181	,245
	Gender	-,616	,667	-,139	-,924	,361
	Age_categorical_scale	-,319	,265	-,183	-1,203	,236
	Education_categrorical	-,378	,447	-,122	-,846	,403

a. Dependent Variable: Worry

Table 5: The outcome of the multiple linear regression with Worry as its dependent variable for Zierikzee

Lastly, as can be seen in Table 6, the individual's level of worry (p=0,010; B=-0,636) and the individual's level of awareness (p=0,010; B=0,057) influence the individual's level of preparedness. The individual's level of worry has a direct, negative relationship with the individual's level of preparedness, whilst the individual's level of awareness has a direct, positive relationship with the individual's level of preparedness. These findings are not in line with previous research by Lechowska (2018) which found that an individual's level of preparedness is influenced by their gender and experience.

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	-,636	,338		-1,878	,068
	Worry	,057	,021	,387	2,736	,010
	Awareness	,046	,017	,386	2,715	,010
	Personal_or_social_experience	,177	,125	,215	1,417	,165
	Trust	-,027	,020	-,186	-1,339	,189
	Water_height	,010	,025	,053	,402	,690
	Gender	,179	,089	,274	2,005	,052
	Age_categorical_scale	-,008	,038	-,029	-,200	,842
	Education_categrorical	,096	,061	,209	1,573	,124

a. Dependent Variable: Prepared_or_planning_to

Table 6: The outcome of the multiple linear regression with Preparedness as its dependent variable for Zierikzee

All outcomes above have been summarized in Table 7, which can be seen below.

Key variable	**Is influenced by…**	**Is not influenced by…**
Awareness	Preparedness (+) Trust (+)	Worry Experience Water height Gender Age Education
Worry	Preparedness (+) Experience (-)	Trust Water height Awareness Gender Age Education
Preparedness	Worry (-) Awareness (+)	Experience Trust Water height Gender Age Education

Table 7: Overview of the relationships as found by this research (made by author) the plus indicates a positive relationship, and the minus indicates a negative relationship

4.6.2. Multiple linear regression Zandvoort

Before looking at the outcomes of the multiple linear analyses, it is important to note that the variable preparedness was removed from the statistic as it was always 0 (not prepared).

As can be seen in Table 8, the individual's level of awareness is not influenced by any of the other variables. This is different from the data from Zierikzee which can be found above in section 4.6.1. Additionally, compared to previous research by Lechowska (2018) these findings are also not in line.

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	6,818	3,475		1,962	,059
	Worry	-,297	,234	-,212	-1,272	,213
	Personal_or_social_experience	,734	1,934	,060	,379	,707
	Trust	,156	,238	,110	,655	,517
	Water_height	-1,003	,534	-,308	-1,878	,070
	Gender	-1,459	,818	-,275	-1,783	,084
	Age_categorical_scale	,031	,351	,015	,090	,929
	Education_categroical	-,267	,603	-,073	-,443	,661

a. Dependent Variable: Awareness

Table 8: The outcome of the multiple linear regression with Awareness as its dependent variable for Zandvoort

By looking at Table 9, it can be found that an individual's level of trust (p=0,033; B=-0,369) is the only variable with an influence on an individual's level of worry. The found relationship is negative, meaning that when the individual's level of trust increases, their level of worry decreases. This finding differs from the findings of the data from Zierikzee, which can be found in section 4.6.1. Furthermore, as discussed in Chapter 2, Lechowska (2018) found that worry was influenced by experience and level of education, both of these relationships are not found in this research.

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	6,714	2,441		2,751	,010
	Awareness	-,162	,127	-,227	-1,272	,213
	Personal_or_social_experience	-,369	1,429	-,042	-,258	,798
	Trust	-,368	,165	-,362	-2,231	,033
	Water_height	,265	,413	,114	,641	,526
	Gender	-,372	,630	-,098	-,591	,559
	Age_categorical_scale	-,075	,258	-,049	-,292	,773
	Education_categroical	-,058	,446	-,022	-,129	,898

a. Dependent Variable: Worry

Table 9: The outcome of the multiple linear regression with Worry as its dependent variable for Zandvoort

All outcomes above have been summarized in Table 10, which can be seen below.

Key variable	Is influenced by…	Is not influenced by…
Awareness		Worry Experience Trust Water height Gender Age Education
Worry	Trust (-)	Awareness Experience Water height Gender Age Education
Preparedness		

Table 10: Overview of the relationships as found by this research (made by author), the minus indicates a negative relationship

4.6.3. Independent samples test comparing Zandvoort and Zierikzee

To investigate if there is a significant difference in the influence of a variable between the cities, an independent samples test was performed. The test statistics can be found in Appendix 15. The independent samples test first shows Levene's test. This test indicates if equal variance between the two locations can be assumed or not. When p>0,050 equal variance can be assumed. When equal variance can be assumed it means that the spread of scores within each sample is similar. When the variances are equal it also suggests that the precision of the measurements across the locations is consistent, which is important for making accurate comparisons. The overview can be seen in Table 11 below.

Variable	Can equal variance be assumed	Is there a significant difference between the locations?
Awareness	Yes (p=0,093)	No (p=0,676)
Worry	Yes (p=0,205)	Yes (p=0,010)
Preparedness	No (p<0,001)	Yes (p=0,024)
Trust	Yes (p=0,194)	No (p=0,224)
Water height	No (p=0,011)	Yes (p<0,001)
Experience	Yes (p=0,053)	Yes (p<0,001)

Table 11: Overview of the differences in variables between the locations (made by author)

4.7. Discussing the results

The risk level of a location proves to influence worry, preparedness, expected water level in case of sea-floods, and experience. As risk perception is the sum of awareness, worry, and preparedness, and two of these prove to have a significant difference between the two locations we can say that for the sample, the risk level of a location does influence the risk perception of it's citizens.

Regarding the research into which controlling and supporting variables proved to influence the key variables, conflicting results were gained per location, this could be explained by the relatively small sample size. This indicates the need for more research into this topic.

5. Conclusion

The purpose of this research was to explore how the risk level of a location influences flood risk perception by comparing two contrasting areas in the Netherlands: Zierikzee, a high-risk sea-flood area, and Zandvoort, a low-risk sea-flood area. Existing literature showed that risk perception is influenced by awareness, worry, and preparedness. These building blocks were used as key variables during the research. Through comparative analysis, it was found that the risk level of a location significantly impacts worry, preparedness, expected water levels in the event of sea floods, and previous experience with flooding.

The key findings indicate that residents in Zierikzee perceive higher levels of sea-flood risk compared to those in Zandvoort. This can be explained by the Watersnoodramp of 1953, which enhances awareness and the perceived need for precautionary measures. Conversely, the lower levels of perceived sea-flood risk in Zandvoort reflect its relatively safer status.

The significant differences observed in two of the three components of risk perception—worry and preparedness—affirm that location does indeed play a crucial role in shaping how residents perceive flood risks. The third component, awareness, while important, appeared more uniformly distributed across both locations, suggesting that general knowledge about flood risks is widespread, regardless of specific geographical risk levels.

In conclusion, this study underscores the importance of geographical context in flood risk perception. Policymakers and emergency planners should take these differences into account when designing and implementing risk communication and preparedness strategies. By tailoring approaches to the specific needs and perceptions of communities in different risk zones, authorities can enhance the effectiveness of their interventions and ensure a more resilient response to potential sea-flood events in the Netherlands.

This study has made contributions to the general understanding of flood risk perception in sea-flood areas. There remain several avenues for future research that could deepen the understanding of flood risk perception. The following recommendations show possible ideas for further research:

- Expand sample size: getting more responses per location ensures that the data is more representative of the population of the area. Additionally, a larger sample size would allow for a better analysis of the relationship between risk perception and the controlling variables.
- Incorporating a broader range of locations: looking into more high-risk and low-risk locations as well as locations with a “medium-risk”.
- Researching locations with fluvial and/or pluvial flood risks.
- Using qualitative methods (interviews, focus groups) for richer insights.
- Considering additional variables: e.g. socioeconomic status.

Understanding the nuanced ways in which various factors interact to shape risk perception will enhance the development of comprehensive and adaptive flood management strategies in the face of climate change.

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Appendix 1: Questionnaire Zierikzee

In the appendix, the questionnaire that was used for Zierikzee can be found. Sections 3.2, 3.3, and 3.4 explain what information will be gained from each question and how this will be used as well as an elaboration on how privacy will be ensured.

Dear reader,

We are Lisa and Karlijn. We are conducting research into flooding for our graduation project at the University of Groningen. We want to investigate how safe people in Zierikzee feel with regard to flooding caused by the Oosterschelde. This survey is completely anonymous and the data will be deleted after the survey is closed.

By completing our survey you not only help us, but you also contribute to a better understanding of safety perception in Zierikzee. We would very much appreciate it if you could share the questionnaire with family, neighbors, friends, etc. who also live in Zierikzee.

If you have any questions, you can contact us at l.dijksterhuis@student.rug.nl or k.hoogendoorn@student.rug.nl (mentioning experience with the Zierikzee flood risk)

1. To make sure you live in the area, please indicate the first four numbers of your postal code.
2. Have you ever experienced a flood caused by the Oosterschelde in your area?
   1: Yes
   2: No, but someone in my social circle experienced flooding caused by the Oosterschelde.
   3: No
3. On a scale from 1 to 10, how concerned are you about the possibility of floods caused by the Oosterschelde occurring in your area? 1 being not concerned at all and 10 being extremely concerned
4. On a scale from 1 to 10, to what extent do you trust the current Oosterschelde-flood measures in your area (such as dikes)? 1 being completely distrusting and 10 being completely trusting
5. In case of flood caused by the Oosterschelde, how high do you think the water would rise in your street? Answer in meters (e.g. 0,5 meters)
6. Have you taken any steps to prepare for a potential flood caused by the Oosterschelde in your area?
   1: Yes
   2: No, but I am planning to
   3: No
   4: I have never thought about it
7. On a scale from 1 to 10, how knowledge do you consider yourself to have regarding North Sea-flood risk and Oosterschelde-flood risk measures? 1 being no knowledge and 10 being expert knowledge
8. What is your age?
   1: 18-25
   2: 26-40
   3: 41-50
   4: 51-65
   5: 66-80
   6: 81+
   7: I prefer not to say
9. What is your gender?

1: Male
2: Female
3: Other
4: Prefer not to say.

10. What is your level of education?
    1: Lower education
2: MBO
3: HBO
    4: UNI
    5: I prefer not to say
11. How many years have you lived in your current area?
12. Do you have any remarks, suggestions, or elaboration regarding Oosterschelde-floods in general?

Appendix 2: Questionnaire Zandvoort

In the appendix, the questionnaire that was used for Zierikzee can be found. Sections 3.2, 3.3, and 3.4 explain what information will be gained from each question and how this will be used as well as an elaboration on how privacy will be ensured.

Dear reader,

We are Lisa and Karlijn. We are conducting research into flooding for our graduation project at the University of Groningen. We want to investigate how safe people in Zandvoort feel with regard to flooding caused by the North Sea. This survey is completely anonymous and the data will be deleted after the survey is closed.

By completing our survey you not only help us, but you also contribute to a better understanding of safety perception in Zandvoort. We would very much appreciate it if you could share the questionnaire with family, neighbors, friends, etc. who also live in Zandvoort.

If you have any questions, you can contact us at l.dijksterhuis@student.rug.nl or k.hoogendoorn@student.rug.nl (mentioning experience with the Zandvoort flood risk)

1. To make sure you live in the area, please indicate the first four numbers of your postal code.
2. Have you ever experienced a flood caused by the North Sea in your area?
   1: Yes
   2: No, but someone in my social circle experienced flooding caused by sea.
   3: No
3. On a scale from 1 to 10, how concerned are you about the possibility of floods caused by the North Sea occurring in your area? 1 being not concerned at all and 10 being extremely concerned
4. On a scale from 1 to 10, to what extent do you trust the current North Sea-flood measures in your area (such as dunes)? 1 being completely distrusting and 10 being completely trusting
5. In case of flood caused by the North Sea, how high do you think the water would rise in your street? Answer in meters (e.g. 0,5 meters)
6. Have you taken any steps to prepare for a potential flood caused by the North Sea in your area?
   1: Yes
   2: No, but I am planning to
   3: No
   4: I have never thought about it
7. On a scale from 1 to 10, how knowledge do you consider yourself to have regarding North Sea-flood risk and North Sea-flood risk measures? 1 being no knowledge and 10 being expert knowledge
8. What is your age?
   1: 18-25
   2: 26-40
   3: 41-50
   4: 51-65
   5: 66-80
   6: 81+
   7: I prefer not to say
9. What is your gender?
   1: Male

2: Female
3: Other
4: Prefer not to say.

10. What is your level of education?
1: Lower education
2: MBO
3: HBO
4: UNI
5: I prefer not to say
11. How many years have you lived in your current area?
12. Do you have any remarks, suggestions, or elaboration regarding North Sea-floods in general?

Appendix 3: Age

In this appendix graphs depicting the age distribution in the samples and populations of Zandvoort and Zierikzee can be found. The information gained from these graphs is further elaborated upon in section 4.1.1.

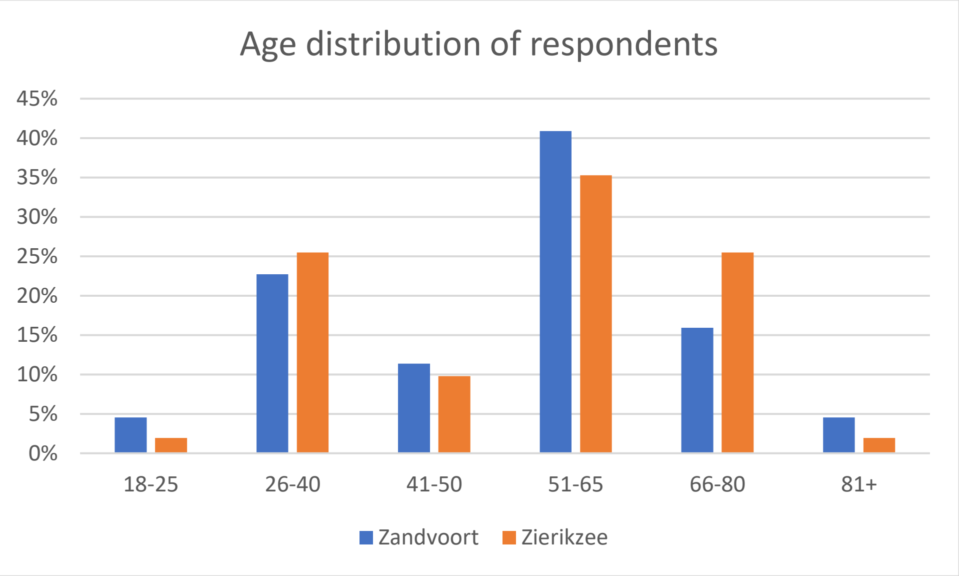

Figure 9: Distribution age of the respondents

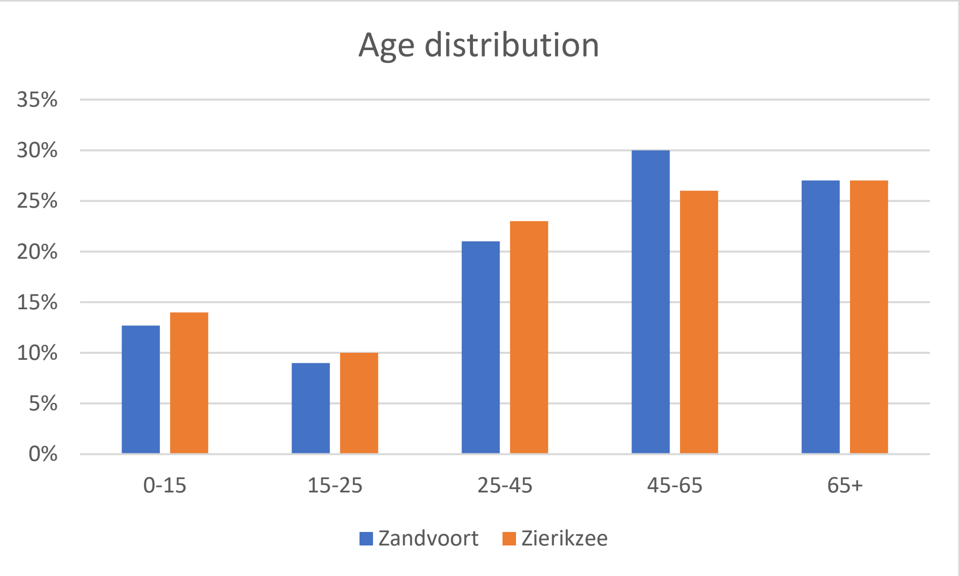

Figure 10: Age distribution in the populations (Allecijfers.nl, 2023a; Allecijfers.nl, 2023b)

Appendix 4: Gender

In this appendix graphs depicting the gender distribution in the samples and populations of Zandvoort and Zierikzee can be found. The information gained from these graphs is further elaborated upon in section 4.1.1.

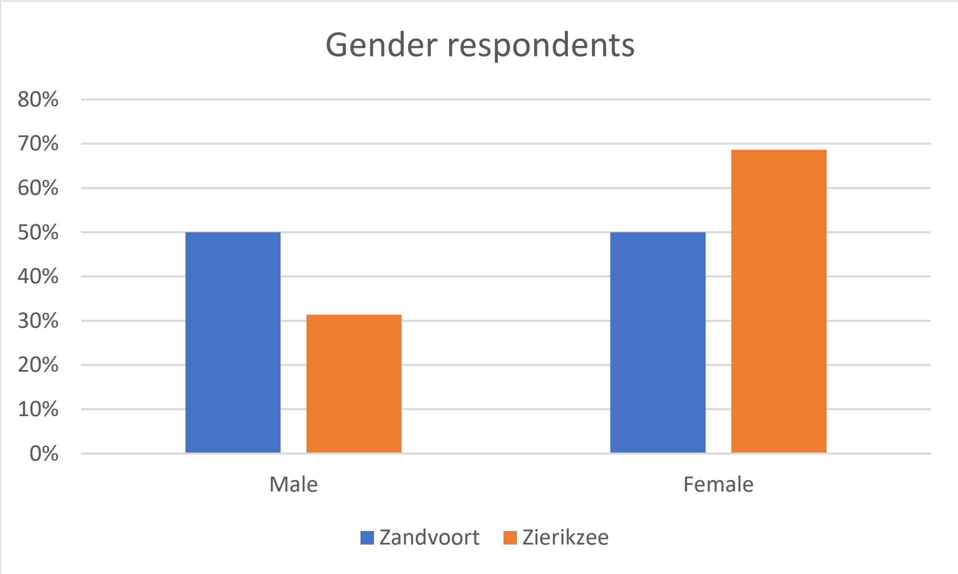

Figure 11: Gender of the samples

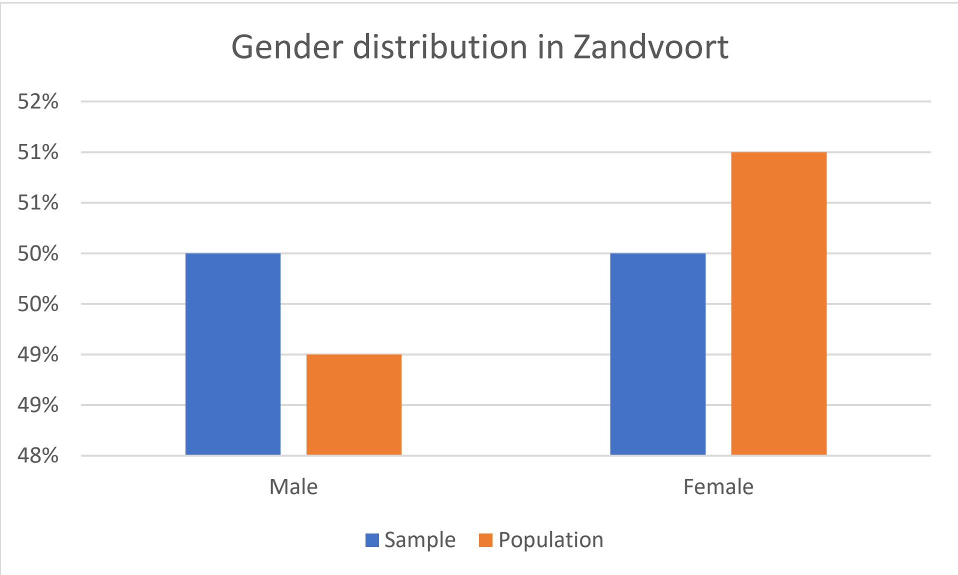

Figure 12: Gender distribution difference sample and population Zandvoort (Allecijfers.nl, 2023a)

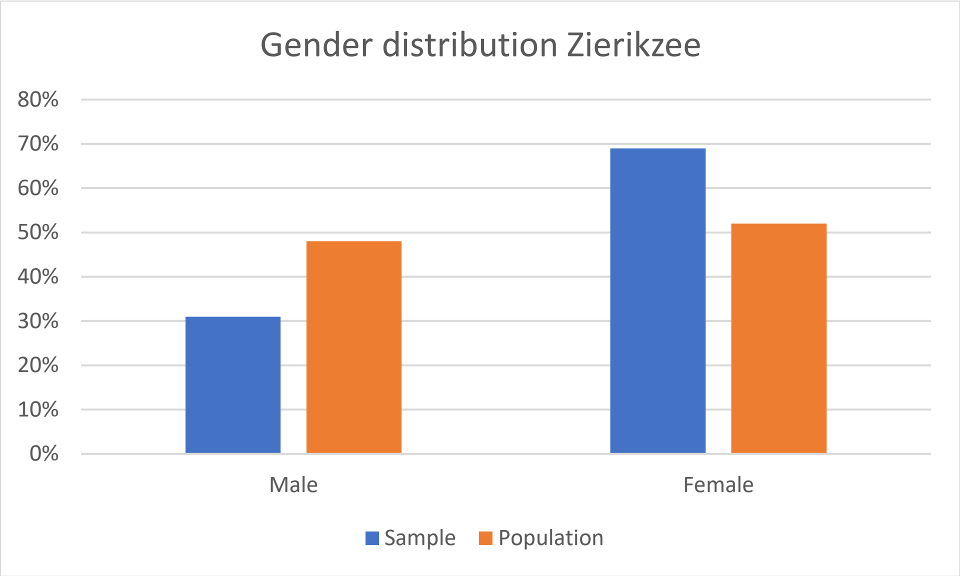

Figure 7: Gender distribution difference sample and population Zierikzee (Allecijfers.nl, 2023b)

Appendix 5: Level of education

In this appendix graphs depicting the distribution in the level of education in the samples and populations of Zandvoort and Zierikzee can be found. The information gained from these graphs is further elaborated upon in section 4.1.1.

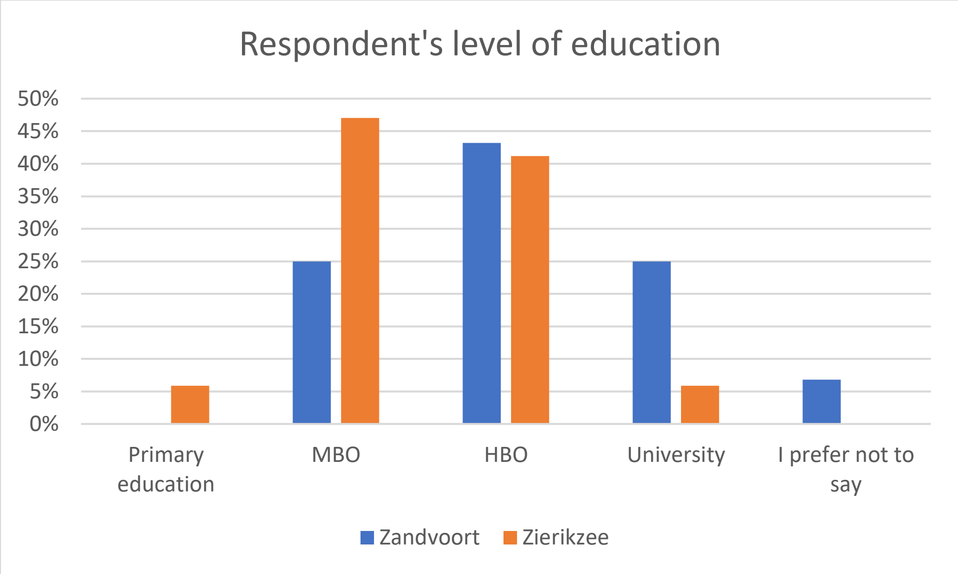

Figure 8: Distribution of level of education of the samples

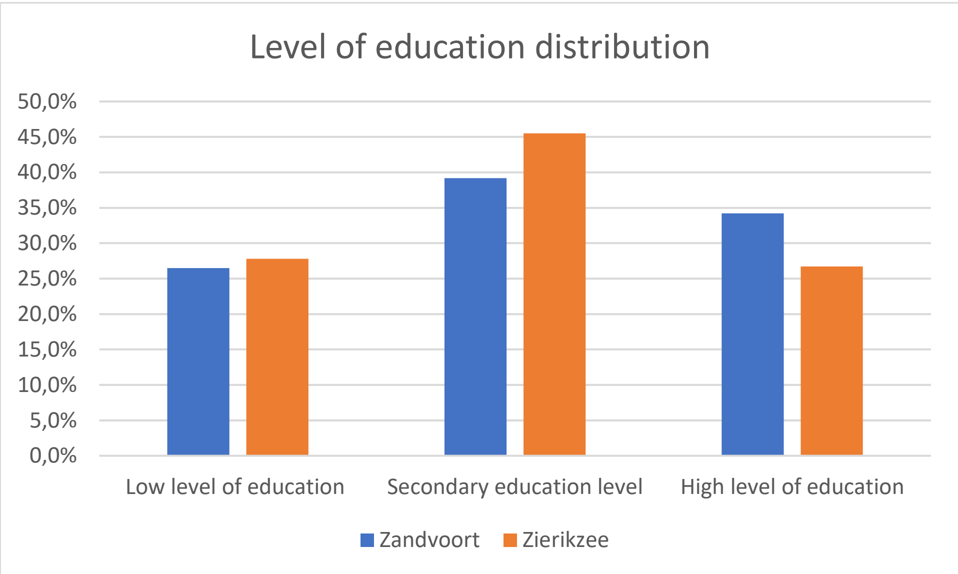

Figure 9: Level of education distribution of the populations (Allecijfers.nl, 2023a; Allecijfers.nl, 2023b)

Appendix 6: Expected water level in case of flood

In this appendix, a graph depicting the expected water level in case of a sea-flood can be found. This information is summarized in Table 3 in section 4.4.2.

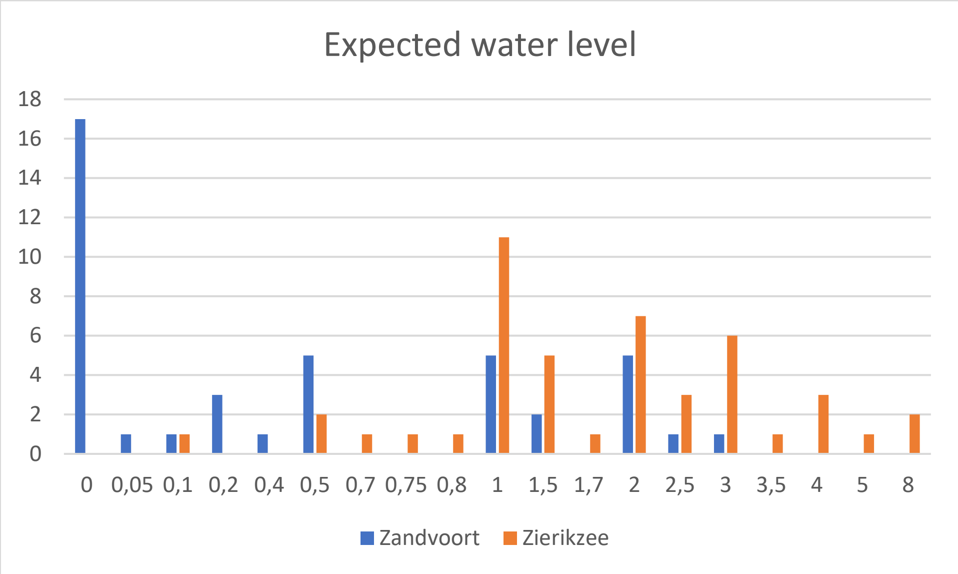

Figure 10: Distribution of expected water level in the samples

Appendix 7: Test Statistic Preparedness Zierikzee

This appendix shows the test statistic gained from a Chi-square test. The meaning and usage of this information are further elaborated upon in section 4.5.1.

Test Statistics

	Prepared	Prepared_or_planning_to
Chi-Square	43,314[a]	32,961[a]
df	1	1
Asymp. Sig.	<,001	<,001

a. 0 cells (0,0%) have expected frequencies less than 5. The minimum expected cell frequency is 25,5.

Appendix 8: Test Statistic Experience Zierikzee

This appendix shows the test statistic gained from a Chi-square test. The meaning and usage of this information are further elaborated upon in section 4.5.1.

Test Statistics

	Personal_or_social_experience	Personal_experience
Chi-Square	24,020[a]	26,843[a]
df	1	1
Asymp. Sig.	<,001	<,001

a. 0 cells (0,0%) have expected frequencies less than 5. The minimum expected cell frequency is 25,5.

Appendix 9: Test Statistic Experience Zandvoort

This appendix shows the test statistic gained from a Chi-square test. The meaning and usage of this information are further elaborated upon in section 4.5.1.

Test Statistics

	Personal_or_social_experience	Personal_experience
Chi-Square	29,455[a]	36,364[a]
df	1	1
Asymp. Sig.	<,001	<,001

a. 0 cells (0,0%) have expected frequencies less than 5. The minimum expected cell frequency is 22,0.

Appendix 10: ANOVA Awareness Zierikzee

This appendix shows the ANOVA which is performed before the multiple linear regression n in SPSS-29. The significance indicates how well the regression equation predicts the dependent variable. The multiple linear regression that was performed after this as well as the discussion of the results can be found in section 4.6.1.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	121,759	8	15,220	2,909	,013[b]
	Residual	193,568	37	5,232		
	Total	315,326	45			

a. Dependent Variable: Awareness

b. Predictors: (Constant), Education_categrorical, Gender, Water_height, Trust, Worry, Prepared_or_planning_to, Age_categorical_scale, Personal_or_social_experience

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Appendix 11: ANOVA Worry Zierikzee

This appendix shows the ANOVA which is performed before the multiple linear regression n in SPSS-29. The significance indicates how well the regression equation predicts the dependent variable. The multiple linear regression that was performed after this as well as the discussion of the results can be found in section 4.6.1.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	78,224	8	9,778	2,867	,014[b]
	Residual	126,211	37	3,411		
	Total	204,435	45			

a. Dependent Variable: Worry

b. Predictors: (Constant), Education_categrorical, Gender, Water_height, Trust, Awareness, Age_categorical_scale, Personal_or_social_experience, Prepared_or_planning_to

Appendix 12: ANOVA Preparedness Zierikzee

This appendix shows the ANOVA which is performed before the multiple linear regression n in SPSS-29. The significance indicates how well the regression equation predicts the dependent variable. The multiple linear regression that was performed after this as well as the discussion of the results can be found in section 4.6.1.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2,003	8	,250	3,777	,003[b]
	Residual	2,453	37	,066		
	Total	4,457	45			

a. Dependent Variable: Prepared_or_planning_to

b. Predictors: (Constant), Education_categrorical, Gender, Water_height, Trust, Worry, Awareness, Age_categorical_scale, Personal_or_social_experience

Appendix 13: ANOVA Awareness Zandvoort

This appendix shows the ANOVA which is performed before the multiple linear regression n in SPSS-29. The significance indicates how well the regression equation predicts the dependent variable. The multiple linear regression that was performed after this as well as the discussion of the results can be found in section 4.6.2.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	95,034	7	13,576	2,330	,049[b]
	Residual	186,466	32	5,827		
	Total	281,500	39			

a. Dependent Variable: Awareness

b. Predictors: (Constant), Education_categroical, Personal_or_social_experience, Worry, Gender, Water_height, Age_categorical_scale, Trust

Appendix 14: ANOVA Worry Zandvoort

This appendix shows the ANOVA which is performed before the multiple linear regression n in SPSS-29. The significance indicates how well the regression equation predicts the dependent variable. The multiple linear regression that was performed after this as well as the discussion of the results can be found in section 4.6.2.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	42,073	7	6,010	1,894	,103[b]
	Residual	101,527	32	3,173		
	Total	143,600	39			

a. Dependent Variable: Worry

b. Predictors: (Constant), Education_categroical, Personal_or_social_experience, Trust, Gender, Water_height, Age_categorical_scale, Awareness

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Appendix 15: Independent Samples Test Zandvoort and Zierikzee

This appendix shows the independent samples test that was performed in SPSS-29 to find if there is a significant difference in the influence of a variable between the cities. The results are discussed in section 4.6.3 and an overview is given in Table 6. This appendix also has information on the next page.

Group Statistics

	City	N	Mean	Std. Deviation	Std. Error Mean
Trust	0	44	7,6364	1,84379	,27796
	1	51	7,0980	2,36013	,33048
Water_height	0	42	,6464	,83727	,12919
	1	46	2,1641	1,67268	,24662
Worry	0	44	2,5000	1,86148	,28063
	1	51	3,5882	2,10881	,29529
Prepared_or_planning_to	0	44	,0000	,00000	,00000
	1	51	,0980	,30033	,04205
Awareness	0	44	5,0682	2,66238	,40137
	1	51	5,2941	2,57910	,36115
Personal_or_social_experience	0	44	,0909	,29080	,04384
	1	51	,8431	,36729	,05143
Gender	0	44	,5000	,50578	,07625
	1	51	,6863	,46862	,06562

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
						Significance				95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
Trust	Equal variances assumed	1,713	,194	1,224	93	,112	,224	,53832	,43969	-,33481	1,41146
	Equal variances not assumed			1,247	92,144	,108	,216	,53832	,43184	-,31932	1,39597
Water_height	Equal variances assumed	6,838	,011	-5,303	86	<,001	<,001	-1,51770	,28619	-2,08663	-,94877
	Equal variances not assumed			-5,451	67,507	<,001	<,001	-1,51770	,27841	-2,07334	-,96206
Worry	Equal variances assumed	1,631	,205	-2,647	93	,005	,010	-1,08824	,41115	-1,90470	-,27177
	Equal variances not assumed			-2,671	92,944	,004	,009	-1,08824	,40737	-1,89720	-,27927
Prepared_or_planning_to	Equal variances assumed	23,574	<,001	-2,164	93	,017	,033	-,09804	,04531	-,18801	-,00806
	Equal variances not assumed			-2,331	50,000	,012	,024	-,09804	,04205	-,18251	-,01357
Awareness	Equal variances assumed	,093	,762	-,419	93	,338	,676	-,22594	,53865	-1,29559	,84372
	Equal variances not assumed			-,418	90,050	,338	,677	-,22594	,53993	-1,29859	,84672
Personal_or_social_experience	Equal variances assumed	3,855	,053	-10,942	93	<,001	<,001	-,75223	,06874	-,88874	-,61572
	Equal variances not assumed			-11,131	92,359	<,001	<,001	-,75223	,06758	-,88644	-,61801