CoastSnap: Working with the Hurunui District Council

GEOG309: Research for Resilient Communities and Environments

Final Report

University of Canterbury
17th October 2025

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France A, McNaught K, O'Malley N, Roulston J, and Wigley T, 2025, *CoastSnap: Working with the Hurunui District Council*. A report produced as part of the GEOG309 - Research for Resilient Communities and Environments course, University of Canterbury, 2025.

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1.0 Executive Summary

This report evaluates the effectiveness of the CoastSnap citizen science initiative for monitoring coastal change along the Hurunui District Coastline and provides insight on factors that are crucial for improving reliability of the project to increase both the frequency and accuracy of photo submissions. CoastSnap enables the public to photograph coastlines from fixed stations and submit them to aid in monitoring shoreline change over time. CoastSnap stands along the Hurunui District coastline have been analysed within this report including, Leithfield Beach, Amberley Beach, Motunau Beach and Gore Bay. Inconsistencies in image frequency, stand placement and unclear instructions limited data accuracy and scientific value across all sites.

Redesigned signage incorporating clearer, visually engaging instructions and a QR-code upload systems across new proposed sites at increased elevations have been developed to simplify participation and ensure essential metadata and visual aspects are included across all image submissions to align with international CoastSnap best practice methods. With implementation of these enhancements the Hurunui District Council's ability to monitor erosion, accretion and storm impacts while also fostering greater community involvement in coastal management. Overall, the CoastSnap project demonstrates that with the implementation of the outlines factors important for improving the frequency of photos submitted and thus the effectiveness of the project, CoastSnap can provide a low-cost tool for coastal monitoring and adaptive management across the Hurunui coastline.

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2.0 Introduction

Coastlines are highly dynamic systems (Antolínez et al., 2019). There is a diverse range of coastline types including sandy beaches and rocky cliff coasts (Stephenson, 2006). They are influenced by frequent events such as regular tidal and wave conditions, as well as less frequent, high intensity events like storms (Antolínez et al., 2019). These coastal Influences lead to coastal changes such as erosion and accretion. Currents and waves move sediment in the nearshore while higher intensity events like storms and cyclones can have greater impacts that last longer (Mentaschi et al., 2018).

Climate change effects further contribute to the changing nature of coastlines through processes such as sea level rise. This can lead to water extending further inland resulting in coastal erosion in areas where it previously did not occur (Griggs & Reguero, 2021). It also causes waves to be larger and stronger more often which leads to an increase in erosion caused by storm events (Griggs & Reguero, 2021; Wang et al., 2023) . As these impacts continue, more flooding and erosion may occur in areas that are used by people, where it previously did not occur (Griggs & Reguero, 2021). Since coastlines change and are impacted by climate change it is important that regular monitoring and analysis is done. It is also important that local communities are aware of their local coastline, how it is changing and the risks that it poses (Islam et al., 2021).

CoastSnap is a citizen science project that aims to monitor coastal change and increase community awareness of coastal monitoring. The project was first used in Sydney, Australia in 2017 and now is used globally with more than 20 countries having established CoastSnap Sites (Harley & Kinsela, 2022). Metal cradles that face a particular orientation along a coastline are put in place (Harley & Kinsela, 2022). Members of the public can place their mobile phones into these cradles and take photos of the coastline. They can then send these photos to the email address of the monitoring organisation or upload the photo to social media or the CoastSnap app. These photos can then be used to monitor and quantify coastal change which can lead to better informed decisions on coastal management (Harley & Kinsela, 2022).

CoastSnap sites have been established at four areas along the Hurunui Coastline (Leithfield Beach, Amberley Beach, Motunau and Gore Bay). This report focuses on these sites. The research question for this project is: In what ways can CoastSnap imagery demonstrate coastal change, and what factors are important for improving project reliability to increase the number and accuracy of photos submitted? This report outlines the methods used to answer this question, presents findings and discusses the limitations of CoastSnap as well as the potential next steps.

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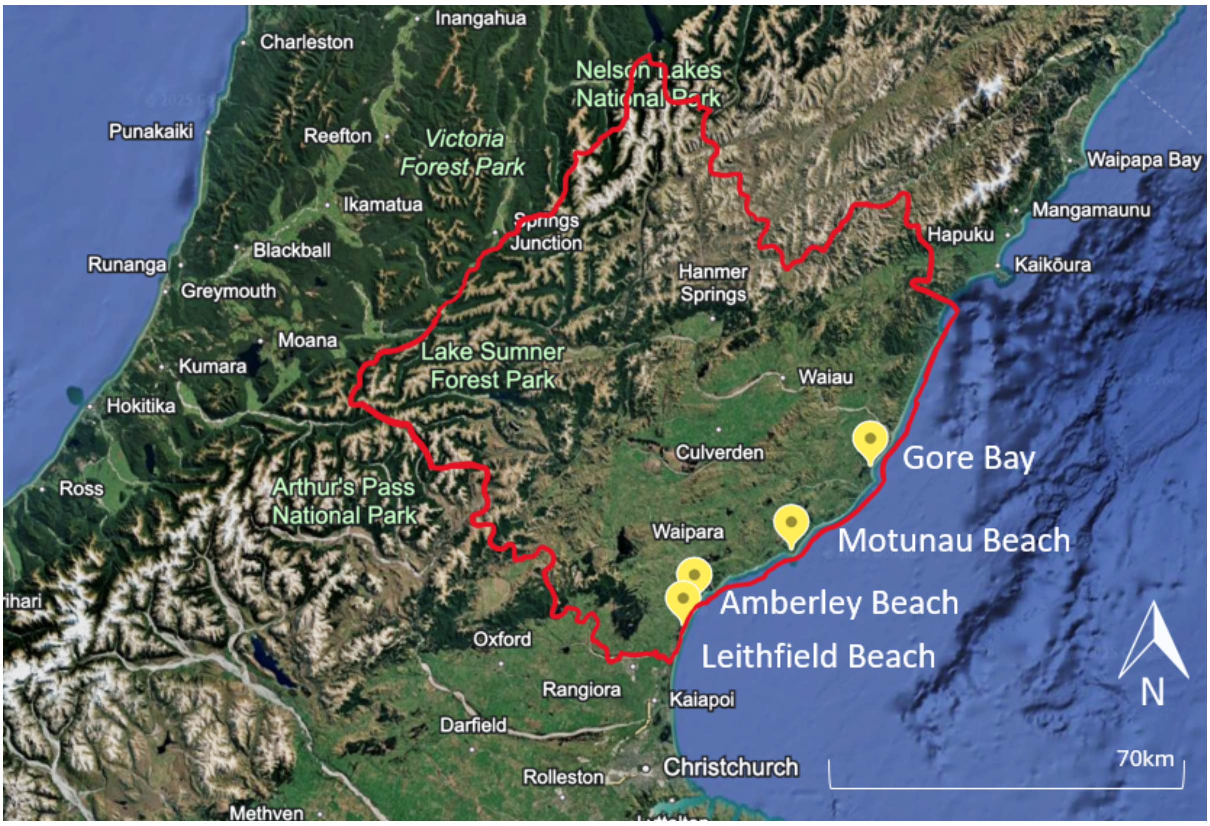

Figure 1: Google Earth image portraying current stand placements in Gore Bay, Motunau, Amberley, and Leithfield.

3.0 Literature Review

The design of the Hurunui CoastSnap project was developed further in the literature regarding sea-level rise, erosion, storm impacts, citizen science and photo analysis. The reviewed literature displays the conceptual and methodological factors that have assisted in the design of the project. Globally, dynamic coastlines are shaped by interacting drivers of storms, sea-level rise, and erosion. The Hurunui coastline consists of the sediment type of mixed sand and gravel (MSG), therefore highly dynamic shorelines are present. The project's research question is two parts, with technical aspects of coastal monitoring and citizen science methods. It directly supported the community partner's interest in increasing involvement and outputs of coastal monitoring.

3.1 Citizen Science and CoastSnap

CoastSnap is a citizen science initiative used to display and monitor coastal change through repeated photography at fixed points. The literature emphasises the importance of citizen science in geographic research and the main concept of the public understanding of science (Bonney et al., 2016). In particular, how it is necessary for understanding and managing global threats including sea level rise and climate change. The literature helped significantly with the early design of the research process, with the importance of community engagement for effective data and results displayed. The literature demonstrated that while the CoastSnap technology works, the effectiveness of the project is dependent on community engagement (Elrick-Barr et al., 2023). Therefore, the project used these findings as a foundation for addressing the challenge of participation by designing simpler, more accessible signs with new site locations.

3.2 Photo Analysis, Methodology, and Requirements

The reliability and accuracy of CoastSnap is dependent on the quantity, quality, and positioning of the photographs over time. International literature demonstrated that images taken by cell phones at fixed points can produce relatively accurate shoreline positioning with sufficient processing (Harley et al., 2019). Photo analysis discusses georectification as a key method as it involves aligning images by changing pixel coordinates in photos to real world coordinates using ground control points allowing for the accurate measurement of coastline change (Harley et al. 2022). Inaccurate angles, framing and insufficient photo submitted influences the ability to identify and quantify shoreline change. These factors assisted with the project's aim surrounding suitable camera angle and stand positioning, ensuring data collection aligns with the research question in relation to reliability and accuracy.

3.3 Drivers of Beach Change over Temporal Scales

Sea-level rise, storms and erosion are key drivers influencing coastline change globally and locally (Stephens, Bell, & Haigh, 2020). Rising sea levels amplify erosion with increase wave energy. Storm surges and extreme wave events intensify coastline changes. The impacts are intensified on MSG beaches (Morton et al. 1993), with their more dynamic nature with coarse and fine sediment. The Hurunui coastline's exposure to storm events was displayed through cliff and shoreline retreat at locations including Motunau Beach. This demonstrated what has been shown globally with storm caused high significant wave heights linked to erosion. Monitoring coastal change is essential for understanding these drivers and the need for more frequent images across tidal cycles to show the change accurately (Jackson, Cooper, & Rio, 2005). This helps with the project's design of using the CoastSnap imagery to display coastal change through these drivers of storms, erosion and sea-level rise.

4.0 Methodology

During this project several research directions were taken to address the different parts of the research question. The methods used to pursue these directions are explained below.

4.1 Tide Data

Tide data was accessed from the NIWA Tide Forcaster and collected for Leithfield Beach, Amberley Beach, Motunau Beach and Gore Bay. The data were extracted using the Export to CSV feature, exporting 31 days of data at a time, covering the period from the date and time of the first image to the last. The tidal height corresponding to the time each photo was taken was recorded to the nearest 30-minute interval across the four sites. An AI tool was then used to separate the photos into groups of 0.1m tidal height intervals, indicating how many images were captured at each tidal height. The frequency of photos within each tidal height interval for each site were then subsequently plotted using a histogram on Microsoft Excel.

4.2 Short-Term Erosion (Storms)

Analysing erosion through the images provided was done through observing an extreme weather event. Through Identifying, the event at Motunau *(Figure 2 and 3),* we were able to compare the identified storm to wave, swell, and weather station data, observing the severity of the storm system. Weather system data was obtained from Rangiora EWS (early warning system), Christchurch backup AERO AWS (automatic weather station), and Amberly reserve road (National Institute of Water and Atmospheric Research [NIWA], n.d.). Significant wave height data was obtained through the Pacific Islands Ocean Observing System ([PacIOOS], n.d). The data obtained was then plotted and displayed in tables on excel, displaying the intensity of the storm event and its erosional capabilities along Motunau.

4.3 CoastSnap Stand Positions

An aim of this project was to work out how the CoastSnap sites on the Hurunui coast could be improved so that deeper analysis of coastal change could be completed. To do this, drawbacks of the positions of the current CoastSnap sites and framing of the current images were identified. This was done by identifying whether the ideal CoastSnap site characteristics, which were explained by Mitchell Harley in a CoastSnap YouTube video, were present at the Hurunui Sites (Harley, 2020). The Hurunui Sites were also compared to a site in Manly, Australia which contains all the ideal CoastSnap site characteristics and has been successfully analysed (*Figure 9).*

4.4 Signage

Signs at the Hurunui CoastSnap Sites were identified to have some flaws. Through research and design recommendations of ways to improve signage at CoastSnap sites were identified. Canva was used to create conceptual designs of signage with improved features that could be implemented at the Hurunui CoastSnap sites. An online QR code generator was used to create QR codes to demonstrate a potential method for improving CoastSnap photo collection, allowing users to send the photos directly to the Hurunui District Council via a QR code.

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5.0 Results

5.1 Image Frequency

The frequency of CoastSnap photos captured in relation to the tidal phase is clustered around different tidal heights *(Figure 1).* Many images are captured at approximately mid-tide, failing to capture the beaches at tidal extremes. Amberley Beach exhibited a moderate frequency of photos submitted, with three distinct peaks in photo frequency corresponding to tidal heights of around -0.6m to -0.79m, -0.1 to 0m, and 0.3m to 0.49m, indicating a limited tidal range was captured. In contrast, both Motunau Beach and Gore Bay have a very low frequency of images, as indicated by the significant gaps on both plots. This restricts the analysis of long-term shoreline change, but may indicate short-term synoptic events, depending on the timing of the images captured.

Figure 2: Histograms representing the times images are taken in relation to the tidal height at the four different beaches, Leithfield, Amberley, Motunau and Gore Bay. Each beach has different tidal heights that are mainly captured, often missing the highest highs and lowest lows. Data sourced from (National Institute of Water and Atmospheric Research [NIWA], n.d.).

Figure 3: Cliff toe at Motunau Beach before erosion, photographed on 18/03/2023.

Figure 4: *Progression of cliff toe erosion at Motunau Beach on 21/05/2023, showing the initial formation of an overhang at the cliff base.*

Figure 5: Collapse of the cliff toe at Motunau Beach on 28/08/2023. The photos reveal debris scattered across the beach and in contact with the ocean.

5.2 Storm Events

The erosional event at Motunau Beach can be linked to storm characteristics and significant wave height (Hs) variations. *Figure 6* illustrates the Hs data collected over the three years CoastSnap has been installed (2022-2025), showing an average Hs of approximately 1 meter. There are scattered peaks and troughs throughout the graph, indicating when high wave energy events (e.g., storms) or usual extreme calm events occurred. Three significant outliers are over 4 m, and six are below 0.5 m (Figure 6). Table 1 compares the peak wave heights during two storms in 2023: the March storm, with a peak of 3.18 meters, and the July storm, which peaked at 2.79 meters. The March storm builds up to one peak, which was experienced on day 2 of the storm. This peak subsides quickly as the storm lessens. The July storm has a sustained peak over the three days. The peak on the first day of the storm reaches almost 3 m, which then subsides to under 2.5 m for 10 hours before increasing again. The second peak remains with slight fluctuations for nearly 20 hours before gradually decreasing back to the 1 m average for Motunau Beach. Additionally, the average Hs during these storms was higher than the typical conditions, reaching 2.07 meters in March and 2.29 meters in July, as shown in Table 2. The weather data, presented in Table 3, further underscores the intensity of these storms. The March storm had higher peak wind speeds (9.58 m/s) and gusts (21.11 m/s), accompanied by 7.8 mm of rain. The July storm exhibited lower winds (6.67 m/s) and gusts (17.5 m/s), but significantly heavier rainfall (69.5 mm) (Table 3). These findings highlight the increased storm activity and its potential impacts on coastal erosion and the overall dynamics at Motunau Beach.

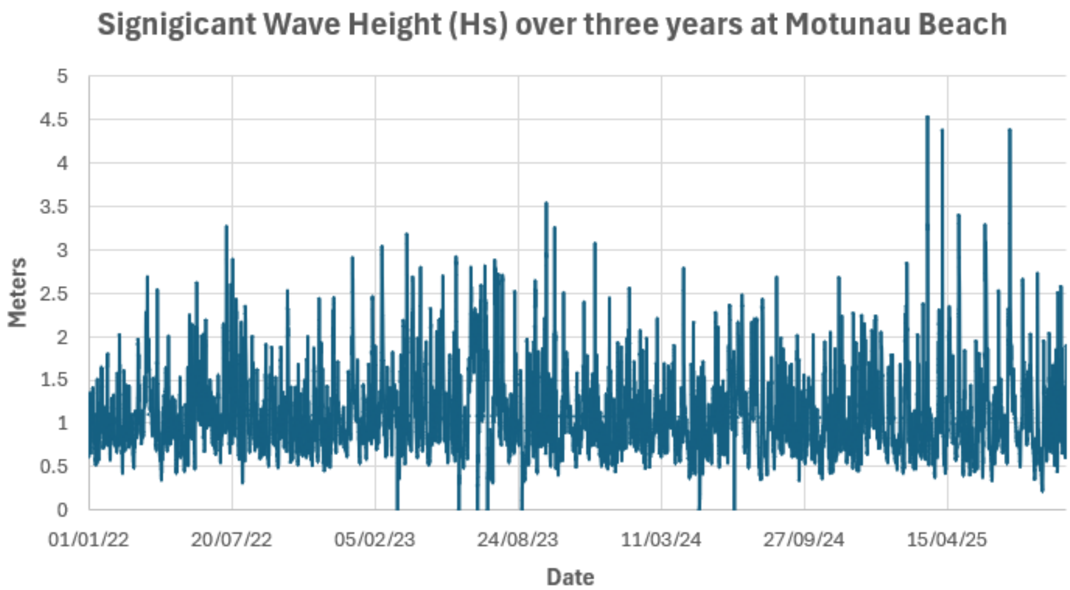

Figure 6: Hs at Motunau Beach over the three years CoastSnap has been installed (2022-2025). This graph indicates an average significant wave height of approximately 1 m. Data sourced from (Pacific Islands Ocean Observing System [PacIOOS], n.d.).

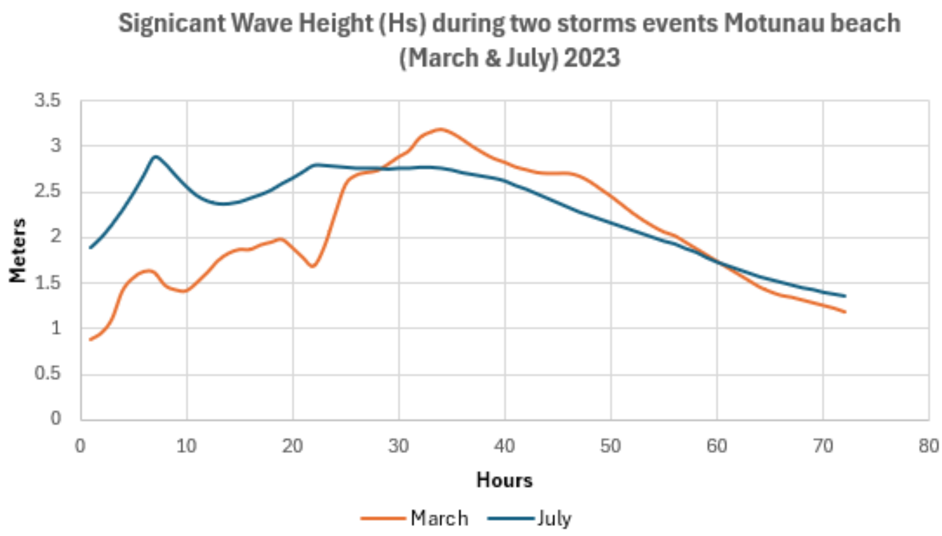

Figure 7*: Comparison of the two-storm events, March and July, at Motunau Beach over three days. Data sourced from (Pacific Islands Ocean Observing System [PacIOOS], n.d.).*

Table 1: Peak significant wave height in Motunau Beach in the storm events in March and July 2023. The peak significant wave height in the March storm was 3.18 m compared to the July storm, which peaked at 2.79 m. Data sourced from (Pacific Islands Ocean Observing System [PacIOOS], n.d.).

	Peak significant wave height (Hs)
Motunau Storm - March 2023	3.18 m
Motunau Storm - July 2023	2.79 m

Table 2: Average significant wave height over the three years CoastSnap has been installed. As well as the average significant wave height for the March and July storms in 2023 (to demonstrate the elevated conditions experienced in the storms). Data sourced from (Pacific Islands Ocean Observing System [PacIOOS], n.d.).

	Average significant wave height (Hs)
Years 2022-2025	1.08 m
March Storm - 2023	2.07 m
July Storm - 2023	2.29 m

Table 3: Weather conditions recorded during the March and July 2023 storm event across three stations: Rangiora EWS, Christchurch Aero Backup AWS, and Amberley Reserve Road. Data includes wind speed, gusts, and rainfall, illustrating elevated storm activity. Data sourced from (National Institute of Water and Atmospheric Research [NIWA], n.d.).

		21/03/2023	**22/07/2023**
Rangiora EWS	Wind Speed	9.58 m/s	6.67 m/s
Rangiora EWS	Gusts	21.11 m/s	17.50 m/s
Christchurch Aero Backup AWS	Wind Speed	9.50 m/s	7.36 m/s
Amberley, Reserve Road	Rain	7.80 mm	69.50 mm

5.3 Stand Placements and Unusable CoastSnap Submissions

Figure 8 presents an example from Leithfield Beach, where the CoastSnap image is unusable due to distorted edges, compromising the data quality. In contrast, *Figure 9* displays an ideal stand position at Manly Beach, Australia. This stand has five fixed structures (corners of solar panels, the edge of a building, and stairs), which serve as reliable ground control points for accurate image alignment (*Figure 9).* Additionally, the elevated positioning of the stand enhances the ability to monitor coastline changes by capturing a balanced view of both the beach and ocean. *Figure 10*, also from Leithfield Beach, highlights another problematic stand placement, where the absence of fixed structures for ground control points limits the image's usefulness for analysis and interpretation. The vegetation present in the image cannot serve as a reliable reference due to its dynamic nature (marked in dashed red lines in *Figure 10).*

Figure 8: *An example of an unusable image taken at Leithfield Beach using the CoastSnap stand. The edges of the image are distorted, compromising data quality.*

Figure 9: This image is an example of a good CoastSnap stands position. This stand is located at Manly Beach in Australia. Five fixed structures (marked in red circles) that won't change over time can be used for ground control points (used for image alignment). Adapted from the example CoastSnap image from the CoastSnap Starter Toolkit (Harley, n.d.).

Figure 10: This image was taken at the CoastSnap stand at Leithfield Beach. This image is missing key characteristics to align with the current CoastSnap analysis. There are no fixed structures in this image to use as ground control points, limiting its usefulness for analysis. The dashed red lines indicate the areas of vegetation; however, they cannot be used as ground control points, as vegetation grows and changes over time.

5.4 New Signage

The current signage at Leithfield Beach is visibly damaged by sun exposure, causing fading and making it difficult to read (*Figure 11*). The instructions are lengthy, and the phone placement area lacks clear orientation guidance. In contrast, *Figure 12* presents two new sign designs with more explicit instructions, images for phone orientation, and an educational component about the dune life cycle and coastal erosion. The new signs also include a QR code, allowing users to receive an automated email with instructions on how to upload their images, which will be sent directly to the Hurunui District Council. This creates clarity on where and at what times images are taken, furthermore simplifying the process of sorting images.

Figure 11: This image was taken at Leithfield Beach. It shows the current CoastSnap stand. The sign has been visibly damaged by likely sun exposure, which has caused the sign to fade in colour. The sign is difficult to read and contains lengthy instructions. The phone placement area is unclear.

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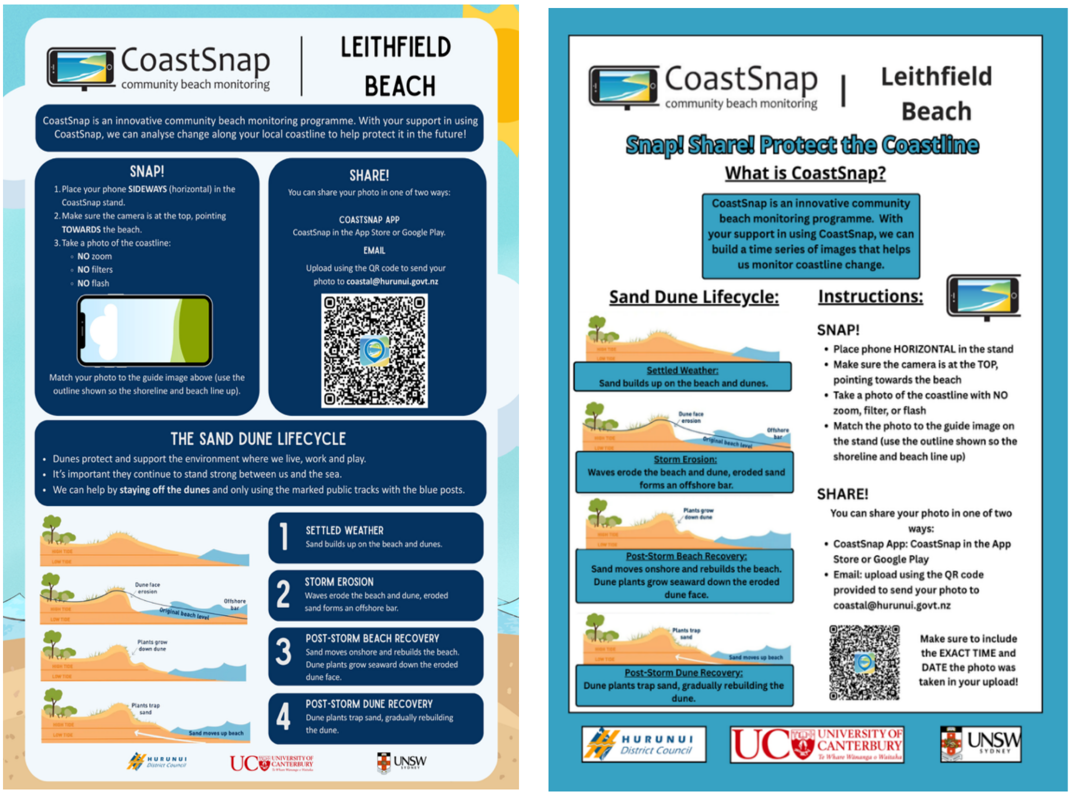

Figure 12: Two new suggested sign designs. They both have more straightforward instructions to increase usability. They have clear images to demonstrate the orientation the user's phone must be in. Each CoastSnap stand will have its own individual QR code linked directly to the Hurunui District Council.

6.0 Discussion

6.1 CoastSnap Imagery to show Coastal Change

6.1.1 Tide Data in Relation to Photo Frequency

Leithfield Beach recorded the highest frequency of CoastSnap photo submissions with 62 photos. Although this site had a greater number of images, both high and low tidal extremes remained underrepresented (*Figure 2)*, and no significant erosional event was captured. Despite having only 29 photo submissions, Motunau Beach successfully captured an erosional event associated with a storm, likely due to the timing of when the photographs were taken. Ensuring scientific rigor and consistency overtime is crucial to ensuring the utility of the data collected so that events such as this can be captured (Soriano-González, Sánchez-García, & González-Villanueva, 2024).

Currently this rigor has failed to be achieved through the implementation of CoastSnap along the Hurunui District coastline, creating a limited scope for analysis. Gaps in data collected make it difficult to draw conclusions. It is important to evaluate the system across all conditions when analysing beach dynamics as variations in tidal cycles can be responsible for changes in morphological aspects between beaches (Jackson, Cooper, & Rio, 2005). An increase in temporal frequency of photo submissions across all sites would enhance the likelihood of capturing additional erosional events, which is a key factor for improving project reliability (Conery, et al., 2023).

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6.1.2 CoastSnaps Ability to Analyse Short-term Erosion Events (Storms)

As CoastSnap is a new initiative, the opportunity to observe long-term change along the Hurunui coast is limited; however, with high volumes of photos, short-term change can be easily identified and addressed. Short-term changes can be caused by extreme weather events, resulting in direct erosion of affected coastal zones. *Figures 3, 4 and 5* present results on CoastSnaps ability to analyse the effects of extreme weather and wave events by demonstrating a cliff toe collapse at Motunau Beach over six months. As the photos are dated, we were then able to link weather and wave data to provide insight into why this erosional event occurred. Over the six months, two storms stood out. *Table 3* shows that on 21 March 2023 and 22 July 2023, two significant storms hit the Hurunui coastlines. The three weather stations used, Rangiora EWS, Christchurch Aero Backup AWS, and Amberley Reserve Road, all displayed high wind speeds, strong gusts, and rainfall for both events.

To understand how these storms influenced wave activity at Motunau Beach, the significant wave height was acquired. The significant wave height (Hs) is the mean of the highest one-third of waves passing through a point during a given period (Hashim, et al., 2016). The square of wave height is equivalent to wave energy; therefore, the Hs can be used to measure the energy arriving at the coastlines. High Hs can increase vulnerability to erosional processes. The average *Hs* for Motunau Beach is roughly 1 m (*Table 2*). However, during the March and July storms, the average increased to over 2 metres—roughly double the usual average. At their peaks, the significant wave heights were greater than 3 metres in March and two and a half metres in July (*Table 2). Figure 7* illustrates that the March storm had a short peak, which occurred within a 10-hour window, whereas the July storm had elevated Hs for over two of the three recorded days. These extreme conditions highlight just how much more energy was hitting the coast compared to normal.

When examining the wider Christchurch region, it is evident that large swells coincide with stormy conditions. By linking the wave data to the weather data, we observed that strong gusts and heavy rainfall were present on the days of high swells. These storm events contributed to the destabilisation of the cliff and its eventual collapse over the six months. Due to the lack of images, we can't pinpoint the exact event that caused the collapse; however, it allows us to see how a significant event may have contributed to it.

6.2 Future Implementations to Increase Project Reliability

6.2.1 Improving Instruction Clarity

Gaps in the data can be attributed to discrepancies in the information provided to participants. Along the Hurunui Coastline, several barriers to effective participation in the CoastSnap project were observed. The existing instructions on signage were lengthy and text heavy, discouraging participants from reading or engaging with the material. In addition to this, several signs were reported to be worn, damaged, removed or completely inaccessible,

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further reducing their effectiveness. These challenges collectively limited both the frequency and quality of the images submitted, constraining the data on a temporal scale.

To enhance participant engagement and data reliability, the instructions were rewritten and condensed to provide clarity. Emphasis on the public understanding of instructions and the communication of scientific initiatives is crucial (Bonney, Phillips, Ballard, & Enck, 2016). Specific issues identified from previous photo submissions such as orientation; use of zoom and cropping have been explicitly addressed to ensure that images are captured in a consistent format for analysis. To draw attention to these critical components, emphasis was placed on direct key words such as *NO, SIDEWAYS* and *TOWARDS*, which were formatted in bold and capitalised reflecting best practices for visual communication (Bubela, et al., 2009).

Contextual information relevant to the local environment was included to enhance participants' sense of purpose and connection to the project. '*The Sand Dune Lifecycle'* was included to demonstrate how frequent monitoring through CoastSnap can be used to show change and connecting participation to scientific outcomes, which has been shown to increase motivation and data quality in citizen science initiatives (Jennett, et al., 2016). A concise overview of the CoastSnap initiative was also included to provide a broader understanding of the project's objectives.

Addressing the clarity and accessibility of instructions was therefore a key factor in improving project reliability to increase the number and accuracy of photos submitted. In citizen science initiatives, it is essential that methods for participation are communicated clearly and easily understood by individuals from a diverse range of backgrounds (Riesch & Potter, 2014). Clear and concise instructions not only reduce any confusion by also improve data quality and participant retention. Simplifying the task to make it more engaging and ensuring that participants recognise that their contribution is meaningful and of scientific value is essential (Turcati, et al., 2025).

6.2.2 Visual and Aesthetic Changes

Figure 11 illustrates the current, faded CoastSnap signage, while *Figure 12* presents the proposed redesigned version. Bright colours are strategically used to attract viewer attention and evoke a sense of engagement or fun, which is crucial for factors including increasing public participation (Awad, et al., 2025). High contrast colour schemes such as dark text on a light background or vice versa has been used to enhance legibility and improve comprehension, particularly in outdoor environments where lighting conditions can vary (Hall & Hanna, 2004). This aesthetic approach not only supports effective communication but also enhances long-term durability of the signage despite UV-induced fading from sunlight. In contrast, the current CoastSnap signs have proven to be ineffective and unreadable after only three years of exposure to the environment, as shown in *Figure 11.* The proposed redesign prioritises

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colour contrast, resilience and communication principles to ensure engagement is sustained within the CoastSnap initiative.

The existing CoastSnap stands instruct users to upload imaged to social media using a hashtag or email them directly to the Hurunui District Council. However, these submission methods present barriers to participation and data quality. Many users, particularly younger participants are reluctant to share CoastSnap photos to their personal feeds due to concerns around self-presentation and aesthetics, while emails images are often perceived as inconvenient or time consuming (Abernethy, et al., 2025). Furthermore, submitting images through social media removes crucial metadata such as time and date which is needed for analysis.

To resolve this limitation, a site specific QR code photo upload method as shown in *Figure 12* was developed to increase the useability of the stands. When scanned, the QR code automatically generates an email to the Hurunui District Council with a pre-filled template prompting the user to input the date and time the image was taken. The user then simply attaches the image and sends the email. This creates a streamlined process and reduces the effort needed from participants to upload their images. By guiding users this way it ensures that factors critical for project reliability and scientific value such as essential metadata required for analysis is consistently included (Freitag, Meyer, & Whiteman, 2016).

6.2.3 Improving Stand Placement for Image Analysis

Coastal erosion and deposition are phenomena that occur that usually are viewed through one dimensional data (Morton, et al., 1993). CoastSnaps goal involves using two-dimensional beach monetization data to allow for maximum low-cost monetization of beach profiles (shorelines, cliffs, MSG beaches). The overall composition of the CoastSnap stands determine how useful the images, will be for coastal change analysis (Harley, et al., 2022). To ensure useful analysis is presented at each stand, CoastSnaps leading professor Mitchel Harley, advises towards including certain requirements so change at the beach can be shown clearly and presented without issue.

These requirements advise the placement of the stands to look along the coastline, portraying the shoreline or coast of interest in the centre of the image, ensure the stand is elevated to portray the entire width of the beach, and include stable points to allow ground control points (GCPS) to be taken (Harley, 2020). *Figure 9* is an example of a CoastSnap stands image from Manly Australia. The Image portrays, all requirements, as well as multiple GCPs. Through meeting these requirements, scientists/researchers can create a quantitative data record of two-dimensional shoreline positions or other relevant features (Harley et al. 2022). When analysing Manly's example compared to the stands/locations along Hurunui, we observed multiple differences causing limitations within the images presented. These are seen in *Figure*

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10. The shoreline is not centred, the stands are not elevated, and solid objects are not visible nor available for further analysis within the figure. Leithfield, Amberley and Motunau all shared this lack of requirements, causing difficulty when analysing how each coastline has changed over the three-year implementation period.

For future implementation, research and increased reliable image analysis through CoastSnap, we advise towards, investigating Mitchel Harleys work and adapting the stands and locations to ensure high quality images can be analysed. We have also gathered GPS locations of proposed areas and analysed GCPS as seen in *Table 4.* The prosed GPS locations promote identified stable points along Leithfield and proposed stand locations in Amberly and Motunau for a better view to identify shoreline positioning. However, besides Motunau, we were unable to find elevated positions for the stands. Due to this being an important requirement, we propose that a small stand platform will provide enough elevation at both Amberley and Leithfield beach for accurate image analysis. Although this does increase the cost and maintenance at both sites. If implemented we believe future analysis of the Hurunui coastal beaches will become simpler, and more reliable.

6.2.4 Implications for the Hurunui District and New Zealand

The findings of this research highlight several key considerations for improving CoastSnap in the Hurunui District's to demonstrate coastal change in an effective way and to improve the long-term reliability of the project. The above improvements will allow for more consistent temporal coverage of the Hurunui Coastline and better identification of both short-term and long-term erosional events. It will provide a more dynamic understanding of how Hurunui's dynamic coastlines respond to natural events and anthropogenically induced climate change. The development of this project aligns with the Hurunui District Councils '*Coastal Conversations'* initiative, aiming to identify current coastal hazards and how these will change over the next 100-years (Hurunui District Council, 2020). Implementing these small changes now, will aid in completion of further phases through providing adequate monitoring through into the future.

7.0 Conclusion

This project aimed to answer the research question: In what ways can CoastSnap imagery demonstrate coastal change, and what factors are important for improving project reliability to increase the number and accuracy of photos submitted?

This report shows that CoastSnap imagery can be used to show the response of coastlines to storm events as demonstrated by the photos capturing the cliff toe erosion at Motunau. CoastSnap photos also have the potential to be used to analyse long-term shoreline change along the Hurunui coast, however some features of the Hurunui CoastSnap sites currently

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limit the analysis that can be done. These limitations include the position of the CoastSnap stands, the absence of ground control points and the low photo submission rate at some sites.

To improve the ability of the CoastSnap project to analyse shoreline change along the Hurunui coastline, there are some improvements that need to be implemented. These include improving CoastSnap stand positions, implementing fixed control points and increasing the number of photo submissions. By researching and suggesting improvements to the signage visibility and instructions for the Hurunui CoastSnap sites, this project has provided recommendations that are likely to increase the number of photo submissions if implemented. Once these limitations are addressed, deeper, quantitative analysis of coastal change along the Hurunui coastline can be carried out.

8.0 Acknowledgements

We would like to extend gratitude to Simon Kingham and Dr. Sophie Horton for their guidance throughout the GEOG309 course. In particular to Dr. Sophie Horton as our project supervisor, for her mentorship, invaluable support and feedback during the development of this project. We are also grateful to have worked with Haojin Tan and the Hurunui District Council. Their collaboration, provision of data, resources and local insight has been key in making this research successful.

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10.0 Appendix

Table 4: Shows GPS points taken along the Hurunui coast. The table consists of proposed stand locations in Motunau and Amberly and identified ground control points (GCP) along Leithfield beach.

Point ID	Latitude	Longitude
Motunau Proposed Location	-43.0483004	173.0711081
Amberly Proposed Location	-43.1747684	172.7792741
Leithfield GCP1	-43.208684	172.7577063
Leithfield GCP2	-43.2089954	172.7574676
Leithfield GCP3	-43.21171	172.7563679

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