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Review

Understanding Preferences for Coastal Climate Change Adaptation: A Systematic Literature Review

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Abstract: Lack of public support for coastal adaptation can present significant barriers for implementation. In response, policy makers and academics are seeking strategies to build public support for coastal adaptation, which requires a deeper understanding of peoples' preferences for coastal adaptation and what motives those preferences. Here, we conduct a systematic literature review to understand preferences for coastal adaptation options and the factors influencing these preferences. Ninety peer-reviewed publications meet the inclusion criteria. The findings revealed that hard protection options were often the most frequently preferred, likely due to a desire to maintain current shoreline, for the protection of recreational spaces and private property, and a perceived effectiveness of hard protection options. Soft protection, including nature-based approaches, accommodation, and no action were the next most preferred options. Finally, retreat options were the least preferred, often due to strong place attachment. We identify twenty-eight factors that could influence preferences, with risk perception, place attachment, and financial considerations occurring most frequently in the literature. In the conclusion, we outline the most significant research gaps identified from our analysis and discuss the implication for adaptation research and practice.

Keywords: climate change; coastal systems; coastal management; adaptation; systematic review; public perception; public opinion; preference; protect; accommodate; retreat

Citation: Mallette, A.; Smith, T.F.; Elrick-Barr, C.; Blythe, J.; Plummer, R. Understanding Preferences for Coastal Climate Change Adaptation: A Systematic Literature Review. *Sustainability* **2021**, *13*, 8594. https://doi.org/10.3390/su13158594

Academic Editor: Just Tomàs Bayle-Sempere

Received: 8 July 2021
Accepted: 27 July 2021
Published: 1 August 2021

1. Introduction

Coastal systems are on the frontline of climate change. They are particularly sensitive to sea level rise, ocean acidification, and rising ocean temperature and will increasingly experience adverse impacts such as coastal flooding and inundation, changes in storm frequency and intensity, and coastal erosion [1]. Coastal adaptation is necessary to minimise the adverse impacts of climate change [2].

Yet in many cases, adaptation stalls in the planning phase [3–5]. Lack of public support is one of the most significant barriers to transforming adaptation planning into action [3,6–11]. Coastal adaptation actions tend to be unpopular and controversial due to vested interests, conflicting priorities, and climate change denial [4,11–13]. In response, policy makers and scholars are seeking strategies to build public support for coastal adaptation [9,14–16]. Building public support for climate action first requires a fundamental understanding of peoples' preference for coastal adaptation actions and what motivates preferences [17]. This knowledge is also essential for designing inclusive, legitimate, and equitable adaptation strategies that fit the local context and reflect lived values and experiences [14,18,19].

In this article, we explore these issues in a global coastal context by systematically reviewing the empirical literature. The review set out to describe: (1) which coastal adaptation options the general public prefer and (2) what factors influence their preferences.

1.1. Coastal Climate Change Adaptation

The scholarly literature on coastal adaptation to climate change has grown dramatically over the past 30 years [1,3,20,21]. In 1990, the IPCC Coastal Zone Management Subgroup Report described three main types of adaptation response to coastal climate change: retreat, accommodate, and protect (which can be further categorised into soft and hard protection) [22,23]. Since, these categorisations have been widely applied in scholarship and practice when discussing coastal adaptation options [1]. More recently, additional categories, terminologies, and distinctions have been made such as "avoid" or "no action" and "advance" [24,25]. While there are several different ways to categorise adaptation [21], for the purposes of this review, adaptation responses were categorised by hard protection, soft protection, accommodate, retreat, and no action.

"Protect" adaptation responses, sometimes referred to as "defend", can be defined as responses that defend land and reduce coastal risk and impacts by decreasing the probability of occurrence, often by manipulating the environment through sociotechnical management, so that existing use of at-risk land can continue [22,25–27]. "Hard protection" options refer to physical/built infrastructure, and includes sea walls, dikes, breakwaters, groynes, revetments, etc. "Soft protection" responses provide natural barriers or nature-based solutions [1,28–30], and include sediment-based options (e.g., beach nourishment and dune creation), as well as ecological solutions (e.g., wetland restoration, mangrove restoration). Accommodation responses are actions that lessen climate risks and impacts through socioeconomic and/or sociotechnical measures to enable continued use of the land. For example, rather than attempting to prevent flooding, society's ability to cope with the effects are increased through adjusting social components such as human activities, the built environment, and living habits [22,25,27,31,32]. Accommodation responses may include social mechanisms (e.g., insurance schemes, early warning systems, financial incentives), physical accommodation (e.g., elevating bridges, building emergency shelters), and regulatory approaches (e.g., building codes, land use regulations). Retreat responses can be defined as those that reduce exposure to the impacts through the withdrawal from at-risk areas [22,25–27,33]. Retreat options may include the relocation of people and of infrastructure, removal of coastal buildings, prevention of new coastal development, and the physical realignment of hard defences. Finally, the title "no action" was used to refer to cases in which there is no active adaptation intervention, and/or cases that take a "wait and see" approach [34].

The economic, ecological, technological, and financial advantages and disadvantages of coastal adaptation options have been discussed elsewhere [1,22,35]. In addition to these considerations, appropriate adaptation options will depend on several factors including the impacts experienced, geophysical context, governance and planning processes, and capacity [1,21,36]. It is understood that these biophysical, technological, and financial limits are core considerations for the appraisal of adaptation options in the adaptation planning process [18].

However, the social context and public buy-in for options will also likely influence what are perceived as appropriate adaptation options [18,37]. Indeed, for decades, public consultation and engagement have been recognised as an essential and valuable element in the adaptation planning process [19,38–40]. In climate scholarship, there is a growing body of literature on the barriers and particularly the social factors that hinder abilities to adapt [16].

1.2. State of the Research on Societal Preferences for Coastal Adaptation

Preferences for adaptation are diverse. They vary between individuals, groups, and regions; likely due to the range of exposure to impacts as well as unique social-economic contexts [9,41–43]. To understand the diversity of factors influencing preferences for coastal adaptation, we look to related bodies of research for insights. These related bodies of research include preferences for mitigation policies [44,45], adaptation in non-coastal settings [37,46–50], or perceptions and preferences as they relate to household adaptive

action [41,51–55]. According to this research, several factors have been associated with preferences, support, and adaptive behaviours. For example, in the mitigation domain, high trust in institutions as well as strong climate change beliefs have been associated with higher positive opinions for climate mitigation policies [45]. In non-coastal adaptation settings, Singh et al. (2017) [37] found that those with lower risk perception of the impacts were less likely to support adaptation policies. A review conducted by Taylor et al. (2014) [41] on support for mostly household adaptation in the UK highlights inconclusive results for the influence of some constructs, such as climate change beliefs, prior experience, and risk perception. In Moser's (2014) [9] review of adaptation communication, she briefly touches on preferences of adaptation across stakeholders and across adaptation contexts, and includes some insights on some of the factors that might be at play in forming opinions or support for adaptation. Broadly, these include familiarity, necessity, engagement, and threat appraisal.

While these related bodies of research are indeed informative for coastal adaptation contexts, coastal systems are unique and complex [56], and therefore, public preferences when it comes to coastal adaptation require specific attention. It is unclear whether the factors at play in shaping coastal adaptation preferences differ from adaptation preferences in non-coastal settings. Furthermore, interpreting the collection of relatively limited evidence on societal preferences for coastal adaptation is difficult due the wide diversity of factors studied and inconsistencies in the findings. Practitioners and researchers require a thorough understanding of the nuances of coastal adaptation preferences, and yet, no review exists to date that focuses solely on coastal contexts. This demonstrates a clear need to collect and synthesise cases of empirical research to provide a more complete and digestible understanding of coastal adaptation preferences and identify any emerging trends and gaps in the literature.

2. Materials and Methods

In recent years, systematic literature reviews have been a common method in social science fields, including climate change domains [20,57,58]. They provide a summary on the current state of knowledge in a transparent manner that attempts to reduce bias from the article selection process [59]. Systematic reviews have an important role in climate change adaptation research because adaptation tends to be "conceptually murkier" than mitigation [57]. Furthermore, they provide useful syntheses of knowledge to inform adaptation planning [57].

Systematic reviews consist of a standardised search of literature, using specific eligibility criteria [57]. Methods and inclusion criteria were specified in advance (Appendix A) [60]. The focus of this review was peer-reviewed literature. Other sources, such as technical reports or "grey" literature, were not a focus, but it is recognised that these sources may provide further insights [16,61]. To identify relevant articles, a search was conducted using SCOPUS database and Web of Science (WoS)—two of the largest and most comprehensive databases for social and environmental sciences [16,20]. A scoping study was conducted whereby a full set of relevant search terms were tested and screened for usefulness, relevance, and redundancy. The final search string used in the literature search was as follows: "Climate change" AND adapt* AND (perception* OR prefer* OR attitude* OR opinion*) AND (coast* OR flood* OR "Storm surge" OR inundation OR "sea level rise" OR erosion).

The search terms were applied to the title, abstract, and keywords. The search was conducted on 23 July 2020 and returned a total of 2224 documents (958 from SCOPUS and 1266 from WoS) (Figure 1). Resulting articles were refined by applying database filters for language, publication date, and type of publication: only English, peer-reviewed articles were included [60]. The search was not limited geographically, but limiting articles to English may result in an underrepresentation in the results geographically. The date delimitations were set from 2007 to 2020. The year 2007 was selected to capture the literature emerging after the IPCC's Fourth Assessment Report (AR4), as the framing of

adaptation, the attention adaptation received, and calls for adaptation research shifted after the release of the AR4 in 2007 [62,63].

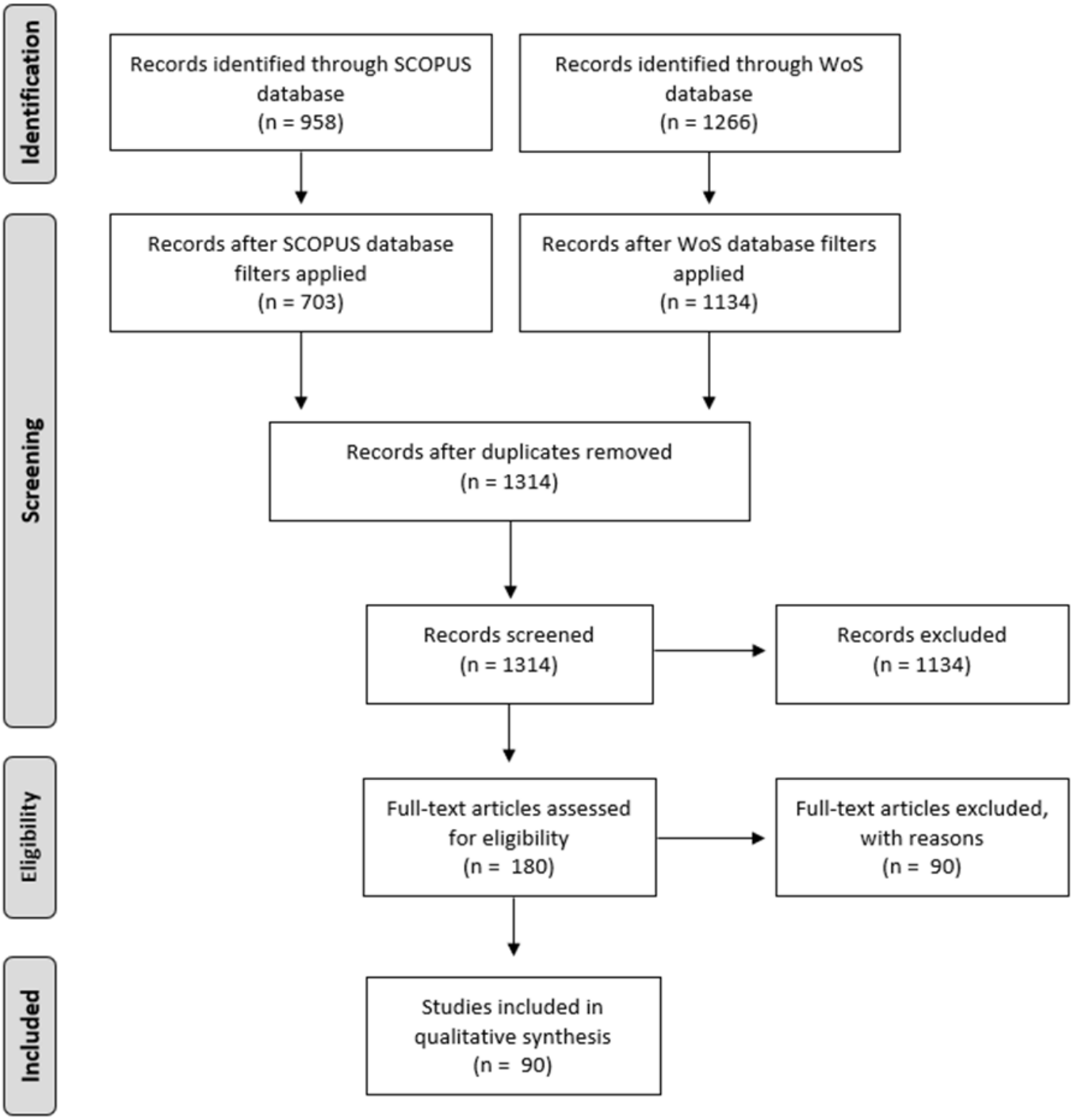

Figure 1. Article identification and screening.

Abstracts of remaining articles were then screened in a standardised manner using the inclusion and exclusion criteria (Figure 1) (see Appendix A). Most articles eliminated at this stage were those with a biological adaptation focus or non-coastal settings (e.g., agriculture) [64,65]. Finally, a full-text scan of articles was conducted, applying the exclusion and inclusion criteria and screening for relevance. Primarily, papers retained needed to empirically document societal perceptions, preferences, or attitudes for coastal adaptation and/or document factors that influence these preferences, referred to henceforth as "influ-

encing factors" (see Appendix A). To enhance objectivity, two reviewers reached consensus for ambiguous articles. One paper appearing to meet inclusion criteria was eliminated as it did not differentiate preferences between types of stakeholders and had only a single public participant [66]. Both quantitative and qualitative data were included. While it is common for systematic reviews to include only quantitative data [67], papers based on qualitative data were retained due to the nature of this review topic — social preferences and opinions. Therefore, mixed method analysis was used.

The final number of papers in the dataset was 90 (Figure 1). A questionnaire was applied to record specific characteristics of the research. This included: authors, year of publication, and journal of publication. The dataset was also further disaggregated by case study, of which there were 121. For each case, the geographic location, the number of participants, and other relevant study information were recorded.

The questionnaire also recorded the types of adaptation studied, findings on public preference, and details on the influencing factors studied for each empirical case study. First, using a binary questionnaire item, case studies were recorded as either 0 ("no") or 1 ("yes") on whether the overarching adaptation categories (i.e., hard protection, soft protection, accommodation, retreat, or no action) were studied. Second, to document the frequency of the more specific types of adaptation studied, adaptation terminology used by authors was recorded verbatim and was subsequently labelled into more specific types of adaptation (see Appendix B for full list and definitions). Note that while the overall categories (hard protection, soft protection, accommodation, retreat, and no action) were coded using a binary approach, the coding of more specific types of adaptation may include multiple types of each category. For example, one case study may compare 2 soft protection types and 2 accommodation types. Two reviewers applied the questionnaire for data validation.

Answering the first research question—which adaptation options are preferred—was challenging due to the available data. As is common in systematic reviews in the social sciences, papers span multiple methodologies and data types (e.g., qualitative, quantitative), and as a result, certain types of data cannot be normalised for the purposes of analyses [67]. For example, some case studies reported an overall preference or quantitative data, while some reported split sentiments or provided more qualitative descriptions. To account for this "messiness", two types of data are summarised in this review. First, for each case in which an overall preference was reported, the preference was recorded verbatim in the database and subsequently labelled by adaptation type. Second, in case studies with more qualitative data, each piece of text relating to opinions of adaptation responses was coded for sentiment. Overall sentiment was coded as either positive, negative, or mixed. As above, not all data types were appropriate for these analyses and therefore, not all case studies could be included.

To answer the second research question—what factors influence preferences—relevant text was coded through open and axial coding using NVivo software [68,69]. Open coding involved labelling text with general codes to keep interpretation possibilities open, and axial coding involved reviewing these initial codes and categorising them depending on similar themes [68,69].

3. Results and Discussion

3.1. Trends in Coastal Adaptation Studies

Publications on perceptions of coastal adaptation have been steadily increasing during the fourteen-year period covered in this review (Figure 2). The number of articles increased nearly fivefold, from an average of two papers per year between 2007 and 2013 to an average of nearly 11 papers per year between 2014 and 2020. This spike in research, could be attributed to several international agendas released around this time, for example, the release of the IPCC AR5 in 2014 and the adoption of the SDGs, one of which is climate action, in 2015. This finding also aligns with other reviews that have highlighted an increase in publications on adaptation following the AR5 [58,70].

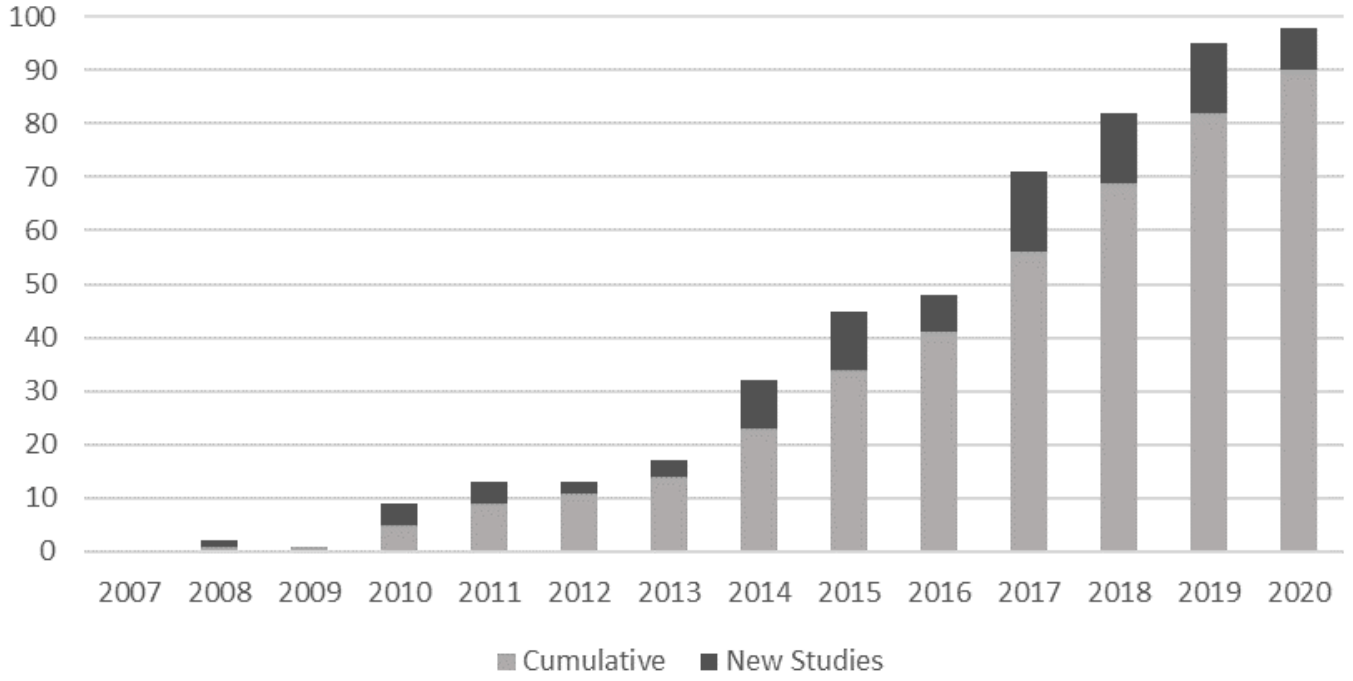

Figure 2. Years of publication for the perceptions of coastal adaptation articles identified in the review.

Coastal adaptation is a complex, cross cutting issue. The complexity is illustrated by the breadth of journals publishing papers on coastal adaptation. The 90 articles reviewed were published in 57 journals, spanning disciplines such as psychology, disaster risk reduction, geography, and tourism, among others. Approximately 7% of articles were published in *Ocean and Coastal Management*, and 6% in *Global Environmental Change*.

Across the 90 articles reviewed, there were 121 empirical cases that report the adaptation preferences of over 20,000 participants. Across all cases, 76% were conducted in developed countries and only 24% were conducted in developing country contexts—only a third of which were based in Small Island Developing States (SIDS) (Figure 3). This underrepresentation of developing country contexts is surprising given that others [5] have found that research of on-ground adaptation practices was most occurrent in developing countries, which might suggest that either there is a stronger focus on the physical adaptation practice rather than the societal response in developing contexts, or that there is some inclination to study societal perceptions in developed country contexts. Australia, the United States, and France far exceed other countries in the number of studies conducted on public perceptions of adaptation (Figures 3 and 4). Hugel and Davies (2020) [38] also found that Australia and the United States had high metrics of research being conducted, with the focus in this context on public participation in adaptation.

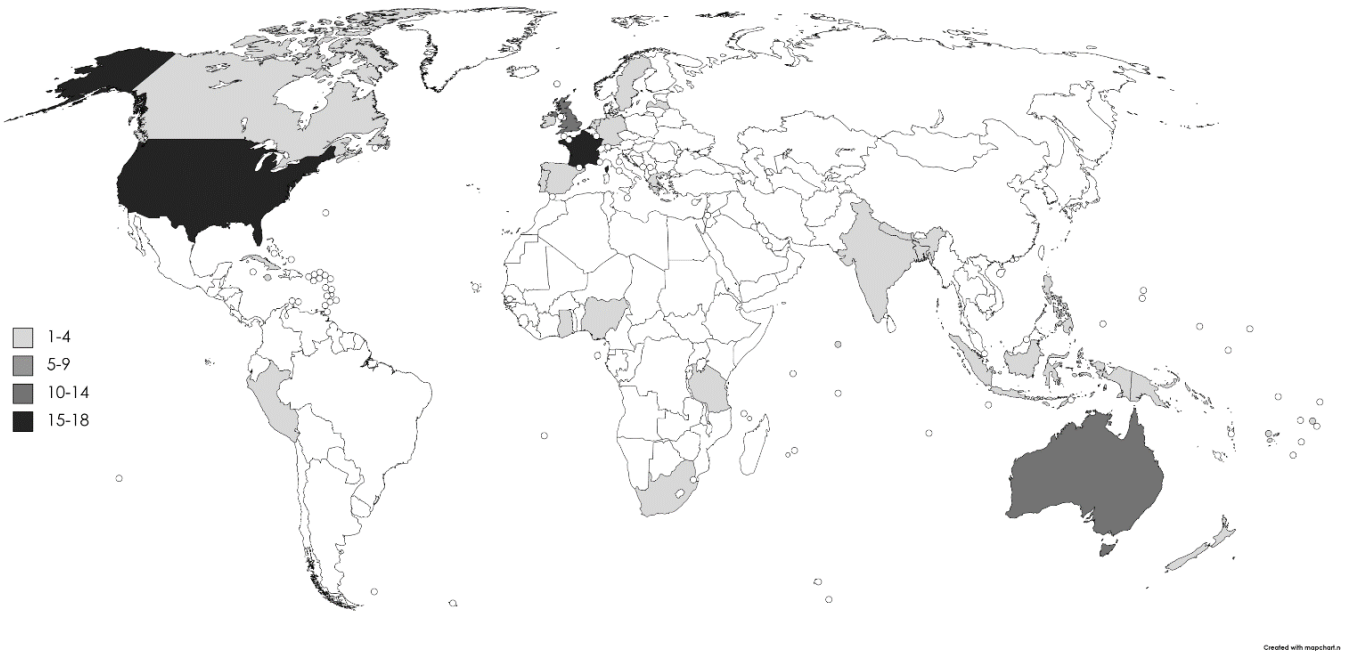

Figure 3. Geographic distribution of case studies on perceptions of coastal adaptation. Grey scale represents the number of case studies in each country.

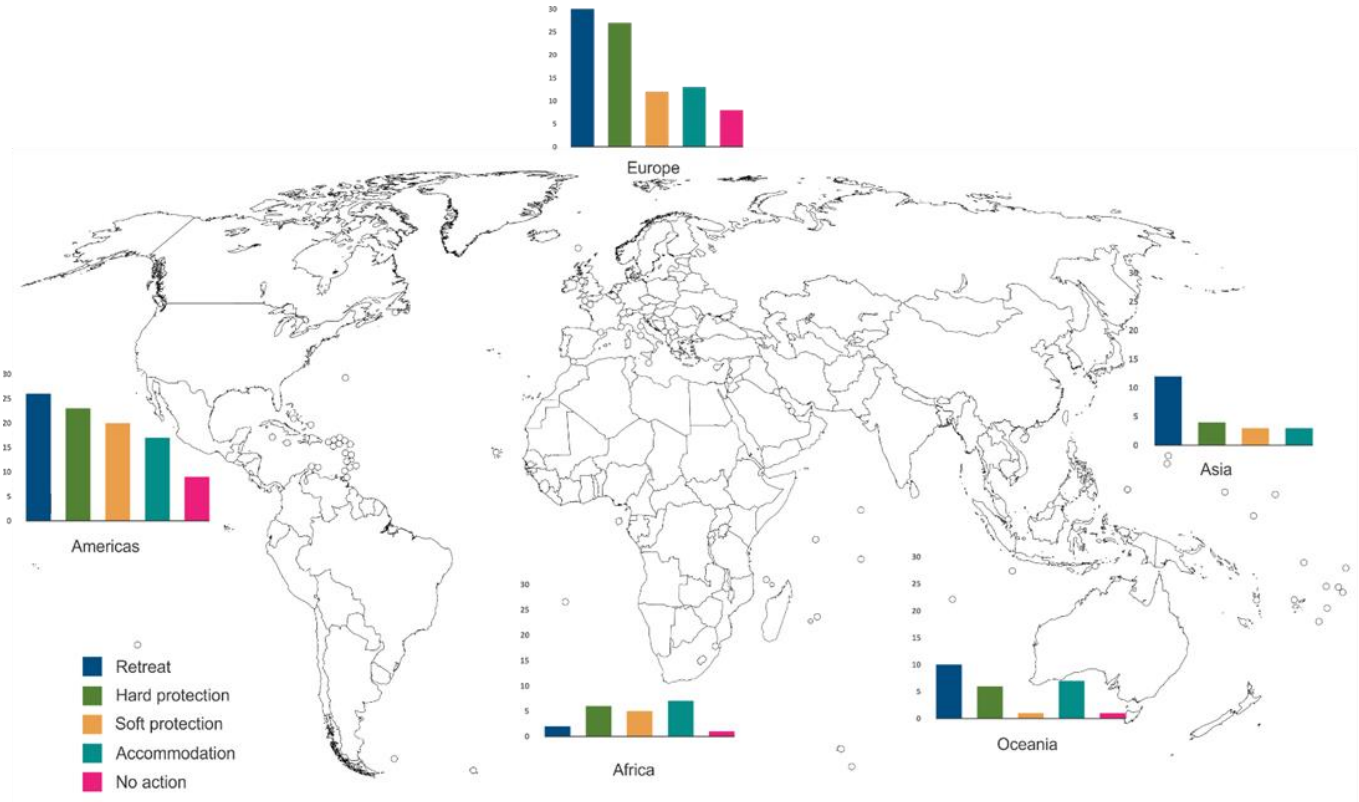

Figure 4. Bar graphs display the frequency count each category of adaptation was studied in each region.

3.2. Coastal Adaptation Options

Various types of coastal adaptation strategies were studied. Retreat adaptation options were the most studied, with 68% of all applicable cases considering at least one retreat option. Common retreat strategies include realignment of hard defences, coastal property buyback, and future development restrictions. Accommodation strategies were studied across 40% of all cases. Hard protection options, such as sea walls or breakwaters, were explored by 56% of all applicable cases. Soft protection options, such as mangrove restoration or beach nourishment, were studies in 35% of all cases. Interestingly, societal perceptions on "do nothing" or "no action" (referred to henceforth as no action) were relatively underrepresented in the sample (only 16% of all cases). Please note, most papers reported on several types of coastal adaptation strategies, so the total adds up to more than 100%.

Retreat and hard protection adaptation approaches were most frequently studied. It is possible that such attention has been given to societal perspectives of retreat options because these options are typically more contentious and resisted [3,33]. This trend perhaps also aligns with the general sense among practitioners and scientists that retreat may be inevitable in some coastal locations [1]. Yet, in practice, protective structures are the conventional and most commonly implemented strategy globally, which might explain the high frequency of research on hard protective structures in this study [25,33,35]. The limited number of articles reporting opinions of a "no action" option may suggest that perhaps either the public, the researchers, or the governing bodies implementing adaptation do not consider "doing nothing" as a possibility. It should be noted, though, that the adaptation approach implemented or studied may also depend on the context of the area and/or the coastal impacts [1,21].

Disaggregating the overall categories of adaptation into more specific types of adaptation responses (Figure 5), we can see that accommodation responses have a slightly higher count than hard protection, which could be due to the fact that often several types of accommodation strategies were studied at the same time [71,72].

Figure 5. The frequency of coastal adaptation strategies studied.

3.3. Preferences for Coastal Adaptation

Hard protection options were the most frequently preferred (Figures 6 and 7). Often, this is driven by a desire to maintain current shoreline conditions and uses, a desire for the protection of recreational spaces and private property, and a perceived effectiveness for hard protection options [73–79]. In fact, in seven of the ten studies that offered "hold the line" as an option to participants, the participants preferred it to any other option (Figure 6). This aligns with previous concepts, such as the "levee effect" or "manipulation pathways", in which reliance on protective measures and the resulting preservation of current conditions increases the desire to continue hard protection [26,33]. Reliance and high value placed on current measures also reduces risk perception, increases complacency, and can decrease the likelihood of preferring other options (such as retreat) [80–82]. These feedbacks might also explain the relatively high preference for taking no action (Figure 6) [83]. While a preference for hard protection options might be expected, it is also apparent that there is a high amount of mixed sentiment. The preference for maintaining current shoreline conditions with effective protective measures is repeatedly juxtaposed with an increasing recognition by the public that hard protection options may be maladaptive, both temporally, spatially, and economically [71,84–89].

Retreat options were the least preferred option (Figures 6 and 7). This is not surprising as others have identified similar barriers to implementing retreat, and the social challenges of retreat options have been extensively recognised [22,33,35]. The relocation of households was generally strongly opposed. Most frequently, opposition to relocation was related to strong feelings of attachment to personal property and entitlement to property rights [8,84,90–92], as well as place attachment to the area. Place attachment more broadly includes: the aesthetic and recreational aspects, the emotional aspects (e.g., emotional attachment to the sea), the heritage aspects (e.g., the property has been in the family for years; strong heritage elements), the social aspects (e.g., familial ties and social networks), and other cultural aspects (e.g., cultural norms, livelihood considerations) [42,93–99]. These findings reinforce the emphasis that previous research has placed on the relationship between place attachment and retreat [33,41,51,100,101]. In some cases, optimism bias and psychological distancing, where those who are most at risk tend to downplay the risks, were also associated with negative sentiment toward retreat and relocation options [8,96,99,102].

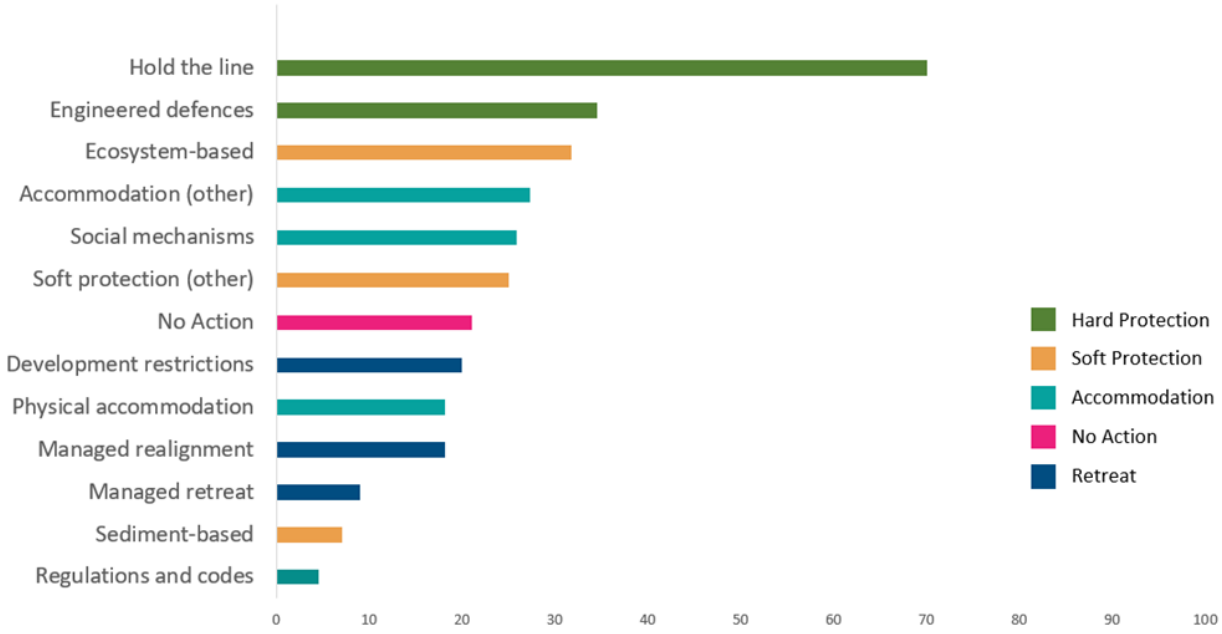

Figure 6. How often each coastal adaptation strategy was recorded as the top preference, relative to the number of cases studying that strategy (expressed as % of cases studying x strategy).

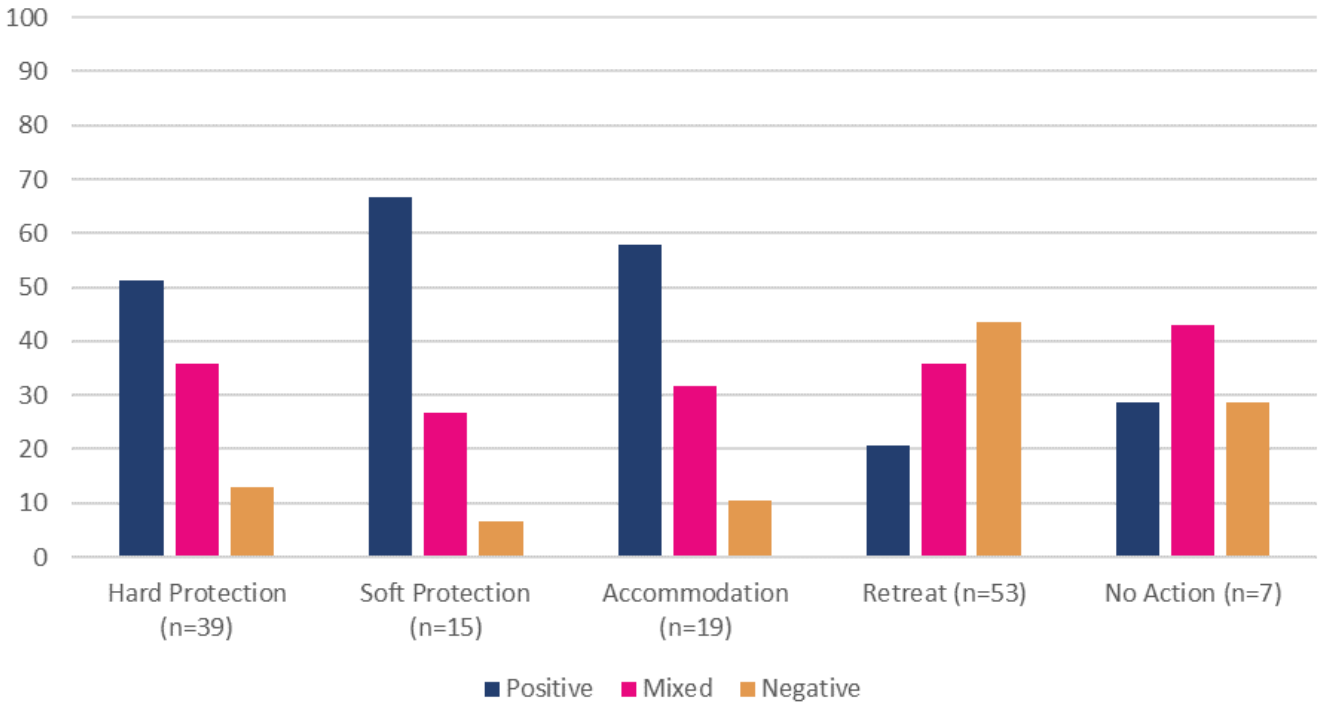

Figure 7. Sentiment toward adaptation strategies (as a percentage of applicable cases that studied the strategy).

Positive sentiment often increased when relocation initiatives provided compensation for property loss [34,103], however, this was not always the case [84]. Preference for retreat options also seemed to increase when the prospects of relocation land were comparable to the present location, a theme that was more frequently mentioned in developing country contexts. In these studies, many participants explained the cultural, spiritual, emotional, and social importance of having similar resources, livelihoods, traditions, social relationships, and access [42,103,104]. In addition, sentiment was more commonly positive for retreat options that concentrate on restricting future development in coastal areas; for example, set-back distances for new buildings or prohibiting new developments in certain areas [71,72,105]. Finally, managed realignment options, in which hard protection measures are realigned or removed allowing a natural progression inland, were generally negatively perceived if they threatened amenities, properties, or livelihoods [34,75,91,106–108]; however, in some cases, more positive opinions existed likely due to the ecological and recreational benefits offered [75].

Public opinions of soft protection options were overall more positive. In fact, negative sentiment toward soft protection was rarely recorded (Figure 7). Soft protection options were perceived as effective at offering coastal protection at a cheaper price than hard protection, while also providing additional benefits such as aesthetic improvements, ecological benefits, and recreational amenities [72,109–113]. Again, these results align with previous research and the commonly accepted notion that soft protection or ecosystem-based adaptation is a "no regrets" option [1,114]. Soft protection options were opposed in cases where it would impede on recreational amenities [112]. Despite an overwhelmingly positive perception of soft protection (Figure 7), preference for soft adaptation options trailed preference for hard protection options (Figure 6). This could suggest that while people would approve of soft protection options and think positively about them, they may prefer to rely on the protection of hard protection options when given the choice.

Like soft protection options, accommodation options tend to be perceived more positively, as they are often low impact and allow people to reside in a location while avoiding drastic changes [81,88,115]. However, considerable negative sentiment towards accommodation also emerged from the review, mostly due to regulations and codes that infringed on perceived rights and freedoms, or potential economic harm from measures [71,89,116].

Twenty-eight "influencing factors" were identified in the review (Figure 8). These factors range from cognitive processes (e.g., perception of risk, psychological distancing, worldviews, beliefs), to social or cultural aspects (e.g., social ties, social norms, cultural traditions), to contextual aspects (e.g., location, demographic characteristics, previous experiences), to appraisal of the adaptation (e.g., financial, ecological, aesthetic benefits and concerns). However, several factors are more complex and multidimensional. For example, place attachment has aspects that are strongly emotional, cultural, social, and cognitive, and is also connected to appraisal considerations (for example, livelihood considerations). In addition, we found that that the conceptual boundaries of these factors are fuzzy, and some terms are used interchangeably (e.g., beliefs, values, worldviews). Several influencing factors exist in complex feedbacks which could not be illustrated within the scope of this review.

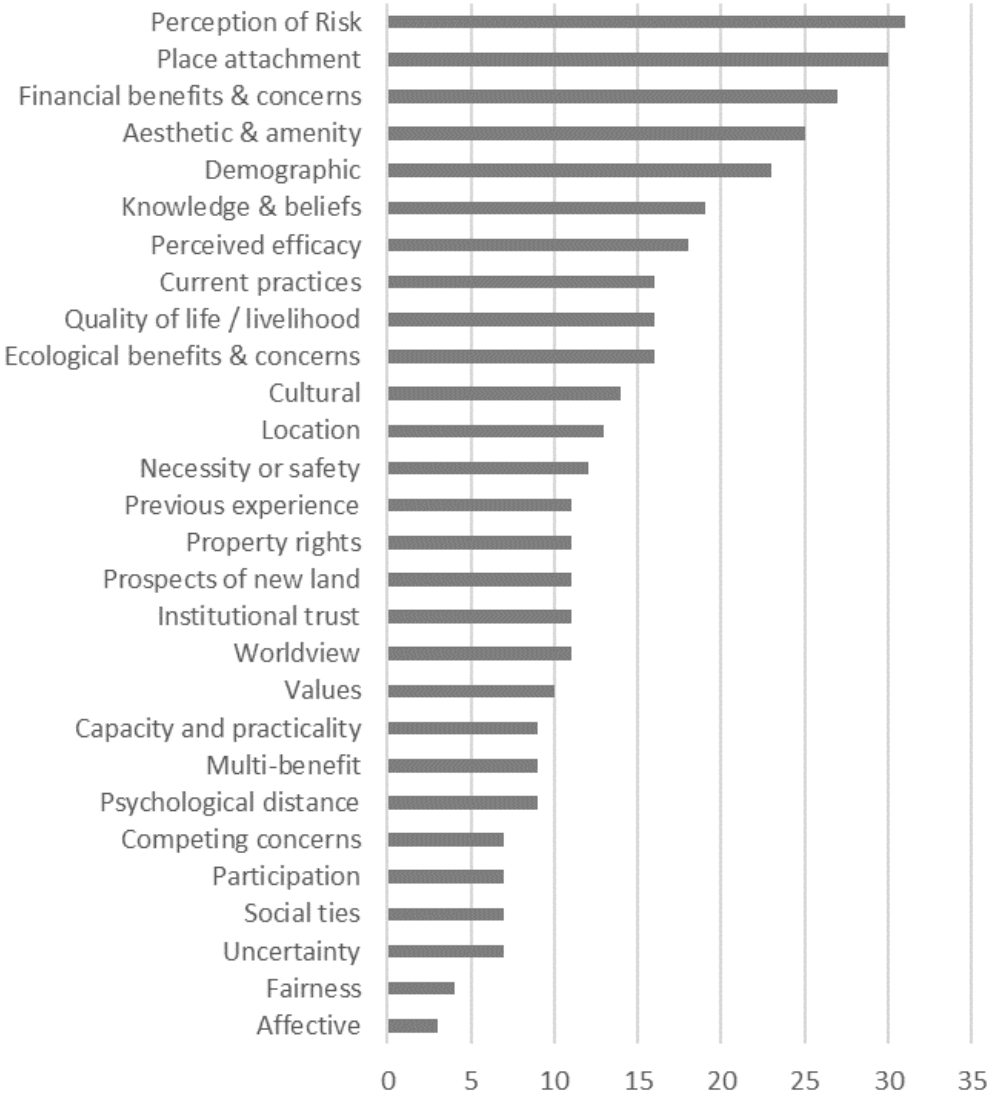

Figure 8. The frequency each influencing factor was studied across applicable case studies (n = 104).

The emerging set of influencing factors aligns with previous research. For example, similar to Wilson et al. (2020) [117], a set of cognitive and affective factors such as previous experience, perceived efficacy, perceived risk, and a set of social factors such as social norms and ties were identified. As well, several factors are similar to those discussed by Moser (2014) [9] such as risk awareness or perception, institutional trust, social norms, and fairness.

The influence of factors on preferences was examined both qualitatively and quantitatively. For example, typically the appraisal factors (such as aesthetic considerations) as well as social factors were not statistically analysed and were commonly identified qualitatively. On the other hand, conventional cognitive factors (e.g., perception of risk and worldviews) as well as demographic variables were more commonly quantitatively analysed for their influence on preferences. Here, we show the frequency that each influencing factor was studied across both types of data (Figure 8). Subsequently, we highlight and describe some of the key findings.

Perception of risk, place attachment, and financial considerations were the three most frequently occurring (Figure 8). The emphasis on risk perception is not surprising. In other research contexts, a large body of literature exists on risk perception and its complex interactions with risk experience, climate change attitudes, concern, and environmental behaviours [44,100,118–123]. It is commonly assumed that risk perception is directly influential on climate change beliefs, support for policies, or adaptive behaviours [37,44]. However, the picture emerging here on the effect of risk perception on coastal adaptation preferences is more complex. For example, some found a significant effect in either a positive or negative direction [96,116,124], while others found no or mixed effect [82,125]. As well, it is evident that psychological distancing and optimism bias play a role in risk perception in coastal adaptation contexts [94,96,99,102,126,127], and that less psychological distancing was associated with more support [37]. Perception of risk is further complicated by several mediating factors such as demographic variables, previous experience (both positively and negatively), place attachment, affective factors and current adaptive practices in place [17,76,80,98], consistent with established literature on risk perception [122,128]. Similarly, while demographic factors were one of the most reoccurring themes, the picture emerging on the effect of these factors is not clear-cut. For example, a demographic variable was found to have an effect only 52% of the time, and no effect, minimal effect, or a dual effect the other half of the time. Some found that age was important [42,84], while others found no differences [129]. Some found that socio-demographic variables were more important than cognitive factors (such as worldviews or beliefs), whereas others found that demographic variables played a negligible role. Similarly, the variable 'location' was found to have inconsistencies. Again, location was found to have an effect approximately half the time and no effect 42% of the time, whereas 8% found mixed effects.

Lastly, one of the most commonly reoccurring themes across the case studies was place attachment. Place attachment is evidently an important factor in the broader literature [130,131], where previous distinctions have been made such as affective place attachment and dependence on place [132]. While most occurrences of place attachment in the data were self-identified (i.e., respondents identified it as a reason), it remains unclear if the prominence observed is due to a trend in scholarship, or the strength of the influence of place attachment. Within the review, it seems that place attachment is an especially important factor for perceptions of retreat options (as discussed above), but also influences how people interpret other options. For example, will an engineered defence obstruct a view or negatively impact the cultural values or recreational space [79]?

While some factors identified in this review may be unique or more important to coastal settings, overall, the factors associated with one's preference or opinion of adaptation are relatively consistent across adaptation, and climate action in general. For example, like climate mitigation policy and other non-coastal adaptation contexts, institutional trust, participation in decision-making, previous experience with risk, and perceived efficacy were important influencing factors [17,34,103,111,119]. While political worldview, beliefs,

and social norms might play a stronger role in climate change mitigation, and other non-coastal adaptation is often motivated by livelihood considerations, coastal adaptation appears to emphasise the aesthetic/amenity considerations, property rights, prospects of new land, and location. This could be due to the recreational use of coasts, direct threat to property and location related impacts, and complexities of retreat.

Temporal Considerations

The review found preference for both proactive [110,133,134] and reactive [11,135] adaptation responses. Reasons for preferring a reactive response included: uncertainty about the impacts, concerns about spending money on proactive adaptation rather than focussing on current issues, and that it is more effective to wait and see [11,135]. There is a tendency to conceptualise climate change as a future issue rather than current issue, which may contribute to the viewpoint that there is ample time to respond [78,127,133,136].

According to Few et al. (2007) [4], adaptation designed to manage impacts over the long-term tends to be more unpopular. Indeed, some cases reported a preference for quick fixes and planning for the short-term [133,136,137]. However, a preference for long-term planning was just as common [110,138]. Common motives for long-term solutions included a moral responsibility to plan for future generations and the cost effectiveness of planning for the future now [11].

What influences an individual's preference for coastal adaptation is dynamic and influenced by a range of factors. For example, preferences are not static, and depend on the context and the information received [11]. As coastal systems plan for a future shaped by climate change and design long-term adaptation that is supported by the public, it is worth considering how perceptions and preferences might change over time and into the future. Within this review, only a few studies reported how participants' preferences changed over time. Everett et al. (2016), reported a change in opinion over years in both directions, influenced by information campaigns and by negative impacts experienced [139]. In Weisner and Schernewski (2013) [107], public opinion only changed when there were major modifications to the adaptation scheme, despite an information campaign and public participation in the process. In the few studies that asked participants how they imagined their preferences might change into the future, there was general awareness and concession that relocation will be necessary in the future and perhaps even preferred [87,99,134,140]. Finally, a few additional studies investigated how perceptions might change in the future using scenarios or simulations of future conditions, finding mixed results in preference changes [137,141].

3.4. Research Gaps

This review highlights a lack of clarity in the empirical evidence on peoples' preferences for coastal adaptation. For example, the findings reveal inconsistencies on the influence of certain factors, such as location /exposure to the coast, perception of risk, and various demographic variables. In-depth understandings of how these factors interact with each other, with certain contexts and with certain preferences, as well as the feedbacks that exist were outside the scope of this review but research in these areas could contribute more clarity to the inconsistencies identified. On the other hand, inconsistencies might also suggest that the influence of such variables might not be generalisable across contexts.

The review also highlights areas that are understudied. For example, the findings reveal that most empirical research has focussed on developed contexts despite developing nations, especially in coastal contexts, being some of the most urgent areas for adaptation [43,142]. Studies that asked participants about taking "no action" were rarer, resulting in an underdeveloped and incomplete evidence base for these options. Despite some highlighting the importance of social factors such as social norms in fostering perceptions [82], it is relatively understudied according to this review. Similarly, but surprisingly, the influence of affective factors, or the emotions people feel, received less attention in the empirical work. The review revealed there is rather limited evidence on how preferences might

change over time and into the future. Research has only begun to address in a coastal context questions such as: are people fluid in their coastal adaptation preferences over time or do they tend to prefer one type of strategy over time? What are the factors or strategies that inhibit or enable change?

Almost always, articles report results that are summarised or generalised across a sample. For example, most articles exploring preferences in an area summarise the preferences, reporting findings such as the percentage of constituents who prefer each option. Very rarely are data disaggregated to examine and report the range of preferences held by individuals. One of the only exceptions [116] explored how individual landowners viewed multiple strategies and found that some patterns existed in preferences based on the strategies having similar characteristics. They labelled five types of preferences: "non-interventionists", "flood defence", "moderate flood defence", "develop-ment-centric" (likely to support management but only slightly opposed to human in-tervention), and "environment-centric" (favour management but letting nature run its course), each with patterns of support and opposition strategies. Milman et al. (2018) [116] argue the need for a more multidimensional understanding of individual perspectives, and explicitly call for more research in these areas. A significant gap is evident from this review: it is extremely rare for empirical work to explore the multidimensional aspects of an individual's preferences and opinions. Understanding whether people prefer a wide range of options or only one option would be insightful to managers and for how scholarship and practice understands and approaches public preferences.

4. Conclusions

A critical global challenge for coastal adaptation is building support for adaptation initiatives. The scholarly discussion on building support for coastal climate action suggests that knowledge of societal perceptions and preferences of coastal adaptation strategies and the drivers behind them is essential for designing action that is in line with societal values and for informing communication and cooperation. Practitioners and researchers would benefit from a thorough understanding of the nuances of coastal adaptation preferences. This study sought to collect, synthesise, and summarise scholarly literature to provide insights into what people prefer and what may influence these preferences. The findings reveal a complex picture of societal preferences and influencing factors, such that these will likely differ on a spatial scale as well as on an individual scale. Retreat options were most frequently studied and were rarely preferred, often due to place attachment. Hard protection options were also frequently studied and received more positive attention, likely due to a desire for the status quo conditions and a perception of efficacy. However more mixed opinions are emerging on retreat and hard protection, possibly due to public recognition of maladaptation. Soft protection and accommodation were generally positively perceived, although not preferred in relation to other strategies. While "do nothing" or "no action" options were rarely studied, they received generally positive sentiment and a relatively high preference. A range of social/cultural, cognitive, contextual, and drawback/benefit factors influence these preferences. Twenty-eight were identified in this review, with risk perception, place attachment, and financial considerations occurring most frequently in the literature.

The findings emerging from this review provide insights for practice and scholarship. For practitioners aiming to implement coastal adaptation, general trends in the findings might suggest potential leverage points in which the option has more positive sentiment; for example, restricting future development in at-risk areas. Soft protection and accommodation options might also be low risk options in terms of social opposition. The findings of the review also demonstrate that repeatedly, several different preferences or mixed sentiments exist within the same regional area, and therefore, decision-makers may face conflict, which is a significant barrier to implementation [101]. Similarly, the mixed findings on the strength and direction of influence for certain factors might suggest that these effects cannot be generalised across contexts, an important scholarly consideration. Therefore,

recognising that each case is context-specific, and that any considerations of preferences should occur on a local scale, coastal adaptation planners and policy makers should consider local preferences as well as what factors influence preferences. The findings support notions that coastal adaptation planning could benefit from going beyond gauging the preferences to understand the "why" in order to foster policy that respects the values of communities and to improve communication with different groups. This review presents a collection of potential influencing factors to guide practitioners and offers initial insights as to how some of these influencing factors interact with preferences.

Author Contributions: Conceptualisation, A.M., T.F.S., C.E.-B., R.P. and J.B.; methodology, A.M.; validation, J.B. and T.F.S.; formal analysis, A.M.; investigation, A.M.; data curation, A.M.; writing—original draft preparation, A.M.; writing—review and editing, T.F.S., C.E.-B., J.B. and R.P.; visualisation, A.M.; supervision, T.F.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research was supported by the Australian Government through the Research Training Program (RTP) and the Australian Research Council Discovery Projects Funding Scheme (Project FT180100652). The views expressed herein are those of the authors and are not necessarily those of the Australian Government or Australian Research Council.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Inclusion and exclusion criteria applied for screening of abstracts as well as full-text articles.

Inclusion Criteria	Exclusion Criteria
Timeframe 2007–2020	Published outside timeframe
Available through Scopus or WoS	Not available through Scopus or WoS
Peer-reviewed journal articles	Books, conference papers, grey literature
English language	Not English
Must pertain to coastal impacts the coastal impacts selected for this study and adaptation these impacts (e.g., not just perceptions of impact risk)	Agricultural adaptation studies (i.e., not coastal)
	Coastal adaptation that refers to offshore coastal ecosystems (e.g., fisheries)
Must pertain to adaptation	Mitigation focused papers
	Biophysical adaptation (e.g., species' adaptation)
Must explicitly mention perceptions/opinions of coastal adaptation and/or reasons for these perceptions	Focused solely on perception of climate change or perception of impacts
General public perceptions (i.e., residents, Indigenous communities, etc.)	Articles that do not include public perceptions (e.g., only decision-makers)
Adaptation at a regional/local scale (i.e., not household actions)	Focus on household adaptation actions
Preference/opinion or adaptation strategy	Actual uptake of adaptation actions, or the intention to adapt
Empirical method (i.e., no literature reviews)	Literature reviews or other non-empirical work
Focus on the outcomes/actual actions of adaptation	Focus on the process of adaptation (e.g., preference for governance structure)

Appendix B

Table A2. Categories of adaptation strategies used when coding articles.

Title 1	Name	Definition	Examples
Hard Protection	Engineered defences	Any physical, engineered structure, both onshore and off-shore. Could also refer to 'hard protection' generally (e.g., authors do not specify)	• "Hard protection measures" • Onshore: seawalls, dikes, revetments, bulkhead • Offshore: breakwaters, reef breakwaters, groynes, jetties
	Hold the line	An approach whereby the current defences are maintained or upgraded to maintain the current line of defence	• Hold the line • Upgrade current defences
Soft Protection	Sediment-based	Soft structures such as beach and shore nourishment	• Beach nourishment • Sand replenishment • Dune creation
	Ecological	Nature-based solution, focused on the conservation or restoration of coastal ecosystems	• Wetland restoration • Mangrove restoration • Vegetation planting
	Soft protection (other)	Refers to 'soft protection' generally (i.e., the authors do not specify)	• "Soft protection option"
Accommodate	Social mechanisms	Includes economic and/or social measures	• Economic measures (e.g., insurance or incentives) • Early warning systems • Temporary evacuation • Awareness raising campaigns
	Regulations and codes	The laws, rules, and regulations that encourage adaptation, reduce risk, or build capacity	• Raising building elevation codes • Other building codes, regulations • Land use regulation • Laws to support disaster risk reduction (e.g., laws for sand removal)
	Physical accommodation	Accommodation that involves physically changing conditions	• Elevating existing buildings • Elevating low-lying bridges • Build evacuation shelters • Modification of drainage
	Accommodation (other)	Refers to accommodation generally (i.e., the authors do not specify), or other less common accommodation options	• "Accommodation option" • Long range planning

Table A2. *Cont.*

Title 1	Name	Definition	Examples
Retreat	Development restrictions	Refers to restrictions on or prohibiting new development in at-risk areas	• Prohibit new development/"no new development" • New setback regulations
	Managed retreat	Residential abandonment and rezoning of existing hazard prone areas	• Acquiring land • Relocating coastal buildings and structures • Only permitting moveable/non-structural buildings • Relocation of people (could include an entire community)
	Managed realignment [1]	Setting back the line of active defences to a new line. Doing so promotes creation of intertidal habitat	• Dike realignment • Dike (re)opening • De-polderisation
	Retreat (other)	Refers to retreat generally (i.e., authors do not specify)	• "Retreat option"
No Action	No action [2]	Refers to no active intervention	• Do nothing • Inaction • Resignation • No defences constructed
	Wait and see	No active intervention due to uncertainty of risks and impacts. Possible action in the future	• Wait and see • Reactive adaptation

[1] Typically, "managed realignment" and "managed retreat are used interchangeably, however, realignment is distinguished from managed retreat here to highlight the difference between moving engineered structures and moving people. [2] No action is distinguished from hold the line, the latter which involves upgrading or maintaining defences, whereas the former takes no action.

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