



Examining the role of human perceptions during cetacean stranding response in New Zealand

Karen A. Stockin^{a,b,*}, Matthew D.M. Pawley^c, Rebecca M. Jarvis^d, Rebecca M. Boys^a

^a Cetacean Ecology Research Group, School of Natural Sciences, College of Sciences, Massey University, Private Bag 102-904, Auckland, New Zealand

^b Animal Welfare Science and Bioethics Centre, School of Veterinary Science, College of Sciences, Massey University, Private Bag 11-222, Palmerston North, New Zealand

^c School of Mathematical and Computational Sciences, College of Sciences, Massey University, Private Bag 102-904, Auckland, New Zealand

^d Department of Environmental Science, School of Science, Auckland University of Technology, New Zealand

ARTICLE INFO

Keywords:

Survival
Human intervention
Animal welfare
Mass strandings
Cognitive dissonance

ABSTRACT

Cetacean strandings often elicit significant media attention and public engagement. However, how human perceptions of such events may influence decision-making during strandings response is poorly understood. To address this, we undertook an online questionnaire targeting stranding relevant/interested parties in New Zealand, Aotearoa to understand perceptions around stranding events and response. Participants responded to questions and statements using the 5-point Likert scale to explore human perceptions and expectations of intervention, decision-making, animal welfare and survival prognosis during strandings. Responses were analysed based on level of experience and role at stranding events using descriptive and multivariate statistics. A total of 268 respondents completed the questionnaire; most stated that human intervention is necessary to assist animals during strandings. However, 43% of respondents indicated that they did not know what affect intervention may have on the animals. Notably, participants felt that human intervention was more likely to improve survival (26%) than welfare (19%). Importantly, experienced responders appeared more welfare complacent, prioritising survival for strandings response decision-making. Respondents from the legislative agency responsible for strandings in New Zealand, indicated that public sentiment may take precedence over welfare considerations when considering euthanasia. Our results highlight a disjunct between perceptions of welfare and survival, despite these variables being inextricably linked. This may be cause for concern in highly publicised strandings events where management decisions are more likely influenced by public sentiment. Comprehensive animal assessments that are informed both by animal welfare and survival prognoses are required to ensure the best outcomes for stranded cetaceans.

1. Introduction

To be successful, wildlife management not only requires robust scientific evidence with which to make informed decisions but also public support to induce change, especially if conservation outcomes are to be achieved [1,2]. Understanding human perceptions could play an important role in conservation management, by providing an understanding of how to achieve public support [3,4]. Many factors can affect human sentiment towards an issue including culture, knowledge, attitudes, values, emotions and in some cases, religion [5–9]. Most communities are heterogeneous, with individuals that vary in their interests and values [10]. As such, understanding that different human

perceptions exist, and recognising this complexity and diversity, is necessary to achieve the best outcomes. Furthermore, actively engaging communities in the ongoing processes of conservation and management will garner more success [10–12].

Wildlife management actions that gain public support and garner positive attitudes often lead to significant alterations in conservation [13–16] and welfare [8,17,18] policy. In such cases, science informs rather than dictates decisions [19]. However, the potentially disparate views between relevant/interested parties can also cause decision-making to be contentious, leading to conflict and in some circumstances, ineffective management [19,20] and/or unknown animal welfare consequences [13,21,22]. The effects of public support on

* Corresponding author at: Cetacean Ecology Research Group, School of Natural Sciences, College of Sciences, Massey University, Private Bag 102-904, Auckland, New Zealand.

E-mail address: k.a.stockin@massey.ac.nz (K.A. Stockin).

<https://doi.org/10.1016/j.marpol.2022.105283>

Received 19 April 2022; Received in revised form 6 September 2022; Accepted 7 September 2022

Available online 13 September 2022

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management decisions are, therefore, pertinent when considering both conservation and animal welfare outcomes [23–25], particularly in the absence of empirical data to underpin decision-making [26]. This includes conservation practices which involve potential rescue and rehabilitation of wildlife [27,28].

Wildlife taxa appear to be rescued at unequal rates and for differing reasons, which may impact both the conservation [29] and animal welfare outcomes of such intervention initiatives. For example, charismatic fauna often elicit a human response when their plight becomes public knowledge [30–33]. Live cetacean (whales, dolphins and porpoises) strandings represent a quintessential example in which human intervention is undertaken in an attempt to rescue and release distressed animals [34,35], although the efficacy of such interventions is rarely measured in any empirical or quantitative manner [36,37].

Live cetacean strandings can involve single animals [38–40] and range up to hundreds of individuals during a mass stranding [41–43]. Such events can result in some instances of prolonged animal-human contact time; leaving rescuers, many of which include the public, bereaved when inevitably at least some animals die [44]. In many cases, this is further exacerbated when publicised more widely via different forms of media.

The significant media attention given to stranding events, especially with the advent of social media, has led to changing human attitudes and increased expectations regarding stranded cetacean management [45, 46]. Indeed, public engagement in stranding events appears to be increasing, with heightened awareness also eliciting contention. For example, conflicting views [44,45,47] and increasing public pressure on managers [45] can give rise to inconsistent, sometimes unorthodox, decision-making. This is particularly notable when decisions to euthanise for welfare reasons conflict with the preservation of life [45, 47–49].

New Zealand demonstrates one of the highest cetacean stranding rates globally [43,50–52]. This coupled with extensive public engagement and media attention, has culminated in strandings needing to be managed via the New Zealand Coordinated Incident Management System or CIMS [53]. Management of stranding events in New Zealand comes under the legal jurisdiction of the Department of Conservation Te Papa Atawhai New Zealand (herein DOC), in partnership with local iwi (representing the indigenous Māori of Aotearoa New Zealand). Additionally, several NGO stranding networks exist from which volunteer marine mammal medics attend stranding events with the aim to refloat animals. The management of stranding events is directed by DOC's standard operating procedure [53] which includes guidance on first aid, refloatation and end-of-life decisions.

The variety of interested parties involved in New Zealand stranding events provides an exceptional opportunity to examine human-wildlife management actions from different perspectives. Notably, all parties (public through to trained medics or management personnel) may differ in their perceptions towards cetaceans and the management measures during strandings. To be able to understand these perceptions and highlight how the expectations of differing parties may influence decision-making concerning animal welfare and conservation, we surveyed human perceptions in response to cetacean stranding events in New Zealand. In undertaking this analysis, we aimed to explore how factors may influence decision-making and animal welfare outcomes. Specifically, this was achieved by examining respondents' perceptions of cetacean stranding events in terms of 1) decision-making, 2) human intervention and 3) animal welfare and survival outcomes, accounting for strandings experience level and particular roles/responsibilities at strandings.

2. Material and methods

Human perceptions and expectations during live cetacean stranding events were elicited using an online questionnaire. Given the wide range of experience levels and the significant proportion of inexperienced

public that regularly attend New Zealand strandings, we assessed a full spectrum of participants including the inexperienced public. Questionnaires were undertaken by members of the public whom themselves had never attended a stranding, through to trained medics and/or highly experienced responders who had attended tens of stranding events. For individuals that had attended a stranding, human perceptions and expectations were further assessed to compare similarities and differences across (1) different roles undertaken at stranding events and (2) among the varying experience levels, based on the number of stranding events attended. Specific topics we aimed to address were (i) whether participants perceived stranded cetacean welfare and survival to be connected, (ii) whether increased experience at stranding events affected perceptions of human intervention and expectations of animal welfare and survival, and (iii) whether human expectations may influence decision-making during stranding events.

2.1. Recruitment and characterisation of participants

A structured online questionnaire [54] was distributed to elicit a response from any interested parties, including but not limited to the public (who comprised both New Zealand residents and international tourists), scientists, trained medics, conservation managers and iwi using a multi-modal recruitment strategy [55]. This included posting to online social media platforms, such as Facebook cetacean interest groups [56] specific to New Zealand marine mammals (e.g. Cetacean Spotting NZ - Whale and Dolphin Watch New Zealand), whale-watching tourism operations and direct emails to DOC marine mammal and iwi liaison groups. Additionally, due to their size and official service provider status to DOC [57], the stranding network Project Jonah was further engaged to disseminate the questionnaire to both their charity supporters and trained medics, several of which further overlap with the small regional stranding networks around New Zealand.

2.2. Questionnaire design and implementation

Prior to distribution, a draft questionnaire was completed by two participants, a native English-speaking specialist (biologist) and a fluent, non-native English speaker non-specialist. These two participants assessed questionnaire clarity, useability, and provided an estimate of the time taken to complete the questionnaire. These results were used to refine the questionnaire but excluded from the final analysis.

The questionnaire (A1) was accessible online via Google Forms for 9 weeks between June and August 2019. Participation in the questionnaire was voluntary and required a participant to be over the age of 18 years old. No identifiable data were collected, ensuring full anonymity [58,59].

At any point in the questionnaire, respondents could opt out by not submitting their answers on the final page. A 75% questionnaire completion rate was required for the responses to be included in the study. A total of 34 questions were included, each designed to address one or more of four core components relating to the perceptions of participants:

1. Experience and roles at stranding events
2. Understanding of decision-making at stranding events
3. Knowledge of human intervention at stranding events
4. Expectations for animal welfare and survival at stranding events

The experimental design employed both multiple choice and scaled items [60]. Seven multiple choice questions related to demographic parameters, including sex, age, ethnicity, education level and time in New Zealand. Participants were further invited to provide information on their involvement at stranding events. Participants were asked to define their stranding experience level, as assessed by the number of stranding events attended, based on pre-defined categories: 0; 1–3; 4–6; 7–10; 11–20; and > 20. Additionally, participants self-defined their role

undertaken at strandings from six provided categories: *observer*; *non-experienced responder*; *experienced responder*; *trained medic*; *scientist*; or *DOC employee*.

Closed-response questions ($n = 20$) were rated using a 5-point Likert scale [60,61] in the form of *strongly agree*; *agree*; *neutral*; *disagree*; and *strongly disagree*. This enabled participants to respond to a range of statements related to decision-making, human intervention, animal welfare and survival. An additional two questions required a ranked response and related to welfare concerns and management priorities. Finally, a further four questions were asked relating to what may occur as part of strandings response, with responses of *yes*; *no*; and *don't know*. Lastly, one multiple choice question addressed the matter of who in New Zealand holds legal jurisdiction at strandings. This question had the option to choose multiple responses.

2.3. Data analysis

Likert scale responses were analysed as ordinal data to examine for differences among the respondent groups. Data were pooled into two categories based on those respondents that had not previously attended a stranding (not attended) versus those that had direct stranding experience (attended). To examine whether attending stranding events influenced human perceptions of cetacean stranding response, we calculated the mode of responses for each statement between the two groups. The differences in responses between categories not attended versus attended were subsequently evaluated using a Mann-Whitney U test ($\alpha = 0.05$).

Raw data were pooled across all participants to examine which welfare concerns were considered most important and what concerns should be management priorities at stranding events. These data were examined based on the percentage distribution of responses. For responses to statements on the Likert scale [60,61], response categories of *strongly agree* and *agree*, as well as *strongly disagree* and *disagree*, were combined to assess the overall response, respectively, for each statement. These data were used to examine the overall responses for all participants, and each category of participants (role and experience) based on percentage agreement or disagreement with each statement.

To further evaluate the relationship between being involved in stranding events and insight into stranding response, we examined the perceptions of those individuals that had attended strandings. Data were separated into different groups, based on the self-defined role undertaken at strandings and additionally based on experience (number of stranding events attended). Both role and experience of respondents were investigated as there was not a direct correlation between the level of involvement in strandings decision-making and the number of strandings attended.

For participants that had undertaken more than one role at stranding events, the role selected for analysis was based on the highest level of involvement at a stranding (from least to highest involvement: *not attended*; *observer*; *non-experienced responder*; *trained medic*; *experienced responder*; *scientist*; *DOC employee*). We examined differences in perceptions among those participants by calculating the proportion of agreement, disagreement, and uncertainty for each statement across each respondent category.

Differences in perceptions among the roles and level of experience were analysed using a multivariate Permutational Analysis of Variance (PERMANOVA) [62]. Due to the ordinal nature of the experience variable (number of strandings attended), we applied Helmert contrasts to examine where differences in perceptions ($\alpha = 0.05$) lay among the level of experience groups (0; 1–3; 4–6; 7–10; 11–20; >20). All multivariate analyses were completed using PRIMER v7 [63] with the PERMANOVA+ package [64].

Additionally, to visualise whether self-identified roles or experience at strandings influenced the agreement/disagreement with the statements provided, we applied linear discriminant analysis (LDA) in R through the software package MASS [65]. Orthogonal axes were

generated from the LDAs that maximally separated the groups in terms of experience (number of strandings attended) and roles undertaken. Visual representation of differences and similarities, based on overlap, among these groups were visualised using the first two axes of the LDA. All figures were prepared using the package ggplot2 [66].

Definitions of the terms “welfare” and “survival” were specifically not provided in the questionnaire to avoid influencing participant responses. When interpreting the results of the questionnaire, we defined “welfare” from the contemporary animal welfare science approach, which considers the interrelated aspects of physical, behavioural, and situation-related factors and how these impact upon animal mental state [67]. “Survival” was considered to include animal health, biological functioning, behaviour and persistence to at least 6 months post-refloating [67].

3. Results

3.1. Participant demographics

A total of 268 respondents participated in the study. All questionnaires submitted were able to be analysed since 100% of respondents completed at least 75% of the questionnaire, with all but 30 respondents completing the entire questionnaire. Most participants (58%, $n = 154$) represented residents of New Zealand for at least half of their life, with only 17% ($n = 45$) reporting visiting or living within New Zealand for less than 1 year (A2 Fig. 1). Respondents ranged in age from 18 to over 50 years old (A2 Fig. 2), with most respondents (77.9%, $n = 208$) identifying as female.

Of the 267 participants that identified their role at strandings, 40% ($n = 107$) had attended a stranding, the majority (43.9%, $n = 47$) of whom identified themselves in the self-defined group of trained medics. Additionally, a significant number (58.4%, $n = 160$) of respondents had not attended a stranding (A2 Table 2). For those that had attended a stranding, most (69%, $n = 74$) had attended between 1 and 3 strandings (A2 Table 2).

Overall, there were minimal differences in perceptions between those respondents that had versus those that had not attended a stranding (Mann Whitney U test: $U=195$; $z = -0.14$; $p = 0.89$; A2 Table 1). Indeed, perceptions of only two statements differed between these groups; one of these statements regarding the conservation impact of strandings, those that had not attended *strongly agreed* that stranding would impact populations, whilst those that had attended only *agreed*. Interestingly, those that had not attended *disagreed* that human intervention would improve welfare, whilst those that had attended a stranding were uncertain (A2 Table 1).

Differences in perceptions both among differing roles at strandings (PERMANOVA, $p = <0.001$) and among the number of strandings attended (PERMANOVA, $p < 0.001$) were detected. The Helmert contrasts revealed significant differences in perception existed between the groups that had attended 11–20 (PERMANOVA, $p = 0.001$) or > 20 strandings (PERMANOVA, $p = 0.005$) and those that had attended 10 or fewer strandings (A3 Table 1).

The LDAs revealed substantial overlap among all groups relating to the level of stranding experience (A3 Fig. 1) and all group roles (A3 Fig. 2). However, some trends were identified from the LDAs. For example, the DOC personnel group differed most from all other self-defined role groups (A3 Fig. 2), and differences among stranding experience signalled within the PERMANOVA results were further evidenced, i.e., that those with the most experience (11–20 and >20 strandings) had differing perceptions compared with other experience levels (A3 Fig. 1).

3.2. Decision-making at strandings

The entity legally responsible for managing strandings was correctly identified as the Department of Conservation (DOC) by 72% ($n = 193$) of

respondents, with 18% stating that Tangata Whenua (iwi) also have legal jurisdiction. As partners to the Crown, iwi are widely consulted and part of any decision-making undertaken by DOC. The remaining 23% stated that they did not know where jurisdiction lay, a result most reflected among the international visitors to New Zealand. Additionally, over 70% ($n = 202$) of participants stated that marine mammal strandings are a *high priority* in New Zealand, with 74% ($n = 198$) stating that New Zealand's reputation for stranding response is *excellent*.

Respondents stated that the priority for decision-making should be to maximise survival. Indeed, while most respondents (59%, $n = 127$) viewed survival as the top priority, considerably less (26.5%, $n = 57$) ranked welfare as the highest priority (A2 Fig. 3). Notably, 14.4% ($n = 31$) of respondents extended further, prioritising the management of human expectations over that of both welfare and/or survival of stranded animals (A2 Fig. 3). Interestingly, more than 50% ($n = 34$) of the respondents that did indicate welfare as the highest priority, comprised those that had not attended a stranding (A2 Fig. 4).

Typically, more experienced responders agreed that health assessments needed to be conducted prior to any rescue attempt (Fig. 1), although this trend became less apparent when examining the roles at strandings. DOC employees and scientists were generally most likely to state that health assessments were necessary prior to any rescue attempt. When seeking clarification on whether such health assessments do take place in New Zealand presently, there was no unanimous response across roles, although most DOC employees and scientists were aligned in their statement that no such assessments currently occur (A2 Fig. 5).

Most participants (72%, $n = 193$) stated that euthanasia is an acceptable outcome at strandings, with the greatest support for this statement being expressed by the more experienced responders (>4 events). Again, when assessing by self-defined role, those who identified as DOC personnel and scientists were most likely to demonstrate higher acceptability of euthanasia (Fig. 2). Overall, 79% ($n = 211$) of participants identified animal welfare considerations as the most important factor to influence decision-making around euthanasia. However, only half of DOC participants agreed with this, with 27% ($n = 6$) stating that public sentiment should take precedence over animal welfare (Fig. 3).

When addressing if species-specific considerations should influence decisions regarding euthanasia, 44% ($n = 119$) of participants felt that conservation threat status should not affect decision-making, whilst 36% ($n = 96$) indicated threat status is an important consideration. However, when assessing these responses by self-defined role or experience level, no consensus was evident (Fig. 4). When determining whether conservation status *currently* influences decision-making during stranding events, 68% ($n = 180$) of respondents stated they were

unsure. Notably, those attending 7–10 strandings indicated their belief that conservation threat status *does* influence euthanasia decision-making, a sentiment contradicted by those who had attended more than 11 strandings (A2 Fig. 6). This was also evidenced in the LDA which indicated that those respondents attending 11–20 and > 20 strandings were, on average, more likely to disagree that conservation status does influence decisions of euthanasia (A3 Fig. 1). Notably, DOC personnel also appeared conflicted about the role that conservation threat status plays when considering rescue versus euthanasia in stranded cetaceans, with equal numbers of DOC employees both agreeing (41%) and disagreeing (41%) with the statement, alongside a further 18% stating they did not know (Fig. 4).

3.3. Human intervention at strandings

There was consensus that the impacts of human intervention on stranded cetaceans during rescue attempts should be considered (90% agreement, $n = 242$). Notably, most participants (79%, $n = 210$) perceived that human intervention would have a direct impact on the welfare of stranded individuals. This agreement was particularly evident in the LDA for the group that had attended > 20 strandings (A3 Fig. 1). Notably, however, only 57% ($n = 152$) of respondents felt that humans should always intervene at stranding events. Those participants that said intervention should not always occur, primarily represented DOC personnel and observer role groups (Fig. 5), and/or those who had attended 11 or more stranding events.

Over half of the respondents (51%, $n = 138$) were unclear about whether the impacts of human intervention itself were currently considered (A2 Fig. 7). Notably, those that indicated that intervention itself was not currently considered in New Zealand (11%, $n = 29$), had themselves typically attended 7 or more stranding events and/or were scientists or DOC employees.

When focusing on respondents that stated human intervention should always occur ($n = 109$), there was uncertainty as to whether the welfare of animals would benefit (30% agree vs 35% disagree, with 35% uncertain). Those that signalled less stranding experience indicated welfare may improve with intervention. However, 100% ($n = 21$) of respondents who attended 7 or more strandings disagreed that welfare would improve. These respondents notably included DOC personnel, scientists, and experienced responders (A2 Fig. 8).

When considering the same respondents in the context of survival, there was also uncertainty as to whether survival would improve (38% agree vs 20% disagree, with 42% uncertain). Interestingly, 100% of respondents that had attended 7–10 strandings believed survival would

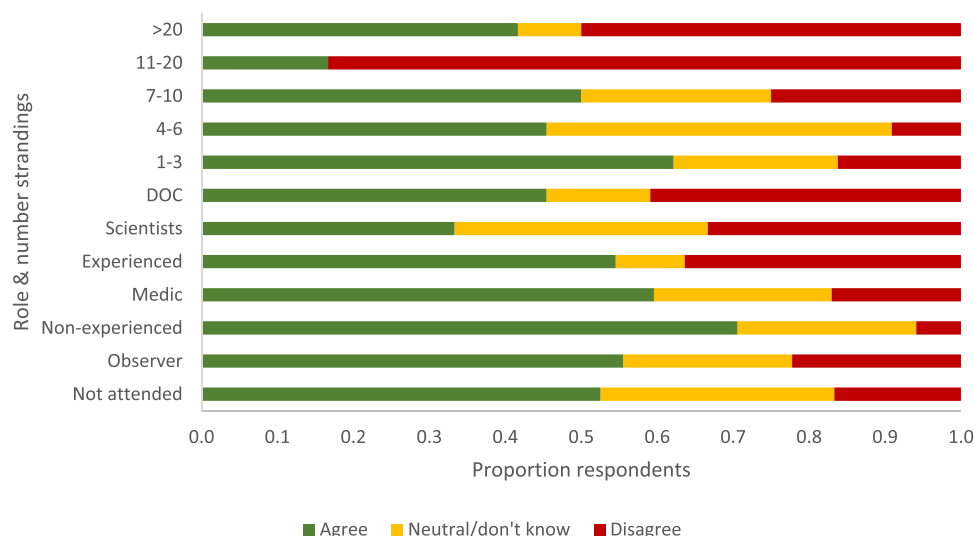


Fig. 1. Opinions of participants ($n = 268$) about whether refloatation should happen without prior health assessment.

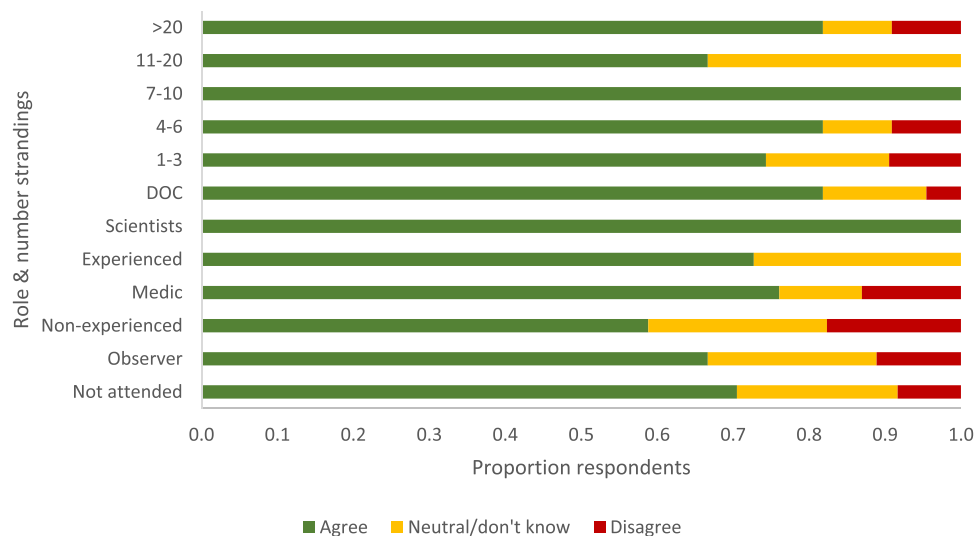


Fig. 2. Opinions of survey participants (n = 267) about whether euthanasia is an acceptable outcome at a stranding.



Fig. 3. Opinions of survey participants (n = 268) about whether animal welfare considerations take precedence over public sentiment when it comes to decisions of euthanasia.

improve, although notably, this was not a statement supported by any of the respondents within the scientist group (A2 Fig. 9).

3.4. Animal welfare and survival at strandings

Despite strong participant views on the need to intervene at strandings, only 19% (n = 50) of respondents believed that animal welfare would improve with human intervention. Notably, these respondents included observers and medics. Generally, the higher the experience level of the responder, the less likely they were to believe that welfare would improve because of human intervention efforts (Fig. 6). However, notably, there was no consensus within roles or number of strandings attended regarding whether cetacean self-refloatation would be more desirable than human intervention (A2 Fig. 10).

While most participants (97%, n = 260) agreed that animal welfare is a critical consideration at stranding events, notably those that disagreed indicated that they had attended between 7 and 20 stranding events (Fig. 7). In contrast, 100% of those attending > 20 strandings, agreed that welfare is critical, a finding further evidenced by the results

of the LDA (A3 Fig. 1). Respondents were also asked whether they think welfare is sufficiently considered at stranding events. Interestingly, there was a general trend that the more strandings a respondent had attended, the more they felt welfare was not sufficiently considered. For example, over half of the respondents (54%) that had attended 7 or more strandings, signalled that welfare is not sufficiently, or known to be, considered in stranding response.

When asked to consider the most important welfare concerns for stranded animals, respondents ranked stress (n = 109), hyperthermia (n = 106) and dehydration (n = 89) as the most important factors (A2 Fig. 11). Notably, the group that had not attended strandings, identified stress followed by dehydration as most important, whereas those that had attended strandings identified hyperthermia followed by stress as the most important welfare concerns (A2 Fig. 12).

Participants suggested that survival was more likely to improve with intervention (26%, n = 70) than welfare (19%, n = 50). Those participants that identified as attending 7–10 strandings and/or self-identified as experienced responders, were most likely to agree that survival would always improve with intervention (Fig. 8). In contrast, no respondents who self-identified as scientists, and few DOC personnel and/or those

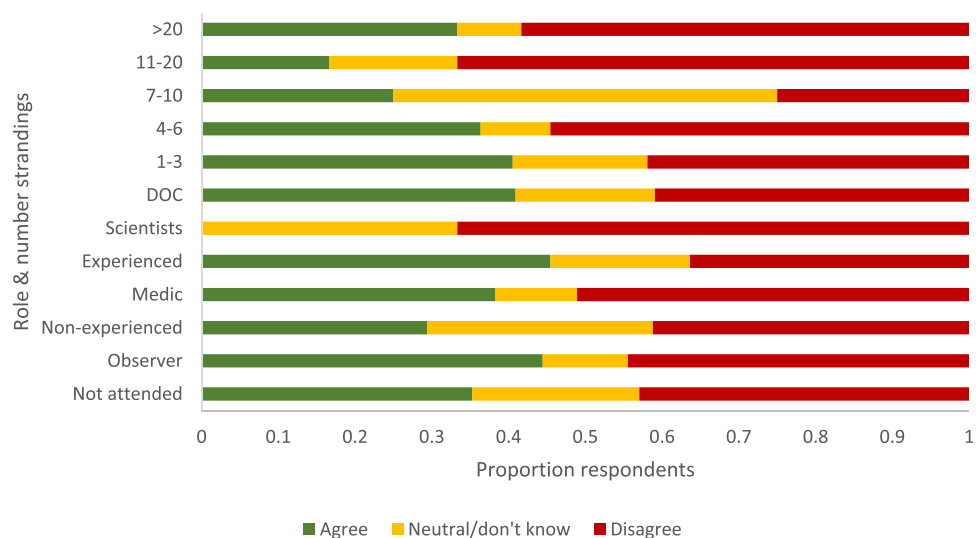


Fig. 4. Opinions of survey participants (n = 268) about whether the conservation status of a species should influence decisions of rescue versus euthanasia.



Fig. 5. Participant opinions (n = 268) on whether humans should always intervene at strandings (either to refloat or euthanise animals).

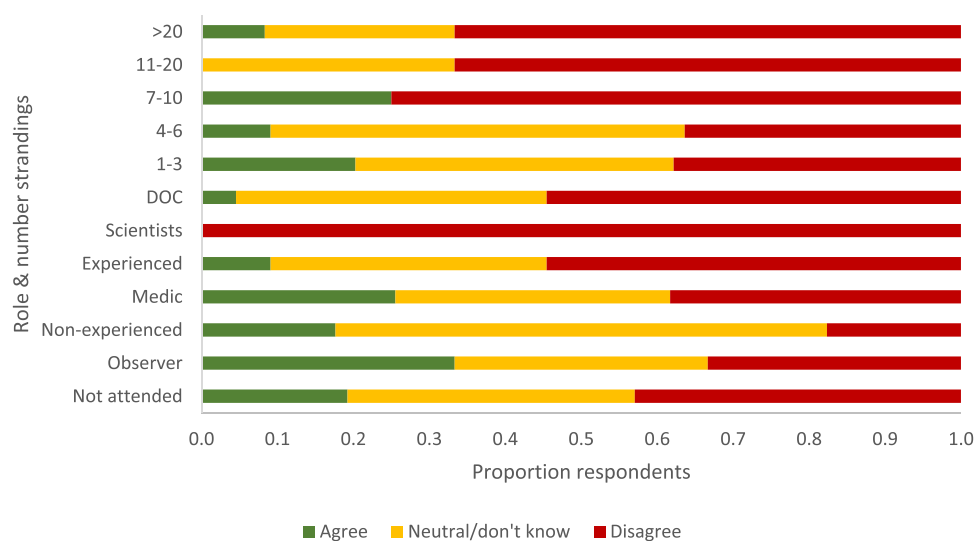


Fig. 6. Participant opinions (n = 268) on whether animal welfare improves with human intervention.

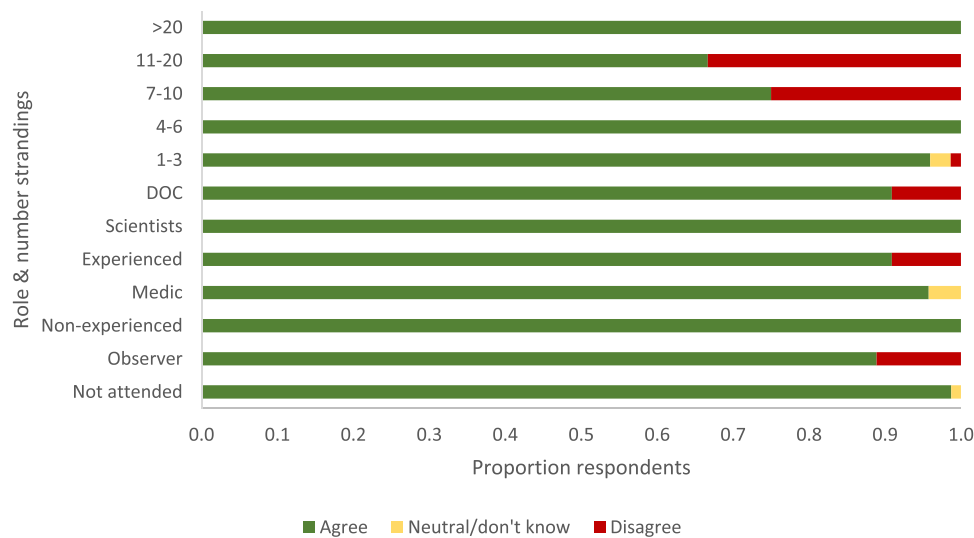


Fig. 7. Participant opinions (n = 268) on whether welfare is critical at a stranding event.

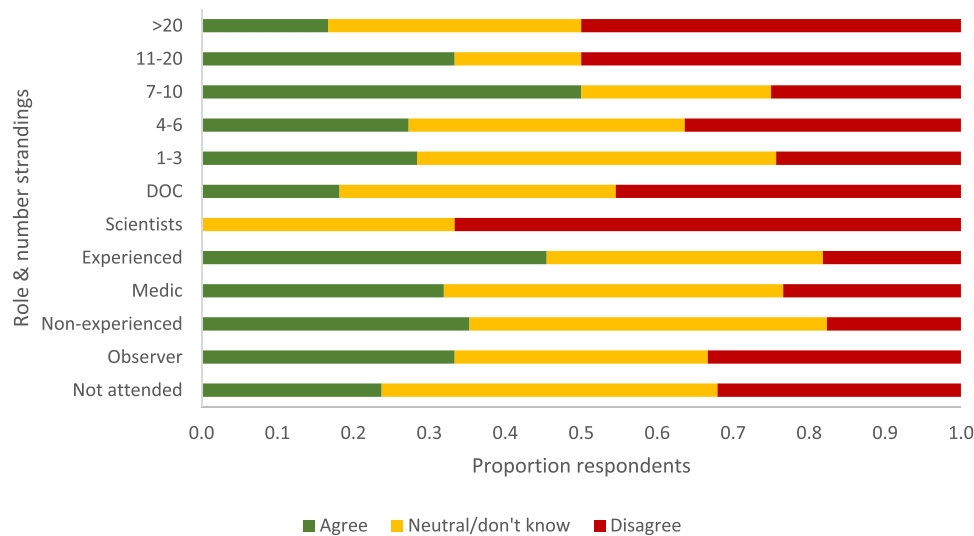


Fig. 8. Participant opinions (n = 268) on whether survival probability improves with human intervention.

that had attended > 20 strandings, perceived survivorship to improve with intervention. When asked whether monitoring rescued animals post-release was necessary, 88% (n = 235) of participants agreed that post-release monitoring should occur to enable an assessment of survival. This agreement was particularly evident in the LDA for the groups attending 11–20 and > 20 strandings (A3 Fig. 2). However, over 50% (n = 141) of participants indicated that they were uncertain whether New Zealand does *currently* monitor refloated animals post-release.

4. Discussion

Our results highlight the importance of considering the human dimension and its impact on decision-making at stranding events. A deeper understanding of human perceptions towards cetacean strandings is important to effectively manage strandings response, including implementing appropriate procedures such as rescue attempts and euthanasia [47]. Furthermore, assessment of public perceptions can provide an indication as to whether management agencies and scientists are successfully communicating animal welfare concerns and the appropriate measures to mitigate these [26,68].

New Zealand has, since records began, experienced frequent and

regular cetacean strandings [69]. In both mass strandings [43] and singleton strandings involving high-profile species, e.g., killer whale (*Orcinus orca*) [49], such events often reach beyond local interest, garnering both national if not international audiences, due to the evolution of social media. This increased exposure to public opinion, and in some cases pressure, may on occasion result in the legislative body responsible for marine mammals deviating from its standard operating procedure in order to address the matter of public antagonism [49].

4.1. Participant demographics

The contrasting demographics of participants in this study, with only 58% having been residents for at least half their life, offers important context to responders of cetacean strandings in New Zealand. Indeed, it is not uncommon to have a significant proportion of responders, especially during mass strandings, comprising international visitors who are alerted to the event only via media. In our study, almost half of the participants (n = 117) had not attended a stranding, thus reflecting non-experienced respondents, as is often observed with public international visitors who commonly attend pilot whale (*Globicephala melas edwardii*) mass strandings during New Zealand's austral summer. However, the

overall responses given by participants who had attended a stranding versus those that had not, were nonetheless remarkably similar in all areas addressed. This similarity may be due to the public becoming increasingly informed about such events, through media reports on strandings, increasingly popular televised programmes relating to the natural environment [46,70] and the ability to become a trained medic.

The sex bias in our respondents (78% female), also reflects a similar female bias noted anecdotally on beaches during stranding events and within marine mammal medic training courses (Project Jonah, *unpub. data*). Similar results have been reported in previous studies including animal rehabilitation workers [71–74], supporting claims that females tend to exhibit higher levels of empathy for animals [75–77] and are consequently more motivated to assist animals in need [78].

While iwi were engaged in this study via DOC liaison officers and the authors directly, we note the low response rate led to minimal representation of their views in this study. This underrepresentation signals an important gap in our understanding of the cultural human dynamic at stranding events [79]. To address this, future work should be tailored to ensure that indigenous views are better represented via in-person interviews.

4.2. Human expectations may influence decision-making at strandings

Most respondents correctly identified DOC as the entity with legal jurisdiction at strandings. However, provisions within the Treaty of Waitangi, do mean decision-making is undertaken in collaboration with iwi. Respondents also stated that New Zealand has an excellent reputation for strandings response. This sentiment is likely due to the high incidence of mass stranding events [43,69] and strandings response which are commonly reported by both national and international media. Despite this consensus, only 20.5% of respondents believed that health assessments are carried out prior to rescue efforts, with most respondents from DOC (50%) and scientists (67%) stating that no such assessments are undertaken.

Although most participants agreed that post-release monitoring should occur, currently, no data on the survival of refloated cetaceans is available in New Zealand, and only minimal data exists internationally [37,80–82]. Consequently, verification of ‘success’ of an outcome of human intervention during strandings response is rare, unless the individual animal is future traced [83–85]. Together with the lack of health or welfare assessments, this indicates that much of the decision-making for strandings response is not typically informed by science, either from a welfare or survival perspective, which poses the question, what drives decisions to rescue over euthanise? This can be especially apparent in cases where expert opinion is not the focus of management actions, as has been evidenced in high-profile events, such as ‘Toa’ a killer whale calf that stranded in New Zealand in 2021 [49]. This contention was highlighted in our study by DOC personnel who appeared conflicted about the role that species threat status plays when considering rescue versus euthanasia.

Respondents stated that the priority at strandings is to maximise survival, whereas minimising welfare concerns was perceived to be considerably less important. This reflects the public desire to rescue, rehabilitate and release [44,47], and notably a lack of understanding of how negative welfare reduces fitness and survival probability [86–88]. Indeed, human interventions to assist wildlife do not always lead to improved conservation, since in some cases, the condition of the animal may not warrant a rescue attempt [28,45].

Notably, 15% (n = 41) of respondents stated that human expectations should be the highest priority at strandings. Indeed, 27% (n = 6) of DOC respondents stated that public sentiments take precedence over animal welfare in decisions of euthanasia. This consideration around the welfare implications of public sentiment regarding euthanasia was also highlighted in a recent study [49], where a reason for not undertaking euthanasia of stranded cetaceans in New Zealand was where “significant antagonism” between DOC and Māori and/or the public was likely.

Despite a limited sample size, our results indicate further work should be considered within DOC to clarify what drives the current disparity in some of the responses provided. Specifically, a conflict of opinion among DOC staff is evident in our study. Do such conflicts represent personal viewpoints only or does the antagonism clause within the current standard operating procedure explain aspects of this disparity?

The influence and importance of public opinion when undertaking decision-making for conservation initiatives is well documented [4,13,14,20]. In such studies, communication and participation are highlighted as factors crucial to ensure public support of management activities. We suggest that the uncertainty and contradicting opinions of decision-making highlighted in our study, could be addressed by improving dialogue between scientists, managers, iwi, and the public, to ensure that strandings response options and the related animal welfare outcomes are fully considered. In many cases, increasing public support to undertake euthanasia, which ordinarily may be viewed negatively, will require ongoing education and engagement of all interested parties, particularly the public. Such educational engagement and outreach have been a key focus of Predator Free New Zealand 2050 initiatives around pest eradication [89,90] and should be considered as an exemplar of where otherwise, human perceptions would not support the wider conservation standpoint of New Zealand.

4.3. Experience affected the perception of human intervention at strandings

Respondents identified that the impacts of human intervention on cetaceans during strandings remain unclear, though maintained that people should intervene to assist regardless. Respondents also acknowledged that despite intervention, welfare and survival would not necessarily improve. This indicates that although there is an innate response for humans to intervene, most participants were either unsure or did not think that their actions would necessarily result in a positive effect for the animal. When assessing if humans should always intervene, polarised views were also evident between DOC personnel and trained medics. While consensus was absent within most self-defined role groups, experienced responders generally were less likely to agree that humans should always intervene (be that to rescue or to euthanise). These results call into question what drives human intervention if indeed, respondents do not believe such interventions improve either the welfare or survival of stranded animals.

The instinctive response of humans to intervene with wild animals that appear to be in difficulty, likely resonates from wildlife being widely televised and thus promoting emotional connections [91–93]. This can lead to perceptions that can potentially place both humans and wildlife at risk by encouraging unrealistic expectations concerning the rehabilitation and release of wild animals. For example, the euthanasia of pre-weaned sea otter (*Enhydra lutris*) pups has been highly controversial for the US public, despite available data suggesting individuals are unlikely to be successfully released [47]. Similar contentious decision-making has been considered a serious welfare issue in other wildlife examples, where non-viable animals have been released as opposed to euthanized as a consequence of conflicting opinions [45,48]. Such exemplars highlight the importance of clear messaging around the advantages and disadvantages of different management interventions.

Understandably, people often do feel a sense of responsibility toward the welfare of wild animals, and this can be the rationale for their participation in rescue attempts [29]. This is especially poignant in cases where the incident has been human-induced, such as an oil spill [30,94] or entanglement [95]. Increasing media coverage of such events also likely increases the public’s sense of responsibility toward affected animals. Furthermore, it has also been noted that species perceived as endangered or iconic, will often attain higher ‘rescue’ rates when in danger [29]. As charismatic megafauna, cetaceans subsequently attain significant public engagement and emotive responses accordingly, which in some instances, may consequently lead to welfare compromise

[49].

4.4. Participants did not perceive animal welfare and survival at strandings to be connected

An unexpected result highlighted by our study was that responders attending between 7 and 20 strandings were more likely to state that welfare is not critical at strandings. Similarly, these respondents further stated that welfare would not improve with human intervention. Such responses bring into question whether attending many stranding events causes complacency about welfare concerns? If so, does such reduced attention to welfare occur because of focused goals to 'save' as many animals as possible, in the hope of increased survival outcomes? While this appears plausible, especially in mass stranding events, that hypothesis is not supported by this study. For example, these high-level experience responders also stated health assessments should be undertaken before refloatation and were also accepting of euthanasia as a stranding outcome. Such health assessments and the option of euthanasia relate of course, to the welfare of animals and not just their long-term prognosis [45,47,96].

Overall, our findings indicate both misperceptions and/or possible cognitive dissonance among respondents when considering animal welfare at stranding events. Cognitive dissonance, whereby a person's actions do not align with their stated beliefs [97], is not uncommon in human-animal interactions [93,98,99]. Interestingly, Engel et al. [99] suggested that more experienced veterinarians were increasingly likely to engage in compensation mechanisms, such as resigning to scientific justification, when animal welfare was compromised in laboratory settings [99]. However, if this indeed explains the disparity of views revealed in our study remains unclear, although certainly plausible.

It is particularly interesting to compare the conflicting perceptions of how welfare and survival are affected by human intervention, and how such views differ between self-defined role groups and levels of experience. Specifically, while most respondents indicated that welfare would not be improved by intervention, more did expect human assistance would improve survival probability. As the literature demonstrates, welfare and survival are inextricably linked [67,88,100], with fitness parameters decreasing significantly with poor welfare [86,87,101,102]. This apparent mismatch highlights why welfare, including health assessments, need to be aligned when considering survivorship probability in conservation initiatives [22,88].

Interestingly, most respondents (88%) stated that post-release monitoring of stranded cetaceans should occur to enable an assessment of survival, although over half of the respondents were unsure whether such assessments currently occur in New Zealand. Currently, the success of intervention and the fate of refloated individuals in New Zealand cannot be empirically evaluated, as post-release monitoring is not routinely conducted. However, the importance of such data has been highlighted in Cape Cod, Massachusetts, USA where tagging of stranded cetaceans is routinely undertaken by the International Fund for Animal Welfare (IFAW) veterinarians and biologists. In this area, post-release data inform decision-making by providing an improved understanding of survival and critical information on prognostic indicators for future strandings [37,103]. The collection of such data in New Zealand would potentially address the critical lack of empirical information regarding the long-term success of human intervention efforts for wildlife [29,36,67].

The major welfare concerns highlighted by respondents were stress, hyperthermia, and dehydration. Notably, even those respondents that had not attended stranding events, suggested that stress was the major concern for stranded cetaceans. These align with expert opinion on stranded cetaceans [67] and human perceptions about other compromised wildlife [28] and confirm that humans perceive these animals to undergo stress due to being in an atypical environment. Such stress would likely be further compounded at stranding events involving human intervention, since potentially these animals may even perceive

human interactions as threatening [104].

While concern for the welfare of cetaceans has sparked international interest [44,46,47,105], there continues to be a lack of empirical evidence to support most human intervention procedures during cetacean strandings response. Nonetheless, all human intervention procedures should be undertaken objectively, in accordance with scientific principles, ethics, and evidence to support the best possible outcomes for stranded cetaceans [27].

Previous studies have highlighted the value of rescue and rehabilitation programmes for educational purposes [71], and to increase support for conservation programmes [47]. However, intervention attempts may also lead to inappropriate ideas and increased expectations from the public regarding our ability to 'rescue' wild animals [48]. Improved public messaging around human interventions, including all possible outcomes, is critical to ensure that the most appropriate management actions are realised. Management options should remain animal versus people centric in their focus.

4.5. Study considerations

Our study utilised a non-targeted approach to collecting responses to capture a broad overview of the perceptions across all parties interested in stranding events. Our approach targeted a diverse array of respondents, from the general public to personnel working for the management agency responsible for stranding events in New Zealand. As the survey was anonymous, participants also self-declared their experience level and role at strandings. This approach can lead to bias, particularly where strong opinions may exist.

We purposefully did not provide definitions for terms such as "welfare", "survival" or "conservation", specifically to avoid influencing participant responses. However, that does mean respondents may have conceptualised these terms from differing views points. Accordingly, this may have affected the level of importance/concern assigned by participants to specific factors (e.g., undertaking health assessments prior to refloatation). Future studies should explore these fine-scale nuances in further detail.

5. Conclusion

Our study has highlighted how human cognitive dissonance may affect both the welfare and survival of stranded cetaceans. The pivotal role that human perception plays, with some respondents ranking public sentiment about euthanasia above that of either animal welfare or survival probability, is problematic from an animal welfare and conservation management stance. Furthermore, this highlights the extreme pressure field officers in New Zealand experience when acting as decision-makers during stranding events. Considering the findings presented here, we recommend future work explore a wider set of methods and approaches, including focused one-on-one interviews, to provide a more in-depth understanding of ecological, social, and cultural perceptions, and unpack themes identified within the management agency responsible for New Zealand's marine mammals.

Furthermore, we recommend that improved public education and transparent policies be developed to better consider animal welfare in strandings management. A key priority should be to explore indicators of animal welfare state and likely longer-term survival that could provide empirical evidence to inform decision-making. Such indicators could then be unambiguously assessed and transparently discussed with all interested parties, to ensure appropriate interventions. For policy-makers and managers to improve conservation outcomes, tools are needed to help guide and balance public expectations alongside animal welfare considerations.

Funding

The Bob Kerridge Animal Welfare Fellowship (2018–2019), Royal

Society Te Apārangi Rutherford Discovery Fellowship (2019–2024) and Animal Ethics Inc (2019–2020) awarded to Karen A Stockin. Rebecca M Boys was supported by an Association of Commonwealth Universities Doctoral Scholarship.

Ethics/permits

This project was evaluated by peer review and assessed to be low risk according to criteria set by Massey University Human Ethics Committees (Human Ethics Notification: 4000020102).

CRediT authorship contribution statement

Karen A. Stockin: Conceptualization, Methodology, Validation, Project administration, Formal analysis, Investigation, Resources, Writing – original draft, Writing – review & editing, Funding acquisition. **Matthew D.M. Pawley:** Validation, Formal analysis, Investigation, Writing – review & editing. **Rebecca M. Jarvis:** Methodology, Writing – review & editing. **Rebecca M. Boys:** Methodology, Validation, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

Data availability

Data will be made available on request.

Acknowledgements

We thank Katie Moon for suggestions and comments on the draft questionnaire and analysis direction. Additionally we thank two participants who provided feedback on an earlier version of the questionnaire. We are grateful to all respondents that participated in the questionnaire, as well as Auckland Whale and Dolphin Safari, Project Jonah and Department of Conservation Te Papa Atawhai New Zealand who circulated the questionnaire directly to specific relevant/interested parties.

Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.marpol.2022.105283](https://doi.org/10.1016/j.marpol.2022.105283).

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