

Article

# Diving Deeper into Wreck Diver Motivations and Attitudes

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**Abstract:** Increased demand by dive tourists for high-quality underwater wreck sites requires managers to balance heritage conservation and tourism at these vulnerable sites to ensure quality diving experiences while protecting underwater cultural heritage. Integral to effective management is a comprehensive understanding of wreck diver characteristics, motivations, and attitudes. This paper reports the outcomes of an international survey of 724 wreck divers including demographics, dive experience, motivations to wreck dive and attitudes to underwater cultural heritage protection. Wreck divers are motivated to see historic shipwrecks, artefacts, and marine life. Most are generally supportive of management controls to protect underwater cultural heritage. Conceptual models of wreck divers' motivations and attitudes were developed to illustrate nuanced complexities in motivations and attitudes, which can inform management strategies to support operational decisions and destination marketing.

**Keywords:** scuba diving; wreck diving; motivation; attitudes; preferences; shipwrecks; protection of underwater cultural heritage; recreation management; tourism management



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## 1. Introduction

Recreational scuba diving developed from the mid-1940s, when equipment became more reliable and accessible to the general public [1]. Since the 1940s, the dive industry has grown substantially to become a multi-billion dollar industry. As a result of the dive community being active and mobile, dive tourism has become significant to many local economies and now forms an important part of the global tourism industry [1–5].

Increased interest in, and demand for, wreck diving has corresponded with the growth and maturation of the dive industry and improvements in technology. Wreck diving is a specialized type of scuba diving that typically involves the exploration of shipwrecks and submerged aircraft (aircraft wrecks). It can also include the exploration of submerged vehicles, such as train carriages, cars and trucks, and machinery [6,7]. Wreck diving offers more diverse and challenging diving experiences, which divers seek as their level of skill and experience rise [3,8].

Shipwrecks have, therefore, become important recreational and tourism resources. They are also important components of underwater cultural heritage, and use of shipwreck sites by divers can diminish their cultural heritage, tourism, and recreation values [9]. The increase in volume of divers visiting shipwrecks has seen an increase in adverse impacts on these sites, particularly those with high levels of visitation. The impacts associated with recreational scuba diving include boat anchor and mooring damage, impairment of site integrity and stability (including removal of artefacts), the effects of unintentional and intentional diver contacts with wrecks, and the effects of divers exhaled air bubbles coming into contact with wrecks. These impacts are described in detail in Edney [3,9].

Shipwrecks are fragile, non-renewable, and finite resources [10–12]. Effective management of shipwreck sites is, therefore, essential if their cultural heritage, recreation, and

tourism values are to be protected [4,9]. Adverse impacts on the marine environment associated with recreational use are known to be greater when managers do not understand recreational user groups' preferences and attitudes towards various management strategies that may be used to manage these impacts [13]. Understanding the divers visiting shipwrecks is therefore crucial to the effective management of these sites. More effective management of sites can be achieved when managers understand the characteristics and motivations of the groups using sites and their attitudes to management rules because it enables a better balance between management objectives and access to sites to be achieved [4,13,14].

There is now a substantial and growing body of literature about general scuba divers, however, literature specific to wreck divers is sparse. Wreck divers are a special interest group of divers, and as such, differ from general scuba divers. Until recently, the literature only contained one example of research specific to wreck divers, Holecek and Lothrop's [15,16] study, which examined the demographics, behavior, expenditure patterns and attitudes towards government regulation of underwater resources of wreck divers in the Great Lakes region of the United States. This study found a predominance of young people (63% aged 21–30) and males (86%), with high levels of income. Observing wrecks was overwhelmingly the most important activity to these divers (85%), followed by "treasure/trophy" (30%), photography (27%), and research (19%). There was a high level of support (around 85%) for the need for some level of management controls to prevent items being removed from the wrecks. However, this study is dated, based on a small sample size and is focused on cold, freshwater wreck diving, and of limited relevance today.

Other more recent studies of wreck divers are Edney's [17] study of wreck divers at Chuuk in the Federated States of Micronesia (survey administered in 2009), and Edney's study of Australian wreck divers (survey administered in 2010), reported in Edney [18,19] and Edney and Spennemann [20,21]. Both studies focused on wreck diver demographics and dive experience, motivations for wreck diving, and wreck diver attitudes to a range of management controls commonly used to manage diver impacts to shipwrecks. These studies found that wreck divers were predominantly male, middle-aged, with high levels of education and income, and highly experienced divers. Their primary motivations for wreck diving were to see marine life, historically significant shipwrecks and artefacts, and to enjoy the peace and tranquility of the underwater environment. Most wreck divers supported some management controls, including invasive controls. These included the use of penalties for removing items from wrecks, the need for permits and special certifications to dive certain shipwrecks, and the use of dive guides to control diver behavior. Motivations and attitudes were found to be moderated by demographic variables and level of dive experience, indicating diversity within the wreck diving community.

These recent studies have provided some baseline data that can assist managers when developing management strategies for sites visited by divers. However, it is only a starting point. More research is required to gain a more comprehensive understanding of wreck diver motivations and attitudes. It needs to encompass a wider range of wreck divers and diversity within the wreck diving community. Understanding diversity within recreational user groups is advantageous for managers because management decisions based on the average participant are likely to overlook the needs of many in the group [22].

Understanding diver motivations informs heritage managers of the types of experiences sought and preferred by divers and provides insights into the effects management decisions may have on diver experiences, enabling these factors to be accommodated in management strategies. A clear understanding of diver attitudes to management controls is also advantageous for heritage managers because it enables them to understand the likely acceptance or opposition to management rules at sites. These insights allow managers to gauge likely levels of voluntary compliance with these rules by divers. Shipwrecks are challenging to monitor due to their location, and costs of enforcement and surveillance are high [9,23–25]. Therefore, maximizing voluntary compliance is beneficial and likely to achieve more effective site management. It is also desirable from a recreation man-

agement perspective, because allowing divers more freedom at sites can deliver higher quality diving experiences [9,26–28]. This information is also relevant to dive and dive and tourism operators and planners because it enables them to offer experiences more closely aligned with wreck diver aspirations and can inform the marketing and promotion of dive opportunities.

The aim of this study was to gain a comprehensive understanding of wreck diver characteristics, motivations, and attitudes to assist heritage managers balance underwater cultural heritage protection and diver access to high-quality diving experiences. The two study objectives were: (1) identify wreck diver characteristics and (2) to examine and critique wreck diver motivations and attitudes. The empirical focus of the research was the Asia-Pacific region.

## 2. Materials and Methods

### 2.1. Sampling and Recruitment

Recreational wreck divers were surveyed between 9 October 2013 and 3 December 2015 using a self-completed web-based questionnaire administered via SurveyMonkey® and Qualtrics. The target population for the survey were significant source populations of wreck divers known to visit wreck diving destinations in the Asia-Pacific region, i.e., Australia, China, Japan, South Korea, Russia, and the United States. As such, the survey was available in five languages, i.e., Chinese, English, Japanese, Korean, and Russian. Divers from other nations, however, were not prevented from participating.

Non-probability sampling techniques were used to recruit participants. Links to the survey were sent to dive operators, dive clubs, and individuals, who were encouraged to participate and requested to forward the link to other wreck divers (snowballing). Dive operators and clubs were identified through internet searches and word of mouth referrals. Information about the survey and links to the survey were posted on a number of international and Australian online dive forums and diver-related Facebook pages. The survey was also promoted by word of mouth to divers and other dive researchers, who were encouraged to participate and forward the link to other wreck divers.

### 2.2. Survey Structure and Content

The survey covered three main areas: diver profiles, which included demographics (six questions) and dive experience (three questions); wreck diving profile, wreck diving frequency (one question) and motivations (one question with 14 parts); and, attitudes to underwater cultural heritage protection, i.e., shipwrecks (one question with nine parts). Closed questions with multiple choice checklists were used for the diver profile and wreck diving frequency questions. Five-point Likert-types scales were used to rate relative importance or level of agreement with the statements in the remaining sections of the survey. These questions also included a “do not know” option to prevent false or unreliable responses from participants who did not hold an opinion or whose views did not accord with the options presented (these responses were excluded from analyses). The survey was open to all divers, and wreck divers were screened from non-wreck divers by a question at the start of the survey.

The questions used in the diver profile were adapted from other scuba diver surveys, including Davis [29–35]. The questions about management of underwater cultural heritage were derived from the range of management strategies used by heritage managers and dive operators throughout the world, some statements adapted were derived and adapted from Holecek and Lothrop [15,16] and Todd et al. [36], and based on the experience of the researcher [17,18].

### 2.3. Ethics

This research was conducted in accordance with the Charles Sturt University Human Research Ethics approval (2012/202), where the study commenced. Then, it was conducted under Southern Cross University Human Research Ethics approval (ECN-15-005 and ECN-

16-008), where the study was completed. Participants were required to be 18 years of age or older, and their participation was voluntary. Informed consent was obtained from all participants. Ethics approvals permitted the collection of IP addresses. This was to enable any incidences of multiple survey responses from a single IP address to be detected. This would suggest a single individual had made multiple responses to the survey, and such practices can distort survey results. The collection of IP addresses did not allow identification of individuals, ensuring that participants remained anonymous.

#### 2.4. Data Analysis

The survey data were exported from SurveyMonkey<sup>®</sup> and Qualtrics to the Statistical Package for the Social Sciences (SPSS Statistics 24), and this software was used to analyze the data. Descriptive and non-parametric inferential statistical analyses (Chi square and Kruskal–Wallis test) were undertaken to investigate differences between groups. The significance threshold for Chi square analyses and Kruskal–Wallis tests were set at 0.05. Actual  $p$  values that were  $<0.05$  were reported, unless they were below 0.001, and in these cases, they were reported as  $p < 0.001$ . In addition, not reported were cases where the  $p$  value was significant but the pairwise comparison follow-up analyses showed no significant differences (Kruskal–Wallis test). Due to small sample size, three countries of residence were excluded from inferential statistics: China ( $n = 4$ ), South Korea ( $n = 4$ ), and Russia ( $n = 10$ ).

### 3. Results

A total of 754 survey responses were received from wreck divers, and of these, 724 responses were included in the analysis. Thirty responses were excluded because they were cases of multiple responses from a single device. The vast majority (89%) of responses were from a single device, 10.5% represented cases of two responses from a single device, and the remainder included two cases of three responses from a single device (Appendix B). All of these responses were retained for analysis. It was considered acceptable for up to three responses to be received from a single device because this would be reasonable from a single household. Additionally, the low number of occurrences of three responses from a single device meant it was unlikely to affect the integrity of the data. There was one case where four responses were received from a single device, and in this case, the first response was retained as the respondent had made a note that the later three responses were made so that a copy of the survey could be made for discussion purposes.

#### 3.1. Diver Profiles

The demographic profile of the participants is presented in Appendix C. Almost three quarters (74.3%) were male and 25.7% female. More than two-thirds (67.5%) were aged between 35 and 64 years and almost half (46.4%) were aged between 35 and 54 years. Two-thirds of participants held an undergraduate or graduate degree (Bachelor or higher degree). Around 40% of participants were from the United States, just over a quarter (25.8%) from Australia and over a quarter (26.8%) from countries not specifically listed in the survey. One-third of this group was from Canada (i.e., 8% of wreck divers) and almost one quarter from Europe (around 6% of wreck divers). These results are presented in Figure 1.

The dive experience profile of the participants is shown in Appendix D. Survey participants were experienced divers with high levels of dive certification. Almost half (45%) had completed 500 or greater dives and over a quarter (27.5%) had completed 1000 or greater dives (Figure 2). More than two-thirds (65.1%) held certifications above the level of Advanced Open Water Diver, one-third held leadership certifications (i.e., divemaster, instructor or master instructor) and almost one quarter (23.8%) had technical diving certifications as their highest level of dive certification (Figure 3). Just under 5% held entry level (Open Water) level certification. Almost half (45.5%) had been diving for

10 or less years, and more than one quarter (26.7%) had been diving for 5 or less years (Figure 4).

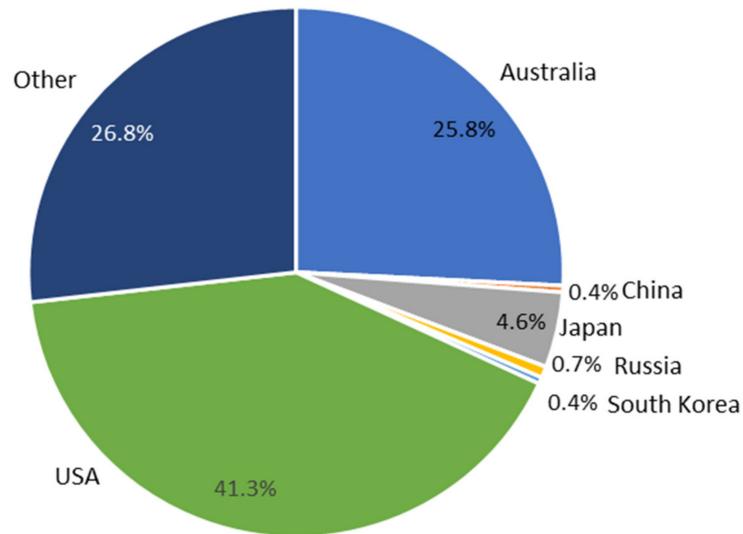


Figure 1. Country of residence.

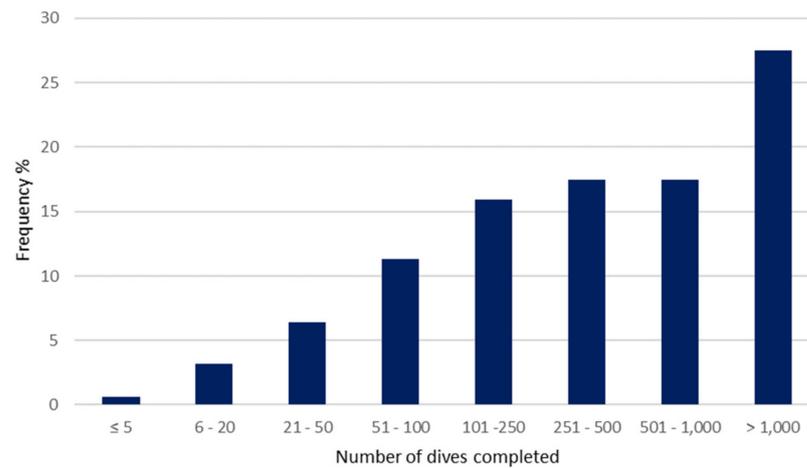


Figure 2. Number of dives completed.

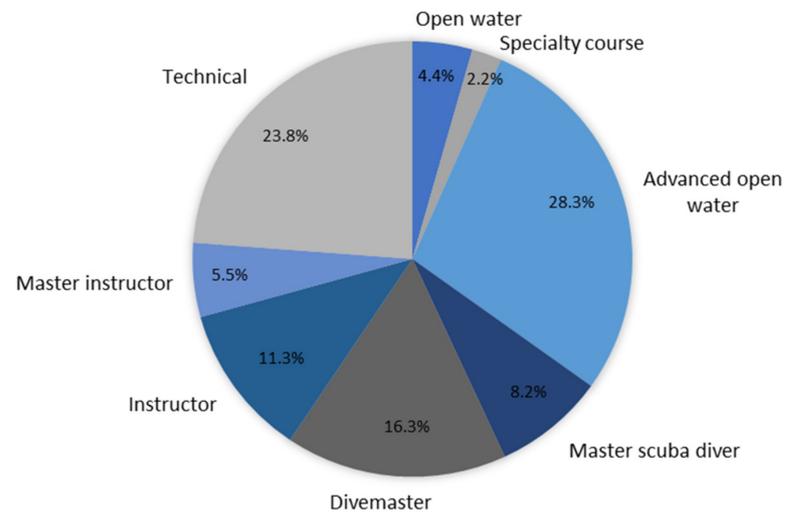


Figure 3. Highest level of dive certification.

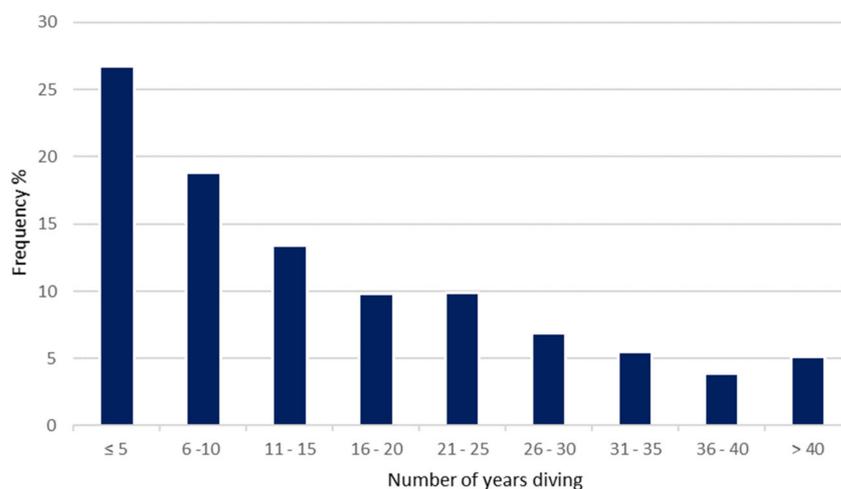


Figure 4. Number of years diving.

### 3.2. Wreck Diving Profile

Just over a third (34.1%) of participants frequently dived shipwrecks, almost half (44.8%) wreck dived occasionally, 11.9% rarely wreck dived, and 9.2% had dived wrecks on five or fewer occasions (Figure 5 and Table S1).

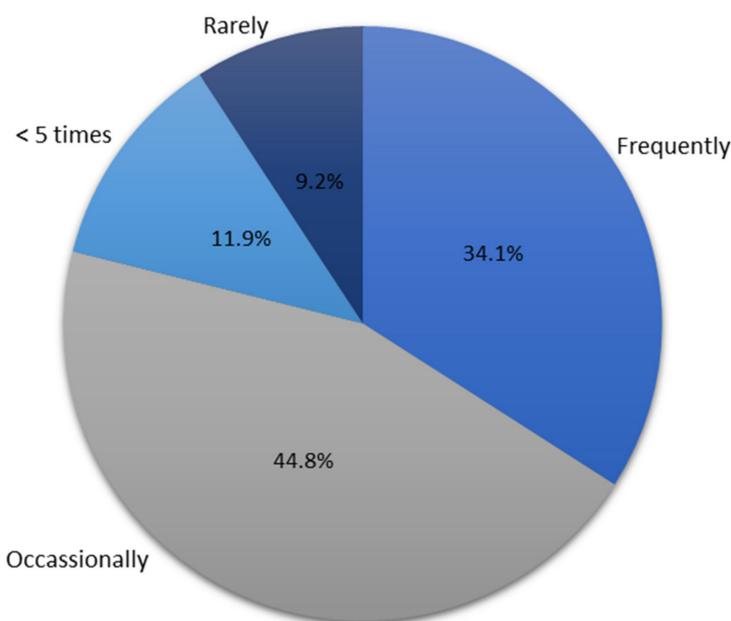


Figure 5. Frequency of wreck diving.

When the means of all responses were compared, the top four motivations for wreck diving were seeing historically significant shipwrecks (mean 3.99), marine life (3.94) and artefacts (3.82), and enjoying the peace and tranquility of the underwater environment (3.78) (Appendix E). Motivations were grouped into four thematic clusters: environmental, history/heritage, structure/technology, and treasure hunting (adapted from Edney and Spennemann [20]). Half of the top four motivations for wreck diving were from the history/heritage cluster and the other half were from the environmental cluster. All but two of the motivations scored relatively highly, with means greater than three, indicating all of these motivations were important to wreck divers. Notably, the least important motivations for wreck diving were collecting artefacts and fittings (1.78) and searching for artefacts and fittings (2.71), both from the treasure hunting cluster.

Statistically significant differences were found in motivations to wreck dive related to frequency of wreck diving and diver profile variables. Frequency of wreck diving had the most influence, followed by level of dive certification and gender. Level of dive experience (i.e., number of dives completed and years diving experience) and country of residence also moderated motivations to a lesser degree (Table S2). The key differences are summarized in Table 1.

### 3.3. Attitudes to Underwater Cultural Heritage Protection

Management controls aimed at the protection of underwater cultural heritage (shipwrecks) were grouped into clusters based on the relative level of control or restriction: high, moderate, and low (Appendix ??). The high restriction cluster includes invasive and highly controlling management actions. The moderate cluster includes management actions that are controlling but to a lesser degree than those in the high cluster. The low cluster includes management actions often referred to as indirect, such as information, education and no restrictions. A final cluster, knowledge, is about the level of knowledge divers have about the effect their actions can have on the impairment of cultural heritage values (site integrity). Only two management controls received convincing levels of support: "harsh penalties should be imposed on some divers who take things from wrecks" (mean 4.00) and "divers should be required to have permits to dive some wrecks" (3.31). The lowest scoring controls were that "wrecks (except artificial reef wrecks) should be protected from all visitation" (1.46) and "moving artefacts around on a wreck site is okay so long as the artefacts remain at the wreck site" (1.60). The low ranking and mean (1.69) value of "there should be no controls on what divers do on wrecks" suggests in principle support for management controls generally.

Statistically significant differences were found between diver profiles and frequency of wreck diving and wreck divers' attitudes to management controls. The variables that had the most influence were frequency of wreck diving, country of residence, and gender. Level of dive experience also influenced attitudes (Table S3). The key differences are summarized in Table 2.

**Table 1.** Motivations to wreck dive: summary of key differences (from [37] (p. 300)).

Diver Profile Variable	Cluster											
	History/Heritage			Environmental			Structure/Technology		Technique/Challenge		Treasure Hunting	
	Seeing Historically Significant Shipwrecks	Seeing Artefacts	Researching and Learning	Seeing Marine Life	Clear Water	Peace and Tranquility	Observing Effects Time (Decay)	Complexity and Size	Explore and Discover Machinery and Fittings	Wreck Penetration	Searching for Artefacts	Collecting Artefacts
More frequent wreck divers	✓	✓	✓				✓	✓	✓	✓	✓	✓
Less frequent wreck divers				✓	✓	✓						
Technical divers	✓	✓	✓					✓	✓	✓	✓	
Leadership certifications			✓		✓		✓			✓		
More experienced wreck divers										✓		
Less experienced wreck divers				✓	✓	✓						
Males	✓	✓						✓	✓	✓	✓	
Females				✓	✓	✓						
Australia (resident)										✓		
Japan (resident)	✓	✓			✓	✓						
The United States (resident)				✓								✓

Key: ✓ more agreement; Note: This table summarizes key differences from Table S2.

**Table 2.** Attitudes to management controls: summary of key differences (from [37] (p. 304)).

Diver Profile Variable	Level of Restriction Cluster							
	High			Moderate			Low	
	Penalties	No Visitation	Permits	Special Certification	Some Wrecks Off-Limits	Dive Guide	Briefing	No Controls
More frequent wreck divers	×	×	×		×	×	×	
Less frequent wreck divers	✓	✓	✓		✓	✓	✓	
Technical divers	×				×	×		
Leadership certifications	✓			✓		✓		
More experienced divers			×	×	×	×		✓
Less experienced divers			✓	✓	✓	✓		×
Males	×	×	×		×	×		
Females	✓	✓	✓		✓	✓		
Japan (resident)	✓		✓	✓		✓	✓	
Australia (resident)	✓			×	×	×		
The United States (resident)	×		×	×		×		✓
Other countries (resident)	✓			✓	✓		×	×

Key: ✓ more agreement; × less agreement; Note: This table summarizes key statistically significant differences from Table S3.

#### 4. Discussion

The majority of wreck divers in this study were male, aged between 35 and 64 years and held an undergraduate or graduate degree. The largest segment of participants lived in the United States, followed by Australia. The gender ratio was similar to other recent studies of wreck divers and the age profile was consistent with Australian wreck divers, while levels of tertiary education were more consistent with the Chuuk survey [17–19].

Wreck divers in the current study were experienced divers with high levels of certification. Almost half had completed more than 500 dives and had been diving 10 or fewer years. More than two-thirds held certifications above the Advanced Open Water diver level, one-third held leadership certifications, and one quarter were technical divers. There were similarities in the number of dives completed and years diving experience between all recent studies of wreck divers. Certification levels were broadly similar, although the wreck divers at Chuuk had a higher proportion of leadership certifications. The Chuuk and Australian wreck diver studies did not record technical diving certifications [17–19].

Seeing historically significant shipwrecks, marine life and artefacts, and enjoying the peace and tranquility of the underwater environment were the highest motivations for wreck diving. These findings were similar to those of the other recent wreck diver studies. The history/heritage and environmental clusters featured in the top three motivations of all studies. Seeing historically significant shipwrecks was the top motivation in this current study and the Chuuk study. The top five motivations in the current study were the same as those in the Australian wreck diver study and the top three were consistent with the Chuuk study, although the rankings differed. Importantly, common to all three studies were the rankings of the least important motivations, both in the treasure hunting cluster. Collecting artefacts was ranked lowest and searching for artefacts second lowest. This consistency is encouraging for heritage and tourism managers, as it indicates that treasure hunting activities are not the focus for the majority of wreck divers and are only important to a minority of wreck divers [17–19].

The current study found that motivations were moderated by frequency of wreck diving and dive profile variables. The most influential were frequency of wreck diving, level of certification, and gender. Country of residence and level of dive experience (i.e., number of dives completed and years diving) influenced motivations to a lesser degree. These findings were generally consistent with the Australian and Chuuk studies [17–19], which found gender, age, country of residence, and level of dive experience moderated motivations, and attitudes. These studies also found that seeing marine life was more important to female wreck divers. Searching for artefacts along with the more challenging, technical, and mechanical aspects of wrecks, including wreck penetration, exploring machinery and fittings, and the size and complexity of a wreck, were of more importance to male divers.

Wreck divers indicated in principle support for the protection of shipwrecks. The majority of wreck divers, however, only supported two management controls: the use of penalties (high restriction) and permits (moderate restriction). Notably, preventing access to sites was not supported, suggesting that while there is in principle support for the protection of sites, divers want access. These findings are consistent with the Australian and Chuuk studies [17–21]. Other notable findings were that two controls commonly used to manage diver underwater behavior, i.e., the use of guides and pre-dive briefings, received low levels of support. Both of these strategies are used at a number of dive locations throughout the world. Dive guides have been found effective in reducing diver impacts on reefs [38–40] and pre-dive briefings have been found effective in reducing diver impacts on the marine environment [38–43]. These findings do not necessarily indicate opposition to dive guides and pre-dive briefings per-se, rather it indicates skepticism about their effectiveness in managing diver behavior. It also demonstrates that wreck divers' perceptions about the effectiveness of dive guides and pre-dive briefings differ from research findings in the literature about their effectiveness in reducing diver impacts.

Attitudes were moderated by wreck diver profile variables and frequency of wreck diving. The variables that had the most influence were country of residence, frequency of wreck diving and gender. Level of dive experience and certification also influenced attitudes, although to a lesser extent. These findings were similar to those of recent wreck diver studies, which found that wreck diver attitudes were moderated by country of residence, gender, and age. Australian wreck divers had higher levels of support for the use of special certifications and permits than their North American counterparts, and female divers were more supportive of the use of dive guides to control diver behavior than were male divers. Older and more experienced wreck divers were less supportive of management controls generally, than younger and less experienced divers [17–21]. A more detailed analysis of the similarities and differences between the recent studies of wreck divers is described in Edney [37].

The consistency of results between this current study and those of recent wreck diver studies indicate that the findings of the current study are a good reflection of wreck diver profiles, motivations, and attitudes more broadly.

#### *4.1. Wreck Diver Motivations Model*

The motivations discussed above and presented in Appendix E represent aggregated data, useful for gaining a broad understanding of the preferences of the majority of wreck divers, or the “average” wreck diver. Aggregated data, however, does not take into account the complexities in wreck diver motivations, resulting from diversity within the wreck diving community.

Understanding this diversity is beneficial. It enables heritage managers and dive and tourism operators to readily determine the types of experiences sought by and more popular with key segments of the wreck diving community. It allows site managers to better assess the effects of different management strategies on different segments of this community and provides opportunities for these factors to be taken into consideration when developing management strategies. Dive and tourism operators can use these data to identify preferences of different segments of the wreck diving community, to inform the choice of dive experiences offered to clients, and in their marketing.

The wreck diver motivations model seeks to illustrate the diversity in motivations within the wreck diving community (Figure 6). It shows the influence wreck diver profile and frequency of wreck diving variables have on wreck diver motivations. The model was derived from the statistically significant differences found in the analyses of wreck diver motivations. Frequency of wreck diving, dive certification level, and gender had the strongest influence on motivations. Figure 6 shows these variables with a thicker line connecting them with motivations to indicate their higher level of influence. Dive experience level (i.e., number of dives completed and years diving) and country of residence also influenced motivations, although to a lesser extent. A thinner line, therefore, connects these variables to motivations.

The wreck diver motivations model highlights the intricacy of wreck diver motivations, as well as some patterns. It illustrates the similarities in motivations between more frequent wreck divers, technical divers, and males. Both structure and technology cluster motivations were of greater importance to these groups of wreck divers, as was wreck penetration (technique/challenge cluster). They also placed higher level of importance on searching for artefacts (treasure hunting).

More frequent wreck divers and technical divers placed greater importance on all three of the history/heritage cluster motivations (seeing historically significant shipwrecks and artefacts, and researching or learning about shipwrecks). Two of these motivations (seeing historically significant shipwrecks and artefacts) were more important for male wreck divers.

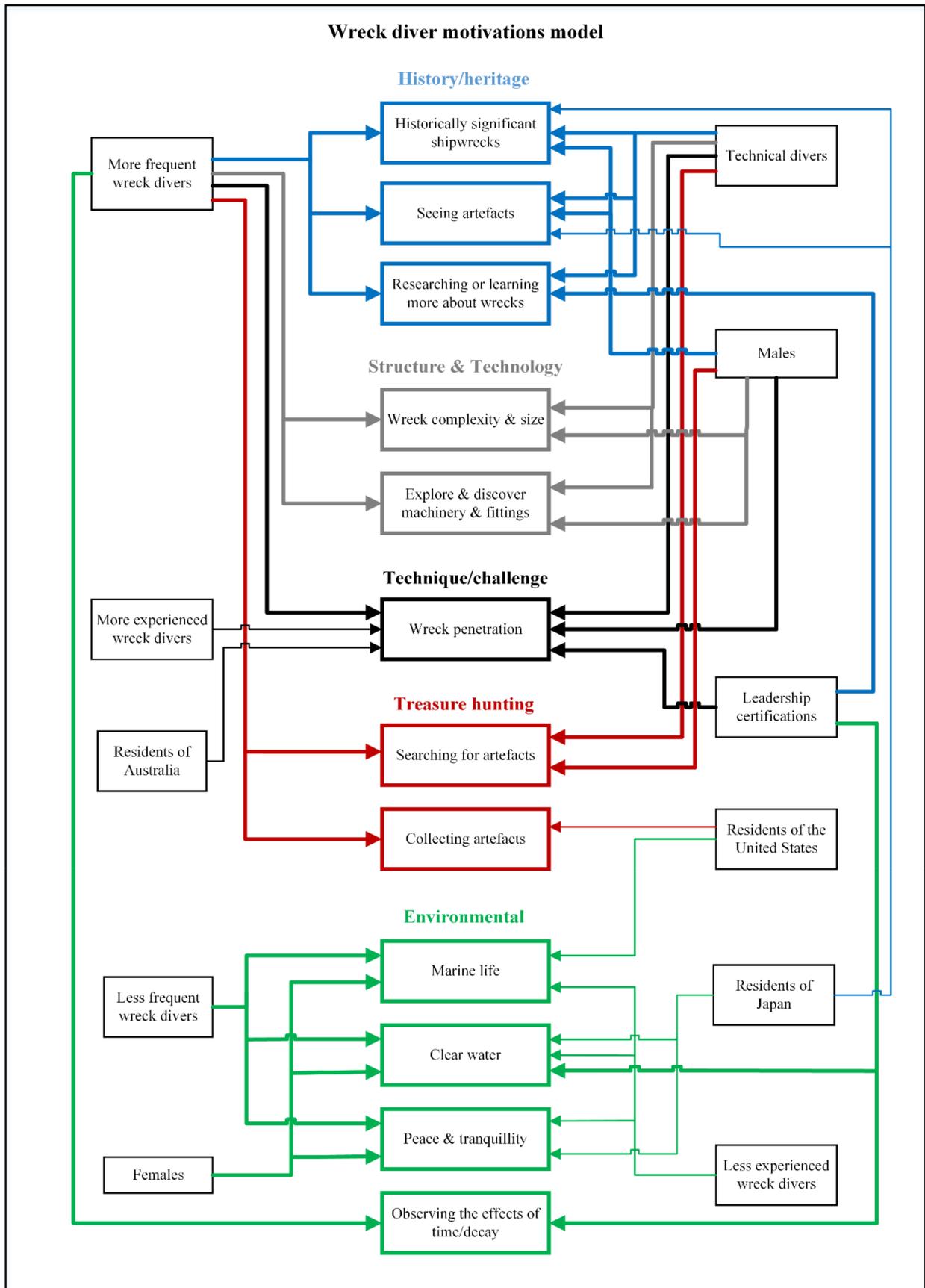


Figure 6. Wreck diver motivations model—adapted from [37] (p. 345).

There were also similarities between less frequent wreck divers, less experienced divers, and females. Three of the four environmental cluster motivations were more important for this group of wreck divers. These included seeing marine life, clear water, and enjoying the peace and tranquility of the underwater environment.

However, not all motivations fitted neatly into groups. Wreck penetration was also important to more experienced divers, those holding leadership certifications and wreck divers from Australia. Collecting artefacts (treasure hunting) was more important to frequent wreck divers. Researching and learning more about wreck, and observing the effects of time (decay) on wrecks were important to more frequent wreck divers and those with leadership certifications. Clear water was also important to participants holding leadership certifications.

Two distinct groups within the wreck diving community emerged from the Wreck Diver Motivation Model, shown in Figure 7. Less frequent and less experienced wreck divers and females formed one group. The environmental thematic cluster motivations were of greater importance to this group. The second group comprised more frequent and more experienced wreck divers, technical divers, and males. The history /heritage, structure and technology, and treasure hunting thematic cluster motivations, along with wreck penetration from the technique challenge cluster were more important to this latter group.

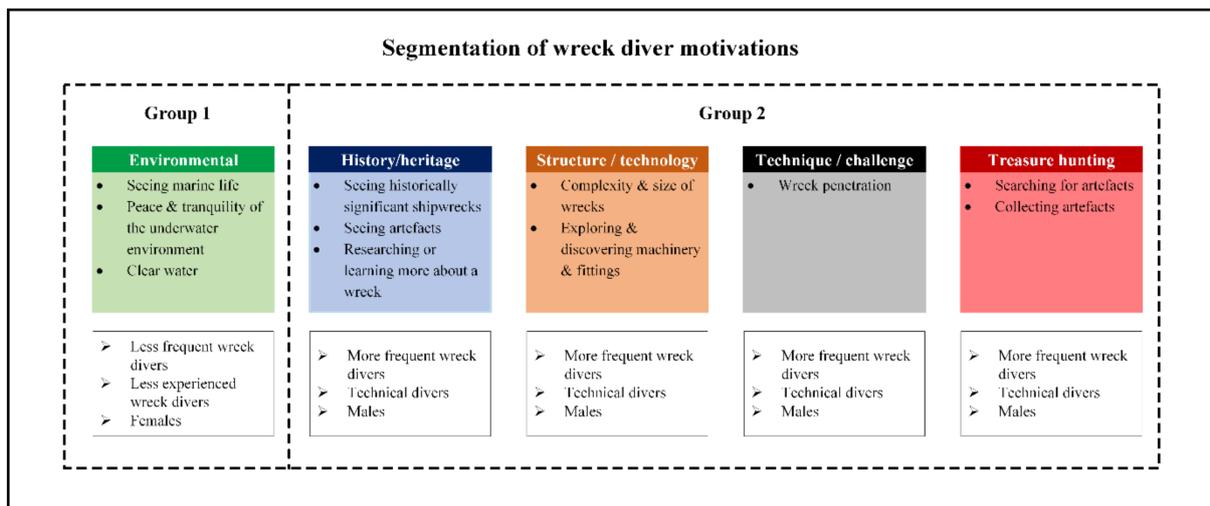


Figure 7. Segmentation of wreck diver motivations—adapted from [37] (p. 347).

#### 4.2. Wreck Diver Attitudes Model

Similar to motivations, the attitudes wreck divers have to management controls put in place to protect shipwrecks discussed above and shown in Appendix ?? are aggregated data. This is useful for gaining a broad understanding of the preferences of the majority of wreck divers or the “average” wreck diver. Aggregated data, however, do not take into account the nuances of wreck diver attitudes resulting from heterogeneity in the wreck diving community. This research found frequency of wreck diving and a number of dive profile variables influenced wreck diver attitudes.

Importantly, these variables are shown to influence attitudes both positively and negatively. Two models are presented in Figure 8 and Figure 10, which illustrate the influence of wreck diver profile variables on attitudes. The Wreck Diver Opposition to Management Controls Model (Figure 8) illustrates the relationship between diver profile variables and specific management controls, where there was stronger opposition to management controls. The Wreck Diver Support for Management Controls Model (Figure 10) illustrates the relationship between diver profile variables and specific management controls, where there was stronger support for management controls. The thickness of the lines in the figures signifies the relative level or strength of influence of each variable. These models

were derived from the statistically significant differences found in the analyses of wreck diver motivations.

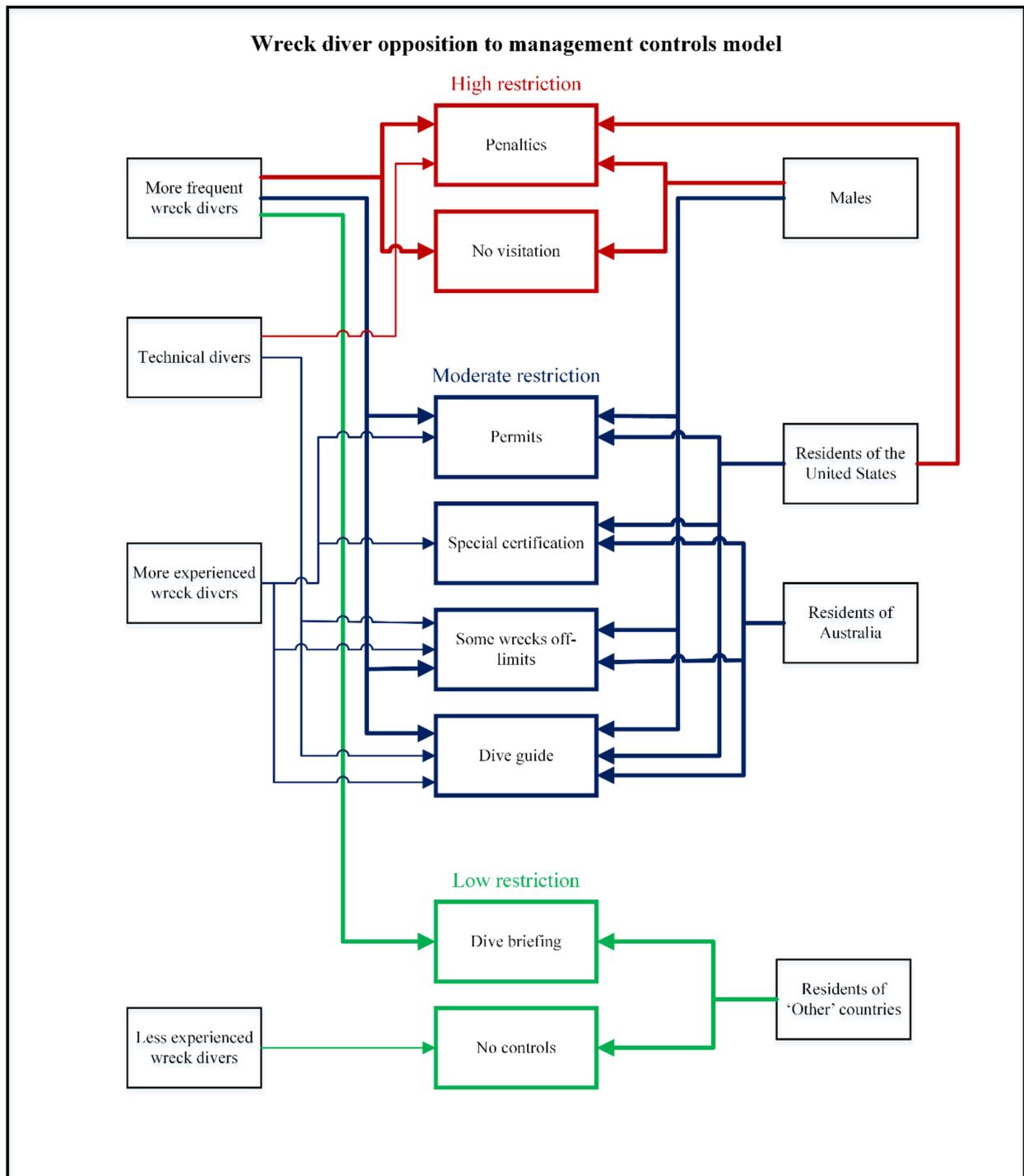


Figure 8. Wreck diver opposition to controls model—adapted from [37] (p. 351).

These models are important because they can assist heritage managers in developing more robust management strategies. Although the aggregated data can indicate overall support for or opposition to specific management controls, it does not recognize the diversity in attitudes within the wreck diving community. If managers only cater to the “average” wreck diver, the likely outcome is potential disenfranchisement of certain segments of the wreck diving. Disenfranchised divers are less likely to voluntarily comply

with management rules [22,44], resulting in less effective management of the sites in question. It follows that divers disenfranchised by management rules will be less likely to have political support for the protection of underwater cultural heritage, and low levels of political support ultimately mean less resources are allocated for management of these sites [45].

#### 4.2.1. Stronger Opposition to Management Controls

The variables that had the most influence over wreck diver opposition to management controls were, in order of influence, country of residence, frequency of wreck diving, and gender (Figure 8). Level of dive experience and certification had a lesser influence, indicated by the thinner lines.

The Wreck Diver Opposition to Management Controls Model shows that more frequent wreck divers and males were more opposed to both high restriction controls: penalties and no visitation to wrecks by divers. Technical divers and wreck divers living in the United States also expressed stronger opposition to penalties. More experienced and more frequent wreck divers, males, and residents of the United States were more opposed to the use of permits (moderate restriction), while more experienced divers and residents of Australia and the United States expressed less support for special certifications (moderate restriction). There was stronger opposition to the other two moderate restrictions—the use of dive guides and some wrecks being off-limits to divers—by more experienced and more frequent wreck divers, males, and residents of Australia. Residents of the United States also expressed less support for some wrecks being off-limits. Allowing divers access to wrecks enables divers to form a connection with underwater cultural heritage and limiting access may lead to less political support for the protection of underwater cultural heritage.

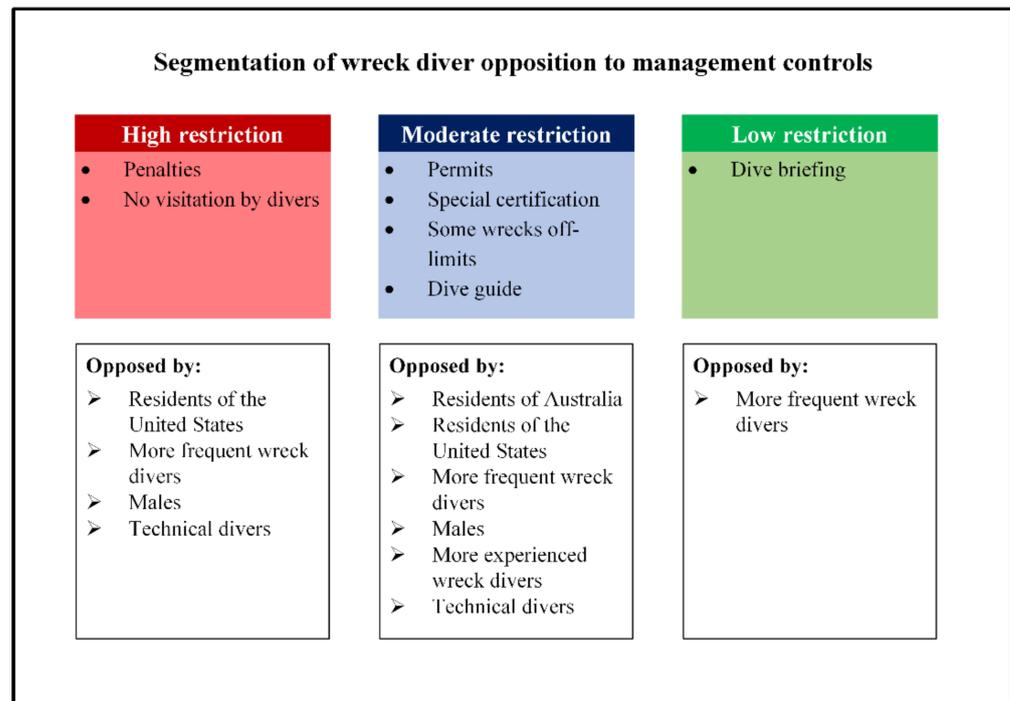
More frequent wreck divers and residents of Australia and the United States expressed lower levels of agreement with the use of dive guides to control diver behavior (low restriction). Wreck divers from locations in the other countries category were more opposed to both low-level restrictions. Less experienced divers were more strongly opposed to there being no controls over divers on wrecks.

The Wreck Diver Opposition to Management Controls Model enriches our understanding of wreck diver attitudes. It demonstrates the complexities of wreck diver attitudes resulting from the diversity in the wreck diver community. The model shifts understanding of wreck diver attitudes beyond the realm of the average wreck diver to a more comprehensive understanding, which incorporates and represents the diversity of attitudes. This diversity is important for heritage managers to understand, as it identifies particular segments of the wreck diving community that are more strongly opposed to specific management controls. Divers strongly opposed to specific management controls are less likely to voluntarily comply with management rules and less likely to support the protection of underwater cultural heritage.

The relationships between wreck diver profile variables and their opposition to management controls, illustrated in the Wreck Diver Opposition to Management Controls Model, have been synthesized in Figure 9. Figure 9 aligns the three clusters of management controls with the diver profile variables that predicate stronger opposition to the controls listed. Strength of influence is indicated by the position of the variable on the list: those at the top have the strongest influence and the remainder are listed in descending order of influence.

#### 4.2.2. Stronger Support for Management Controls

The variables that had the most influence over wreck diver support for management controls were, in order of priority, country of residence, frequency of wreck diving, and gender (Figure 10). Level of dive experience and certification had a lower level of influence on specific management controls.



**Figure 9.** Segmentation of wreck diver opposition to management controls—adapted from [37] (p. 352).

Support for the use of penalties (high restriction) is evident from less frequent wreck divers; those holding leadership certifications; females; and wreck divers from Australia, Japan, and locations in the other countries category. The less experienced wreck divers supported all four moderate-level restrictions. Less frequent wreck divers and females supported three of the moderate-level restrictions: the use of permits, dive guides, and some wrecks being off-limits to divers. Wreck divers from Japan also supported three of the moderate restrictions: the use of permits, special certifications, and dive guides. Residents from locations in the other countries category supported the use of special certifications, dive guides, and some wrecks being off-limits to divers. Wreck divers with leadership certifications supported the use of special certifications and dive guides. The use of briefings to control dive behavior (low restriction) gained stronger support from less frequent wreck divers and residents of Japan. The other low-level restriction was not having any controls over what divers can do on wrecks, and this was supported by more experienced divers and residents of the United States. Although the majority of divers did not support no controls over what divers can do on wrecks (low restriction), more experienced divers and residents of the United States expressed higher levels of agreement to this approach.

The Wreck Diver Support for Management Controls Model enhances our understanding of wreck diver attitudes. It demonstrates the complexities of wreck diver attitudes resulting from the diversity in the wreck diver community. The model shifts understanding of wreck diver attitudes beyond the average wreck diver to a more comprehensive understanding, which incorporates and represents the diversity of attitudes. This diversity is important for heritage managers, as it identifies particular segments of the wreck diving community that more strongly support specific management controls. This allows managers to gauge the management controls that are more likely to gain higher levels of voluntary compliance.

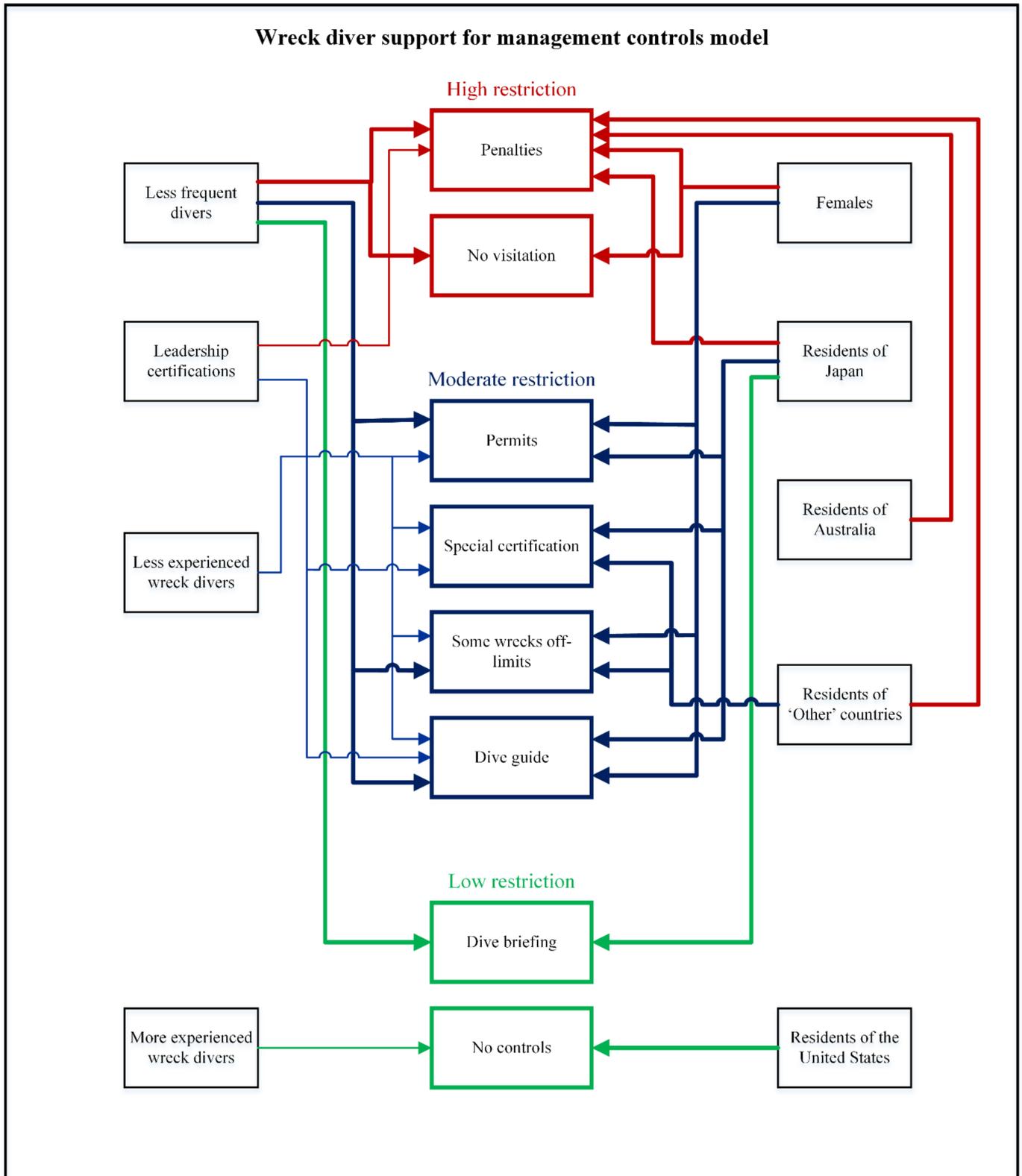
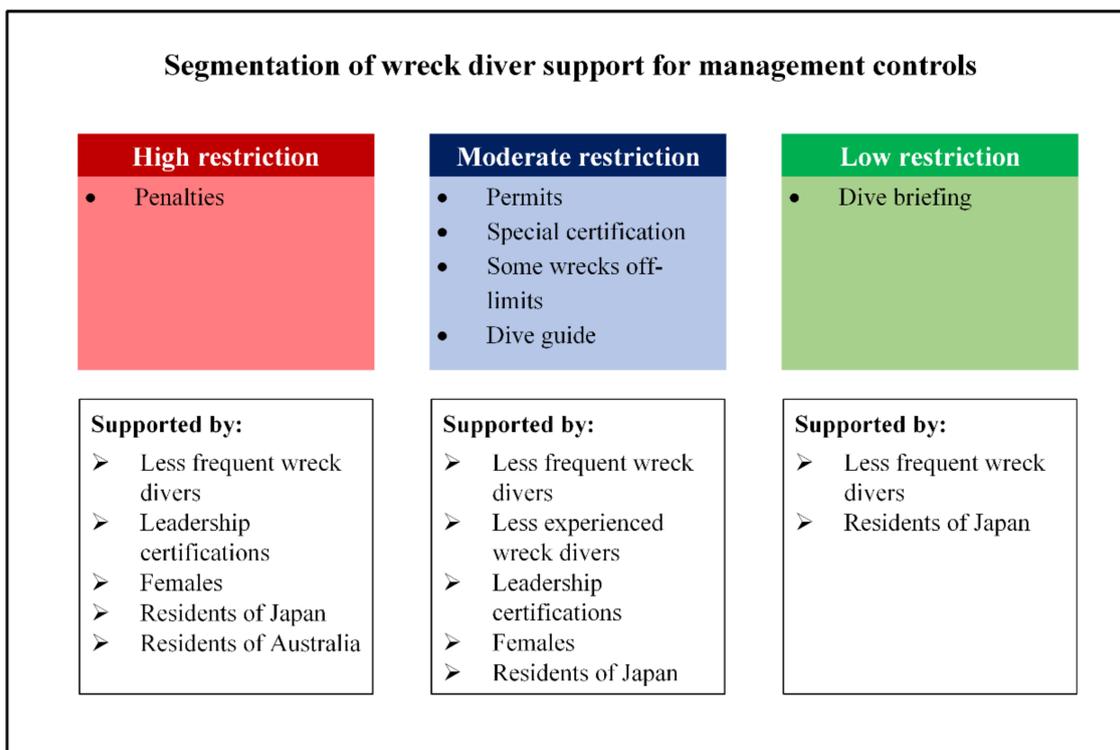


Figure 10. Wreck Diver Support for Management Controls Model—adapted from [37] (p. 353).

The relationships between wreck diver profile variables and their support for management controls, illustrated in the Wreck Diver Support for Management Controls Model, are synthesized in Figure 11, which illustrates the links between the three clusters of management controls and diver profile variables that predicate stronger support. The strength of

influence is indicated by the position of the variable in the list, with those at the top having the strongest influence and the others listed in descending order of influence.



**Figure 11.** Segmentation of wreck diver support for management controls—adapted from [37] (p. 355).

## 5. Conclusions

The majority of wreck divers are motivated to see historically significant shipwrecks, artefacts, and marine life and to enjoy the peace and tranquility of the underwater environment, and least motivated by treasure hunting. Wreck diver motivations are complex, due to diversity within the wreck diving community. Motivations are heavily influenced by frequency of wreck diving, level of certification, and gender. Two distinct groups of wreck divers emerged based on motivation preferences: the first, females and the less frequent and less experienced wreck divers and second, males and more frequent wreck divers and technical divers.

Most wreck divers have in principle support for the use of management controls to protect shipwrecks. Penalties and permits, however, were the only two specific controls that gained convincing levels of support. Although management controls were generally supported, there was notable strong opposition to preventing diver access to shipwrecks. Importantly, wreck diver attitudes were nuanced, and this should be considered by site managers when developing management strategies.

When heritage managers understand the diversity in motivations within the wreck diving community, they are better placed to accommodate wreck diver aspirations when developing management strategies. They will also be better positioned to understand the impacts management actions that may have on wreck divers and which segments of the wreck diving community may be most affected. The conceptual models presented in this paper can help guide managers in this respect. They also allow the dive and tourism industries to identify the types of experiences more popular with different segments of the wreck diving community, which can assist when deciding on the choice of dive experiences offered to clients, and marketing of destinations.

A more comprehensive understanding of diver attitudes is also pertinent to heritage managers. Understanding the complexity and diversity in diver attitudes to management

controls enables managers to gain a better appreciation of the way in which specific management controls may be received by different elements of the wreck diving community. It is beneficial to recognize which segments of the wreck diving community support certain rules and those who oppose them. Management strategies can then be designed to address these considerations, leading to potentially higher levels of voluntary compliance and more effective site management. Understanding the heterogeneity of wreck diver attitudes is also relevant to dive and tourism operators who may use certain management controls to protect the sites their businesses are reliant upon.

The study achieved its objectives of identifying wreck diver characteristics and examining and critiquing wreck diver motivations and attitudes. It highlighted the heterogeneity in motivations and attitudes that exist within a special interest group of divers and presented models that illustrate and synthesize this diversity. These findings contribute to informing cultural heritage and tourism management decisions. Further research is recommended. Future research can build on specific elements, in particular, the segments of wreck divers more opposed to management controls could be probed further to identify and examine management actions they would accept and why. It would be useful to test the applicability of the approach used to develop the conceptual models presented in this paper to other samples of divers, including special interest divers, e.g., cave divers or underwater photographers. More broadly, the potential to apply this approach to develop conceptual models of motivations and attitudes to other recreational activities and settings could be explored. Further research could also explore any relationships between diver motivations, attitudes, and knowledge about underwater cultural heritage protection, and the certification agency from where the dive certification was obtained, particularly, wreck diver certifications.

**Supplementary Materials:** The following are available online at <https://www.mdpi.com/article/10.3390/tourhosp2020012/s1>, Table S1: Frequency of participation in wreck diving, Table S2: Motivations to wreck dive—statistically significant differences, Table S3: Attitudes to management controls—statistically significant differences.

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**Institutional Review Board Statement:** This research was conducted in accordance with the Charles Sturt University Human Research Ethics approval (2012/202), where the study commenced. Then, it was conducted under Southern Cross University Human Research Ethics approval (ECN-15-005 and ECN-16-008), where the study was completed. Participants were required to be 18 years of age or older and their participation was voluntary.

**Informed Consent Statement:** Informed consent was obtained from all participants.

**Data Availability Statement:** Ethics approvals do not permit sharing of the raw data. All processed data supporting the results are included in the manuscript and Supplementary Materials.

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## Appendix A

**Table A1.** Analysis of participants' internet protocol addresses.

Number of Responses for Single IP Address	Number of Cases	Response/Action
1	641	All responses retained for analysis
2	38	All responses retained for analysis
3	2	All responses retained for analysis
4	1	The first response was kept and the following three from this IP address were deleted
12	1	All of these responses were deleted and excluded from the analysis
15	1	All of these responses were deleted and excluded from the analysis

## Appendix B

**Table A2.** Wreck diver demographic profile.

Demographic Variable	Frequency (%)
<i>Gender</i>	
Female	25.7
Male	74.3
<i>Age</i>	
<25 years	5.0
25–34 years	19.6
35–44 years	25.8
45–54 years	20.6
55–64 years	21.1
65–74 years	7.1
>74 years	0.8
<i>Level of education</i>	
Primary school	0.3
Secondary school	6.7
Trade qualification	11.9
Diploma	15.1
Degree/higher degree	66.0
<i>Country of residence</i>	
Australia	25.8
China	0.4
Japan	4.6
Korea (South)	0.4
Russia	0.7
The United States	41.3
Other	26.8
<i>Country of birth/nationality</i>	
Australia	21.3
China	4.6
Japan	0.6
Korea (South)	0.1
Russia	0.8
The United States	40.3
Other	32.3

*N* = 724; adapted from [37] (p. 163).

## Appendix C

Table A3. Wreck diver dive experience profile.

Experience Variable	Frequency (%)
<i>Number of dives completed</i>	
≤5	0.6
6–20	3.2
21–50	6.4
51–100	11.3
101–250	15.9
251–500	17.5
501–1000	17.5
>1000	27.5
Do not know	0.1
<i>Highest level of certification</i>	
Open water	4.4
Specialty course	2.2
Advanced open water	28.3
Master scuba diver	8.2
Divemaster or equivalent	16.3
Instructor	11.3
Master instructor	5.5
Technical	23.8
<i>Years of diving experience</i>	
≤5	26.7
6–10	18.8
11–15	13.4
16–20	9.8
21–25	9.9
26–30	6.9
31–35	5.5
36–40	3.9
>40	5.1

N = 724; adapted from [37] (p. 165); Note: certification levels are PADI (or equivalent). PADI certification levels were used because PADI is the world's largest dive certification agency [46].

## Appendix D

Table A4. Motivations for wreck diving.

Motivation Factor	Cluster	N	Mean *	Mean Rank	SD
Seeing historically significant shipwrecks	History/heritage	711	3.99	1	1.09607
Seeing marine life	Environmental	712	3.94	2	1.06777
Seeing artefacts	History/heritage	713	3.82	3	1.12078
Peace and tranquility of the underwater environment	Environmental	712	3.78	4	1.13458
The clear water	Environmental	712	3.41	5	1.24284
Researching or learning more about a wreck	History/heritage	712	3.40	6	1.20961
Complexity and size of the wreck	Structure/technology	711	3.34	7	1.23120
Observing effects of time (decay) on the wreck	Environmental	712	3.34	8	1.20831
Penetrating a wreck	Technique/challenge	710	3.28	9	1.36441
Photography	Technique/challenge	713	3.22	10	1.41756
Exploring and discovering machinery and fittings	Structure/technology	713	3.15	11	1.32766
Searching for artefacts	Treasure hunting	716	2.71	12	1.33903
Collecting artefacts and/or fittings	Treasure hunting	711	1.78	13	1.18103

\* Value is the mean score on a 5-point scale ranging from 1 = not important to 5 = very important. From [37] (p. 169).

## Appendix E

Table A5. Wreck diver attitudes to management controls (from [37]).

Statement	Cluster	N	Mean *	Mean Rank	SD
Harsh penalties should be imposed on some divers who take things from wrecks	High restriction	694	4.00	1	1.33441
Divers should be required to have permits to dive some wrecks	Moderate restriction	703	3.31	2	1.49226
Only divers who have special certification should be allowed to dive on wrecks	Moderate restriction	707	2.85	3	1.45080
Some accessible wrecks should be off-limits to divers	Moderate restriction	686	2.71	4	1.48161
An underwater guide should control what divers do underwater	Moderate restriction	704	2.60	5	1.34558
A dive briefing is enough to control diver behavior	Low restriction	704	2.31	6	1.07902
There should be no controls on what divers do on wrecks	Low restriction	704	1.69	7	1.16568
Moving artefacts around on a wreck site is okay so long as the artefacts remain at the wreck site	Knowledge	699	1.60	8	1.00231
Wrecks (except wrecks deliberately sunk as artificial reefs) should be protected from all visitation	High restriction	704	1.46	9	0.84900

\* Value is the mean score on a 5-point scale ranging from 1 = not important to 5 = very important. From [37] (p. 177).

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