THE EFFECTIVENESS of ENVIRONMENTAL COMMUNICATION with SCUBA DIVERS: A Case Study Comparing the Curricula of BSAC, PADI, and SSI Entry-Level Certification Courses

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ABSTRACT

Scuba diving and international dive tourism are becoming increasingly popular activities (Tourism Queensland, 2003) and divers' are significant factors contributing to the degradation of marine ecosystems (Barker & Roberts, 2004; Curtin & Garrod, 2008; Davenport & Davenport, 2006; Davis, & Tisdell, 1996; Medio et al., 1997; Motavalli, 1997; Walters & Samways, 2001). While extensive research has been conducted on the efficacy of pre-dive briefings and Dive Master interference in mitigating damage when depreciative behaviours are observed (Barker & Roberts, 2004; Davis & Tisdell, 1996; Dearden, Bennett & Rollins, 2007; Medio, et.al., 1997; Rouphael & Inglis, 1997), limited research has been conducted on the content of diver certification courses (Lindgren, et al., 2008), or the effectiveness of this form of communication.

The purpose of this study was to determine the effectiveness of the environmental communications contained in novice certification course manuals. This was accomplished by reviewing the effectiveness of these communications across three certifying bodies, the British Sub Aqua Club (BSAC), the Professional Association of Diving Professionals (PADI) and Scuba Schools International (SSI), using the framework of the Elaboration Likelihood Model of Persuasive Communication (Petty, McMichael & Brannon, 1992), and its associated message delivery styles, as a framework for evaluation.

The messages conveyed to scuba divers through each agency's novice certification course manual were analyzed using software-assisted content analysis. The content analysis examined the manifest and latent content to determine the overt and covert messages inherent within the texts. This was accomplished using a mixture of inductive emergent category development and deductive category application. Images were also coded to indicate whether they supported or contradicted the environmental messages espoused in the manual. All written messages were assigned codes that indicated the message delivery style, and route to persuasion, used. Once each certifying bodies' textbook had been systematically coded, and categories / themes had been

identified, a comparison of the environmental messages communicated across certifying bodies was undertaken to determine the manuals' relative efficacies.

Based on the content analysis, an e-survey was created and administered to determine respondent divers' levels of knowledge retention and demographic characteristics. Descriptive statistics (frequencies) were used to determine general descriptors and demographic characteristics of the sample. One-way ANOVAs, Crosstabs and Chi Square analyses were run to determine the percentage of respondent divers from each agency who answered questions correctly and in a statistically significant manner. This allowed the researcher to determine which key concepts were not as well retained by sub-groups of respondent divers.

The steps used in the sequential methodological triangulation, lead to a more holistic understanding of effective environmental communications with scuba divers. Triangulating the data from the content analysis with those of the e-survey, in an examination of the statistically significant differences between the number of BSAC, PADI and SSI respondent divers' who answered individual questions incorrectly, illustrated the impact that communication along the central and peripheral routes to persuasion have on knowledge retention and its potential behavioural implications.

This study found that respondent divers' across all three certifying bodies had statistically similar levels of knowledge retention. The most effective messaging technique, which resulted in an increased level of knowledge retention, was the central route to persuasive communication of the ELM followed by a combination of messages delivered using the central and peripheral routes to persuasion. This had an additive effect on divers' levels of knowledge retention, and processing whereby the repetitive delivery of peripheral messages (sanctions, knowledge / fact provision messages and plea messages) was reinforced through well timed and supportive attribution and interpretive messages. The additive effect of the use of multiple message delivery styles encouraged knowledge retention among respondent divers.

These finding aided in describing and modeling theoretical patterns in divers' adoption of attitudes towards low impact diving and their resulting in-water behaviour.

Despite the consistent effective pattern of the observed messages delivery styles and routes to persuasion which accords well with the theoretical 'persuasive communication-information processing-attitude-predicative behaviour' pathway of the ELM, it failed to completely explain the observed phenomena. As such, a Predictive Behavioural Outcomes Model of Effective Communication was proposed, which models a theoretical 'persuasive communication-information processing-attitude-skills competency-behaviour' pathway while taking into consideration the impact of constraints on respondent divers' ability to adopt desired behaviours.

Given that course instructional materials / manuals are constantly evolving and the expense associated with producing and rolling out revised additions, it is important for certifying bodies to understand the affect that the environmental messages they convey have on divers. Furthermore, it is important that divers are taught the skills required to mitigate their impact. Because the continued operation of the recreational diving and dive tourism industries are dependent on divers' continuing to want to dive, and diving destinations lose their aesthetic appeal if they are degraded, it is important that the industry teaches divers' to mitigate their impacts on marine environments. Therefore, based on the findings of this research, several recommendations are provided for revisions to BSAC, PADI and SSI's novice certification manuals, including removing all negative images, revising contradictory written messages, and capitalizing on missed education opportunities, to ensure they promote low impact diving principles and skills.

Areas for future research include determining the nature and source of divers' strongly positive and strongly negative attitudes towards low impact diving and differences in certified divers' knowledge retention immediately after attaining entry-level certification, during their inactive phase, and immediately before and after they undertake their next open water dive following a period of diving inactivity. Additionally, pre- and post-testing of personal attribution and divers' self perceived low impact diving skills competencies after exposure to different low impact diving, and skill teaching, messages should be conducted.

Key words: Environmental Communication, Effective Environmental Education, Depreciative Behaviours, Dive Tourism, Low Impact Diving, Persuasive Communication, Scuba Diving

Dedication

This thesis is dedicated to the memory of Dr. Ian Donald Mac Leod M.D. (1928 – 1997) who believed in me no matter what, whose faith in my academic ability was unfailing, and for the many times I've wanted to say "Don't boller me … I living in Maine now!" while writing this thesis. I miss you Poppa.

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Our view of nature will influence the way we treat nature,
and our view of human nature will
affect our understanding of human responsibility.

- Ian G. Barbour, 1997

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CHAPTER 1.0 INTRODUCTION

Extensive research has been conducted on diver impacts on marine environments, especially coral reefs (Barker & Roberts, 2004; Hawkins, Roberts, Van't Hof, De Meyer, Tratalosa & White, 1999; Tratalosa & Austin, 2001; Zakaia & Chadwick-Furman, 2002). Despite being certified, divers continue to have negative impacts on marine environments (Medio, Ormand & Pearson, 1997; Townsend, 2008a; Townsend, 2008b). Although diver impacts on coral reefs are less severe than the effects of global climate change related coral bleaching, or natural disasters, diver induced damage can result in coral disease infestations that affect the shift from massive to branching coral dominance at dive sites and can render coral reef ecosystems less capable of recovering from bigger environmental stressors like hurricanes, storms, disease and fish predation (Barker & Roberts, 2004). Additionally, diver damaged corals are more likely to become infected by other pathogens or invading organisms, and have higher mortality rates than undamaged colonies (ibid).

Tourism Queensland (2003) estimates that there are 5 to 7 million active divers worldwide, with approximately 32,600 in Australia, 2.5 million in the United States and 100,000 in the United Kingdom. The British Sub Aqua Club (2005), estimated these numbers as closer to 200,000 divers in the United Kingdom, 600,000 divers in Australasia, and 2.5 million divers in the Americas, with additional records of 150,000 divers on the African Continent, 100,000 divers in the Middle East, 1 million divers in Europe (including the UK), and 1.5 million divers in the Far East. Tourism Queensland's (2003) study reported that 60 percent of certified divers were between 15 and 34 years of age while approximately two-thirds were male; 80 percent of all certified divers held a valid passport, were well educated and travelled overseas regularly. Although female participation is increasing, scuba diving remains a male-dominated sport (Garrod & Gössling, 2008).

Reef tourism is a major global industry, with scuba divers visiting coral reefs in 91 countries and states annually (Spalding, Ravilious and Green 2001). Although tourism has demonstrated minimal benefit to marine environments, a recent study found that substantial risks to the sustainability of coral reefs occur when 5,000 or more dives

are completed at a site in a one-year period (Tourism Queensland, 2003). Major diving destinations like the Great Barrier Reef Marine Park attract over 1.8 million visitors annually and generate approximately $1 billion from reef-based tourism each year (Tourism Queensland, 2003), illustrating the size and importance of the industry to the global economy.

The largest group of divers (holiday divers) rarely move beyond initial certification (Lindgren, et al. 2008). As such, their skills and knowledge will center predominately on dive safety and over time their practical skills and theoretical knowledge on topics such as buoyancy control and low impact diving practices are likely to erode (Lindgren et al., 2008). The time interval between receipt of dive training / diver environmental education and participation in diving as well as the potential loss of knowledge and skills are especially high for holiday divers, who are inactive in the diving community and do not use their diving skills unless on a dive tourism-centered holiday. This gap between certification and participation in dive tourism has implications for the magnitude of diver impacts on marine environments.

Because of this, scuba diver certification courses attempt to make divers aware of their impact, and encourage low impact diving practices. This is attempted through certification course curricula, pre-dive briefings, advanced training / continuing education / specialty courses, and organization-sponsored conservation agency programs. While extensive research has been conducted on the efficacy of pre-dive briefings in mitigating diver impacts and on Dive Master interference when depreciative behaviours are observed (Barker & Roberts, 2004; Davis & Tisdell, 1996; Dearden, Bennett & Rollins, 2007; Medio, et. al., 1997; Rouphael & Inglis, 1997), limited research has been conducted on the content of diver certification courses (Lindgren, Palmlund, Wate, & Gössling, 2008), or the effectiveness of this form of communication (Medio, et al, 1997). Similarly, Orams (1997) noted that educational psychology studies have demonstrated the difficulty experienced by tourism operators who attempt to change tourists' behaviour, largely because their educational programmes are not appropriately structured. Additionally, given the rapid growth of dive tourism (Tourism Queensland, 2003), and the industry's dependence and impact on pristine diving

destinations (Davenport & Davenport, 2006), further research into diver impacts, diver environmental education / communication and the factors that influence compliance with low impact diving practices is needed.

This research, therefore, examines the effectiveness of the environmental communications contained in the entry-level scuba diver certification courses across three certifying bodies: the British Sub Aqua Club (BSAC), the Professional Association of Diving Instructors (PADI) and Scuba Schools International (SSI) using the Elaboration Likelihood Model (ELM) of persuasive communication (Petty, McMichael & Brannon, 1992) as a framework for evaluation. The effectiveness of environmental communications is evaluated based on key concepts related to low impact diving skills and practices and divers' abilities to retain the taught curriculum.

The objectives of this research are therefore:

- To determine the breadth and depth of the environmental and low impact diving messages communicated to entry-level divers in their novice certification course;
- To determine how much knowledge of marine environments, low impact diving practices, and diver impacts on marine environments, divers retain after completing their entry-level certification courses; and,
- To determine whether this retention varies by certifying body, length of time since certification, variations in diving history (frequency of skills use, etc.) or the socio-demographic characteristics of divers.

To meet the objectives of this research, the study was undertaken in several phases. The first phase involved a comprehensive content analysis of diver certification course materials. Because all divers must be certified to purchase compressed gas cylinder refills for diving, it is legitimate to assume that all divers will have been exposed to the content of basic certification courses from major certifying bodies. The purpose of the content analysis phase was to examine the major themes and differences across the curricula of certifying bodies to establish:

a) what information divers are provided regarding their impact on marine environments, including coverage of the principles of low impact diving;
b) what, if any, low impact diving skills are taught as a portion of their curriculum; and,
c) what message delivery style(s), and therefore routes to persuasion, are most frequently used by each agency to deliver these messages to divers.

The second phase involved the development of an e-survey. The purpose of administering this survey was to determine:

a) the degree to which divers retain the environmental messages conveyed to them in their entry-level certification courses; and
b) diver demographics and recent dive histories.

The next chapter provides an overview and discussion of the literature that informs this research, including a broad discussion on international dive tourism and the three certifying agencies under examination, along with a review of the literature pertaining to low impact diving and divers environmental knowledge. Importantly, the way that knowledge can act as a predictor of pro-environmental behaviour and how this is connected to predictors of personal responsibility and diver environmental stewardship is discussed, concluding with an examination of the Elaboration Likelihood Model of Persuasive Communication, which guided this study. Chapter Three begins with a description of the worldview that guides the research and a reflexive situating of the researcher. The mixed methods, and associated phases of data collection and analysis are then described. Chapters Four and Five present an analysis of the data collected during the qualitative content analysis and quantitative e-survey phases; this is followed by Chapter Six, which triangulates the data sets. The thesis culminates in a presentation of recommendations for changes to each agency's manual, followed by a discussion of the delimitation and limitations of the study, the study's practical applications and suggestions for future research.

CHAPTER 2.0 LITERATURE REVIEW

The multifaceted impacts of recreational scuba diving, and its associated industries, including dive tourism, have recently come under academic examination. This literature review examines diver impacts on marine environments; the principles of low impact diving are discussed as is the global diving industry and the hierarchy of diver environmental knowledge. This discussion is followed by a more general discussion of knowledge as a predictor of pro-environmental behaviour. The predictors of personal responsibility and diver environmental stewardship are also discussed as well as effective environmental messaging. The literature review concludes with a discussion of environmental education, and the Elaboration Likelihood Model (ELM) of Persuasive Communication.

2.1 Diver Impacts on Marine Environments

Scuba diving is becoming an increasingly popular recreational activity and, as discussed in Chapter 1, international dive tourism is a popular activity among scuba divers. While "divers are rarely the sole cause for environmental change in marine ecosystems … they can be significant factors of disturbance and damage" (Lindgren et al., 2008, pp. 115). This is because unlike other popular marine recreation and tourism activities (like whale watching, power boating, and sea-dooing), participation in scuba diving puts individual divers in positions where, through a lack of skill in manipulating their diving equipment, knowledge, or fore thought they can do extensive harm to the marine and coastal environments in which they dive. The most frequent type of damage results from the disruption of coral communities, failure to secure loose dive gear, and intrusive overcrowding of marine life (Barker & Roberts, 2004; Curtin & Garrod, 2008; Davenport & Davenport, 2006; Davis, & Tisdell, 1996; Medio et al., 1997; Motavalli, 1997; Walters & Samways, 2001).

Scuba diving is also a skill intensive activity requiring divers to be proficient swimmers, and to possess knowledge and skills in the use of their dive gear as well as knowledge of marine environments and diver impacts. Because individual characteristics play a large role in the degree of impact that divers have on marine

environments various studies (sec for example Barker & Roberts, 2004) have determined that certain diver characteristics have been linked to increased levels of damage, and have been the focus of most of the research on divers' impacts. For this reason researchers often categorize divers into the following groups: 'photographers and non-photographers', 'limited skills / new divers and experienced divers', 'day and night divers', and 'shore and boat divers'. Davenport & Davenport (2006) found that novice divers caused damage on one in six dives, compared to highly experienced divers, who caused damage on one in every 123 dives. Similarly, Barker and Roberts (2004) found that inexperienced divers, with less than 100 dives, were more likely to cause damage than experienced divers. The reduction in damaging contacts made by experienced divers has been attributed to their skills - increased buoyancy control, proper weighting and kicking techniques and a greater sense of awareness of both self and personal equipment (Barker & Roberts, 2004; Davenport & Davenport, 2006). Furthermore, Barker and Roberts (2004) found that although a large portion of divers have contact with the reefs while diving, it is male divers, underwater photography and the initial phase of a dive that are associated with the highest levels of environmental damage.

In addition, Lindgren, et al. (2008) found that while environmental management is generally understood to consist of policies, communication, an educational component and actions that seek to avoid or minimize the negative impacts of an industry or activity, it is different in the dive industry than in other industries. This is because production and consumption occur simultaneously in diving, resulting in individual divers being responsible for the bulk of environmental damage, with the obvious exclusion of transportation related impacts (Lindgren, et al., 2008). As such, Lindgren, et al. (2008) note that diving-related environmental management "needs to focus primarily on clients … and seek to involve divers in the management process" (pp. 120).

These examinations and others (Barker & Roberts, 2004; Curtin & Garrod, 2008; Davenport & Davenport, 2006; Davis, & Tisdell, 1996; Medio et al., 1997; Motavalli, 1997; Walters & Samways, 2001; Lindgren, et al.,2008) suggest that research that specifically examines the training received by novice divers is needed to determine if

this training is effective in teaching low impact diving techniques, and in effectively conveying information about diver impact on marine environments.

2.2 Principles of Low Impact Diving

Literature on the principles of low impact diving is sparse. Brylske's (2008) article *Take Only Memories Leave Only Bubbles – A Guide to Responsible Snorkeling* covers many of the principles of low impact diving. To his recommendations, Brylske (2008) adds several unique and often unpublished recommendations aimed at Dive Leaders. These recommendations include: (i) talking to divers about the environment they are going to visit, and ensuring they understand that coral is a living organism; (ii) ensuring that divers maintain a horizontal body position, even high above the bottom because an upright position (combined with kicking) can suspend silt in the water smothering smaller marine life; (iii) discouraging divers from wearing gloves as it reduces the tendency to touch the reef; (iv) carefully selecting entry and exit points to ensure the reef is not damaged as divers enter and exit the boat; and, (v) anchoring over sand, or on a mooring buoy.

The Byron Underwater Research Group's (BURG) discussion of low impact diving focuses on divers' body position and fining technique, noting that assuming a correct body position is the first step in minimizing a diver's impact. According to BURG (2009), correct body position for low impact diving involves:

1. holding the body in a horizontal position, with arms tucked close to the body;
2. arching the back, with the abdomen the lowest part of the diver;
3. holding the head and knees up;
4. avoiding dropping the knees even when fining; and
5. using fining techniques where the feet are flat, and the soles are up.

The use of these techniques, in conjunction with knowledge of marine environments, helps to minimize both the (re)suspension of sediment and accidental reef contact (BURG, 2009).

The Tasmanian Parks and Wildlife Service (2009) requires all divers to observe low impact diving guidelines while diving in Tasmanian waters. They also recommend

to prevent damage to marine habitats, maintaining neutral buoyancy to avoid resuspension of sediments by fins, and avoiding gripping or touching underwater objects for support or to prevent drift (Tasmanian Parks and Wildlife Service, 2009). Lastly, they remind all divers to check with the Tasmanian Parks and Wildlife Service for information about changes to environmental protection and conservation regulations that affect divers prior to diving (ibid). Rainbow, Warnken & Buckley (n.d.) also list low impact diving techniques for divers and general rules for diving in their publication *the Green Guide to Scuba Diving.*

Clearly, while the recommendations covered in this literature vary (Brylske, 2008; BURG, 2009; Rainbow, Warnken & Buckley, n.d.; Tasmanian Parks and Wildlife Service, 2009), they can be reduced to encompass 14 principles of low impact diving, as summarized by Johansen (2008):

1. appropriate fining techniques;
2. neutral buoyancy;
3. securing loose dive gear to avoid damage;
4. avoiding the negative impacts of collecting marine life specimens or artifacts;
5. not harassing marine wildlife or interrupting their normal behaviours, such as mating, feeding or resting, by crowding them;
6. not touching any living underwater plants or animals, including corals;
7. avoiding the negative impacts associated with interacting with marine wildlife;
8. acknowledging the negative impacts divers, and dive tourism, can have on marine environments;
9. possessing knowledge of the nature of Marine Protected Areas (MPAs);
10. possessing knowledge of the factors that govern diver in-water behaviour (regulations, bi-laws, etc);
11. possessing knowledge of key ecological concepts related to coral and marine environment biodiversity (coral is alive and can be damaged, etc);
12. diving as guests;
13. following either a personal low impact diving ethic or the one espoused by a training agency; and
14. undertaking continuing education / specialty training to build and maintain diving skills, proficiency and knowledge.

Similarly, Johansen (2008) identified six low impact diving skills central to the effective execution of these principles. They are:

1. low impact ascents;
2. proper body position;

3. low impact descents;
4. appropriate fining techniques;
5. maintaining neutral buoyancy; and,
6. spatial awareness.

2.3 The Global Diving Industry and the Hierarchy of Diver Environmental Knowledge

The global diving industry is comprised of various independent international and national scuba diving certifying agencies, including but not limited to BSAC, PADI, and SSI. Given that each of these agencies operates internationally, they of necessity possess regional branch offices that deal with the specific demands of the area of their respective geographic responsibility and in turn are granted the right to certify divers through the provision of training courses and examinations (Lindgren, et al., 2008).

Diving organizations, like PADI, SSI and BSAC make decisions about what they communicate to divers through their certification, and continuing education, courses (Figure 2.1) and for liability and safety reasons often prioritise skills training related to safety and emergency procedures above the dissemination of environmental and low impact diving knowledge (Lindgren et al., 2008). As a result of the top down dive industry infrastructure, there is a hierarchy to the environmental knowledge and environmental management practices disseminated through certifying bodies to divers.

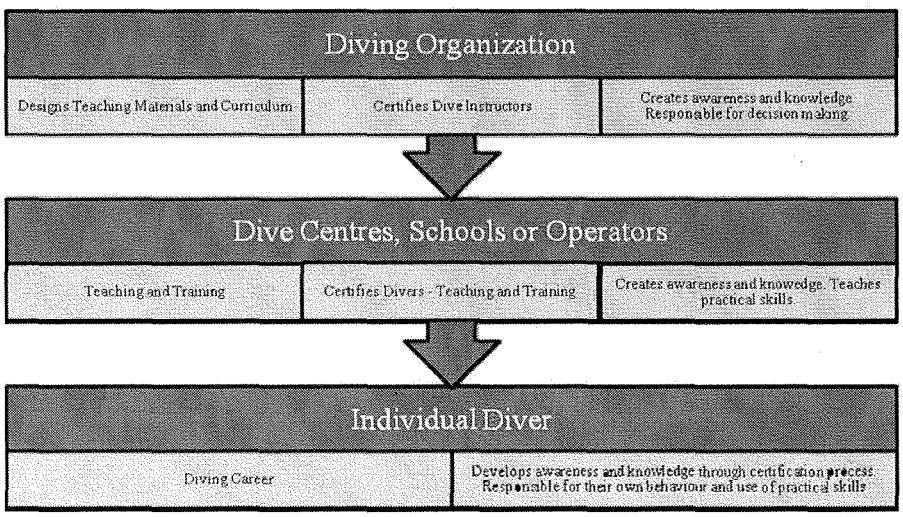


Figure 2.1 Educational structure of the Dive Industry
(From Lindgren, Palmlund, Wate, & Gössling, 2008)

Dive instructors are a key component of the diver educational process, and receive their teaching certification from the organizations whose material they teach (Figure 2.1). Therefore, their understanding of, and the importance they place on, low impact diving is shaped by the curricula and by their employers' values as well as their own educational experiences (Lindgren et al., 2008). This is similar to the experience of divers whose theoretical and practical training is based on the educational materials provided by these certifying bodies (Figure 2.1), but is also influenced by their instructors. As a result, the educational experience of divers can and does vary in terms of length of training, maximum student group size, content and emphasis (Lindgren et al., 2008). The outcome of a divers' training depends to an extent "on the individual dive instructor, his or her knowledge, and his or her interpretation of, and emphasis on, different parts of the educational process" (Lindgren, et al., 2008, pp. 121). A diver's in-water behaviour is contingent upon her/his theoretical and practical knowledge, as well as the control and intervention of their dive guides; as such, their in-water behaviour and knowledge will also continue to change throughout their diving career (Lindgren et al., 2008). These changes can be both positive and / or negative, as a divers' knowledge and skills can either increase or decrease based upon frequency of use, and further training (ibid). Additionally, divers' attitudes towards low impact diving may change, either positively or negatively, based upon their experiences as a certified diver.

Despite the extent of the damage caused by dive tourists and recreational divers, and research about changes in divers' knowledge and skills over time, there has been limited research conducted on divers' levels of environmental knowledge or predictors of pro-environmental behaviour among recreation divers or dive tourists. Lindgren et al. (2008) conducted a content analysis of PADI's 2005 course material to determine "how environmental management is currently considered by dive organisations and incorporated in the educational process" (pp. 122). In their study they evaluated three PADI dive manuals: *the Instructor Manual, the Open Water Diver Manual* and *the Advanced Open Water Diver Manual*. In their examination of PADI's 2005 *Open Water Diver Manual* (since revised in October 2007), Lindgren et al. (2008) found that it contained a one-page advertisement for Project AWARE, which failed to provide sufficient program details, as well as "one page of text with some general comments on

the fragility of marine life and general principles of behaviour, generally following the principles of 'do not touch, do not disturb, do not interact'" (pp. 127). They also found that PADI Open Water Diver candidates were expected to complete homework questions throughout the course of their Open Water Course; of the 240 questions asked of the Open Water PADI Student, they were only required to answer the following five environment-related questions:

1. Aquatic bottom compositions include what six types?
2. What are the two ways to avoid bottom contact?
3. What are the two basic classifications for interaction between divers and aquatic life?
4. Nine simple precautions minimize the likelihood of being injured by an aquatic animal – what are they? and
5. Why should divers follow local fish and game laws? (Lindgren et al., 2008, pp. 127).

Lindgren et al. (2008) concluded that diver environment education was limited in the 2005 PADI *Open Water Diver Manual*, that environmental management (a central goal of PADI) was not appropriately integrated into curricula and training, and that their training was characterized by the following weaknesses:

1. Environmental education for divers is focused on raising awareness, even though it remains uncertain which level of diver awareness is actually achieved and how this awareness is characterized;
2. The knowledge of marine ecosystems, conservation and appropriate behaviour in marine environments is examined in a superficial way, and its acquisition depends on the personal interest of the diver (through choosing or not choosing specific [advanced training or continuing education] courses);
3. There is no information at all on the interaction of climate change and dive tourism, i.e. more global perspectives on environmental change and tourism's contribution to and interaction with these changes; and,
4. The examination of key skills of divers such as to establish and maintain buoyancy is subject to the judgement of individual dive instructors. Even divers not achieving the required buoyancy skills seem regularly to pass such examination (Lindgren et al., 2008, pp. 127).

Given that PADI is not the only certifying body within the dive industry and that variations exist within the delivery of a certifying body's courses and between individual certifying bodies' course content and educational hierarchies, their findings cannot be generalized to other institutions such as BSAC or SSI. Additionally the availability of

both certifying institutions and certifying bodies' courses vary by region and country with BSAC being a popular certifying institution in Europe and the Mediterranean and PADI and SSI being more popular in the Americas. This adds to the overall inability to generalize their findings to the diving population as a whole. Furthermore, the PADI *Open Water Diver Manual* was revised in 2007.

Thapa, Graefe & Meyer (2005) examined recreation specialization (Bryan, 1977), or the ordered placement of recreationists on a continuum from novice to expert, among scuba divers and its effect on divers' marine-based environmental knowledge and self-reported in-water behaviour. Their study, which examined divers across certifying agencies, acknowledged the need for a greater understanding of the diving community, including its level of environmental knowledge and subsequent in-water behaviour (Thapa et al., 2005). Their study evaluated divers marine-based environmental knowledge based on a series of 11 true / false / do not know questions, as well as their behaviour (16 questions) and level of recreation specialization (17 items). Of the eleven statements used to determine divers' environmental knowledge one question asked about the locus of divers' control, five questions were ecology-based and five centered on diver or dive tourism impacts on marine environments.

They found that "the majority of respondents demonstrated good general marine-based knowledge" (Thapa et al., 2005, pp. 59) as evidenced by a score of 91 percent or higher among 42 percent of respondents and a score of 100% achieved by 20 percent of respondents. It should be noted however, that 38% of respondents therefore responded incorrectly to one or more of the environmental knowledge questions, "two of whom failed to answer any of the statements correctly" (Thapa et al., 2005, pp. 59). Their study also determined that between 86 percent and 96 percent of respondents reported never (or rarely) feeding, or riding, marine animals, nor standing on, holding or collecting coral, marine life or artifacts. Respondents predominately rated their skills as intermediate, with the majority certified by PADI (45%) and the National Association of Underwater Instructors (NAUI), (34%) (Thapa et al., 2005). They found that knowledge had a significant effect on reported in-water behaviour, however the extent of this effect

was diminished as specialization increased; divers' level of specialization was directly related to marine-based environmental knowledge (ibid).

While this study indicated that divers' possess significant levels of environmental knowledge, derived from extensive participation in diving, watching TV programs about the environment, marine life and conservation, and reading books or magazines about environmental issues, and even participating in community clean ups, the focus was on general aquatic and coral reef based environmental knowledge, and did not examine divers' knowledge, or retention, of low impact diving principles conveyed during novice certification (Thapa et al., 2005). While general aquatic and coral reef based environmental knowledge can result in a willingness to engage in pro-environmental behaviours, it does not guarantee that divers are aware of, frequently engage in, or possess the skills to engage in, low impact practices (as per Orams, 1997 who studied effective environmental education among marine tourists). The following section examines the effect of knowledge as a predictor of pro-environmental behaviour.

2.4 Knowledge as a Predictor of Pro-Environmental Behaviour

This section examines the literature concerning the effect that knowledge has on human behaviour in natural environments, and the role that environmental education plays in predicting pro-environmental behaviour. Because studies on knowledge as a predictor of pro-environmental behaviour have not focused on recreational divers or dive tourists, this section will focus on other recreation and tourism sector participants and will discuss knowledge as a predictor of pro-environmental behaviour in a generalized context.

According to Alessa, Bennett, and Kliskey (2003), "the effect of human values, knowledge and perception in affecting biologically costly behaviours has rarely been examined" (pp. 207). However, given that "human activities levy a biological cost on ecosystems as resources are accessed and utilized at rates which are often incompatible with inherent ecosystem processes and structures" (Alessa et al, 2003, pp. 207) this kind of research is becoming increasingly important. Hines, Hungerford and Tomera (1987), concluded that a statistically significant correlation (0.30) exists between level of

environmental knowledge and pro-environmental behaviour while Fransson and Garling (1999) found that a lack of specific knowledge centered on pro-enviromnental behaviour was a barrier to engage in environmentally beneficial behaviours despite possession of a generally pro-conservation attitude. In contrast, Alessa, et al. (2003) studied the recreational impact of humans on intertidal zones by measuring depreciative behaviours, and the attitudes and perceptions of ecosystem resilience, of visitors to Wick Headland in Pacific Rim National Park, British Columbia, Canada. Their study found that visitors with greater knowledge of intertidal ecology engaged in more depreciative behaviours than visitors with less knowledge. Furthermore, visitors who perceived high ecosystem resilience in the intertidal zone engaged in more depreciative behaviours that resulted in higher biological costs, than those who perceived lower ecosystem resilience. Alessa et al. (2003) also found that depreciative behaviours decreased when visitors attributed negative consequences to their individualized actions. These findings are supported by Orams (1997), who studied the educational aspects of Human-Dolphin interactions in Tangalooma, Australia. His study showed that while tourists who participated in human-dolphin interactions reported a desire to change their behaviour "those … not given the structured educational program seldom carried out these good intentions" (pp. 304).

Like Alessa et al. (2003), Bradford and McIntyre (2007) note that "visitors' presence in natural areas imposes some degree of biological cost, but … inappropriate behaviours can exacerbate those costs where visitors are more active in damaging areas they frequent" (pp. 3). During the 2004 visitor season, they studied social trail use at St. Lawrence Islands National Park, Ontario, Canada to determine the effectiveness of signs in mitigating social trail use, and found that "an attribution message was more effective than a plea message at eliciting desired behaviours" (Bradford & McIntyre, 2007, pp. 1). Furthermore, they found that when signs were posted at social trailheads, social trail use was reduced significantly, especially when compared to trailheads where no messages were posted, or where messages were located at points of entry to the islands. In this case study, "sign effectiveness [was] attributed to a message design which incorporated awareness and internal locus of causality and control" (ibid).

Further studies have been conducted on the causes of depreciative behaviours, such as those by Widner Ward and Roggenbuck (2003) who studied petrified wood theft, and management strategies to mitigate these thefts. They suggested that depreciative behaviours result from a failure by perpetrators to comply with social norms. They go on to suggest that depreciative behaviours result from five types of norm violations, including: unintentional; uninformed; releasor cue; responsibility-denial; and status confirming. Unintentional norms violations occur because visitors, recreationists or tourists are unaware of the norms violation; similarly, uninformed norms violations occur because individuals do not know the consequences of the depreciative behaviours (Widner Ward & Roggenbuck, 2003). Releasor cue norms violations occur because environmental conditions "cue" or promote the depreciative behaviour; examples of these "cues" can be the presence of social trails or observing someone else engaging in the depreciative behaviour (ibid). This is different from status confirming norms violations, in which depreciative behaviours are engaged in as a result of peer pressure (ibid). According to Widner Ward and Roggenbuck (2003) "some visitors that violate an existing norm may [also] do so because they feel that, in their particular case, the violation is justified" (pp. 69) or because they disagree with authority or the restriction on behaviour; these are examples of responsibility-denial norms violations.

Given that divers engage in behaviour that has a negative impact on marine environments, and that depreciative behaviours have been linked to norms violations resulting from a lack of knowledge about appropriate behaviours, an examination of diver environmental knowledge and knowledge of low impact diving practices and skills, as achieved through the novice certification process, is needed. Insights into divers' level of knowledge retention, and potential correlations between knowledge retention, message frequency and message delivery style, can in turn be utilized to increase the effectiveness of environmental and low impact diving messages in the certification courses taught to novice divers.

2.5 Predictors of Personal Responsibility and Diver Environmental Stewardship

Lindgren, et al. (2008) noted that "while divers are rarely the sole cause for environmental change in marine ecosystems … they can be significant factors of

disturbance and damage" (pp. 115). They also state that dive centers, dive schools and dive tourism operators have a responsibility for, and central role to play in, managing diver behaviour. This is because they provide information about environmentally harmful activities, and are uniquely situated to actively influence divers' in-water behaviour through intervention and training focused on diver impacts and environmental responsibility (Barker & Roberts, 2004; Lindgren, et al., 2008; Medio et al., 1997).

According to Cottrell and Meisel (2004), many divers stay active within the diving community because of an interest in marine environments. For this reason "PADI, as well as other diver-certification organizations and individual businesses, [have] put significant resources into conservation and … public-awareness programmes" (Townsend, 2008b, pp. 139). Furthermore, dive industry funded and diver run organizations like PADI Project AWARE (Aquatic World Awareness, Responsibility and Education) Foundation and REEF (Reef Environmental Education Foundation), focus specifically on marine conservation (Townsend, 2008b). The outreach programs facilitated by these, and similar organizations, such as SSI's Platinum Pro Foundation and Frontier Conservation, a UK based volunteer tourism operator, enable divers to volunteer to collect environmental information while diving. This data is then used in fisheries rehabilitation and other conservation projects of direct benefit to local peoples while providing aquatic environmental education to children (ibid). However beneficial these programs are, they rely heavily on more experienced divers' who exhibit an inherent interest in marine conservation and thus seek out advanced training in these areas, or who volunteer their time for conservation projects, instead of providing experiences during the basic certification process that instil a conservation ethic in divers and teach them a practical skill set that can be utilized on a personal level to decrease their individual impacts on dive sites.

Cottrell and Meisel (2004) studied predictors of personal responsibility to protect the marine environment among scuba divers in the Florida Keys, USA. They found that participants' perceived knowledge of environmental issues, environmental beliefs, certain experience preferences in recreational activities, positive attitudes towards enforcement of diving related environmental regulations, and diver expectations of good

service were greater predictors of diver personal responsibility to act pro-environmentally while diving than diver background variables like years diving, number of logged dives, diver skill level, age and education (Cottrell & Meisel, 2004). Additionally, Barker and Roberts (2004) found that individual diver differences, such as gender, activity (non-photographer vs. photographer) and level of training, made a difference in the severity of diver impacts.

These findings were contradicted by Todd, Cooper and Graefe (2001) who studied differences in the environmental beliefs, ascriptions of responsibility and management preferences of freshwater divers in the Great Lakes. Their study "documented the need for continuing support to educate divers on safe and responsible use of underwater resources" (Todd et al., 2001, pp. 131). Furthermore, by segmenting divers based on self-identified and varying levels of development ranging from novice to expert and post-expert, they found that "divers with higher levels of development tend to take progressively more responsibility for their actions" (Todd et al., 2001, pp. 139).

Similarly, Todd, et al. (2001) found that "although SCUBA diving is a self-regulated industry, participation does require certification. Many certification agencies include environmental awareness in their novice courses, but because certification docs not expire, being kept informed of how not to negatively affect the environment may not occur" (pp. 132) therefore, divers "often rely on charter boat operators, SCUBA diving clubs, and gear shops for current information and arc influenced by their attitudes and practices when it comes to environmental issues" (pp. 140).

The findings of Bradford (2005) who studied attribution, or "the matching of incoming data and intentions to cognitive schematic images of known past behavioural outcomes" (pp. vii) and its affect on depreciative behaviours, suggests that

> Persons with high personal attribution arc more likely to hold him/herself responsible for having caused some sort of damage, be able to cognitively analyze the effects of individual and accumulated actions, as well as apply these effects more broadly … and behave accordingly when the consequences of the action(s) arc brought to their attention (Bradford, 2005, pp. vii).

She also found that environmental concern was influenced by age, socio-economic status, place of residence, experience in the outdoors, political ideology, education and gender. The inconsistencies between the findings of the depreciative behaviour studies discussed above suggests a need for further research into divers' specific attitudes towards and compliance with low impact diving practices, and predictors of divers' levels of personal responsibility to engage in low impact diving.

2.6 Effective Environmental Messaging

Semb and Ellis (1994) conducted an extensive literature review of studies on the retention of knowledge taught in schools; they found that there is evidence of long term retention of taught knowledge, and that the level of retained knowledge is actually much higher than expected. Their review, however, did not touch on studies that addressed psychomotor or procedural skills (such as tennis, scuba diving, driving or equipment operation). Nonetheless, their findings can be applied to the knowledge component of the taught curriculum of entry-level, novice, certification courses.

Many factors influence the level of knowledge retained post knowledge acquisition, as well as the outcome of knowledge retention tests (Semb & Ellis, 1994). These factors include: prior knowledge; guessing on the knowledge test (made easier depending on the nature of the exam questions, e.g. multiple choice and true / false vs. long answer); the degree that knowledge / skills are utilized during the retention interval, and additional related learning undertaken during the retention interval (ibid).

Donavant (2009), who studied the effectiveness of online education versus traditional instruction with continuing education adult learners, noted that adults derive their educational motivation from the value they feel that material will have in their daily lives and adult roles. Therefore, imposed learning that is perceived as irrelevant is typically meet with resentment (Donavant, 2009). As such, motivation and perceived applicability of information also have implications for knowledge retention.

Semb and Ellis (1994) found that prior knowledge typically interacts with new knowledge and can help assimilate it into semantic memory; however, they

acknowledge that substantial retention occurs even when this impact is accounted for. Therefore, most studies do not separate prior knowledge from that learned over the course of instruction (ibid). Semb and Ellis (1994) also found that while different courses have different content and differ in the ways that content knowledge is assessed, "different types of content often require students to perform similar tasks" (Semb & Ellis, 1994, pp. 266) thus making it possible to compare the content of differing courses. Therefore, while the subject matter of BSAC, PADI and SSI's courses, and the instructional methods used to convey this material, may be different, their common goal of teaching safe and effective diving suggest that their content can be compared.

Madden (2006) studied nursing students' acquisition and retention of CPR knowledge and skills. She determined that despite the purpose of CPR certification being to ensure knowledge and skill retention, there is compelling evidence that nurses lack basic competence in CPR (Madden, 2006). In her study, Madden (2006) examined the taught curriculum of CPR courses offered by the Irish Heart Foundation, or IHF, an affiliate of the American Heart Association, in terms of participants' ability to retain both psychomotor skills and cognitive knowledge. Cognitive knowledge was assessed through the use of a 21 item structured multiple choice assessment that was based on a review of the taught curriculum and was validated by experts. Nurses' psychomotor skills were assessed using a structured CPR performance observation. Performance was evaluated using a Resusi-Anne manikin and Laerdal skill-meter (used in Nursing and Paramedic qualifying exams to determine CPR compression effectiveness).

The phenomenon observed by Manning (2006) is similar to the current situation regarding scuba diving certification and instruction. While BSAC, PADI and SSI all espouse the desire to teach scuba diving techniques and instil low impact diving values in their students, scuba divers continue to have a negative impact on marine environments. While this study will not examine scuba divers psychomotor skills, it will examine course content, in conjunction with divers' environmental and low impact diving knowledge retention, to determine the effectiveness of certification course content and what factors influence divers' knowledge retention of the taught values and low impact diving skills. Madden (2006) analyzed her cognitive and psychomotor data

using basic descriptive and inferential statistics (e.g. t-tests, ANOVA, Chi-squared); this allowed her to compare participants' mean scores and determine their relative levels of cognitive and psychomotor retention. A similar technique will be utilized in this study (*see 3.5.3 Data Collection and Analysis*).

Besides the literature on knowledge retention, extensive research into the efficacy of environmental messages in eliciting desired pro-environmental behaviour has been conducted (Bradford, 2005; Bradford & McIntyre, 2007; Cialdini, et.al., 2006; Cole, 1998; Duncan & Martin, 2002; Fransson & Garling, 1999; Marion & Reid, 2007; Robbins, 2005). This research has examined the differences between the efficacies of multiple messaging formats, including: attribution messages (Bradford, 2005; Bradford & McIntyre, 2007), interpretive messages (Duncan & Martin, 2002; Robbins, 2005), knowledge provision messages (Cialdini et al., 2006; Fransson & Garling, 1999), plea messages (Cole, 1998), prohibition messages (Bradford, 2005), sanction messages (Robbins, 2005), and skill teaching messages (Fransson & Garling, 1999).

Kohl (2005) examined interpretative and sanction messages and their impact on conservation in parks, through the Elaboration Likelihood Model and found that interpretation messages resulted in long term behavioural changes while sanction messages resulted in temporary changes in the behaviours of park visitors. Littlefair (2003) examined the use of attribution messages and role modeling in managing National Park visitors' behaviour; she found that attribution messages were more effective in eliciting long term behavioural change. Role modeling affected short-term behavioural change.

While not all of these studies (Table 2.1) have examined all of the aforementioned message delivery styles, their combined findings are sufficient to rank all six message delivery styles in terms of their relative effectiveness in mitigating depreciative behaviours.

Table 2.1 Summary of the Recent Research on Message Efficacy and Depreciative Behaviours

Authors / Date	Study	Major Finding
Bradford (2005); Bradford & McIntyre (2007)	Social trail use in St Lawrence Island National Park (Canada).	Attribution messages were more effective than a plea message in mitigating social trail use.
Cialdini, et al. (2006)	Petrified Wood theft in Arizona's Petrified Forest National Park (USA).	Attribution messages were more effective than knowledge provision messages in mitigating petrified wood theft.
Cole (1998)	Visitors willingness to read trailside bulletin board message about low-impact trail use in the Selway-Bitterrot Wilderness Area, Montana (USA).	Attribution messages were more effective than plea messages in encouraging visitors to read trailside signage.
Duncan & Martin (2002)	Comparing the effectiveness of interpretive and sanction messages for influencing wilderness visitors intended behaviour (California, USA).	Interpretive messages were equally effective as sanction messages in affecting intended behaviour; both were more effective than no message.
Gramann & Vander Stoep (1986)	Reducing depreciative behaviour in Shiloah National Military Park (USA).	Attribution messages were effective in reducing depreciative behaviours while hiking in a National Park.
Ham (1992)	Environmental interpretation.	Interpretive messages were more effective than knowledge provision messages in eliciting knowledge retention.
Hocket (2000)	Reducing wildlife feeding at picnic areas in Shenandoah National Park (USA).	Attribution messages were more effective than sanction messages in reducing wildlife feeding.
Hunt & Hosegood (2008)	The effectiveness of signs at restricting vehicle traffic: a case of seasonal closures on forest access roads.	Sanction messages and associated enforcement yielded close to 90% compliance with seasonal closures on forest access roads.
Jacobi (2003)	The effectiveness of trailside signs in discouraging visitors from building or altering rock cairns (USA).	Attribution messages deterred visitors from building or altering rock cairns.
Johnson & Swearingen (1992)	Off-trail hiking in Mt. Rainier National Park (USA).	Sanction messages were more effective than plea messages in deterring off-trail hiking.
Kernan & Drogin (1995)	Interpretive messages impact on depreciative behaviours in Mount Rainer National Park (USA).	Interpretive messages were more effective than no messages in deterring depreciative behaviour engagement.
Kohl (2005)	Putting Environmental Interpretation to Work for Conservation in a Park Setting	Interpretation messages resulted in long term behavioural changes. Sanctions resulted in temporary changes to behaviour.
Littlefair (2003)	The effectiveness of interpretation in reducing the impacts of visitors in national parks.	Attribution messages were more effective in eliciting long term behavioural change while role modeling affected short term behavioural change.
Marion & Reid (2007)	Summary of recent literature on depreciative behaviour and effective communication with recreationists.	Awareness of the audience's level of low impact knowledge level and their recreation activity perspective allows an educator to target efforts to a specific group, regardless of the way the message is delivered. Repetitious and consistent messaging is needed to improve memory retention.
Martin (1992)	Pumice removal from Mount St. Helens National Park (USA).	Sanction messages were more effective than plea, interpretive and knowledge provision messages in deterring pumice theft.
Sorice, Flamm & McDonald (2007)	Factors Influencing Behavior in a Boating Speed Zone and their impact on manatee conversation	Sanction messages were more effective than interpretive messages in reducing boating in a manatee zone.
Stubbs (1991)	Low-impact recreational practices and wilderness users (USA).	Messages must be consistent to be effective in encouraging low-impact recreational practices among wilderness users.
Widner Ward & Roggenbuck (2003)	Petrified wood theft in Petrified Forest National Park	Interpretative messages were more effective than prohibition messages in deterring petrified wood theft.

Examining the findings of the aforementioned researchers, it can be seen that the varying degrees of efficacy of these message delivery styles can be ranked from the most effective to the least effective, as follows: attribution messages; interpretive messages; sanction messages; prohibition messages; plea messages; and lastly,

knowledge provision messages. These studies point to the fact that attribution and interpretation messages are more effective in eliciting long-term behavioural changes, whereas the other message delivery styles elicit short-term behavioural changes (see *Appendix 1 – Glossary of Key Terms*).

This hierarchical ranking of message delivery styles allows for the evaluation of the efficacy of multiple message sources that contain multiple / diverse messages delivery styles through a comparison of the message delivery styles use and the percentages of the total content that use each message delivery style. It additionally allows a comparison of the likelihood of each manual to affect long- versus short-term behavioural change.

2.7 Environmental Education and the Elaboration Likelihood Model

The Elaboration Likelihood Model (Petty & Cacioppo, 1986), or ELM, has been used extensively to model effective environmental communication and visitor education in recreation, tourism and natural resource management. Previous research used the Elaboration Likelihood Model to a) determine ways to encourage responsible behaviour related to the new public right of access in Scotland (Carter, 2001), b) study interpretive education in parks and protected areas (Kohl, 2005; Littlefair, 2003; Marion & Reid, 2007; Wiles & Hall, 2003), c) examine the effects of pre-dive briefings on rates of coral damage by scuba divers (Medio, et al., 1997), d) explore the factors influencing recreationists' behaviour in boating speed zones and their impact on the Florida manatee (Sorice, et al., 2007) and e) generate persuasive communication for off-road vehicle management in the Yukon territory (Ycomans, 2006). The ELM also provides a way to visualize the effectiveness of environmental communication with scuba divers through an examination of how the central and peripheral routes to persuasion (Roggenbuck, 1992; Vande Kamp, Johnson & Swearingen, 1994) are used to encourage scuba divers to engage in low impact diving practices, and use low impact diving skills.

According to Marion and Reid (2007) "the central route to persuasion is most appropriate when educational goals focus on instilling an enhanced environmental ethic, or when … targeting unintentional deviant or depreciative behaviours" (pp. 11). The

central route to persuasion, often utilized unintentionally by protected area managers (Marion & Reid, 2007), relies on visitor attention, consideration and internalization of messages related to depreciative behaviours and environmental education (ibid) and arises from the Theory of Planned Behaviour (Kohl, 2005). It is particularly effective because it allows message recipients to process the information and synthesize incoming messages with information from past experiences, and existing knowledge, and to evaluate the arguments presented to them (Marion & Reid, 2007). As a result, message recipients' attitudes change and the resultant attitude is integrated into the message recipients' belief structure, resulting in long term behavioural change (Figure 2.2) (ibid).

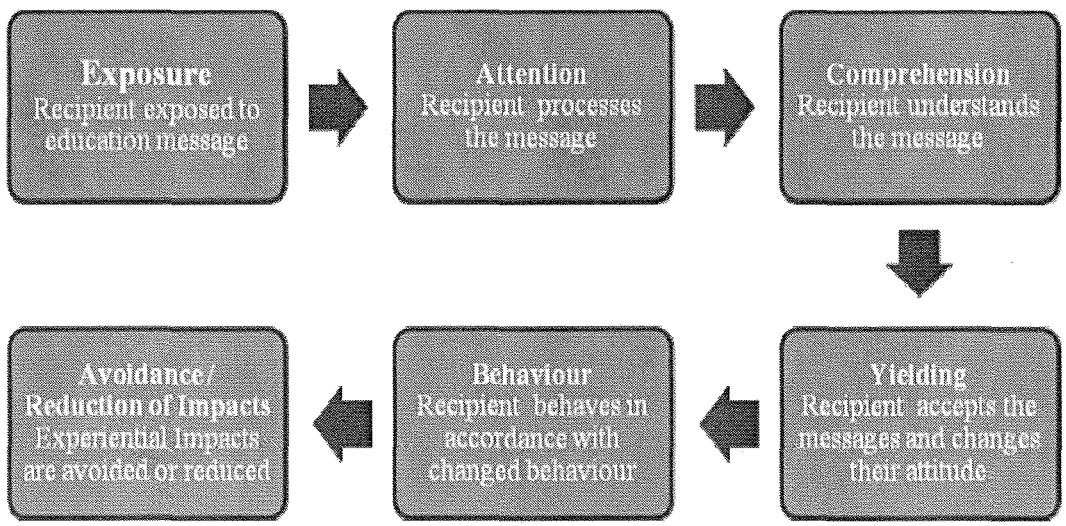


Figure 2.2 Model of How the Central Route of Persuasion Influences Behaviour Change Resulting in Avoidance or Reduction of Experiential Impacts (From Marion & Reid, 2007)

According to Marion and Reid (2007) message recipients are likely to behave in accordance with their changed attitudes "if they retain the message and attitudes in their memory" (pp. 11).

Kohl (2005) notes that environmental messages and education can also result in changed behaviour without alterations to recipients' core beliefs; this occurs through the peripheral route to persuasion. The peripheral route differs from the central route to persuasion; it relies on the message source or other cues, not the message (Roggenbuck, 1992), and as such does not provide issue-relevant motivations for behavioural change

(Marion & Reid, 2007). Instead it uses authority figures or spokespersons (source credibility or attractiveness) to convey pro-environmental messages through conditioning, and cueing (Kohl, 2005; Roggenbuck, 1992). As such, attitude change is short-term (Kohl, 2005; Marion & Reid, 2007) and is more effective when competing for recipients' attention or targeting children (Marion & Reid, 2007).

According to Kohl (2005), managers and park officials often use sanctions, including fines, expulsions, and arrests, to persuade visitors to avoid depreciative behaviours and not provoke a sanction (Kohl, 2005). Sorice, et al. (2007) noted that fear appeals, or sanctions, are a form of persuasive communication designed to arouse anxiety through the use of personally relevant threats which must be capable of arousing self-efficacy in the message recipient. Self-efficacy relates to "an individual's belief that they can perform the recommended behaviour to avert the threat" (Sorice, et al, 2007, pp. 359). For these messages to be effective and result in the greatest amount of behavioural change, sanctions must be strong and the perceived threat must mediate the relationship between fear and behaviour (Sorice et al., 2007).

It can, therefore, be seen that when combined with the literature on message delivery styles, attribution and interpretative messages fall under the central route to persuasion of the Elaboration Likelihood Model. These messages are, therefore, appropriate for communication in entry-level novice certification courses, where certifying bodies seek to affect the long-term adoption of low impact diving practices and skills that result from attitudinal change. Alternatively, knowledge / fact provision messages, sanctions, and plea messages, resulting in short-term behavioural adoption, fall in the peripheral route to persuasion. They are, therefore, more appropriate for pre-dive briefings when authority figures, like MPA Rangers or Dive Masters, seek to effect short-term behavioural changes, while competing for divers' attention that is often diverted to gear assembly and buddy checks (Medio et al, 1997). Combining the central and peripheral routes to persuasion gives rise to the Elaboration Likelihood Model of Persuasive Communication (Figure 2.3), which can be used to predict or chart how individuals and groups will respond to various forms of communication.

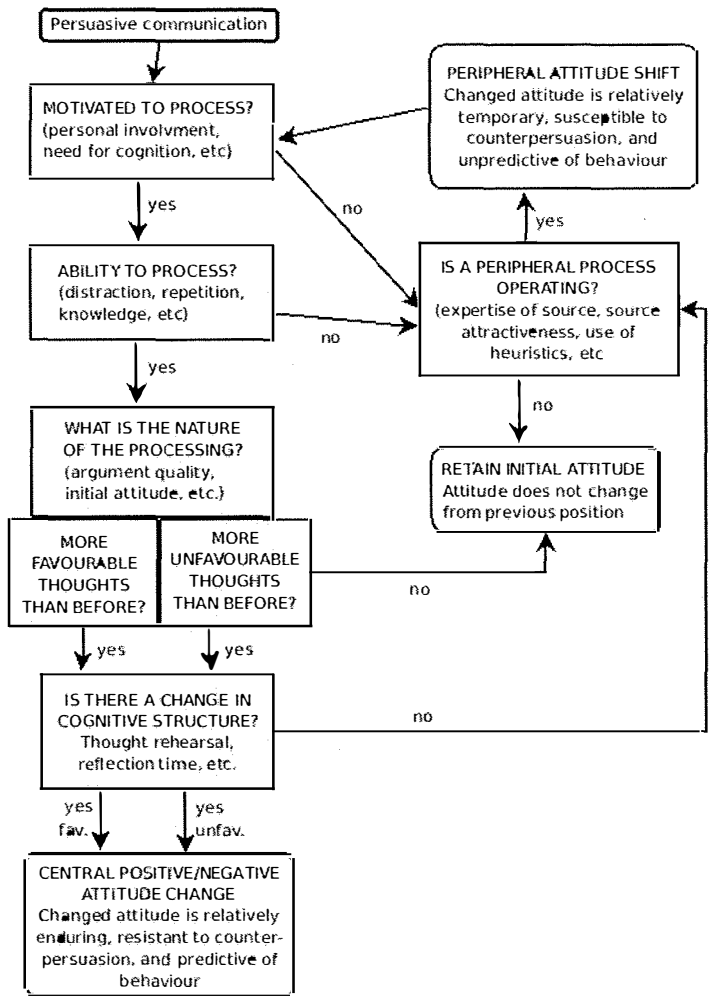


Figure 2.3 The Elaboration Likelihood Model
(From http://kaiwright.typepad.com/.a/6a0115705777c6970b01156ff4724a970c-800wi)

2.8 Conclusion to the Literature Review

This literature review discussed the impacts of recreational scuba diving and dive tourism and examined international diver demographics. The principles of low impact diving and pivotal low impact diving skills were presented and the global diving industry and diver environmental knowledge were discussed. The following Methods Chapter discusses the application of the Elaboration Likelihood Model, and the central and peripheral routes to persuasion, to the analysis of the effectiveness of environmental communication with scuba divers contained within the entry-level scuba diver certification manuals of BSAC, PADI and SSI.

CHAPTER 3.0 METHODOLOGY

In this research, a *sequential-exploratory strategy* was undertaken, involving an initial qualitative phase, used to inform the development of the subsequent quantitative phase; the results of these two phases are then triangulated in a final stage (Creswell, 2009). This type of study was selected because it allowed the researcher to use the quantitative findings to support the interpretation of the qualitative content analysis.

The first phase of this study involved a content analysis of diver education materials contained within the certification course manuals published and used by BSAC, PADI, and SSI in their entry-level, novice, diver certification courses. The second phase involved the administration of a quantitative e-survey that tested divers' retention of the curricula taught in the previously mentioned courses as well as providing a profile of divers. The final phase triangulated the findings of the first two phases to create a holistic understanding of effectiveness of the environmental messages communicated to BSAC, PADI and SSI novice divers.

This chapter situates the research and researcher within the pragmatic worldview and discusses the development of the research aims and objectives that guided this study. The certification processes and statistics of each of the three certifying bodies under study (BSAC, PADI and SSI) are described, to set the context for the examination of their content aimed at determining the extent of their environmental messaging. The mixed methods phases used to gather the data for this research are explored within the context of the Elaboration Likelihood Model's central and peripheral routes to persuasion. This chapter concludes with a discussion of the methods used to triangulate the qualitative and quantitative datasets.

3.1 Situating the Research and Researcher

According to Annells (1996), a paradigm is "a set of propositions that explain how the world is perceived, [while]… a paradigm of inquiry informs a researcher as to what is important, what is legitimate, [and] what is reasonable concerning systematic inquiry" (pp. 383). Therefore, even though "philosophical ideas remain largely hidden in research, they still influence the practice of research and need to be identified"

(Creswell, 2009, pp. 5). Samdhal (1999) also notes that "dominant paradigms and contemporary social beliefs are significant factors that shape the direction of research" (pp. 120). To acknowledge the potential influences or biases created by the larger philosophical ideas that the researcher espouses, this section situates both the research and the researcher within the pragmatic worldview and explains why a mixed methods approach was chosen for this study. The pragmatic worldview is the paradigm that guided this research. Pragmatic research is often conducted as mixed methods research because it allows for the use of multiple approaches to collect and analyze data, as opposed to subscribing to a single methodology (Creswell, 2009).

Beyond the worldview, situating oneself within the research is an important aspect of acknowledging why certain research and methodological approaches are undertaken (Annells, 1996; Creswell, 2009; Samdahl, 1999). As an SSI certified Master diver, and an avid dive tourist, I have had the opportunity to both engage in international dive tourism, and view firsthand the impact of divers who, either through lack of knowledge or skill, do not engage in low impact diving practices. As an environmentally-minded individual, I am saddened to see the damage that this lack of knowledge and skill inflicts; as an environmentally-conscious diver I recognize that my ability to continue diving at pristine dive sites is dependent on the continued health of marine environments, both in terms of personal enjoyment, and access. Finally, this concern, coupled with past experience researching divers' in-water behaviour and impact on marine environments (Johansen, 2008) strongly influenced the nature of the questions that this research attempts to answer.

3.2 Research Aims and Objectives

This study aims to determine both the nature and effectiveness of environmental communications with scuba divers contained in entry-level certification course content across three certifying bodies: BSAC; PADI; and, SSI. The effectiveness of these communications is evaluated based on divers' abilities to retain key concepts communicated during entry-level certification courses through the use of the central and peripheral routes to persuasion and the six persuasive message delivery styles discussed in the literature review.

The objectives of this research are:

- To determine the breadth and depth of the environmental and low impact diving messages communicated to entry-level divers in their novice certification course;
- To determine how much knowledge of marine environments, low impact diving practices, and diver impacts on marine environments, divers retain after completing their novice certification courses;
- To determine if the routes to persuasion used to communicate environmental messages to scuba divers has an impact on the diver retention; and,
- To determine whether this retention varies by certifying body, length of time since certification, variations in diving history (frequency of skills use, etc.) or socio-demographic characteristics.

The four major research questions that arose from the objectives are:

1. Do scuba divers retain higher levels of environmental knowledge and low impact diving principles when their certifying body's manuals' communicate these messages through strong, consistent and plentiful environmental messages delivered through the central route to persuasive communication?
2. Do scuba divers possess a lower level of environmental and low impact diving knowledge when their entry-level scuba diver certification courses contained little to no environmental communications, when these messages are communicated through the peripheral route to persuasion, or when plentiful messages were combined with a high volume of contradictory written and visual messages?
3. Do advanced specialized divers (recreation and professional) possess a higher level of environmental and low impact diving knowledge than novice divers?
4. Do scuba divers' retain higher levels of environmental knowledge and low impact diving principles when they report a shorter time since their last logged open water dive?

The following sections articulate the three phases of the mixed-methods approach undertaken in this study to answer the questions outlined above and conclude with a discussion of the final phase of the study, the triangulation of the qualitative and quantitative datasets.

3.3 Study Group and Sample

This study focuses on a defined population, to determine the nature and effectiveness of environmental communication with scuba divers certified in three agencies' entry-level scuba diver certification courses, and the extent to which participating divers' retained the information in the courses offered by BSAC, PADI and SSI. While there are other diver certifying agencies worldwide (e.g. AUSI - the

Association of Underwater Scuba Instructors, CMAS - the World Underwater Federation and NAUI - National Association of Underwater Instructors), the three selected agencies were chosen because they are internationally recognized and respected for their instructional quality. Additionally, BSAC is the world's largest and oldest diving club (Ellerby, 2009), while PADI is the largest certifying body in the world (PADI, 2008) and SSI is its largest competitor. The sample for this study was, therefore, drawn from certified divers who undertook their novice training with BSAC, PADI or SSI.

Although there are differences among the certification processes across training agencies, in terms of nomenclature and skills covered, all certifying bodies require divers to demonstrate core skills and knowledge competencies before progressing to the next level of training, or in the case of novice divers, obtaining certification. The following subsections provide a brief overview of each certifying body and their novice certification courses and compare the certification statistics of the three agencies.

3.3.1 An Overview of BSAC, PADI and SSI

The British Sub Aqua Club (BSAC) was founded in London, England in 1953 with the aim "to promote underwater exploration, science and safety" (Ellerby, 2009, pp. 150). By 1954, the British Sub Aqua Club had over 1,100 members and it has since grown to over 40,000 active members. BSAC remains the world's largest and oldest diving club and is one of the world's most respected diver training agencies (Ellerby, 2009).

BSAC diver qualification begins with the BSAC Ocean Diver course; divers are allowed to dive recreationally, and autonomously, with divers of the same qualification level or higher, to a depth of 20m (Ellerby, 2009). This certification course includes training in basic buddy rescue; divers are not taught to engage in dives that require in-water decompression stops or to dive without surface support (ibid). The BSAC Sports Diver certification is an extension of the skills learned in the Ocean Diver course; divers are able to dive autonomously to 35m, can conduct dives requiring in-water decompression, and are taught rescue skills, including first aid (Ellerby, 2009). Beyond the Sports Diver certification, BSAC qualifications are divided allowing divers to pursue

either dive leader (recreational) certifications or instructor (professional) certifications (Figure 3.1).

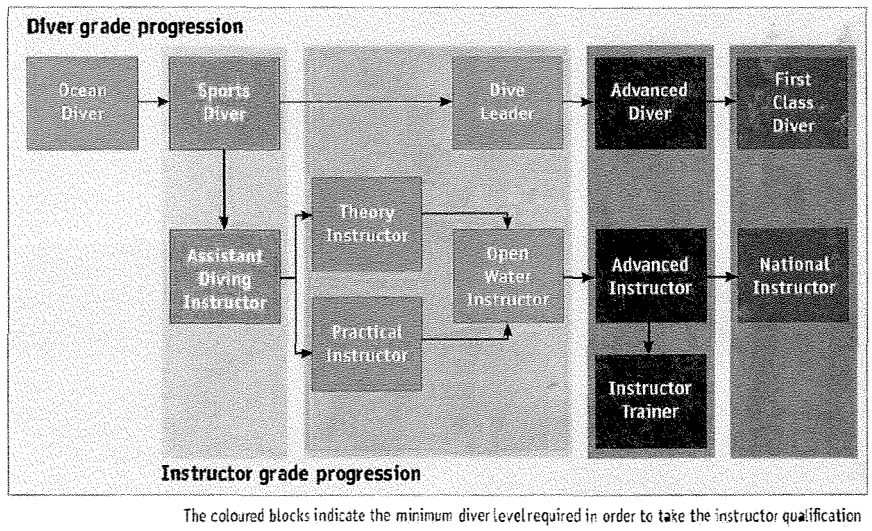


Figure 3.1 BSAC Diver Certification Grade Progression
(From Ellerby, 2007)

To progress along either the dive leader or instructional track, BSAC certified divers must meet minimum skills and knowledge requirements. Besides certification levels, BSAC also awards buoyancy standards through Qualification Cards (Ellerby, 2009). BSAC defines four levels of buoyancy control, including Bronze, Silver, Gold and Black; standards are based on a divers' ability to hold a stop for 2 minutes or more, at a depth of six meters or less. Obtaining a Bronze ranking, whereby divers are able to remain within ± 2m of a set depth for a two minute interval is expected of beginner divers; remaining within ± 1m of a set depth qualifies divers for Silver ranking, ± 0.5m or less of movement qualifies divers for Gold level ranking, and remaining at a set depth, with no deviation over a 2 minute interval qualifies divers for the elite Black standard. BSAC is the only agency with buoyancy expectations for entry level divers.

The Professional Association of Diving Professionals (PADI) was founded in 1966 in Illinois, USA, to increase the professional nature of diving instruction and promote the use of state-of-the-art instruction (PADI, 2008). PADI has over 5,700 dive shops and resorts (ibid). PADI enjoys one of the most diverse memberships in the dive community, due in part to its status as the world's largest diver training agency

(Shreeves, 2007). Its 130,000 Instructors, Assistant Instructors and Dive Masters teach diving in 183 countries, with PADI educational materials available in 24 languages (Shreeves, 2007; PADI, 2008).

To undertake novice training with PADI, scuba diving students must be at least 10 years of age (Junior Open Water Diver certification) or 15 (Open Water Diver certification). They must also be able to float for 10 minutes, swim for 200m without assistance, and 300m with a mask, fins and snorkel. After completing the PADI Open Water Diver Course, a diver must complete five specialty courses including navigation and deep diving to qualify for PADI Advanced Open Water Diver certification. To qualify for Rescue Diver Certification, a diver must have completed the Advanced Open Water Diver certification and be trained in first aid and CPR. After the Rescue Diver certification, a diver can progress towards their Master Scuba Diver (with a minimum of 50 logged dives), the highest non-professional certification offered by PADI, or take the professional training track which culminates in Course Directorship (Figure 3.2).

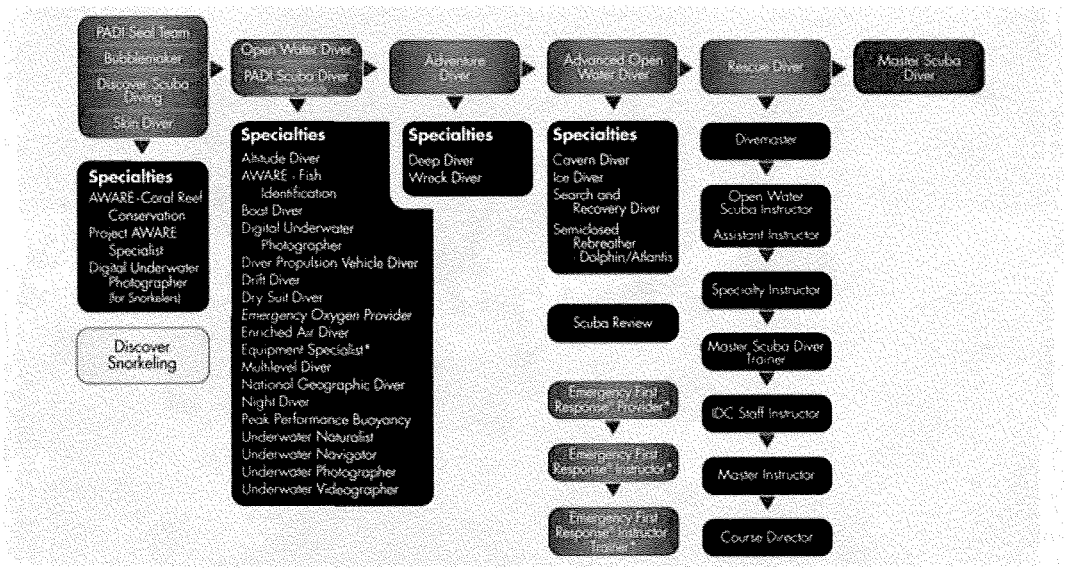


Figure 3.2 PADI Diver Certification Progression
(From www.padi.com)

Additional training opportunities exist for PADI certified divers, including non-compulsory specialty training courses.

Scuba Schools International (SSI) is a worldwide diver certification and education organization, founded in 1970. It has expanded to include over 30 regional offices with 2,400 international locations in over 110 countries (Scuba Schools International, 2003; Scuba Schools International, 2009). Like PADI, SSI has minimum requirements for novices to undertake entry-level scuba diving training. These requirements include: a minimum age of 16 years, a general comfort level in the water, and the ability to pass a short medical questionnaire. Beyond the Open Water Diver Certification, SSI offers recognition for a variety of experience levels, as well as specialty training courses, which when combined allow divers to achieve higher certification levels, including specialty diver, advanced open water diver, master diver, century diver, gold diver, platinum diver and platinum pro diver status (Figure 3.3).

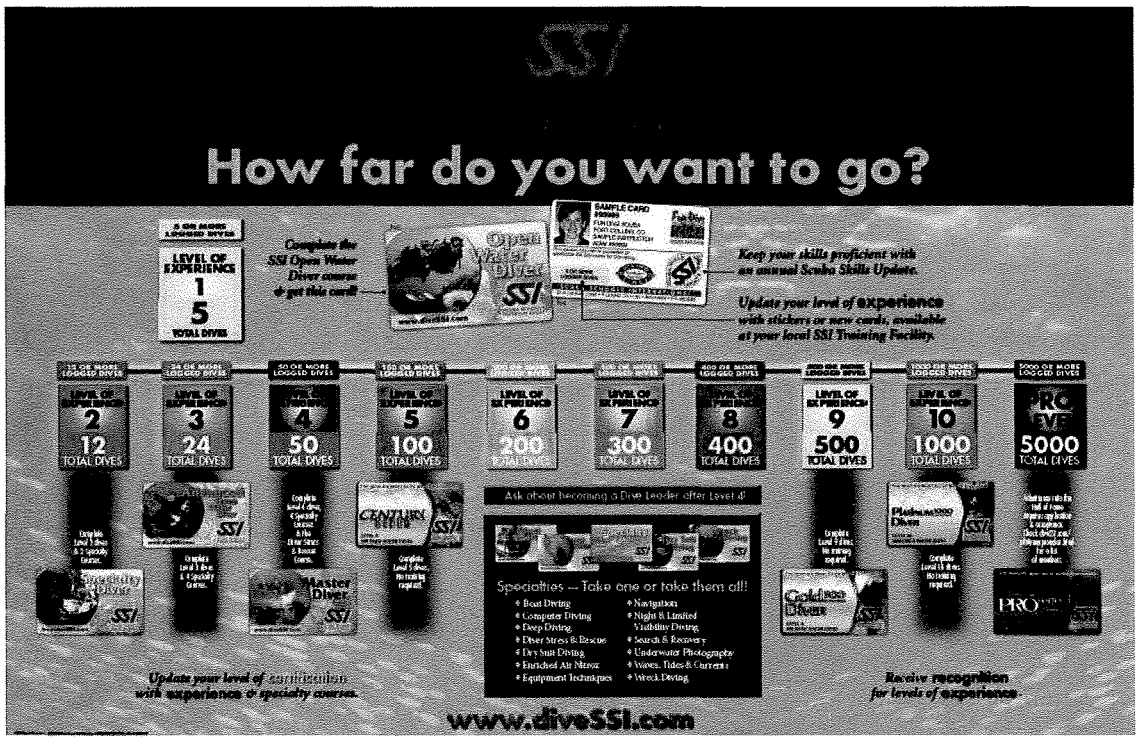


Figure 3.3 Diver Certification Grade Progression
(From www. www.scubajedi.com)

For a novice diver to attain Specialty Diver Status she or he must complete two specialty courses and 12 dives; Advanced Open Water Diver status means completing a total of 24 dives and four specialty courses; Master Diver certification requires a total of 50 logged dives, 5 completed specialty courses and diver stress and rescue certification

(Scuba Schools International, 2009). To undertake dive leader or instructor training with SSI, divers must first obtain Master Diver certification. From there, professional candidates can progress from dive guide to dive master, snorkel instructor, dive control specialist (similar to PADI's assistant instructor ranking), Open Water Diver and Specialty Instructor, Advanced Open Water Instructor, Dive Control Specialist Instructor, Master Instructor and finally to Instructor Trainer (Scuba Schools International, 2009).

In order to minimize confusion, this study refers to respondent divers' by their specialized level of training (Table 3.1), and not the highest level of training they achieved. This is because the names of each certifying body's training levels differ, and while comparable, use of the agency specific names can lead to confusion.

Table 3.1 Breakdown of the Classification of Respondents' Self-Reported Specialized Levels of Training across Certification Bodies

Groupings			
Specialized Levels of Training	BSAC	PADI	SSI
Beginner Recreational	Ocean Diver	PADI Scuba Diver	Scuba Diver
	Sport Diver	Open Water Diver	Open Water Diver
			Indoor Diver
Intermediate Recreational	Dive Leader	Adventure Diver	Specialty Diver
		Advanced Open Water Diver	Advanced Open Water Diver
Advanced Recreational	Advanced Diver	Rescue Diver	Master Diver
	First Class Diver	Master Scuba Diver	Dive Leader
Entry-Level Professional	Assistant Diving Instructor	Dive Master	Dive Guide
		Assistant Instructor	Dive Master
			Dive Control Specialist
Professional	Theory Instructor	Open Water Scuba Instructor	Training Specialist
	Practical Instructor		Open Water Instructor
	Instructor		Instructor
	Open Water Instructor		Specialty Instructor
Advanced Professional	Advanced Instructor	Master Scuba Diver Trainer	Advanced Open Water Instructor
		IDC Staff Instructor	Dive Control Specialist Instructor
	Instructor Trainer	Master Instructor	Master Instructor
		Course Director	Instructor Trainer
Other	Other	Other	Other

3.3.2 BSAC, PADI and SSI Certification Statistics

The BSAC information sheet *M5 – Assistance with Study Projects* (2005) provides the most up-to-date BSAC certification statistics and estimates of the total number of divers certified across agencies worldwide. BSAC estimates that the total club membership was 38,490 in 2004, down from 52,247 in 1995 when club

membership was at its all time high (British Sub Aqua Club, 2005). In addition to club members, the UK sports diving population is in the order of 200,000, many of whom were originally certified by BSAC but now dive independently (ibid).

Qualifications held by BSAC members at the end of 2002 included: 14,500 members under training; 4,000 Club and Ocean Divers; 9,000 Sport Divers; 6,500 Dive Leaders; and, 7,000 Advanced Divers. These divers included: 500 First Class Divers; 2000 Club Instructors; 2,000 Open Water Instructors; and, 1,500 Advanced Instructors (British Sub Aqua Club, 2005) as divers may hold more than one certification concurrently. Therefore, BSAC members under training (14,500) and BSAC beginner recreational divers (13,000) outnumber BSAC intermediate (13,500) and advanced divers (6,000).

PADI maintains records of its' annual certifications statistics which are published on the organization's website (www.padi.com). Since its inception in 1967, PADI has issued over 17 million scuba certifications worldwide (PADI, 2008). Annual worldwide PADI entry-level certifications have been consistently in the magnitude of 900,000 certifications since 2001 (Figure 3.4).

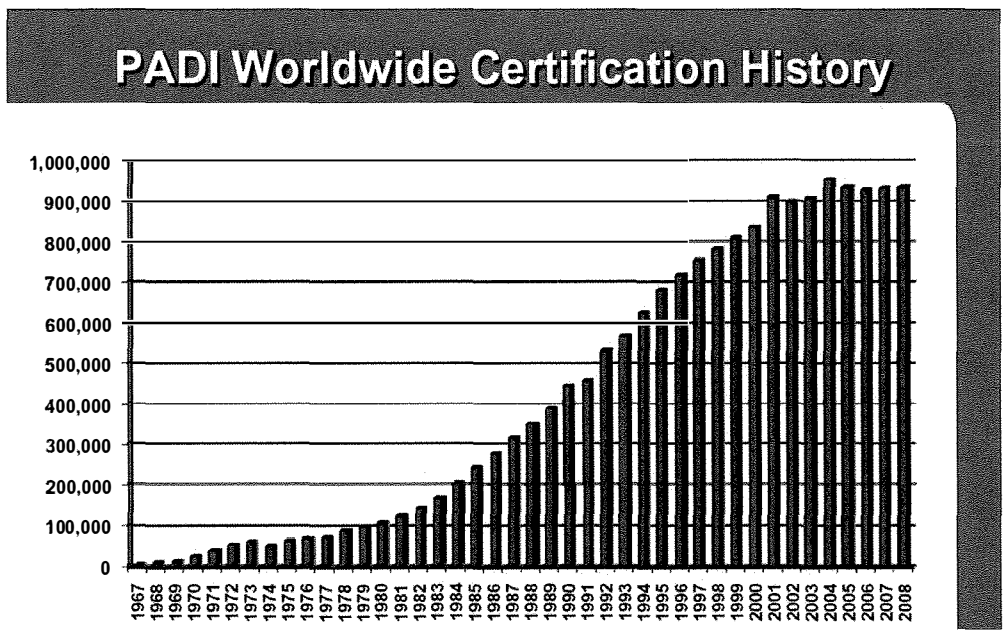


Figure 3.4 PADI Worldwide Certification History
(From www.padi.com)

Entry-level certifications encompassed in these numbers include: PADI Scuba Diver, Junior Scuba Diver, Open Water Dive, Junior Open Water Diver, Skin Diver, National Geographic Diver and Junior National Geographic Diver.

SSI does not publish their certification statistics. Instead, the Diving Equipment & Marketing Association (DEMA) publishes quarterly USA certified diver counts compiled from PADI, SDI and SSI certified diver files (DEMA, 2005). According to these statistics, the SDI, SSI and PADI's combined USA certifications from 2000 – 2008 range from 150,000 - 170,000, with a marked decline from 2001 to 2008, despite a surge in certifications during the years 2005 – 2007 (DEMA, 2005). It is important to note that these statistics are only reflective of the Open Water Diver certifications issued in the United States, and are representative of the combined certifications issued by three agencies; they do not solely illustrate the open water diver certifications issued by Scuba Schools International.

3.3.3 Sample and Population

The sample of this study was a convenience, purposive, snowball sample of certified divers, who took their entry-level training with BSAC, PADI or SSI, were 18 years of age or older, and were recruited through their membership in online SCUBA diving forums or through dive club, dive store or dive resort, e-mail lists. The total membership numbers of the online scuba diver forums, blogs, communities and websites used, combined with the number of emails sent are known, excluding the numbers associated with the scuba divers targeted through snowball sampling (Table 3.2).

As Table 3.2 illustrates, up to 221,985 scuba divers were targeted. This number is comprised of approximately 220,776 potential respondent divers targeted through postings on online forums, communities, bulletin boards, and Facebook / LinkedIn groups and 1,209 potential respondent divers targeted through email recruitment. The total number should only be seen as a rough estimate of the number of potential respondent divers targeted in this research, as scuba divers may have memberships to multiple forums and communities, may read multiple diving blogs, and because the total number of divers accessed through snowball sampling is unknown.

Table 3.2 Summary of Research Led Online Respondent Recruitment

Facebook Groups	URL	Members
SSI Scuba Diving	http://www.facebook.com/groups.php?ref=sb#!/group.php?v=wall&ref=search&gid=2245753906	1,904
Scuba Diving	http://www.facebook.com/topic.php?topic=12472&uid=2202960620#!/group.php?gid=2202960620	14,570
SCUBA Diving!	http://www.facebook.com/topic.php?topic=22482&uid=11744111529#!/group.php?gid=11744111529	5,214
Scuba Diving	http://www.facebook.com/search/?flt=1&q=scuba+diving&o=69&sid=158300427.1988361816..1&s=0#!/group.php?gid=7882458454&ref=mf	1,345
TOTAL:		23,033
LinkedIn Groups	**URL**	**Members**
BSAC Divers Group	http://www.linkedin.com/groups?home=&gid=721857&trk=anet_ug_hm&goback=%2Eanh_721857	111
Great Lakes Diving Group	http://www.linkedin.com/groups?gid=52893&trk=hb_side_g	69
Linked Scuba Divers	http://www.linkedin.com/groups?gid=49850&trk=myg_ugrp_ovr	1,959
PADI Members	http://www.linkedin.com/groups?home=&gid=56917&trk=anet_ug_hm&goback=%2Eana_56917_1265647132819_3_1	476
PADI Scuba Diver	http://www.linkedin.com/groups?home=&gid=58970&trk=anet_ug_hm&goback=%2Eana_58970_1265647132820_3_1	4,672
Scuba Diver	http://www.linkedin.com/groups?home=&gid=103879&trk=anet_ug_hm&goback=%2Eana_103879_1265647132821_3_1	171
SSI Scuba Schools International	http://www.linkedin.com/groups?gid=153980&trk=myg_ugrp_ovr	432
TOTAL:		7890
Other	**URL**	**Members**
Scuba Board	www.sucbaboard.com/forums	143,232
SCUBA Diving Magazine Forum	http://divertodiver.scubadiving.com/default.aspx	14,600
BSAC Diver Forum	http://www.bsacforum.co.uk/	30,797
Scuba Adviser@twitter	www.twitter.cm/scubaadivser	1,224
Recruitment Emails Sent by Researcher	**Certifying Body Associated with Dive Shop or Dive Resort**	**Number Sent**
Canada, UK, New Zealand and Australia	SSI	70
United States	SSI	312
Caribbean and Central America	SSI	76
Mediterranean	SSI	29
Dive Shops	BSAC	147
Dive Clubs	BSAC	575
	TOTAL EMAILS SENT:	1,209
	TOTAL EMAIL RESPONSES RECEIVED:	138
	ESTIMATE TOTAL TARGETTED DIVERS TARGETED BY THE RESEARCHER:	221,985

It was not possible to segment memberships on dive forums by gender, certifying body or home geographic region as this information is not made available by site administrators; as such determining how representative the sample is of the total targeted population is impossible.

3.4 Phase 1: Content Analysis

An extensive content analysis of the entry-level scuba diving certification manuals of BSAC, PADI and SSI was conducted. This content analysis was undertaken to determine the nature and of the environmental messages communicated through the entry-level certification processes of each agency, the message delivery styles used to communicate these messages and which route to persuasion each agency favoured in their communication of environmental messages. As such, certain sections (diving imagery, motivations for diving, and 'other additional aspects') were found and coded but not reported as they bore no connection to the objectives of this thesis. The content analysis also established the knowledge retention questions that were asked during the first section of the self-administered e-survey.

The use of documentary data has historically been central to social science research; however, the methods for analyzing them have varied (Manning & Cullum-Swan, 1994). Content analysis, as the most systemically evaluative technique for documentary analysis (ibid) was used in this study. According to Manning & Cullum-Swan (1994), content analysis is the process by which "standardized measurements are applied to metrically defined units [which are then] used to characterize and compare documents" (pp. 464) such as magazines, diaries, books (Manning & Cullum-Swan, 1994), transcripts of interviews, discourses, protocols of observations, video tapes, and documents (Mayring, 2000). Content analysis examines not only the manifest content of the examined material, but also the latent content (Mayring, 2000; Grancheim & Lundman, 2004). This allows researchers to explore differentiated levels of the content, including the themes and main ideas of the text as well as the context of the information (including what is missing or not included) thus, providing a broader understanding of the material (Mayring, 2000). The content analysis process is completed in a stepwise

fashion (Figure 3.5) and analytical categories can be either inductively developed or deductively applied.

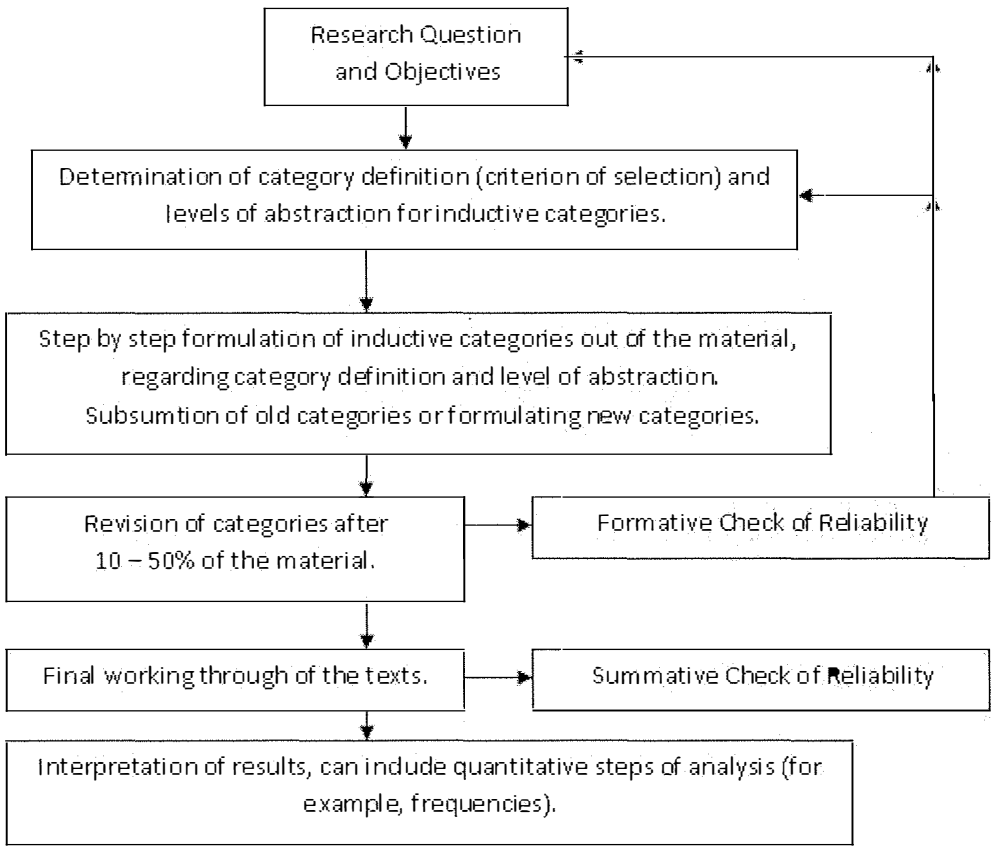


Figure 3.5 Stepwise Model of Category Development
(Adapted from Mayring, 2000)

Inductive category development involves formulating a criterion of definitions derived from an examination of the literature and an understanding of the research question or questions (Mayring, 2000). Therefore, inductive category development involves the step-wise development of emergent categories which are worked through and tentatively reduced by the application of a feedback loop that revises those categories and eventually reduces them to a set of pivotal emergent categories that can be checked for reliability. Alternatively, "deductive category application works with prior formulated, [theoretically] derived aspects of analysis, bringing them in connection with the text" (Mayring, 2000, pp. 4); deductive category application, therefore, involves assigned a category or categories to a passage of text in a controlled repeatable manner.

In short, inductive categories are developed from the themes that emerge from the text, whereas deductive categories are predetermined and applied to the text.

In this study, a manifest and latent content analysis approach was used to determine the overt and covert messages inherent within the texts (Graneheim & Lundman, 2004). A mixture of both inductive emergent category development and deductive category application were chosen due to the limited literature on diver environmental education from which to draw "explicit definitions, examples and coding rules for each deductive [categorization, and for] determining exactly under what circumstances a text passage can be coded with a category" (Mayring, 2000, pp. 5). Themes were developed "to link the underlying [latent] meanings together... [so that] recurring regularit[ies] developed within categories or cutting across categories" (Graneheim & Lundman, 2004, pp. 107) could be explored. The following themes, identified through the literature, were used as sources for potential codes:

a. the six pivotal Low Impact Diving Skills;
b. the 14 Principles of Low Impact Diving;
c. both coral reef based and general aquatic environment knowledge; and,
d. the message delivery styles used in each manual.

Using both inductive and deductive category development also allowed for the acknowledgment that each of the manuals could contain both manifest and latent messages; as such additional themes which emerged from the analysis reflected: missed education opportunities; visual images that supported the written messages in the text; visual images that contradicted the written messages of the text; written messages which contradicted the low impact diving principles and skills, and the environmental messages (coral based and general aquatic) in the manuals; and, messages about the espoused educational and environmental beliefs of each organization. Leeway was provided to allow additional codes to emerge from the text if they reflected the goals and objectives of the study.

The basic unit of analysis was the individual certifying bodies' textbooks. Individual textbooks were chosen as the unit of analysis because they represented the

individual bodies of knowledge conveyed by each certifying body to their specific entry-level novice scuba diving students. To aid in the analysis of the three certifying bodies' textbooks (ranging in volume from 158 pages for the BSAC manual, to 260 pages for the PADI manual and 236 pages for the SSI manual) each textbook was scanned, and the resulting .tif files were then converted and merged into a larger .PDF file. Optical Character Recognition (OCR) was then run on the individual textbooks' .PDF files before they were uploaded to Atlas.ti, a qualitative analysis software package. Running OCR on each of the documents made it possible for the software to recognize individual characters and words in the documents, thus facilitating the analysis of the manuals.

Qualitative analysis software packages like Atlas.ti, DEXi and QSR's NVivo have been used extensively in recreation and tourism research (Arcidiacono & Procentese, 2005; Cerveny & Ryan, 2008; Kayat, 2002; Pan, Chon & Song, 2008; Salazar, 2005; Xiang & Formica, 2007). Konopásek (2008) argues that use of computer programs like Atlas.ti speed up the analysis process, allow researchers to map concepts that are otherwise difficult to grasp, and increase the researcher's ability to systematically organize the content understudy. Konopásek (2008) notes, however, that the researcher must still do the critical work of coding the data and drawing connections between the codes within and between documents.

In this study, individual textbooks were systematically coded for theme-based meaning units (Graneheim and Lundman 2004) that conveyed an environmental message or were representative of the themes outlined above. Where text referred to or was accompanied by an image, the image was also coded. Image codes indicated whether or not the associated image either supported or contradicted the environmental messages espoused in the manual.

Meaning units, also referred to as Open Codes, were then categorized into Axial Codes (Graneheim & Lundman, 2004), which were then categorized to allow for thematic analysis. Created categories were both exhaustive and mutually exclusive to ensure that all environmental communication data was included, but did not fall into multiple categories (Grancheim & Lundman, 2004).

The development of categories also included the development of sub-categories to allow for varying levels of abstraction in the description of the content of each certifying body's manual. Assigning multiple axial codes, and categories, to single open codes allowed the researcher to simultaneously a) explore the messages conveyed to entry-level divers and b) evaluate the effectiveness of the messages' medium of delivery in affecting engagement in desired low impact diving practices.

Once each certifying bodies' textbook had been systematically coded, and categories / themes had been identified within each textbook, a comparison of the environmental messages communicated to divers across certifying bodies was undertaken. Prior to this analysis, two 'error checks' were performed using redundancy checks built into Atlas.ti. Identical quotations were merged, and a redundant code analysis was conducted; this process minimizes human coding error. Merging identical quotations allowed identical quotes to be merged under multiple codes, if assigned more than one code, while eliminating double counting. The redundant code analysis allowed for the elimination of overlapping codes that partially referenced the same quotation(s).

Through triangulation, the analysis of certification course manual content provided a greater understanding of the environmental and low impact diving knowledge communicated to entry-level certified divers. This greater understanding was facilitated by running a co-occurrence matrix in Atlas.ti. The co-occurrence matrices allowed for the examination of the co-occurrences of an identified theme (i.e. low impact diving skills) with its associated message delivery styles (i.e. attribution messages or skill teaching messages). Understanding which message delivery styles were used to communicate which pro-environmental messages aided in the development of the knowledge retention portion of the online quantitative questionnaire, while simultaneously adding to the depth of understanding of the relative efficacies of each manual's content. It also provided a way to clearly visualize how each of the environmental messages communicated to scuba divers fell within the central or peripheral routes to persuasion of the Elaboration Likelihood Model. The greater understanding gained by conducting the content analysis increased the reliability and validity of the questions designed as a component part of the e-survey, discussed next.

3.5 Phase 2: The E-Survey

The second phase of this research involved the creation and administration of an e-survey which included two sections pertaining to the research questions that guided this study. These two sections were designed to determine: divers' level of knowledge retention; and, diver demographics and recent diving history. Before providing a description of the survey and it implementation, an overview of e-surveying techniques is given, as this technique was integral to Phase 2 of this study.

Anderson and Kanuka (2003) recommend the use of e-surveys as a means to obtain perception, attitude and behavioural data, particularly in educational research. E-surveys provide a means to gather descriptions of the target population (in this case certified divers), to determine associations between data items (knowledge retention and dive history) and to explore questions or issues (impact of message delivery style on knowledge retention).

An e-survey was chosen over more traditional questionnaire implementation strategies (phone, mail, fax and onsite survey) because e-surveys allow researchers to design the survey instrument, implement it, and collect data with greater case than traditional methods (Grennberg, Kit & Mahoney, 2005). When compared to mail and telephone questionnaires, which can be prohibitively expensive (due to the cost of postage, stationary, printing and telephone bills, etc.) online questionnaires can be fairly inexpensive and are typically free for students (Anderson & Kanuka, 2003). The use of an e-survey also allowed the researcher greater access to divers, a globally dispersed population, and provided time and cost savings.

There are several additional advantages to online questionnaires or e-surveys. One particular advantage is that they have built-in in-situ error checking. Answers to particular questions can also be used to direct respondents to other sections of the questionnaire (through strategic page jumping); this has the potential to minimize confusion for participants who would have to guide themselves through self-administered paper surveys (Anderson & Kanuka, 2003). Online surveys also have the potential to be more accurate than telephone surveys as participants enter their own

responses which are then directly converted into an MS Excel spreadsheets or similar database (Anderson & Kanuka, 2003). These steps help minimize measurement error, or errors that arise during the data collection and recording phases.

There are several disadvantages to the use of e-research techniques, including: finding, identifying and recruiting potential respondents; and, concerns about validity and reliability (Anderson & Kanuka, 2003). Potential respondents were found, identified and recruited through online scuba diving forums, bulletin boards and communities as well as through recruitment emails sent to dive shops. As a long-term member of the diving community, I have observed that divers are a highly internet savvy group of recreationists and tourists. Considerable online blogs or diving e-magazines (www.cyber-diver.com), forums (www.scubadvisor.com, www.basc.com/forum), communities (Facebook groups administered by certifying agencies, dive clubs, and divers) and diving industry magazine website communities (www.dtmag.com) exist. These online diving communities and groups have memberships ranging from the thousands to hundreds of thousands. Additionally, dive holidays are typically researched and booked online. While the specific means of recruiting respondents will be discussed later, it is important to note here that the diving community has a strong online presence.

One disadvantage of e-surveys is that many individuals do not have access to the internet; this is a form of frame or coverage error (Dillman, 2000). While this may bias responses towards "English-speaking, well-educated, and affluent populations" (Anderson & Kakuna, 2003, pp. 150) this demographic accurately represents international dive tourists (Todd, Cooper & Graefe, 2001; Tourism Queensland, 2003). Additionally, as discussed, scuba divers are a well connected community with hundreds of online forums and communities used to facilitate dialogue on environmental issues and training opportunities, find new dive buddies and get advice on dive travel, as well as to maintain friendships built through dive tourism experiences. Additionally, measures were taken to ensure a wide variety of recruitment techniques were used to increase the likelihood of reaching the greatest number of divers. The researcher, however, acknowledges that a master email list of all certified divers does not exist, and that all divers do not have access to the internet, or if they have access to the internet,

they may not choose to be members of, or read, the targeted forums, communities, e-magazines, or blogs.

Along with the potential errors inherent in all types of questionnaires, online questionnaires are also subject to their own sources of potential errors and have several disadvantages alien to traditional questionnaires (Anderson & Kanuka, 2003; Granello & Wheaton, 2004). Authenticity of responses is a potential bias that is greater for e-surveys, compared to other forms of questionnaires (Anderson & Kanuka, 2003). However, this is mitigated by the fact that there is not much that a researcher can do to control the authenticity of the participants' answers in any kind of questionnaire (ibid). Anderson & Kanuka (2003) state that one of the biggest disadvantages to using web-based surveys is the protection of the participants' confidentiality; this was easily addressed here as the survey administration tool used in this research does not track or record respondents' IP addresses in a means accessible to the researcher.

An additional concern is that of respondent self-identification and self-selection both of which are forms of response bias. Unlike in-situ survey administration, the onus for authenticity of identification is placed on respondents, who must self-identify as being members of the target population. As such, the researcher acknowledges that there is no way to guarantee, with 100% accuracy, that all respondents to the online questionnaire were certified divers, as collecting their certification numbers would have infringed upon their privacy and right to anonymity. Similarly, respondents self-selected to participate in the online questionnaire, which has the potential to bias received responses towards strongly environmental-minded divers and / or divers with strong opinions about the inclusion of environmental education in entry-level dive training.

Lastly, non-response bias is a potential concern. Non-response bias is a type of non-sampling error that arises when some sub-groups of the sample respond less than the remaining sub-groups of the sample. Efforts were made to reach members of each of the three sub-groups (BSAC, PADI and SSI certified divers) through the use of specific online communities aimed at members of the three sub-groups (see Table 3.2). When distinct differences in the number of responses received by members of specific sub-groups were noted, additional measures were implemented to increase the number of

response by self-identified members of these subgroups. These measures included email recruitment through sub-group specific dive clubs and dive training centers. The researcher acknowledges that there is an increased chance of recruiting members of the PADI sub-group from generic diver blogs and e-magazines open to all members of the diving community as a result of their higher membership numbers.

3.5.1 Survey Design, Pre-Testing and Revisions

The purpose of the e-survey was to determine: divers' retention of environmental and low impact diving knowledge conveyed in their open water diver certification courses; overall diver demographics; and, individual divers' recent diving history.

The online quantitative questionnaire consisted of two sections (*Appendix 2 - Diver E-Survey*) - a third series of questions was included in the survey as part of a larger study, but are not reported on in this thesis as they do not pertain to the research objectives of this study. The first section was designed to determine divers' retention of the content of their entry-level certification course and their knowledge of diver impacts on marine environments, low impact diving principles and skills. Using page jumping logic embedded in the e-survey, divers were able to navigate to the page that contained the knowledge retention questions designed for respondents who self-identified as having received their novice certification from each of the certifying bodies (BSAC, PADI or SSI). This was done based upon their answer to an initial routing question.

The structure and nature of the questions asked in this section of the e-survey were guided by each agency's dialogue on the 14 Principles of Low Impact Diving and six pivotal low impact diving skills as determined through the content analysis in Phase 1. Part A of the e-survey used True and False, Multiple Choice and Image Selection questions to determine respondents' retention of the aforementioned material.

The first question on each agency's knowledge retention questionnaire, was a true / false question, and related to appropriate fining techniques. The second and third questions, also true / false, were related to whether divers' caused damage when diving and the negative impacts of collecting marine creatures, specimens and, or artifacts, respectively. Questions four through nine were also multiple choice questions,

regarding: crowding marine life; marine protected areas; agency support for conservation; diving as a guest; whether coral was a living organism; and, neutral buoyancy. These questions related to the principles of low impact diving.

Questions 10 through 14 asked divers to check all the applicable boxes, and related to the remaining principles of low impact diving, and the pivotal low impact diving skills. Question 10 asked respondents about the implications of diving with loose dive gear, while questions 11 and 12 asked about certifying bodies' codes of conduct. Question 13 asked respondents about the importance of advanced training beyond initial certification, and question 14 asked about the factors governing divers' in-water behaviour. The final question in Part A of the e-survey asked divers to select the image which represented the diver who possessed the best body position for use while diving; divers made their choice out of six possible images. Several of these questions were given a negative perspective to provide a system of checks to minimize the possibility of response fatigue / bias. These methods are similar to those used by Thapa et al. (2005) in their study of the moderator and mediator effects of scuba diving specialization on marine-based environmental knowledge contingency.

While many of the studies examined in Semb and Ellis' (1994) review compared known original learning scores obtained through a test of original learning administered immediately after course completion, against tested retention scores, this was not done in this study. Instead, the study assumed that all divers achieved an 80% (minimum passing score) or higher on their entry-level diver certifying exam and compared their achieved score with the assumed minimum score in order to determine theoretical levels of knowledge retention.

Semb and Ellis (1994) found that prior knowledge increases the likelihood of knowledge retention, but also acknowledged that "there is still substantial retention after prior knowledge is accounted for" (pp. 264). Therefore, most studies that they examined "did not attempt to separate prior knowledge from what is learned during the instructional process" (Semb & Ellis, 1994, pp. 259). As it has been established that prior knowledge has a limited impact on knowledge retention, and given the time constraints of this study, prior knowledge was not determined. Additionally, no pre-

determined or pre-set retention interval was used in this study to determine if knowledge retention varied with time or advanced training and use of knowledge / skills. Similarly, neither of these considerations where undertaken by Thapa et al. (2005) in their related study on diver specialization and marine-based environmental knowledge.

The second section of the e-survey was comprised of a series of questions that asked divers about their attitudes towards diver environmental education, low impact diving practices, and perception of the necessity of low impact diving practices. As previously indicated, these questions do not pertain to the research objectives of this study, and are therefore not reported on, or discussed, in this document.

The third, and final, section of the e-survey was designed to determine basic demographic information about divers, respondents' recent diving history, which, if any, certifying bodies they had undertaken advanced level training with, and the highest level of certification they had achieved (*Appendix 2 - Diver E-Survey – Part C*).

To reduce measurement bias arising from poor survey design, the survey was pre-tested using a convenience sample of known certified divers and diving professionals across the three certifying bodies. In total 15 surveys were completed, five from each of the three certifying bodies. Based on feedback received from pre-test respondents the phrasing of several questions in the knowledge retention and dive history portions of the e-survey were altered to increase clarity; several questions were also added to the knowledge retention portion of the e-survey so that it covered all 14 principles of low impact diving in greater detail; and, a question asking divers to report their gender (erroneously omitted from the piloted survey) was added. The size of the images for the final question in Part A were also increased, and reformatted so that all images were the same size, to allow respondents to better answer the question and to avoid biasing responses towards larger images. No changes were made to Part B of the e-survey. No statistical analysis was conducted on the pre-test data, due to a low response rate (n = 15); however, valuable information was gathered that increased the validity of the research instrument, and increased the flow of the document as a whole.

3.5.2 The E-Survey Implementation

The e-survey was implemented over six weeks (February 8th to March 19th 2010). Implementation was facilitated through the use of an online survey administration tool (www.surveygizmo.com). Recruitment occurred through the use of an initial blog, community, or forum posting which requested divers' assistance with the e-survey (*Appendix 3 – Recruitment Letter for Online Scuba Diver Communities*) and through recruitment emails (*Appendix 4 – Recruitment Email*) distributed to known scuba diving clubs and dive shops.

Reminders on the websites, blogs, communities and forums were posted, or sent via email, each week; these reminders were targeted to the websites, blogs, communities and forums that were frequented most often by divers' certified by agencies which had the lowest interval response rates. Reminder emails were also sent to those potential respondents who had not yet completed a survey; this was facilitated by the survey administration tool and did not involve the collection of personal or identifying information by the researcher. All IP and email addresses collected to facilitate the submission of partially completed surveys were stored internally at Survey Gizmo and were never released to the researcher; email addresses were only collected when respondents, having completed a portion of the survey, self-identified as wanting to complete the rest of the survey at a later date.

The use of recruitment emails was added in response to negative 'trolling', defined as posting often inflammatory, extraneous, or off-topic messages in an online community that attempt to solicit either emotional responses or to provoke fruitless arguments (Herring,Job-Sluder, Scheckler & Barab, 2002) and 'flaming', defined as hostile, derogatory and insulting interactions between users, or messages sent to specific users, that usually occur on online forums or boards as the result of the discussion of real-world issues (Kehus, 2000). Both 'trolling' and 'flaming' were experienced on one of the forum sites; harassing emails were also sent to the researcher.

The email method of recruitment was initially added so that the forum postings could be taken down without jeopardizing the response rate of divers certified by one of

the agencies. It was subsequently used when a discrepancy was noted in the number of responses received by SSI certified divers. Potential email recipients were identified through the use of online dive club listings and training center contact and partner listings.

Additionally, snowball sampling was used. Although not originally intended as a part of the sampling process, the researcher was contacted by several dive shops, scuba diving instructors, and scuba diving bloggers who asked permission to post a link to the e-survey on their websites and blogs or for permission to email a 'copy and pasted' version of the recruitment email or cover letter to their students, and dive tourism, dive shop or dive resort clients. Lastly, several scuba diving Facebook group postings were found that had been copied and posted onto other Facebook groups' walls by group members, and not by the researcher.

In total 851 responses were received of which 499 were usable. Of the total number, 349 respondents were immediately removed because of their responses to the first pre-screening question, which asked respondents to select the certifying body with whom they took their novice certification. If respondents indicated that they had undertaken their novice training with 'Other' certifying bodies they were immediately re-routed to a page which thanked them for their interest in the e-survey, and explained their ineligibility to participate. Of the remaining 502 participants, three were removed during the data cleaning process because they indicated that they were either under 18 years of age (despite having indicated on the cover letter page that they had read the cover letter and were 18 years of age or older) or failed to complete a sufficient portion of the e-survey (a minimum of one of three sections of the e-survey).

3.5.3 Data Collection and Analysis

During the data collection phase, responses were collected and automatically tabled in an MS Excel file by the survey administration tool, www.surveygizmo.com. Throughout the implementation interval, this data was stored online on Survey Gizmo's internal server.

To aid in the analysis of the data, this MS Excel file was exported from the survey administration website once the survey implementation interval was officially closed (at 11:59:59 p.m. March 19th, 2010). The MS Excel file was then cleaned and the three remaining ineligible respondents were identified and removed from the data set as described above. The data cleaning process involved the following steps:

1. Amalgamating the knowledge retention questionnaires across the three certifying bodies to assist in the statistical comparison;
2. Identifying questions that were purposefully left blank by respondents, as well as those incorrectly and correctly answered;
3. Calculating individual respondents' final knowledge retention test score (as a score out of 30 and as a final percentage);
4. Identifying those specialty courses that respondents indicated were important, vs. those that were perceived as unimportant, as well as whether individual respondents had left the question intentionally blank or were not certified by the agency offering the specialty course;
5. Re-coding respondent identified Home Geographic Regions into the correct geographic regions identified by the researcher (i.e. UK and Scotland were re-coded into the existing region Europe) and creating new geographic regions based upon respondents' data (i.e. Oceania, comprised of Tasmania, Australia, and New Zealand);
6. Re-coding Occupations into the following categories: Business; Consultant; Dive Industry; Education; Emergency Services; Engineering; Government; IT / Computers; Legal; Medical; Military; Other; Researcher; Retired; Sales; Scientists; Self Employed; Skilled Trades; Student; and, Travel / Tourism / Hotel Industry;
7. Identifying missing data (coded as -- 999);
8. Creating a new variable, called Continuing Education is Important (based on respondents' answers to the question discussed in #4 above);
9. And, creating a new variable, called Specialized Level of Training that allowed for the comparison of certifications across certifying bodies.

Amalgamating the knowledge retention tests, calculating overall retention scores, and determining whether individual respondents had passed or failed allowed for the comparison of divers' levels of knowledge retention by certifying body. Additionally, identifying divers' reported specialized levels of training allowed for the later extended analysis of knowledge retention scores across certifying bodies and by divers' self-reported specialized level of training (Table 3.1).

The exported, cleaned, MS Excel file was then uploaded into SPSS; string data was re-coded into numeric data for ease of statistical analysis. While there was no 100

percent precise method of determining if duplicate responses were received, steps were taken in the creation of the e-survey to ensure that multiple responses could not be received from the same IP address. This was done internally by www.surveygizmo.com; no stored IP addresses were shared with the researcher.

Descriptive statistics, including frequencies, were initially run in order to eliminate instances of researcher re-coding and amalgamation error. Once these errors were corrected, frequencies were run again, and were used to determine general descriptors and demographic characteristics of the sample. Descriptive statistics were also used to generate basic descriptions of the frequencies of divers' responses to key questions in the knowledge retention portion of the e-survey, as well as the pass / fail rates of respondents from each entry-level certifying body.

One-way ANOVAs were used to determine whether statistically significant ($p < 0.05$) differences existed in respondents' ability to answer individual knowledge retention questions correctly at a 95% confidence level. Pairwise comparisons were determined to be significant using a Bonferroni post-hoc analysis. Subsequent to running One-way ANOVAs, Crosstabs and Chi Square analyses were used to determine the percentages of respondent divers from each of the three certifying bodies who answered questions correctly and in a statistically significant manner; this allowed the researcher to determine which key concepts, related to low impact diving principles and skills, were not retained as well by sub-groups of respondent divers.

3.6 Phase 3: Triangulating the Two Datasets

This research used triangulation to bring the multiple methods and sources used in this study together (Farmer, Robinson, Elliot and Eyles, 2006) through a sequential-exploratory mixed methods strategy, and "between methods" triangulation. According Farmer et al. (2006) the purpose of triangulation is to increase the validity of research findings by improving the likelihood that the findings, and their subsequent interpretation, are both credible and dependable. Triangulation accomplishes this by illustrating the way that the different methodological approaches have produced

convergent findings about the same phenomena as well as by providing a more complete picture of the phenomenon under study (ibid).

Denzin (1978) identified four types of triangulation techniques: methodological, data, theoretical, and investigator triangulation. This research used both methodological and data triangulation. The use of these two triangulation techniques complements the use of a sequential-exploratory mixed methods strategy.

According to Morse (1991) methodological triangulation can be simultaneous or sequential. Sequential methodological triangulation, used for this study, is required when one phase of the research informs the next. The creation of the knowledge retention portion of the e-survey was dependent on the understanding gained from the qualitative content analysis of BSAC, PADI and SSI's entry-level certification manuals.

Despite the appeal of an intuitive approach to triangulation, in which the researcher intuitively links the findings obtained through the implementation of the two data collection phases, a procedural approach to triangulation was used. This documents each comparative step taken in the triangulation process, and ensures the transparency and replicability of the triangulation process (Farmer et al., 2006).

The following step-wise process was used during the triangulation of the qualitative and quantitative datasets. According to Morse (1991), the first step in sequential methodological triangulation is to determine whether or not the research problem is predominately qualitative or quantitative in nature. Given that the concepts under study in this research are relatively "immature" and that there is not a large body of research to draw upon, as well as the fact that there is a need to explore and describe effective environmental communication in recreational and tourism activities in which depreciative behaviours can only be effectively avoided through knowledge retention based upon effective communication in tandem with the use of psychomotor procedural skills, this research is, of necessity, predominantly qualitative.

The second and third phases of the triangulation process involved the completion of the qualitative content analysis and the quantitative data collection and analysis

respectively. The second, qualitative, phase was designed to shed light on the nature of environmental communication with scuba divers, while the third phase was designed to determine the extent that respondent divers' retained these communications, as well as their general demographic characteristics and recent diving history. These two phases represent the data triangulation used in this study.

According to Morse (1991) "blending or merging of the data does not occur in the process of analysis but in the fitting of the results from each study [phase] into a cohesive and coherent outcome or theory, or confirming or revising existing theory" (pp. 121). This study revises the Elaboration Likelihood Model so it can be applied to persuasive communication, while modeling the theoretical relationship between message persuasiveness, knowledge retention, psychomotor skill competency and theoretical behaviour implications. Given that this research did not use qualitative interviews during the qualitative phase of the study, it combined and interpreted both sets of results within the context of present knowledge about depreciative behaviours, diver impacts and persuasive communication, fitting the findings together like puzzle pieces (Morse, 1991). As such, the fourth and final phase of the sequential methodological triangulation involved the stepwise integration of the findings of the qualitative content analysis and quantitative e-survey to determine the nature and effectiveness of environmental communication with scuba divers; it drew upon the findings of the qualitative content analysis, interpreting it in light of the findings of the e- survey to modify an existing theory.

3.7 Conclusion to the Methods

This Chapter situated the research and researcher within the pragmatic worldview, articulated the aims, objectives and research questions that guided this study and provided details study group and sample. It also discussed the three phases of the study. The following two chapters will present the results, and discuss the findings, of the qualitative and quantitative data collection and analysis phases. This will be followed by a Chapter that triangulates the two datasets providing a holistic understanding of the effectiveness of environmental communication with scuba divers.

CHAPTER 4.0 FINDINGS OF THE QUALITIATIVE CONTENT ANALYSIS

This Chapter presents and discusses the results of the content analysis of BSAC, PADI and SSI entry level scuba diving certification manuals. The environmental messages they contain are compared, and their relative abilities to articulate the Principles of Low Impact Diving are discussed. The effectiveness of each manual was evaluated based on their coverage of the Low Impact Diving Skills and Principles of Low Impact Diving, and their potential effectiveness in eliciting behaviour based on their use of the central and peripheral routes of the ELM.

4.1 Content Analysis of BSAC's *The Diving Manual*: Results and Findings

The 4th Edition of British Sub-Aqua Club's *The Diving Manual: An Introduction to scuba diving* (2009; 158 pages) was examined to determine the nature and effectiveness of the messages conveyed to the entry-level divers that they certify.

The introductory chapter provides a general understanding of diving, learning to dive, dive tourism and advanced certifications. From there, the manual discusses diving skills, and the proper use of each major component of a dive system. An exploration of the underwater world follows, including underwater visibility, the underwater world's flora and fauna, and human interactions / impacts. Chapter Four explores diving medical emergencies while Chapters Five and Six deal with diving equipment use and diving skills, and buddy rescue, respectively. Chapter Seven discusses the physical properties of water. Marine life, photography, the history of diving, and personal development are discussed in Chapter Eight. The Appendices provide BSAC decompression, conversion and calculation tables, basic first aid instructions, a history of the British Sub-Aqua Club, the BSAC Divers' Code of Conduct and a discussion of advanced qualifications and continuing education.

In total 265 content message quotations and 314 axial codes where identified in the BSAC Manual, delivered in five styles (Table 4.1). Both supporting (n = 31) and contradicting (n = 20) visual images were found in the manual, as were missed education opportunities (n= 20).

Table 4.1 Breakdown of the BSAC Manual's Content

Categories	Sub-Categories	Axial Codes	BSAC	Percentage
Content	Environmental Messages	Environmental Knowledge Based Messages	30	9.6%
		Coral Reef Knowledge Based Messages	4	1.3%
	Low Impact Diving Messages	*Number of the 14 Principles of Low Impact Diving Covered in the Manual*	**14**	
		1. Appropriate Fining Techniques	4	1.3%
		2. Neutral Buoyancy	1	0.3%
		3. Secure Loose Gear	3	1.0%
		4. Negative Impacts of Specimen Collecting and Hunting	4	1.3%
		5. Negative Impacts of Crowding	1	0.3%
		6. Negative Impacts of Touching / Contact	7	2.2%
		7. Negative Impacts of Interacting with Marine Wildlife	6	1.9%
		8. Divers' have an impact on marine environments	7	2.2%
		9. Marine Protected Areas	1	0.3%
		10. Factors governing divers in water behaviour	12	3.8%
		11. Key ecological concepts related to coral and marine environment biodiversity	4	1.3%
		12. Dive as a guest	9	2.9%
		13. Adopt a personal or agency based low impact dive ethic	39	12.4%
		14. Continuing education as a means to build and maintain skills proficiency and knowledge	16	5.1%
	Agency	Agency's Educational Beliefs	39	12.4%
		Agency's Environmental Beliefs	1	0.3%
	Other	Other	84	26.8%
	Skills	*Number of the 6 Low Impact Diving Skills Covered in the Manual*	**6**	
		Low Impact Diving Skills - Ascents	1	0.3%
		Low Impact Diving Skills - Body Position	7	2.2%
		Low Impact Diving Skills - Descent	1	0.3%
		Low Impact Diving Skills - Fining	3	1.0%
		Low Impact Diving Skills - Neutral buoyancy	13	4.1%
		Low Impact Diving Skills - Spatial Awareness	5	1.6%
Message Delivery Style		*Attribution Messages*	12	4.5%
		Interpretive Messages	0	0.0%
		Knowledge / Fact Provision Messages	195	73.6%
		Plea Messages	35	13.2%
		Sanction Messages	5	1.9%
		Skill Teaching Messages	18	6.8%
Supporting & Contradicting Images and Messages	Images	Supporting Image	31	60.8%
		Contradicting Images	20	39.2%
	Other	Missed Education Opportunities	20	

The relevant content of the BSAC manual is comprised of environmental messages (10.9%), low impact diving principles (36.3%), agency beliefs (12.7%), other important messages (26.8%) and low impact diving skills (9.5%). Low impact diving and environmental messages account for only a part of the total volume of the manual with these messages found on 48 of 158 pages (or 30.4% of the manual pages).

4.1.1 BSAC Low Impact, Environmental and Coral Reef Based Messages

The BSAC manual articulates low impact, environmental and coral reef-based messages, which account for a combined 47.1% of the relevant manual content. Environmental messages, either general (9.6%) or specific to coral reefs (1.3%), accounted for 10.8% of the content. Low impact diving messages, related to the principles of low impact diving (36.3%) and low impact diving skills (9.6%), accounted for 45.9% of the relevant codes in the manual.

The BSAC manual touched on all fourteen of the Principles of Low Impact Diving and all six Low Impact Diving Skills. Messages related to appropriate fining techniques (Principle # 1) reinforce the need for divers to "be careful that careless finning does not cause physical damage to what are often delicate seaweeds or animals" (Ellerby, 2009, pp. 59) and warn that stirring up the seabed is not environmentally friendly. Messages related to benefits of maintaining neutral buoyancy (Principle # 2) communicate the value of maintaining a safe distance from marine life to avoid unnecessary and damaging contact.

One of the BSAC Manual's strengths is that it covers both the positive and negative diver impacts of diving (Principles # 8). Its discussion of marine protected areas (Principle # 9) is limited, covering underwater heritage sites only. The discussion of the factors governing divers' behaviour (Principle #10) is extensive, touching on the roles of: dive masters and instructors; pre-dive briefings; and, local guidelines, customs, bylaws and regulations. Messages about marine biodiversity (Principle # 11) are present; divers are reminded to dive as a guest (Principle # 12).

The BSAC manual minimally addresses all six low impact diving skills. The passages dealing with ascents highlight the importance of a horizontal body position while the section discussing body position uses two images (Figure 4.1) to describe both the desired and an undesirable body position.

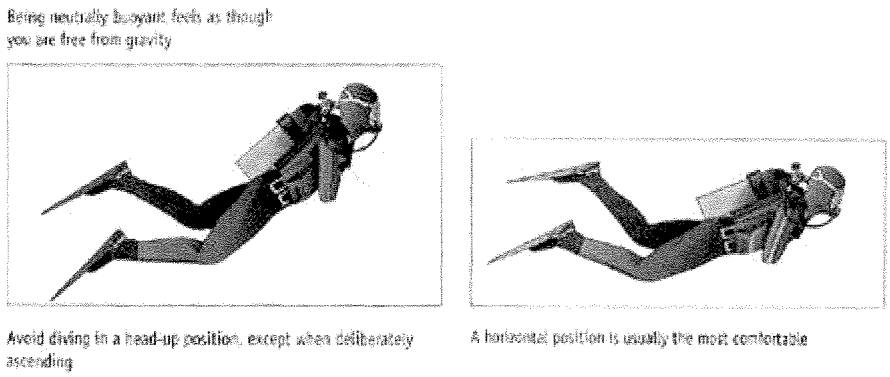


Figure 4.1 Incorrect vs. Correct Body Position when Diving
(Adapted from Ellerby, 2009)

Divers are also told to use their hands as little as possible and to control their body altitude by depth of breathing and to maintain a horizontal position.

The second low impact skill (body position) is discussed in greater detail than the first. Divers are reminded to maintain a horizontal body position, with their fins above their hips, gear secured and arms tucked close to their chest. This discussion is aided by diagrams. Passages related to safe descents are closely tied to transitioning from positive to neutral buoyancy and to proper weighting. Divers are told to submerge just below the surface and transition to a horizontal position before descending to depth head first.

Discussion of fining (Skill #4), include fining techniques that decrease damaging contact and techniques for diverse diving conditions. Reminders are included about kicking from the hips in long, slow fin strokes.

While these discussions are minimal, Duncan and Martin (2002) and Kernan & Drogin (1995) note that minimal communication is better than no communication at all as long as these messages are consistent and delivered repeatedly (Stubbs, 1991; Marion & Reid, 2007). Increasing the frequency and depth that these skills are communicated, and including more visual cues, would improve the effectiveness of the BSAC manual.

Ellerby (2009) reminds divers that "a good exercise for all divers is to fine tune your buoyancy so you can hover motionless in mid-water, able to sense the slight upward and downward movement as you breathe gently in and out" (pp. 49). Divers' are taught to achieve neutral buoyancy by

> altering [their] overall volume by means of an external piece of diving equipment. Normally this would be your BC or, if worn, drysuit. It is easy to see that introducing breathing gas into either of these enclosed spaces will increase their volume, thus increasing the amount of water they displace. In turn, this will increase the upward-acting force on them and result in an increase in your overall buoyancy. Similarly by venting gas from your BC or drysuit you will decrease their volume, creating less upthrust and so have less buoyancy. To avoid unwanted rapid upward or downward movements take care to control the amounts of breathing gas you allow in or out of such equipment (Ellerby, 2009, pp. 49).

This passage is used to encourage divers to be aware of the changes in their body size which result from donning dive gear. When kitted up, divers'

> girth is enlarged by the addition of [their] dive cylinder, and [their] length is increased by wearing fins, while gauges and hoses also protrude to increase the space [they] occupy. This enlarged space is what you have to consider when swimming close to other divers, cliffs, the sea bed or other underwater objects (Ellerby, 2009, pp. 59).

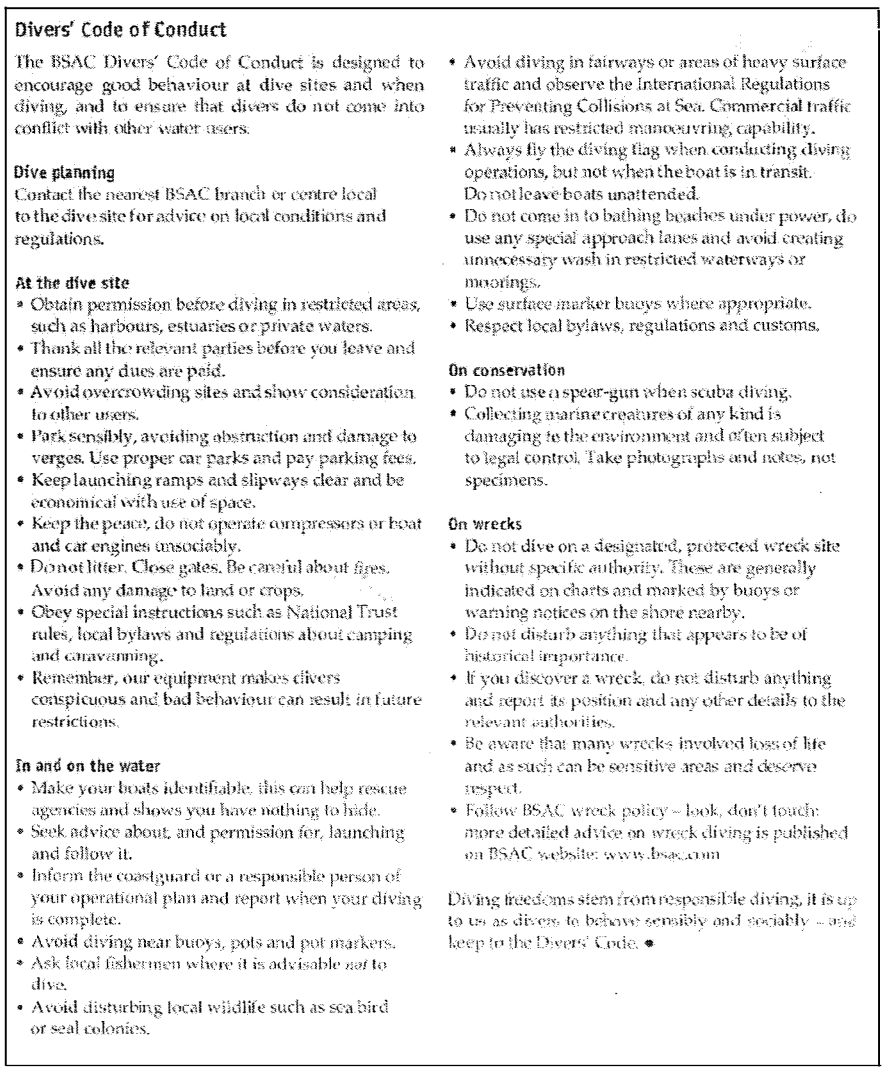
This valuable reminder is reinforced by suggestions that divers develop spatial awareness and remain aware that cylinders increase their girth and that fins extend their body length.

4.1.2 BSAC's Educational and Environmental Beliefs

BSAC's educational and environmental beliefs account for 12.7% of the total relevant manual content. The manual touches on agency-specific educational beliefs, highlighting the necessity of continued education, the need for refresher courses, and the confidence acquired through repetitive practice and use of diving skills. They also articulate BSAC's commitment to continuous development and improvement. Ellerby (2009) also reminds divers' that dive operators may want evidence of recent diving history and discusses the benefits of advanced training in marine life identification, marine biology and conservation. He also suggests that divers use manuals and

advanced training courses to gain new skills and "improve and polish the skills you already have by increasing your diving experience" (Ellerby 2009, pp. 141).

BSAC's environmental beliefs are summarized in the statement that divers' goals should always be "to protect and preserve the underwater habitat and its occupants, interfering with the delicate balance of nature as little as possible" (Ellerby, 2009, pp. 130) and in their Divers' Code of Conduct (Figure 4.2).



Divers' Code of Conduct

The BSAC Divers' Code of Conduct is designed to encourage good behaviour at dive sites and when diving, and to ensure that divers do not come into conflict with other water users.

Dive planning

Contact the nearest BSAC branch or centre local to the dive site for advice on local conditions and regulations.

At the dive site

- Obtain permission before diving in restricted areas, such as harbours, estuaries or private waters.
- Thank all the relevant parties before you leave and ensure any dues are paid.
- Avoid overcrowding sites and show consideration to other users.
- Park sensibly, avoiding obstruction and damage to verges. Use proper car parks and pay parking fees.
- Keep launching ramps and slipways clear and be economical with use of space.
- Keep the peace, do not operate compressors or boat and car engines unsociably.
- Do not litter. Close gates. Be careful about fires. Avoid any damage to land or crops.
- Obey special instructions such as National Trust rules, local bylaws and regulations about camping and caravanning.
- Remember, our equipment makes divers conspicuous and bad behaviour can result in future restrictions.

In and on the water

- Make your boats identifiable, this can help rescue agencies and shows you have nothing to hide.
- Seek advice about, and permission for, launching and follow it.
- Inform the coastguard or a responsible person of your operational plan and report when your diving is complete.
- Avoid diving near buoys, pots and pot markers.
- Ask local fishermen where it is advisable *not* to dive.
- Avoid disturbing local wildlife such as sea bird or seal colonies.
- Avoid diving in fairways or areas of heavy surface traffic and observe the International Regulations for Preventing Collisions at Sea. Commercial traffic usually has restricted manoeuvring capability.
- Always fly the diving flag when conducting diving operations, but not when the boat is in transit. Do not leave boats unattended.
- Do not come in to bathing beaches under power, do use any special approach lanes and avoid creating unnecessary wash in restricted waterways or moorings.
- Use surface marker buoys where appropriate.
- Respect local bylaws, regulations and customs.

On conservation

- Do not use a spear-gun when scuba diving.
- Collecting marine creatures of any kind is damaging to the environment and often subject to legal control. Take photographs and notes, not specimens.

On wrecks

- Do not dive on a designated, protected wreck site without specific authority. These are generally indicated on charts and marked by buoys or warning notices on the shore nearby.
- Do not disturb anything that appears to be of historical importance.
- If you discover a wreck, do not disturb anything and report its position and any other details to the relevant authorities.
- Be aware that many wrecks involved loss of life and as such can be sensitive areas and deserve respect.
- Follow BSAC wreck policy – look, don't touch: more detailed advice on wreck diving is published on BSAC website: www.bsac.com

Diving freedoms stem from responsible diving, it is up to us as divers to behave sensibly and sociably – and keep to the Divers' Code. ●

Figure 4.2 Complete BSAC Divers' Code of Conduct
(From Ellerby, 2009)

The BSAC Divers' Code is designed to encourage responsible behaviour, minimize user conflict (Ellerby, 2009) and regulate dive planning. Conservation is included in general

statements like "avoid disturbing local wildlife such as sea bird or seal colonies ... do not use spear guns when scuba diving ... [and] collecting marine creatures of any kind is damaging to the environment and often subject to legal control" (Ellerby, 2009, pp. 154). It ends with the statement "Diving freedoms stem from responsible diving, it is up to us as divers to behave sensibly and sociably - and keep to the Divers' Code" (Ellerby, 2009, pp. 154). Figure 4.2 summaries the BSAC Divers' Code and doubles as a reference for acceptable behaviour. It is a valuable addition to the manual, centralizing and clarifying BSAC's vision of acceptable behaviour. It also reinforces the independent messages throughout the manual (n = 39, 12.4%), increasing their effectiveness.

Providing consistent messages about agency educational and environmental beliefs increases divers' willingness to engage in low impact diving (Barker & Roberts, 2008). Barker & Roberts (2008) found that divers "generally accept the regulations that are imposed on them ... through their initial training" (pp. 184). It is important that certifying bodies teach, and reinforce, messages about low impact diving practices and skills by discussing their educational and environmental beliefs.

4.1.3 BSAC Images

Of the visual images (n= 51), 60.8% (n= 31) support the low impact diving messages in the BSAC manual. These images depict divers maintaining a proper horizontal body position, with arms and gauges tucked into the chest and adequately distancing themselves from the seabed, marine life or wrecks (Figure 4.3).

Figure 4.3 Sample of a Positive Image from the BSAC Manual (From Ellerby, 2009)

Similarly, the BSAC manual contains positive skill teaching diagrams that demonstrate ascents, proper body positions, and descents (Figure 4.4). These images illustrate key mechanical components of taught skills. These diagrams help divers to visualize executing the taught skills.

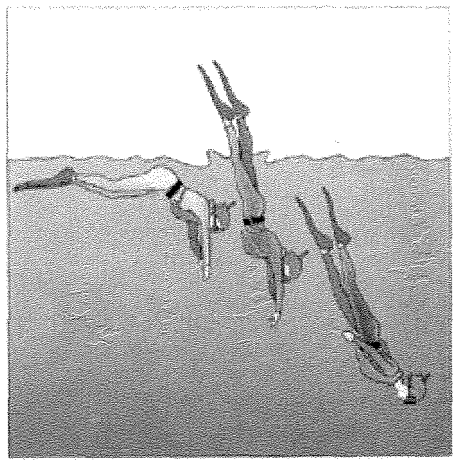


Figure 4.4 A Sample of a Skill Teaching Diagram from the BSAC Manual (From Ellerby, 2009)

Other positive images show divers fining in a relaxed, steady manner, or enjoying diving. Images also depict the underwater world, showing divers what they can expect from their open water dives. These images reinforce low impact diving principles, providing practical visual cues showing divers that engaging in low impact diving allows them to visit pristine and interesting dive sites. Diagrams that illustrate the step by step execution of low impact diving skills provide divers with knowledge they can use, when they are trying a skill for the first time, progressing towards mastery or as a reference after periods of inactivity.

Negative, or contradicting, images account for 39.2% (n=20) of the relevant images in the BSAC manual. These images commonly depict divers crowding, or chasing marine life (Figure 4.5) and contradict messages within the manual that caution against interfering with the life of marine species.

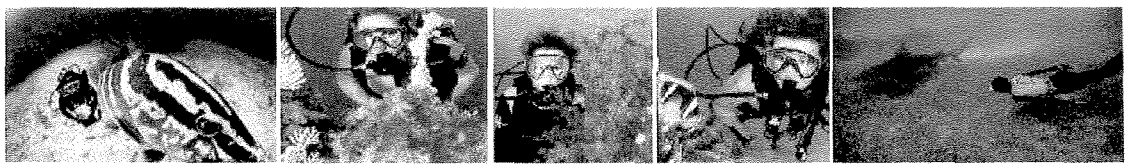


Figure 4.5 Summary of Negative Images Depicting Divers Crowding Marine Life found in the BSAC Manual (Adapted from Ellerby (2009)

Other common negative images found in the BSAC Manual show divers making contact with the seabed, not maintaining an appropriate distance from the seabed by not monitoring their negative buoyancy or using a vertical body position which can result in the resuspension of sediment or damaging contact with coral (Figure 4.6).

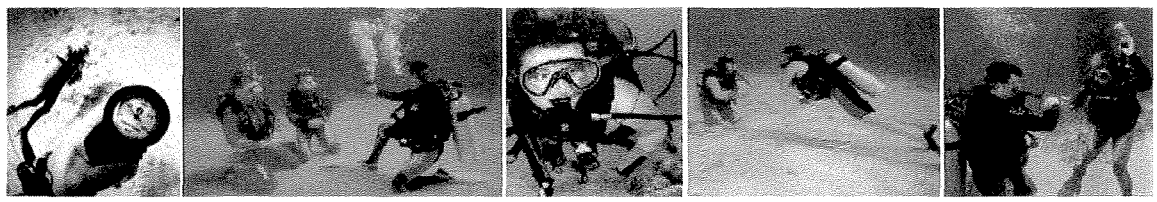


Figure 4.6 Summary of Negative Images Depicting Seabed Contact, Negative Buoyancy and Vertical Body Positions (Adapted from Ellerby, 2009)

Using supporting images and diagrams to reinforce messages helps ensure that divers understand the value BSAC places on these messages, and helps decrease recreationists' and tourists' engagement in depreciative behaviours (Marion & Reid, 2007; Stubbs, 1991). Images that depict divers having fun reinforces that using low impact diving skills does not detract from the diving experience. It also conveys the value BSAC places on these behaviours, modeling how divers can enact them.

Alternatively, contradictory images devalue positive messages and images (Stubbs, 1991). They may communicate to divers that they do not have to follow the principles associated with these images (Figure 4.5 and Figure 4.6). The inconsistency in the visual images (60.8% positive vs. 39.2% negative) may also confuse divers.

4.1.4 Missed Education Opportunities

Twenty-one missed education opportunities were found in the BSAC manual. The most frequent related to: entries (n= 6; 28.5%); neutral buoyancy (n = 4; 19%); the impact of lights or flash-use on photosensitive marine life (n = 4, 19%); securing loose

gear (n = 3, 14.4%); protective gear (n = 2, 9.5%); and, fins / resuspension of sediment (n = 2, 9.5%).

Missed education opportunities highlight areas where the BSAC manual can be improved. The manual should inform divers that they need to check the depth of the water and for the presence of marine life before entering to ensure that the added length of their fins does not contact marine life, or living substrate. Divers must be told that they should only use a vertical position to check their gear post-entry in water deep enough that fin action does not resuspend sediment. Otherwise, they inflate their BCD and roll onto their back, floating in a horizontal position. Missed education opportunities also fail to discuss maintaining neutral buoyancy as low impact behaviour. Because marine life accustomed to the darkness of living at increased depths or a nocturnal lifecycle can be temporarily blinded, and disoriented by bright lights (Barker & Roberts, 2004; Rouphael & Inglis, 2004) divers need to know how to use lights appropriately. The need to secure loose gear should be included in the pre-dive check list and in discussions of donning dive gear and buoyancy compensator devices (BCDs or BCs) but was not. The passage:

> "Most BCs will have one or two storage pouches or pockets and possibly a number of D-ring attachment points to enable various items of ancillary equipment - such as torches - to be carried" (Ellerby, 2009, pp. 91)

could be improved by including the bolded portion below,

> Most BC's will have one or two storage pouches or pockets and possibly a number of D-ring attachment points to enable various items of ancillary equipment – such as torches – to be carried. **Divers should use these D-rings as attachment points for loose gear. Using gauge clips on large retractors, attached to these D-rings, to secure alternate air sources or gauges prevents gear from dragging on the seabed or having unnecessary and damaging contact with marine life or living substrate**.

Similarly, stating that wearing gloves does not give divers free reign to touch coral and that it removes its protective mucosal layer making it susceptible to infection and disease is important (Davenport & Davenport, 2006), but missing. During the discussion about sedimentary matter, the manual states:

> Sedimentary and minute living organisms in the water can blur our vision, rather like a fog. The sedimentary matter, in the sea frequently comes from material flushed [into] the vicinity from local rivers. The areas affected vary … according to inland rains (Ellerby, 2009, pp. 54).

It fails, however, to mention that resuspending sediment can suffocate living substrate and that a divers' awareness of their fins can stop this from happening.

4.1.5 Message Efficacy

Attribution messages, knowledge or fact providing messages, plea messages, sanction messages and skill teaching messages were used in the BSAC manual. A summary of the extent of each message delivery styles use is provided in Table 4.1.The most common message delivery style used was knowledge or fact provision messages accounting for 73.6% of all delivered messages, followed by plea messages (13.2%), skill teaching messages (6.8%), attribution messages (4.5%) and sanction messages (1.9%). No interpretative messages were used.

To determine the relative effectiveness with which the 14 Principles of Low Impact Diving, six Low Impact Diving Skills, Environmental Knowledge, Coral Reef Based Environmental Knowledge, and BSAC's Educational and Environmental beliefs, were communicated to divers, a co-occurrence matrix was generated using Atlas.ti (Table 4.2). This table illustrates the number of times when a relevant quotation was simultaneously coded as both a message delivery style and one of the aforementioned components of the BSAC manual. The numeric value in the right hand column under each subheading (i.e. Knowledge/ Fact Provision Messages) represents the number of times when the two axial codes co-occured. For example, Aquatic Environmental Knowledge co-occurs with Knowledge / Fact Provision Messages 33 times. The percentage value in the left hand column under each subheading represents the co-occurrence value (e.g. 33) divided by the number of times that the axial code (Knowledge / Fact Provision Messages) occurred in the document (n= 195). Given that a single quote can be represented by multiple axial codes, these percentages do not necessarily sum to 100.

Table 4.2 Co-Occurrence Matrix illustrating the Message Delivery Styles used to Communicate Themes in the BSAC Manual

Content Message Type	Attribution Messages (n = 12)		Interpretive Messages (n=0)		Knowledge - Fact Provision Messages (n= 195)		Plea Messages (n = 35)		Synectics Messages (n = 5)		Skill Teaching Messages (n = 18)	
Aquatic Environmental Knowledge	NA	0	NA	0	17.00%	33	NA	0	NA	1	NA	0
BSAC Environmental Beliefs	NA	0	NA	0	NA	0	3.00%	1	NA	0	NA	0
BSAC Education Beliefs	NA	0	NA	0	21.00%	41	1.00%	1	NA	0	2.00%	1
Coral Reef Based Environmental Knowledge	NA	0	NA	0	3.00%	5	NA	0	NA	0	NA	0
Low Impact Diving Message 01 - Appropriate Fining Techniques	14.00%	2	NA	0	1.00%	2	3.00%	1	NA	0	16.00%	3
Low Impact Diving Message 02 - Neutral Buoyancy	8.00%	1	NA	0	NA	0	NA	0	NA	0	NA	0
Low Impact Diving Message 03 - Loose Gear / Gauges	NA	0	NA	0	NA	0	NA	0	33.00%	2	5.00%	1
Low Impact Diving Message 04 - Negative Impacts of Collecting / Hunting	15.00%	2	NA	0	NA	0	3.00%	1	NA	1	NA	0
Low Impact Diving Message 05 - Negative Impacts of Crowding	NA	0	NA	0	1.00%	2	NA	0	NA	1	NA	0
Low Impact Diving Message 06 - Negative Impacts of Touching / Contact	12.00%	2	NA	0	2.00%	3	11.00%	4	NA	1	NA	0
Low Impact Diving Message 07 - Negative Impacts of Interacting with Marine Wildlife	2.00%	2	NA	0	2.00%	3	5.00%	2	NA	1	NA	0
Low Impact Diving Message 08 - Divers have an impact on marine environments	27.00%	4	NA	0	2.00%	3	2.00%	1	NA	0	NA	0
Low Impact Diving Message 09 - Marine Protected Areas	NA	0	NA	0	1.00%	1	3.00%	1	NA	0	NA	0
Low Impact Diving Message 10 - Factors governing diver behaviour	4.00%	1	NA	0	4.00%	8	21.00%	8	NA	1	NA	0
Low Impact Diving Message 11 - Coral and Marine Biodiversity	NA	0	NA	0	3.00%	5	NA	0	NA	0	NA	0
Low Impact Diving Message 12 - Dive as a Guest	11.00%	2	NA	0	2.00%	4	13.00%	5	NA	0	NA	0
Low Impact Diving Message 13 - Dive Ethic / Code of Conduct	13.00%	6	NA	0	5.00%	12	57.00%	27	NA	2	NA	0
Low Impact Diving Message 14 - Continuing Education to build / maintain skills	NA	0	NA	0	8.00%	15	4.00%	2	NA	0	NA	0
Low Impact Diving Skills – Ascents	NA	0	NA	0	NA	0	NA	0	NA	0	12.00%	2
Low Impact Diving Skills - Body Position	NA	0	NA	0	3.00%	5	NA	0	NA	0	9.00%	2
Low Impact Diving Skills – Descent	NA	0	NA	0	1.00%	1	NA	0	NA	0	19.00%	3
Low Impact Diving Skills – Fining	NA	0	NA	0	1.00%	1	NA	0	NA	0	31.00%	5
Low Impact Diving Skills - Neutral buoyancy	NA	0	NA	0	3.00%	6	NA	0	NA	0	94.00%	15
Low Impact Diving Skills - Spatial Awareness	NA	0	NA	0	3.00%	6	3.00%	1	NA	1	NA	0
Other - Dive Tourism	NA	0	NA	0	10.00%	19	NA	0	NA	0	NA	0
Other - Diving Imagery	NA	0	NA	0	35.00%	66	NA	0	NA	0	NA	0
Other - Diving Motivations	NA	0	NA	0	6.00%	11	NA	0	NA	0	NA	0

As illustrated above, attribution messages were used exclusively to communicate the Principles of Low Impact Diving. Interpretative messages were not used. Knowledge / fact provision messages were used to communicate most aspects of the BSAC Manual as were plea and sanction messages. Finally, skill teaching messages were used to communicate Low Impact Diving Skills, the Principles of Low Impact Diving and BSAC Educational Beliefs. Knowledge / fact provision messages and plea messages convey 86.8% of the BSAC manual's content and are the least effective message delivery styles. Attribution, interpretative and sanction messages are more effective, but are the least frequently used (6.4%); skill teaching messages, an integral aspect of low impact diving education, account for only 6.8% of the total message content.

Attribution messages were used to communicate the following nine Principles: appropriate fining techniques (14%); neutral buoyancy (8%); the negative impact of hunting / collecting (15%); the negative impacts of touching / contact (12%); the negative impacts of interacting with marine wildlife (2%); the fact that divers have an impact on marine environments (27%); factors governing divers' behaviour (4%); the needs to dive as a guest (11%); and divers' codes of conduct (13%). As the most effective means of eliciting behaviour among recreationists (Bradford & McIntyre, 2007; Cialdini, et al., 2006; Cole, 1998; Gramann & Vander Stoep, 1986; Hocket, 2000; and Jacobi, 2003), the BSAC manual should use attribution messages more frequently. Interpretative messages were not used, despite being a valuable education tool.

Knowledge / fact provision messages were used to communicate almost the entire BSAC manual. While the least effective message delivery styles, Alessa, et al. (2003) found that visitors with greater knowledge of ecology were less likely to engage in depreciative behaviour, as did Hines et al. (1987). This content is valuable and should be rephrased. Plea and sanction messages were broadly used with plea messages used more frequently (13.2% vs. 1.9%); they are both examples of the peripheral route to persuasive communication and result in temporary behaviour change. While some messages must be conveyed as sanctions, such as those communicating behavioural infractions, plea messages should be rephrased as attribution or interpretative messages.

Finally, skill teaching messages were used to communicate: low impact diving skills and principles; and, BSAC's educational beliefs. Fransson & Garling (1999) found that a lack of specific knowledge centered on pro-environmental behaviour was a barrier to engagement despite a pro-conservation attitude. Similarly, in skill intensive recreation / tourism activities like diving, recreationists must possess sufficient skill and equipment competency to engage in low impact behaviour. Therefore, BSAC's inclusion of skill teaching messages (6.8%) should be increased to improve the quality of the manual.

The BSAC manual also contains a high percentage of negative or contradictory visual media (39.2%). Combined with 21 missed education opportunities, they decrease the efficacy of the manual. Therefore the overall efficacy of the environmental messages communicated to novice divers in BSAC's *The Diving Manual* is relatively low.

Discussing the BSAC manual's content within the framework of the Elaboration Likelihood Model provides further insight, situating the message delivery styles along the routes to persuasive communication. Attribution and interpretive messages represent the central route to persuasion, and are more likely to affect long-term behavioural change. The remaining message delivery styles elicit short-term behavioural change through the peripheral route to persuasion. The BSAC manual uses attribution messages in its communication of several principles of low impact diving; interpretive messages are not used. The central route to persuasion is used in its discussion of Principles #1, #2, #4, #6 – #8, #10, #12, and #13; it uses the peripheral route to persuasion in its remaining communications. Therefore, 91% of the messages in the BSAC manual were delivered using the peripheral route, while only 8.6% used the central route to persuasion. BSAC respondent divers are therefore expected to possess a low overall level of retention with higher retention of the messages communicated through the central route to persuasion.

4.2 Content Analysis of PADI's *Open Water Diver Manual*: Results and Findings

PADI's *Open Water Diver Manual* (2007; 260 pages) was examined to determine the nature and effectiveness of the messages conveyed to PADI entry-level divers.

The Introduction covers course prerequisites, provides a detailed history of PADI, and outlines the Open Water Diver Course. Chapter One discusses the underwater world and diving equipment. Chapter Two discusses adapting to the underwater world. In Chapter Three, the diving environment, dive planning, and problem management are discussed; general open water diving skills are introduced. The fourth chapter discusses: dive accessories; health for diving; breathing air at depth; and dive tables and dive computers. The final chapter discusses advanced dive skills. Dive safety practices are summarized and reference materials are provided in the Appendices.

In total, 390 content messages quotations where identified in the PADI Manual. They are represented by 436 axial codes and are delivered using the six message delivery styles (Table 4.3). PADI's entry-level certification manual can also be broken down into environmental messages (5.7%), low impact diving principles (45.2%), agency beliefs (16.3%), other important messages (14.4%) and low impact diving skills (18.3%).

Low impact diving skills, principles, and environmental messages account for only a part of the total volume of the PADI manual, with relevant low impact diving or environmental information discussed on 138 of 260 pages (53.1%); messages ranged from a single relevant sentence per page to full pages with multiple relevant messages. This is a drastic improvement over the 2005 PADI *Open Water Diver Manual*, which "contain[ed] roughly one page of text with some general comments on the fragility of marine life and general principles of behaviour" (Lindgren et al., 2008, pp. 127).

Table 4.3 Breakdown of the PADI Manual's Content

Categories	Sub-Categories	Axial Codes	PADI	Percentage
Content	Environmental Messages	Environmental Knowledge Based Messages	22	5.0%
		Coral Reef Knowledge Based Messages	3	0.7%
	Low Impact Diving Messages	*Number of the 14 Principles of Low Impact Diving Covered in the Manual*	*13*	
		1. Appropriate Fining Techniques	3	0.7%
		2. Neutral Buoyancy	15	3.4%
		3. Secure Loose Gear	21	4.8%
		4. Negative Impacts of Specimen Collecting and Hunting	3	0.7%
		5. Negative Impacts of Crowding	13	3.0%
		6. Negative Impacts of Touching / Contact	33	7.6%
		7. Negative Impacts of Interacting with Marine Wildlife	11	2.5%
		8. Divers' have an impact on marine environments	15	3.4%
		9. Marine Protected Areas	0	0.0%
		10. Factors governing divers in water behaviour	16	3.7%
		11. Key ecological concepts related to coral and marine environment biodiversity	6	1.4%
		12. Dive as a guest	8	1.8%
		13. Adopt a personal or agency based low impact dive ethic	7	1.6%
		14. Continuing education as a means to build and maintain skills proficiency and knowledge	46	10.6%
	Agency	Agency's Educational Beliefs	62	14.2%
		Agency's Environmental Beliefs	9	2.1%
	Other	Other	63	14.4%
	Skills	*Number of the 6 Low Impact Diving Skills Covered in the Manual*	*5*	
		Low Impact Diving Skills - Ascents	10	2.3%
		Low Impact Diving Skills - Body Position	0	0.0%
		Low Impact Diving Skills - Descent	15	3.4%
		Low Impact Diving Skills - Fining	15	3.4%
		Low Impact Diving Skills - Neutral buoyancy	38	8.7%
		Low Impact Diving Skills - Spatial Awareness	2	0.5%
Message Delivery Style		*Attribution Messages*	26	6.7%
		Interpretive Messages	7	1.8%
		Knowledge / Fact Provision Messages	247	63.3%
		Plea Messages	43	11.0%
		Sanction Messages	2	0.5%
		Skill Teaching Messages	65	16.7%
Supporting & Contradicting Images and Messages	Images	Supporting Image	18	56.3%
		Contradicting Written Messages	13	
		Contradicting Images	14	43.8%
	Other	Missed Education Opportunities	68	

4.2.1 PADI Low Impact, Environmental and Coral Reef Based Messages

The PADI manual conveys low impact diving, general environmental and coral reef-based environmental messages (n = 284; 50.9% cumulatively). Environmental messages (either general or specific to coral reefs) accounted for 5.7% of the axial codes; low impact diving messages accounted for 63.5%. Low impact messages can be broken down into low impact diving principles (45.2%) and skills (18.3%). Low impact diving messages touched on thirteen of the 14 Principles of Low Impact Diving (information about MPAs is omitted). Therefore, PADI divers lack knowledge of their existence and MPA regulations that directly impact divers or can prohibit diving in their confines. Excluding MPAs misses opportunities to discuss conservation and underwater cultural heritage sites. Similarly, only five of the six Low Impact Diving Skills are discussed; body position is omitted. PADI divers lack knowledge of how adopting an appropriate body position can help reduce their impact on marine environments.

Shreeves' (2007) discussion of the principles of low impact diving is limited; emphasis is placed on continuing education (Principle # 14). Reminders like "be an active diver – dive – this helps maintain your dive skills" (Shreeves, 2007, pp. 188) reinforce the value PADI places on keeping skills current. Shreeves (2007) tells divers that "if you're away from diving for a while … refresh your dive skills and knowledge" (pp. 188) through the PADI Scuba Review. These statements explain that maintaining existing, and regaining lost, skills is important.

The negative impacts of touching marine organisms (Principle # 6) receives the second highest attention (n= 33, or 7.6%). Statements like "Realize that even a light touch can harm or kill some organisms" (Shreeves, 2007, pp. 84) highlight the fragility of marine life. Quotes related to contact with branching coral or coral communities state that if you "Break a 25cm / 10in piece of coral … you've destroyed a decade of growth" (Shreeves, 2007, pp. 84) highlight the fragility of coral and inform divers that it is a living, growing, organism. These messages are important; they place the locus of causality and control firmly on divers through the use of attribution messages.

The necessity of securing loose gear (Principle # 3) is also discussed (n= 21 or 4.8%). Messages like "While diving, don't let your [submersible pressure gauges]… drag or dangle, which not only damages [it], but can damage fragile aquatic life" (Shreeves, 2007, pp. 53) reinforce the importance of securing loose gear and connect the failure to do so with damage to divers' equipment and the environment. Using attribution messages increase the likelihood of divers' securing their gear by informing them of the consequences of their actions.

Principle # 10, the factors governing divers' in-water behaviour, is also discussed (n= 16; 7.6%), including: fish and game laws; diving regulations and laws; and, pre-dive briefings. Statements like "Typically a crew member briefs you about diving procedures, which you'll need to listen to closely" (Shreeves, 2007, pp. 150) reinforce the value of pre-dive briefings. The statement: "Keep in mind that in many areas, the local dive community does not engage in game taking, even if legal" (Shreeves, 2007, pp. 135) implies that divers who take game may be ostracized by the local dive community.

Specific messages that convey coral reef based environmental messages were minimal (n=3) and center on the diversity, vibrancy and abundance of pristine coral reefs, the multitude of species that inhabit them and the fact that even apparently uninhabited areas actually teem with living organisms. The fragility of coral is discussed; however, the fact that it is alive is omitted.

The discussion of neutral buoyancy (Principle # 2) and diver impacts on marine environments (Principle # 8) is limited. Statements like "Staying neutrally buoyant keeps you off the bottom so you avoid injuring delicate aquatic life" (Shreeves, 2007, pp. 15) are an important; they explain how low impact diving skills minimize impacts. They are contradicted by messages, such as "On the bottom, get your bearings and swim into the current" (Shreeves, 2007, pp. 151), that detract from a divers' ability to discern appropriate behaviours. Shreeves (2007) uses statements like "being aware and using some simple techniques … minimize[s] accidental damage" (pp.84) to connect diver damage with knowledge there is a way to avoid it. The message that "you need to take the responsibility of ensuring that your active interactions … cause minimal damage and

disruption to the environment and organisms you interact with" (Shreeves, 2007, pp. 132) communicates to divers that they can minimize their impact.

Messages about the impacts of overcrowding (Principle #5), account for 3% of the manual's content (n = 13). Shreeves (2002) notes that "Approaching aquatic animals can cause them to alter their behaviour" (pp. 132). These messages are minimal and contradicted by images that depict divers crowding marine life (Figure 4.7).

Figure 4.7 Divers Crowding a Group of Nautili (Adapted from Shreeves, 2007)

The lack of repetitious and consistent messages related to: the negative impacts of interacting with marine wildlife (n= 11); diving as a guest (n= 8); adopting a personal or agency based low impact dive ethic (n= 7); key ecological concepts related to coral and marine environment biodiversity (n= 6); the negative impacts of specimen collecting and hunting (n= 3); and, appropriate fining techniques (n= 3) detracts from divers' abilities to retain key concepts related to the principles and practices of low impact diving - as per the findings of Marion & Reid (2007).

Coral reef-based and Environmental messages (Principle # 11) account for a combined 5.7% of the manual's relevant content (n= 25). Environmental messages were more plentiful (n=22) , than coral-reef specific ones (n= 3), discussing the affect the environment can have on divers and diving conditions as well as injuries from crowding or frightening marine animals. Readers were told that most marine animals are not aggressive towards divers, and attacks are usually the result of a defensive reaction. Regional differences and the differences in animal and plant compositions between fresh water and salt water environments are also discussed. Many of these messages were not

related to low impact diving, conservation, preservation or biodiversity. Failure to clearly articulate the intrinsic value of marine life can lead to the belief that the ocean and its inhabitants are only valuable because of their utility to divers – as objects of observation and photography or as game species.

The PADI manual touches on five of the six Low Impact Diving Skills, excluding body position. This discussion is heavily weighted towards neutral buoyancy (47.5%), followed by descents and fining (18.75% each) and ascents (12.5%). The discussion of spatial awareness, although minimal and hardly exhaustive, is better than not discussing it at all (Duncan & Martin, 2002; Kernan & Drogin, 1995).

The PADI manual's discussion of ascents focuses heavily on safety (ascent rate and communication). This discussion could be improved by espousing the need to maintain a horizontal body position while ascending, and the importance of avoiding vertical fining. Similarly, the discussion of descents is confusing and contradictory. Divers are told to descend slowly and look down as they descend, both positive low impact practices, but they are also told to keep their fins beneath them so that they can ascend quickly in case of an emergency. Clarifying this passage would be beneficial. Messages about fining are clear and concise; examples include "Swim next to the reef rather than above it. This avoids damage from your fin kick[s]" (Shreeves, 2007, pp. 68) or "Swim with your fins up to avoid stirring the sediment" (Shreeves, 2007, pp. 131). They are also repeated consistently and provide basic verbal instruction about the execution of these skills.

Neutral buoyancy skills are the most plentifully discussed skill in the PADI manual. These messages include stepwise instructions and information about proper weighting and its impact on divers' abilities to attain neutral buoyancy. These messages also include information about why neutral buoyancy is important and how it minimizes impacts on marine environments. Conversely, spatial awareness is barely discussed (n = 2); these messages, while consistent, are not plentiful. Including cylinders, fins and gauges in this discussion would improve their delivery.

4.2.2 PADI's Educational and Environmental Beliefs

Messages about PADI's educational and environmental beliefs account for 16.3% of the manual's content, and are mostly education related (n= 62). Messages about knowledge development, short quizzes and in-water skills evaluations are provided. Effective learning strategies and educational tools, opportunities to review personally challenging materials on a group or individual basis, are discussed. The PADI manual stresses the importance of refresher courses, but omits a timeframe after which a refresher is required. The importance of, and steps in, PADI's continuing education streams are explained. While these are important, increased emphasis should be placed on messages about PADI's environmental beliefs, ethics, and practices which are much less prevalent (n= 9). The PADI manual does not contain a diver code of conduct. While one can be pieced together, Shreeves (2007) fails to provide a singular reference to a summative code. Readers must assume what constitutes acceptable behaviour based on how the manual emphasizes certain behaviours. While this may be mitigated through the instructional process (e.g. communication from instructors) the manual should contain an outline of acceptable behaviour. This is particularly important in light of the fact that:

1. Divers' may do their open water dives with a different school, resort or instructor than they took the course from and it may be assumed that the 'other instructor' did or will cover acceptable in-water behaviour;
2. Divers' use the *Open Water Diver Manual* as a resource (especially when refreshing their skills after long periods of inactivity);
3. Reinforcing the importance of a diver's code of conduct increases the likelihood it will be adopted; and,
4. Given the prevalence of missed education opportunities, and contradictory visual images and written messages found in the PADI manual, novice divers' may not be able to piece together a code of conduct on their own.

Failure to include a diver's code may leave the impression that the actions discussed less frequently are not as important to avoid. Discussion of PADI's Project AWARE programs, involvement in coral reef and shark conservation efforts and their commitment to environmentally sound practices should also be highlighted in greater detail. Placing an emphasis on PADI's environmental efforts would communicate a greater valuation of aquatic environments. Emphasis should also be placed on

environmental continuing education opportunities, the use of low impact diving skills, and using scuba in biodiversity counts or shoreline and underwater clean-ups.

4.2.3 PADI Images

Of the total visual images (n= 32), 56.3% (n= 18) support the low impact diving messages conveyed in the PADI manual. These messages depict divers with good trim, gear secured to their body, using a proper body position and maintaining an appropriate distance from the reef / wreck / bottom while diving (Figure 4.8).

Figure 4.8 Sample of a Positive Image from the PADI Manual
(From Shreeves, 2007)

Additional supporting images highlight how divers should secure their dive gear on the front of the BCD in the 'triangle' between their hips and chin.

Contradicting visual images in the PADI manual, account for 43.8% of the images in the manual (n= 14) and depict divers in contact with the reef, bottom or living substrate, in close proximity to the reef, crowding marine organisms, and in a vertical body position (Figure 4.9).

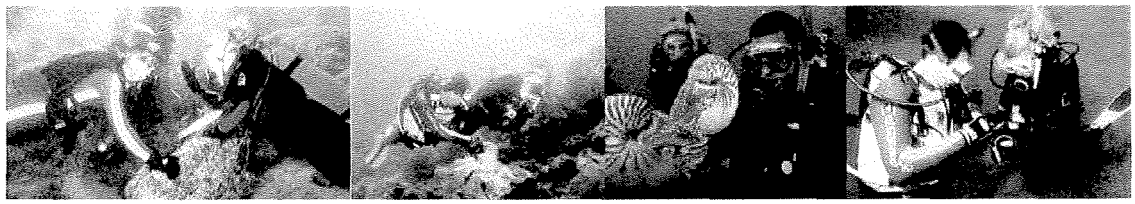


Figure 4.9 Summary of Negative Images Depicting Divers as found in the PADI Manual (Adapted from Shreeves, 2007)

The effectiveness of positive images and written messages are hindered by the inclusion of contradictory images. They countermand positive messages reducing the clarity and consistency of the manual. The inconsistency between supporting images and contradictory images hinders the effective communication of environmental messages and may lead divers to question whether PADI values marine environments.

4.2.4 PADI Contradicting Written Messages

In addition to contradictory images, the PADI manual contains contradicting written messages (n= 13) that compound the contradictory effect of the negative images, reducing the efficacy of the low impact messages delivered elsewhere in the manual. Contradictory messages tell divers it is acceptable to touch living substrate, to keep their fins underneath their body during ascents (i.e. ascend in a vertical position), to dive 'on the bottom' (instead of at depth), endorse spear fishing and game taking, all of which countermand messages to respect aquatic flora and fauna. For example, the message, "If you experience overexertion symptoms underwater, stop all activity, breathe deeply and rest. Catch your breath. Hold on to an object for support, if possible and relax" (Shreeves, 2007, pp. 81) contradicts messages that tell divers not to touch anything. While this is a rare scenario, in which the health of the diver in question supersedes the potential environmental impact, it should be accompanied by a statement that this is the only time when contact is acceptable.

Additionally contradictory messages like, "Descend slowly, keeping your fins beneath you so you can kick upward if you need to" (Shreeves, 2007, pp. 116) contradict messages to maintain a horizontal body position and descend on an angle. Messages like, "On the bottom, get your bearings and swim into the current" (Shreeves, 2007, pp.

151) contradict earlier messages about staying off the bottom and remaining neutrally buoyant. These messages should be rearticulated or removed.

4.2.5 Missed Education Opportunities

There is a high number of missed education opportunities in the PADI manual (n = 68); this is partially because of its higher page count. The PADI manual is almost 100 pages longer than the BSAC manual. It contains three times as many missed education opportunities; these missed education opportunities center on key themes (Table 4.4).

Table 4.4 Summary of Missed Education Opportunities in the PADI Entry-Level Certification Manual

Missed Education Opportunity	
Failure to discuss that...	Frequency
Accidental Diver Impacts Increase When Divers Wear Gloves or Exposure Suits	9
Differences between "at depth" and "on the bottom"	2
Dive Knives Are Not for Collecting Specimens	1
Game Laws or Protection aspect of Game Laws	3
Impacts on Marine Animals	3
Low Impact and Environmental Continuing Education Opportunities	1
Low Impact Ascents	2
Low Impact Benefits of Buoyancy Control	3
Low Impact Benefits of Proper Weighting	7
Low Impact Benefits of Securing Loose Dive Gear	11
Low Impact Benefits of Spatial Awareness	3
Low Impact Benefits of Streamlined Body Position	2
Low Impact Benefits of Wrist Mounted Gauges	1
Low Impact Descents	1
Low Impact Entries	3
Marine Animals' intrinsic value / or interests	1
Negative Impacts of Resuspending Sediment	4
Negative Impacts of Vertical Fining	1
Not touching things, even if you know what they are	2
Photosensitivity of Marine Animals	1
Reef Impacts	4
Sediment's Ability to Smother Coral Communities	3

The most frequent missed education opportunities fail to communicate: the low impact diving benefit of securing loose dive gear to a divers BCD (n= 11, 16.17%); that accidental diver impacts with coral and marine species increase when divers wear gloves

or exposure suits because of decreased dexterity, decreased worry about getting cut or stung, and decreased awareness of contact, especially with thicker exposure suits (n = 9, 13.24%). Opportunities to discuss the low impact diving benefits of ensuring that divers are properly weighted for the conditions, environment and activity (n= 7, 10.29%), are also missed.

Missed education opportunities provide insight about improvements to the PADI manual. They highlight opportunities to integrate procedural skills with low impact diving practices to increase the PADI manual's efficacy. Examples of missed education opportunities that fail to communicate the need to secure loose gear include "Keeping your equipment streamlined, watching where you go, and avoiding dense growth areas help minimize the chances of snagging or tangling" (Shreeves, 2007, pp. 135). This passage could be improved by changing the ending to read 'snagging, tangling **or environmental damage**'.

The failure to discuss the increased accidental diver impacts with coral and marine species when divers wear gloves or exposure suits can be summarized in the passage below:

> You want to protect your hands on virtually every dive. In warmer water, you may use lightweight noninsulating gloves ("reef" gloves, left); in moderately cool water, wet suit gloves provide insulation and protection (center); thick wet suit mitts may be worn in colder water (Shreeves, 200, pp. 90).

This passage could be improved with the addition of 'Wearing gloves, mitts and wetsuits reduces your dexterity, and sensitivity to touch, making it harder to avoid accidental contact. Use extra caution to avoid environmental damage. In these scenarios, it is best to increase your distance from marine life and living substrate'.

Similarly, the following passage fails to communicate the importance of ensuring that divers are properly weighted for diving conditions, the diving environment (salt vs. fresh water) and activity (wreck diving, drift diving or underwater photography):

> Since fresh water weighs less than salt water, you're not as buoyant for a given displacement. This means if you dive in fresh water after diving in salt water,

> assuming you're wearing the same gear and exposure suit, you'll need less weight (Shreeves, 2007, pp. 137).

This passage could be improved by including 'For this reason, it is important to ensure you are correctly weighted for each dive. Knowing the diving conditions and equipment you will use on your dive is an important first step; take the time to get properly weighted on a check-out dive or in a pool to minimize diver impacts resulting for a lack of the ability to establish neutral buoyancy'.

The high volume of missed education opportunities in the PADI manual detracts from its ability to effectively communicate environmental messages to divers.

4.2.6 Message Efficacy

The relative effectiveness of PADI's communication of the Principles of Low Impact Diving, Low Impact Diving Skills, environmental knowledge, coral reef-based environmental knowledge, and PADI's educational and environmental beliefs were determined by running a co-occurrence matrix analysis. This analysis generated Table 4.5 illustrating the number of times when a relevant quotation was simultaneously coded as both a message delivery style and one of the aforementioned components of the PADI manual. This allows for a better understanding of the ways low impact diving and environmental messages are communicated to PADI divers.The value in the right hand column of the table represents the number of times that each axial code co-occurs. The percentage values in the left hand column under each subheading were calculated as described above, and represent the co-occurrence value (e.g. one for Aquatic Environmental Knowledge) divided by the number of times that the axial code (e.g. Interpretive Messages) occurred in the document (n = 8). Axial codes were assigned multiple codes as necessary; therefore, these numbers may not sum to 100 percent.

The most common message delivery style used in the PADI manual was knowledge / fact provision messages, accounting for 63.3% of all messages. This was followed by skill teaching messages (16.7%), plea messages (11.0%), attribution messages (6.7%), interpretive messages (1.8%) and sanction messages (0.5%).

Table 4.5 Co-Occurrence Matrix illustrating the Message Delivery Styles used to Communicate Themes in the PADI Manual

Content Message Type	Attribution Messages (n = 26)		Interpretive Messages (n = 8)		Knowledge / Fact Provision Messages (n = 248)		Plea Messages (n = 43)		Sanction Messages (n = 2)		Skill Teaching Messages (n = 64)	
Aquatic Environmental Knowledge	NA	0	3.00%	1	7.00%	18	0.00%	0	NA	0	NA	0
Coral Reef Based Environmental Knowledge	0.00%	0	0.00%	0	1.00%	3	0.00%	0	NA	0	NA	0
Low Impact Diving Message 01 - Appropriate Fining Techniques	0.00%	0	0.00%	0	0.00%	0	7.00%	3	NA	0	NA	0
Low Impact Diving Message 02 - Neutral Buoyancy	14.00%	5	5.00%	1	2.00%	6	5.00%	3	NA	0	3.00%	2
Low Impact Diving Message 03 - Secure Loose Gear / Gauges	7.00%	3	0.00%	0	6.00%	15	7.00%	4	NA	0	NA	0
Low Impact Diving Message 04 - Negative Impacts of Collecting / Hunting	7.00%	2	0.00%	0	0.00%	1	0.00%	0	NA	0	NA	0
Low Impact Diving Message 05 - Negative Impacts of Crowding	5.00%	2	5.00%	1	2.00%	6	8.00%	4	NA	0	NA	0
Low Impact Diving Message 06 - Negative Impacts of Touching / Contact	16.00%	8	5.00%	2	6.00%	15	12.00	8	NA	0	1.00%	1
Low Impact Diving Message 07 - Negative Impacts of Interacting with Marine Wildlife	NA	0	NA	0	5.00%	13	0.00%	0	0.00%	0	NA	0
Low Impact Diving Message 08 - Divers have an impact on marine environments	NA	4	NA	1	4.00%	10	2.00%	1	0.00%	0	NA	0
Low Impact Diving Message 09 - Marine Protected Areas	NA	0	NA	0	0.00%	0	0.00%	0	0.00%	0	NA	0
Low Impact Diving Message 10 - Factors governing diver behaviour	NA	1	NA	0	4.00%	11	4.00%	2	50.00%	1	NA	0
Low Impact Diving Message 11 - Coral and Marine Biodiversity	NA	2	NA	0	3.00%	7	2.00%	1	0.00%	0	NA	0
Low Impact Diving Message 12 - Dive as a Guest	NA	5	NA	0	0.00%	1	4.00%	2	0.00%	0	NA	0
Low Impact Diving Message 13 - Dive Ethic / Code of Conduct	NA	1	NA	0	0.00%	1	11.00	5	0.00%	0	NA	0
Low Impact Diving Message 14 - Continuing Education to Build / Maintain Skills	NA	0	NA	0	16.00%	40	14.00	11	50.00%	1	NA	0
Low Impact Diving Skills – Ascents	0.00%	0	NA	0	0.00%	1	0.00%	0	NA	0	14.00%	9
Low Impact Diving Skills - Body Position	0.00%	0	NA	0	0.00%	0	0.00%	0	NA	0	NA	0
Low Impact Diving Skills – Descent	0.00%	0	NA	0	0.00%	0	0.00%	0	NA	0	23.00%	15
Low Impact Diving Skills – Fining	0.00%	0	NA	1	1.00%	2	2.00%	1	NA	0	16.00%	11
Low Impact Diving Skills - Neutral buoyancy	3.00%	2	NA	1	3.00%	7	1.00%	1	NA	0	48.00%	33
Low Impact Diving Skills - Spatial Awareness	8.00%	2	NA	0	0.00%	0	0.00%	0	NA	0	3.00%	2
Other - Diving Imagery	0.00%	0	NA	0	22.00%	55	0.00%	0	NA	0	NA	0
Other - Diving Motivations	0.00%	0	NA	0	1.00%	3	0.00%	0	NA	0	NA	0
Other - Positive Impacts of Diving	0.00%	0	NA	0	3.00%	8	6.00%	3	NA	0	NA	0
PADI Environmental Beliefs	3.00%	1	NA	0	5.00%	12	0.00%	0	NA	0	NA	0
PADI Educational Beliefs	0.00%	0	NA	0	24.00%	60	2.00%	2	NA	0	NA	0

Table 4.5 breaks down the message delivery styles used to convey content messages, increasing the understanding of PADI's environmental communication. Attribution messages were used to communicate the principles of low impact diving (89 %), low impact diving skills (11%) and PADI's environmental beliefs (3%). Interpretive messages were used to communicate aquatic environmental messages (3%), the principles of low impact diving (20%) and low impact diving skills (7%). Knowledge / fact provision messages (63.3%) and plea messages (11.0%) are least effective in the long-term mitigation of depreciate behaviours (Bradford & McIntyre, 2007; Cialdini, et al., 2006; Cole, 1998; Ham, 1992; Johnson & Swearingen, 1992; and Martin 1992); yet are most frequently used. Attribution, Interpretative and Sanction messages, found to be the most effective means of mitigating depreciative behaviours, were the least frequently used (cumulatively 9.0%). Skill teaching messages, an integral aspect of low impact diving education, conveyed 16.7% of the total message content.

Besides the relative inefficacy of these message delivery styles, the PADI manual contains negative or contradictory visual media (43.8% of all images) and contradictory or negative written messages (n= 13). Combined with 68 missed education opportunities, the efficacy of the PADI manual is drastically reduced. Consistent and repetitious messages are need to improve memory retention and deter depreciative behaviours (Marion & Reid, 2007; Stubbs, 1991).

Examining the PADI co-occurrence matrix within the context of the ELM provides further insight in the manual's efficacy. It uses attribution messages to communicate several Principles of Low Impact Diving, Low Impact Diving Skills and PADI's environmental beliefs; interpretive messages communicated Principles of Low Impact Diving, Low Impact Diving Skills and aquatic environmental knowledge. This represents the extent of the PADI manual's use of the central route to persuasion. Similarly, the PADI manual uses the peripheral route to persuasion in its discussions of: aquatic and coral reef-based knowledge; the Principles of Low Impact Diving; the Low Impact Diving Skills; diving imagery; diving motivations; the positive impacts of diving; and, PADI's environmental and educational beliefs. It is expected that PADI

respondent divers will have a low retention rate, given the predominance of messages communicated through the peripheral route to persuasion (89.6%).

4.3 Content Analysis of SSI's *Open Water Diver Manual*: Results and Findings

A comprehensive analysis of the SSI manual was conducted to determine the nature of the environmental messages conveyed to SSI divers throughout their manual. The 4th Edition of the SSI manual (2003) is 237 pages divided into a Preface, Introduction, six Sections and an Appendix. The Preface includes a guide to the Manual's three icons, including "Pearl" the oyster, the "CE" or continuing education icon, and the "E" or environmental icon (Figure 4.10), used to highlight key information

Figure 4.10 SSI Manual Icons

"Pearl" indicates information integral to new divers' success. The "CE" icon highlights SSI continuing education courses. The "E" icon highlights environmental issues.

Section One introduces scuba diving equipment. Section Two discusses basic skills and equipment use. Section Three discusses the effects of pressure on divers' bodies. Diving emergencies are also covered. Section Four discusses the SSI Dive Tables and dive computers. Section Five discusses fundamentals of wave, tide and current action and their impact divers; coral reefs are also discussed. Marine life identification (coral, and fish, and potentially hazardous marine life) is introduced. The last section discusses maintaining skills proficiency and SSI Continuing Education Ratings. The importance of specialty and continuing education training is discussed along with the requirements to earn SSI Levels of Recognition. The SSI manual concludes with a brief appendix.

A breakdown of the quotations, axial codes and message delivery styles used to communicate environmental messages to SSI certified divers can be found in Table 4.6.

Table 4.6 Breakdown of the SSI Manual's Content

Categories	Sub-Categories	Axial Codes	SSI	Percentage
Content	Environmental Messages	Environmental Knowledge Based Messages	118	20.2%
		Coral Reef Knowledge Based Messages	30	5.1%
	Low Impact Diving Messages	*Number of the 14 Principles of Low Impact Diving Covered in the Manual*	***11***	
		1. Appropriate Fining Techniques	15	2.6%
		2. Neutral Buoyancy	10	1.7%
		3. Secure Loose Gear	4	0.7%
		4. Negative Impacts of Specimen Collecting and Hunting	3	0.5%
		5. Negative Impacts of Crowding	0	0.0%
		6. Negative Impacts of Touching / Contact	4	0.7%
		7. Negative Impacts of Interacting with Marine Wildlife	2	0.3%
		8. Divers' have an impact on marine environments	0	0.0%
		9. Marine Protected Areas	6	1.0%
		10. Factors governing divers in water behaviour	7	1.2%
		11. Key ecological concepts related to coral and marine environment biodiversity	0	0.0%
		12. Dive as a guest	9	1.5%
		13. Adopt a personal or agency based low impact dive ethic	16	2.7%
		14. Continuing education as a means to build and maintain skills proficiency and knowledge	103	17.7%
	Agency	Agency's Educational Beliefs	75	12.9%
		Agency's Environmental Beliefs	10	1.7%
	Other	Other	89	15.3%
	Skills	*Number of the 6 Low Impact Diving Skills Covered in the Manual*	***6***	
		Low Impact Diving Skills - Ascents	23	3.9%
		Low Impact Diving Skills - Body Position	2	0.3%
		Low Impact Diving Skills - Descent	10	1.7%
		Low Impact Diving Skills - Fining	8	1.4%
		Low Impact Diving Skills - Neutral buoyancy	30	5.1%
		Low Impact Diving Skills - Spatial Awareness	9	1.5%
Message Delivery Style		*Attribution Messages*	28	4.8%
		Interpretive Messages	2	0.3%
		Knowledge / Fact Provision Messages	423	72.6%
		Plea Messages	11	1.9%
		Sanction Messages	4	0.7%
		Skill Teaching Messages	55	9.4%
Supporting & Contradicting Images and Messages	Images	Supporting Image	28	68.29%
		Contradicting Written Messages	3	NA
		Contradicting Images	13	31.71%
	Other	Missed Education Opportunities	35	

A total of 583 content message quotations where identified in the SSI manual, delivered using 6 message delivery styles (knowledge / fact provision messages, 80.9%; skill teaching messages, 10.5%; attribution messages, 5.4%; plea messages, 2.1%; sanction messages, 0.8%; and, interpretive messages, 0.4%). Supporting (n = 28) and contradicting (n = 13) visual images, contradicting written messages (n= 3), and missed education opportunities (n= 35) were found in the SSI manual.

These messages are represented by the following axial codes: environmental and coral reef messages (28.0% combined); low impact diving principles (33.9%); agency beliefs (16.1%); other important messages (16.9%); and, low impact diving skills (5.1%). Relevant environmental messages accounted for only a part of the SSI manual's total volume, accounting for 135 of 237 pages (56.96% of the manual); pages ranged from a single relevant sentence to multiple relevant messages or images.

4.3.1 SSI Low Impact, Environmental and Coral Reef Based Messages

Low impact, environmental and coral reef-based messages account for a 67.0% of the relevant SSI manual content. They focused on the Principles of Low Impact Diving (33.9%) and environmental messages (22.3%); the rest were: coral reef-based (5.7%) or low impact diving skills- related (5.1%).

Messages related to appropriate fining techniques (Principle #1) are the third most frequently discussed (n = 15). They articulated the fact that fins extend past divers' feet and that divers to look down avoid unnecessary reef contacts. The most common fining techniques (flutter and dolphin kick), the importance of not fining in a vertical position, and that powerful fining means divers' can use their hangs to carry extra equipment, or leave them relaxed at the sides, were discussed.

Neutral Buoyancy (Principle # 2) was the fourth most frequently discussed (n = 10). Messages conveyed the impact of negatively buoyant divers, stressed that divers should "always maintain neutral buoyancy and practice good buoyancy control over reefs" (Scuba Schools International, 2003, Section 5, pp. 23) and highlighted that

buoyancy control requires practice and is an essential skill. These messages relate the maintenance of neutral buoyancy to proper BCD use and weighting.

Securing loose gear (Principle # 3) was sparsely covered (n = 4) in SSI's manual. Scuba Schools International (2003) states that "Loose equipment is susceptible to damage, is difficult to locate under water and can damage valuable marine life" (Section 2, pp. 21). The need to secure loose dive gear or gauges, is sparsely covered in SSI's manual (n=4). Despite the infrequency of messages related to the need to secure loose dive gear, SSI communicates the importance of this low impact diving behaviour in a unique and effective way. The manual states that "Loose equipment is susceptible to damage, is difficult to locate under water and can damage valuable marine life" (Scuba Schools International, 2002, Section 2, pp. 21). This three-fold approach, attribution message, plays on divers' desires to avoid the cost of replacing damaged gear, their safety concerns associated with not being able to locate dive gear in an emergency, and on environmentally-conscious divers' desires not to damage the environments. These messages also explain how to secure loose dive gear with velcro straps, buckles and other attachments. Communicating these message in this way increases the likelihood that divers' will engage in this low impact diving practice by giving reasons for the desired behaviour that motivate divers on multiple levels.

The negative impacts of collecting and / or hunting (Principle # 4) was briefly discussed (n = 3). Divers were informed that regulations governing licensing, catch limits, gaming seasons and hunting / collecting in marine parks exist and that they need to be familiar with, and respect, them. The negative impacts of touching, or interacting with, marine wildlife (Principles #6 and #7) are discussed in a limited context (n = 4 and n = 2, respectively). Messages state that "It is best to appreciate the reefs with the eyes rather than the hands" (Scuba Schools International, 2003, Section 5, pp. 23) and that "humans incur injur[ies from marine animals] as a result of negligence … and their own aggressive behavior" (Scuba Schools International, 2003, Section 5, pp. 28). The lack of consistent and repetitious messages related to these principles reduces the overall effectiveness of SSI's environmental communications. Failure to repeat and reinforce

these messages can convey to divers that these principles are less important, and that SSI places less value on them.

The SSI manual also communicates the importance that SSI places on low impact diving practices and pro-environmental behaviour by including fill-in-the-blank knowledge review questions. Divers are required to retain this information for their final exam. Knowledge review questions like:

> It is estimated that plant production in the oceans may be __10__ times more than on land. More than __85%__ of the oxygen is produced by marine plants. Even the photosynthesis that takes place on land requires water, which originates in the oceans (Scuba Schools International, 2002, Section 5, pp. 35).

and

> For us as divers, the oceans may be playgrounds, but playgrounds are only fun and exciting if we keep them __clean__ and well __maintained__ (ibid).

reinforce the importance SSI places on pristine marine environments and on low impact diving. Including repetitious and consistent messages, in the form of knowledge review questions, improves the likelihood of divers' retention of these concepts (Marion & Reid, 2007) and reinforces the importance of acquiring and retaining this knowledge.

Messages related to MPAs, Low Impact Diving Principle #9 (n = 6) discuss the legislated protection of dive sites, and affirm that this protection helps keep dive sites pristine and protects marine wildlife. They state that "It is up to all divers to respect local laws and to help protect the corals and sea life" (Scuba Schools International, 2003, Section 5, pp. 22). Similarly, messages related to the factors that govern divers in-water behavior (Principle #10, n = 7), are discussed. These messages explain that divers must respect local laws and help protect coral and sea life; they note the importance of following the rules and dive plans set out in pre-dive briefings.

Diving as a Guest (Principle #12) is the fifth most frequently discussed (n = 9). Messages stress the privilege of diving, and tie divers' continued ability to dive to divers' in-water behaviour with statements like "Always dive as a visitor, as the guest

that you are, in this new environment. As long as you do, you will be welcomed and have many opportunities to return" (Scuba Schools International, 2003, Section 5, pp. 1).

Messages related to divers codes of conduct (Principle # 13) account for the second highest number (n = 16) of these quotes. Messages like,

> As an SSI diver, we encourage and invite you to share responsibility for protecting these valuable resources. One simple way you can participate is to embrace a personal ethic of leaving the natural world the way you find it. Many dive boats and dive resorts already have this policy; you can model and support it. Your behavior can help ensure that divers of the future will still be able to experience and enjoy the beauty of 'innerspace' (Scuba Schools International, 2003, Section 5, pp. 1),

help to reinforce the importance SSI places on establishing a personal dive ethic and stress the importance of role modeling. Scuba Schools International (2003) also articulates a diver code of conduct that includes an environmental component:

1. Diving within the limits of my ability and training;
2. Evaluating the conditions before every dive and making sure they fit my personal capabilities;
3. Being familiar with and checking my equipment before and during every dive;
4. Respecting the buddy system and its advantages;
5. Accepting the responsibility for my own safety on every dive; and,
6. Being environmentally conscious on every dive (Section 6, pp 8).

The importance of continuing education (Principle #14) is associated with the highest number of quotes (n = 103). In addition to linking course material to SSI continuing education courses, these messages highlight the importance of continuing education as a means to build and maintain dive skills. Messages stress the importance of advanced training, specialized dive training, and practical skills; divers are invited to learn about marine life and underwater photography. SSI's manual states that "even though your certification is valid for a lifetime, it is important to keep your scuba skills proficient. The only way to stay proficient is by diving. While there is no magic number, a good rule of thumb is to dive at least four to five times per year" (Scuba Schools International, 2003, Section 6, pp. 7). If this is not possible, SSI recommends updating dive skills annually. The fact that reviewing and practicing skills helps to maintain skills

proficiency is discussed, as is the availability of diving publications for acquiring new knowledge.

The SSI *Open Water Diver Manual* discusses eleven of the 14 Principles of Low Impact Diving; excluding the negative impacts of crowding (Principle # 5), the fact that divers' have an impact on marine environments (Principle # 8) and key ecological concepts related to coral and marine biodiversity (Principle # 11). This limits the effectiveness of SSI's environmental communications. Excluding ecological concepts has implications for divers' in-water behaviour. Alessa et al., (2003) and Hines, Hungerford & Tomera (1987) found that individuals with greater knowledge of ecology were less likely to engage in depreciative behaviour; SSI certified divers may be more likely to engage in depreciative behaviours as a result of a lack of this type of environmental information.

Similarly, without the knowledge of the negative impacts of crowding marine, novice SSI divers are more likely to crowd marine animals due to the excitement of viewing these animals in the wild for the first time, and because they will be unaware of its impact. Without the knowledge that divers' can have negative impacts on marine environments, divers are less likely to understand the importance of engaging in low impact diving practices. The efficacy of the SSI manual's communication of environmental messages could be improved through the inclusion of messages related to the three excluded principles of low impact diving.

The SSI manual discusses all of the Low Impact Diving Skills. Messages related to ascents (n=23) teach divers now to conduct a safe and minimal impact ascent. They stress starting from a position of neutral buoyancy, using a gentle fin kick, monitoring your ascent rate, using a dive line and looking down when you kick. These messages could be improved by highlighting how they help minimize diver impacts.Body position is discussed minimally (n = 2) with messages related to avoiding the use of arms as means of locomotion, and using them to secure loose gear. These messages could be improved in frequency and by including a diagram or verbal cues about how, where, and why divers should secure loose gear (Marion & Reid, 2007; Stubbs, 1991). Messages related to descents (n = 10) discuss the connection between neutral buoyancy,

appropriate use of the BCD to control descents, and fining. Increasing the number of these messages would increase the effectiveness of their communication.

Multiple effective fining strategies are discussed (n = 8), including flutter and dolphin kicks, and appropriate times to use each kick. Diagrams that illustrate the differences in their mechanical execution, and increasing their frequency would be beneficial (Marion & Reid, 2007; Stubbs, 1991).

Neutral buoyancy is discussed (n = 30) along with proper weighting, the effective use of the BCD and breathing control all of which are integral aspects of neutral buoyancy. The various parts of the BCD and their use in attaining and maintaining neutral buoyancy are mentioned. Selecting a proper BCD and wetsuit are also discussed and lift is mentioned; the additional buoyancy of thicker wetsuits and its impact on proper weighting are discussed.

Spatial awareness is discussed (n = 9) with respect to the additional body length added by fins and body girth added by the cylinder, as well as awareness of body proximity to the bottom, reef and marine life. The need to foster awareness of one's proximity to the bottom, reef and marine life is mentioned; however, no minimum distance is noted. Noting this would be beneficial as would illustrating this with images and providing relatable examples of distances, such as a car length, instead of numeric distances (5 meters).

4.3.2 SSI's Educational and Environmental Beliefs

SSI's educational and environmental beliefs account for 12.7% and 1.7% of the relevant manual content respectively. The discussion of SSI's educational beliefs centers on the three educational icons and the effective use of the manual. The importance of continuing diving education is stressed and quality assurance measures are noted.

The discussion of SSI's environmental beliefs is limited (n = 10), accounting for 1.7% of the relevant manual content. Statements like "SSI has always supported and promoted environmental awareness" (Scuba Schools International, 2003, Preface, pp. i) and "SSI believes that care for the environment should be a standard part of diver

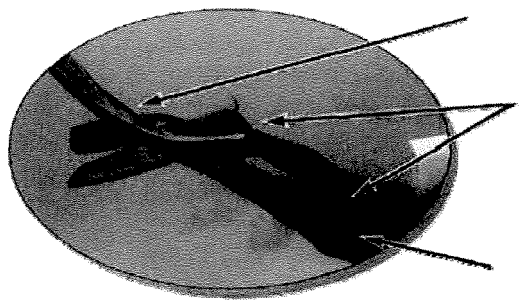
education from start to finish" (ibid), emphasize the value SSI places on environmentally responsible behaviour. These messages, however, appear in the Preface and should be reinforced and reiterated, with examples, throughout the text. While the manual references the Platinum Pro Foundation "an independent, non-profit group formed in 1997 with a mission of educating children about the waters of the world" (Scuba Schools International, 2003, Section 6, pp. 21), it is in the last 5 pages, giving the impression that the statement at the beginning of the manual is lip service. Increasing the frequency that SSI communicates its commitment to environmental issues would increase divers' understanding of the value that the agency places on the environment. Entry-level divers are encouraged to support the Foundation, through donations and volunteer opportunities. Other messages reinforce the importance placed on the environmental aspect of the SSI Diver Code of Conduct.

4.3.3 SSI Images

Twenty-eight supporting images are found in the SSI manual. These images depict divers with good buoyancy control, and maintaining an appropriate distance from the reef, with good trim and their dive gear secured (Figure 4.11).

Figure 4.11 Example of a Positive Image from the SSI Manual
(From Scuba Schools International, 2003)

Positive and supporting images also illustrate ways divers can ascend or descend with minimal impact on the environment, and how to effectively fin (Figure 4.12).



1. Legs are kept elongated and the toes pointed
2. The knees bend slightly and the relaxed ankles swing back and forth with the natural motion of the fins
3. The stroke is slow and powerful, utilizing the full length of the legs; it's a "hip" kick not a knee kick.

Figure 4.12 Sample of a Skill Teaching Diagram from the SSI Manual (Adapted from Scuba Schools International, 2003)

Other positive images depict divers having a good time diving.

However, the SSI manual also contains negative images (n = 13) that depict divers engaged in behaviour that contradict positive written or visual images. Negative images depict divers fining in a vertical position (46.2%), kneeling on the bottom or too close to the reef (38.5%), and crowding or chasing marine life (15.3%). Images depicting divers kneeling on the bottom (Figure 4.13) contradict statements to "avoid impact with the bottom" (Scuba Schools International, 2003, Section 2, pp. 25).

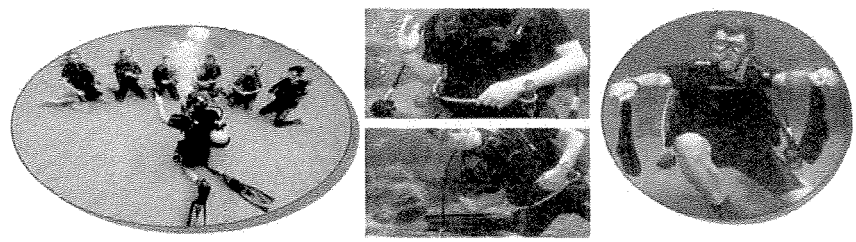


Figure 4.13 Sample of Negative Images in the SSI Manual Depicting Divers Kneeling on the Bottom (Adapted from Scuba Schools International, 2003)

Images of divers overcrowding marine life (Figure 4.14), while not contradicting messages within the SSI manual which fails to discuss the negative impacts of crowding, contradict the 14 Principles of Low Impact Diving. They should therefore be removed and replaced with images of divers observing acceptable distances from marine life and avoiding contact with the substrate.

Figure 4.14 Sample of Negative Images in the SSI Manual Depicting Divers Crowding Marine Life (Adapted from Scuba Schools International, 2003)

Lastly, images which depict divers fining in a vertical position, or at an inappropriate angle (Figure 4.15) contradict messages that: teach divers appropriate fining techniques; discuss spatial awareness; and, articulate concerns about fin contacts.

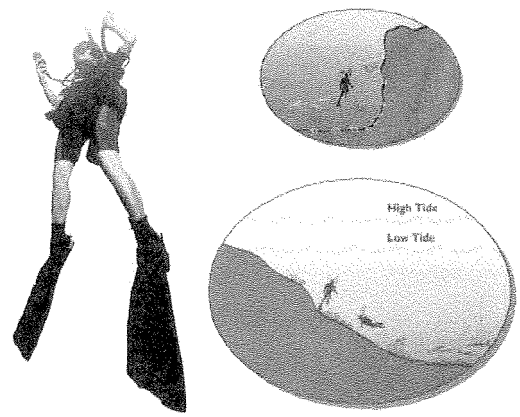


Figure 4.15 Sample of Negative Images in the SSI Manual Depicting Divers Fining in a Vertical Position (Adapted from Scuba Schools International, 2003)

While positive, supporting, images and diagrams account for 63.6% of the relevant images and diagrams found in the text, increasing the number and frequency of their appearance would reinforce appropriate in-water behaviour. Increasing images depicting divers maintaining appropriate distances from living substrate, the bottom, marine wildlife and wrecks would be of benefit too.

4.3.4 SSI Contradictory Written Messages

Contradictory written messages (n = 3) can also be found in the SSI manual. These messages include "if you cannot positively identify a shell, do not pick it up" (Scuba Schools International, 2003, Section 5, pp. 30) which contradicts messages that

tell divers to avoid contact with marine organisms and artifacts. The statement "to start your descent, begin in a feet-first position" (Scuba Schools International, 2003, Section 2, pp. 25) contradicts messages to use a horizontal body position with the fins above the hips.

Furthermore, contradictory messages, like "If you cannot positively identify a shell, do not pick it up" (Scuba Schools International, 2003, Section 5, pp. 30) can be improved to convey a supportive message as follows:

> **Even** if you can positively identify a shell, do not pick it up. **Picking up shells, or other artifacts, can have a negative impact on marine animals, many of whom either reside in discarded shells, like the hermit crab, or who grow a protective exoskeleton like the sea urchin. By avoiding contact with shells, and other artifacts, divers can help conserve marine environments, and reduce their risk of injury from sharp spikes or boney proliferations which often grown on the outside of shells. Remember, wearing gloves protects you; it doesn't stop you from injuring marine life.**

This reinforces existing messages and provides important information about marine wildlife, ecosystems, and biodiversity. Removing contradictory images and written messages would increase the effectiveness of SSI's environmental communications by removing inconsistencies (Marion & Reid, 2007; Stubbs, 1991).

4.3.5 Missed Education Opportunities

Thirty- five missed education opportunities occur in the SSI manual. Messages relate to: buoyancy control and proper weighting (n = 7); entries and exists (n = 6); gauges (n = 6); ascents and descents (n = 5); equipment (fins and cylinders) (n = 3); the protective nature of gloves and wetsuits (n = 3); dive lights (n = 2); reaching depth (as opposed to the bottom) (n = 1); contact with marine life (n= 1); and, disentanglement from kelp (n = 1). All of these messages are missing the low-impact diving statements that should accompany them.

Buoyancy control and proper weighting messages could be improved by relating these concepts to avoiding damaging contact with living substrate; entries and exits should be discussed in tandem with the implications of not ensuring adequate depth for

entries; and, gauges and gear discussions should include the negative impacts of loose gear. Similarly, ascents and descents should be discussed in conjunction with maintaining a horizontal body position and avoiding vertical fining. Divers should be told that equipment increases a diver's profile; these messages should be included in discussions of spatial awareness. Messages about the protective nature of gloves and wetsuits need to include statements about the negative impacts of touching / contact and should highlight that thick wetsuits make it hard to maintain awareness of accidental contact. Discussions about dive lights should mention their impact on photosensitive marine life (Barker & Roberts, 2004; Rouphael & Inglis, 2004). Reaching depth (not the bottom) should always be at the forefront of discussions about neutral buoyancy, descents and spatial awareness.

4.3.6 Message Efficacy

The relative communicational efficacy of the SSI manual was determined through a co-occurrence matrix (Table 4.7) analysis that mapped the number of times a quotation was coded as both a message delivery style and as one of the components of the SSI manual. The value in the right hand column represents the number of times that the axial codes co-occurred whereas the percentage values in the left hand column represent the co-occurrence value (i.e. Coral Reef Based Environmental Knowledge co-occurred once with Attribution Messages) divided by the number of times that the axial code (Attribution Messages) occurred in the document (n = 29). Understanding which message delivery styles were used to convey each of the components of the SSI manual increases the understanding of how SSI communicates environmental messages.

The most common message delivery styles used in the SSI manual are: knowledge / fact provision messages accounting for 72.6% of all messages; followed by skill teaching messages (9.4%); attribution messages (4.8%); plea messages (1.9%); sanction messages (0.7%); and, interpretive messages (0.3%).

Table 4.7 Co-Occurrence Matrix illustrating the Message Delivery Styles used to Communicate Themes in the SSI Manual

Content Message Type	Attribution Messages (n = 50)		Interpretive Messages (n = 5)		Knowledge / Fact Provision Messages (n = 425)		Plea Messages (n = 14)		Sanction Messages (n = 4)		Skill Teaching Messages (n = 55)	
Coral Reef Knowledge Based Messages	2.00%	1	NA	0	8.00%	32	NA	0	0.00%	0	NA	0
Environments Knowledge Based Messages	5.00%	7	NA	0	30.00%	125	NA	0	1.00%	1	NA	0
Low Impact Diving Message 01 - Appropriate Fining Techniques	7.00%	3	NA	0	2.00%	9	NA	0	NA	0	13.00%	8
Low Impact Diving Message 02 - Neutral Buoyancy	3.00%	1	0.00%	0	2.00%	7	11.00%	2	0.00%	0	NA	0
Low Impact Diving Message 03 - Secure Loose Gear / Gauges	NA	0	0.00%	0	1.00%	5	0.00%	0	0.00%	0	NA	0
Low Impact Diving Message 04 - Negative Impacts of Collecting / Hunting	0.00%	0	0.00%	0	1.00%	3	0.00%	0	0.00%	0	NA	0
Low Impact Diving Message 06 - Negative Impacts of Touching / Contact	3.00%	1	0.00%	0	0.00%	2	7.00%	1	0.00%	0	NA	0
Low Impact Diving Message 07 - Negative Impacts of Interacting with Marine Wildlife	3.00%	1	0.00%	0	0.00%	1	0.00%	0	0.00%	0	NA	0
Low Impact Diving Message 08 - Divers have an impact on marine environments	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	NA	0
Low Impact Diving Message 09 - Marine Protected Areas	17.00%	5	0.00%	0	1.00%	5	0.00%	0	0.00%	0	NA	0
Low Impact Diving Message 10 - Factors governing diver behaviour	16.00%	5	0.00%	0	1.00%	6	0.00%	0	0.00%	0	NA	0
Low Impact Diving Message 12 - Dive as a Guest	6.00%	2	22.00%	2	0.00%	2	11.00%	2	18.00%	2	NA	0
Low Impact Diving Message 13 - Dive Ethic / Code of Conduct	18.00%	7	6.00%	1	1.00%	5	8.00%	2	5.00%	1	NA	0
Low Impact Diving Message 14 - Continuing Education to build / maintain skills	2.00%	2	NA	0	23.00%	100	2.00%	2	1.00%	1	1.00%	1
Low Impact Diving Skills – Ascents	0.00%	0	NA	0	0.00%	0	0.00%	0	NA	0	44.00%	24
Low Impact Diving Skills - Body Position	0.00%	0	NA	0	0.00%	2	0.00%	0	NA	0	2.00%	1
Low Impact Diving Skills – Descents	0.00%	0	NA	0	0.00%	2	0.00%	0	NA	0	14.00%	8
Low Impact Diving Skills – Fining	0.00%	0	NA	0	1.00%	5	0.00%	0	NA	0	11.00%	6
Low Impact Diving Skills - Neutral Buoyancy	0.00%	0	NA	0	3.00%	13	0.00%	0	NA	0	33.00%	21
Low Impact Diving Skills - Spatial Awareness	12.00%	4	NA	0	1.00%	3	5.00%	1	NA	0	2.00%	1
Other - Dive Tourism	0.00%	0	NA	0	4.00%	17	NA	1	NA	0	NA	0
Other - Diving Imagery	0.00%	0	NA	0	14.00%	57	NA	1	NA	1	NA	0
Other - Emotions Experienced with Diving	0.00%	0	NA	0	1.00%	6	NA	0	NA	0	NA	0
Other - Marine Animal Attacks	13.00%	5	NA	0	4.00%	17	NA	0	NA	0	NA	0
SSI Educational Beliefs	1.00%	1	NA	0	19.00%	81	NA	0	NA	0	NA	0
SSI Environmental Beliefs	3.00%	1	NA	0	3.00%	13	NA	0	NA	0	NA	0

A preliminary examination of Table 4.7 shows that Attribution Messages were most commonly used to communicate Coral Reef and Environmental Knowledge, the Principles of Low Impact Diving, and SSI educational and environmental beliefs, whereas Knowledge / Fact Provisions Messages were used uniformly to communicate all of the various aspects of the SSI Manual. Skill Teaching Messages were used almost exclusively to communicate Low Impact Diving Skills; Interpretative Messages were used solely to communicate Principles of Low Impact Diving. Sanction Messages co-occurred with Environmental Knowledge, Principles of Low Impact Diving and Other aspects of the SSI Manual. Lastly, Plea Messages were used to communicate Principles of Low Impact Diving, Low Impact Diving Skills and Other Aspects of the SSI Manual.

Table 4.7 also illustrates the degree that each message delivery style is used in the SSI Manual and the effectiveness of SSI's environmental communications. The most common message delivery style used was knowledge / fact provision messages (72.6%). Knowledge / fact provision messages were used to communicate all aspects of the SSI entry-level manual and least effective in affecting changes in recreationists and tourists engagement in depreciate behaviours (Bradford & McIntyre, 2007; Cialdini, et al., 2006; Cole, 1998; Ham, 1992; Johnson & Swearingen, 1992; and Martin 1992).

While Alessa et al. (2003) and Hines, et al (1987) acknowledge that individuals with greater knowledge of ecology were less likely to engage in depreciative behaviour, Madden (2006) notes that skill teaching messages are an essential part of education in skill intensive activities that require the retention of procedural or psycho-motor skills. Skill teaching messages, while the second most frequent message delivery styles used in the SSI manual (9.4%), should be increased.

Attribution (4.8%), Interpretative (1.9%) and Sanction (0.7%) messages, found to be the most effective means of mitigating depreciative behaviours, were the least frequently used. Attribution messages were used to communicate the bulk of the SSI manual's content. Interpretive messages were used to communicate two of the 14 Principles of Low Impact Diving. Next to interpretive messages, sanction messages were the least frequently used; only communicating environmental knowledge and three of the 14 Principles of Low Impact Diving.

Plea messages (1.9%) were used to communicate most of the SSI manual, excluding: both types of environmental knowledge; and, SSI's environmental beliefs. These messages should be converted to attribution or interpretive messages, to increase the manual's effectiveness. Therefore, the SSI manual's content was communicated, predominantly, through the use of the least effective message delivery styles. It also has a high percentage of negative or contradictory visual media and written messages (36.4% combined). In addition, 35 missed education opportunities further reduce the efficacy of the positive environmental and low impact diving messages communicated to SSI's entry-level divers.

Examining the SSI manual's communication of environmental messages through the framework of the ELM provides further insight. The SSI manual used the central route to persuasion to discuss: coral reef and aquatic environmental knowledge; low impact diving principles; low impact diving skills; and the factors that precipitate marine animal attacks, and in its communication of SSI's educational and environmental beliefs.

The SSI manual used the peripheral route to persuasion in the remainder of its discussions about: coral reef and aquatic environmental-based knowledge; the principles of low impact diving; low impact diving skills; dive tourism; diving imagery; the emotions experienced while diving; the factors that contribute to marine animal attacks; and, SSI's educational and environmental beliefs. It is, therefore, expected that SSI respondent divers will possess a higher level of retention of messages communicated through the central route to persuasion, than those topics communicated through the use of the peripheral route to persuasion.

4.5 Conclusion to the Content Analysis

This section concludes the content analysis of the BSAC, PADI and SSI manuals by comparing and ranking the efficacy of the manuals' communication of environmental messages. A numerical comparison can be found below (Table 4.8). The SSI Manual contains the most environmental knowledge-based messages (n = 118), followed by BSAC (n=30) and PADI (n = 22). A similar trend is seen in the manuals' content of coral reef-based messages, with SSI, BSAC and PADI containing 30, 4 and 3 messages

respectively. The BSAC manual falls short in communicating its educational and environmental beliefs (n= 39 and n= 1). The SSI and PADI manuals come close in communicating their agencies beliefs, with the SSI manual communicating these slightly more frequently than the PADI manual. The PADI manual contains the most skill teaching messages (n = 65), followed by SSI's (n = 55), then BSAC's (n = 18).

Table 4.8 Summary Comparison of the Content Analysis of BSAC, PADI and SSI's Entry-Level Manual

Categories	Sub-Categories	Axial Codes	BSAC	PADI	SSI
Content	Environmental Messages	Environmental Knowledge Based Messages	30	22	118
		Coral Reef Knowledge Based Messages	4	3	30
	Low Impact Diving Messages	*Number of the 14 Principles of Low Impact Diving Covered in the Manual*	*14*	*13*	*11*
		1. Appropriate Fining Techniques	4	3	15
		2. Neutral Buoyancy	1	15	10
		3. Secure Loose Gear	3	21	4
		4. Negative Impacts of Specimen Collecting and Hunting	4	3	3
		5. Negative Impacts of Crowding	1	13	0
		6. Negative Impacts of Touching / Contact	7	33	4
		7. Negative Impacts of Interacting with Marine Wildlife	6	11	2
		8. Divers' have an impact on marine environments	7	15	0
		9. Marine Protected Areas	1	0	6
		10. Factors governing divers in water behaviour	12	16	7
		11. Key ecological concepts related to coral and marine environment biodiversity	4	6	0
		12. Dive as a guest	9	8	9
		13. Adopt a personal or agency based low impact dive ethic	39	7	16
		14. Continuing education as a means to build and maintain skills proficiency and knowledge	16	46	103
	Agency	Agency's Educational Beliefs	39	62	75
		Agency's Environmental Beliefs	1	9	10
	Other	*Other*	84	63	89
	Skills	*Number of the 6 Low Impact Diving Skills Covered in the Manual*	*6*	*5*	*5*
		Low Impact Diving Skills - Ascents	1	10	23
		Low Impact Diving Skills - Body Position	7	0	2
		Low Impact Diving Skills - Descent	1	15	10
		Low Impact Diving Skills - Fining	3	15	8
		Low Impact Diving Skills - Neutral buoyancy	13	38	30
		Low Impact Diving Skills - Spatial Awareness	5	2	9
Message Delivery Style		*Attribution Messages*	12	26	28
		Interpretive Messages	0	7	2
		Knowledge / Fact Provision Messages	196	247	423
		Plea Messages	35	43	11
		Sanction Messages	5	2	4
		Skill Teaching Messages	18	65	55
Supporting & Contradicting Images and Messages	Images	Supporting Image	31	18	28
		Contradictory Written Messages	0	13	3
		Contradicting Images	20	14	13
	Other	Missed Education Opportunities	20	68	35

In contrast, the SSI manual contains the most knowledge / fact provision messages (n= 423) compared to PADI's 247 and BSAC's 196. While beneficial in providing new information (Bradford & McIntyre, 2007; Cialdini, et al., 2006; Cole, 1998; Ham, 1992; Johnson & Swearingen, 1992; Martin 1992; Roggenbuck, 1992; Vande Kamp, et al., 1994), these messages would be more effective if rephrased to attribution, or interpretative, messages.

The BSAC manual references all 14 principles of low impact diving while PADI references 13, and SSI only 11. Similarly, BSAC and SSI's manuals reference all 6 Low Impact Diving Skills, while PADI's only references five. Despite referencing all the Principles of Low Impact Diving, compared to the PADI Manual's and the SSI manuals, the BSAC manual generally explores each Principle to a lesser degree with the exception of Principles # 7, # 10 and #13. While some of this discrepancy results from the differing lengths of each of the manuals, only three of the Principles are referenced more than 10 times in the BSAC manual compared to the four Principles in the SSI manual and PADI's eight.

The PADI and SSI manuals both include contradictory written messages (n= 13, and n= 3 respectively); the BSAC manual does not. Despite being the smallest of the three manuals, the BSAC manual contains 31 supporting images, while SSI's - the middle length manual - contains 28 supporting images; PADI's manual, the longest at 260 pages, contains the least supporting images (n= 18). In contrast, the BSAC manual contains the most contradictory images (n= 20), while SSI's contains the least (n= 13).

The PADI manual contained the most missed education opportunities (n = 68), followed by SSI (n= 35) and BSAC (n= 20). Given the higher volume of the PADI and SSI manuals it is not surprising that they contain more missed education opportunities. Their higher axial code content (n= 314 for BSAC, vs. n= 436 for PADI and n= 583 for SSI) also increases the likelihood of missed education opportunities. Although missed education opportunities do not detract from the overall effectiveness of the manuals to the same degree as contradictory messages and negative images, they provide insight into the ways that each manual could be improved.

A similar trend is observed in the frequency of low impact diving skills. While BSAC references all six skills, only one skill is mentioned more than 10 times (neutral buoyancy); SSI, who also discusses all six skills, references ascents, descents, and neutral buoyancy more than 10 times. This contrasts the PADI manual's discussion of low impact diving skills. While the longest, it only references five low impact diving skills, all of which are discussed more than 10 times.

When examined in the context of the findings of Marion and Reid (2007) and Stubbs (1991), all three of the manuals have areas they could improve (eliminating contradictory written messages and visual media and capitalizing on missed education opportunities). Those manuals that present each of the principles of low impact diving and low impact diving skills in a plentiful manner (SSI and PADI) are more likely to affect long-term memory retention than those that present the skills less frequently (BSAC). SSI's manual is more likely to affect memory retention than PADI's due to the decreased volume of contradictory written and visual messages. Those messages that BSAC does communicate are likely to be more effective, due to its lack of contradictory messages, and lower level of missed education opportunities, despite its reduced content.

Using the findings of Marion and Reid (2007) and Stubbs (1991), the manuals can be ranked in decreasing levels of efficacy starting with SSI (most effective), followed by BSAC and lastly, PADI. These ranking changes when considered in the context of the findings of Duncan and Martin (2002) and Kernan and Drogin (1995), who determined that minimal was better than no discussion. Those manuals that cover a broader spectrum of the principles of low impact diving and low impact diving skills (BSAC and PADI for the principles and BSAC and SSI for skills) are more effective. This changes the ranking slightly, to BSAC, then SSI, and lastly PADI.

These rankings change when the data is considered within the framework of the ELM. Because the manuals range from 158 pages (BSAC manual), to 260 pages (PADI manual) with the SSI manual containing 236 pages, the comparison of their use of the central and peripheral routes to persuasion of the ELM focuses on the percentage of each manual communicated through the six representative message delivery styles (Table 4.9).

Table 4.9 Comparative Co-occurrence Matrix for BSAC, PADI and SSI Manuals Illustrating their Use of the Central and Peripheral Routes to Persuasion of the Elaboration Likelihood Model

	Central Route to Persuasion						Peripheral Route to Persuasion											
	Attributed Messages			Interpretive Messages			Fact Provided Messages			Bias Messages			Sanction Messages			Skill Teaching Messages		
Content Message Type	BSAC	PADI	SSI	BSAC	PADI	SSI	BSAC	PADI	SSI	BSAC	PADI	SSI	BSAC	PADI	SSI	BSAC	PADI	SSI
	(c=23)	(c=20)	(c=30)	(c=0)	(c=3)	(c=6)	(c=355)	(c=218)	(c=340)	(c=55)	(c=15)	(c=10)	(c=5)	(c=2)	(c=4)	(c=18)	(c=61)	(c=55)
Aquatic Environmental Knowledge	0	0	1	0	1	0	33	18	32	0	0	0	1	0	0	0	0	0
BSAC Environmental Beliefs	0	0	7	0	0	0	0	3	125	1	0	0	0	0	1	0	0	0
BSAC Education Beliefs	0	0	3	0	0	0	41	0	9	1	3	0	0	0	0	1	0	8
Coral Reef Based Environmental	0	5	1	0	1	0	5	6	7	0	3	2	0	0	0	0	2	0
Low Impact Diving Message 01 -	2	3	0	0	0	0	2	15	5	1	4	0	0	0	0	3	0	0
Low Impact Diving Message 02 -	1	2	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0
Low Impact Diving Message 03 -	0	2	1	0	1	0	0	6	2	0	4	1	2	0	0	1	0	0
Low Impact Diving Message 04 - Negative Impacts of Collecting /	2	8	1	0	2	0	0	15	1	1	8	0	1	0	0	0	1	0
Low Impact Diving Message 05 -	0	0	0	0	0	0	2	13	0	0	0	0	1	0	0	0	0	0
Low Impact Diving Message 06 - Negative Impacts of Touching /	2	4	5	0	1	0	3	10	5	4	1	0	1	0	0	0	0	0
Low Impact Diving Message 07 - Negative Impacts of Interacting	2	0	5	0	0	0	3	0	6	2	0	0	1	0	0	0	0	0
Low Impact Diving Message 08 - Divers have an impact on marine	4	1	2	0	0	2	3	11	2	1	2	2	0	1	2	0	0	0
Low Impact Diving Message 09 -	0	2	7	0	0	1	1	7	5	1	1	2	0	0	1	0	0	0
Low Impact Diving Message 10 -	1	5	2	0	0	0	8	1	100	8	2	2	1	0	1	0	0	1
Low Impact Diving Message 11 -	0	1	0	0	0	0	5	1	0	0	5	0	0	0	0	0	0	24
Low Impact Diving Message 12 -	2	0	0	0	0	0	4	40	2	5	11	0	0	1	0	0	0	1
Low Impact Diving Message 13 -	6	0	0	0	0	0	12	1	2	27	0	0	2	0	0	0	9	8
Low Impact Diving Message 14 - Continuing Education to build /	0	0	0	0	0	0	15	0	5	2	0	0	0	0	0	0	0	6
Low Impact Diving Skills –	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	2	15	21
Low Impact Diving Skills - Body	0	0	4	0	1	0	5	2	3	0	1	1	0	0	0	2	11	1
Low Impact Diving Skills –	0	2	0	0	1	0	1	7	17	0	1	1	0	0	0	3	33	0
Low Impact Diving Skills – Fining	0	2	0	0	0	0	1	0	57	0	0	1	0	0	1	5	2	0
Low Impact Diving Skills -	0	0	0	0	0	0	6	55	6	0	0	0	0	0	0	15	0	0
Low Impact Diving Skills - Spatial	0	0	5	0	0	0	6	3	17	1	0	0	1	0	0	0	0	0
Other - Dive Tourism	0	0	1	0	0	0	19	8	81	0	3	0	0	0	0	0	0	0
Other - Diving Imagery	0	1	1	0	0	0	66	12	13	0	0	0	0	0	0	0	0	0
Other - Diving Motivations	0	0	0	0	0	0	11	60	0	0	2	0	0	0	0	0	0	0

As illustrated above, both the PADI manual and SSI manual use all six message delivery styles. The BSAC manual, however, excludes the use of interpretive messages. The PADI and SSI manuals use attribution messages more frequently than the BSAC Manual. Attribution messages, found to be the most effective, in terms of their long term ability to persuade recreationists and tourists to avoid depreciative behaviours (Kohl, 2005; Marion & Reid, 2007; Roggenbuck, 1992; Vande Kamp, Johnson & Swearingen, 1994), communicate using the central route to persuasion (Roggenbuck, 1992; Vande Kamp, Johnson & Swearingen, 1994). These messages are more likely to result in behavioural adoption, resulting from changes in core values and beliefs. Therefore, the frequency that the manuals use attribution messages should be increased.

Interpretative messages are also a way of communication using the central route to persuasion (ibid), but are not used in the BSAC manual. The PADI and SSI manuals use interpretative messages to a limited extent. While these numbers should be increased, their combined use of the central route to persuasion increases the efficacy of these manuals and the likelihood of long term knowledge retention, and attitudinal change. Their communications are more likely to result in low impact practices.

Sanction messages are more frequently used in the BSAC manual (n= 5) and the SSI manual (n= 4) than in PADI's (n=2). Sanction messages fall along the peripheral route and are likely to result in short term behavioural change. The number of sanction messages should be limited and converted to attribution or interpretative messages.

Knowledge / fact provision and plea messages are also representative of the peripheral route and should be limited. The SSI manual uses the highest number of these messages, followed by PADI and BSAC. While a certain amount of knowledge must be conveyed through these messages, they should be reinforced with attribution or interpretative messages to ensure retention and adoption of low impact diving practices. SSI's dependence on knowledge / fact provision messages (72.6% of messages) drastically impacts the likelihood their divers will retain, and act on, information about low impact diving. PADI uses a high number of these messages (63.3%) with similar results. In contrast, SSI has the lowest use of plea messages, followed by BSAC then

PADI. Plea messages are also a means of communicating along the peripheral route; these messages should also be rewritten into attribution or interpretative messages.

The relative efficacy of the BSAC, PADI and SSI manuals can also be compared based on their use of each of the message styles that represent the ELM's central and peripheral routes to persuasion. This comparison was explored in percentages of overall manual content and percentage of the manual dedicated to skill teaching messages to ensure the differing lengths of the manuals did not bias it.

Messages using the peripheral route to persuasion are communicated through knowledge / fact provision, sanctions and plea messages and are less effective than the central route to persuasion. They are likely to result in short-term retention, and are not an effective means of communicating as many entry-level divers do not progress past their basic certification (Lindgren, et al., 2008). The use of the peripheral route to persuasion can be ranked: BSAC (85.45%); SSI (83.59%); and, PADI (74.94 %).

The central route to persuasion, communicated through attribution and interpretative messages, is more likely to result in long term retention. Communications using these message styles are more likely to result in long-term retention and attitude change and to affect the adoption of low impact behaviour. It is a more effective means of communicating with entry-level scuba divers. The manuals' use of the central route to persuasion can be ranked as: PADI (8.7%); BSAC (8.00%); and, SSI (5.92%). It is important to note that all the manuals contain few uses of the central route to persuasion, and that this ranking is only relative. None of the manuals effectively use the central route to persuasion. It, therefore, appears highly unlikely that entry-level divers certified by these agencies will retain or adopt low impact diving principles or skills. While the PADI manual is ranked higher than BSAC's and SSI's, there are still many ways it could be improved. Given that PADI issues more novice certifications per year than both SSI and BSAC, they have a responsibility to ensure that their divers receive, and retain, a low impact diving education resulting in the adoption of a low impact ethic.

Although not related to the Elaboration Likelihood Model, or persuasive communication, the extent to which entry-level divers are taught the low impact diving

skills needed to enable them to abide by the principles of low impact diving is a fundamental aspect of each manual's efficacy. The manuals' inclusion of skill teaching messages can be ranked as follows: PADI (16.37%); SSI (10.50%); and, BSAC (6.55%). As per Madden (2006), the execution of procedural skills plays an important role in carrying out retained knowledge. While divers may retain knowledge of, and a commitment to, the principles of low impact diving, their ability to execute the skills needed to enable them to abide by these principles is dependent on their ability to effectively execute their associated psychomotor procedural skills. While this has been discussed briefly in this study, given its' lack of in-situ observations or testing of procedural skill retention, the discussion of scuba divers' low impact psychomotor procedural skills competencies should be investigated further.

Based on the previous subsections, each manual can, and should, be improved to increase the efficacy of their environmental communications. Recommendations for each manual will be explored in a preliminary manner here. With respect to the manuals' relative efficacy it can be concluded that:

- the BSAC Manual contains the lowest number of axial code quotes, but covers the most low impact diving principles and skills. It contains the most supporting and contradictory images;
- the PADI Manual, while communicating fewer low impact diving principles and skills, uses the second highest number of axial code quotes and the more effective message delivery styles most frequently. It contains the highest number contradictory written messages and lowest number of supporting images; and,
- the SSI Manual communicates the highest number of axial code quotes, communicating less of the low impact diving principles and skills through the highest number of the more effective message delivery styles. It contains neither the most nor the least number of supporting images, contradictory written messages and visual images.

Therefore, the PADI manual is the most effective of the three manuals, both in its use of the central route to persuasion and inclusion of low impact diving skill teaching messages, followed by BSAC. The SSI manual is the least effective. This conclusion is based upon its higher dependence on the peripheral route to persuasion, and lower level of use of the central route to persuasion.

Lastly, the information gathered through the content analysis of the three manuals informed the creation of the first section of the e-survey, which used True and False, Multiple Choice and Image Selection questions to determine respondents' knowledge retention. The structure and nature of the questions was guided by each agencies dialogue on the 14 Principles of Low Impact Diving and 6 Low Impact Diving Skills. This was done to ensure that questions were communicated in a manner consistent with the way that these messages were originally communicated by BSAC, PADI and SSI.

Additionally, given that each agency has its own organizational culture, and uses unique phrases to express similar concepts (e.g. BSAC refers to putting on a divers' gear as getting 'kitted up', while PADI refers to it as 'donning dive gear'), questions were phrased in a way that acknowledged these differences to minimize response bias or error. Where concepts were not discussed in a manual, questions were designed to address the omitted principle or skill in a way that would be familiar to, and understood by, divers' certified by the respective agency.

This Chapter has presented and discussed the results of the content analysis of BSAC, PADI and SSI's entry-level certification manuals. It has also discussed and compared the results of the analysis in terms of the relative effectiveness of the agency's communication of environmental messages to entry-level scuba divers.

The subsequent Chapter will present and discuss the results of the implementation of the e-survey. This will be followed by a Chapter that triangulates the findings of the content analysis with those of the e-survey to provide a more holistic understanding of the effectiveness of BSAC, PADI and SSI's environmental communication with scuba divers.

CHAPTER 5.0 FINDINGS OF THE QUANTITATIVE E-SURVEY

This chapter will report the results of the quantitative analysis of the data collected through the implementation of the three part e-survey, discussing them within the context of the literature on environmental education, divers' impacts on marine environments and depreciative behaviours. Implications for communication via the central and peripheral routes of persuasion of the Elaboration Likelihood Model of Persuasive Communication will be explored.

As discussed previously, the e-survey was implemented over the 6 week interval beginning February 8th 2010 and ending March 19th 2010. A total of 851 responses were received, 499 of which were useable. Eliminated responses were deemed unusable for the following reasons: 349 were ineligible due to respondents' reported entry-level certification by a non-target agency (i.e. CMAS, NAUI, NASDS, etc.); two were eliminated because they self-reported their age as being below the age of majority and were therefore ineligible to complete the e-survey; and, one was eliminated due to a failure to complete a sufficient portion of the e-survey.

5.1 Results of the E-Survey

Of the 499 usable responses to the e-survey, 128 respondent divers received their novice certification through BSAC, 301 through PADI, and 70 through SSI. Respondent divers' took advanced training from: PADI (36.1%); BSAC (29.6%); SSI (14.3%); a combination of NASDS, NAUI and PADI (7.1%), NAUI (2.0%) and Other Agencies (10%); others took no advanced training (0.9%). Respondent divers also reported their highest level of training. This information was used to segment divers into specialized levels of training generated from a list of training levels across certifying bodies and their cross-over equivalents (Table 5.1).

Respondent divers were: beginner recreational (15.6%); intermediate recreational (16%); advanced recreational (16.8%); entry-level professional (12.4%); professional (12%); advanced professional (15.6%); and other (1.4%). Fifty respondent divers (10%) did not answer this question. Analyses presented later compare divers' specialized levels of training (Table 5.1), not highest level of training achieved.

Table 5.1 Breakdown of Specialized Levels of Training by Certifying Body

Breakdown of Specialized Levels of Training by Certifying Body			
Specialized Levels of Training	BSAC	PADI	SSI
Beginner Recreational	Ocean Diver	PADI Scuba Diver	Scuba Diver
	Sport Diver	Open Water Diver	Open Water Diver
			Indoor Diver
Intermediate Recreational	Dive Leader	Adventure Diver	Specialty Diver
		Advanced Open Water Diver	Advanced Open Water Diver
Advanced Recreational	Advanced Diver	Rescue Diver	Master Diver
	First Class Diver	Master Scuba Diver	Dive Leader
Entry-Level Professional	Assistant Diving Instructor	Dive Master	Dive Guide
		Assistant Instructor	Dive Master
			Dive Control Specialist
Professional	Theory Instructor	Open Water Scuba Instructor	Training Specialist
	Practical Instructor		Open Water Instructor
	Open Water Instructor		Specialty Instructor
Advanced Professional	Advanced Instructor	Master Scuba Diver Trainer	Advanced Open Water Instructor
		IDC Staff Instructor	Dive Control Specialist Instructor
	Instructor Trainer	Master Instructor	Master Instructor
		Course Director	Instructor Trainer
Other	Other	Other	Other

This allowed for a comparison of equivalent training levels while eliminating potential confusion. For example, the novice certification achieved by PADI and SSI divers are called PADI Scuba Diver and Scuba Diver respectively; BSAC divers achieve Ocean Diver status. Referring to all divers with this level of training as "beginner recreational divers" simplifies the comparison.

Year first certified varied, ranging from 1956 to 2010; 50.7% of respondent divers were certified 10 years or less. The rest were certified between 11 – 20 years (24.2%), 21 – 30 years (12.4%), 31 – 40 years (7.8%) or 41+ years (2.2%). The number of logged dives also varied and was divided into ranges for comparison (Table 5.2).

Table 5.2 Summary of Respondent Diver Reported Logged Open Water Dives

Total Number of Logged Dives	
50 or less	20.4%
51 – 100	11.3%
101 – 500	36.1%
501 - 1000	12.0%
1001 – 5000	17.9%
5001 or more	2.3%

Respondent divers (n = 449) also indicated when their last dive occurred (Figure 5.2) with 84.86% of the last logged dives occurring between 1 day and 6 months ago.

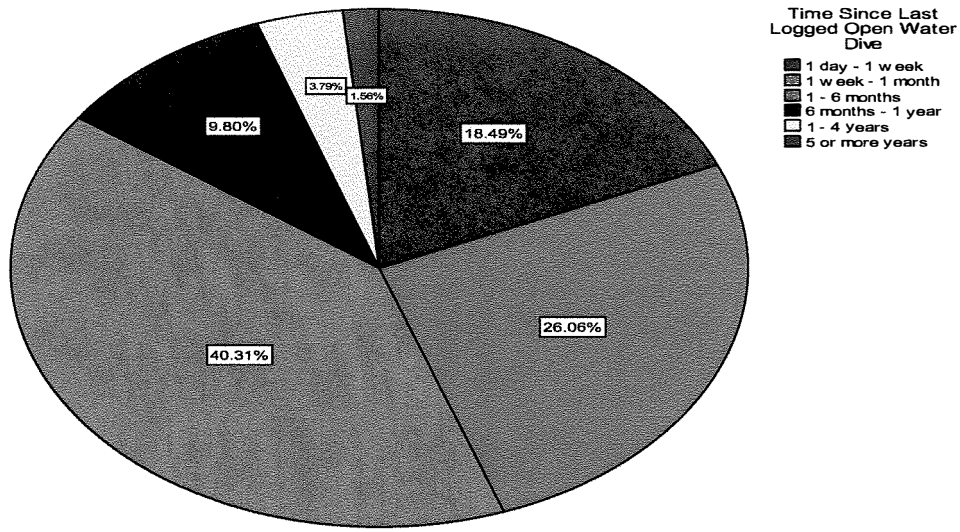


Figure 5.1 Breakdown of Reported Time since Respondent Divers' Last Logged Dive

Despite indicating that taking a refresher course was important (86%), only 50.7 % of divers who had logged their last dive over 6 months ago indicated they would take a refresher. The most common reason provided was that: divers' felt that they had kept their skills current by engaging in pool training sessions or teaching; followed by divers' who thought taking a refresher course was necessary after 12 months of inactivity or that easing back into diving was sufficient. Other reasons included: no longer being medically cleared to dive; having decided to stop diving; preferring to do easy buddy-based check out dives to reviewed skills; and, feeling that they were competent enough not to require refreshers. Lastly, two divers stated that they would pursue advanced training instead and one stated he had no opportunity to take a refresher course.

Of the respondent divers, 44.9% engaged in underwater photography, 44.7% did not (10.4% did not respond to this question). Female divers accounted for 24.5% (n = 79) of respondents; 75.5% were male (n = 243). Similarly, 22% were 35 or under (n = 99), 40.1% were between 36 and 50 (n = 200), and 30.1% were 51+ (n = 150). Respondent divers also reported their home geographic region (n= 447); 49% were from Europe and 38 % stated were from North America. The remaining 13% indicated their home geographic regions were: Africa; Asia; the Caribbean; the Indo-Pacific; Mediterranean; Middle East; Oceania; and South America.

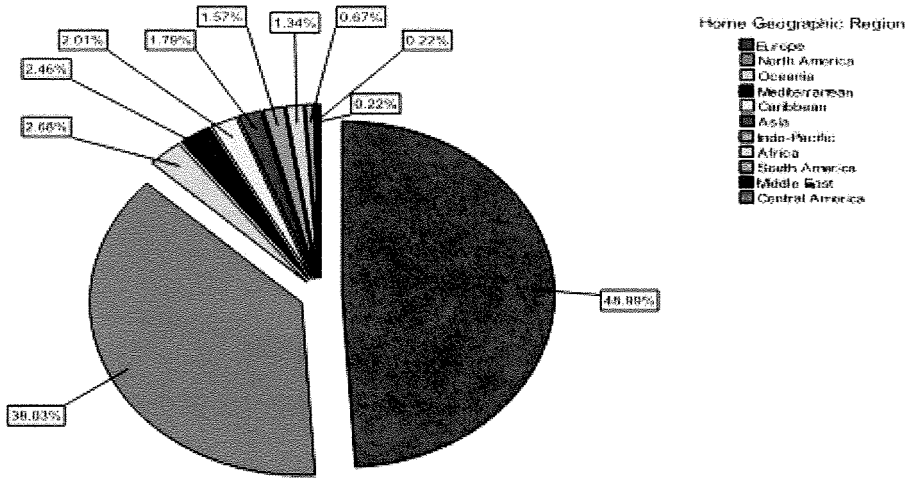


Figure 5.2 Breakdown of Respondent Divers' Home Geographic Region

Of the 499 respondent divers, 78.5% had received a three year college or university degree or higher (Figure 5.3). The remaining 21.5% reported completion of some high school, high school, trade school or some college / university.

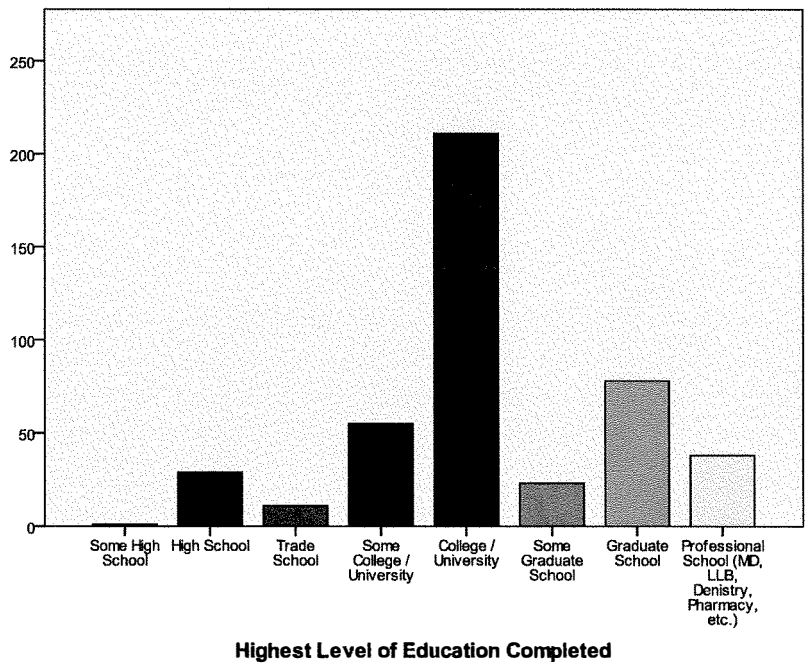


Figure 5.3 Summary Chart of Respondent Divers' Highest Level of Education

Of respondent divers, 32.4% reported an average annual household income of over $100,000, 15.0% reported an average annual household income of $81,000 -

$100,000 and 14.2% reported an average annual household income of between $61,000 and $80,999. The most frequent occupation was business (17.8%), followed by the dive industry (14.1%) and engineering (12.0%). Other fields included consultancy, education, emergency services, government, IT / computers, legal, medical, military, "other", research, retired, sales, skilled trades, the sciences, self employment, students, and, the travel / tourism and hotel industry.

BSAC divers were more heavily weighted towards male divers, and PADI was slightly more weighted towards female divers, than the total sample (Table 5.3). Similarly, a greater portion of BSAC and PADI divers were over 36 years of age; while, a higher percentage of SSI respondent divers reported being 35 and under (23.9%). BSAC divers were almost exclusively European (95.7%), while SSI divers' were predominately North American; PADI divers' were more geographically dispersed (Table 5.3).

Table 5.3 Comparison of BSAC, PADI and SSI Divers' Demographic Characteristics

	BSAC (n = 128)	PADI (n = 301)	SSI (n = 70)	Total Sample (n = 499)
Female	14.6%	30.0%	23.9%	24.5%
Male	85.4%	70.0%	76.1%	75.5%
Age 36 +	87.0%	76.3%	68.7%	70.2%
European	95.7%	37.2%	negligible	49.0%
North American	negligible	48.3%	60.3%	38.0%
Received a 3 year degree or higher	78.6%	79.2%	75.1%	78.5%
Annual Household income over $100,000	34.4%	34.0%	22.6%	32.4%

Most respondent divers possessed a 3 year college / university degree or higher, with very little variation across the three agencies (Table 5.3). Alternatively, an income of over $100,000 was reported by 34.4% of the BSAC divers, and 34% of PADI divers, but by only 22.6% of SSI divers, of whom a greater percentage (24.2%) reported an average annual household income of $41,000 – $60,999. BSAC divers were most likely to be employed in engineering (20.2%) or business (11.7%) or to be retired (14.9%), while PADI divers who were employed in: business (18.8%); the dive industry (16.1%); engineering (10.3%); or, IT / Computers (10.3%) and SSI divers were predominately employed in either: business (24.1%); or the dive industry (15.5%).

BSAC divers most often took advanced training from BSAC (89.6%) with 97.7% indicating that advanced training was important. When asked to indicate which courses were important, they ranked Buoyancy and Trim (95.3%) and Safety and Rescue (94.5%) as important, followed by Oxygen Administration (91.4%), Dive Planning (89.8%), Navigation (89.8%), First Aid (88.3%), Life Saving (88.3%), Enriched Air Nitrox (69.5%), Chartwork (62.5%), and Boat Handling (62.5%). Wreck Appreciation and Marine Life Appreciation were important to 61.7% and 59.4% of BSAC divers.

Only 57% of PADI divers reported receipt of advanced level training from PADI; however 96% indicated that continuing education was important. The PADI courses ranked with the highest level of importance were: First Aid and CPR (78.1%); Rescue Diver (76.7%); Peak Performance Buoyancy (72.8%); and, Underwater Navigation (64.5%). PADI's environmental courses were perceived as important by less than 60% of PADI divers (Reef Conservation, 59.8%; AWARE Fish Identification, 50.2%; Underwater Naturalist, 48.8%; Project AWARE Specialist, 46.5%; and, National Geographic Diver 23.6%).

A high percentage of SSI divers reported receiving advanced training from SSI (82.8%). Similarly, 98.6% indicated that continuing education was important, including the following courses: Diver Stress and Rescue (92.9%); First Aid and CPR (88.6%); Navigation (88.6%); Night and Limited Visibility Diving (84.3%); Deep Diving (75.7%); Boat Diving (71.4%); Computer Diving (71.4%); Equipment Techniques (71.4%); Enriched Air Nitrox (68.6%); Waves, Tides and Currents (65.7%); Wreck Diving (62.9%) and Underwater Photography (60%). SSI's environmental courses were perceived as important by more than 60% of SSI respondent divers (Marine Conservation, 75.7% and, Marine Life and Fish Identification, 65.7%).

BSAC divers were typically certified 10 or less years (35.7%) or 11 – 20 years (27.8%), while PADI and SSI divers were certified between 10 and 20 years (83.0% and 79.7%, respectively). The highest levels of dive training achieved by BSAC respondent divers were: Instructor (24.3%); Dive Leader (20.9%) and Sport Diver (13.9%). BSAC divers were, therefore, typically: Professional (24.3%); Advanced Recreational (23.5%); Beginner Recreational (16.5%); and, Advanced Professional (15.7%) divers. BSAC

divers were as likely to engage in underwater photography or videography (52.6%) as not (47.4%). The highest levels of dive training achieved by PADI divers were: Advanced Instructor (10.3%); Dive Master (15.3%); Advanced Open Water Diver (19.9%); and, Open Water Diver (15.3%). Therefore, PADI divers were typically: Advanced Professional (15.9%); Entry-Level Professional (17%); Advanced Recreational (16.3%); Intermediate Recreational (21.9%); and Beginner Recreational (18.1%) divers. PADI divers were both underwater photographers (51.7%) and non-photographers (48.3%). The highest levels of training achieved by SSI divers were: Advanced Instructor (19.3%); Master Diver (15.9%); Open Water Diver (15.9%); and Advanced Open Water Diver (14.3%). SSI divers were typically: Advanced Professional (26.6%); Advanced Recreational (20.3%); Intermediate Recreational (15.6%); Beginner Recreational (15.6%); Professional (10.9%); and, Entry-Level Professional (10.9%) divers. SSI divers were less likely to engage in underwater photography or videography (39.1%) compared to BSAC and PADI divers.

BSAC divers typically logged between 101 - 500 dives (44.1%), followed by 501 – 1000 dives (20.7%) and 1001 – 5000 dives (20.7%). Most BSAC divers had recorded their last logged dive in the last 6 months (88.7%). PADI divers had logged: 50 or less dives (24.3%); 51 – 100 dives (14.2%), 101 - 500 logged dives (33.3%), and 1001 – 5000 logged dives (16.9%) and had recorded their last open water dive within 6 months (83.7%) and between 6 months and a year (10%). SSI divers typically had: 51 – 100 logged dives' (33.3%); followed by 50 or less (27.0%); and, 1001 – 5000 (17.5%). Most SSI divers had logged their last dive within the past 6 months (92.2%).

The knowledge retention portion of the e-survey was scored out of 30; true / false, multiple choice and image selection questions were used. Of the 499 respondents, 90.4% (n = 451) passed the knowledge retention portion of the e-survey with a score of 80% or higher, while 9.6% failed with a score of 79.9% or lower. The highest score achieved was 100% (n = 29 respondents); the lowest was 33.3% (n= 2).

Of all the respondents, 99.2% acknowledged that divers can cause damage to marine environments and 90.2% correctly identified the image of the diver(s) who

exhibited a correct body position. Additionally, 96.8% indicated that continuing education was important while 86% indicated that a refresher course was important.

Table 5.4 Comparison of BSAC, PADI and SSI Divers' Knowledge Retention Results

	BSAC (n =128)	PADI (n = 301)	SSI (n = 70)	Total Sample (n = 499)
Passed with a Score of 80% or higher	90.6%	90.0%	91.4%	90.4%
Divers' can cause damage	98.4%	99.3%	100.0%	99.2%
Correctly identified image of diver with correct body position	91.4%	91.0%	84.3%	90.2%
Continuing Education is Important	97.7%	96.0%	98.3%	96.8%
Maintaining skills helps reduce impact	70.7%	68.8%	70.0%	69.8%
Refresher Courses are Important	86.0%	88.7%	78.6%	86.0%

There was no statistically significant ($p > 0.05$) difference between the number of BSAC, PADI and SSI respondent divers' who passed the knowledge retention test ($x^2 = 0.139$, df = 2, $p = 0.933$). Nor were there statistically significant variations in the mean test scores of respondent divers, ($F = 0.242$, df = 2, $p = 0.785$) when segmented by novice certifying body ($M_{BSAC} = 88.3\%$, $SD = 11.17$; $M_{PADI} = 88.5\%$, $SD = 8.75$; $M_{SSI} = 89.2\%$, $SD = 8.26$). This is unsurprising, given the similarities in the percentages of divers from each agency who passed the knowledge retention test (Table 5.4). The highest score achieved by the BSAC divers was 100% (n = 5) while their lowest was 33.33% (n= 2). Similarly, PADI divers' highest score was also 100% (n = 16) while their lowest was slightly higher at 46.67% (n= 1). Lastly, SSI divers' highest score was 100% (n = 8), while their lowest score was slightly higher, again, at 63.33% (n= 2).

Of all BSAC divers, 98.4% acknowledged that divers can cause damage to marine environments, compared to 99.3% of PADI and 100% of SSI divers (Table 5.4). Considerably less SSI divers were able to correctly identify the images of a diver using a correct body position and trim in the water (84.3%) than BSAC (91.4%) and PADI (91%) divers (Table 5.4).

While most respondent divers agreed that undertaking continuing education was important (Table 5.4) only 70.7% of BSAC, 68.8% of PADI and 70% of SSI divers indicated that maintaining their skills would help them to minimize their impacts.

Similarly, only 86% of BSAC, 88.7% of PADI and 78.6% of SSI divers indicated that taking a refresher course would have the same effect.

Questions frequently answered incorrectly related to:

- appropriate fining techniques (16.6%);
- the fact that loose gear is susceptible to damage (16.2%);
- that loose gear can be lost (25.6%);
- that taking a refresher course is important (13.4%);
- that chasing marine life is damaging (10.4%);
- that maintaining dive skills is important (28.6%);
- that avoiding flash photography is a low impact diving practice (54.3%)
- that compass navigation is not (39.6%);
- that looking down as divers descend is beneficial (12.6%);
- and, that a code of conduct (11.8%) and local laws (13.8%) govern divers behaviour.

Questions frequently left blank included: the image selection question (2.6%) and those about the factors governing divers' behaviour (1.6%).

Questions typically answered incorrectly by BSAC divers included:

- describing appropriate fining techniques (12.5%);
- the negative impact of collecting specimens and artifacts (20.3%);
- that loose dive gear can get lost (15.6%);
- that taking a refresher course helps divers minimize their impacts (13.3%);
- that it is not ok to chase marine life (10.3%);
- that maintaining dive skills helps minimize environmental impacts (21.9%); as does avoiding flash photography (61.7%);
- that compass navigation does not minimize diver impacts (45.3%); and,
- that local laws govern divers' in-water behaviour (14.8%).

PADI divers typically answered the following questions incorrectly:

- describing appropriate fining techniques (21.3%);
- that loose dive gear is susceptible to damage (17.3%) and can get lost (28.9%);
- that taking a refresher course helps minimize diver impacts (11.6%);
- that it is not ok to chase marine animals (11.3%);
- that maintaining dive skills also minimizes diver impacts (31.2%), as does avoiding flash photography (52.8%);
- that compass navigation docs not minimize diver impacts (36.5%);
- that looking down as divers descend helps to minimize impacts (16.6%); and,

- that a diver code does not govern divers' behaviour (15.6%).

SSI divers frequently answered the following questions incorrectly:

- that loose dive gear is susceptible to damage (27.1%) and can get lost (30%);
- that taking a refresher course helps minimize diver impacts (21.4%);
- that maintaining dive skills minimizes diver impacts (30.0%) as does avoiding flash photography (47.1%);
- that compass navigation is not a way to minimize diver impacts (42.9%) but that proper weighting is (10%); and,
- that local laws (12.9%) and pre-dive briefings (10%) govern divers' in-water behaviour.

There were statistically significant ($p < 0.05$) differences in the number of BSAC, PADI and SSI divers' who answered individual questions incorrectly. These differences highlight areas where the certifying bodies can improve their environmental communications. The following points illustrate those questions where significant differences in responses were found:

- Question #1: Proper Fining techniques ($x^2 = 14.463$, df = 2, $p = 0.001$). PADI divers answered this question incorrectly (21.3%) more frequently than BSAC (12.5%) or SSI (4.3%) divers.

- Question #3: negative impacts of collecting ($x^2 = 23.947$, df = 2, $p = 0.001$). BSAC divers typically answered this question incorrectly (20.3%) more frequently than SSI (5.7%) and PADI (5.7%) divers.

- Question #4: negative impacts of crowding ($x^2 = 15.221$, df = 2, $p = 0.001$). BSAC divers typically answered this question incorrectly (10.2%) more frequently than PADI (2.4%) and SSI (1.4%) divers.

- Question # 7: ($x^2 = 14.287$, df = 2, $p = 0.001$). SSI divers' typically answered this question incorrectly (5.7%) more frequently than PADI respondent divers of whom only 0.7% answered incorrectly, and BSAC respondent divers, all of whom answered this question correctly.

- Question #10: loose dive gear being susceptible to damage ($x^2 = 10.528$, df = 2, $p = 0.005$). Of the SSI divers, 27.1% answered this question incorrectly, compared to 17.3% of PADI, and 9.4% of BSAC.

- Question #11: loose dive gear getting lost ($x^2 = 7.058$, df = 2, $p = 0.029$). Of the SSI divers, 30% answered this question incorrectly compared to 28.9% of PADI divers, and 15.6% of BSACs.

- Question #18: avoiding flash photography ($x^2 = 6.565$, df = 2, $p = 0.038$). BSAC divers typically answered this question incorrectly (61.7%) more frequently than PADI (52.82%) and SSI (47.1%) divers.

- Question #24: look down when descending ($x^2 = 6.656$, df = 2, $p = 0.022$). PADI divers answered this question incorrectly (16.6%) more than BSAC (8.6%) and SSI (7.7%) divers.

- Question # 27: whether a divers' code governs in-water behaviour ($x^2 = 10.215$, df = 2, $p = 0.006$). PADI divers answered it incorrectly (15.6%) more than SSI (10%) and BSAC (6.3%) divers.

Because there was no statistically significant ($p > 0.05$) differences between the number of BSAC, PADI and SSI divers' who passed the knowledge retention portion of the e-survey, $x^2(2, N= 499) = 0.139$, $p = 0.933$, or the mean knowledge retention test scores achieved by BSAC, PADI and SSI divers, $F(2,496) = 0.242$, $p = 0.785$, the mean knowledge retention scores were compared by demographic descriptors to determine if socio-demographic characteristics were better predictors of knowledge retention.

A t-test was used to compare the mean knowledge retention test scores achieved by male and female respondents. An independent-samples t-test was run, with a 95% confidence interval. No significant difference was found in the mean knowledge retention scores of male and female respondents ($t = 0.547$, df = 320, p = 0.158).

Because the remaining demographic descriptors had three or more subgroups, one way ANOVAs and Chi-squared analyses were used to determine significant variations in the mean knowledge retention scores achieved by sub-groups of the following demographic groups: age; home geographic region; highest level of education completed; average annual household income; occupation; specialized levels of training; range of time certified; and, specialized level of training.

A one-way ANOVA was run comparing the knowledge retention scores of the three age ranges of divers (35 and under, 36 – 50, and 51 and over). No statistically significant difference was found ($F = 1.031$, df = 2, $p = 0.358$). Similarly, no statistically significant differences were found in respondent divers' knowledge retention scores when compared by their: home geographic region ($F = 0.824$, df = 10, $p = 0.606$); highest level of education received ($F = 0.288$, df = 7, $p = 0.959$); average annual house-

hold income ($F = 1.758$, df = 5, $p = 0.120$); occupation ($F = 1.053$, df = 19, $p = 0.399$); range of time certified ($F = 0.344$, df = 4, $p = 0.848$); and, specialized level of training ($F = 1.208$, df = 6, $p = 0.301$).

Given the lack of statistically significant variations in the mean knowledge retention scores achieved by divers segmented by demographic groups, the pass / fail rates were compared to determine if there were statistically significant differences. Because the descriptor gender has two sub-categories, an independent-samples t-test was run, using a 95% confidence interval. No significant difference were found in the pass / fail rates of male and female respondents ($t = 0.547$, df = 320, $p = 0.280$). This is unsurprising as 91.1% of female, and 93.0% of male, respondent divers passed.

A one-way ANOVA was run comparing the pass / fail rates of the three age ranges of divers (35 and under, 36 – 50, and 51 and over). No statistically significant difference was found ($F = 2.788$, df = 1, $p = 0.096$). Similarly, no statistically significant differences were found in respondent divers' pass / fail rates by their: home geographic region, ($F = 0.81$, df = 1, $p = 0.776$; level of education ($F = 0.009$, df = 1, $p = 0.925$); occupation ($F = 0.852$, df = 1, $p = 0.356$); range of time certified ($F = 0.807$, df = 1, $p = 0.370$); and, specialized level of training, ($F = 0.511$, df = 1, $p = 0.475$).

Statistically significant results were found in the pass / fail rates of respondent divers' segmented by average annual household income ($F = 8.801$, df = 1, $p = 0.003$). As respondent divers average annual household income increased, so did their pass rate, with 85.3% respondent divers' with an average annual household income of $20,999 or less and 98.5% of respondent divers with an average annual household income of over $100,000 passing the knowledge retention portion of the e-survey.

5.2 Discussion of the Findings of the E-Survey

This study used a convenience, purposive, snowball sample, and as such is not representative of the larger population. However, comparing the demographics of the sample with those of the known international diving population is possible. As noted above, 43.9% of respondent divers indicated that their home geographic region was Europe, while 34.1% resided in North America; the remaining 12% were residences of:

Africa; Asia; the Caribbean; the Indo-Pacific; Mediterranean; Middle East; Oceania; and South America. When compared to the demographic profiles published by Tourism Queensland (2003) and the British Sub Aqua Club (2005), these numbers are strongly weighted towards European divers (43.9%), who consist of 14 – 20% of the known international diving population, while the number of North American divers (34.1%) is relatively consistent compared to the global diver demographic profile (35 – 50%).

The sample was overly representative of divers who had received a 3 year college or university degree or higher (78.5%), compared to the known global population (64%). Similarly the median income of the sample (over $100,000 USD) was elevated compared to the median income published in 2003 by Tourism Queensland (US$60,000 to $69,999 per annum). As noted above, 22% of respondent divers were 35 years of age or younger while the demographic profile indicated that 60% of divers are between 15 and 34 years of age. It should be noted however, that this study limited its sample to those divers 18 years of age or older which may account for some of this variation. Lastly, 24.5% of respondent divers were female while 75.5% were male; the sample was, therefore, slightly overrepresented by males (Tourism Queensland, 2003).

Given that details of the demographic breakdown of BSAC, PADI and SSI entry-level certified divers are unknown, it is not possible to compare the sample sub-groups to a known population.

As noted 90.4% of the respondent divers passed the knowledge retention portion test with a score of 80% or higher, while 9.6% failed with a score of 79.9% or lower. While this pass / fail rate may initially appear surprising, divers must achieve a minimum score of 80% or higher to be certified. Certified divers must, therefore, demonstrate a higher level of initial knowledge compared to students in academic institutions, the typical subject of knowledge retention studies (Semb & Ellis, 1994).

Semb and Ellis (1994) found that prior knowledge, combined with higher scores on tests of original learning, increased knowledge retention, as did knowledge acquisition and use during the retention interval. Given that the majority of respondent divers logged their last dive within the past 6 months (84.86%) and underwent advanced

training (99.1%), it is legitimate to assume that some, if not all, of the respondent divers' acquired additional knowledge post-certification and that these experiences improved their retention. Furthermore, given the sampling and recruitment techniques used to identify respondents for this study, it is possible that those self-identified divers who participated in the study did so because of strong opinions about low impact diving.

As discussed above, respondent divers were able to correctly answer most of the questions related to the principles of low impact diving, with the exception of those questions about taking a refresher course after long periods of inactivity (13.4% fail rate), maintaining diving skills through regular use (28.6% fail rate), avoiding flash photography (54.3% fail rate) and local laws as a factor governing divers' in-water behaviour (13.8% fail rate).

Additionally, while a pass rate of 90.4% is indicative of a high level of knowledge retention, it does not address whether or not divers possess the necessary psychomotor or procedural skills to effectively use this knowledge. Despite evidence of a high retention rate, and that 90.2% of respondent divers correctly identify the image(s) of divers using a correct body position, this does not indicate whether they are able to achieve or maintain it themselves. Additionally, 16.6% of respondent divers failed to correctly answer the question on appropriate fining techniques and 12.6% failed to identify 'looking down while descending' as a low impact diving practice.

Madden (2006) tested both cognitive knowledge and psychomotor procedural skills retention. Given that the ability of scuba divers to execute low impact diving techniques and practices requires the retention of psychomotor procedural skills like proper weighting, the ability to attain and maintain neutral buoyancy, and to use appropriate fining techniques, further study related to divers' retention of these psycho-motor, procedural, skills is needed. Whether or not divers encounter constraints that inhibit their ability to execute low impact diving skills, and their self-perceived efficacy in executing these skills, should also be examined.

Because no statistically significant variations were found in the knowledge retention of divers segmented by certifying body, knowledge retention levels were

examined by demographic descriptors. Townsend (2008b) discussed some of the challenges associated with using diver environmental education to mitigate diver impacts. In her paper, she identified three problem groups often targeted as recipients of low impact diving education: novices; experts; and, photographers. She notes that some of the challenges to diver environmental education arise from the demographic characteristics of divers and the variety of training within any group of certified dive tourists (Townsend, 2008b).

Townsend (2008b) also notes that the success of this education is dependent on the audiences' receptivity to the material and its delivery. Both of these comments reflect aspects of the Elaboration Likelihood Model of Persuasive communication. The audiences' receptivity is related to whether or not a message recipient is motivated and able to process the material. The effective delivery of the material relates to the use of the central or peripheral route to persuasive communication. While this research studied the effective delivery of environmental communications, further research into divers' receptivity to pro-environmental messages is needed.

Novices, male divers and photographers are associated with the highest levels of diver damages (Townsend, 2008b). As such, the implications of respondent diver demographic characteristics were explored to determine if statistically significant variations could be found in their levels of knowledge retention. While no significant variations were found in the levels of knowledge retention of respondent diver demographic sub-groups, all that can be concluded from this finding is that novices, male divers and photographers retained statistically similar levels of low impact diving knowledge. This suggests that knowledge retention is not a factor that contributes to their higher levels of damage. Instead, this may be a result of attitudinal differences among these sub-groups. Therefore, research on divers' attitudes towards low impact diving education, including pre- and post-certification, should be examined.

5.3 Conclusion to the Quantitative E-Survey

This Chapter reported and discussed the results of the E-Survey, including those related to divers' retention of environmental messages. In total 499 usable responses

were received to the E-Survey. They were comprised of: 128 BSAC divers; 301 PADI divers; and; 70 SSI divers. Respondent divers were relatively evenly dispersed between beginner recreational, intermediate recreational, advanced recreational, entry-level professional, professional and advanced professional divers. BSAC divers were typically certified 10 years or less or 11 – 20 years, while PADI and SSI divers had predominately been certified between 10 and 20 years.

Most respondent divers reported that their last logged dive had occurred with between 1 day and 6 months ago. Despite the majority indicating that taking a refresher course was important, only half of the divers who had logged their last dive over 6 months ago indicated they would take a refresher. Respondent divers were evenly distributed between underwater photographers and non-photographers.

Most respondent divers were between 36 and 50 years of age, and either European or North American; female divers accounting for approximately a quarter of respondents. Three quarters of respondent divers held a three year college or university degree or higher and one third reported an average annual household income of over $100,000. The most frequent occupational fields were business, the dive industry and engineering.

BSAC divers most often took advanced training from BSAC, as did SSI divers; a little over half the PADI divers reported taking advanced training from PADI. Wreck Appreciation and Marine Life Appreciation were important to approximately 60% of BSAC divers. PADI's environmental continuing education courses (Reef Conservation; AWARE Fish Identification; Underwater Naturalist; Project AWARE Specialist; and, National Geographic Diver) were perceived as important by less than 60% of PADI divers. Alternatively, SSI's environmental continuing education courses (Marine Conservation; Marine Life and Fish Identification) were perceived as important by more than 60% of SSI divers.

Of all the respondents, 90.4% passed the knowledge retention portion of the e-survey with a score of 80% or higher. There was no statistically significant ($p > 0.05$) difference between the number of BSAC, PADI and SSI respondent divers' who passed

the knowledge retention test. Nor were there statistically significant variations in the mean test scores of respondent divers when segmented by novice certifying body.

There were, however, statistically significant differences in the number of BSAC, PADI and SSI divers' who answered individual questions incorrectly. These differences highlight areas where the certifying bodies can improve their environmental communications. These differences arc explored more fully in the subsequent Triangulation chapter.

Because there was no statistically significant differences between the number of BSAC, PADI and SSI divers' who passed the knowledge retention portion of the e-survey, or the mean knowledge retention test scores achieved by BSAC, PADI and SSI divers, the mean knowledge retention scores were compared by demographic descriptors to determine if socio-demographic characteristics were better predictors of knowledge retention. No significant difference was found in the mean knowledge retention scores of male and female respondents, or among respondents segmented by age, home geographic region, level of education, average annual house-hold income, occupation, range of time certified, or specialized level of training.

Given the lack of statistically significant variations in the mean knowledge retention scores achieved by divers segmented by demographic groups, the pass / fail rates were compared to determine if there were statistically significant differences. No significant difference were found in the pass / fail rates of male and female respondents. No statistically significant difference was found among divers segmented by age, home geographic region, level of education, occupation, range of time certified and specialized level of training. Statistically significant results were found in the pass / fail rates of respondent divers' segmented by average annual household income. As respondent divers average annual household income increased, so did their pass rate.

The following Chapter will triangulate these findings with those of the content analysis of the BSAC, PADI and SSI entry-level certification manuals to provide a holistic understanding of the effectiveness of environmental communication with novice divers.

CHAPTER 6.0 TRIANGULATING THE DATASETS

This Chapter triangulates the findings of the qualitative content analysis of the BSAC, PADI and SSI entry-level certification manuals with those of the quantitative e-survey using the sequential methodological triangulation steps previously outlined. Triangulating the two datasets allows for an exploration of the effectiveness of environmental communication with scuba divers and the potential behavioural implications of the communication strategies used by the three training agencies. The Elaboration Likelihood Model of Persuasive Communication is revised to consider the constraints to message recipients' engagement in desired behaviours as a result of the need to possess psychomotor procedural skills.

6.1 Triangulating the Qualitative and Quantitative Datasets

This section uses the results of the knowledge retention test to explore those of the qualitative content analysis, addressing the four research questions that guided this study. Comparing each certifying body (4.5 Conclusion to the Content Analysis, pp. 97) allowed a prediction of how each agency's use of these message delivery styles, and routes to persuasion, would influence knowledge retention among their novice divers. Given the predictions made about the inefficacy of the three manuals, as a result of this comparison, the high pass rate of respondent divers (90.4%) is surprising, as is the lack of statistically different levels of knowledge retention across certifying bodies. This suggests that other previously unaccounted for factors may influence divers' acquisition and retention of environmental messages. As such, the statistically significant differences between the number of BSAC, PADI and SSI respondent divers' who answered individual questions incorrectly were explored.

Triangulating the data from the content analysis (Table 4.2, pp. 65; Table 4.5, pp. 80; Table 4.7, pp. 95) with the statistically significant differences between the number of BSAC, PADI and SSI respondent divers' who answered individual questions incorrectly illustrates the impact that communication along the central and peripheral routes to persuasion have on knowledge retention (Table 6.1).

Table 6.1 Summary of Questions with Statistically Significant Variations in the Percentage of Correct Responses Achieve Across Certifying Bodies and the Message Delivery Styles Associate with the Delivery of their Related Content

Question	BSAC			PADI				SSI	
	Percent Incorrect Responses	# of Messages Delivered	*Message Style Used*	Percent Incorrect Responses	# of Messages Delivered	*Message Style Used*	Percent Incorrect Responses	# of Messages Delivered	*Message Style Used*
# 1 - Proper Fining Techniques	12.5%	5	60.0% Peripheral Route 40.0% Central Route	21.3%	3	100% Peripheral Route	4.3%	12	75% Peripheral Route 25% Central Route
# 3 - Negative Impacts of Collecting	20.3%	4	50% Peripheral Route 50% Central Route	5.7%	3	33.3% Peripheral Route 66.6% Central Route	5.7%	3	100% Peripheral
# 4 - Negative Impacts of Crowding	10.2%	3	100% Peripheral Route	2.4%	13	76.9% Peripheral Route 23.1% Central Route	1.4%	0	Not Applicable
# 7 - Dive as a guest	0.0%	11	81.8% Peripheral Route 18.2% Central Route	0.7%	8	37.5% Peripheral Route 62.5% Central Route	5.7%	10	60.0% Peripheral Route 40.0% Central Route
# 10 - Loose gear susceptible to damage	9.4%	2	100% Peripheral Route	17.3%	22	86.4% Peripheral Route 13.6% Central Route	27.1%	5	100% Peripheral
# 11 - Loose gear gets lost	15.6%	2	100% Peripheral Route	28.9%	22	86.4% Peripheral Route 13.6% Central Route	30.0%	5	100% Peripheral
# 18 - Avoid flash photography	61.7%	0	Not Applicable	52.8%	0	Not Applicable	47.1%	2	50% Peripheral Route 50% Central Route
# 24 - Look down when descending	8.6%	1	100% Peripheral Route	16.6%	0	Not Applicable	7.7%	2	100% Peripheral Route
# 27 - Divers' Codes Govern in-water behaviour	6.30%	47	87.2% Peripheral Route 12.8% Central Route	15.6%	7	85.7% Peripheral Route 14.3% Central Route	10%	16	50% Peripheral Route 50% Central Route

As illustrated in Table 6.1, PADI divers typically answered the first knowledge retention question incorrectly more frequently than BSAC or SSI respondent divers. This was not unexpected given that the PADI manual communicated 100% of their messages related to appropriate fining techniques using the peripheral route to persuasion compared to SSI's 75% and BSAC's 60%, both of which corresponded with higher retention rates. What is surprising is that SSI's retention rate (95.7%) was higher than BSAC's (87.5%), despite SSI's higher dependence on the peripheral route to persuasion. This suggests that other previous unaccounted for factors influenced divers' levels of retention. This disparity may be a result of their relative inclusion of skills teaching messages (BSAC = 3, SSI = 8), but may also illustrate the additive effect of messages delivered through the peripheral route to persuasion. As noted by Marion & Reid (2007) and Stubbs (1991), messages must be plentiful and consistent to be effective and the SSI manual delivered more than double the number of messages related to appropriate fining techniques than the BSAC manual and triple that of the PADI manual.

BSAC respondent divers typically answered the third question incorrectly (20.3%) more frequently than SSI (5.7%) and PADI (5.7%) respondent divers. These results are surprising, given that the SSI manual relied completely on the peripheral route to persuasion, while the BSAC manual used the peripheral and central route equitably, and the PADI manual predominately used the peripheral route to persuasion. This suggests that other factors likely influenced divers' retention of messages related to the negative impacts of collecting.

Similarly, BSAC divers typically answered the fourth question incorrectly (10.2%) more frequently than PADI (2.4%) and SSI (1.4%) divers. The BSAC manual barely touched on the negative impacts of crowding (n = 3), while the PADI manual discussed it in greater detail (n = 13), using both the central and peripheral routes. Surprisingly, while the SSI manual did not discuss it at all, SSI divers had the lowest fail rate for this question. This difference suggests that other previously unaccounted for factors influence divers' acquisition and retention of environmental messages related to low impact diving. For example, it is possible that SSI instructors cover this material in

the classroom, pool and / or open water portions of the course, or that SSI certified divers' acquired this knowledge post-initial certification.

Alternatively, SSI divers' typically answered the seventh question incorrectly (5.7%) more frequently than PADI respondent divers (0.66%), and BSAC respondent divers (0.0%). This is unsurprising given that the SSI manual had the second highest use of the central route to persuasion, and the second highest frequency of messages.

Similarly, of the SSI divers, 27.14% answered the tenth question, about loose dive gear and its susceptibility to damage incorrectly, compared to 17.28% of PADI, and 9.38% of BSAC, divers. As with the previous two significant questions, 30% of SSI divers answered the eleventh question incorrectly compared to 28.9% of PADI, and 17.19% of BSAC, divers. The SSI manual covers the implications of loose dive gear solely through both the peripheral route (n = 5) persuasion, and in a limited capacity, as does the BSAC manual (n = 2), while the PADI manual discusses it extensively, both the central and peripheral (routes to persuasion. This accounts for PADI divers' pass rate being higher than SSI's but does not explain why it is lower than BSAC's. Given that BSAC divers had the lowest fail rate for this question, and that the BSAC manual relied solely on the peripheral route to persuasion, it is legitimate to conclude that other factors influenced BSAC divers' acquisition and retention of these messages.

BSAC divers typically answered the eighteenth question, related to avoiding flash photography, incorrectly (61.7%) more frequently than PADI (52.8%) and SSI (47.1%) divers. The BSAC and PADI manuals do not touch on this concept, while the SSI manual used both the central and peripheral routes to discuss this concept in a limited capacity (n = 2). Given that all three agencies offer continuing education courses on underwater photography, it is possible that BSAC and PADI reserve this discussion for those courses. However, given that only 52.6% of BSAC, 51.7% of PADI, and 39.1% of SSI respondent divers indicated that they actively engaged in underwater photography while diving, these retention rates are not unexpected. As Donavant (2009) notes "adults are intrinsically motivated toward learning, but that motivation is premised on their perception of the need to learn … the material in relationship to their adult roles" (pp. 228). As such, respondent divers, irrespective of their certifying body, may

perceive this information as irrelevant, and thus may not retain it, if they are not underwater photographers / videographers.

PADI divers typically answered the twenty-fourth question, related to looking down as divers descend, incorrectly (16.6%) more frequently than BSAC (8.6%) and SSI (7.7%) divers. The PADI manual did not discuss looking down while descending, while the BSAC and SSI manual's did, although minimally and through the peripheral routes to persuasion.

Lastly, PADI divers typically answered question twenty-seven, related to a divers' code of conduct, incorrectly (15.6%) more frequently than SSI (10%) and BSAC (6.3%) divers. All three manuals used both the central and peripheral routes to persuasion to communicate these messages. The PADI manual covered it minimally, and with a greater dependence on the peripheral route to persuasion; the SSI manual also covered it minimally but with a slightly higher use of the central route to persuasion, thus accounting for SSI divers' higher retention rate. The BSAC manual's heavy emphasis on diver codes of conduct, as evidenced by their 31 part diver code of conduct, helps to explain why BSAC divers' attained the highest retention rate. The PADI manual does not espouse a dive ethic while the SSI manual espouses a six part diver code of conduct. Thus, the varying depth of coverage of this topic across the three certifying bodies' manuals may be a contributing factor in respondent divers' retention. This, again, suggests that factors other than the use of effective message delivery styles may be influencing divers' acquisition and retention of environmental messages. The factor is likely the repetitive discussion of this concept (Marion & Reid, 2007; Stubbs, 1991), further reinforcing the additive effect of messages communicated through the peripheral route to persuasion.

Triangulating the data from the content analysis with that gathered during the implementation of the e-survey illustrates the impact that communication along the central and peripheral routes to persuasion have on knowledge retention. Therefore, environmental messages communicated to scuba divers using the central route to persuasion resulted in higher levels of knowledge retention (Research Question 1). Similarly, a combination of messages delivered through the central and peripheral routes

to persuasion resulted in higher knowledge retention levels among respondent divers; while not considered as part of the original research questions, this finding emerged from the triangulation process and has implications for the suitability of the ELM to model persuasive communication. Similarly, messages communicated solely through the peripheral route to persuasion were less effective in eliciting knowledge retention (Research Question 2), unless these messages were delivered in a plentiful manner, and / or were supported by accompanying diagrams / illustrations and their associated skill teaching messages. While this finding was only partially predicted, the implication of the additive effect of plentiful messages communicated through the peripheral route to persuasion emerged from the triangulation process and also has implications for the suitability of the ELM to model persuasive communication.

In addition to the implications of the message delivery styles used to communicate environmental concepts to scuba divers, it was expected that advanced specialized divers (recreation and professional) would possess a higher level of environmental and low impact diving knowledge than novice divers (Research Question 3) as a result of continuing education, advanced training and higher experience levels. However, no statistically significant variations were found in knowledge retention levels based on diver' specialized level of training. This result was unexpected, and has implications for the effectiveness of diver continuing education. Despite the fact that 97.7% of BSAC, 96% of PADI, and 98.6% of SSI divers indicated that taking advanced training was important, the lack of importance placed on environmentally-centered continuing education courses by BSAC, PADI and SSI divers' may indicate a lack of advanced pro-environmental education and training. As such, it is recommended that pro-environmental concepts are included in all continuing education and refresher courses, and in pre-dive briefings, as well as in novice training, to ensure acquisition of a low impact diving education.

Lastly, it was expected that scuba divers' would retain higher levels of environmental knowledge and low impact diving principles when they reported a shorter time since their last logged open water dive (Research Question 4) as a result of the recent use of low impact diving knowledge, skills and principles. However, no

statistically significant variations were found in knowledge retention levels based upon length of time since last logged dive. While unexpected, this is unsurprising given that 84.86% of the respondent divers indicated that their last logged dives occurred between 1 day and 6 months ago and as such this analysis was heavily weighted towards active divers.

6.2 Exploring Potential Implications for Attitudes and Behaviour through the Elaboration Likelihood Model of Persuasive Communication

This subsection discusses the potential implications of knowledge retention and message delivery styles for respondent divers' attitudes towards low impact diving education and practices. It will also discusses the potential for the routes to persuasion, and retained knowledge, to impact the nature of divers' in-water behaviour.

The formation of scuba divers' pro-environmental attitudes, and their subsequent adoption of low impact diving behaviours, is dependent upon their level of knowledge retention and the nature of their processing of these messages. As noted by Donavant (2009), adult learners derive their motivation to learn information and skills from their perception of its relevance, and ultimately its applicability, to their adult roles. Therefore, according to the ELM, if a diver possess an initially positive attitude towards low impact diving education, they are likely to approach learning about it and its associated skills with a positive attitude, resulting in retention of communicated messages and their positive attitude, even if exposed to messages communicated through the peripheral route to persuasion. As such, they are likely to adopt low impact diving behaviours. Conversely, if a diver enters their novice certification course with either a neutral or negative attitude towards low impact diving education, they are unlikely to be persuaded to retain environmental messages or to adopt low impact diving behaviours by messages communicated through the peripheral route to persuasion. Instead, they will likely adopt these behaviours only in situations where fear of a sufficient sanction affects a temporary shift in their attitude (Sorice, et al, 2007).

Alternatively, divers' exposed to environmental messages communicated through the central route to persuasion are more likely to either retain, or gain, positive

attitudes towards low impact diving education. This may lead to higher knowledge retention levels and long-term adoption of low impact diving behaviours. If, however, divers exhibit an initially negative attitude towards low impact diving, the nature of their processing of environmental communications may further their unfavorable attitude towards low impact diving. These divers are unlikely to permanently adopt low impact diving behaviours, only adopting them if threatened with sanctions or in the presence of other peripheral cues (Sorice, et al., 2007).

Because of the three manuals' heavy dependence on messages communicated using the peripheral route to persuasion, divers' certified by BSAC, PADI and SSI were expected to exhibit low levels of knowledge retention. This, however, was not the case; 90.4% of respondent divers' passed with a score of 80% or higher. There was also no statistically significant difference in knowledge retention across certifying bodies irrespective of their use of diverse communication strategies. This indicates that the combination of messages delivered using the central and peripheral routes to persuasion had an additive effect on message recipients' acquisition and retention of environmental communications not accounted for by the ELM.

This, in turn, has potential implications for their processing of environmental messages, level of knowledge retention, subsequent attitudes towards low impact diving, and resulting in-water behaviour. The repetitive delivery of peripheral messages reinforced through well timed and supportive attribution and interpretive messages, may actually lead to positive attitudes towards low impact diving, knowledge retention and thus the long term adoption of low impact diving behaviour, instead of the short-term behavioural changes predicted by the Elaboration Likelihood Model. This is supported Cottrell and Meisel (2004) who found that participants' knowledge of environmental issues, environmental beliefs, and positive attitudes diving-related environmental regulations was predictors of divers' personal responsibility to act pro-environmentally.

As a result of respondent divers' high level of knowledge retention, this research predicts that respondent divers' exposed to the environmental messages communicated in the BSAC, PADI and SSI manuals will possess generally positive attitudes towards low impact diving, and will be willing to engage in low impact diving practices. This is

supported by Barker and Roberts (2008), who found that divers generally possess a positive attitude towards regulation, and low impact diving, and a clear understanding of appropriate in-water behaviour.

Exceptions to this likely include variations among subgroups of the total respondent diver population with lower levels of knowledge retention or who either possess, attain, or retain, a negative attitude towards low impact diving as a result of exposure to sparse environmental communications delivered through the peripheral route to persuasion. Therefore, while higher levels of knowledge retention are predicted to be associated with more positive attitudes towards low impact diving education and practices, those divers' who undergo a negative processing of the communicated messages will be more likely to exhibit negative attitudes, and not adopt low impact diving behaviour, irrespective of their level of knowledge retention.

It is also predicted that higher knowledge retention scores have the potential to result in lower levels of engagement in depreciative behaviours, unless hindered by negative attitudes. This prediction is based in part, upon the framework of the ELM, but also upon their retention of the psychomotor procedural skills required to enact low impact diving practices and behaviours. Irrespective of the formation of a generally positive attitude towards low impact diving education and practice, which can in turn be predictive of long-term adoption of low impact diving behaviours, respondent divers' actual engagement in low impact diving practices is dependent on whether they can negotiate internal and external constraints.

External constraints, or unanticipated events (e.g. swells, fear for their dive buddies safety), can reduced divers' abilities to engage in low impact diving. Internal constraints, such as skills competency also have an impact. Unlike hiking, where recreationists can choose to avoid depreciative behaviours simply by staying on designated trails (Bradford, 2005), scuba divers must possess a series of psychomotor procedural skills to effectively engage in low impact diving. For example, to avoid contact with the bottom or living substrate, divers' must maintain neutral buoyancy, a skill comprised of proper weighting and breath control, an understanding of how to compensate for swells, current and changes in buoyancy which can move a diver

uncontrollably in the water column, descending in a controlled manner, securing loose gear; spatial awareness, and how to move without excessive fining or hand paddling.

Despite the fact that 90.2% of respondent divers were able to correctly identify the image(s) depicting divers with the correct body position and trim in the water, 16.6% of respondent divers failed to correctly answer the question related to appropriate fining techniques and 12.6% of respondent divers failed to correctly identify 'looking down while descending' as a low impact diving practice. This disparity suggests that a significant percentage of respondent divers may not be able to attain a similar body position themselves, or effectively maintain it over the course of a dive when factors like fatigue, safety concerns, or buoyancy shifts may decrease their ability to execute skills. Without the ability to enact these skills, divers will continue to have an impact on marine environments despite possessing sufficient knowledge, and a positive attitude towards low impact diving education and practice.

Each manual's communication of skill teaching messages must, therefore, be considered in predictions of divers' adoption of low impact diving behaviour. The BSAC manual contained 18 skill teaching messages (6.8% of the total manual content), the PADI manual contained 64 (16.7%) and SSI's contained 55 (9.4%). The BSAC manual contained the lowest percentage of manual content devoted to skill teaching messages; BSAC respondent divers are, therefore, predicted to engage in higher levels of depreciative behaviour, including accidental and purposeful contacts, than both PADI respondent divers and SSI respondent divers.

The ELM, while capable of explaining the majority of the predicted phenomena, fails to take into consideration three major aspects of effective environmental communication with scuba divers skill teaching messages, internal / external constraints, and the evolving nature of environmental communication with scuba divers. The impacts of external and internal constraints on message recipients' actual abilities to adopt the desired behaviours communicated to them through persuasive communications are not considered in the ELM. As such it is unable to accurately predict all message recipients' behavioural outcomes based solely on their retention, and processing, of communicated messages, and resulting attitudes. Therefore, while the Elaboration Likelihood Model

effectively models the central and peripheral route to persuasion and their potential impact on the formation of recipients' attitudes, and the most likely behavioural outcomes, it is only capable of doing so where no psychomotor procedural skills competencies are required.

Similarly, it fails to take into consideration the length of a divers' diving career or the impact of repetitive exposure to pro-environmental messages. Environmental communications with scuba divers' are a component part of an instructional process. As such, divers' are exposed to these messages repeatedly throughout their certification course which ranges from four to six days in a compressed course to several weeks in a full length course. Similarly, written communications are not the only messages that scuba divers' receive throughout the course of their entry-level certification course. Divers' arc also exposed to videos, lectures, and practical instructional components and also witness the behaviour of their diving instructors. While these aspects of the instructional process were not studied in this, they have an impact on respondent divers' retention of pro-environmental messages, the formation of their attitudes towards low impact diving and their subsequent behaviour.

The ELM also fails to articulate the evolving, repetitive and cyclical nature of environmental communication with scuba divers; instead it views persuasive communication as a singular event with a logical termination point (the message recipients' predicted behaviour). Because of the nature of scuba diving, recreational divers and dive tourists are continually exposed to message through continuing education courses, MPA regulations, social and regulatory sanctions, dive master intervention and pre-dive briefings. Divers' attitudes towards low impact diving are, therefore, likely to change throughout their diving careers (Townsend, 2008b). The Elaboration Likelihood Model of Persuasive Communication only explains part of this phenomenon. I, therefore, propose the Predictive Behavioural Outcomes Model of Effective Communication.

6.3 Modeling Effective Communication to Predict Behavioural Outcomes

In light of the conclusions espoused above, I propose the Predictive Behavioural Outcomes Model of Effective Communication that better explains environmental communication with scuba divers. It considers the impact of skills training, internal and external constraints and the continually evolving nature of environmental communication with scuba divers. The Predictive Behavioural Outcomes Model of Effective Communication (Figure 6.1), while based upon the Elaboration Likelihood Model of Persuasive Communication, moves beyond it.

When a message recipient first encounters a message, as with the ELM, the nature of their processing of the message is dependent on whether or not they are motivated and able to process the message. If they are unable or unmotivated to do so, and a peripheral process is not acting on them, they are likely to retain their previous attitude, and therefore not adopt the desired behaviour.

If, however, a peripheral process is operating on them, and they undergo a peripheral attitude shift, they are likely to attempt to adopt the desired behaviour. This adoption is dependent on whether or not they encounter internal or external constraints, and whether or not they possess the necessary psychomotor procedural skills. If they encounter constraints, or do not possess the required skills, they will not be able to adopt the desire behaviour. If, however, they possess the skills, and do not encounter any constraints, they will temporarily adopt the communicated behaviour.

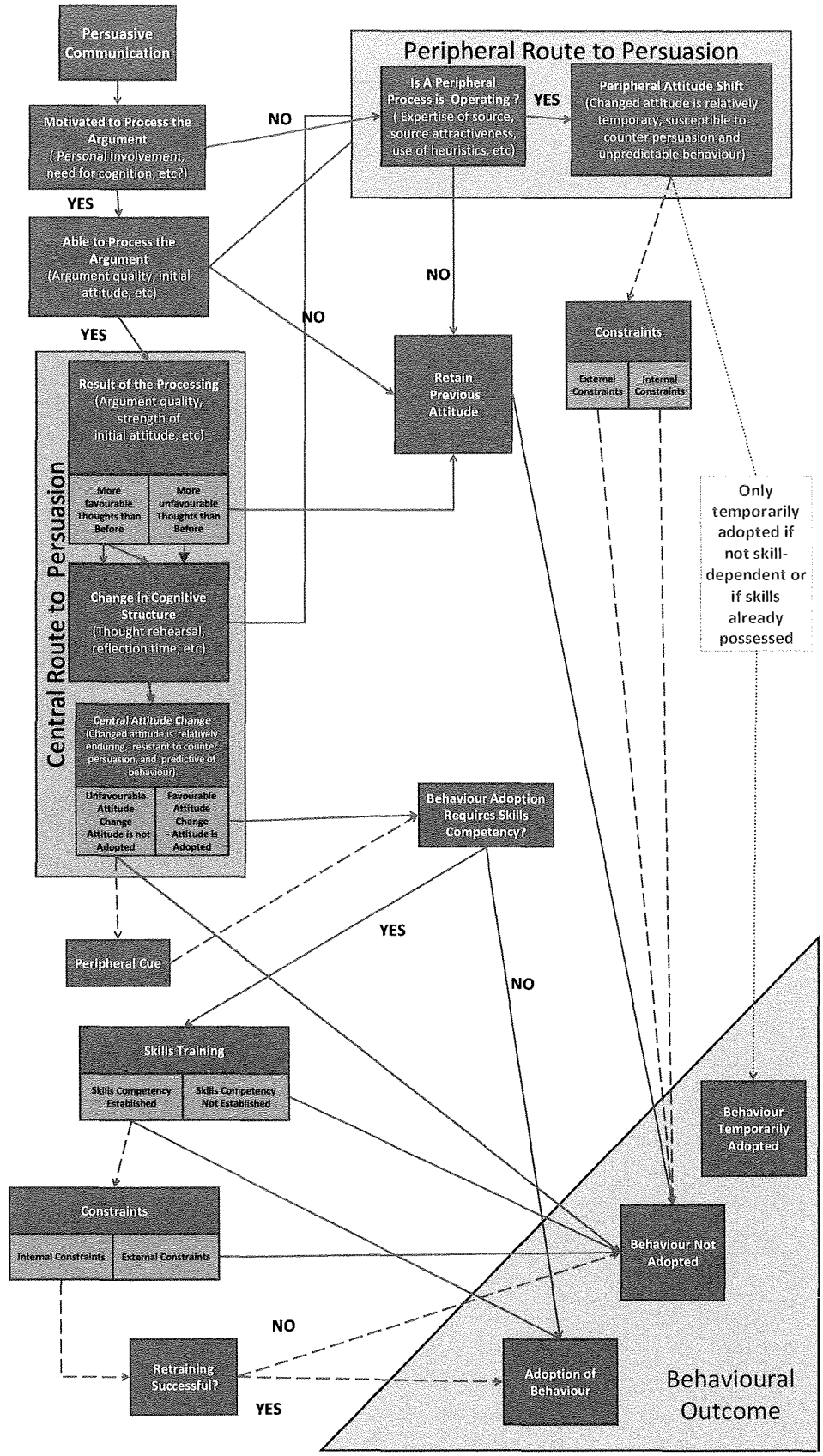


Figure 6.1 The Predictive Behavioural Outcomes Model of Effective Communication

If the message recipient is motivated but unable to process the message, they will retain their previous attitude and not adopt the behaviour. Factors that contribute to the inability to process messages include contradictory written messages and visual media, and missed education opportunities. Message recipients may also be affected by a lack of associated skill teaching messages. The presence of mixed messages reduce message recipients' abilities to process incoming messages, increase confusion over complex concepts and act as barriers to comprehension. As a result, message recipients are unable to process the messages and cannot adopt the communicated behaviour.

Alternatively, if the message recipient is motivated, and able to process the message, the nature of their processing of the message will impact their resulting attitude and behaviour. If the message recipient undergoes a negative processing of the message, they will retain, or gain, a negative attitude and not adopt the communicated behaviour. Therefore, if the nature of the processing results in the establishment of a negative attitude towards the communicated behaviour, the message recipient will only adopt the communicated behaviour if a sufficiently strong peripheral cue is present (Sorice, et al., 2007). In the case of scuba divers, this peripheral cue may take the form of sanctions, including fear of being ostracized from their recreational peer group, MPA regulations, and sanctions imposed Dive Masters or Diver Operators such as dive site access restrictions, or fines imposed by Park Rangers. The desire behaviour is, then, adopted temporarily until the threat of the sanction is relieved.

If message recipients undergo a positive change in their cognitive structure, their attitude may shift from: neutral to positive; negative to positive; or, positive to more positive. If a positive attitude is established, the communicated behaviour will be adopted, unless a level of skills competency is required. In this case, they will adopt the behaviour only if their skill level is sufficient and they do not encounter constraints. For example, if a scuba diver possesses buoyancy control skills, and a positive attitude towards low impact diving practices, they will stay off the bottom unless they encounter an external constraint (swells, a current, or a diving emergency) or an internal constraint (loss of psychomotor skills due to infrequent skill use or fatigue). In either case, further skills training may be required.

If the message recipient does not initially possess the required skills, but has a desire to adopt the communicated behaviour, they will need to undergo skills training aimed to instill the required degree of competency. If successful in their skills training, they will be able to adopt the desired behaviour, provided they do not encounter constraints. If constraints are encountered, they will progress as per the previously described scenario. If they are unsuccessful in their skills training, the behaviour will not be adopted and further training may be required.

Besides the behaviour patterns mapped above (Figure 6.1) it is important to note that this process is continual. New scenarios may arise that result in divers' reconsidering their attitudes towards low impact diving. For example, divers with negative attitudes towards low impact diving may adopt a positive attitude towards it after repeated exposure to low impact diving messages, experiencing sufficient sanctions, or viewing diver damaged reefs. Similarly, divers with positive attitudes may undergo a shift in attitude. This attitudinal shift may be temporary, such as when they dive in quarries, or collect scallops for personal consumption, or can be long term, resulting from perceived decreases in enjoyment while engaged in low impact diving.

Recognizing the psychomotor procedural skills competency requirements of low impact diving, internal and external constraints to behavioural adoption, and the continually evolving nature of divers' environmental communication post-novice, entry-level, certification is an important step in understanding the effectiveness of environmental communication with divers. The Predictive Behavioural Outcomes Model of Effective Communication fills these voids in the Elaboration Likelihood Model's mapping of persuasive communication.

In addition to being applicable to low impact diving, this model is applicable to other skill intensive low impact activities, including but not limited to:

- catch and release fishing;
- educational curricula that includes a psychomotor procedural skills component (e.g. defensive driving and first aid / CPR); and,
- skills training programs, such as workshops where participants learn the skills required to participate in volunteer environmental monitoring.

6.4 Conclusion to the Triangulation

This Chapter triangulated the results of the qualitative content analysis with those of the quantitative e-survey, leading to a more holistic understanding of effective environmental communications and the potential behavioural implications of the communication strategies used by the three training agencies.

Triangulating the data from the content analysis with those of the e-survey, in an examination of the statistically significant differences between the number of BSAC, PADI and SSI respondent divers' who answered individual questions incorrectly, illustrated the impact that communication along the central and peripheral routes to persuasion have on knowledge retention. It also suggested that other previously unaccounted for factors may be influencing divers' acquisition and retention of environmental messages, including the additive effect of messages delivered through the peripheral route to persuasion. Lastly, the triangulation phase highlighted the importance of psychomotor procedural skill competencies established through plentiful skill teaching messages.

Based on these results, this research suggests a revision to the Elaboration Likelihood Model of Persuasive Communication (Petty, McMichael & Brannon, 1992), through the proposed Predictive Behavioural Outcomes Model of Effective Communication, which better describes the constraints to message recipients' engagement in desired behaviours as a result of the need to possess psychomotor procedural skills.

The following chapter concludes this thesis by making recommendations for changes to promote effective communication of environmental, coral reef-based and low impact diving messages to novice divers in each of BSAC, PADI and SSI's manuals, and by exploring this research within the context of past studies on diver impacts and education and its limitations and delimitations. Finally, concludes by discussing the practical application of the study's findings and the need for further research.

CHAPTER 7.0 RECOMMENDATIONS AND CONCLUSION

The previous chapters reported the findings of the qualitative content analysis of the BSAC, PADI and SSI entry-level certification manuals and the implementation of the quantitative e-survey, and the findings were subsequently triangulated. This chapter makes recommendations based on these findings and is broken down by certifying body. Recommendations are made for revisions to the BSAC, PADI and SSI manuals and highlight areas where the content identified as containing missed education opportunities or contradictory written messages can be re-worded to reinforce the principles and skills of low impact diving. It also includes recommendations for alternative, non-contradictory, images and recommends were content can be clarified with the addition of skill teaching diagrams.

This Chapter also discusses the unique nature of this research within the context of past studies on diver impacts and education. It discusses the delimitations and limitations of the studying, touching on the researcher imposed boundaries of the study, and the researcher's decision to explore environmental communication with scuba divers through the framework of the Elaboration Likelihood Model. The limitations imposed on the study as a result of temporal and financial constraints, and as a result of the use of a convenience, purposive, snowball sample of certified divers and, e-research techniques are divulged. It concludes by discussing the practical application of the study's findings and the need for further research.

7.1 Recommendations for Revisions to the BSAC, PADI and SSI Manuals

As previously discussed, 39.2% of the images in the BSAC manual were negative or contradictory. These images depict divers crowding, or chasing, marine life and contradict messages that caution against interfering with the lives of marine species; other common negative images depict divers in contact with the seabed, not maintaining an appropriate distance from the seabed, or using a vertical body position. These images should be replaced with ones that show divers' using low impact diving skills, thus reinforcing the values espoused by the BSAC diver code of conduct. While communicating to divers that viewing wildlife on their dives is desirable, images of

divers crowding, or negatively interacting with, wildlife indicate that it is acceptable for divers to crowd or chase marine life, instead of viewing them from a respectful distance. Similarly, divers should always be shown in a horizontal, body position, or accompanying text should explain why the use of a different is warranted. Lastly, divers' should always be photographed in positions high above the seabed, or living substrate. If it is necessary to depict divers in close proximity to the seabed / coral reef / wreck, it is important that manuals communicate the reason that divers are acting in this way, and highlight the potential damage this proximity can cause.

Twenty missed education opportunities were found in the BSAC manual. The most frequent missed education opportunities related to entries (n= 6; 28.5%), neutral buoyancy (n = 4; 19%), the implications of lights or flash camera use for photosensitive marine life (n = 4, 19%); the need to secure loose gear (n = 3, 14.4%), that protective gear does not protect the reef from divers and does not give them free reign to touch anything they want (n = 2, 9.5%) and fins / the resuspension of sediment (n = 2, 9.5%).

Missed education opportunities related to entries fail to mention the ecological implications of each entry, or to mention ways divers can minimize the impact of their entries. When entering from a boat, using either a giant stride, front roll or back roll, instructional manuals should inform divers to check the depth of the water and for the presence of marine life before they entering to ensure that the added length of their fins means they will not contact marine life, or living substrate (like corals). Additionally, divers should be warned that using a vertical body position, while doing their buddy checks, should only be done in water deep enough that their vertical fin action does not resuspend sediment; otherwise divers' should be told to inflate their BCD, roll onto their back, and float in a horizontal position with their faces out of the water.

Neutral buoyancy-related missed education opportunities fail to explain that it allows divers to minimize, or even negate, unnecessary contact with living substrate and resuspension of sediment. The BSAC manual should highlight the importance of working towards the Bronze, Silver, Gold and Black buoyancy standards awarded by BSAC and should highlight the ecological implications of attaining these rankings.

The impacts of lights or flash use on photosensitive marine life is not discussed in the BSAC manual; appropriate times to discuss this include during discussions of underwater photography, night diving, and additional light source use. There are several negative implications related to the use of dive lights or flash photography, including temporary blindness and disorientation for marine life that is accustomed to the darkness, ultimately leading to an alteration of their normal behaviour patterns and possibly increasing the risk of diving in these environments. As such, divers need to be taught how to uses lights unobtrusively.

Additionally, discussions of the importance of securing loose gear were omitted from the BSAC manual. The need to secure loose gear should have been included in the pre-dive equipment check list. Securing loose gear should be related to a decreased likelihood of negative contact resulting in diver impacts and / or gear damage. Other opportunities to address the importance of securing loose gear include discussions of donning dive gear, or "getting kitted up", and buoyancy compensator devices (BCDs or BCs). For example the following passage:

> "Most BCs will have one or two storage pouches or pockets and possibly a number of D-ring attachment points to enable various items of ancillary equipment - such as torches - to be carried" (Ellerby, 2009, pp. 91)

could be improved by including the bolded portion below,

> Most BC's will have one or two storage pouches or pockets and possibly a number of D-ring attachment points to enable various items of ancillary equipment – such as torches – to be carried. **Environmentally-aware divers can use these D-rings as attachment points for loose gear. Using gauge clips on large retractors, attached to these D-rings, to secure alternate air sources or gauges prevents gear from dragging on the seabed or having unnecessary and damaging contact with marine life or living substrate**.

Discussions of protective gear (wetsuits, drysuits and gloves) fail to mention that wearing protective gear does not protect the reef from divers. Divers need to know that wearing gloves does not give them free reign to touch what they want and that touching coral removes its protective mucosal layer making it susceptible to infection and disease (Davenport & Davenport, 2006). This is missing from the BSAC manual. While the manual states that donning fins increases divers' body length, and that divers need to be

spatially aware, it is only mentioned once, and opportunities to discuss it are missed. During the discussion about sedimentary matter, the manual states

> Sedimentary and minute living organisms in the water can blur our vision, rather like a fog. The sedimentary matter, in the sea frequently comes from material flushed [into] the vicinity from local rivers. The areas affected vary … according to inland rains (Ellerby, 2009, pp. 54).

This passage fails to mention that resuspending sediment can suffocate living substrate or that fin awareness stops this damage. This passage could be improved, as follows:

> Sedimentary and minute living organisms in the water can blur our vision, rather like a fog. The sedimentary matter, in the sea frequently comes from material flushed [into] the vicinity from local rivers. The areas affected vary … according to inland rains. **Sedimentary and minute particles can be resuspended by fining action. This sediment smothers living substrate as it settles. Divers should practice spatial awareness and neutral buoyancy, avoiding unnecessary, careless and / or vertical, fining close to the seabed.**

Adding low impact diving messages and connecting them to the procedural skills' components of the course would provide divers with reinforced messages about low impact diving, and reinforce the importance of low impact diving skills. Reinforcing and repeating these messages is an effective way to increase memory retention and reduce depreciative behaviours (Marion & Reid, 2007; Stubbs, 1991). Reinforcement, however, should also be accomplished by skill teaching diagrams which depict the following: the triangle between a divers chin and hips where D-rings can be used as attachment points to secure loose gear; proper body position in the water column; step-by-step execution of proper fining techniques in a variety of environments; and, how to attain neutral buoyancy.

The PADI Manual contains both contradictory images and written messages. Contradicting images account for 43.8% of the images in the manual (n= 14). Contradictory images depict divers in contact with, or close proximity to, the reef, bottom or living substrate, crowding marine organisms, and in a vertical position. These images should be replaced with ones that support low impact diving practices. Divers should be shown an appropriate distance from the reef and from marine wildlife. They should exhibit a horizontal body position, with gear secured to their person or BCD.

The PADI manual also contains contradicting written messages (n= 13). These messages contradict low impact or environmental messages and should be rearticulated. Contradictory messages tell divers: it is acceptable to touch living substrate; to keep their fins underneath their body during ascents; to dive 'on the bottom' (instead of at depth); endorse spear fishing and game taking; and, countermand messages to respect aquatic flora and fauna.

Divers should never be told that it is acceptable to touch the living substrate, to secure reef hooks to coral or to poke around / move rocks. In the case of an emergency or extreme fatigue, divers should be told to do a controlled (buddy-assisted) surface ascent and to signal for their dive boat / move towards shore instead of being told to "stop all activity, breathe deeply and rest. Catch your breath. Hold on to an object for support, if possible and relax" (Shreeves, 2007, pp. 81). Not only is it safer for divers to surface, it is safer for the environment and does not result in damaging contact. Similarly, messages like "On the bottom, get your bearings and swim into the current" (Shreeves, 2007, pp. 151) contradict earlier messages that state "Maintain neutral buoyancy and stay off the bottom" (Shreeves, 2007, pp. 134). This should be re-worded to state: **at depth,** get your bearings and swim into the current.

Lastly, the message that "Fish and game laws exist to ensure a continuing supply of these animals for the future" (Shreeves, 2007, pp. 134) contradicts earlier messages that state that these laws exist to protect marine animals because there are intrinsically worth protecting. This message should be re-worded to include the following:

> Fish and game laws exist to **protect marine animals, many of which are endangered or have been identified as species at risk. Abiding by fish and game laws, and respecting maximum catch sizes, helps to ensure that these species have a chance to recover, or that they never become endangered or at risk in the first place.**

Besides contradictory written messages and visual media, the PADI manual contains the most missed education opportunities (n = 68). While part of the reason this number is higher than in the other manuals can be accounted for by the higher page count of the PADI Manual, this number is still extremely high. The PADI manual is approximately 100 pages longer than the BSAC manual but contains over three times as

many missed education opportunities. While similar in volume to the SSI manual, the PADI manual still contains twice as many missed education opportunities. The most frequent missed education opportunities related to a failure to communicate: the benefit of securing loose dive gear to a divers' BCD (n= 11, 16.17%); that accidental diver contact with coral and marine species increase when divers wear gloves or exposure suits (n = 9, 13.24%); and, the benefit of ensuring that divers are properly weighted (n= 7, 10.29%).

Examples of missed education opportunities that fail to communicate the need to secure loose gear include the message "Keeping your equipment streamlined, watching where you go, and avoiding dense growth areas help minimize the chances of snagging or tangling" (Shreeves, 2007, pp. 135). This message could be improved by including:

> Keeping your equipment streamlined, watching where you go, and avoiding dense growth areas help**s** minimize the chance of snagging or tangling **thus ensuring divers don't cause necessary damage to fragile marine flora and fauna.**

The failure to discuss the fact that accidental diver impacts with coral and marine species increase when divers wear gloves or exposure suits can be summarized in the passage below:

> You want to protect your hands on virtually every dive. In warmer water, you may use lightweight noninsulating gloves ("reef" gloves, left); in moderately cool water, wet suit gloves provide insulation and protection (center); thick wet suit mitts may be worn in colder water (Shreeves, 200, pp. 90).

This passage could be improved by including the following bolded text:

> You want to protect your hands on virtually every dive. In warmer water, you may use lightweight noninsulating gloves ("reef" gloves, left); in moderately cool water, wet suit gloves provide insulation and protection (center); thick wet suit mitts may be worn in colder water. **It is important that divers' remember that wearing gloves doesn't mean that they can touch anything they want. Use caution when wearing gloves, especially thicker ones, as you are less likely to notice accidental contacts with marine flora and fauna. Remember, coral is alive, and accidental contact can remove its' protective mucosal layer making it more susceptible to environmental diseases and pathogens. Keep your hands close to your body to avoid unnecessary contact.**

Similarly, the following passage fails to communicate the importance of ensuring that divers are properly weighted for diving conditions, the diving environment (salt vs. fresh water) and activity (wreck diving, drift diving or underwater photography):

> Since fresh water weighs less than salt water, you're not as buoyant for a given displacement. This means if you dive in fresh water after diving in salt water, assuming you're wearing the same gear and exposure suit, you'll need less weight (Shreeves, 2007, pp. 137).

This passage could be improved by including the following, bolded, statement:

> Since fresh water weighs less than salt water, you're not as buoyant for a given displacement. This means if you dive in fresh water after diving in salt water, assuming you're wearing the same gear and exposure suit, you'll need less weight. **Proper weighting is an important skill for divers' to master – not only does it make it easier to attain neutral buoyancy, it helps keep you and your surroundings safe! Uncontrolled shifts in buoyancy can be dangerous to divers and can result in damaging contacts with marina flora and fauna. Take the time to get properly weighted before each dive.**

Lastly, unlike the BSAC and SSI manuals the PADI manual does not clearly articulate a PADI Divers' Code of Conduct. Readers are left to piece together what constitutes acceptable in-water behaviour based on the other environmental messages communicated in the manual. Given the extent of the missed education opportunities, and the contradictory written messages and visual media, it is unlikely they will be successful. It is recommended that PADI articulates a clearly defined diver code of conduct, which is easily referenced, and discussed throughout the manual. The code of conduct should at minimum cover: safe diving; dive and dive site etiquette; and, the need for environmentally responsible behaviour.

The SSI manual contains negative images (n = 13). These images depict negative behaviours that contradict written or visual images related to low impact diving. Common negative or contradictory images include pictures of divers kneeling on the bottom, too close to the reef, crowding or chasing marine life, using flashes close to marine life, and fining in a vertical or angled position. Images depicting divers fining in a vertical position account for 46.2% of the negative images, followed by images

depicting divers kneeling on the bottom, or too close to the reef (38.5%) and crowding or chasing marine life (15.3%).

Images that depict divers kneeling on the bottom to demonstrate skills directly contradict statements to "avoid impact with the bottom" (Scuba Schools International, 2003, Section 2, pp. 25). These images should be replaced with images of divers' demonstrating skills in a pool, or should have notes below them, stating the reason divers are kneeling on the bottom, accompanied by reminders that this behaviour is generally unacceptable.

Images depicting divers chasing, or overcrowding marine life, with or without photography equipment, while not contradicting messages within the SSI manual, do contradict the principles of low impact diving. These images should be removed. While a large part of the appeal of diving is observing or interacting with marine life, it is possible to do so with minimal impact. Images of divers photographing marine wildlife in an unobtrusive manner should be included in the manual instead.

Images depicting divers fining in a vertical position, or at an inappropriate angle, contradict messages that teach divers appropriate fining techniques, discuss spatial awareness, and articulate concerns related to unnecessary fin contact. These images should be replaced with images of divers maintaining an appropriate distant from the living substrate and exhibiting a horizontal body position, with loose gear secured.

Contradictory written messages (n = 3) are also found in the SSI manual. These messages include "if you cannot positively identify a shell, do not pick it up" (Scuba Schools International, 2003, Section 5, pp. 30). This contradicts messages to avoid contact with marine organisms and artifacts, and should be amended as follows:

Even if you can identify a shell, do not pick it up**. While it may appear uninhabited, the animal that calls it home may be hiding. Removing empty shells from the water robs animals of temporary shelter or food. Animals like hermit crabs need abandoned shells which they find, and occupy, as they grow out of the ones they are currently using.**

The statement "to start your descent, begin in a feet-first position" (Scuba Schools International, 2003, Section 2, pp. 25) contradicts messages to use a horizontal body position with the fins above the hips; as does the message "you may need to do a feet-first surface dive to get yourself started" (ibid). These messages should include reminders to use these techniques only in situations where vertical fin action will not cause damage or resuspend sediment, and messages that provided step by step instruction for low impact descents in shallow water.

Thirty-five missed education opportunities also occur throughout the SSI manual. These messages are related to: buoyancy control and proper weighting (n = 7); entries and exists (n = 6); loose gear and gauges (n = 6); ascents and descents (n = 5); equipment (n = 6); dive lights (n = 2); reaching depth (n = 1); contact with marine life (n= 1); and, disentanglement from kelp (n = 1). These messages should be revised.

Messages that miss opportunities to discuss the ways that buoyancy control and proper weighting help divers' mitigate their impact on marine environments should be rephrased to included messages about maintaining an appropriate distance from living substrate. Similarly, entries and exists should be discussed in conjunction with low impact entries and exists, and ascents and descents in shallow water.

Discussions about dive gear, particularly gauges, gloves and wetsuits should always include low impact diving messages. Divers' should be taught how, where and why to secure loose gauges. Message about gauges need to discuss the benefits of securing gear (avoiding contact, gear damage and entanglement) and conversations about gloves and wetsuits need to include information about decreased dexterity, and the decreased ability to determine accidental contact is made with marine life. Conversations about dive lights should always include warnings about their impact on photosensitive marine wildlife. This conversation should highlight the fact that bright lights can stun them, resulting in altered behaviour, including aggression and panic.

Lastly, discussions about contact with marine life and disentanglement from kelp should teach divers to avoid damaging contact or entanglement; these conversations should not be limited to how to cut free. Divers also need to be briefed about the ways

that their behaviour, and contact, have negative impacts on marine life including: aggression; altered feeding and mating patterns; dependency on humans for food; and, habituation to humans.

7.2 Past Studies

While extensive research has been conducted on the efficacy of pre-dive briefings and Dive Master interference in mitigating diver impacts when depreciative behaviours are observed (Barker & Roberts, 2004; Davis & Tisdell, 1996; Dearden, Bennett & Rollins, 2007; Medio, et.al., 1997; Rouphael & Inglis, 1997), limited research has been conducted on the content of diver certification courses (Lindgren, et al., 2008), or their effectiveness in encouraging divers to be aware of their surroundings and to engage in less damaging behaviour through the use of low impact diving practices.

After reviewing the literature, it is apparent that this is the first study to use the Elaboration Likelihood Model of Persuasive Communication to evaluate the effects of communication in a recreational / instructional certification program or to determine the impact of knowledge retention and message processing on the formation of pro-environmental attitudes and their impact on depreciative behaviour engagement.

7.3 Delimitations and Limitations of the Study

Delimitations are the restrictions researchers impose prior to the inception of their study to narrow its scope; they are the characteristics of the study defined by the boundaries of inquiry (Pajares, n.d.; Phelps, 1978). Delimitations are determined by the conscious exclusionary and inclusionary decisions made by the researcher throughout the development of their proposed study. They include the choice of objectives and questions, variables of interest, and alternative theoretical perspectives (ibid). This research was guided by the framework of the Elaboration Likelihood Model; as such, the researcher was able to infer the nature of respondent divers' processing of the environmental messages communicated to them through their entry-level certification manuals based upon their level of knowledge retention. The Elaboration Likelihood Model was chosen over the Theory of Planned Behaviour (TpB) because the TpB did

not allow the researcher to explore the nature or "persuasiveness" of the messages communicated through the certification manuals' content.

Additional delimitations include not collecting attitudinal and behavioural data. Because respondent divers' were not observed or asked to self-report their past engagement in depreciative behaviours, past engagement in low impact diving, and intended future behaviour it was not possible to definitely determine the impact of knowledge retention on behaviour and attitudes. Instead, the impacts were predicted based upon the framework of the ELM. The decision to exclude behavioural and attitudinal data was made because of the potential for discrepancies between respondent divers' self-reported behaviour and their actual behaviour and because behavioural observations were not possible. Additionally, determining divers' pre- and post-certification attitudes was not possible within the time constraints of this study. However, because respondent divers were surveyed, proposed internal mechanisms, such as their negative or positive processing of environmental messages and its subsequent theoretical influence on their attitudes and behaviour, were able to be predicted. This study did not examine divers' retention of psychomotor procedural skills due to the time constraints. In the future, divers' skills competencies, whether or not they encounter constraints in using or executing their low impact diving skills, and their self-perceived competency in executing these skills should be assessed.

Given the temporal, and budgetary, restrictions of this study it was not possible to observe the instructional process either, as such the verbal and visual messages communicated to divers during the classroom or practical component of the instructional process were not analyzed and their impact on respondent divers' knowledge retention, attitudes and behaviours are unaccounted for.

Irrespective of the fact that BSAC, PADI and SSI all have quality control mechanisms in place, and that there is a certain level of instructional consistency, the educational experience of divers can and does vary by length of training, maximum student group size, content and emphasis (Lindgren et al., 2008). The outcome of a divers' training, therefore, depends "on the individual dive instructor, his or her knowledge, and his or her interpretation of, and emphasis on, different parts of the

educational process" (Lindgren, et al., 2008, pp. 121). Therefore, while observing an instructor from each of the certifying bodies may have conferred a greater understanding of the instructional process, the observations would not be relevant to the instructional experiences of all divers certified by each agency.

The limitations of the study are the characteristics of design that set parameters on the application or interpretation of the results of the study; that is, the constraints on the generalizability, and utility, of the study's findings as a result of the devices of design or method and that establish internal and external validity (Pajares, n.d.; Phelps, 1978). The limitations of this study relate to the sampling and data collection methods.

Because a convenience, purposive, snowball sample of self-identified certified divers was used, the ability to draw descriptive or inferential conclusions from sample data about a larger group is compromised. Given that respondent divers' were not targeted through random sampling it is possible that those self-identified certified scuba divers who elected to respond to the e-survey did so because of strong opinions and beliefs about low impact diving.

Similarly, while the researcher attempted to expose the largest number of potential respondent divers' possible to the study, the use of e-research techniques meant that respondent divers' were heavily weighted towards English-speaking, well-educated, and affluent populations (Anderson & Kanuka, 2003); it is important to note that these characteristics accurately describe the majority of the global diving population (Tourism Queensland, 2003). Additionally, given the high number of scuba divers' certified through PADI, it was more likely that PADI certified divers were recruited through the use of forums, blogs and communities intended for the general scuba diving population.

7.4 Practical Application of the Study's Findings

The provision of instructional materials that clearly and effectively communicate the importance of adopting pro-environmental attitudes and the use of low impact diving techniques to divers can be enhanced by using the central route to persuasion, and its representative message delivery styles (attribution and interpretative messages) and by teaching the necessary skills needed to execute low impact diving practices through the

provision of repetitive and consistent skill teaching messages. These skill teaching messages need to be accompanied by sufficient visual messages (diagrams and pictures) that illustrate the stepwise execution of skills, and depict them as enjoyable and not limiting the extent of divers' recreational or tourism opportunities. They should also be accompanied by sufficient confined and open water diving opportunities to practice these skills under the direction and supervision of a qualified diving instructor so that divers complete their entry-level certification course with high levels of self-perceived skill competencies and have a resource to draw on following prolonged periods of diving inactivity.

Divers also need to be taught to negotiate constraints to their use of low impact diving skills, such as how to maintain neutral buoyancy as their cylinder becomes positively buoyant, and how to avoid contact with their surroundings if they encounter swells or currents. These skills will help mitigate diver impacts on marine environments, and keep divers' safe by minimizing the risk of diving-related medical emergencies associated with ascending or descending too quickly while breathing compressed gas.

This study identified the nature of the environmental messages communicated to respondent divers during their entry-level, novice, certification courses, and their level of knowledge retention. It also predicted the impact of divers' levels of knowledge retention, and their processing of these environmental messages, on the formation of their attitudes towards low impact diving education and practice. This study found that the most effective messaging technique, which resulted in an increased level of knowledge retention, was the central route to persuasive communication; this was followed by a combination of messages delivered using the peripheral route to persuasion reinforced by messages delivered through the central route to persuasion. The repetitive use of messages delivered through the peripheral route to persuasion had an additive effect on divers' levels of knowledge retention, and were reinforced through well timed and supportive attribution and interpretive messages.

According to Bradford (2005) these additive effects access pro-environmental attitudes (I don't want to damage the reef) or triggering attitudes (I don't want to damage my dive gear) which subsequently alter behaviour (therefore I will secure my loose

gauges). They also act as a situational constraint against depreciative behaviour engagement, and can come in the form sanction messages (if I do this, I won't be allowed to dive here again, therefore I will comply) or a normative influences (my fellow divers and dive master don't want me to do this, they may ostracize me if I do, therefore I won't). The additive effect of the use of multiple message delivery styles are likely to encourage more divers to make the decision to engage in low impact diving techniques than just those that already exhibit a generally pro-environmental attitude.

These results demonstrate a consistent pattern of the effectiveness of messages delivered through the central route to persuasion, and the additive effectiveness of the combined use of the central and peripheral routes to persuasive communication. This in turn theoretically results in positive impacts on divers' attitudes and behaviours and accords well with the theoretical 'persuasive communication-information processing-attitude-predicative behaviour' pathway of the ELM. However, the ELM fails to completely explain the observed phenomena. This is because it does not consider the impact that internal and external constraints have on message recipients' adoption of desired behaviours, or whether or not message recipients' posses the required psychomotor procedural skills to adopt the desired behaviours effectively. As such, the Predictive Behavioural Outcomes Model of Effective Communication was proposed, modeling a theoretical 'persuasive communication-information processing-attitude-skills competency-behaviour' pathway while taking into consideration the impact of constraints on the adoption of desired behaviours.

Given the evolving nature of course instructional materials / manuals and the expenses associated with producing and rolling out revised additions, it is important for certifying bodies to understand the affect that the environmental messages they convey have on divers, in terms of their knowledge retention, adoption of pro-environmental attitudes / positive attitudes towards low impact diving and in-water behaviour. Given the extent of divers' impacts on marine environments, it is also important that divers are taught the skills required to mitigate their impact. Because the continued operation of the recreational diving and dive tourism industries is dependent on divers' continuing to want to dive, and that diving destinations lose their appeal if they are degraded, it is

important that the industry teaches divers' how to effectively mitigate their impacts on marine environments. As such, these three manuals should be revised to include increased instances of attribution and interpretive messages and positive visual media (diagrams and photographs); and to eliminate the contradictory messages and remove negative images which depict divers engaged in depreciative behaviours.

This research met the goals and objectives of determining the nature of environmental communications with scuba divers, examining their levels of knowledge retention post-certification, the theoretical impact of knowledge retention and message processing on divers' attitudes towards low impact diving and in-water behaviour thereby ascertaining whether or not the environmental messages contained in the certification manuals of BSAC, PADI and SSI entry level courses were effective. The research concluded that the manuals were moderately effective in achieving this goal, but that revisions to each of the three manuals, in terms of content and emphasis, would increase their effectiveness. In light of this, the study was able to shed light on the effectiveness of environmental communication with scuba divers.

7.5 Future Research

In developing instructional and educational packages which aim to minimize the impacts of recreational and tourist behaviour while retaining the quality of these experiences, the researcher believes future research needs to focus on determining the factors that result in the adoption of negative attitudes towards low impact diving techniques, the additive effect of exposure to low impact diving messages in pre-dive briefings and to sanctions imposed as a results of impactive behaviours. Future research should also focus on scuba divers' retention of psychomotor skills during extensive periods of diving inactivity (6 months or more), and their self-perceived competency in executing low impact diving skills post-certification. This can be undertaken through:

- Qualitative interviews with certified divers who exhibit strongly negative and strongly positive attitudes towards low impact diving;

- Qualitative interviews with, and surveys of, respondent divers' exposed to low impact diving messages in their pre-dive briefings combined with covert observations of their in-water behaviour;
- Qualitative interviews with certified divers immediately after they attain their entry-level certification, during their inactive phase, and immediately before and after they undertake their next open water dive following a period of diving inactivity;
- Pre- and post-testing of personal attribution after exposure to several different low impact diving message types. These messages should be varied in terms of their delivery style, including written, visual and verbal messages, and should be delivered using the central and peripheral routes to persuasion; and
- Pre- and post-testing of divers' low impact diving skills competencies after exposure to several different skill teaching strategies. The instructional processes should be varied in terms of their delivery style, including written, visual and verbal messages, and should be delivered using the central and peripheral routes to persuasion.

This information could be used to design instructional materials, refresher courses and check-out dives / pre-dive briefings that meet the needs of managers for the protection of sensitive marine environments, while meeting the expectations of scuba divers (related to enjoyment of diving experiences and exposure to diverse and pristine dive site) and reducing the dive industry's dependence on dive master interference and sanctions as strategies aimed at deterring depreciative behaviour engagement.

Previous studies have shown that users are unlikely to contribute to impacts that degrade their recreational experiences (Lynn & Brown, 2003). By increasing divers' awareness of the nature of their impacts, and the implications of those impacts in terms of reduced ability to access pristine dive sites and providing them with the knowledge and skills to mitigate their impact in an enjoyable and unobtrusive way, it is likely that recreational divers and dive tourists, two groups who "usually respond positively to environmental information and are receptive to education" (Baker & Roberts, 2008, pp. 184), will be less likely to continue their engagement in depreciative behaviours.

CHAPTER 8.0 REFERENCES

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CHAPTER 9.0 APPENDICES

Appendix 1 – Glossary of Key Terms

Attribution messages, comprised of a locus of causality and control, are generalizable across time, situations and people (Bradford & McIntyre, 2007). As such these messages inform recreational users that their behaviour is directly linked to the erosion of natural resources and empower them to control or change their behaviour by adopting low impact practices that are generalizable across time and into similar situations and other contexts (ibid). Attribution theory therefore suggests that persuasive messages that are designed to influence environmental behaviour must: create awareness that a problem exists; be personalized so that recipients internalize causality; and, focus on transferring the control and means of reducing impact to the individual message recipient (ibid). An example of an attribution messages is: "Be careful that careless finning does not cause physical damage to what are often delicate seaweeds or animals" (Ellerby, 2009, pp. 59).

Depreciative behaviour involves "resource damage by tourists that is uninformed in nature" (Bradford, 2005, pp. vii). While there are similarities in the beliefs, attitudes and intentions of the perpetrators of both depreciate behaviours and vandalism, unlike vandalism, which is malicious in its intent, depreciate behaviours are the result of "a lack of understanding of appropriate behaviours" (Bradford, 2005, pp. vii).

Effective environmental communications with scuba divers is defined as: communication which produces or is capable of producing a high level of knowledge retention and results in divers adopting: a commitment to utilize low impact diving practices; and, a favourable attitude towards low impact diving (as evidenced by a score of 80% or higher on a knowledge retention test).

Low Impact Diving is defined as: diving practices that minimize the impact of diving and its associated activities on marine environments, including but not limited to its living flora and fauna. These practices are understood to include, but are not limited to: maintaining proper buoyancy, learning proper fining techniques,

securing all dive gear to your person, not chasing after fauna, not touching or collecting marine life or specimens, and regularly maintaining diving vessels and equipment.

International dive tourism is "travel to a foreign country where at least one scuba diving expedition is included" (Tourism Queensland, 2003, pp. 1).

"***Interpretive communication*** may … use images, analogies, metaphors, or stories to explain the significance of natural resources or cultural events, or to present the rationale behind management policies or regulations" (Duncan & Martin, 2002, pp. 20). An example of an interpretative message is,

> Injuries from animals that may seem aggressive, such as eels and stingrays, actually result from frightening animals, causing them to react defensively - such as if you carelessly stick your hand in an eel's hole without looking first. (If a giant arm came in your front door and started groping around your living room, you'd bite it, too) (Shreeves, 2007, pp. 133).

Knowledge / fact provision messages, referred to as "descriptive normative information" by Cialdini, et al. (2006), provide recipients with new information through the use of informative statements. These types of messages are often used to inform visitors or guests of expected or appropriate behaviours in parks and protected areas, or other similar situations (Bradford & McIntyre, 2007). An example of a knowledge / fact provision message is the following: "Thanks to modern equipment and training techniques, diving is available to virtually everyone of normal fitness, from people in their early teens to octogenarians" (Ellerby, 2009, pp.18).

Missed education opportunities are instances in which a skill or fact is discussed without tying it to the appropriate and related low impact diving practice(s). For example, fining techniques are often discussed without tying the use of these skills to minimizing diver damage or without noting that fins add extra length to a diver's body requiring the diver to use increased spatial awareness. Missed education opportunities highlight areas of the instructional manual that can be

improved by including additional information about low impact diving practices and skills.

Plea messages are often the simplest form of communication with recreationists or tourists. These types of messages ask that visitors engage in a certain type of behaviour without providing any rationalization for the request or sanctions if these behaviours are not used. Examples of this type of message include the statements "Please maintain neutral buoyancy while diving" and "Look, don't touch!".

"A ***sanction*** [emphasis added] … is defined as threatening a penalty … for behaviours considered inappropriate by the managing agency" (Duncan & Martin, 2002, pp. 21). Sanctions include: monetary fines, expulsion for a recreation area, or social sanctions like embarrassment or distancing from a peer group. The statement "Remember, our equipment makes divers conspicuous and bad behaviour can result in future restrictions" (Ellerby, 2009, pp. 154) is a sanction message.

Skill teaching messages are an important part of education in skill intensive activities involving the retention of procedural or psycho-motor skills (Madden, 2006). As such, messages that teach recreationists the skills needed to engage in low impact practices are a necessary part of low-impact education. Skill-teaching messages provide instruction in the practice of low-impact, or other, skills. The following is an example of a skill-teaching message:

> To descend from the surface you must change from being positively buoyant to neutrally buoyant. It is normal to enter the water with your BC, and drysuit if worn, partially inflated so that you are positively buoyant. When ready to descend gradually vent the BC and then dry suit, if worn, until you are neutrally buoyant. If you are correctly weighted - carrying the minimum weight to be neutral at the end of the dive - you should achieve neutral buoyancy just before the BC or dry suit is totally vented. This is because the weight of the breathing gas in your cylinder will make you slightly heavier. When correct weighting and buoyancy are mastered, starting the descent by simply exhaling will usually be possible. When completely submerged you can pivot to continue the descent head first. An alternative is to position yourself horizontally face down at the surface and obtain neutral buoyancy (Ellerby, 2009, pp. 42).

Appendix 2 - Diver E-Survey

Pre-Screening Page

Participants will either be directed to Part A: Diver Environmental Knowledge (for BSAC, PADI or SSI) or to the page jumping page which thanks them for their interest (if they were not certified by BSAC, PADI or SSI) depending on their response to this pre-screening question.

Certifying Body with whom you took your **FIRST entry-level novice certification** with: (Required)

☐ BSAC - British Sub Aqua Club

☐ NASDS - National Association of Scuba Diving Schools

☐ NAUI - National Association of Underwater Instructors

☐ PADI - Professional Association of Diving Instructors

☐ SSI - Scuba Schools International

☐ Other _____

Part A: Diver Environmental Knowledge (BSAC)

1. Please select the appropriate response within each section.
Careless fining, and the resulting resuspension of sediment, does not cause physical damage to seaweeds, coral, or animals.

☐ True

☐ False

2. Diving is your new form of transport, providing you with privileged access to the underwater world, and it is important that you do not abuse that privilege, even inadvertently, by lack of knowledge or skill.

☐ True

☐ False

3. Collecting marine creatures of any kind, as well as artifacts (coral, shells, bottles, etc) found on dives, is acceptable.

☐ True

☐ False

4. Approaching aquatic animals can cause them to alter their behavior and the natural rhythm of their lives; it can also cause unnecessary stress for the animal in question.

☐ True

☐ False

5. Many dive sites throughout the world are considered marine parks and are protected by law. This protection helps to keep these dive sites in pristine condition by protecting the coral and other aquatic marine life.

☐True

☐False

6. The British Sub Aqua Club does not support marine conservation or the protection of our underwater heritage.

☐True

☐False

7. Whatever a divers level of interest, they should always remember that their goal should be to protect and preserve the underwater habitat and its occupants, interfering with the delicate balance of nature as little as possible.

☐True

☐False

8. Some marine life while superficially appearing to be plants, are actually animals, such as the community dwelling corals of the tropics or the many coloured sponges and siphons. ☐ True

☐ False

9. Divers should keep a safe distance from the sea bed and other underwater objects, through the establishment of neutral buoyancy, to avoid contact that could damage either themselves or the environment.

☐ True

☐ False

10. Check all that apply.

Loose dive gear:

☐... is susceptible to damage

☐... is difficult to locate under water

☐... can damage valuable marine life

11. Chcck all that apply.

The BSAC Divers' Code of Conduct was created to:

☐Encourage good behaviour at dive sites and when diving.

☐Ensure that divers to not come into conflict with other water users.

☐Protect the Environment.

12. Check all that apply.

The BSAC Divers' Code of Conduct includes the following principles, and or diver responsibilities:

☐ Obtain permission before diving in restricted areas, such as harbours, estuaries or private waters.

☐ Avoid overcrowding sites and show consideration to other users.

☐ Do not litter. Close gates. Be careful about fires.

☐ Avoid disturbing local wildlife such as seabirds or seal colonies.

☐ Respect local bylaws, regulations and customs.

☐ Do not use a spear-gun when scuba diving.

☐ Collecting marine creatures of any kind is damaging to the environment and often subject to legal control.

☐ Take photographs and notes, not specimens.

☐ Do not dive on a designated, protected wreck site without specific authority.

☐ Do not disturb anything that appears to be of historical significance.

13. Check all that apply.

The Ocean Diver Course teaches basic diving skills only. Continuing your diving education in the following areas is important:

☐ Scientific Diver Course

☐ First Aid

☐ Underwater Photography

☐ Lifesaving

☐ Marine Life Identification

☐ Boat Handling

☐ Chartwork and Position Fixing

☐ Compressor Usc

☐ Marine Life Appreciation

☐ Underwater Navigation

☐ Oxygen Administration

☐ Outboard Engine and Boat Maintenance

☐ Enriched Air Nitrox Diving

☐ Buoyancy and Trim

14. Check all that apply.

☐ The following factors govern divers' behaviour underwater:

☐The BSAC Divers' Code of Conduct.

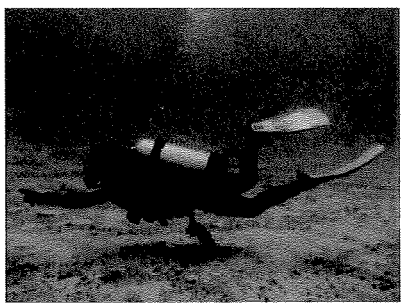
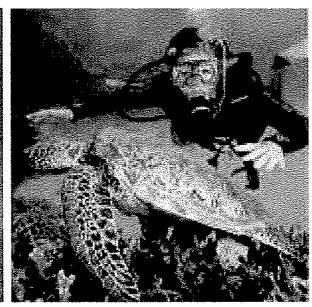
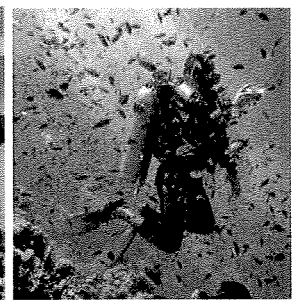
☐ Local regulations governing spearfishing, limits and game seasons.

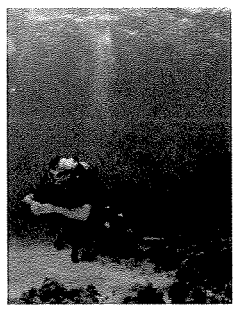
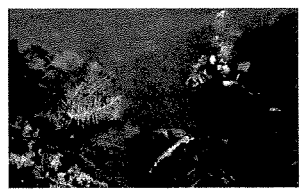
☐ Marine park and protected area regulations.

☐ Pre-dive briefings and dive operator specific rules.

15. The following images show scuba divers actively engaged in diving.

Select the image, by clicking on it, which you feel represents the best body position for divers to use while diving. (Required).

Part A: Diver Environmental Knowledge (PADI)

1. Divers should swim with their fins up to avoid stirring the sediment because it reduces visibility which can be a safety concern for divers. Stirring up sediment has no impact on marine animals, like coral and fish.

☐ True

☐ False

2. When divers explore the fragile environment around corals, sponges and other, aquatic life they can unintentionally kick, kneel on or bump against fragile aquatic life.

Being aware and using some simple techniques can minimize accidental damage.

☐ True

☐ False

3. Collecting marine creatures of any kind, as well as artifacts (coral, shells, bottles, etc) found on dives, is acceptable.

☐ True

☐ False

4. Approaching aquatic animals can cause them to alter their behavior and the natural rhythm of their lives; it can also cause unnecessary stress for the animal in question.

☐ True

☐ False

5. Many dive sites throughout the world arc considered marine parks and are protected by law. This protection helps to keep these dive sites in pristine condition by protecting the coral and other aquatic marine life.

☐ True

☐ False

6. PADI Diving Society support environmental conservation efforts, and environmental training for divers.

☐ True

☐ False

7. Divers can classify their interactions with the environment as either active or passive. Even passive intcraction affects aquatic life, which is very sensitive to its environment.

Divers should move quietly and smoothly - which is less likely to disturb marine life - and remember diving is a privilege that carries with it a responsibility to leave nothing but bubbles.

☐ True

☐ False

8. Coral ...

☐ was alive once, but is now dead.

☐ is a form of rock.

☐ is a living, growing, marine organism.

9. Divers should watch their buoyancy, and not dive overweighted. Staying neutrally buoyant helps divers to avoid the tendency to drag along the reef where their legs and feet can destroy things.

☐ True

☐ False

10. Check all that apply.

Loose dive gear:

☐ ... is susceptible to damage

☐ ... is difficult to locate under water

☐ ... can damage marine life

11. Responsible Diver codes exist, and are supported by Diver Certifying bodies.

☐ True

☐ False

12. PADI has an Scuba Diver Code of Conduct which is taught in the Open Water Diver Course.

☐ True

☐ False

13. Check all that apply.

The Open Water Diver Course teaches basic diving skills only. Continuing your diving education in the following areas is important:

☐ Equipment Specialist

☐ Cavern Diver

☐ Underwater Naturalist

☐ Dry suit Diver

☐ Boat Diver

☐ Drift Diver

☐ Deep Diver
☐ Rescue Diver
☐ Digital Underwater Photography
☐ Underwater Videographer
☐ Search and Recovery Diver
☐ Icc Diver
☐ Project AWARE Specialist
☐ Underwater Photography
☐ AWARE Fish Identification
☐ Night Diver
☐ Underwater Navigator
☐ Multilevel Diver
☐ Wreck Diver
☐ Coral Reef Conservation
☐ Enriched Air Nitrox
☐ Peak Performance Buoyancy
☐ National Geographic Diver
☐ Altitude Diver
☐ First Aid and CPR
☐ Diver Propulsion Vehicle Diver

14. Check all that apply.

Using these skills or doing these actions help divers minimize their impact on marine environments:

☐ Putting your hands into small places like cracks, crevices and small caves.
☐ Chasing, touching or poking marine life.
☐ Taking a refresher course after long periods of inactivity.
☐ Navigating with a compass.
☐ Buoyancy Control.
☐ Maintaining skills by diving at least 5 times a year.
☐ Proper Finning Techniques.
☐ Securing loose dive gear, like gauges to your BC.
☐ Resting on the bottom.
☐ Proper Weighting Techniques.

☐ Avoiding flash photography.

15. Check all that apply.

The following factors govern divers' behaviour underwater:

☐ A Divers' Code of Conduct.

☐ Local regulations governing spearfishing, limits and game seasons.

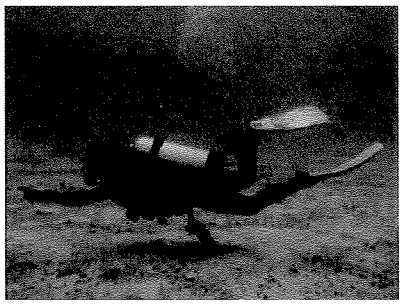
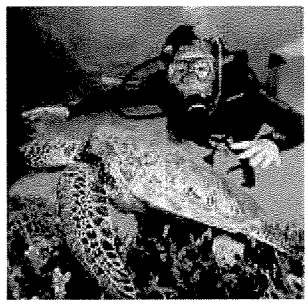
☐ Marine park and protected area regulations.

☐ Pre-dive briefings and dive operator specific rules.

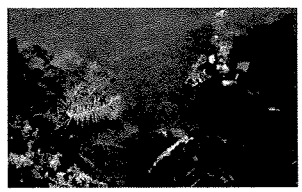
Looking down as your descend.

16. The following images show scuba divers actively engaged in diving.

Select the image, by clicking on it, which you feel represents the best body position for divers to use while diving. (Required).





Part A: Diver Environmental Knowledge (SSI)

1. Your fins extend well past your feet and can cause damage to the reef by breaking coral structures, disturbing marine life or stirring up the bottom.

☐ True

☐ False

2. Careless divers can end up kicking corals with their fins, or hitting the reefs with their cylinders causing damage.

☐ True

☐ False

3. Collecting marine creatures of any kind, as well as artifacts (coral, shells, bottles, etc) found on dives, is acceptable.

☐ True

☐ False

4. Approaching aquatic animals can cause them to alter their behavior and the natural rhythm of their lives; it can also cause unnccessary stress for the animal in question.

☐ True

☐ False

5. Many dive sites throughout the world are considered marine parks and are protected by law. This protection helps to keep these dive sites in pristine condition by protecting the coral and other aquatic marine life.

☐ True

☐ False

6. Many dive sites throughout the world are considered marine parks and arc protected by law. This protection helps to keep these dive sites in pristine condition by protecting the coral and other aquatic marine life.

☐ True

☐ False

7. Scuba Schools International supports the ongoing efforts of the diving industry to protect our oceans, coral reefs, and all aquatic environments for future generations.

☐ True

☐ False

8. Even though the underwater world is a divers' playground, you should always dive as the guest that you are.

☐ True
☐ False

9. Coral ...

☐ was alive once, but is now dead.
☐ is a form of rock.
☐ is a living, growing, marine organism.

10. To avoid injuring yourself or the coral, always maintain neutral buoyancy and practice good buoyancy control over reefs.

☐ True
☐ False

11. Check all that apply.

Loose dive gear:
☐ ... is susceptible to damage
☐ ... is difficult to locate under water
☐ ... can damage marine life

12. Responsible Diver codes exist, and are supported by Diver Certifying bodies.

☐ True
☐ False

13. The SSI Responsible Diver Code includes the following principles, and or diver responsibilities:
☐ Being familiar with and checking my equipment before and during every dive.
☐ Evaluating the conditions before every dive and making sure they fit my personal capabilities.
☐ Accepting the responsibility for my own safety on every dive.
☐ Being environmentally conscious on every dive.
☐ Diving within the limits of my ability and training.
☐ Respecting the buddy system and its advantages.

14. The Open Water Diver Course teaches basic diving skills only. Continuing your diving education in the following areas is important:

☐ Dry Suit Diving

☐ Computer Diving

☐ Deep Diving

☐ Wave, Tides & Currents

☐ Spear Fishing

☐ Navigation

☐ Search & Recovery

☐ Equipment Techniques

☐ Night / Limited Visibility Diving

☐ Underwater Photography

☐ Boat Diving

☐ Marine Conservation

☐ Enriched Air Nitrox

☐ Diver Stress & Rescue

☐ Wreck Diving

☐ First Aid and CPR

☐ Altitude Diving

☐ Marine Life and Fish Identification

15. Check all that apply.

Using these skills or doing these actions help divers minimize their impact on marine environments:

☐ Looking down as your descend.

☐ Maintaining skills by diving at least 5 times a year.

☐ Securing loose dive gear, like gauges to your BC.

☐ Putting your hands into small places like cracks, crevices and small caves.

☐ Proper Finning Techniques.

☐ Taking a refresher course if inactive in diving for more than 6 months.

☐ Avoiding flash photography.

☐ Proper Weighting Techniques.

☐ Navigating with a compass.

☐ Resting on the bottom.

☐ Chasing, touching or poking marine life.

☐ Buoyancy Control

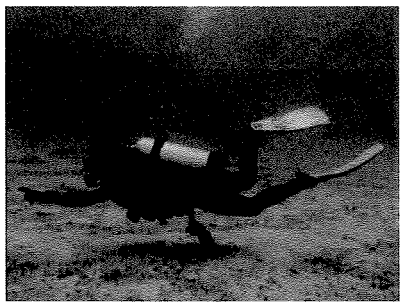
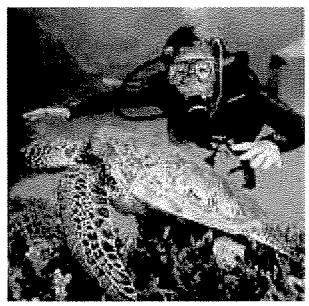
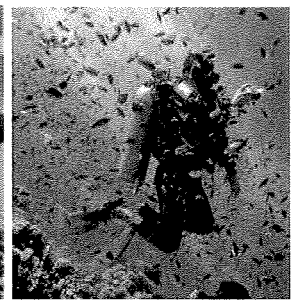
16. Check all that apply.

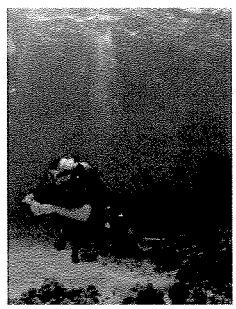
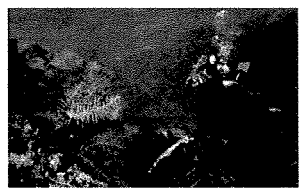
The following factors govern divers' behaviour under water:

☐ Local regulations governing spearfishing, limits, and gaming seasons.
☐ Marine parks and protect area regulations.
☐ Pre-dive briefings and dive operator specific rules.
☐ The SSI Responsible Diver Code.

17. The following images show scuba divers actively engaged in diving.

Select the image, by clicking on it, which you feel represents the best body position for divers to use while diving. (Required).

Part B: Attitudes towards Scuba Diving related Environmental Education – Please answer each of the following questions by checking the box which corresponds to the number that best describes your opinion (unless otherwise stated 1 = Strong Negative, 2 = Mildly Negative, 3 = Unsure / Undecided, 4 = Mildly Positive, and 5 = Strongly Positive).

Some of the questions may appear to be similar, but they do address different issues. Please read each question carefully.

1. Learning about marine environments and their relative health is
Undesirable :___1__:___2__:___3__:___4__:___5__: Desirable

2. Learning low impact diving techniques (learning proper fin techniques, buoyancy control, how to distinguish between living and dead coral) is

Undesirable :___1__:___2__:___3__:___4__:___5__: Desirable

3. How many times did you **accidentally** touch (kick, brush against, etc) the reef / wreck / my surroundings during your last dive?

During my last dive, I **accidentally** touched the reef / wreck / my surroundings _____ times.

4. How many times did you **purposely** touch (stabilize yourself, attach a reef hook, pick up coral, etc) the reef / wreck / fauna (fish, dolphins, sea turtles, etc) or re-suspend the substrate during your last dive?

During my last dive, I **purposely** touched the reef / wreck / fauna / re-suspended sediment _____times.

5. How often to you experience constraints or unanticipated events (swells, currents, low visibility, tight passages in wrecks, concerns about buddy safety) that hinder your ability to engage in low impact diving practices?

very rarely :___1__:___2__:___3__:___4__:___5__: very frequently

6. In the past I have regularly engaged in low impact diving practices (good buoyancy control, not touching reefs / marine life, etc)

Strongly Disagree :___1__:___2__:___3__:___4__:___5__: Strongly Agree

7. I plan to engage in low impact diving practices (good buoyancy control, not touching reefs / marine life, etc) on future dives

Extremely unlikely :___1__:___2__:___3__:___4__:___5__: Extremely likely

8. Whether or not I engage in low impact diving practice (good buoyancy control, etc) is completely up to me

Strongly disagree :___1__:___2__:___3__:___4__:___5__: Strongly agree

9. For me engaging in low impact diving practices

Inhibits my enjoyment of a dive :___1__:___2__:___3__:___4__:___5__: Increases my enjoyment of a dive

10. Generally speaking, how much do you care about your training agency.beliefs about how you behave under water (whether you comply with low impact diving practices or not)?

☐ They have no right to an opinion about my underwater behaviour

☐ I do not care about their opinion of my underwater behaviour

☐ Neutral, I neither care or don't care about their opinion of my underwater behaviour

☐ I care a little about what they think of my underwater behaviour

☐ I care a lot about what they think of my underwater behaviour

11. Engaging in low impact diving practices will help me reduce my impact on marine environments

extremely unlikely :___1__:___2__:___3__:___4__:___5__: extremely likely

12. My training agency thinks that I should engage in low impact diving practices.

extremely unlikely :___1__:___2__:___3__:___4__:___5__: extremely likely

Part C: Demographic Information - Please check the box(es) which best apply to your situation.

1. Gender

☐Male

☐Female

2. Age

☐ Under 18 years of age

☐ 18 – 20

☐ 21 – 25

☐ 26 – 30

☐ 31 – 35

☐ 36 – 40

☐ 41 – 45

☐ 46 – 50

☐ 51 – 55

☐ 56 – 60

☐ 61 – 65

☐ 66 +

3. Home Geographic Region

☐ North America

☐ Central America

☐ South America

☐ Europe

☐ Mediterranean
☐ Asia
☐ Africa
☐ Indo-Pacific
☐ Other _____

4. Highest Level of Education Completed

☐ Some high school
☐ High school
☐ Trade School
☐ Some College / University
☐ College / University
☐ Some Graduate School
☐ Graduate School
☐ Professional School (MD, LLB, Dentistry, etc)

5. Average Annual Household Income (in USD)

☐ Under $20,000
☐ $21 – 40, 999
☐ $41 – 60,999
☐ $61 – 80,999
☐ $81 – 100,000
☐ Over $100,000

6. Occupation

_____

Diving Experience and History

1. Certifying Bodies from whom you have undertaken **additional, advanced level training:**

☐ BSAC
☐ NASDS
☐ NAUI
☐ PADI

☐ SSI
☐ Other_____

2. Year First Certified

_____

3. Highest Level of Training Achieved

☐Open Water Diver
☐Ocean Diver
☐Sport Diver
☐Rescue Diver
☐Advanced Open Water
☐Advanced Diver
☐Master Diver
☐First Class Diver
☐Dive Leader
☐Dive Master
☐Dive Control Specialist
☐Assistant Instructor
☐Instructor
☐Advanced Instructor
☐Instructor Trainer
☐Other _____

4. When Diving, I regularly engage in underwater photography / videography?
☐Yes
☐No

5. Total Number of Logged Dives to Date

_____

6. Prior to today, when was your last logged dive: (Required)
☐ 1 day – 1 week
☐ 1 week – 1 month
☐ 1 – 6 months
☐ 6 months – 1 year

☐ 1 – 4 years

☐ + 5 years

7. Your last logged dive was 6 or more months ago.

Will you take a refresher course before your next dive?

☐Yes

☐N●

8. You indicated you would not take a refresher course, even though your last logged dive was 6 or more months ago.

Why?

_____

_____

_____

_____

Part D: Page Jumping Appended Pages

1. Under Age of Majority Page

If age is given as under 18 years of age then the following message is displayed before respondents are exited from the survey.

Thank you for your interest in this research.

You have indicated that you are under the Age of Majority, and are therefore ineligible to complete this survey.

Thank you for your time!

2. Not certified by BSAC, PADI or SSI

If certifying body is given as anything other than BSAC, PADI, or SSI (including other) then the following message is displayed before respondents are exited from the survey.

Thank you for your interest in this research.

You have indicated that you were certified by an organization not being studied in this research, and are therefore ineligible to complete this survey.

Thank you for your time

3. No Consent Given Page

At the bottom of the Cover Letter, the following question is posed:

I have read the information provided above, and hereby declare that I am 18 years of age (or older) and therefore of the age of majority and that I have consented freely to participate in this survey.

I agree to complete the survey.

☐Yes

☐No

If a NO, is given as the response, then the following message is displayed before respondents are exited from the survey.

Thank you for your interest in this research. You have indicated that you that you do not agree to the stipulations of the consent form, or are under the age of 18, and are therefore ineligible to complete this survey.

Appendix 3 – Recruitment Letter for Online Scuba Diver Communities

Dear Fellow Scuba Divers,

My name is Kelsey Johansen, and I am a graduate student in the School of Outdoor Recreation, Parks and Tourism at Lakehead University in Thunder Bay, Canada. As a part of my thesis, entitled *The Effectiveness of Environmental Communication with Scuba Divers: A Case Study Comparing the Curricula of BSAC, PADI, and SSI Open Water Diver Certification Courses,* I am surveying certified scuba divers about their knowledge of low impact diving practices.

To help me out with this, I am asking you to fill out a questionnaire, accessible by the link below, which will take approximately 5 - 8 minutes to complete and is based on a broad set of questions about scuba diving and marine environments, as well as your recent diving experiences.

If you are under the age of 18 please do not take part in this study!

Your participation is completely voluntary and you are free to refrain from answering any questions or to withdraw from the survey at any time. All questionnaires will be kept confidential and all data will be analyzed in statistical form to assure your anonymity.

As a member of the diving community, you know how
important preserving dive sites is, so please take the time to fill out this short survey!

http://www.surveygizmo.com/s/179389/kgzv7

Thank you for your time!

Sincerely,

Kelsey Johansen
HBOR, HBSC, BA
SSI Certified Master Diver
Masters Candidate
MES in Nature Based Recreation and Tourism
School of Outdoor Recreation, Parks and Tourism
Lakehead University
955 Oliver Rd.
Thunder Bay, ON
P7B 5E1
phone: 1-807-343-8876
email: kmjohans@lakeheadu.ca

Appendix 4 – Recruitment Email

Dear Fellow Scuba Diver,

My name is Kelsey Johansen, and I am a graduate student in the School of Outdoor Recreation, Parks and Tourism at Lakehead University in Thunder Bay, Canada. As a part of my Master's thesis, entitled The Effectiveness of Environmental Communication with Scuba Divers: A Case Study Comparing the Curricula of BSAC, PADI, and SSI Open Water Diver Certification Courses, I am surveying certified scuba divers about their knowledge of low impact diving practices.

To help me out with this, I am asking you to fill out a questionnaire, accessible by the link below, which will take approximately 5 - 8 minutes to complete and is made up of:
1) a broad set of questions about scuba diving and marine environments,
2) a section about your recent diving experiences and
3) a set of questions about you, and your certifications.

If you are under the age of 18 please do not take part in this study!

Your participation is completely voluntary and you are free to refrain from answering any questions or to withdraw from the survey at any time. All questionnaires will be kept confidential and all data will be analyzed in statistical form to assure your anonymity.

As a member of the diving community, you know how important preserving dive sites is, so please take the time to fill out this short survey!

The following link will take you to the survey:
http://www.surveygizmo.com/s/179389/kgzv7
Thank you for your time, and if you know of anyone else who may be interested in taking this survey, please feel free to forward this email to them.

Sincerely,

Kelsey Johansen
HBOR, HBSC, BA
SSI Certified Master Diver
Masters Candidate
MES in Nature Based Recreation and Tourism
School of Outdoor Recreation, Parks and Tourism
Lakehead University
955 Oliver Rd.
Thunder Bay, ON
P7B 5E1
phone: 1-807-343-8876
email: kmjohans@lakeheadu.ca

Appendix 5 - Covering Letter for E-Survey

Dear Sir or Madame,

As a certified diver, you are being asked to participate in a research project entitled The Effectiveness of Environmental Communication with Scuba Divers: A Case Study Comparing the Curricula of BSAC, PADI, and SSI Open Water Diver Certification Courses. This research will examine scuba divers' retention of Open Water Diver certification course content being conducted by Kelsey Johansen, a Master's of Environmental Studies in Nature-Based Recreation and Tourism student from the School of Outdoor Recreation, Parks and Tourism at Lakehead University in Thunder Bay, Canada.

The information you provide will be extremely beneficial and will be used to determine divers' demographics as well as divers' level of environmental knowledge. This data will then be used to draw conclusions about the ways in which diver certification bodies can improve diver education. Upon completion of the research project, all confidential data will be securely stored for five years at Lakehead University, as required by University policy. The data you provide will only be accessible by the researcher and her faculty advisor.

The completion of this questionnaire will take between 5 – 8 minutes, and will involve answering true and false, or check-the-box type questions. The information you provide will be kept confidential. As no indentifying information will be collected, individual participants will not be identified in published results and data will be published in aggregate form. There are no correct answers and all of your responses will be accepted. Your participation in this questionnaire is completely voluntary and you are free to refrain from answering any questions or to withdraw from your questionnaire at any time.

By completing the survey, you are indicating your willingness to participate in this study and that you understand and agree to the following terms, that:

1. Your participation in this research is voluntary and that you are free to withdraw at any time;
2. Your anonymity will be protected throughout all phases of this research project;
3. You have the right to withdraw from this study at any time without penalty of any kind; you may choose not to answer any question asked as part of the research;
4. The information you provide will be utilized to create documents for publication;
5. The data generated from this research will be securely stored at Lakehead University for 5 years; and
6. You can receive copies of publications that result from this research, if requested.

Should you have any questions you are free to print and keep a copy of this letter, and to contact either myself or my thesis advisor, Dr. R. J. Payne, via the information provided below.

Sincerely,

Kelsey Johansen, BA, HBSc, HBOR
MES in Nature-Based Recreation and Tourism Student
School of Outdoor Recreation Parks and Tourism
C/O Lakehead University
955 Oliver Rd
Thunder Bay, ON
CANADA
P7B 5E1
Ph: 1.807.343.8876
email: kmjohans@lakeheadu.ca

Dr. Rhonda Koster
Associate Professor
School of Outdoor Recreation Parks and Tourism
C/O Lakehead University
955 Oliver Rd
Thunder Bay, ON
CANADA
P7B 5E1
Ph : 1.807.343.8554
email : rkoster@lakeheadu.ca

Research Ethics Board - Lakehead University
Phone: 1.807.766.7289 Fax: 1.807.346.7749

I have read the information provided above, and hereby declare that I am 18 years of age (or older) and therefore of the age of majority and that I have consented freely to participate in this survey.

I agree to complete the survey.

☐Yes

☐No