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Diving Local, Thinking Global: Can Dive Professionals Contribute to Climate Change Literacy?

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Climate Change Literacy?

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Can Dive Professionals Contribute to Climate Change Literacy?

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Executive Summary

The recreational dive industry has successfully contributed towards greater marine conservation on a local-scale, and diving can increase individual divers' environmental consciousness. The dive industry is facing losses in economic viability as the effects of global climate change decrease the attractiveness of global dive destinations. The effects of sea level rise, warmer temperatures ocean acidification deoxygenation, and increased storm frequency, contribute to loss of kelp and corals, diminishing the value of diving. Dive professionals are distinctly appropriate as climate change educators as their livelihoods are affected by climate change, and they have access to clients with a revealed willingness-to-pay for a healthy marine environment. A research survey was conducted to international dive professionals through social media platforms in order to assess how climate change information has affected dive professionals' beliefs, knowledge and actions. The results indicated that dive professionals overwhelmingly believe in climate change, but that high belief does not correlate with high knowledge or actions. This observed dichotomy between pro-climate beliefs and actions likely exists beyond the recreational scuba diving industry, and suggests that conservation approaches should emphasize putting climate change in a real-world context, with tangible action-items to promote effective change.

Introduction & Background

The Dive Industry is a Global Industry

Recreational diving is a global phenomenon, despite industry marketing and research emphasis on regional and local diving. The dive industry is self-regulating so, the actual number of divers, dive professionals, dive shops, facilities, and retailers all over the world, is not easily ascertained (Dimmock & Musa, 2015). The Professional Association of Diving Instructors (PADI) is the world's largest certification agency, and is believed to issue about half a million new certifications annually in 183 different countries, 24 different languages, with as many as 17.8 million divers certified as of 2008 (Frank & Drew, 2010; Ong & Musa, 2012). Diving follows similar distributional patterns to the global tourism industry, where divers typically originate from developed countries in northern latitudes, travelling to warmer, developing nations for their recreational activity (Dimmock & Musa, 2015). Motivations for dive travel differ between different experience-level divers, but in general, tropical diving is the most popular globally, as divers have greater access to warmer waters, and colorful, high-diversity reefs (Gössling, Scott, Hall, Ceron, & Dubois, 2012). Advances in transportation, diving technology and safety, and increased environmental awareness have led the World Trade Organization to recognize scuba diving as one of the fastest growing sectors in international tourism (Dimmock & Musa, 2015).

The Dive Industry avoids the Global problem

On the global level, it is nearly impossible to tease out the impacts of diving, separate from those of international tourism. According to Hall (2018), if tourism were a country, its emissions contribution to global climate change would rank in the top five of all nations global emissions. The dive industry has a clear awareness of the negative consequences of climate-related impacts, but does not acknowledge its own role in creating those impacts (Dimmock & Musa, 2015). For example, researchers conducted an analysis of the UK Scuba News, and found that over a six-year period, over 140 stories focused on the effects of climate change (coral bleaching, loss of marine life, acidification) and how it influenced diving economics. However, not one story focused on the emissions contributions coming from scuba diving tourism itself (Dimmock & Musa, 2015).

Climate Change is Affecting the Dive Industry

Climate change includes increasing sea level, temperature, and frequency and intensity of storm and weather events. These climate-related changes can have major impacts on tourism and revenue for years, especially when extreme weather events are highlighted by news media, giving the impression of near-total destruction (Klint et al., 2012). After Hurricane Irma in 2017, Florida had an estimated \$2.5 billion loss from decreased tourism revenue (Florida, 2018).

Climate change is changing the diving landscape with the increasing prevalence of coral bleaching events, as well as the spread of invasive species (Barker & Roberts, 2004; Gössling, Bredberg, Randow, Sandström, & Svensson, 2006). In a research survey conducted on the popular diving destination of Bonaire in the Dutch Caribbean, 76% of tourists said they would be unwilling to return for the same price in the event that corals suffered severe bleaching and mortality (Uyarra et al., 2005). In additional studies exploring tourists' motivations, there was found to be a general lack of understanding between the tourists' contribution to climate change, compared to tourism being affected by climate change (Gössling et al., 2006, 2012).

The consequences of climate change are well understood to have a negative impact on the marine environment, as well as to the economic longevity of diving. What is not well understood, is that divers contribute to these negative effects merely by travelling to their dive destinations (Gössling et al., 2006). The effects of climate change are, and will continue to reduce the attractiveness of dive tourism. Given the immense changes to dive destinations anticipated with climate change, some researchers have questioned if future generations will be able to, or even want to, participate in recreational scuba diving (Dimmock & Musa, 2015).

The Dive Industry Facilitates Local Marine Conservation

The recreational scuba diving industry has made important contributions towards marine conservation efforts, prompting local marine protected area establishment in the Red Sea, the Philippines, the Caribbean, and elsewhere (Dimmock & Musa, 2015; Hawkins & Roberts, 1994; Oracion, 2013). Economics research has shown that divers have a willingness to pay (WTP) additional fees for greater environmental protection in local popular diving locations (Green & Donnelly, 2003; Sorice, Oh, & Ditton, 2007).

Diving provides opportunities for direct exposure to marine life which can have a lasting impact on individual attitudes and perceptions of conservation (Arin & Kramer, 2002; Lück, 2003; White & Campbell, 2008). This immersive activity can foster a cumulative learning-in-nature experience, central to the evolution of an individuals' environmental consciousness (James, Bixler, & Vadala, 2010). Scuba dive training can foster ecological awareness in individual divers.

Dive Industry Research on Local Impacts

While diving has promoted local marine park establishment, and increased individuals' environmental awareness, there are also negative consequences associated with recreational diving (Hammerton, 2017; Jadot, Bertuol, Oliveira, Krumholz, & De Leon, 2016; Ong & Musa, 2012). Diving is often considered a "non-consumptive" activity because it does not necessarily involve any extraction or damage to the environment on a large scale, especially compared to other coastal sources of income such as fishing and the aquarium trade (Lucrezi, Saayman, & Van Der Merwe, 2013). However, there are situations in which divers do negatively impact the environment through direct contact with the marine benthos, kicking or hitting corals, as well as stirring up sediment which smothers corals, and changing the natural behavior of marine organisms through feeding, pursuit or human presence (Dearden, Bennett, & Rollins, 2007; Lucrezi et al., 2013; Roupheal & Hanafy, 2007).

Researchers have attempted to quantify and qualify the damage done by divers to specific dive locations in South Africa, Malaysia, Australia, the Dutch Caribbean, and elsewhere (Hammerton, 2017; Jadot et al., 2016; Lucrezi et al., 2013; Ong & Musa, 2012). For example, Jadot et al 2016 observed divers in Bonaire for 30 minutes in the water, over a month study period, to record accidental and intentional diver contact with the benthos and reef. While the study does not summarize the damage incurred, it does support other researchers who have found that divers with cameras, and divers who have been absent from diving for long periods, have the greatest unintended impacts on the reef.

While diving can have these direct negative impacts on the marine environment, there are also indirect consequences to coastal communities. Developing nations with coastal dive-

destinations face increasing pressure to expand tourism infrastructure, and associated coastal development (Lucrezi, Saayman, & Van Der Merwe, 2013). Diving impact research thus far has primarily focused on the direct, observable environmental impacts of diving, while virtually no research has been conducted on the indirect local or global impacts of the recreational diving industry.

Diver behavior can be changed by Dive Professionals

Individual divers' behavior can be changed and influenced by dive professionals (Barker & Roberts, 2004; Davis & Tisdell, 1995; Dearden et al., 2007; Medio, Ormond, & Pearson, 1997; Roupheal & Inglis, 1997). Thorough and comprehensive pre-dive briefings have been shown to significantly reduce the occurrences of incidental impact and diver-caused local damage (Dearden et al., 2007; Medio et al., 1997). Dive professional interference in-water can also reduce diver impacts on the benthos (Barker & Roberts, 2004; Davis & Tisdell, 1995; Roupheal & Inglis, 1997). Dive professionals are role models to the larger diving industry, and their knowledge and behavior can have a large impact on novice recreational divers. In February of 2019, Reef-World Foundation, with support from UN-Environment and Professional Scuba Schools International, developed the first ever online course designed to help dive professionals reduce the negative impacts of scuba diving on the environment (Editors, n.d.). The course emphasizes the dive professional responsibility to practice role-model behavior, but focuses exclusively on local impacts: anchoring practices, touching marine life, wearing gloves, photographers/buoyancy, use of marine toilets, fish feeding, trim, corrective behavior, and finning techniques (Foundation, Fins, & Environment, 2019). Nowhere in the course is there any mention of the global impacts of the divers' travel, or the larger dive industry.

Can Dive Professionals Start the Conversation on Climate Change?

Dive professionals are on the frontline of observing environmental changes, and will suffer the economic losses as global tourism reacts to continued climate change. For dive professionals, their economic livelihood is dependent on a healthy environment, and they have access to individuals eager to experience the ocean, with revealed willingness-to-pay for access to a healthy marine environment (Gill, Schuhmann, & Oxenford, 2015; Lucrezi, Saayman, & van der Merwe, 2013; Maccarthy, O'neill, & Williams, 2006). Therefore, dive professionals are distinctively positioned to be ambassadors for marine conservation issues, and as climate change educators, more specifically.

For the purposes of this study, "dive professionals," are defined as any individual with a Divemaster-rating or above, working in any sphere of the dive industry, including training organizations, manufacturers, retail, dive shop managers, as well as instructors and dive guides. Teaching-status dive instructors are qualified to guide, assist, and teach diving courses, according to the standards put forth by the training organization(s) with which they are certified.

The purpose of this research is to understand what dive professionals know about climate change, and whether dive professionals are engaged and teaching on topics of conservation and climate change. This research is intended to explore what role dive professionals currently play in marine conservation, and how to empower them to become climate change educators.

Hypotheses for the Survey

Based on the aforementioned previous research on the dive industry, conservation and climate change, the following hypotheses were made:

- High belief in climate change would correlate with high knowledge and high actions;
- Full-time employed dive professionals would exhibit higher beliefs, knowledge and actions than part-time or inactive dive professionals, as they are more financially invested in the marine environment;
- Training organization affiliation would impact beliefs, knowledge and actions, based on their different emphases and ethos;
- Geography would impact beliefs, knowledge and actions, based on the sociopolitical perceptions of climate change between different nations;
- Most dive professionals do not work in their country of origin; Those who do work in their country of origin would have higher beliefs, knowledge and actions because they are more invested in the local environment;
- Dive professionals who are willing to teach beyond training organization standards would have higher beliefs, knowledge and actions because they teach beyond the minimum requirements;
- Dive professionals who spend more time on communication would have higher beliefs, knowledge and actions because they invest more time in their clients;

Methods & Analysis

In order to assess dive professionals understanding of and willingness to teach about climate change, a research survey was conducted. The research survey was administered to understand:

1. What do dive professionals believe, know and act upon based on their understanding of global climate change?
2. How do dive professionals' beliefs, knowledge and actions on climate change get communicated to their dive students or clients?
3. If communication about climate change is not occurring, what are the perceived barriers that inhibit them, and what resources could support the mitigation of those barriers?

The questionnaire was developed with the aid of the Survey Design and Analysis course at Scripps Institution of Oceanography from January to March 2019. The survey instrument addresses the above topics by asking a series of questions under the following sections:

- Professional dive experience
- Ecosystem and conservation understanding
- Diver communication and conservation
- Demographic information

The questionnaire is presented in Appendix I.

The questionnaire and research plan were submitted for approval to the University of California, San Diego Institutional Review Board (IRB), and exempt status was received. Subsequent amendments were submitted and approved through the end of March, 2019.

The questionnaire was not designed to test dive professionals on their climate change knowledge, but rather to understand their perceived knowledge on various topics. Therefore, several survey questions were weighted and constructed into an index, or coincident indicator, for an overall "Conservation & Climate Change" index score out of one-hundred (Crossman, 2018; Pozdena, 2012). The overall index was built out of three composite index scores for "Beliefs," "Knowledge" and "Actions." The weighting of the index was conceived by independent dive professionals without bias from the researcher, prior to the publishing of the questionnaire. The total index scores were out of 100, with the beliefs and knowledge scores out of 30, and the action score out of 40. The complete building and weighting of the index can be seen in Appendix II.

Given that there are no publicly accessible databases of dive professionals, nor of active divers in general, it was not possible to ascertain a population estimate of global dive professionals, resulting in non-probability sampling. PADI, National Association of Underwater Instructors (NAUI), and GreenFins were contacted in attempts to gain access to their mailing database, but no access was granted. Given the limited population demographics information accessible, the research survey was distributed through social media and email listservs, targeting dive professionals specifically. Six Facebook groups were selected for distribution (Table 1). The questionnaire was also distributed via Divebums diving digest listserv <http://divebums.com/>. Divebums was chosen to increase the representation of divers from California, however it is not exclusively for dive professionals, so it was only posted to twice.

The survey was pre-tested by seven individuals from the researchers' personal network, representing a range of dive professional experiences, and input from three different nationalities. The results of the pre-testing informed a more accurate estimate of the time to complete the survey, and indicated certain questions were too difficult to answer; such questions were removed or rewritten and resubmitted for IRB approval.

<i>Social Media Network</i>	<i>Global Network</i>	<i>Scuba Jobs</i>	<i>PADI Dive</i>	<i>Scuba Jobs</i>	<i>Best Dive</i>	<i>Dive Jobs</i>	<i>Dive- bums</i>
<i>Total Membership</i>	521	19,691	10,367	20,340	10,634	60,020	800
<i>(monthly users)</i>		(11,000/m)				(35,900 /m)	
<i>First post</i>	Mar 27	March 28	March 28	March 28	pending	March 27	April 7
<i>2nd post</i>	April 6	April 6	April 15	April 6	pending	April 6	April 29
<i>3rd post</i>	April 22	April 24	pending	April 24	pending	April 22	
<i>4th post</i>	April 29	May 1	pending	May 1	pending	April 29	

Table 1. Social Media and email platforms contacted, membership numbers, and posting schedule. Full titles (left to right): global network of dive professionals; scuba jobs worldwide & more; PADI dive professionals – job offers; scuba job & pro-level training; best dive jobs worldwide; dive jobs worldwide; Divebums digest.

The questionnaire was closed on May 6th, 2019, and all incomplete responses were excluded from analysis. Survey collection was open for over one month, however there were several logistical and processing issues due to the nature of data collection through social media platforms. Prior to the publishing of the questionnaire, each of the Facebook group administrators were contacted in order to ascertain detailed analytics about posting to the groups. Specifically, administrators' were asked to provide the number of active users per month, and the day of the week and time of day for peak page traffic. Such metrics were desired in order to optimize posting visibility and enumerate the sample frame. However, this information was only provided by two out of the six groups. Therefore, it was not possible to calculate an accurate sample frame, or coverage error given the lack of information about dive professional population demographics, and the unresponsiveness of the social media administrators.

Two of the group administrators never approved the posts, so the sample frame was smaller than anticipated. The posts were completed as described above (Table 1). The Facebook

groups also varied in their settings requiring approval for linked-file posts, so there was some variation in when the questionnaire was visible on the group page based on the administrators' approval. Because most of the group pages required post-approval from administrators, the time of day, and day of the week for posting was dependent on the administrators' activity and not the posting schedule of the researcher. The survey was closed in early May to due to time constraints for conducting analysis.

Results & Discussion

At the time of the close of the survey on May 6th, 342 survey responses were recorded, with 195 usable data collected (Table 2). Post-survey close, 66 additional responses were received and recorded as partially completed, thus excluded from the analysis.

Total Survey Response, May 6	Non-dive professionals	Incomplete surveys	Total Usable Responses
342	74	73	195

Table 2. Breakdown of survey responses at the close of data collection on May 6th, 2019. “Non-dive professionals” was determined by the first survey question: “Are you a dive professional?” If individuals answered “No,” or “Unsure,” they did not continue the survey, so their response-data were excluded from analysis. Likewise, 73 respondents did not fully complete the survey (i.e. completed less than 52% of the questionnaire), and were also excluded from the analysis. Usable responses were dive professionals, who completed over 52% of the questionnaire.

Overall Index Calculations & Results

As stated in the Methods section above, the “Conservation and Climate Change” index was intended to compile self-reported beliefs, knowledge, and actions, in order to understand dive professionals understanding of climate change and conservation. The index was not intended to qualify actual, specific beliefs, knowledge or actions, but to quantify, subjective, self-reported beliefs, knowledge and actions. The average overall index score was 58%. Of the three component scores, “Beliefs,” had the highest scores, while “Actions,” had the lowest scores (Figure 1). For the total index, more than half the respondents scored between 53%-63%, only four respondents scored over 80%, and nineteen respondents scored under 40%.

The questions which contributed to the beliefs index score were adopted in part from the Yale program on climate communication (Howe, Mildenerger, Marlon, & Leiserowitz, 2016). Scores were calculated based on: current beliefs on climate change; belief in climate change affecting their personal livelihood; and their belief in the role the dive industry has to play in climate change and global conservation.

The questions which contributed to the knowledge index score were not intended to test the respondents’ actual knowledge on climate change topics. Instead, knowledge scores were calculated based on: educational experience, knowledge of climate change terms, awareness of climate change evidence in their environments, and their self-reported comfort explaining topics. The knowledge questions showed less consistency in their responses (Figure 1).

Action scores were overall the lowest component scores, and contributed the most to the overall index calculations. Action scores were made from the responses to four different questions: behavior changes due to knowledge on climate change, participation in various conservation-in-diving initiatives, participation in Marine Protected Area (MPA) activities, and participation in other marine-conservation initiatives such as lionfish derbies, coral restoration, coral nursery, or coral implantation projects, etc.

Beliefs are greater than Knowledge and Actions

It was expected that the index scores would exhibit correlation between respondent's beliefs, knowledge and action scores. Instead, beliefs scores were much higher than any other index category, and had less spread throughout the responses. Belief scores were weighted out of thirty points for the overall index score; the average beliefs score was 83% (Figure 1).

Knowledge scores were overall, twenty-four points lower than the average belief scores (Figure 1). Knowledge scores were also weighted out of thirty points; the overall average knowledge score was 59%. Knowledge scores had more variation and spread, as seen through the range in Figure 1 below.

Action scores were overall the lowest scores in the index calculation. Action scores were weighted out of forty points, and therefore contributed the most to the overall index scores. The action score average was forty-three points lower than the beliefs score, and nineteen points lower than the knowledge score, with the average action score of only 40% (Figure 1).

Figure 1. Average results of the Climate Change and Conservation Index. Scores were calculated into percentages based on the maximum score per index “Beliefs” and “Knowledge” were each out of thirty; index “Actions” was out of forty. The “x” in the center of the rectangles represent the mean for each score, and the rectangles represent the first and third quartile of the response distribution. No maximum scores were achieved in any category, except for beliefs (n = 195).

These results are contrary to the expectation that high beliefs would correlate with high knowledge and high actions; instead, there is an overt disconnect between the dive professionals surveyed overwhelmingly high beliefs, yet very low action scores. Several

demographics and independent variables were examined to attempt to understand the disagreement between beliefs and actions.

Index Scores compared to Demographics

The research survey was comprised of twenty-six questions, thirteen of which contributed directly towards the index score (Appendix I & II). In order to understand the discrepancy between belief and action scores, the remaining thirteen demographic and independent questions were examined in comparison to the overall and component index scores.

There was no significant difference in component or overall index scores based on dive professional's employment status (Table 3). It was hypothesized that dive professionals with full-time employment might exhibit higher overall index scores, as their economic livelihood is directly impacted by the marine environment, more so than those dive professionals who have alternative sources of income. These results indicate that for the dive professionals surveyed, employment status was not correlated with higher "Conservation and Climate Change" index scores (Table 3).

	BELIEF	KNOWLEDGE	ACTION	TOTAL
FULL-TIME (83)	83%	60%	40%	59%
PART-TIME (82)	82%	59%	39%	58%
INACTIVE (30)	82%	59%	39%	58%

Table 3. Respondents' employment status compared to index scores. The parenthesis adjacent to the employment status indicate the individual number of responses. There was no significant difference in index scores between full-time, part-time, or inactive dive professionals (n=195).

There was no significant difference in component or overall index scores based on affiliation with different training organizations (Table 4). Training organizations qualify dive professionals, set the standards by which dive professionals must act, and provide curricula for dive professionals to teach. Therefore, it was hypothesized that the different training organizations may differ in their conservation-emphasis, and contribute towards a difference in index scores. There was no observed difference in index scores between different training organizations (Table 4). 91% of dive professionals surveyed were affiliated with PADI; Scuba Schools International (SSI) was the next most-represented training organization (14%), while 26% of respondents were affiliated with more than one training organization (n=195).

	BELIEF	KNOWLEDGE	ACTION	TOTAL
PADI (178)	59%	83%	40%	59%
SSI (28)	63%	85%	42%	61%
OTHER (53)	60%	80%	40%	58%
MULTIPLE (51)	59%	83%	41%	48%

Table 4. Respondents' training organization affiliation compared to index scores. There was no significant difference between index scores based on training organization affiliation. SSI dive professionals had higher than average index scores, but not significantly (n=195).

The response data had a near even split between male and female respondents, which indicated a bias towards a higher proportion of females' participation and survey completion

than expected (Purchaser et al., 2013). According to statistics from Dive Equipment and Manufacturers Association (DEMA), women typically represent only about 24% of the global dive industry. Women represented 48% of all survey responses, which is double their representation in the diving world. However, females overall scored higher than males on each component of the index; females scored three points higher on knowledge, eight points higher on beliefs, and four points higher on actions (Table 5).

	BELIEFS	KNOWLEDGE	ACTIONS	TOTAL
MALE (100)	79%	58%	38%	56%
FEMALE (91)	87%	61%	42%	61%

Table 5. Gender distribution by index scores. Females scored overall higher on each component index score (n = 191).

Given that an estimated 76% of the global dive industry is male, these results indicate that the female divers, while a minority, may play a larger role in conservation and climate change initiatives (Purchaser et al 2013). In recent years, several training organizations have developed initiatives to increase female representation in the diving world. For example, in 2015 PADI launched their first ever “PADI Women’s Dive Day,” (PADI CITATION) to promote and celebrate female divers. If women are not only more conservation-minded, but also more conservation-active, increasing the proportion of female divers could have positive consequences for marine conservation and climate action, as well as for increasing gender diversity in diving.

Index Scores compared to Geography

The dive professionals surveyed represented 31 different nationalities, with 87% originating from North America or Europe (Figure 2). Respondents from Australia, New Zealand, India, Pakistan, China, South Africa, Egypt, Israel, Brazil and Colombia comprised the remaining 13% of nations represented (Figure 2). While the response data is skewed towards North America and Europe, these results indicate that the survey was accessible to many different nationality participants.

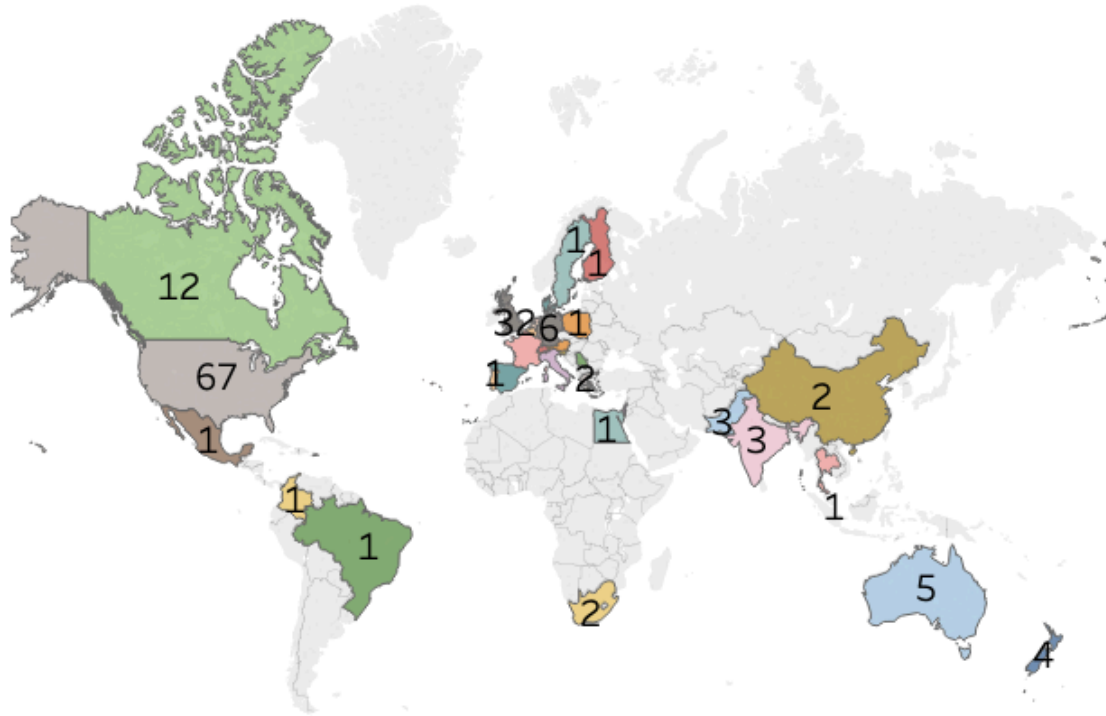


Figure 2. Nationalities reported by survey respondents. No respondents indicated a national origin from Central America or the Caribbean (n=194).

In order compare index scores with geography, nationalities were grouped into geographic regions: North America; Europe; Other (Table 6). There was no significant difference in index scores based on national origin (Table 6). Respondents from Europe scored slightly higher than respondents from North America on knowledge and beliefs, but lower than North Americans on the action score (Table 6). Both Europeans and North Americans scored higher than the “Other,” category represented by the nationalities indicated in the figure above (Figure 2, Table 6).

	BELIEFS	KNOWLEDGE	ACTIONS	TOTAL
N. AMERICA (80)	85%	58%	43%	60%
EUROPE (88)	83%	61%	38%	59%
OTHER (26)	79%	56%	33%	54%

Table 6. Index results based on nationalities by regions (n=194).

The differences between the component scores of European and North American respondents is interesting, especially given the increasingly divergent political approach to climate change between the two continents. It was hypothesized that European dive professionals would have higher knowledge, beliefs and actions, given that there are political and socioeconomic mechanisms in place in the European Union, such as carbon cap-and-trade schemes, and continued commitments to the Paris Agreement (Citation). However, it bears repeating that the action score was not based on actual behaviors, but on self-reported perceptions of behavior change. Therefore, the European respondents might have more conservation and climate motivated actions than those from North America, or might feel that their governments are doing more to address climate therefore individual action is less valued, but the North Americans had higher self-reporting of climate-precipitated behavior change (Table 6).

Respondents indicated they have worked as dive professionals as many as ninety-one different nations, with a larger proportion of the globe covered by dive professionals working, than by the nationalities they represented (Figure 2 & 3). Respondents were asked to list up to five most recent countries in which they have worked as divers. Several responses were not of specific countries, but of regions they've worked in, such as "Caribbean," "Western Europe," and "Central America," (n=10). The most mentioned individual nation for work was the USA (11% of total mentions), however the part of the United States was not specified, so this could include California, Florida, Hawaii, Puerto Rico, US Virgin Islands, or other United States territories and islands. There was likely some overlap, as respondents who indicated they have worked in the USA will likely include individuals who have worked in Florida, Puerto Rico and the US Virgin Islands, which could have also been included in the "Caribbean," category. The top ten most mentioned employment locations in order were: USA (53), Thailand (42), Mexico (22), Honduras (20), Philippines (19), Maldives (18), Indonesia (17), Malaysia (17), Australia (17), and Spain (15), which represented 50% of all location-mentions. Seventy nations had fewer than five mentions (Figure 3). Nations that dive professionals originate from were very different than the nations where dive professionals work (Figure 2 & 3).

¹ If the respondents population is indicative of the general population.

	BELIEFS	KNOWLEDGE	ACTIONS	TOTAL
N. AMERICA (52)	85%	60%	46%	62%
EUROPE (49)	83%	60%	41%	59%
OCEANIA (27)	84%	60%	49%	63%
ASIA (77)	82%	63%	45%	62%
MIDDLE EAST (18)	85%	59%	40%	59%
AFRICA (9)	82%	56%	42%	58%
S. AMERICA (4)	85%	60%	44%	61%
CENTRAL AMERICA (36)	83%	59%	50%	62%
CARIBBEAN (45)	83%	61%	47%	62%

Table 7. Index scores by region where dive professionals have worked. Respondents could list up to five most recent countries where they have been employed (n=193).

It was hypothesized that dive professionals who work in their country of origin might score higher on the “Conservation and Climate Change,” index than those who work in foreign countries, because they are more invested in the conservation practices of their home country. It was also expected that most dive professionals do not work in the country in which they were born. 40% of respondents do work as a dive professional in their country of origin (Table 8). It should be noted, that of those 76 respondents who work in their country of origin, over a third of them were California divers, who were specifically targeted through the Divebums listserv (Table 9).

There was no real difference in index scores for dive professionals who work in the country in which they were born, compared to those who work in other countries (Table 8). This suggests that dive professionals are not motivated to have pro-conservation actions based on their geography. Action score unevenness with geography may be in part due to the variation in availability of certain conservation-in-diving initiatives based on location, as suggested above (Table 7).

	BELIEFS	KNOWLEDGE	ACTIONS	TOTAL
YES, I WORK AS A DIVER IN MY NATIVE COUNTRY (76)	84%	59%	40%	59%
NO, I DO NOT WORK IN THE COUNTRY WHERE I WAS BORN (117)	83%	59%	41%	59%

Table 8. Index results based on dive professionals working in the nation they were born in compared to those who work in foreign nations (n=193).

Dive professionals from California were specifically targeted through the Divebums listserv in order to increase representation from cold-water diving locations. The state of California is considered a leader on climate action in the United States as well as internationally, so it was hypothesized that dive professionals from California would score above average on the “Conservation and Climate Change,” index. Despite the targeted surveying, only 13% of respondents were divers who are from and work in California (Table 9). There was no significant difference between index scores from California compared to those from elsewhere, but surprisingly, the index scores from Californians were lower than those from

elsewhere (Table 9). In contrast to the perception that California is leading the way on climate action, California diver knowledge scores and action scores were below average (Table 9).

	BELIEFS	KNOWLEDGE	ACTIONS	TOTAL
CALIFORNIA (26)	83%	54%	36%	56%
NOT CA (168)	83%	60%	41%	59%
TOTAL AVERAGE	83%	59%	40%	59%

Table 9. Index results of Californians compared to dive professionals not from California (n=194).

Overall, geography, be it where respondents originated, where they worked, if they worked where they were from, or if they were from and worked in California, did not significantly affect the “Conservation and Climate Change” index scores. However, geography did show some variation, particularly in the action scores. These results corroborate the large difference between index belief scores and index action scores, though the geographic variables do not elucidate why the difference exists.

Index Scores compared to Independent Variables

In addition to demographic and geographic questions, there were a few additional questions asked in the survey which did not directly contribute towards the index scores. These independent variables were explored to understand the discrepancy between belief and action scores.

Survey respondents were asked how much time they spend, on average, communicating with their dive clients / students. Studies have shown that communication pre-diving can reduce negative impacts, and communication post-diving can help foster greater long-term environmental consciousness (Goffredo et al., 2010; Medio, Ormond, & Pearson, 1997). Most dive professionals responded that they or their shops did both pre- and post- trip communication (85% and 72%, respectively) (n=192). However, the content of the pre- and post- communication was not asked, so it is not possible to discern the environmental aspect of this communication.

Dive professionals were asked the total amount of time they spend communicating with their students / clients on a day of diving. Overall, dive professionals spent an average hour and a half communicating with their divers, with the most time dedicated to “safety” and “building rapport,” (19 minutes each) and the least time spent on “diver awareness” and “marine conservation topics” (12 minutes each) (n=178). It should be noted that these questions on time-spent were reworked after pre-testing, but their final iteration was still considered confusing or difficult to answer by some, so incomplete responses were excluded from analysis. “Total time,” had a large amount of variability in response, (from 1 to 500 minutes), and nineteen respondents indicated they did not know how to estimate total time spent; these results suggest that individuals still had a hard time estimating the time-spent total figure, from which the categorical minutes were calculated.

It was hypothesized that dive professionals who spend more time on diver communication would have higher index scores because they commit more time to teaching various topics. The results of overall time spent indicate there was no significant difference in index score based on the amount of time spent communicating with dive clients (Table 10). In contrast to the expected results, dive professionals who spent less than thirty minutes on diver communication had the highest knowledge scores (Table 10). However, this re-emphasizes the disparity between beliefs, knowledge and actions, as their higher knowledge scores did not correlate with higher belief or action scores (Table 10).

	BELIEFS	KNOWLEDGE	ACTIONS	TOTAL
LESS THAN 30 MINS (49)	82%	60%	42%	60%
31-60 MINS (49)	85%	57%	44%	60%
61-120 MINS (50)	83%	59%	42%	60%
MORE THAN 120 MINS (28)	80%	59%	42%	59%

Table 10. Index results compared to total time communicating with divers (n=176).

In addition to time spent on diver communication, dive professionals were asked their opinion about teaching to training organization standards. Each training organization issues their own set of standards for safety protocols, training, teaching and so forth. Dive

professionals must teach all the standards set forth by their qualifying training organization, for safety and legality. However, dive professionals are allowed to teach *beyond* standards, i.e. to cover additional material or skills with students not covered in the curricula set forth. This allows dive professionals to tailor dive curricula with additional information to location-based specifics, or additional conservation or marine science information based on their own and their dive clients' interests.

Survey respondents were given the statement: It is my responsibility, as a dive professional, to teach the standards provided by the training organization, and nothing more or less. It was hypothesized that those who agreed with this statement would score lower on the indices, as they would view the teaching of marine conservation or climate topics as beyond the scope of dive professionals because they are not included in standards; those who disagreed were expected to have higher index scores as they would be willing to teach additional information beyond standards. These hypotheses were supported by the results (Table 11). Respondents who disagreed, i.e. believe they can teach more than standards, scored overall higher knowledge, beliefs, and action scores than those who, agreed i.e. they should teach standards and no more (Table 11). Specifically, those dive professionals who teach beyond standards scored six-points higher on knowledge, three-points higher on beliefs, and nine-points higher on the action scores (Table 11). These results suggest that opinions on dive standards could be an indicator of conservation-thinking and teaching.

	BELIEFS	KNOWLEDGE	ACTIONS	TOTAL
STRONGLY DISAGREE (48)	83%	60%	44%	61%
NEITHER AGREE NOR DISAGREE (118)	84%	59%	40%	59%
STRONGLY AGREE (32)	80%	54%	35%	54%

Table 11. Index scores compared to opinions about teaching only dive standards (agree), compared to teaching more than dive standards (disagree) (n=198).

Lastly, independent of the index calculation, dive professionals were asked how often climate change is discussed, amongst employees and/or with dive clients and students. It was hypothesized that individuals who discuss climate change more often would have higher belief, knowledge and action scores than those who rarely discuss climate change. The results supported this hypothesis, as dive professionals who discussed climate change “very often,” had knowledge, belief and action scores well above the average index scores (Table 12). Dive professionals could indicate they discussed climate change: very often, (daily); often (weekly); sometimes (few times a month); rarely (few times per year); never. Those who discussed climate change daily compared to those who never discussed climate change, had eighteen-points higher knowledge scores, fourteen-points higher belief scores, and almost double the action scores (Table 11). It should be noted that only five individuals indicated they never discuss climate change; though the sample size is small, the results are consistent with those who were in the “rarely discussed climate change” category as well (Table 11).

	BELIEFS	KNOWLEDGE	ACTIONS	TOTAL
VERY OFTEN (DAILY) (36)	88%	67%	50%	66%
OFTEN (WEEKLY) (66)	86%	61%	43%	61%
SOMETIMES (A FEW TIMES A MONTH) (63)	83%	55%	32%	54%
RARELY (A FEW TIMES PER YEAR) (25)	72%	54%	39%	53%
NEVER (CLIMATE CHANGE IS NEVER DISCUSSED) (5)	74%	49%	26%	47%

Table 12. Index results compared to how often dive professionals discuss climate change (n=195).

How often climate change is discussed, and personal opinion on teaching to dive standards, were found to be the independent variables which were most predictive of dive professionals index scores (Table 10 & 11). While these variables proved to be indicators of overall index scores, they still do not explain the large disparity overall between high belief scores and low action scores.

Conclusions

The recreational dive industry needs to be viewed from a global lens in order to tackle global problems. Climate change is affecting the dive industry, and reducing the economic viability of diving as popular destinations are and will continue to be affected by increased storm intensity and frequency, sea level rise, warmer temperatures, coral bleaching, and ocean acidification.

It was hypothesized that dive professionals would have high index beliefs, knowledge and actions because their livelihoods are dependent on healthy marine environments, which are already facing degradation due to climate change. The results indicate that dive professionals do overwhelmingly believe in climate change, but the high belief does not correlate with equally high knowledge or action. None of the demographic, geographic or independent variables were found to explain this disconcerting disparity between beliefs and actions.

Previous research on recreational diving has focused on location-specific, amateur divers, and willingness-to-pay scenarios, which can provide valuable insights on how the industry will respond to continued degradation due to climate change. In order for the dive industry to take a proactive approach to the industries' longevity, future research should examine motivations for pro-conservation behavior change in the present. Future studies should also continue to examine dive professionals specifically, as role models for the industry, and a population with greater investment in a healthy ocean than novice divers. Likewise, conservation efforts might benefit from a higher proportion of females in the dive industry, as women scored overall higher than men in their "Conservation and Climate Change," scores; additional studies to understand the gender imbalance in the dive industry may prove valuable for marine protections as well as social equality.

Research on dive professionals, and the dive industry in general, is limited by the lack of publicly available data on the population size, geographic distribution, and frequency of diving professionals worldwide. Training organizations will face economic losses as climate change decreases the financial viability of the dive industry; therefore, training organizations should make population data more readily available, or sponsor research themselves, in order to utilize and empower this key diving demographic. In addition to sponsoring research, the global dive industry and training organizations must start to recognize this self-perpetuating contradiction: the dive industry is financially dependent on promoting travel, yet the travel itself, through the carbon emissions yielded, decreases the financial viability of the dive industry. Training organizations must acknowledge and address this paradox for the survival of the industry itself.

Beyond the dive industry itself, the results of this research survey may be indicative of an incongruence between climate change beliefs and climate change action in general. These results also suggest that greater impacts could be made by pro-climate and pro-conservation organizations redirecting their attention away from purely informational campaigns; dive professionals should be educated and empowered to role model climate-positive behaviors to novice divers, rather than just teaching a syllabus. Dive professionals can participate in climate-positive actions by: getting involved with local politics, regardless of national origin and nation of employment; putting pressure on the dive industry itself to take greater accountability for emissions and waste production; maintaining an individual commitment to personal behavior changes, however much possible.

Climate change belief and knowledge must be put into context with tangible, readily-observable climate effects, emphasizing the various way to perform action-items, through which individuals, divers or otherwise, can reduce their negative environmental impacts, and increase their climate-positive behaviors.

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Appendix I: Questionnaire

Dive Professionals & Climate Change Literacy

Start of Block: Introduction

Thank you so much for taking the time to contribute to this survey. Your responses will contribute to our understanding of dive industry and climate change.

The survey should only take only about 10 minutes to complete. Be assured that all the answers you provide will be kept strictly confidential.

Please click the arrow to continue

End of Block: Introduction

Start of Block: Professional Dive Experience

1 I am a qualified Dive Professional*

**For the purposes of this study, "dive professionals" are defined as any individual with a divemaster-rating or above, working in any sphere of the dive industry, including training organizations, manufacturers, retail, dive shop managers, as well as teaching instructors and dive-guides.*

- Yes
- No
- Unsure

Skip To: End of Survey If I am a qualified Dive Professional *For the purposes of this study, "dive professionals" are de... = Unsure*

Skip To: End of Survey If I am a qualified Dive Professional *For the purposes of this study, "dive professionals" are de... = No*

2 The following describes my current status as a dive professional

- I work as a dive professional full-time
- I work as a dive professional part-time
- I am not active status, but I have previously had active status
- Other (please specify) _____

3 Please list all training organization(s) you are affiliated with as a dive professional (PADI, NAUI, SSI, etc)



4 Which of the following reflects your experience with Marine Science in general (check all that apply)

- No formal marine science education
- I did coursework in marine science in high school
- I studied marine science in college / at university
- I have an advanced degree in marine science
- I have done short-term educational programs in marine science (internships, summer camps, educational tourism, etc)
- I have at least 5 years working in marine environment
- I read a lot about marine science issues
- I follow marine scientists on social media
- Other (please specify)

5 Do you agree or disagree with the following statement:

As a dive professional, it is my responsibility to teach the standards provided by the training organization, and nothing more or less

- Strongly Agree
- Somewhat Agree
- Neither agree nor disagree
- Somewhat Disagree
- Strongly Disagree

End of Block: Professional Dive Experience

Start of Block: Ecosystem & Conservation Understanding



6 I have heard of the following terms (Check all that apply)

- Climate Change
- Greenhouse Gases
- Carbon Dioxide Emissions
- Methane Emissions
- Sea Level Rise
- Thermal Expansion
- Sea Surface Temperature Increase
- Eutrophication / Nutrient Loading
- Ocean Acidification
- Ocean Deoxygenation



7 The following reflects my current beliefs about global climate change (Check all that apply)

- Climate change is happening
- Climate change is caused mostly by natural variability in the environment
- Climate change is affecting the weather
- There is a lot of disagreement among scientists about whether or not climate change is happening
- I am worried about climate change
- Climate change will affect my livelihood
- None of these reflect my beliefs

Skip To: 9 If The following reflects my current beliefs about global climate change = Climate change is caused mostly by natural variability in the environment

Skip To: 9 If The following reflects my current beliefs about global climate change = None of these reflect my beliefs

8 Have you changed your personal behaviors* as you have learned more about climate change?

**For the purposes of this study "changes in personal behaviors" refers to any changes you have made to your own patterns of consumption and purchasing, due to information learned about climate change. These can include a wide-range of changes, from how long you spend in the shower, to your mode of transportation, to where you buy products and what types of products you purchase.*

- No, I have not really changed any of my behaviors
- Yes, I have changed a few of my behaviors
- Yes, I have changed some of my behaviors
- Yes, I have changed a lot of my behaviors
- Yes, I have changed most of my behaviors

9 Do you agree or disagree with the following statements:

	Agree	Disagree	Unsure
Climate Change will impact the environment where I work as a dive professional (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Climate Change will impact the dive industry globally (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I wish I personally knew more about climate change as it relates to diving (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



10 In the environment(s) where I work, I have seen the following:

- Coral bleaching
- Decreased coral cover
- Effects of sea level rise (loss of beaches, more sediment on reefs, etc)
- Increasing water temperatures
- Decreased kelp cover / quality
- Increased storm / extreme weather frequency
- I have not seen any evidence of climate change affecting my local environment



11 Of the following conservation programs in diving, which have you heard of, participated in, or never heard of before

	I have heard of:	I have participated in:	I have never heard of:
Project AWARE Specialty Course (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mission 2020 (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reef Check (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mission Deep Blue (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Green Fins (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Coral Watch (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Green the Fleet (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project AWARE Dive Against Debris (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please specify) (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12 Which of the following reflects your engagement with Marine Protected Areas (MPAs)* where you currently work

**For the purposes of this study, "Marine Protected Areas," refer to any formally defined and*

managed marine area in which extractive uses are limited or prohibited. These can include Marine Reserves, Marine Conservation Areas, and fishing no-take zones.

- There are no MPAs near where I work
- I do not know if there are MPAs near where I work
- I sometimes dive in MPAs
- I mostly dive in MPAs
- I don't understand what is meant by Marine Protected Areas



13 Have you ever participated or volunteered in the following:

	Yes	No	I don't know what that is
Coral restoration projects (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Coral nursery maintenance (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Coral implantation (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MPA activities for recreation / leisure (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lionfish derbies / culling events (in Caribbean) (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Ecosystem & Conservation Understanding

Start of Block: Diver Communication & Conservation

14 How often is climate change discussed when where you are a dive professional (among employees, and / or with dive clients / students)?

- Never (climate change is never discussed)
- Rarely (a few times per year)
- Sometimes (a few times a month)
- Often (Weekly)
- Very Often (Daily)

15 Do you, or does your dive shop or company, do pre-trip and post-trip communication* with dive clients and students?

**For the purposes of this study, Pre-trip communication refers to any communication with clients before they arrive on-site to conduct diving. Post-trip communication refers to any communication with clients after they have left your facilities.*

	Yes (1)	No (2)	Unsure (3)
Pre-trip communication (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Post-trip communication (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



16 On Average, how much time do you spend communicating with dive clients / students (in briefings, debriefs, surface intervals etc.) Please answer in number of minutes.



17 What percentage of time do you spend discussing the following in dive briefings or debriefs on a typical dive-day? (Answers should total 100)

Dive Safety (missing buddy procedures, hand signals, emergency procedures, etc) : _____

Local Conditions (currents, swell, surge, dive site information, etc) : _____

Local Points of Interest (marine life, special features, etc) : _____

Environment-Impacts (buoyancy control, finning techniques, arms, etc) : _____

Marine Conservation Topics (climate change, local stressors, observable impacts, etc) : _____

Building Rapport (casual conversation, relationship building) : _____

Other (please specify) : _____

Total : _____

18 Please select if you agree or disagree with the following statements:

	Agree	Disagree	Unsure
The dive industry should play a greater role in global conservation efforts (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Divers should be knowledgeable about threats facing the oceans (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The dive industry must take actions on climate change for its own sake (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The dive industry should educate divers on climate change (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

19 Rate your comfort in explaining the following concepts as they relate to divers

	Very Comfortable	Somewhat Comfortable	Not at all Comfortable
Climate Change (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sea Level Rise (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ocean Acidification (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Eutrophication / Excess Nutrients (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Local threats where I work (please specify) (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20 Please put these in order by dragging and dropping them to rank the importance of the following barriers to teaching climate change to dive students (7 = largest barrier; 1 = smallest barrier)

- _____ Inconclusive science
- _____ Political nature of climate change & fear of offending people
- _____ Lack of resources from training organizations (PADI, NAUI, SSI, etc)
- _____ Lack of resources from independent / non-profit organizations tailored to diving specifically
- _____ Time constraints of diving & dive instruction
- _____ Lack of personal knowledge / expertise on the subject matter
- _____ Other (please specify)



21 Please use the slider to indicate which of the following would be valuable to you in a "climate change tool kit" from an independent non-profit source, for teaching your students more easily (7= most valuable; 1= not at all valuable)

Not at all Valuable Most Valuable

1 2 3 4 5 6 7

Videos on climate change as it relates to diving ()	
Curriculum to introduce climate change to diving students ()	
Regular digest (weekly,monthly) on Climate information and articles related to diving ()	
Posters and other graphics about climate change and diving ()	
In-person training workshops for teaching climate change to divers ()	

End of Block: Diver Communication & Conservation

Start of Block: Location Information

22 Please list your nationality

Nationality(s) _____

23 Please indicate if you work in California

I work in California

I do not work in California

24 I currently work as a dive professional in the country in which I was born

yes

no

25 Please list the countries in which you have worked as a dive professional (up to 5 most recent)

26 Please indicate your gender

- Male
- Female
- Other
- Prefer not to say

End of Block: Location Information

Appendix II: Final Index Scoring

Question Number	Composite Category	Maximum Points	Scoring
4	Knowledge	4	If $\leq 3 \rightarrow 1$ If 4 or 5 $\rightarrow 2$ If $\geq 6 \rightarrow 4$
6	Knowledge	4	If $\leq 3 \rightarrow 1$ If = 4 to 7 $\rightarrow 2$ If $\geq 8 \rightarrow 4$
7	Beliefs	3	Climate change will affect livelihood $\rightarrow 1$ I am worried about climate change $\rightarrow 2$ None of these reflect my beliefs $\rightarrow -1$
8	Actions	14	Yes, most $\rightarrow 14$ Yes, a lot $\rightarrow 10$ Yes, some $\rightarrow 6$ Yes, few $\rightarrow 3$ No $\rightarrow 0$
9	Beliefs	5	1 agree $\rightarrow 1.5$ 2 agree $\rightarrow 2$ 3 agree $\rightarrow 1.5$ Unsure = 0 Disagree $\rightarrow -1$
10	Knowledge	3	Each seen $\rightarrow +1$ ≥ 3 seen $\rightarrow +3$ Not seen $\rightarrow -1$
11	Knowledge	4	Each "heard of" $\rightarrow +0.5$ Never heard of $\rightarrow 0$
11	Actions	16	Each "participated in" $\rightarrow +2$
12	Actions	5	Mostly $\rightarrow +5$ Sometimes / no MPAs $\rightarrow +3$ I don't know $\rightarrow -1$
13	Actions	5	Yes $\rightarrow 1$ No $\rightarrow 0$ Don't know $\rightarrow -1$
18	Beliefs	12	Agree $\rightarrow +3$ Disagree $\rightarrow -1$ Unsure $\rightarrow 0$
19	Knowledge	15	Very comfortable $\rightarrow +3$ Somewhat comfortable $\rightarrow +1$ Not at all $\rightarrow 0$
21	Beliefs	10	6 & 7 $\rightarrow +2$ 3 -5 $\rightarrow +1$ 1 & 2 $\rightarrow 0$

Table AA. Final Index Scoring by Question.

draft_1	beliefs_1	knowledge_1	actions_1
Beliefs = 20 Knowledge = 30 Actions = 50		4	
		4	
	7		
			20
	3		
		3	
		4	16
			6.5
			7.5
	3		
		15	
	7		
	20	30	50
mean_1	8.33333333		
median_1	6.75		
mode_1	3		

Table AB. Index Scoring Draft 1.

draft_2	beliefs_2	knowledge_2	actions_2
Beliefs = 30 Knowledge = 30 Actions = 40		4	
		4	
	7		
			14
	7		
		3	
		4	16
			5
			5
	9		
		15	
	7		
	30	30	40
mean_2	8.33333333		
median_2	7		
mode_2	7		

Table AC. Index Scoring Draft 2.

final_index	beliefs_index	knowledge_index	actions_index
Beliefs = 30 Knowledge = 30 Actions = 40		4	
		4	
	3		
			14
	5		
		3	
		4	16
			5
			5
	12		
		15	
	10		
	30	30	40
mean_index	8.333333333		
median_index	7		
mode_index	7		

Table AD. Final Index Scoring.

Appendix III: Index Compared to Independent Variables.

	Beliefs	Knowledge	Actions	Total Index
Overall Average (n=195)	83%	59%	40%	59%
Demographic: Current Status as Dive Professional (n=195)				
Full-time (83)	83%	60%	40%	59%
Part-time (82)	82%	59%	39%	58%
Inactive (30)	82%	59%	39%	58%
Demographic: Index by Training Organization (n=195)				
PADI (178)	83%	59%	40%	59%
SSI (28)	85%	63%	42%	61%
Other (53)	80%	60%	40%	58%
Multiple (51)	83%	59%	41%	48%
Demographic: Index by Gender (n=195)				
Male (100)	79%	58%	38%	56%
Female (91)	87%	61%	42%	61%
Didn't Say (4)	89%	55%	44%	61%
Geographic: Index by nationalities by region (n=194)				
N. America (80)	85%	58%	43%	60%
Europe (88)	83%	61%	38%	59%
Other (26)	79%	56%	33%	54%
Geographic: Index by California residents (n=194)				
California (26)	83%	54%	36%	56%
Not CA	83%	60%	41%	59%
Geographic: Index by employment in nation of origin (n=193)				
Yes, I work in my native country (76)	84%	59%	40%	59%
No, I do not work in my native country (117)	83%	59%	41%	59%
Geographic: Index by nations of employment (n=317)				
Asia (77)	82%	63%	45%	62%
N. America (52)	85%	60%	46%	62%
Europe (49)	83%	60%	41%	59%
Caribbean (45)	83%	61%	47%	62%
Central America (36)	83%	59%	50%	62%
Oceania (27)	84%	60%	49%	63%
Middle East (18)	85%	59%	40%	59%
Africa (9)	82%	56%	42%	58%
South America (4)	85%	60%	44%	61%
Other: Agreement: standards alone should be taught, Disagreement: beyond standards can be taught; compared to Index				
Disagreement (48)	83%	60%	44%	61%
Neither Agree nor Disagree (118)	84%	59%	40%	59%
Agreement (32)	80%	54%	35%	54%
Other: How often is Climate Change Discussed?				

Very Often (36)	88%	67%	50%	66%
Often (66)	86%	61%	43%	61%
Sometimes (63)	83%	55%	32%	54%
Rarely (25)	72%	54%	39%	53%
Never (5)	74%	49%	26%	47%
Other: Time Spent on Communication by Index				
Less than 30 mins (49)	82%	60%	42%	60%
31-60 mins (49)	85%	57%	44%	60%
61-120 mins (50)	83%	59%	42%	60%
More than 120 mins (28)	80%	59%	42%	59%

Table AE. Index Compared to all Independent Variables. Parenthesis after the heading indicates the number of respondents or mentions. See Appendix I for the complete wording of the survey questions.