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## DIVE TOURISM IN LUGANVILLE, VANUATU: SHOCKS, STRESSORS, AND VULNERABILITY TO CLIMATE CHANGE

LOUISE MUNK KLINT,\* MIN JIANG,\* ALEXANDRA LAW,\* TERRY DELACY,\*  
SEBASTIAN FILEP,\* EMMA CALGARO,† DALE DOMINEY-HOWES,‡ and DAVID HARRISON§

\*Centre for Tourism and Services Research, Victoria University, Melbourne, Australia

†Department of Environment and Geography, Macquarie University, Sydney, Australia

‡Australian Tsunami Research Center and Natural Hazards Research Laboratory,  
University of New South Wales, Sydney, Australia

§School of Tourism and Hospitality, University of South Pacific, Suva, Fiji

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Luganville is a developing dive tourism destination region (DTDR) in Vanuatu, which relies on tourism. This article reports on the shocks and stressors faced by Luganville's dive tourism sector and climate change's exacerbation of these. The study's methodology was based on rapid rural appraisal and case study principles, involving methods of semistructured interviews, group discussions, and personal observations. Data were analyzed using a thematic analysis approach. Key shocks identified include cyclones, earthquakes, effect on demand due to media footage, and changes to international flights. Main stressors were starfish outbreaks and environmental degradation. Unlike the indigenous communities, expatriates show little concern for the potential impact of climate change, presenting response challenges that must incorporate different perspectives to develop effective adaptation options.

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**Key words:** Dive tourism; Climate change; Vulnerability; Shocks and stressors; Vanuatu

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### Introduction

The Earth's climate is changing. The Intergovernmental Panel on Climate Change (IPCC) (2007a) concluded in their Fourth Assessment Report<sup>1</sup> that even with radioactive forcing agents<sup>2</sup> stabilized at year 2000 levels, a general warming of the Earth will occur and that sea level rise will continue. This will impact on physical, as well as biological systems all around the world (IPPC, 2007a;

Pearman, 2008). Scientists (Commonwealth of Australia, 2011; IPCC, 2007a; Preston, Suppiah, Macadam, & Bathols, 2006) predict sea level rise, temperature increases (sea and air), more intense cyclones, changes in precipitation, and increases in extreme weather events as a result of climate change. Thus, climate change will have an effect on human activities globally as well as locally.

Tourism is an important economic but highly climate sensitive sector in Pacific Island Countries

and Territories (PICTs). Tourism represents an opportunity for these nations to compete in global markets and accounts for between 3% (i.e., Tuvalu) and 47% (i.e., Cook Islands) of gross domestic product (GDP) (Commonwealth of Australia, 2006). For approximately half of PICTs, tourism is the leading export earner (Becken & Hay, 2007; Commonwealth of Australia, 2009). The tourism sector in many tropical nations is based heavily on the sun, sea, and sand attractions (Briguglio, Archer, Jafari, & Wall, 1996, p. 206), making climate a key determining factor in the decision-making process for tourists (Uyarra et al., 2005). Therefore, tourism is highly sensitive to changes to the climate and natural resources (Moore, 2010; Payet, 2008; Scott et al., 2008). Sea level rise and resultant inundation from storm surges threaten coastal tourism infrastructure (Belle & Bramwell, 2005; Commonwealth of Australia, 2011; Richardson & Witkowski, 2010) and communities (Buultjens, White, & Willacy, 2007). Apart from the direct impacts, the tourism sector may also experience indirect impacts. For example, even modest ocean warming causes coral bleaching (Riegl, Bruckner, Coles, Renaud, & Dodge, 2009) affecting coral reefs as tourism attractions (Cesar, 2000; Commonwealth of Australia, 2011; Hall & Higham, 2005; Sem & Moore, 2009; Tourism Authority Thailand [TAT], 2011). As stated by Becken and Hay (2007), these indirect impacts may also include discomfort, ill health, coastal erosion, land loss, and acidity of water affecting the health of reef systems. The tourism literature has in recent years acknowledged the impact (direct, as well as indirect) that climate change will have on the sector and identified the need to address this challenge now (Becken & Hay, 2007; Hall & Higham, 2005; Scott et al., 2008; Sem & Moore, 2009; World Tourism Organization [WTO], 2003).

Like the tourism sector, small island developing states and territories (SIDST) are vulnerable to climate change (Mehéux, Dominey-Howes, & Lloyd, 2007). In their Fourth Assessment Report (FAR), the IPCC (2007b) stated<sup>3</sup> that the characteristics of small island states “make them especially vulnerable to the effects of climate change, sea-level rise, and extreme events” (p. 689). General characteristics of SIDST include, but are not limited to, their

small physical size and isolation; limited natural resources; a proneness to natural hazards and climate extremes; poorly developed infrastructure (Lück, 2008); limited freshwater resources; high population density and growth rates; limited economic and human resources; and a low economic resilience due to the high sensitivity to changes in external markets (IPCC, 2007b; Mehéux et al., 2007; Sem & Moore, 2009). Consequently, SIDS are more vulnerable to climate change than other nations.

Tourism in SIDST is particularly vulnerable to the impacts of climate change. Vulnerability has been defined as the exposure of a system to stressors (Adger, Kelly, & Ninh, 2001). Nevertheless, as Romieu, Welle, Schneiderbauer, Pelling, and Vinchon (2010) state, assessing the vulnerability at a community scale can include pressures from both shocks (short-term events, such as natural hazards) and stressors (long-term processes, such as climate change or environmental degradation). The tourism sector in SIDST is especially vulnerable when the sector depends on natural resources, like coral reefs, fisheries, and beaches (Richardson & Witkowski, 2010). For example, coral reefs play an important role to many nations by being a source of coastal protection, food, income, employment, and being a contributor to beach formation (Burke, Reyta, Spalding, & Perry, 2011; de Groot, Wilson, & Boumans, 2002). Yet, this natural ecosystem is one of the most sensitive natural systems to the effects of climate change (Riegl et al., 2009).

Vanuatu has been highlighted as a nation which is especially vulnerable to climate change (Global Environmental Facility [GEF], United Nations Development Program [UNDP], & Secretariat of the Pacific Regional Environmental Program [SPREP], 2009; Pelesikoti, Government of Vanuatu & Pacific Disaster Risk Management Partnership Network, 2007; Sem & Moore, 2009). Other PICTs, such as Samoa also have a high coral reef threat exposure and high reef dependence, but due to high levels of adaptive capacity are less vulnerable (Burke et al., 2011). Vanuatu, on the other hand, has been pinpointed as a nation “with high to very high exposure and reef dependence, and low to medium adaptive capacity” (Burke et al., 2011, p. 74), and this vulnerability will influence various economic sectors and

local livelihoods. Consequently, Vanuatu's tourism sector and in particular, its dive subsector (which is so important to its people's future livelihood), is threatened by the effects of climate change.

This article aims to determine the current key shocks and stressors faced by the dive tourism sector in Vanuatu, with a particular focus on the destination of Luganville, thereby providing a foundation for assessing its vulnerability. The article then discusses how these shocks and stressors may be exacerbated by climate change. Finally, the varying perceptions of stakeholders to climate change risks are assessed as a basis for developing effective adaptation strategies.

### The Study Site: The Dive Tourism System in Luganville, Vanuatu

Vanuatu is a small island state located in the South West Pacific (Fig. 1) offering an abundance of natural tourist attractions, including coral reefs, beaches, waterfalls, and a warm climate year round (Méheux & Parker, 2004). In 2009, tourism and travel contributed 37.55% of Vanuatu's GDP and represented 33.6% of the employment (World Travel & Tourism Council, [WTTC], 2009). Tourism represents one of the main foreign exchange earners (Republic of Vanuatu, Global Environment Facility [GEF], United Nations Development Program [UNDP], United Nations Framework Convention on Climate Change [UNFCCC], & National Advisory Committee on Climate Change [NACCC], 2007). In 2008, Vanuatu received 196,795 international tourism arrivals, 90,657 of which arrived by air and a further 106,138 arrived by cruise ship (Vanuatu National Statistics Office [VNSO], 2009). However, tourism is still in the early stages of development with the majority of larger hotels being owned or operated by foreigners (expatriates) and enterprises at the lower end of the market being owned by Ni-Vanuatu (indigenous people of Vanuatu) (Harrison, 2003, p. 18).

### *Luganville's Dive Tourism Destination Region (DTDR)*

Luganville—a small municipality on the island of Espiritú Santo (colloquially called Santo) in the SANMA province of Vanuatu—is a key dive tourism

destination region (DTDR). Accounting for approximately 10% of visitors arriving by air to Vanuatu, Santo is the second most visited destination (TRIP Consultants, 2008) providing just under 200 rooms (South Pacific Tourism Council [SPTO], 2003).

Dive tourism is of key importance to Luganville as compared to Port Vila or Tanna, which are the two other main tourism destinations in Vanuatu (SPTO, 2003; Vanuatu National Statistics Office [VNSO], 2007). As the Lonely Planet guide states, "Want to dive? Then Santo is the place to be. In fact, you shouldn't come to Santo without trying a dive" (Harewood, Chinula, Talbot, Carillet, & Sorokin, 2006, p. 128). The key dive sites in Luganville include the world famous SS President Coolidge (called the Coolidge) and Million Dollar Point. The SS President Coolidge is an American World War II (WWII) carrier wreck located off the coast of Luganville. The wreck is highly accessible (considered one of the most accessible wrecks in the world) and is ranked in the top 15 dive sites of the world (Garrod & Gössling, 2008). The Million Dollar point is an "undersea junkyard," left as a memory to the presence of the US military during the WWII, followed by smaller wrecks, coral reef sites, and blue holes. Apart from the wrecks, the coral reefs located off the coasts of Vanuatu make diving and snorkeling an important tourism activity. Snorkeling topped the list of activities engaged in by visitors while in Vanuatu (VNSO, 2007). However, the destination's tourism sector is small in scale and in the early stages of its development.

The dive tourism subsector, like any other tourism subsector, is complex in its structure and involves a range of stakeholders with numerous linkages to other sectors, such as agriculture, construction, transport, and entertainment (Weaver & Oppermann, 2000, p. 256). As a result of an in-country policy analysis (see Klint et al., in press), Figure 2 provides an overview of the dive tourism system with a focus on Luganville, its key players and attractions.

Luganville's DTDR comprise natural and cultural attractions, private sector businesses, including dive operators, accommodation, cafés and restaurants, tour operators, and local transport. This is supported by the work done by NGOs and the policies and practices of the public sector, whether

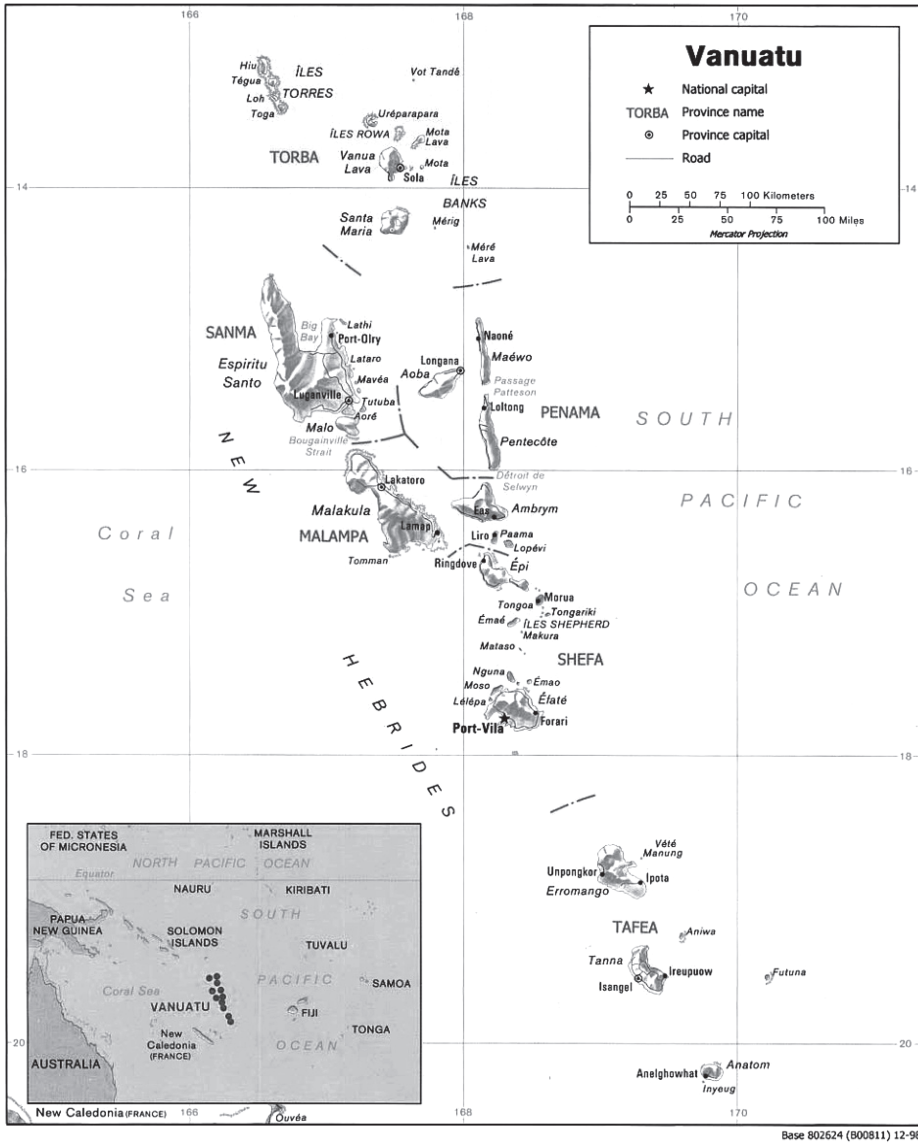


Figure 1. Map of the Republic of Vanuatu situated within the SW Pacific (University of Texas Libraries, 1998).

at local, regional, or national level. The main driver of the system is the arrival of the tourists, linking the Tourism Generating Region (TGR) and the Transit Route (TR) to the whole functioning of the system. The municipality, like Vanuatu in general, relies on tourism for much of its cash economy and although other sectors such as agriculture, forestry, and fisheries are important (Republic of Vanuatu et al., 2007), tourism presents a real opportunity for improved livelihoods.

### Climate Change in Vanuatu

Vanuatu may be impacted by climate change in a range of ways. The National Adaptation Program for Action (NAPA)<sup>4</sup> report for Vanuatu (Republic of Vanuatu et al., 2007) stated that Vanuatu is highly vulnerable to climate change, and noted the following key issues: coastal erosion, cyclones, flooding, intense and prolonged rainfall, landslides, expansion of mosquito distribution inland, scarcity

of water sources and salinity of groundwater, increases in temperature that potentially will impact agricultural crops, and drought as a result of El Niño events. In addition, the SANMA province will also experience increased ciguatera incidences (food poisoning caused by the ingestion of seafood with ciguatoxin) and is vulnerable to climate change due to a limited awareness of climate change (Republic of Vanuatu et al., 2007). Consequently, climate change will likely produce a series of impacts affecting key sectors.

Climate change can influence future disaster risks in a number of ways: (1) it can increase the possibility of weather and climate hazards; (2) it can increase the vulnerability of communities and (3) it can produce higher levels of hazard exposure to more people (Bhatia et al., 2010). As the NAPA report highlights: "Climate change will impact on tourism, the marine and terrestrial biodiversity, and as a consequence on the livelihoods of local communities" (Republic of Vanuatu et al., 2007, p. 42). All of these impacts can take the form of potential shocks and stressors that can influence dive tourism's vulnerability to climate change. As Harrison

(2003, p. 14) emphasizes, the crucial resources for tourism in Pacific Islands are terrestrial and marine attractions. Yet, these resources are already stressed from the existing population pressures and environmental pollution (Pacific Islands Regional Assessment Group, 2001). Therefore, the key challenge for Vanuatu will be to address current shocks and stressors that are impacting tourism and the nation, while at the same time, reducing their vulnerability to future climate change.

## Methodology

### Case Study Approach

The analysis of vulnerability always begins with who (the system) is vulnerable and to what (the shocks and stressors), making the event (or events) that destabilizes the existing system the natural starting point for the analysis of a destinations vulnerability levels (Calgaro, 2010). Individual shocks and stressors can be identified from scientific reports, but vulnerability is place (Calgaro, 2010) or system (Füssel, 2007) specific. Due to this place/system-based nature of vulnerability, a case study approach

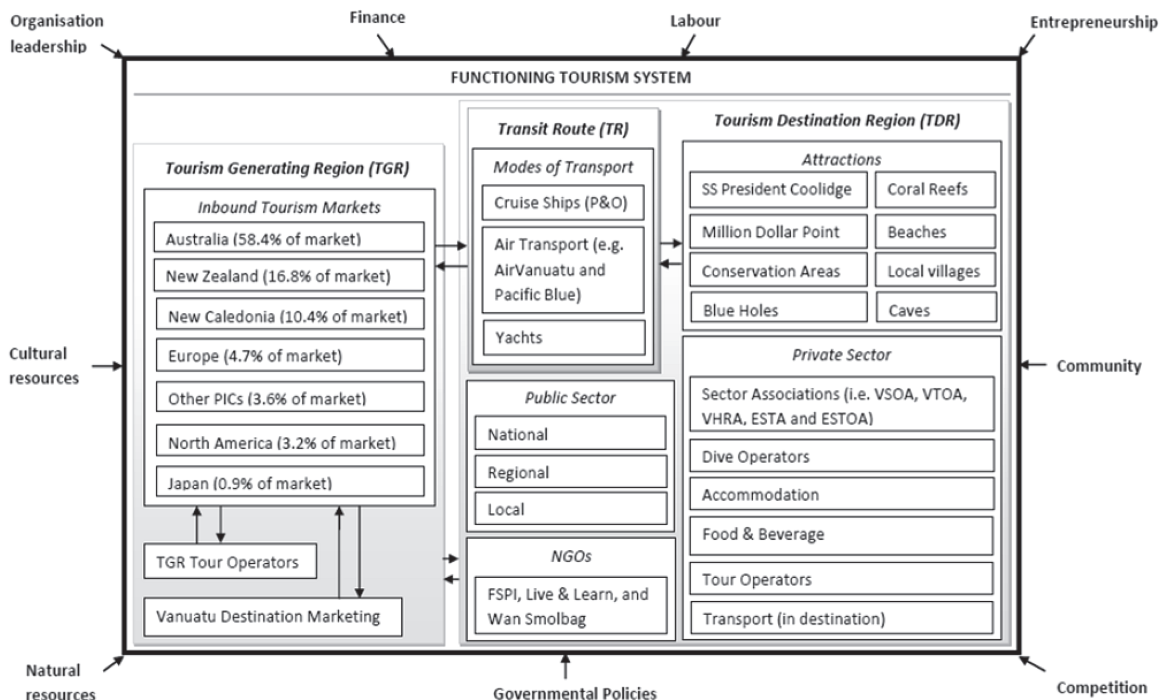


Figure 2. Luganville's dive tourism system. Based on primary data (Gunn, 1994; Leiper, 2004; TRIP Consultants, 2008).



was selected to provide a deeper understanding of the vulnerability of the DTDR through an assessment of the shocks and stressors experienced by this sector (Berg, 2007). The case study is primarily intrinsic in nature as the study is assessing the vulnerability of the dive tourism system in Vanuatu, but becomes an instrumental case study when the results provide an insight into the vulnerability of PICTs and generalizations can be made (Stake, 2005). Gallopín (2006) states;

vulnerability is a function of the system's sensitivity and capacity of response, and the transformation suffered by the system is a function of its vulnerability, the properties of the perturbation, and the exposure of the system to the perturbation." (p. 296)

In other words, analyzing the vulnerability of a system effectively requires an understanding of the dynamic nature of a systems interaction with hazards, such as shocks and stressors (Dazé, Ambrose, & Ehrhardt, 2009). Diverse systems are more tolerant to disturbances and environmental conditions than are simple systems (Fraser, 2003). Therefore, a broader understanding of the system is required.

### *Rapid Rural Appraisal*

Due to the complexity and diversity of the DTDR system, this study also made use of the rapid rural appraisal methodology. Developed in the 1970s, Rapid Rural Appraisal (RRA) is the umbrella term for a number of methodologies involving a multidisciplinary team, working with the local community (initially farming communities) in a rapid yet systematic manner (McCracken, Pretty, & Conway, 1988). This study combined the RRA with the case study methodology, as RRA approaches and methods can provide qualitative information and insights that traditional methods cannot (Chambers, 1992). A team of three researchers went to Vanuatu from September 26 to October 17, 2010 to collect primary data. It was a multidisciplinary team covering legal and tourism backgrounds with both environment and cultural heritage oriented researchers.

### *Methods*

Multimethod research is highly valuable allowing for different aspects of a research problem to be

illuminated (Henninck, 2007). The use of multiple methods also allows for multifaceted meanings (people may view the same phenomena in different ways) to be summarized in a finite article, thereby allowing the reader to develop his/her view on the phenomena (Stake, 2005). Therefore, a number of methods were applied to the case study to ensure enough information was gained about Luganville's DTDR (the case) in Vanuatu (Stake, 2005). The methods used during this study included semistructured interviews (28), group discussions (3), and personal observations recorded in fieldtrip diaries (3). Each of these methods has advantages and disadvantages, as shown in Table 1.

### *Sample and Sampling Techniques*

Respondents were selected through purposeful sampling techniques to allow for information-rich cases that could provide significant information about the issues being studied (Patton, 2002). The data sample included in total 28 interviews, including 13 with government, 11 with the tourism industry, and 4 with NGOs and donors, 3 group discussions, including 1 with Port Vila based dive operators (expatriate), 1 with Santo tour operators (Ni-Vanuatu), and 1 with a Santo community (Ni-Vanuatu), and 3 fieldtrip diaries. The data sample included 25 females and 52 males of which 18 were expatriate and 58 Ni-Vanuatu. The sample is skewed slightly, as the community meeting involved 32 Ni-Vanuatu community members, but not all spoke. To ensure confidentiality of respondents, a further break down of the sample has not been provided.

### *Interview Questions*

The interview questions were adapted from a recent study, which used a systems approach to assess the vulnerability and resilience of tourism destinations in Thailand after experiencing the shock of the 2004 Indian Ocean tsunami (Calgaro, 2010). The interview questions covered events that had affected tourism and/or the destination in the past (i.e., shocks and stressors), tourism system and destination characteristics (natural, sociocultural, and economic), and past adjustments and adaptations undertaken. Table 2 details a sample of the questions that were asked under each theme. All

Table 1  
A Selection of Advantages and Disadvantages for the Methods Applied in This study

Method	Advantages of Method	Disadvantages	References
Semistructured interviews	<ul style="list-style-type: none"> <li>• Information about actions and reactions, motives and meanings of people in the context of everyday life can be captured</li> <li>• Based on a set of topics rather than standardized questions</li> <li>• Allows for clarification and detailed responses</li> </ul>	<ul style="list-style-type: none"> <li>• Importance of rapport between participant and researcher</li> <li>• Recording of interviews may inhibit the conversations</li> <li>• Data capturing and analyzing is slow and time consuming</li> </ul>	Babbie (2007), Gray (2004), Minichiello, Arnoi, Timewell, & Alexander (1995)
Group discussion	<ul style="list-style-type: none"> <li>• Valuable qualitative data can be gained about the topic of interest through discussion in permissive and nonthreatening environment</li> <li>• A range of views can be recorded</li> <li>• New issues can be identified</li> </ul>	<ul style="list-style-type: none"> <li>• Absolute confidentiality cannot be ensured, as participants reveal themselves to others</li> <li>• Influence of social pressure</li> <li>• Group dynamics will influence the data collected</li> <li>• Researcher has less control than in a individual interview</li> </ul>	Babbie (2007), Henninck (2007), Krueger and Casey (2009), Smith (1995)
Personal Observations	<ul style="list-style-type: none"> <li>• Allows for exploring the world in many ways</li> <li>• Presence of the observer</li> </ul>	<ul style="list-style-type: none"> <li>• Observer is part of the activity, unless the observer takes the role of spectator</li> <li>• Not all observations are recorded</li> </ul>	Babbie (2007), Patton (2002)
Fieldtrip diaries	<ul style="list-style-type: none"> <li>• Provides a reflection of things that were mentioned or not mentioned as well as what was observed</li> </ul>	<ul style="list-style-type: none"> <li>• Fieldtrip diaries need to be written immediately after an activity</li> </ul>	Minichiello et al. (1995)

Table 2  
Examples of Semistructured Interview Questions

Theme of Questions	Types of Questions
Exposure to shocks and stressors	<ul style="list-style-type: none"> <li>• What events have affected tourism numbers and business in the past 15 years (since 1995–96)?</li> <li>• Has Vanuatu experienced an increase or decrease in tourism numbers following negative events (political unrest, natural disasters, and health epidemics) that have occurred in-the Asia-Pacific (rival destinations)?</li> </ul>
Sensitivity of system	<ul style="list-style-type: none"> <li>• What skills and training/education opportunities are available for the locals to draw upon to set up tourism-related businesses?</li> <li>• Do the current policies and plans include building standards and or development regulations (including coastal set-backs)?</li> </ul>
Adaptive capacity of system	<ul style="list-style-type: none"> <li>• Are you aware of any existing/planned government policies that are designed to assist the tourism industry and your communities to respond to climate change?</li> <li>• Are you concerned about climate change's impact on tourism (including diving) activities?</li> </ul>



interviews were conducted in English, apart from the community meeting where one of the respondents helped translate English to Bislama and vice versa. Bislama is the official national language of Vanuatu and a type of Pidgin English (Harewood et al., 2006).

The group discussions followed a detailed question outline covering the five categories of questions (i.e., opening, introductory, transition, key, and ending), as adapted from Krueger and Casey (2009). Questions included among others: 1) Who is involved in making tourism work in Luganville/Vanuatu?; 2) Tell us about an event which has occurred in the past, where you have had to change your way of life or business?; 3) Using the most concerning stressor and shock (these terms were defined to the participants), what are the actions that are needed to deal with shocks/stressors? The group discussion participants were then provided with a written summary of the discussions post data collection for their approval.

### *Thematic Analysis of Data*

A thematic analysis was applied to the transcripts using the NVivo software (Patton, 2002), in line with Calgaro (2010). A thematic analysis (a subcategory of content analysis) is carried out through the identification of categorical themes that are identified in the data as core meanings of the data (Patton, 2002). As one of the aims of this article was to identify the current key shocks and stressors experienced by the dive tourism sector, these two themes were used in the analysis. The theme of shocks included the following subthemes: *cyclones*, *earthquakes*, *effect on demand due to media coverage*, and *changes to international flights*. The theme of stressors involved the following subthemes: *Crown-of-thorns (COTS) outbreaks* and *environmental degradation*.

A third theme was applied exploring the participant's perceptions of climate change, as there was a divergence in the perceptions held by Ni-Vanuatu and expatriates. This may have an impact on the vulnerability of the sector, as perceptions related to the scale (significance, as well as timing) of a threat (e.g., climate change) influence our response to environmental problems (Belle & Bramwell, 2005). It is worth noting that interviewees were not

asked directly what they thought about climate change, but questions under the climate change and adaptation section of the semistructured interview question outline, such as *Are you concerned about climate change's impact on tourism (including diving) activities?* helped identify the respondents' perception of climate change.

### Results

Two tables have been developed to show the results of the study. Table 3 lists the key shocks and stressors, the number of interviews in which the shock or stressor was mentioned, a number of illustrative examples from the interviews for each of the shocks and stressors, and a brief summary of how climate change may exacerbate these individual shocks and stressors.

Table 3 highlights the shocks and stressors that were of key concern to the stakeholders of the dive tourism system. This was identified by the number of data sources that included coding nodes of the particular shock and/or stressor. *Cyclones* and *earthquakes* stood out as the most frequently mentioned shocks. These are of environmental nature, which is not surprising due to the geographical location of Vanuatu in a disaster prone area (Méheux & Parker, 2004). Two anthropogenic shocks were also identified in terms of *the effect on demand due to media coverage* and *changes to direct international flights*.

Table 4 provides a synthesis of perceptions held by Ni-Vanuatu and expatriate respondents. As the study did not set out to identify the respondent's perception of climate change, not all data sources (interviews and group discussions) provided a clear indication of the respondent's perception of climate change. All sources with a clear link to the respondent's perception of climate change have been included in Table 4.

Table 4 indicates that Ni-Vanuatu stakeholders are more concerned than expatriate stakeholders. Expatriate stakeholders seem to be much more skeptical towards climate change than the Ni-Vanuatu stakeholders, although some Ni-Vanuatu respondents are less concerned than others. Further studies into the perception of the two types of stakeholders would clarify why there seems to be such divergent views. The results from both Table

Table 3

Key Shocks and Stressors Identified in Data, Number of Interviews (Single and Group Discussions) in Which Shock or Stressor Was Identified, Illustrative Examples From the Data, and Climate Change's Possible Exacerbation of the Individual Shocks and Stressors, as Identified in the Literature

Shocks & Stressors	No. of Source Mentions	Illustrative Examples	Climate Change's Exacerbation of Shocks & Stressors
<i>Shocks</i>			
Cyclones	24	<ul style="list-style-type: none"> <li>• "Natural disasters, such as cyclones, have affected infrastructure, which then limits the number of tourists that come here." (donor agency)</li> <li>• "Extreme events have had an impact—the one that springs to mind is Cyclone Uma, which wiped out the infrastructure in 1987." (public sector)</li> <li>• "Many expats have not seen a cyclone in their time in Vanuatu. Building standards have gone down as a result of this, so when a cyclone hits it will hit hard." (private sector)</li> <li>• Cyclone—immediately after you see a decrease in tourist numbers. (public sector)</li> <li>• "The 1999 Zuman [Cyclone]—the entire village and Luganville was destroyed. It took one month to rebuild by all 3,000 people in the community." (group discussion, Santo community)</li> </ul>	<ul style="list-style-type: none"> <li>• More severe and frequent cyclones (Commonwealth of Australia, 2011; IPCC, 2007a; Preston et al., 2006)</li> </ul>
Earthquakes	21	<ul style="list-style-type: none"> <li>• "Recent earthquake had a real impact because of attitudes. 10–15 people flew home and packed up." (group discussion, Port Vila-based dive operators)</li> <li>• "Latest earthquake no impact on tourism. [It measured] 7.5. [and] only affected Efate." (public sector)</li> <li>• "Major earthquake, but no major damages, tourism industry has not been affected greatly." (public sector)</li> <li>• "Worry about disasters as in disaster zone. Right in the fault line. Been through 15 earthquakes in the last 3–4 years." (donor agency)</li> </ul>	<ul style="list-style-type: none"> <li>• Earthquakes are non-climatic events (Mirza, 2003) and, therefore, climate change cannot exacerbate this shock directly.</li> </ul>
Effect on demand due to media footage	11	<ul style="list-style-type: none"> <li>• "The publicity of the recent earthquake caused cancellations of bookings." (private sector)</li> <li>• "Climate change—it has to be something drastic. I am a bit of a sceptic. However, media could have an impact." (private sector)</li> <li>• "Rape is a common thing happening—a few have happened to tourists (1–2 cases). Really need chiefs and elders to help prevent this. Really bad with violence being displayed in media." (public sector)</li> <li>• "Media—when cyclones hit, people do not realize that Vanuatu is an archipelago and that therefore cyclones do not impact all parts of Vanuatu." (public sector)</li> <li>• "Australia and New Zealand impacts will impact on flow of tourists, for example if media picks up incidence related to NZ or Australian visitors. 72 hours" (public sector)</li> </ul>	<ul style="list-style-type: none"> <li>• Changes to the demand of tourism: Changes to the number of tourist arrivals; Changes to the seasonality; Changes to the types of activities undertaken.</li> </ul>

*continued*

Table 3  
Continued

Shocks & Stressors	No. of Source Mentions	Illustrative Examples	Climate Change's Exacerbation of Shocks & Stressors
Changes to direct international flights	11	<ul style="list-style-type: none"><li>• "It [a decrease in tourism numbers] just happened last time when government stopped the direct flight from Brisbane. It was very difficult for business. I am afraid of flight changes in the future, the government changes every four years and this could have an impact" (private sector)</li><li>• "AirVanuatu cancelled international flights from Brisbane—it took a while to recover" (private sector)</li></ul>	<ul style="list-style-type: none"><li>• Carbon taxes may affect flights or demand (Cohen &amp; Higham, 2010; DeLacy &amp; Lipman, 2010; Nurse et al., 2009).</li><li>• Local climate change policies may affect international flights (DeLacy &amp; Lipman, 2010).</li></ul>
<i>Stressors</i> Crown-of-thorn starfish (COTS) outbreaks	6	<ul style="list-style-type: none"><li>• "A recent CRC (coral reef check) study stated that one to two Crown-of-thorns per hectare of reef is sustainable. Here you have four to five on a hectare . . . 3 years ago, 50% less tourists, no boats, no EIA assessments, but also no Crown of Thorns" (private sector)</li><li>• COTS outbreaks, 20–30 picked up a day, dry out and bury them. (private sector)</li><li>• "Crown of Thorns damage is a major issue." (group discussion, Port Vila-based dive operators)</li><li>• People have been "tearing down trees to get more gardens, [they] don't understand the impact of this in relation to climate change" (public sector)</li><li>• "Can we make a product out of dead coral reefs?" (private sector)</li><li>• "Filling up the lagoon, destroying mangroves—the lungs of the oceans. Ultimate do not touch. Now they wonder why the water is not clear any more. . . . Lagoons are a real issue—water quality going down." (private sector)</li><li>• "Resorts developed on water front have led to coastal damage. Tourists walking over corals with reef shoes." (NGO)</li></ul>	<ul style="list-style-type: none"><li>• Higher sea temperatures can increase COTS outbreaks through: Faster development of larval COTS; and The death of 'crustacean guards' (Hoegh-Guldberg, 1999).</li></ul>
Environmental degradation	12		<ul style="list-style-type: none"><li>• Additional stress on ecosystems that in some cases may lead to the collapse of ecosystems (The World Bank, 2010).</li></ul>

Table 4

Broad Overview of Perceptions About Climate Change, Expatriate Versus Ni-Vanuatu Views

Expatriate Perceptions of Climate Change	Ni-Vanuatu Perceptions of Climate Change
<ul style="list-style-type: none"> <li>• “Cyclone, damage to coral and boats. 1980s–1990s—a lot more cyclones than now. Can’t blame climate change for everything.” (group discussion, Port Vila dive operators)</li> <li>• “Climate change—no idea. . . . Global warming—not warming at all, now they call it climate change. I believe climate change is just like the big millennium panic. The climate has changed for centuries. Was there the ability to notice the changes back then when.” (private sector)</li> <li>• “Climate change—it has to be something drastic. I am a bit of a sceptic.” (private sector)</li> <li>• “Don’t know much about climate change, don’t see the change here. It is something that happens overseas. 5 years—no cyclones. Not mentioned at any sector association meetings.” (private sector)</li> <li>• “Climate change’s impact—I’m not really concerned. It is a constant debate whether human or natural. If sea level rises, this will impact some coastal areas, but many Ni-Vans live inland, high ground (not like Kiribati).” (public sector)</li> <li>• “Climate change—I don’t think there is enough ramifications.” (private sector)</li> <li>• “Private sector nominated by expats, they have a sceptical view of climate change. Quite difficult to bring up the topic without negative comments.” (donor agency)</li> <li>• “Concerned about climate change’s impact. We’re all concerned. Don’t have enough information about climate change. This should be provided by governments, schools, and media (i.e., radio).” (private sector)</li> <li>• “Tourists do not talk about climate change. . . . I am worried about climate change, there are signs of erosion, it is a big issue for diving and snorkelling.” “Worried about climate change—a worry for everyone.” (private sector)</li> </ul>	<ul style="list-style-type: none"> <li>• “Climate change is a global thing and involves the economy . . . Policies may affect their investment sector, so we need to be involved in climate change adaptation. Climate change is everybody’s business.” (public sector)</li> <li>• “Climate change is an issue that is very challenging and therefore we are starting to diverse our activities” (public sector)</li> <li>• “For small island states, climate change will impact tourism development. . . . I am scared of carbon taxes’ impact. We still don’t have a policy in place to look into this.” (public sector)</li> <li>• “In education department they tend to teach more about geography and animals. They should teach about climate change.” (group discussion, Santo community)</li> <li>• “Vanuatu is vulnerable to climate change and natural disasters.” (public sector)</li> <li>• “We do take climate change as a serious concern. When investors come we advise them to build 50 metres away from the high water mark.” (public sector)</li> <li>• “Climate change—I am worried to a certain degree, especially along coast line and low lying areas.” (public sector)</li> <li>• “I am worried about climate change, seeing changes. . . . I am worried about the environment, climate change—I do worry a lot about it.” (public sector)</li> <li>• “I am concerned about climate change’s impact on tourism. If climate change happens it will impact the entire community, will impact spending and saving of money and then my job in the end.” (public sector)</li> <li>• “Our islands are big enough to be resilient to climate change compared to other nations. They can sustain more compared to Tonga.” (public sector)</li> <li>• “Yes, I am concerned about climate change’s impact. It impacts the livelihood of people as they depend on tourism to pay for school and bring food on the table. I am worried about cyclones, tsunamis, and affect on marine life. People put their life in building bungalows in coastal areas. If wiped out in cyclone or tsunami—it is a real concern.” (public sector)</li> <li>• “I am afraid of climate change, it is hot every day and there will be water issues, some places will lose the underground water [supply]. Now with drought and long times of sun it is a real issue” (private sector)</li> </ul>

3 and 4 will be discussed further in the following section.

#### Discussions: Understanding the Impact of Climate Change on the DTDR System in Vanuatu

Vanuatu’s dive tourism system is currently facing a number of shocks and stressors. Table 3 outlines the key shocks and stressors that have been identified through the interviews and group discussions. These include: *cyclones*, *earthquakes*, *effect on demand due to media footage*, and *changes to direct international flights*. Notable stressors include *COTS outbreaks* and *environmental degradation*.

Climate change may impact these shocks and stressors in various ways and may lead to an exacerbation of these shocks and/or stressors. If they are exacerbated, it will have a potentially serious impact on the tourism system. The following will provide a discussion of each of these results.

#### *Shocks and Climate Change Exacerbation*

Four key shocks have been identified for Vanuatu: cyclones, earthquakes, effect on demand from media coverage, and changes to flights. More than 120 cyclones have affected water resources, infrastructure (transport and health), and food crops in

Vanuatu since 1939 with Cyclone Uma (1987) costing the economy an estimated AU\$25 million (approx. VT 2.3 billion) while Cyclone Ivy (2004) cost an estimated VT\$427.6 million (approx. AU\$4.6 million) (GEF et al., 2009). In terms of storms, Vanuatu ranks number eight in terms of relative GDP exposure (Bhatia et al., 2010). Consequently, cyclones have affected the dive tourism system in Vanuatu in the past, and with cyclones projected to increase in intensity, this shock will continue to impact the tourism sector in the future. One expatriate interviewee from the private sector highlighted that the tourism system has experienced cyclones in the past, but unless it was a major disaster, "it only takes a few months to recover."

As climate scientists have predicted that cyclone intensity will increase in future years (Nicholls & Lowe, 2004), climate change will likely exacerbate this existing shock. As argued by Méheux et al. (2007), coral reefs in SIDST may be affected by tropical cyclones. Cyclones affect the coastal environment through storm surges and large waves (Nicholls & Lowe, 2004), and with recent cyclone damages to reefs reported in Vanuatu (Morris & Mackay, 2008), any increase in cyclone intensity and frequency may have major implications for dive tourism. It can also have significant implications for the tourism sector more generally, because of the importance of coral reefs to the provision of seafood, the protection of shorelines including to the impact from tsunamis, the attractiveness of these for recreational services (Folke et al., 2002), and as a natural resource base for tourism (Sem & Moore, 2009). Furthermore, critical infrastructure is often located in coastal areas of SIDST and these coastal areas form the centre of tourism activity (Sem & Moore, 2009).

Earthquakes are also significant shock events experienced in Vanuatu. Earthquakes are nonclimatic events and cannot be exacerbated by climate change. On the other hand, "Vanuatu has the world's highest relative GDP exposure" (Bhatia et al., 2010, p. 10) accounting for a 60.4% loss related to the GDP. This economic exposure may influence the overall vulnerability of the DTDR. Although the current data represented in Table 3 indicate that the tourism sector did not experience any significant changes, albeit from the direct impact on the tourism demand, which links to the third key shock.

Media coverage plays a key role in affecting tourism destination choice. Hall and Higham (2005) highlighted the potential role that media can play in people's perception of place. Negative media coverage, such as that of terrorism or political upheaval can influence the individual's perception of a destination (Sönmez, Apostolopoulos, & Tarlow, 1999). The role media plays in destination choice also becomes clear in the case of Vanuatu's dive tourism sector. As two NGO representatives highlighted, the political turmoil in neighboring countries like Fiji, and the ethnic conflicts in the Solomons have had a positive impact on tourism numbers in Vanuatu. This is supported by local newspapers (Nadkarni, 2007), but can at the same time affect negatively on tourism arrivals in the Pacific in general (Cheer, 2010). Similarly, riots in Luganville reported in the media present a real threat to the tourism destination. As an industry representative mentions in regards to local conflicts: "Once the media hits the market, it slows down the numbers and it affects our business." Positive impacts from media coverage include the declaration of Vanuatu being the happiest place on Earth in 2006 (Marks, Abdallah, Simms, & Thompson, 2006; Nadkarni, 2007) and the world's happiest place in 2010 (Lonely Planet, 2010).

The degradation of coral reefs whether caused by cyclones, temperature increases or human activities have impacted the image of dive destinations negatively in the past (Cesar, 2000). Therefore, should climate change exacerbate cyclone intensity or coral bleaching then resulting media coverage poses a very real threat to the local dive tourism sector. Such a possibility should be tested empirically via interviews with tourism clients about their stated preferences for future travel in relation to extreme events.

Changes to international flights may impact tourism demand in Luganville. Changes to aviation and infrastructure policy have had a positive effect on tourism numbers, as the recent airline deregulation that ended the monopoly of AirVanuatu shows (Commonwealth of Australia, 2006). The emergence of Pacific Blue (a low cost carrier based in Australia) coincides with the rapid growth in visitor numbers that have taken place in Vanuatu (Cheer, 2010). Yet, the Vanuatu government recently canceled a direct flight from Brisbane, which caused a



significant impact on local tourism businesses, as an expatriate business owner explained, “The cancelled flight had a real effect (on tourism numbers).” Furthermore, Nurse, Niles, and Dookie (2009) highlight the issue of taxation schemes that can deter holidaymakers from long-haul travel. Carbon policies, as a result of international climate change mitigation efforts, may affect long-haul travel to the PICTs through increased costs of travel and from implications of ethical considerations by consumers (DeLacy & Lipman 2010). A recent study also indicated that it could be possible that short-haul travel might also be impacted by the same effects (Cohen & Higham, 2011). In order to build resilience in the local tourism sector to such potential shocks, the strong involvement of local communities in the development and diversification of the tourism sector is crucial (Payet, 2008).

### *Stressors and Climate Change Exacerbation*

As can be seen in Table 3, two stressors were identified during the interviewing process: Crown-of-Thorns starfish (COTS) outbreaks and environmental degradation. COTS outbreaks present a real threat to coral reefs in Vanuatu. All stakeholders closely involved with divers or dive operators highlighted the threat of COTS outbreaks, which Vanuatu is currently facing. This is further supported by an article by Radio Vanuatu (2010), which states that COTS is a most serious problem facing the coastal villages.

An expatriate tourism stakeholder highlighted an issue related to COTS and the current overfishing of reefs: “If herbivores do not eat the algae off the skeleton of the coral reefs, then algae infestation occurs and corals cannot recover . . . there is a correlation between Crown-of-thorns and Blue Green Algae.” This correlation seems to be supported by current literature, which states: “that human-induced eutrophication might cause more frequent outbreaks of the Crown-of-Thorn starfish, as well as diseases such as Black-band disease” (Nyström, Folke, & Moberg, 2000, p. 414). Black-band disease is caused by three layers of different types of Blue Green Algae, also named cyanobacteria (Bright, 1999). As Thacker and Paul (2001) hypothesized in their research, blooms of cyanobacteria may be the result of a reduction in herbivores and

an increase in coastal eutrophication. Nevertheless, this hypothesis would have to be properly tested to confirm any correlation between the two.

Although the real reason for these COTS outbreaks are still not clear (Vogler, Benzie, Lessios, Barber, & Wörheide, 2008), there is a real chance of this stressor being exacerbated by climate change. For example, climate change may increase the rate of COTS outbreaks due to sea temperature increases, which then cause the death of coral “crustacean guards” or faster development of larval COTS (Hoegh-Guldberg, 1999). With increasing rates of COTS outbreaks, environmental degradation is increasingly likely.

Environmental degradation can make systems more vulnerable to climate change. As a result of one group discussion, the following aspects of environmental degradation in Vanuatu related to dive tourism were discussed: siltation, effluent flowing into the sea, and unsustainable Aquarium Trade methods. These are all environmental stressors that can lead to the destruction of reefs (Garrod & Gössling, 2008). For example, unsustainable Aquarium Trade methods are currently being employed where Aquarium Trade scuba divers target rarer species, such as the colorful flame-angel fish and blue tangs, and break up coral to attract and make catching easier (group discussion—Vila based dive operators). These activities have a negative impact on dive tourism attractions. Climate change will be an additional pressure on current stressors, such as habitat degradation, invasive species, air and water pollution, and in some cases may lead to the collapse of ecosystems (The World Bank, 2010).

### *Perceptions About Climate Change*

The shocks and stressors discussed above can be addressed in a number of ways. The preservation of natural ecosystems, such as mangroves, can save lives through their ability to act as coastal protection, as was seen in the Maldives during the 2004 Indian Ocean tsunami (Green, 2008), and with a dependence upon the natural resources on which the tourism sector is based (Briguglio et al., 1996, p. 206), the protection of this resource is crucial. Consequently, it is vital to have policies in place as well as adequate enforcement of legislation to



ensure that natural ecosystems, such as coral reefs and mangroves, are protected. Apart from policy related adaptations, Scott, de Freitas, and Matzarakis (2008) present adaptation measures under the categories of *technical*, *business management*, *behavior* and *research and education* that may also help reduce the dive tourism sector's vulnerability to climate change (Scott et al., 2008). Whichever type of adaptation measure, it is imperative to involve stakeholders in the development of an effective adaptation strategy (Jopp, DeLacy, & Mair, 2010). The capacity to engage stakeholders at the community level in the management of resources will, in fact, determine whether the response to climate change is successful or not (Tompkins & Adger, 2003).

Stakeholders' awareness and perception of climate change is crucial to the development and implementation of effective adaptation measures. It is vital that the public and private sectors are aware of vulnerability towards climate change (Richardson & Witkowski, 2010). The data presented in Table 4 shows a major divergence between the expatriate community and the Ni-Vanuatu community in relation to the perception of climate change risk. For example, an expatriate tourism sector respondent mentioned: "I believe climate change is just like the big millennium panic. The climate has changed for centuries." A Ni-Vanuatu respondent from the tourism sector stated the following: "I am afraid of climate change, it is hot every day and there will be water issues, some places will lose the underground water (supply). Now with drought and long times of sun it is a real issue." The reason for this divergence in perceptions of climate change is unclear and should be studied further. For example, is this caused by the Ni-Vanuatu respondents having a greater historical knowledge of climatic changes amassed through personal experiences gained throughout their lifetime as opposed to the expatriates, which may only recently have arrived to the country?

With an identified skepticism towards climate change, parts of the tourism sector in Luganville would most likely not consider climate change adaptation as a priority. This will have significant ramifications for the implementation of adaptation measures, and thereby influence the sector's vulnerability. Consequently, the data highlights the need to disseminate information about the impacts of climate change on tourism to ensure some

common ground between stakeholders and the need to provide possible adaptation strategies.

### Reducing Vulnerability Through Adaptation

Successful adaptation is one method of increasing the resilience of a destination and thereby reducing the overall vulnerability. Adaptive capacity, which is influenced by a range of factors, such as access to the resources needed to adapt, has a strong link to resilience (Dazé et al., 2009). To ensure successful adaptation in this sector, there is a need to disseminate information about the challenges tourism will face as a result of climate change. Furthermore, stakeholders should be involved in developing adaptation options for implementation at different levels (i.e., community, enterprise, destination, and government level) to ensure the effectiveness of these. Community based adaptation approaches should be linked to committed government policies that also address other development issues (Green, 2008) and effective governance systems (Sem & Moore, 2009) to ensure they are effective and successful. The above can only be achieved through the recognition by the dive tourism sector that climate change will likely exacerbate current shocks and stressors and a concerted effort to implement adaptation measures to reduce their current vulnerability.

Climate change may also offer opportunities for the tourism sector (Becken & Hay, 2007; Scott, et al., 2008). As highlighted by Jopp et al. (2010), opportunities may include a decrease in seasonality, an increase in the number of beach days or an increase in domestic tourism due to a decrease in outbound tourism and/or inbound tourism as a result of the cost of long haul travel. Therefore, more studies should be undertaken in assessing the impact of climate change in Vanuatu to highlight opportunities available. Policies should, consequently, aim to reduce the vulnerability of the dive tourism sector and build on emerging opportunities. Finally, "Vanuatu's vulnerability to climate change and sea-level change will be determined by the decisions that are made today" (GEF et al., 2009).

### Conclusion and Implications

Being a tourism sector in a SIDST that is highly dependent on the health of the natural resources, Vanuatu's tourism sector has a predisposed

vulnerability to climate change. Luganville's dive sector is particularly vulnerable to such changes. Current climate change projections suggest that the dive sector is at great risk from coastal erosion, cyclones, flooding, and issues of water availability.

The key aim of this article was to ascertain the current shocks and stressors experienced by Luganville's DTDR. The DTDR in Luganville comprises a range of key stakeholders. These include: tourists from primarily Australia and New Zealand, tour operators and marketing agencies, the transportation sector (especially the aviation industry), public sector ministries and agencies at local and national levels, NGOs, private sector businesses (e.g., dive operators, accommodation, food and beverage providers, tour operators, in-destination transportation businesses), and the representative sector associations (e.g., Vanuatu Scuba Operators Association and Vanuatu Hotels and Resorts Association). Other crucial components of the dive tourism system that are threatened by climate change are Luganville's built attractions, such as cultural heritage sites (including the SS Coolidge and Million Dollar Point) and natural sites such as coral reefs, blue holes and beaches, and caves.

The following key shocks were identified: cyclones, earthquakes, effect on demand due to media footage, and changes to direct international flights. Luganville stakeholders also identified two types of stressors that pose a threat to the viability of the dive sector, namely COTS outbreaks and environmental degradation. The majority of these current key shocks and stressors will be exacerbated by climate change and make the dive tourism sector more vulnerable to climate change. Consequently, adaptation measures are needed to reduce the sector's vulnerability to climate change. Such measures may prove a challenge to implement given the different climate change perceptions that presently exist in the community. Adaptation cannot occur without the existence of a strong will to act.

The second aim of the article was to identify the perceptions held by the expatriate and Ni-Vanuatu stakeholders of Luganville's DTDR. The data showed a clear divergence between the expatriate and Ni-Vanuatu communities, with many of the expatriates showing very little concern about the impact of climate change on business, as opposed to the views of the Ni-Vanuatu communities.

Future studies that 1) assess the impact of climate change on the tourism sector in Vanuatu, 2) identify the perceptions of stakeholders (e.g., tourists, business owners/managers, government and/or NGO representatives) of the system, and 3) evaluate the effectiveness of current adaptation strategies should be undertaken. Studies like these will not only highlight barriers to climate change adaptation and knowledge gaps, they will also identify opportunities for adaptation and reveal appropriate platforms for effective and consolidated action.

#### Notes

<sup>1</sup>The Fourth Assessment Report is to date the most extensive and comprehensive report on climate change involving the work of 152 lead authors and more than 600 experts from around the world (IPCC, 2007a).

<sup>2</sup>This includes greenhouse gas emissions, aerosols, albedo, contrails, solar irradiance, and the ozone.

<sup>3</sup>Very high confidence = "At least 9 out of 10 chance of being correct" (IPCC, 2007b, p. 4).

<sup>4</sup>The NAPA is a climate change initiative for Least Developed Countries (LDC) which provides the process in which the nations can identify priority activities that will help respond to their urgent and immediate needs for adaptation (United Nations Framework Convention on Climate Change [UNFCCC], n.d.). It is financially supported by the Special Fund of the United Nations Framework Convention on Climate Change for the Least Developed Countries.

#### Biographical Notes

Ms. Louise Munk Klint is a Ph.D. Candidate and Research Associate at the Centre for Tourism and Services Research at Victoria University (VU). Louise holds a Bachelor of Tourism with Distinction and a Master of Social Science with Distinction from University of Western Sydney. She has taught in sustainable systems for hospitality management, sustainable operations and introduction to events. Her research focuses on dive tourism and climate change in Vanuatu.

Dr. Min Jiang is a research fellow at the Centre for Tourism and Services Research at Victoria University (VU) and project coordinator of the Pacific Tourism-Climate Adaptation Project (PT-CAP). Min holds a Bachelor of Law (LLB), a Master of Law (LLM), and a PhD in environmental law. Her research focuses on tourism and climate change, fresh water tourism, and environmental law and policy.

Ms. Alexandra Law is a research officer and postgraduate research scholar at the Centre for Tourism and Services Research, Victoria University. Since graduating with a B.Sc. (Hons.) from London Metropolitan University, she has

contributed to a number of research projects in Australia and the Pacific. Her research interests include sustainable tourism, with a particular focus on mitigating tourism's greenhouse gas emissions, and the sector's adaptation to climate change.

Dr. Terry DeLacy is research professor in sustainable tourism at Victoria University and was previously director of the national Australian Cooperative Research Centre for Sustainable Tourism and dean of the Agriculture and Natural Resources Faculty at the University of Queensland. Terry's current research focus is on the tourism sector's adaptation to climate change and strategies for destination to move into the emerging green economy.

Dr. Sebastian Filep is a Research Fellow at the Centre for Tourism and Services Research at Victoria University in Melbourne, Australia. He is a tourist behavior expert and holds a Ph.D. from James Cook University. He has published internationally on topics related to tourism psychology and is currently involved in initiatives in the Pacific seeking to explore tourists risk perceptions and quality of visitor experiences.

Dr. Emma Calgaro is a member of the Australia-Pacific Tsunami Research Centre and Natural Hazards Research Laboratory, University of New South Wales, Sydney Australia and holds a Ph.D. in Human Geography from Macquarie University. Drawing upon her tourism industry experience and theoretical grounding in sustainability science, Emma's research focuses on understanding and facilitating developmental practices that enhance sustainability in the context of tourism and constant environmental change.

Associate Professor Dale Dominey-Howes is Co-Director of the Australia-Pacific Tsunami Research Centre and Natural Hazards Research Laboratory, University of New South Wales, Sydney Australia. A natural hazards expert, Dale holds a Ph.D. in geography and geology. His expertise spans the socioecological systems of hazards and their associated disasters. He works on disaster risk reduction in problems globally. He is Vice Chairman of the Commission on Hazard and Risk of the IGU.

Professor David Harrison is a sociologist/anthropologist of development who has researched the impacts of tourism on developing countries for more than thirty years. He has worked in and written on tourism in Eastern Europe, the Caribbean, South-east Asia, Southern Africa and the South Pacific, and currently Heads the School of Tourism and Hospitality Development at the University of the South Pacific.

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