



Summary The severe mass coral reef bleaching event in 2010 has led to coral mortality in the Andaman Sea of Thailand. The present study aims to assess socio-economic impacts and tourist perceptions of the 2010 coral bleaching event in Mu Koh Surin, Mu Koh Similan and Trang Province, southern part of Thailand, based on questionnaire surveys, secondary data sources and interviews of key informants. The surveys revealed that 52-91% of the tourists interviewed were aware of the 2010 coral reef bleaching event. Approximately 27-50% of tourists in the samples were SCUBA diving/snorkeling at the diving sites for the first time. The tourists mentioned that the diving was not as good as they expected it to be before coming to the islands because of coral bleaching. However they were happy to pay the extra fee of 10, 184 and 27 USD to see a better coral reef condition in Mu Koh Surin, Mu Koh Similan and Trang, respectively. About 85-95% of tourists interviewed said that they would like to visit the diving sites again. A proper management plan should be implemented with close collaboration between marine national parks and private companies in order to ensure sustainable tourism in the Andaman Sea.

Introduction Coral reefs are among high productive marine ecosystems that provide a variety of valuable goods and services to human, including recreational opportunities for SCUBA diving, snorkelling, and sight-seeing, coastal protection and nursery ground for commercial and recreational fisheries, and the welfare related to the existence of diverse natural ecosystems (Brander et al. 2007, Uyrre et al. 2009). Although coral reefs provide many valuable services, several threats cause coral degradation such as destructive and illegal fishing, sedimentation, land-based pollution, eutrophication, mining, dredging, tourism impacts, and climate change related coral bleaching due to increases of temperature (Cesar, 2000). In 2010, the Andaman Sea faced the most extensive coral bleaching event (Yeemin et al. 2010, Yeemin et al. 2011). Certain locations, such as Mu Koh Surin, were especially affected with recorded coral mortality over 80%. As high poverty levels in most coastal areas with coral reefs, the socio-economic impacts of coral reef degradation are a major concern of many tropical countries (Cesar, 2000, Grandcourt, Cesar 2003, Leujak, Ormond 2007, Cinner et al. 2012). Diving and other marine tourism are very important sources of income for communities along the coastline of Thailand. The socio-economic impacts of massive coral bleaching in the Andaman Sea are likely to be severe. Expressing losses from coral reef degradation in monetary terms is becoming accepted and is gradually considered to strengthen the political interest in natural resources conservation and management. The present study aims to assess socio-economic impacts and tourist perceptions of the 2010 coral bleaching event in Mu Koh Surin, Mu Koh Similan and Trang Province, southern part of Thailand, based on questionnaire surveys, secondary data sources and interviews of key informants.

Material and Methods The present study is based on secondary data sources, questionnaire surveys and key informants interview. The questionnaire surveys were carried out for tourists at Mu Koh Surin and Mu Koh Similan in Phangnga Province and a group of islands in Trang Province, Thailand. Key informant interview included dive instructors, resort managers and owners and boat drivers. The tourist questionnaires were filled out by over 200 tourists, in the period November 2010-April 2011. The questionnaires were in Thai and English.

The questions related to the willingness-to-pay for improvement in coral reef quality, interest in the environment, knowledge concerning coral bleaching, and basic background questions, such as nationality, age, education, income, etc. The statistical analysis of the data from questionnaires and key informant interviews were kept simple, using descriptive statistics.

Results surveys showed that most tourists at Mu Koh Surin and Trang Province were Thai but those at Mu Koh Similan were foreigners. The surveys revealed that 52-91% of the tourists interviewed were aware of the 2010 coral reef bleaching event (Fig. 1).

Approximately 27-50% of tourists in the samples were SCUBA diving/snorkeling at the diving sites for the first time. The tourists mentioned that the diving was not as good as they expected it to be before coming to the islands because of coral bleaching (Fig. 2).

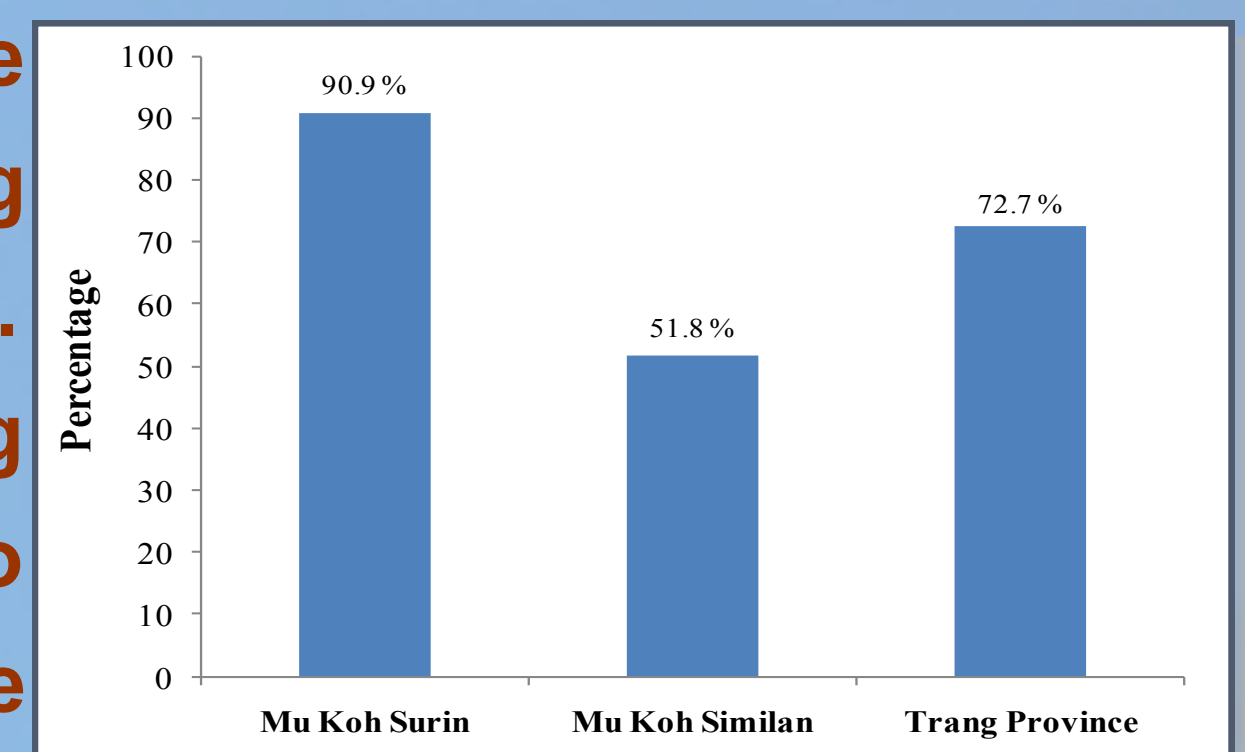
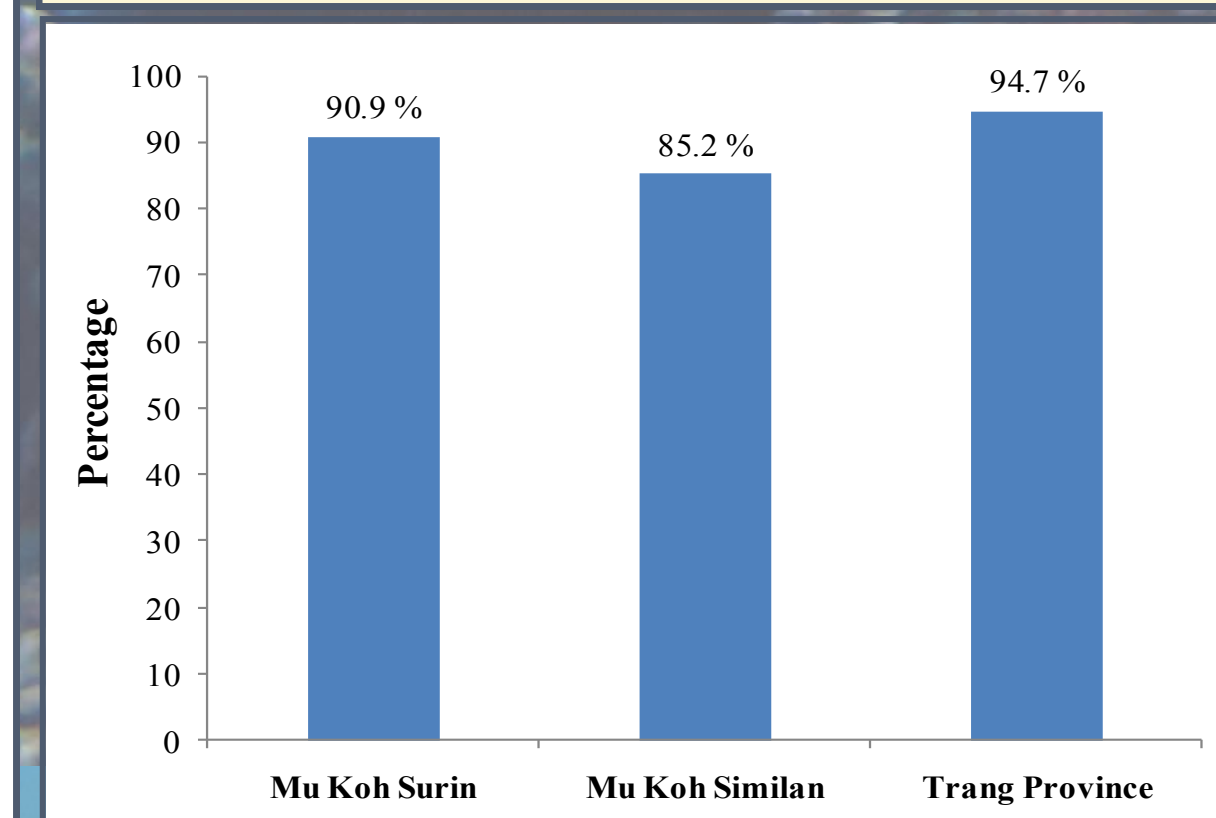
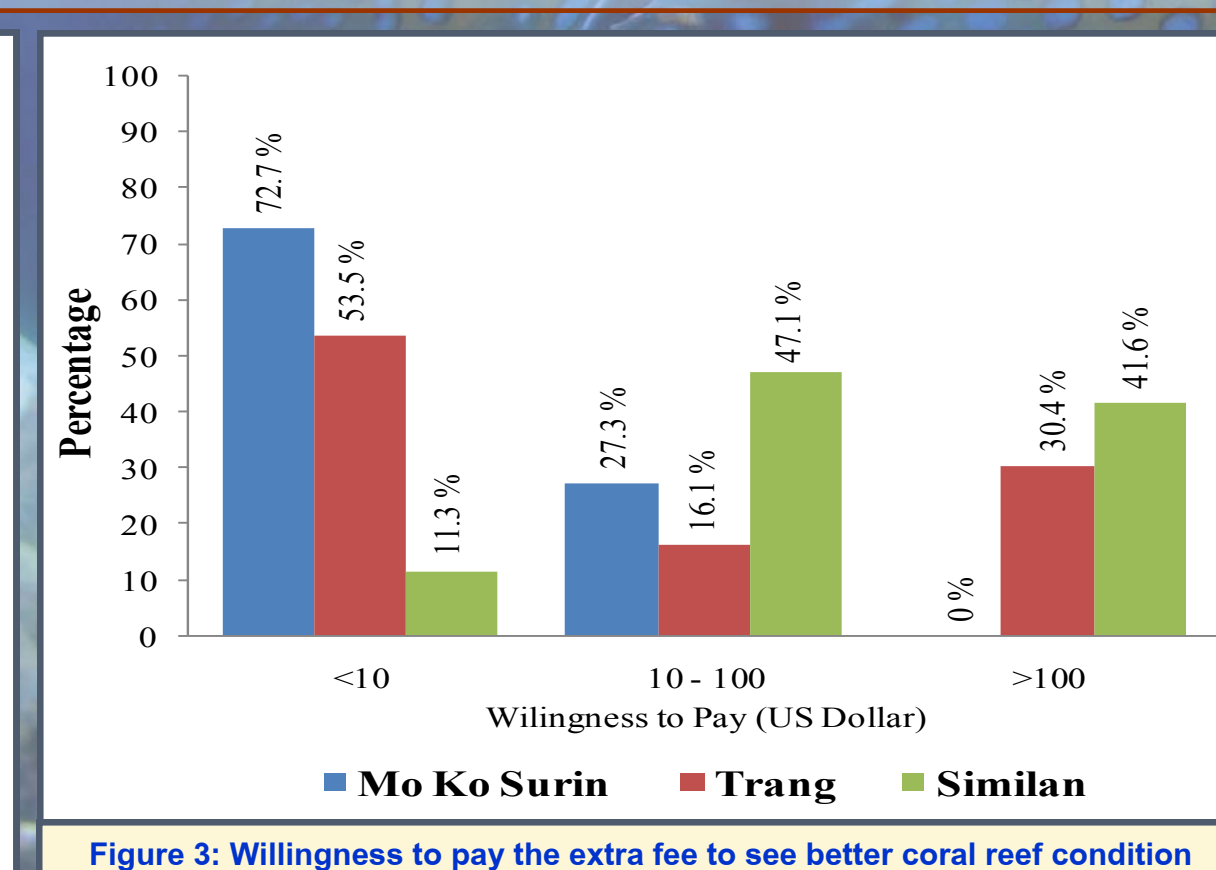
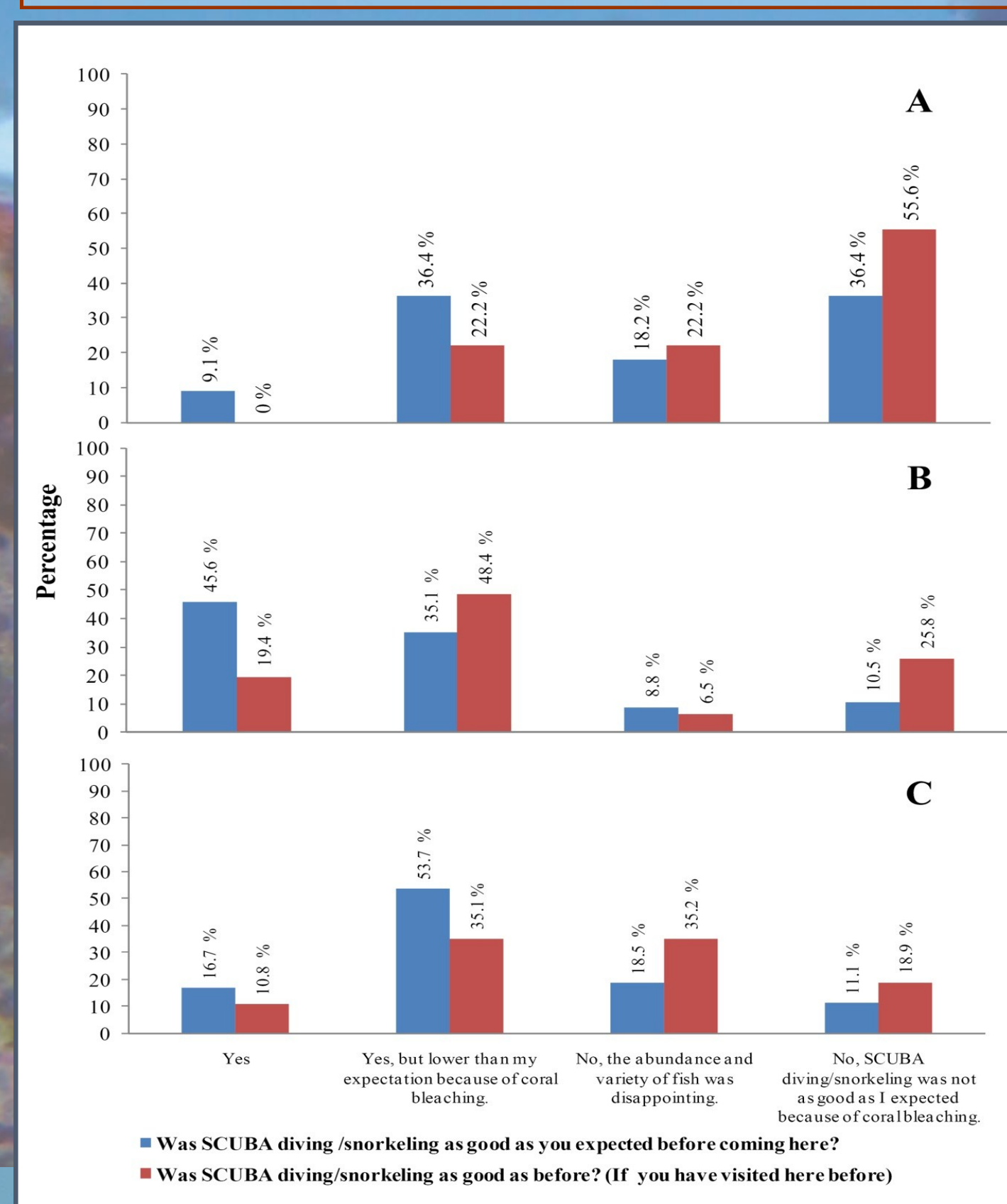


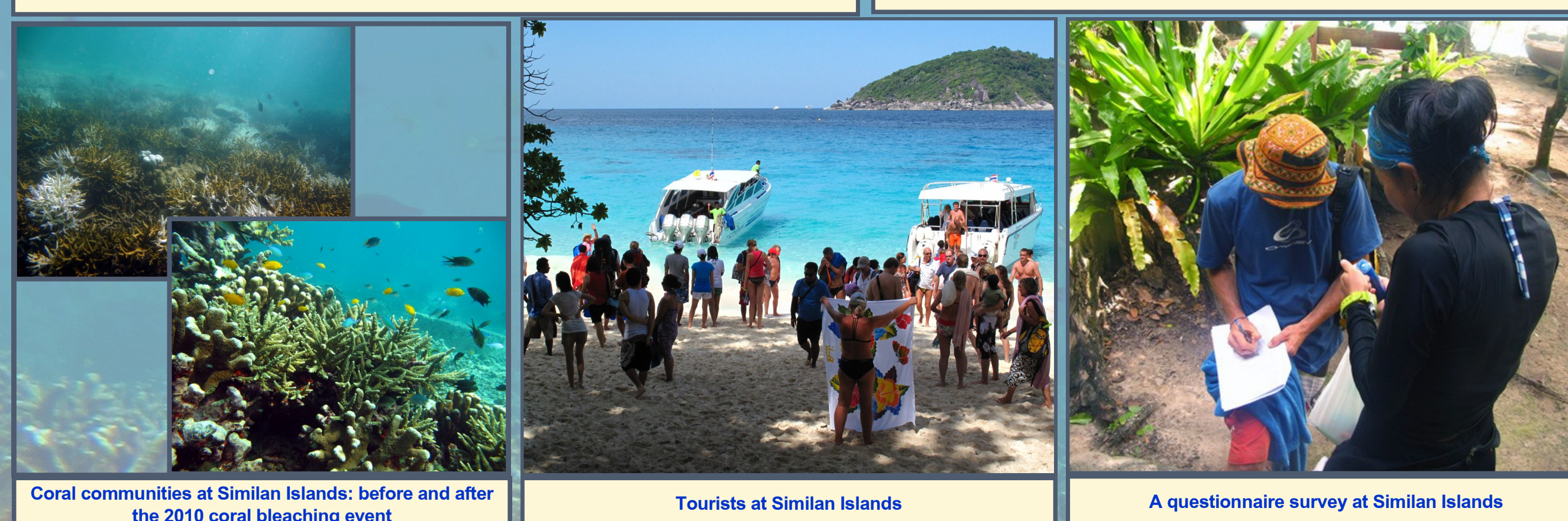
Figure 1: Were you aware of coral bleaching before you came here this year?

The majority of tourists at Mu Koh Surin expressed the diving was not as good as they expected because of coral bleaching. However, the tourists were happy to pay the extra fee of 10, 184 and 27 USD to see a better coral reef condition in Mu Koh Surin, Mu Koh Similan and Trang Province, respectively (Fig. 3). When we asked the tourists about their opinion to visit this place again, about 85-95% of tourists interviewed said that they would like to visit the diving sites again (Fig. 4)



Discussion A previous study in the Indian Ocean suggested that the cumulative losses over a 20 year time period in net present value terms are between 8 US\$ 600 million (optimistic scenario) and 8,000 million (pessimistic scenario). In the pessimistic scenario, the total coral damages over a 20 year time period are primarily from coastal erosion (US\$ 2.2 billion), tourism losses (US\$ 3.3 billion) and fishery losses (1.4 billion US\$). In the optimistic scenario the losses are still considerable stemming mainly from losses in tourism (US\$ 0.5 billion) (Cesar, 2000). However most tourists interviewed in our study said that they would like to visit the three diving sites in the Andaman Sea again so the tourism losses in Thailand would be lower.

This supports Andersson (2007) who found that despite losses in utility due to coral bleaching the tourists still visited the recreational sites. Future research in Thailand's coral reefs should focus on the specific attributes that divers and other tourists are looking for in their holiday experience. This can support the marine national parks in the Andaman Sea for management of natural resources as well as tourism business. A proper management plan should be implemented with close collaboration between marine national parks and private companies in order to ensure sustainable tourism in the Andaman Sea.



References

Andersson JE (2007) The recreational cost of coral bleaching: a stated and revealed preference study of international. *Ecol Econ* 62: 704-715
 Bejder L, Eriksson PV, Cesar HSJ (2007) The recreational value of coral reefs: A meta-analysis. *Ecol Econ* 63:209-219
 Cesar HSJ (2000) *Collected Essays on the Economics of Coral Reefs*. CORDIO, Department for Biology and Environmental Sciences, Kalmar University, Kalmar, Sweden, p.241
 Cinner JE, McClanahan TR, Dutton NA, Dew TM, Mwangi J, Brown SM, Wamukota A, Brown K, Bodin O (2012) Vulnerability of coastal communities to key impacts of climate change on coral reef fisheries. *Sci Tech* 22:22-20
 Grandcourt EM, Cesar HSJ (2003) The bio-economic impact of mass coral mortality on the coastal reef fisheries of the Seychelles. *Fish Res* 60:539-554
 Leujak W, Ormond RFG (2007) Visitor Perceptions and the Shifting Social Carrying Capacity of South Sinal's Coral Reefs. *Env Manage* 39:472-489
 Uyrre MC, Watkinson AR (2008) Managing Diver Tourism for the Sustainable Use of Coral Reefs: Validating Diver Perceptions of Attractive Site Features. *Environ Manage* 43:1-16
 Yeemin T, Pengsakun S, Klinthong W, Yeemin T, Donsomjit W, Suthasakop M (2011) Tourism impacts on a shallow coral reef at Ang Numchal, Mu Koh Similan, the Andaman Sea. *Proc 37th Congress on Science and Technology of Thailand*, p.4
 Yeemin T, Saenghaikul C, Pengsakun S, Donsomjit W, Klinthong W, Saengmanee K, Suthasakop M (2010) Quantitative surveys on a mass coral bleaching event in Mu Koh Similan, the Andaman Sea. In: *Proc 36th Congress on Science and Technology of Thailand*, p.4

Acknowledgement

We thank staff Mu Koh Surin, Mu Koh Similan and Hat Thae Mai National Parks and Marine Biodiversity Research Group, Faculty of Science, Ramkhamhaeng University for their supports. This research was funded by a budget for research promotion from the Thai Government to Ramkhamhaeng University in the fiscal years B.E. 2552-2555.