



## USC RESEARCH BANK

<http://research.usc.edu.au>

This is the published version of:

Schaffer, V, Lawley, M A (2010) Sink It: But Will They Continue to Come?: Future of Artificial Dive Tourism in Australia. 2010 Council for Australian University Tourism and Hospitality Education (CAUTHE) Conference: Tourism and Hospitality: Challenge the Limits, 8-11 February 2010, Hobart, Australia.

### **PERMISSIONS**

Permission has been granted by the copyright holder to deposit this published version as Open Access in the USC Research Bank. Open Access research is digital, online and free of charge, and is made possible by the consent of the author or copyright holder.

Copyright © 2010 Council for Australian University Tourism and Hospitality Education, CAUTHE Inc. Reproduced here in accordance with the publishers copyright policy.

**Sink it: But will they continue to come? Future of artificial dive tourism in Australia**

**Author Name: Vikki Schaffer**

**Affiliation: University of the Sunshine Coast**

**Address: Sippy Downs, Sunshine Coast, QLD Australia**

**Author Name: Meredith Lawley**

**Affiliation: University of the Sunshine Coast**

**Address: Sippy Downs, Sunshine Coast, QLD Australia**

Keywords: economic impacts; dive tourism; economic sustainability; artificial reefs

## Abstract

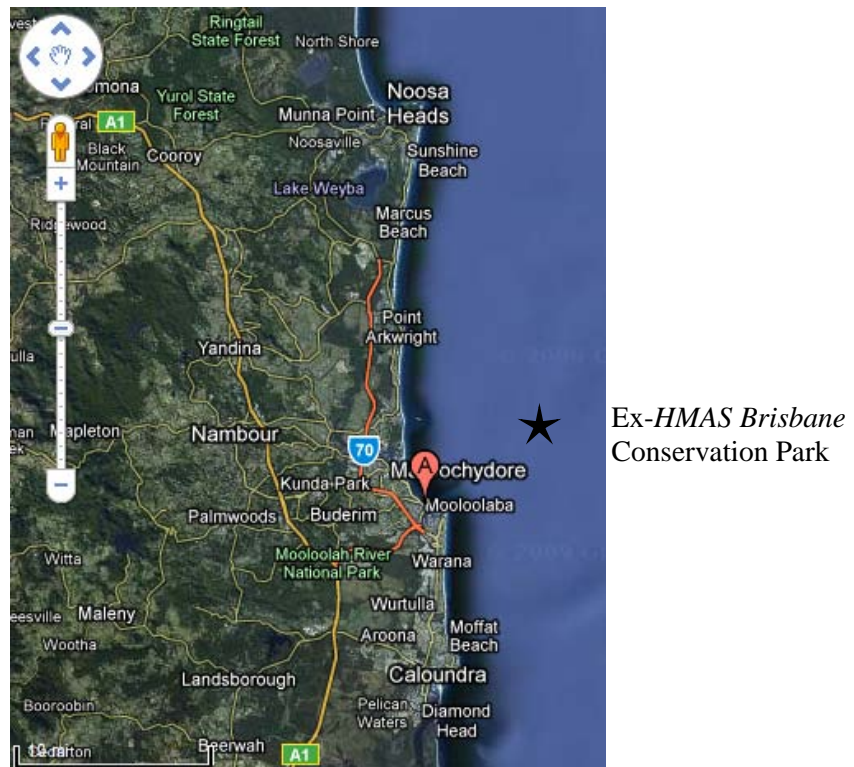
The impetus for scuttling vessels to create artificial reefs has been to enhance dive tourism and boost regional economies. However, data collected to measure the economic value of these artificial reefs in Australia is limited or internationally focussed. One such reef, the *ex-HMAS Brisbane* Conservation Park, located nine nautical miles off the Queensland coast, celebrated its fourth anniversary in July 2009. Australia's desire for artificial reefs continues with the *ex-HMAS Canberra* recently sunk (October 2009) off Victoria and the race is on to secure *HMAS Tobruk*, due for decommissioning in 2012. This paper reports a study of the economic value of the *ex-HMAS Brisbane* Conservation Park. Revenue generated by the Park via dive tourism is estimated at over AU\$4.5million per year, indicating the Conservation Park has made a positive contribution to the host community. Combined figures suggest the *ex-HMAS Brisbane* Conservation Park has provided a positive return on investment to date. However, over-time figures reveal diver numbers, and associated revenue, are decreasing, raising questions about the long term effectiveness of scuttling ships for dive tourism.

## Introduction

Numerous artificial reefs have been created around the world to enhance recreational SCUBA diving. Data from several international sites suggest artificial reefs generate economic benefits and represent a significant economic opportunity that should not be underestimated (Dowling and Nichol, 2001; Pendleton, 2005; Rowe, 2006). However, limited comparable data on the economic benefits of artificial reefs is available in the Australian context where diver numbers are significantly lower. Hence Australian governments, the dive industry and host communities must make the decision to sink or not to sink using international, estimated or outdated data. Research adding to the body of knowledge about the economic impact of artificial dive tourism is crucial to the sustainability of this industry.

Much media attention, political commentary and public awareness preceded the sinking of *ex-HMAS Brisbane*. In 2003, the Queensland Government accepted *ex-HMAS Brisbane* from the Commonwealth for the development of a world-class dive destination and artificial reef (State of Queensland Environmental Protection Agency, 2007). Two years later the ship was scuttled approximately nine nautical miles from the entrance to Mooloolaba Harbour on the Sunshine Coast, Queensland. As a Conservation Park, this is a non-extraction site with only SCUBA diving related recreational, research and education activities permitted.

Photograph 1: Location of ex-HMAS Brisbane Conservation Park



Google maps, 2009

Given the identified lack of Australian economic data on artificial dive sites, the purpose of this paper is to undertake an economic value assessment of one of the newest such dive sites, the *ex HMAS Brisbane* Conservation Park. The remainder of this paper is presented in four sections. Next, the background outlines existing research into economic assessments of artificial dive sites as well as different approaches to assessing economic value. Following this the method used to collect and analyse data is discussed. The third section reports results and finally the implications and issues arising from the research are discussed.

### Background

“An artificial reef is one or more objects of natural or human origin deployed purposefully on the seafloor to influence physical, biological or socio-economic processes related to living marine resources” (Seaman, 2000, p 5). Increasingly, government and non-government organisations are using these structures to protect shorelines, create new habitats for marine life and provide recreational and commercial fishing (consumptive) and SCUBA diving (non-consumptive) opportunities (Baine, 2001).

Dive tourism in Australia (travel where at least one SCUBA diving expedition is included in the trip) is referred to as a relatively small but high yield market (TQ, 2003). In the 12 months to March

2007, the National Visitor Survey estimated Queensland hosted 345,000 visiting SCUBA divers (TQ, 2007). Between 2008 and 2009, international visitors participating in marine activity in Australia decreased by 5.2% (TTF, 2009). Of the 416,000 international visitors participating in marine activity, 48,639 went SCUBA diving (TTF, 2009). By far the largest segment of the Australian SCUBA diving market was the domestic market with 1.5 million overnight visitors participating in a dive experience (TTF, 2009). Accurate data on marine tourism, specifically SCUBA diving and use of artificial reefs in Australia is limited. Data sourced from the National Visitor Survey (Tourism Research Australia) provides useful information but “does not provide a true indication of the marine tourism industry” (SKM, 2007, p 63).

Dowling and Nichol (2001) conservatively estimated the total regional economic impact of the ex-*HMAS Swan* dive site generated approximately US\$1.39 million (approximately AU\$903,500) between December 1997 and May 1999 from 18,000 SCUBA divers. As these figures are a decade old comparison is ineffective.

Turning specifically to the ex-*HMAS Brisbane*, Conservation Park managers indicated the aim for the Park was to be economically self-sustaining (*pers comm.* Bakhash & Thomas, 2007). The cost of developing the Conservation Park was AU\$4.75 million (*pers comm.* Thomas, 2008) with ongoing annual maintenance costs of approximately AU\$77,900 (August 2008). Additional costs needing consideration are those associated with the purchase of goods and services by dive operators such as luxury dive boats, additional diving equipment, mooring lease fees and additional staff. As a public project, the Conservation Park must justify the public funds expended towards its development, management and maintenance. Although important for decision-making, stakeholders directly associated with the Conservation Park identify that Australian-based economic data on artificial reefs was unavailable. Accurate economic estimates of value for a specific resource are reliant on determining the expenditure associated solely with that resource (Johnson & Moore, 1993). Attributable expenditure is the expenditure that can be ascribed to the Conservation Park or the expenditure by divers whose purpose for coming to the region was specifically to dive at the Conservation Park.

Most economic impact assessments of artificial reefs have been conducted in the United States of America (Ditton & Thailing, 1997; Bell, Bonn & Leeworthy, 1999; Johns, Leeworthy, Bell & Bonn, 2001; Hazen & Sawyer, 2004; Pendleton, 2005). Various methods have been employed to calculate economic impact including contingent valuation and willingness to pay (Milon, 1989) and travel cost method (Seenprachawong, 2001; Hazen & Sawyer, 2004), making accurate comparison difficult. With finite financial resources and multiple protected areas requiring these resources, park managers would benefit from the ability to compare the variety of geographically, physically and spatially different parks being managed. Knowing park visitation patterns and the financial resources generated and expended across a wide range of natural and artificial (modified) areas would aid in prioritising their economic, social and environmental needs.

In Australia, Carlsen and Wood (2004) conducted the first economic value assessment of tourism and recreation in Western Australian national parks, marine parks and forests in Western Australia. Total direct expenditure for the two regions found the Southern Forest Region generated AU\$70.5 million and the Gascoyne Coast Region AU\$138 million. Tremblay (2007) measured the total direct expenditure of Kakadu National Park as AU\$350.39 million. Both studies sought to address the need for accurate and reliable data that can be compared to other natural areas. Direct expenditure calculations are simple and open to scrutiny albeit produce conservative results (Tremblay, 2007). The study reported in this paper presents the findings of an economic value assessment of the ex-*HMAS Brisbane* using a slightly modified version of Carlsen and Wood's technique.

### **Method**

The research adopted a descriptive design, gathering data via personally administered surveys. Three key issues influenced survey design and administration: consideration of the time period over which data was collected, how to access divers, and how to maximise response rates once respondents were accessed. Each of these issues is addressed in turn, followed by a description of the data analysis approach adopted.

Tourism faces numerous challenges associated with fluctuating demand, seasonality, weather conditions and fads. To address these issues and provide as reliable data as possible, data were collected for 12 consecutive months between March 2008 and February 2009, covering weekdays, weekends, public holidays and school holidays. Visitor expenditure information was collected from both local and tourist SCUBA divers diving at the Conservation Park.

To gain access to respondents, authorised dive operator co-operation was essential. Ditton and Baker (1999, p 3) were unable to achieve desirable sampling goals for their study in Texas "due to a lack of cooperation by dive boat operators". Interviews were arranged with authorised dive operators to explain the research and enlist support. These dive operators take divers to the local natural reefs as well as the Conservation Park. To identify appropriate divers (those diving at the Conservation Park) the dive operators were telephoned several times a week to determine if dive trips were planned, which dive trips would be going to the Park and if it was appropriate for divers to be surveyed. Data collection was conducted based on operator availability and weather conditions which dictated when dives, and therefore data collection, could take place. The researcher was introduced to SCUBA divers by authorised dive operators either before or immediately after undertaking the Conservation Park dive experience. Recall error was reduced as divers completed questionnaires immediately before or after undertaking the dive.

The extant literature and confirmation from dive operators, identified respondent fatigue as an issue for SCUBA divers, as they must complete numerous items of paperwork before and after the dive experience (Bonn, Joseph & Dai, 2005). An economic impact study conducted on the *HMCS Yukon* generated low response rates in preliminary surveys featuring open ended questions

(Pendleton, 2005). Response rates were improved in a subsequent survey using questions that required respondents to tick one response from several choices (Pendleton, 2005). Therefore, a one-page, researcher-administered, respondent-completed, easy to follow questionnaire featuring closed ended and multiple choice questions was developed.

Turning to data analysis, choosing an economic value assessment method that enabled comparison between terrestrial and marine sites would be beneficial to stakeholders involved in managing and marketing the sites as well as those conducting business in these regions. To accomplish this and advance the literature, this study applied the direct expenditure method (DEM) to measure economic value of the Conservation Park.

DEM is a quantitative technique that can be an effective predictor of the economic contribution of tourism in natural, artificial and modified environments (Carlsen & Wood, 2004). DEM includes calculating estimated total expenditure, attribution and substitution related expenditure and expenditure categories assessment. Attribution value measures expenditure directly apportionable to the primary reason for visiting the region: in this case, to dive at the Conservation Park. Substitution value estimates the expenditure gained directly because of the existence of the Conservation Park. In other words, if the Conservation Park had not been developed would these divers still have visited the Sunshine Coast. The final expenditure assessment task involved estimating expenditure within various categories (accommodation, food and beverage, the dive experience and other items such as merchandise).

## Results

This section begins by presenting a profile of respondents before reporting the results before finishing with an extrapolation of expenditure over-time.

**Profile of Respondents.** Divers are required to purchase a permit to visit the Conservation Park. During the 12 months of data collection, permits were issued to 4,943 divers visiting the site with an authorised dive operator or using personal watercraft. Permits for divers visiting the Park with an authorised dive operator totalled 4,475 with 894 divers (18%) successfully surveyed. A satisfactory response rate was due to questionnaires being administered in a captive location (Musa, 2002).

Of the 894 surveyed divers, 116 (13%) were residents of the Sunshine Coast and 778 (87%) were tourist divers. In keeping with previous studies (Ditton & Baker, 1999; Musa, 2002), Conservation Park divers were mostly males (78-79%) aged 25-50 years. Tourist divers were predominantly Australian (640; 82%) with the majority of these residing in Queensland (430; 55%). Overseas divers numbered 138 (18%) originating from 20 countries. The most common countries of origin for overseas visitors were Germany (14%), USA (10%) and New Zealand (7%). Survey responses revealed:

- Divers undertook the dive experience for recreational purposes (95%);
- Two thirds visited alone (504; 65%);

- A small number were accompanied by children (37; 5%);
- Half of all Queensland divers were day visitors (420; 54%); and
- Only a small number of tourist divers stayed overnight on the Sunshine Coast (63; 11.5%) with 64 (12%) staying for 15 nights. The most frequent length of stay was seven nights (144; 26%).

**Total and Average Visitor Expenditure.** As the aim of the research was to estimate the economic value the Conservation Park generated for the host community, divers provided estimates of the total amount spent in connection with their dive experience. The total expenditure by the 778 the tourist divers surveyed was AU\$680,543 with an average of AU\$874.73 per diver. In contrast, the 116 local divers spent approximately AU\$39,857 or an average of AU\$343.59 per diver.

**Attribution.** Attribution is the expenditure ascribed to the Conservation Park. This is expenditure by tourist divers whose purpose for coming to the region was specifically to dive at the Conservation Park. Tourist divers were asked to state whether the main purpose for visiting the Sunshine Coast was to dive the *ex-HMAS Brisbane*. Over three quarters (590; 76%) of the 778 tourist divers said the purpose of their trip was to dive at the Conservation Park. One hundred and eighty-eight divers (24%) visited the Sunshine Coast regions for other reasons, with 127 (57%) on holiday, 77 (34%) visiting family and friends and 18 (8%) on business trips. The total visitor expenditure attributable to the Park from the 590 divers whose main purpose was to dive at the Conservation Park was AU\$338,513. However, the amount not attributable to the Park was AU\$342,030. Non-attributable expenditure is greater even though this amount represents less than 25% of all surveyed divers visiting the Park. Of these divers, holiday makers accounted for AU\$229,344 (average per diver AU\$1,806).

**Substitution Value.** Substitution value occurs when visitors would have substituted an alternate destination for their trip to the Sunshine Coast. To identify substitution value, a scenario question determined the likely holiday destination choice of surveyed divers if the Conservation Park did not exist. One third (262; 34%) of the 778 tourist divers would still have visited the Sunshine Coast. Five hundred and sixteen (66%) tourist divers would not have come to the Sunshine Coast. Of these divers, 263 (51%) indicated they would have visited another region in Queensland and 63 (8%) another region in Australia. Only four divers (1%) would have opted to visit an overseas destination.

Substitution value was determined by calculating the total tourist diver expenditure of the 262 divers who still would have visited the Sunshine Coast. Substitution value was estimated at AU\$361,938 (average per diver AU\$1,381). Substitution value relating to local divers revealed 89 divers (77%) would dive on other natural dive sites located on the Sunshine Coast if the Conservation did not exist thus keeping or re-circulating approximately AU\$30,580 in the host region.

**Comparison of expenditure.** Three methods of calculation were used to determine the economic value of the Conservation Park and provided deeper insight into the related economic value. Expenditure totals range from AU\$720,400 (Total expenditure) to AU\$338,513 (Attribution) for



spending associated with surveyed divers. This insight aids park managers and political, community and business groups to make valid, accurate decisions regarding the Conservation Park.

Table 1: Comparison of estimated expenditure within the three techniques related to surveyed divers

Technique	Tourists	Locals	Approx. Total
<b>Total Expenditure</b>	N=778	N=116	<b>N=894</b>
	AU\$680,543	AU\$39,857	<b>AU\$720,400</b>
<b>Attribution</b>	590		<b>N=590</b>
	AU\$338,513		<b>AU\$338,513</b>
<b>Substitution</b>	N=262	N=89	<b>N=361</b>
	AU\$361,938	AU\$30,579.94	<b>AU\$392,518</b>

**Expenditure categories.** Economic sustainability requires expenditure to be shared throughout the host community but as dive tourism is the focus of the Conservation Park, dive operators are thought to be the main economic beneficiaries of expenditure created by users. Dive operators share in economic benefits with between 14% and 27% of tourist diver and between 35% and 58% of local diver expenditure spent on the dive experience. Expenditure within other categories revealed that 85% of tourist divers purchased food and beverage on the Sunshine Coast during their trip with 76% spending between AU\$1 and AU\$400. A small number (2%; 13) of divers spent more than AU\$1,001 on food and beverage, with one tourist diver indicating they spent AU\$3,000 in Sunshine Coast restaurants during their week long stay. Of the 271 (35%) divers staying in Sunshine Coast accommodation, 25% spent under AU\$400.

Table 2: Expenditure by Tourist divers within the Sunshine Coast per Category

	Percentage (%) of Diver Spending within the Sunshine Coast region per Category				
	Accommodation	Food/ Beverage	Attractions	Equipment	Other – Merchandise etc
<b>\$1-50</b>	8	35	10	26	39
<b>\$51-150</b>	6	18	11	11	9
<b>\$151-250</b>	5	14	11	10	3
<b>\$251-400</b>	6	9	6	2	1
<b>\$401-550</b>	3	3	2	1	1
<b>\$551-700</b>	2	3	1	-	-
<b>\$701-850</b>	2	1	1	1	-
<b>\$851-1000</b>	1	1	2	-	-
<b>\$1001+</b>	3	2	-	1	-

**Local Divers.** Local divers indicated they spent from AU\$1 to a maximum of AU\$250. The majority of local divers spent between AU\$1-50. Sixty-eight percent of divers spent money on fuel (transport), 49% on food and beverage and 41% on dive related equipment.

**Extrapolation and Over-time Expenditure.** The total number of permits issued between August 2005 and end of July 2009 was approximately 19,802. Using this figure and the combined average expenditure derived from all surveyed divers the approximate total economic value for the Conservation Park relating to dive tourism was determined as AU\$18,335,939. This represents an average of AU\$4,583,984 per year for the four years since the Park began receiving divers. However, over-time analysis reveals a decline in diver numbers and their associated expenditure from approximately AU\$4,688,552 during 2005/06 to AU\$3,854,935 during 2008/09 (Table 3).

Table 3: Diver number and associated expenditure

Year	Combined Diver Numbers	Estimated Expenditure (AU\$)
*August 2005 – June 2007	*10 720 5360 per year	*9 377 105.60 4 688 552.80
July 2007 – June 2008	4625	4 045 626.25
July 2008 – June 2009	4407	3 854 935.11

*\*Note: August 2005 and June 2007 are combined figures for the first 23 months as provided by the permit office.*

Divers visiting the Conservation Park must purchase a permit costing AU\$20. As the divers surveyed visited with authorised dive operator permit revenue is included. To appreciate economic value distribution and context, a measure of permit generated revenue was estimated at AU\$181,640 over four years of operation.

### Discussion

Results demonstrate the Conservation Park provides economic benefits to the Sunshine Coast region. Economic sustainability is enhanced when economic benefits are shared within the host community. In addition to purchases relating to authorised dive operators for the dive experience (cost of the dive, dive equipment hire/purchases etc), tourist divers spend between 73% and 86% of total expenditure within various hospitality sectors. Local divers also spend between 42% and 65% of their total expenditure predominantly within hospitality sectors. As hospitality businesses purchase goods and services from a multitude of other businesses, expenditure is clearly being moved throughout this and other regions. Reviews in Australia, and overseas, question the value of artificial reefs to regional economies (Pears & Williams, 2005). Two major issues affecting economic sustainability are the inconsistencies linked to climatic changes, seasonality and intermittent weather

conditions; and the surge and wain associated with the novelty of new sites, coupled with a finite number of active scuba divers.

Economic sustainability questions are raised when reviewing over-time economic value. Since the *HMAS Brisbane* was scuttled (sunk), the Conservation Park has experienced declining economic returns. Federal Minister, Peter Slipper, announced in Parliament that the Conservation Park would attract 10,000-12,000 divers per year (Slipper, 2004). This has not been realised with less than 5,000 divers per year acquiring permits to dive at the site. Authorised dive operators indicate that initial demand was high due to the novelty of the dive experience. Managing agents and authorised dive operators expect Conservation Park diver figures to remain steady as the ship continues to evolve from a bare ship to a highly complex marine environment. As accurate global diver numbers are difficult to obtain, secondary resources estimate between 1.3 million and 1.65 million active divers (divers undertaking on average five dives per year). Globally, “*active diver numbers are increasing very slowly*” suggesting the dive industry has potentially, albeit momentarily, peaked (*pers comm.* McKinnon, July 2009). The existence of new dive destinations does not necessarily create a corresponding increase in divers; consequently dive destinations draw from a finite pool of existing divers. Each site essentially competes for diver attention; thus new sites are essentially “*competing for the same market, basically taking divers from other sites*” (*pers comm.* McKinnon, July 2009).

As with tourism in general, factors such as the weather threaten economic value. Open water destinations within the marine environment amplify weather related issues. During data collection, an average 22% (6.7) of days per month were adversely affected by poor weather conditions reducing the number of possible dive trips. Conversely, during the summer of 08/09 perfect weather conditions meant multiple dive trips were undertaken. Adverse weather may account for the apparent decline in diver numbers (Table 3).

With a large number of global dive sites and a slowly increasing number of divers, operators and organisations need to focus on not just the dive experience but the additional aspects the location offers. With over 34% of divers visiting with another person, including children, regional geographic features and activities (beaches, rainforests, sightseeing and bushwalking) and hospitality aspects (restaurants, bars, accommodation, attractions, shopping) may contribute to preparing tourism packages for the diving market. Western Australia markets their artificial reefs as a Dive Park. As the Great Barrier Reef, a popular dive destination, is located in northern Queensland, and Queensland has the highest number of artificial reef sites numbering approximately 1600 (Tourism Queensland, 2003) a dive trail (likened to a wine trail) could be developed and marketed.

The *Brisbane* was the fourth ex-naval warship deliberately scuttled as a dive site in Australia. *HMAS Swan* and *HMAS Perth* lie off Western Australia and *HMAS Hobart* is in South Australia. After much anticipation and several challenges, *ex-HMAS Canberra* was scuttled in the temperate waters off Victoria on October 4, 2009. Varying water temperatures between these sites means each will exhibit differing colonisation rates, species abundance and diversity, water temperature and clarity,

providing a level of uniqueness to the dive experiences. These factors including uniqueness were identified by Conservation Park divers to be very important to the dive experience (Schaffer, 2009). Whether this will be sufficient to keep the finite pool of divers visiting both sites thus improving their economic sustainability is uncertain.

Sunshine Coast resident and Federal minister, Mr Slipper, is actively pursuing *HMAS Tobruk* due to be decommissioned in 2012, to expand the Conservation Park. Other destinations including the Gold Coast are actively seeking the ship: but questions must be asked. What is more sustainable, placing additional vessels in an existing site thus increasing the economic value and attraction of that site? If one ship provides a good rate of return such as shown by the Conservation Park, will another vessel compound these benefits or create a diminishing rate of return? Or, will placing the ship elsewhere effectively diminish the overall potential by stretching resources and diver expenditure over a wider range? Scuttling ex-naval vessels is an expensive public project with uncertain economic, social and environmental benefits (Schaffer, 2009). Future research is needed to address these questions.

Internationally artificial reefs have been developed by non-profit organisations. In Australia, artificial reefs are being developed by government environmental departments with the project manager of the ex-*HMAS Brisbane* Conservation Park being EPA Queensland and Parks Victoria the project manager of the ex-*HMAS Canberra* dive site. However, there appears to be conflicting ideas between the Australian States regarding the value of artificial reefs. The South Australian government is discouraging future construction of additional artificial reefs driven by 'the lack of strong evidence in support of the utility of artificial reefs' (Sutton & Bushnell, 2007, p 6). Victoria, Western Australia, Queensland and New South Wales are actively deploying or pursuing vessels on the assumption that they will bring desirable tourism revenue. Again, additional research is required, particularly over-time, multiple site evaluation.

The environmental condition of natural reefs is a growing concern. Global warming, climate change and pollution negatively impact natural reefs. Artificial reefs could provide the best of both worlds as an artificial site is literally transformed from a man-made object into a flourishing, dynamic ecosystem. The existence of an artificial reef may increase diver related expenditure coming into a region while reducing visitation, thus damage, to neighbouring natural reefs. Dive operators on the Sunshine Coast indicated the number of dives to the Conservation Park outnumber those to the natural reefs. Not everyone believes artificial reefs enhance destination image suggesting scuttling vessels could be perceived by tourists as environmentally unfriendly, akin to dumping. Destinations wanting to develop a green image may perceive built attractions as not conducive to this plan.

Finally, although this paper has focused on non-extraction dive tourism on artificial reef sites, the Queensland Government has developed a AU\$1 million trial artificial reef program as a key element of the Moreton Bay Marine Park Zoning Plan. The plan is designed to protect Moreton Bay and provide recreational anglers with alternative fishing locations (DERM, 2008; McNamara, 2008).

These artificial reef sites host an extraction activity, recreational fishing. Research regarding whether artificial reefs increase particular fish species is uncertain with artificial reefs thought to act as aggregating devices (PIRSA, 2009). The constructing of artificial reefs to enhance recreational fisheries is “considered questionable by fisheries managers if we are to maintain fish stocks at sustainable levels” (PIRSA, 2009). Further research is needed into the effects of artificial reefs fish stocks, ecology and productivity of the marine ecosystem is required. Extending research to include these sites provides valuable opportunities for understanding and comparing recreational and tourism economic sustainability of marine protected areas.

The sustainability of artificial dive sites is poorly understood requiring urgent assessment given the current penchant for sinking ex-naval vessels for recreational diving. Long term sustainability requires the assessment of not only economic value but social and environmental values of artificial reefs (Schaffer, 2009). Further research is highly recommended.

### References

- Baine, M. (2001). Artificial reefs: a review of their design, application, management and performance. *Ocean and Coastal Management*. 44, 241-259.
- Bonn, M. A., Joseph, S. M. & Dai, M. (2005). International versus domestic visitors: An examination of destination image perceptions. *Journal of Travel Research*. 43 (3), 294-301
- Carlsen, J. & Wood, D. (2004). Assessment of the economic value of recreation and tourism in Western Australia's national parks, marine parks and forests. CRC for Sustainable Tourism Pty Ltd. Australia
- DERM. (2008). Trial artificial reef program. Parks and Forests. Moreton Bay Marine Park Zoning Plan. Environment and Resource Management, The State of Queensland. Australia. [Online] [Accessed 7 October, 2009] Available: [http://www.epa.qld.gov.au/parks\\_and\\_forests/marine\\_parks/moreton\\_bay\\_marine\\_park\\_zoning\\_plan\\_review/trial\\_artificial\\_reef\\_program.html](http://www.epa.qld.gov.au/parks_and_forests/marine_parks/moreton_bay_marine_park_zoning_plan_review/trial_artificial_reef_program.html)
- Ditton, R. B., and Baker, T. L. (1999). Demographics, attitudes, management preferences, and economic impacts of sport divers using artificial reefs in offshore Texas waters. Technical Report no. HD-99-01. *Human Dimensions of Fisheries Lab*, Texas A&M University, College Station, Texas, USA. p 44.
- Dowling, R.K. & Nichol, J. (2001). The HMAS Swan Artificial Dive Reef. *Annals of Tourism Research*. 28, (1), 226-229.

- Hazen & Sawyer, P.C. (2004). Socioeconomic Study of Reefs in Southeast Florida. In association with Florida State University and the National Oceanic and Atmospheric Administration. Final Report. October 2001, Broward County, Florida. [Online] [Accessed 7 October, 2009] Available: <http://marineeconomics.noaa.gov/reefs/martincounty2004.pdf>
- Johnson, R.L. & Moore, E. (1993). Tourism Impact Estimation. *Annals of Tourism Research*, 20, 279-288.
- McNamara, A. (2008). Work begins on Moreton Bay's artificial reefs. Minister for Sustainability, Climate Change and Innovation. Media release issued 16/12/2008. The Queensland Government funded Queensland Outdoor Recreation Federation (QORF). [Online] [Accessed 4 October, 2009] Available: [http://www.qorf.org.au/01\\_cms/details.asp?ID=1097](http://www.qorf.org.au/01_cms/details.asp?ID=1097)
- Milon, J.W. (1989). Artificial marine habitat characteristics and participation behaviour by sport anglers and divers. *Bulletin of Marine Science*, 44 (2), 853–862.
- Musa, G. (2002). Sipadan: a SCUBA-diving paradise: an analysis of tourism impact, diver satisfaction and tourism management, *Tourism Geographies*, 4 (2), 195–209
- Pears, R.J. & Williams, D. McB. (2005). Potential effects of artificial reefs on the Great Barrier Reef: background paper. *CRC Reef Research Centre Technical Report No. 60*, CRC Reef Research Centre, Townsville, Australia.
- Pendleton, L. (2005). Understanding the Potential Economic Impacts of Sinking Ships for SCUBA Recreation. *Marine Technology Society Journal*, Summer 39 (2), 47-52
- PIRSA. (2009). Do Artificial Reefs Work. Government of South Australia. Primary Industries and Resources, SA. [Online] [Accessed 24 November, 2009] Available: [http://www.pir.sa.gov.au/fisheries/recreational\\_fishing/artificial\\_reefs/do\\_artificial\\_reefs\\_work](http://www.pir.sa.gov.au/fisheries/recreational_fishing/artificial_reefs/do_artificial_reefs_work)
- Schaffer, V. (2009). Economics and Beyond. Objectively Valuing Protected Areas (Artificial Reefs) and their Influence on Decision Making by Interested Parties. Unpublished doctoral dissertation, University of the Sunshine Coast, Queensland, Australia.
- Seaman, W, Jr. (2000). Artificial Reef Evaluation. With Application to Natural Marine Habitats. CRC Press, New York.
- Seenprachawong, U. (2001). An Economic Analysis of Coral Reefs in the Andaman Sea of Thailand. School of Economics, Sukhothai Thammathirat Open University.

- SKM. (2007). Non-Fisheries Resource Use Activities in the East Marine Planning Region. SINCLAIR KNIGHT MERZ. [Online] [Accessed 17 October, 2009] Available: <http://www.environment.gov.au/coasts/mbp/publications/east/pubs/non-fisheries-chapter6.pdf>
- Slipper, P. (2004). House of Representatives Grievances Debate. Fisher Electorate: Former HMAS Brisbane Speech. March 1st 2004. By Authority House of Representatives. [Online] [Accessed 17 November, 2009] Available: [http://parlinfo.aph.gov.au/parlInfo/genpdf/chamber/hansardr/2004-03-01/0108/hansard\\_frag.pdf;fileType=application%2Fpdf](http://parlinfo.aph.gov.au/parlInfo/genpdf/chamber/hansardr/2004-03-01/0108/hansard_frag.pdf;fileType=application%2Fpdf)
- State of Queensland Environmental Protection Agency. (2007). Managing parks and forests. Queensland Government. [Online] [Accessed 17 December, 2007] Available: [http://www.epa.qld.gov.au/parks\\_and\\_forests/managing\\_parks\\_and\\_forests/](http://www.epa.qld.gov.au/parks_and_forests/managing_parks_and_forests/)
- Sutton, S.G. & Bushnell, S. (2007). Socio-economic aspects of artificial reefs: Considerations for the Great Barrier Reef Marine Park. *Ocean & Coastal Management*, 50, 829 – 846
- Tremblay, P. (2007). Economic Contribution of Kakadu National Park to tourism in the Northern Territory. CRC for Sustainable Tourism Pty Ltd. Australia
- TQ. (2003). Dive Tourism. Tourism Queensland. [Online] [Accessed 4 September, 2007] Available: [http://www.tq.com.au/fms/tq\\_corporate/research/fact\\_sheets/dive\\_tourism.pdf](http://www.tq.com.au/fms/tq_corporate/research/fact_sheets/dive_tourism.pdf)
- TQ. (2007). Recreational Dive and Snorkel Market, YE March 2007. Tourism Queensland. [Online] [Accessed 14 October, 2009] Available: [http://www.tq.com.au/fms/tq\\_corporate/research/fact\\_sheets/Microsoft%20PowerPoint%20-%20Dive%20and%20Snorkel\\_final.pdf](http://www.tq.com.au/fms/tq_corporate/research/fact_sheets/Microsoft%20PowerPoint%20-%20Dive%20and%20Snorkel_final.pdf)
- TTF. (2009). Marine Tourism Report. June Quarter 2009. TTF Tourism Statistics. Tourism & Transport Forum. [Online] [Accessed 14 October, 2009] Available: <http://docs.google.com/gview?a=v&q=cache:qt7KO5rmImMJ:www.ttf.org.au/DisplayFile.aspx%3FFileID%3D582+tourism+scuba+diving+market+statistics+and+data+australia&hl=en&sig=AFQjCNGmykSv g6BZHM9FAOYTDHaXtQPb2A>