Comparison Between Traditional Ecological Knowledge of Coastal Villagers in Thailand and Scientific Ecological Knowledge Regarding Dugong

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ABSTRACT

Previous studies of traditional ecological knowledge (TEK) of dugongs are sparse. Moreover, they did not compare TEK and SEK (scientific ecological knowledge) with statistical testing. Hence, this paper examined an equal proportion of TEK and SEK. The study covered five coastal communities in Trang province. In-depth interviews were used with coastal village elders by snowball sampling and with the team leaders of 5 coastal resource conservation groups by purposive sampling—a total of 40 interviewees. Qualitative analysis was applied by coding the knowledge issues of TEK for a comparison with the SEK that was derived from literature reviews and knowledge sharing in fora among villagers, academics, and other sectors. Consistent issues were scored as 1 and inconsistent issues were scored as 0, with the maximum score being 86. The proportion of TEK to SEK was tested by chi-square. The findings indicated that for the dugong morphology, the proportion of TEK was equal to SEK (p = .370). For dugong behavior, including swimming, breathing, feeding, and social behavior and communication, the proportion of TEK was equal to SEK (p = 1.000, .366, .715 and 1.000, respectively), while the proportion of TEK on breeding and parental care of calves was not equal to SEK (p = .034). In other words, the proportion of TEK on parental care of calves was equal to SEK (p = .405), while the proportion of TEK on breeding was not equal to SEK (p = .033). From the test results above, it could be concluded that the villagers' traditional ecological knowledge regarding dugongs was comparable to the scientific ecological knowledge. Therefore, it is an extremely valuable source of knowledge. The study results suggested that traditional ecological knowledge regarding dugongs directly influences dugong conservation with the dugong being an important indicator of the abundance of aquatic resources. Moreover, the use of the traditional ecological knowledge not only empowered the coastal villagers to participate in dugong conservation, but also supported their participation in dugong planning because the coastal villagers were stakeholders in the co-management.

Keywords: traditional ecological knowledge, scientific ecological knowledge, dugong, coastal villagers

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บทคัดย่อ

การศึกษาความรู้เชิงนิเวศแบบภูมิปัญญาเกี่ยวกับพะยูนก่อนหน้านี้มีไม่มากนัก อีกทั้งการศึกษาเหล่านั้นไม่ได้มีการเปรียบเทียบโดยการทดสอบทางสถิติระหว่างความรู้เชิงนิเวศแบบภูมิปัญญากับความรู้เชิงนิเวศวิทยาศาสตร์ ดังนั้น รายงานฉบับนี้จึงต้องการศึกษาว่าสัดส่วนของความรู้เชิงนิเวศแบบภูมิปัญญาเท่ากับความรู้นิเวศวิทยาเชิงวิทยาศาสตร์ การศึกษาครอบคลุม 5 ชุมชนชายฝั่งในจังหวัดตรัง โดยสัมภาษณ์ปราชญ์ชาวบ้านที่สุ่มตัวอย่างแบบลูกโซ่ และทีมแกนนำกลุ่มอนุรักษ์ทรัพยากรชายฝั่ง 5 กลุ่ม ที่สุ่มตัวอย่างแบบเฉพาะเจาะจง รวมสัมภาษณ์ 40 คน วิเคราะห์ข้อมูลเชิงคุณภาพโดยกำหนดประเด็นความรู้เชิงนิเวศแบบภูมิปัญญาเปรียบเทียบกับความรู้นิเวศเชิงวิทยาศาสตร์ที่ได้จากการทบทวนวรรณกรรมและจากเวทีแลกเปลี่ยนเรียนรู้เรื่องพะยูนระหว่างชาวบ้าน นักวิชาการ และภาคส่วนอื่น ถ้าสอดคล้องให้ 1 คะแนน ถ้าไม่สอดคล้องให้ 0 คะแนน โดยคะแนนสูงสุดเป็น 86 คะแนน ต่อไปทำการทดสอบสัดส่วนระหว่างความรู้เชิงนิเวศแบบภูมิปัญญาและความรู้เชิงนิเวศทางวิทยาศาสตร์ ผลการศึกษา พบว่า ความรู้นิเวศแบบภูมิปัญญาด้านลักษณะทางสัณฐานวิทยาของพะยูน มีสัดส่วนเท่ากับความรู้เชิงนิเวศเชิงวิทยาศาสตร์ (p = .370) อีกทั้งความรู้นิเวศแบบภูมิปัญญาด้านพฤติกรรมของพะยูน ได้แก่ การว่ายน้ำ การหายใจ การกินอาหาร และพฤติกรรมทางสังคมและการสื่อสาร มีสัดส่วนเท่ากับความรู้เชิงนิเวศเชิงวิทยาศาสตร์ (p = 1.000, .366, .715 และ 1.000 ตามลำดับ) ขณะที่ในเรื่องการสืบพันธุ์และการเลี้ยงดูลูกมีสัดส่วนไม่เท่ากัน (p = .034) กล่าวคือ สัดส่วนของความรู้นิเวศแบบภูมิปัญญาเท่ากับความรู้นิเวศเชิงวิทยาศาสตร์ในเรื่องการเลี้ยงดูลูก (p = .405) แต่ในเรื่องการสืบพันธุ์ไม่เท่ากัน (p = .033) จากผลการทดสอบดังกล่าวข้างต้นสามารถสรุปได้ว่าความรู้นิเวศแบบภูมิปัญญาของชาวบ้านเกี่ยวกับพะยูนเป็นความรู้ที่ค่อนข้างเทียบเท่ากับความรู้ทางวิทยาศาสตร์จึงเป็นความรู้ที่มีคุณค่าอย่างยิ่ง จึงเสนอแนะว่าความรู้นิเวศแบบภูมิปัญญาเกี่ยวกับพะยูนส่งผลโดยตรงกับการอนุรักษ์พะยูน เนื่องจากพะยูนเป็นตัวชี้วัดที่สำคัญของความสมบูรณ์ของทรัพยากรสัตว์น้ำ ดังนั้น การนำความรู้นิเวศแบบภูมิปัญญาเกี่ยวกับพะยูนไปใช้นอกจากเป็นการเสริมสร้างพลังของชาวบ้านในชายฝั่งให้มีส่วนร่วมในการอนุรักษ์พะยูนแล้ว แต่ยังสนับสนุนการมีส่วนร่วมในการวางแผนด้วย เพราะชาวบ้านในชายฝั่งเป็นผู้มีส่วนได้ส่วนเสียในการจัดการร่วม

คำสำคัญ: ความรู้นิเวศแบบภูมิปัญญา ความรู้นิเวศเชิงวิทยาศาสตร์ พะยูน ชาวบ้านในชายฝั่ง

INTRODUCTION

Dugongs are rare animals that can be found in many countries, with the largest dugong population being in Australia (Preen, 2004, p. 205; Marsh & Kwan, 2008, p. 2152). In Thailand, dugongs reside in two marine coastal areas: the Gulf of Thailand and the Andaman Sea (Adulyanukosol, 2000, p. 191). In 2001, a survey documented the dugong population at around 123 individuals in Trang waters (Hines, Adulyanukosol, & Duffus, 2005, p. 536). In 2005, the number of dugongs was reported to be 42–126 individuals around the Talibong-Muk Islands (Adulyanukosol & Thongsukdee, 2005, p. 1) reportedly the largest dugong herd in Thai waters (Adulyanikosol, 2000, p. 191).

Dugong are at high risk of becoming extinct because they have a low reproduction rate (Marsh et al., 1984, p. 785; Morton, 2001, p. 420; North Australian Indigenous Land Sea Management Alliance, 2006, p. 48). Moreover, the mortality rate of dugongs is also high, specifically in Trang province, where it was reported that the dugong mortality rate was around 15 per year (Anonymous, 2011). Marsh (2009, p. 334) said that most dugong

deaths were mainly caused by gill nets and commercial fishers. Moreover, Hines, Adulyanukosol, Duffus, and Dearden (2005, p. 655) said that along the Andaman coast, the trawl and push nets of commercial fishers reached into shallow water destroying the seagrass beds and catching dugongs unintentionally. Dugong sightings in Trang province continued to decrease during 2005–2012, as shown in Figure 1.

In former times, dugong conservation was not extensive. Dugongs were always hunted or killed. Dugong conservation was initiated by the 1947 Fishery Act in which dugongs were protected by strictly prohibiting possession, catching, trapping, and destruction (Adulyanukosol Prasittipornkul, Thongsukdee, & Boukaew, 2008, p. 3, 5). Dugong conservation was stronger in 1991–1992 when the Yadphon Association conducted a campaign targeting coastal villagers to make them more aware and caring of the local resources. The campaign utilized dugongs as a tool to prevent trawl and push nets which were destroying the seagrass beds, from trespassing into a conservation zone of 3,000 m from shore. One of the activities was to stick poles around seagrass areas (Boonprakam, 1998, p. 78). Moreover, the 1992 Wildlife Preservation and Protection Act generally states that the dugong is one of 15 species on the wildlife reserve list in Thailand (Adulyankosol et al., 2008, p. 3).

Dugong conservation should be based upon knowledge consisting of traditional knowledge supporting scientific knowledge (D'Incao and Reis, 2002, p. 531). Fishers' knowledge about fish, the fishery, and the ecosystem is experience-based knowledge that improves the management process (Gray & Hatchard, 2008, p. 163). Not only does the use of traditional ecological knowledge (TEK) support the decision making process and sustainable resource management, it also empowers people to manage their own destiny that is one goal of development (Hewawasam, 2000, p. 361; Phuthego & Chanda, 2004, p. 57).

Previous studies concerning TEK are abundant. However, the studies linking TEK and scientific ecological knowledge (SEK) are few (Bergmann, Hinz, Blyth, Kaiser, Rogers, & Armstrong, 2004, p. 374; Krupnik & Ray, 2007, p. 2946; Anadón Giménez, Ballestar, & Pérez, 2009; Anadón Giménez, & Ballestar, 2010, p. 1443; Shen et al., 2012). Specifically, the studies of TEK regarding dugongs are even fewer, such as Adulyanukosol Hines, & Boonyanate (2000) and Matthews (2003). These studies presented descriptive statistics (e.g. percentage), but did not provide any links to TEK. Therefore, this paper examined and compared the TEK of coastal

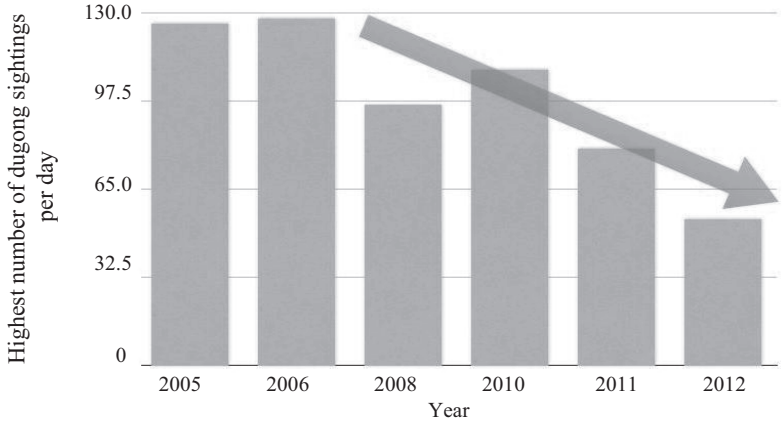

Figure 1 Highest number of dugong sightings per day in Trang province
Sourced: Kittiwattana (2012). Note that data are not provided for 2007 and 2009.

villagers regarding dugongs with the scientific knowledge in order to utilize the TEK to conserve dugongs and seagrass in the future.

METHODOLOGY

Study area

Some herds of dugong have been seen in Trang province, with the Talibong-Muk Islands in Trang province having the highest dugong population in Thai waters (Adulyanukosol, 2000, p. 191). Thus, the study area consisted of five communities surrounding the habitat of the dugongs: Libong Island, Muk Island, Had Yao Chao Mai Village, Pramoung Village, and Modtanoi Village.

Target population

The population in this study included coastal villagers possessing local knowledge and leaders of coastal resource conservation groups.

Steps of study

1. Literature review was conducted to synthesize scientific ecological knowledge (SEK) on dugongs (Adulyanukosol et al., 2000; Silvano & Begossi, 2005, p. 43; Lopez-Arevalo, Gallina, Landgrave, Martínez-Meyer, & Muñoz-Villers, 2011, p. 1452; Taylor, Morrison, & Shears, 2011, p. 3039).

2. Research instrument: a question guideline was constructed for in-depth interviews of coastal villagers on traditional ecological knowledge (TEK on dugongs.

3. Sampling: coastal villagers, who had local knowledge, were randomized with snowball sampling (Carter & Nielsen, 2011, p. 299; Taylor et al., 2011, p. 3038). Leaders of conservation groups/networks were randomized with purposive sampling, for a total of 40 people.

4. Data collection: villagers possessing local knowledge and 60 years of age or more, were interviewed individually (Armitage, Berkes, Dale, Kocho-Schellenberg, & Patto, 2011, p. 995; Carter & Nielsen, 2011, p. 300; Weiss, Hamann, Kinney, & Marsh, 2012, p. 178) and leaders of coastal resource conservation groups/networks were also interviewed (Carter & Nielsen, 2011, p. 300).

5. Data analysis

5.1 Knowledge identifiers: content analysis was conducted by identifying the tacit knowledge of coastal villagers and defining codes for the main issues and sub-issues (Carter & Nielsen, 2011, p. 300). Tacit knowledge was divided into two parts: 1) dugong morphology and 2) dugong behavior (e.g. swimming, breathing, feeding, breeding and parental care of calves, and social behavior and communication).

5.2 Knowledge comparison: knowledge was compared between TEK and SEK (Bergmann et al., 2004, p. 374; Krupnik & Ray, 2007, p. 2946; Anadón et al., 2009; Anadón et al., 2010, p. 1443). Consistent issues were scored as 1 and inconsistent issues were scored as 0, with the maximum score being 86.

5.3 Knowledge verification: five academics verified the knowledge comparison from 5.2 and above. Knowledge issues and scores were adjusted according to the recommendations of the experts.

5.4 Hypothesis testing: Chi-square was used for proportional testing of TEK and SEK at 0.50 : 0.50.

RESULTS

As shown in Table 1, considered as a whole, the results of proportional testing between the TEK and the SEK of dugongs indicated that the proportion of coastal villager knowledge was not different from the scientific knowledge (p = .060). Considered separately, it was found that villagers' knowledge and ecological scientific knowledge of both dugong morphology and dugong behavior were not different (p = .370 and .890, respectively).

For dugong behavior, the results showed that four items of knowledge—swimming, breathing, feeding, and social behavior and communication—

Table 1 Proportional testing of dugong knowledge between traditional ecological knowledge (TEK) and scientific ecological knowledge (SEK)

Knowledge item	TEK	SEK	Chi-square	*p*-value
1. Dugong morphology	27	34	0.80	.370
1.1 Body color	1	1		
1.2 Skin	1	1		
1.3 Mouth	3	3		
1.4 Teeth	1	1		
1.5 Tusks	4	5		
1.6 Eyes	2	3		
1.7 Ears	1	2		
1.8 Nostrils	2	2		
1.9 Flippers	3	4		
1.10 Tail fluke	3	3		
1.11 Breast/ nipples	4	5		
1.12 Sex	2	4		
2. Dugong behavior	36	52	2.91	.890
2.1 Swimming	5	5	0.00	1.000
2.2 Breathing	4	7	0.82	.366
2.3 Feeding	14	16	0.13	.715
2.3.1 Main food	1	1		
2.3.2 Grazing characteristics	1	1		
2.3.3 Grazing traces	1	1		
2.3.4 Water conditions	1	1		
2.3.5 Water depth	2	2		
2.3.6 Grazing period	1	1		
2.3.7 Types of seagrass grazed	2	2		
2.3.8 Characteristics of seagrass grazed	1	1		
2.3.9 Parts of seagrass grazed	1	1		
2.3.10 Eating in a crowd	1	1		
2.3.11 Surface breathing during grazing	0	1		
2.3.12 Seagrass cropping	1	1		
2.3.13 Other types of food	1	2		
2.4 Breeding and parental care of calves	8	19	4.48	.034*
2.4.1 Breeding	3	11	4.57	.033*
- Maturity at breeding	0	2		
- Breeding seasonal	0	1		
- Breeding activities	1	1		
- Duration of pregnancy	1	2		
- Number of calves per time	1	1		
- Time interval between newborns	0	1		
- Place of giving birth	0	1		
- Calf size	0	2		
2.4.2 Parental care of calves	5	8	0.692	.405
- Duration of breastfeeding	1	2		
- Mother precautions	1	1		
- Closeness of mother and calf	1	1		
- Grazing seagrass of calf	1	3		
- Mother and calf looking for food	1	1		
2.5 Social behavior and communication	5	5	0.00	1.000
2.5.1 Social behavior	3	3	-	-
2.5.2 Communication	2	2	-	-
Total	63	86	3.55	.060

the proportion of TEK was equal to SEK (p = 1.000, .366, .715 and 1.000, respectively), while the proportions of TEK on breeding and parental care of calves were not equal to SEK (p = .034). In other words, the proportion of TEK on parental care of calves was equal to SEK (p = .405) while the proportion of TEK on breeding was not equal to SEK (p = .033).

DISCUSSION

In part, the coastal villagers' knowledge of dugongs was derived from legend and beliefs handed down by their parents or older people in the communities. As Crowshoe (2005, p. 2) stated, traditional knowledge shared utilization through cultural and traditional change, including story telling. Elder persons would impart their knowledge to other people in the community. Culture was considered knowledge because it was public subject matter. Moreover, many researchers (Correa, 2001, p. 3; Barton et al., 2002, p.73; Hansen & VanFleet, 2003, p. 3; Crowshoe, 2005, p. 2) mentioned that people in a community created, improved, maintained, and transmitted knowledge from generation to generation. Hence, traditional knowledge was an important part of cultural identity; it has been very active, and would continue to be active, in the daily lives of many people.

The knowledge of coastal villagers regarding dugong was experience-based due to their manner of living in coastal areas, which was the habitat of dugongs, and it was their careers in small-scale fishery that allowed them to observe dugongs normally while fishing. As Good (1973, p. 325) mentioned, knowledge was facts, truth, regulation, and information that humans obtained and accumulated from their experiences. Moreover, Hammond, Austin, Suzanne Orcutt and Rosso (2001, p. 9) said that contemporary learning theory indicated two roles—experience and reflection—which result in thinking development and skill. This is consistent with Gray and Hatchard (2008, p. 163) who said that fishers had knowledge about fish, the fishery, and ecology that was used to improve the management process. Moreover, in the past before dugong conservation, coastal villagers used to consume meat from dugong that had been caught in their fishing gear. Coastal villagers eviscerated the dugong for food because they thought that dugong meat was halal food that could be eaten without conflict with their religion. However, at present, most coastal villagers have changed their habits to conserve dugongs. Hansen and VanFleet (2003, p. 3) mentioned that traditional knowledge was information that people in the community defined and that depended on experience, adaption, and the local culture and surroundings, which developed over time and is still further developing. These kinds of knowledge would be used in preserving the community and culture and protecting necessary genetic resources for the continuous survival of the community. Traditional knowledge also included mental inventories of local biological resources—animals, local plants, and trees.

Knowledge acquired by the coastal villagers of dugong was derived from their participation in dugong conservation. Specifically, villagers were appointed by the governor to carry out surveillance for illegal fishing gear. Moreover, villagers delivered dead dugong bodies to research and development institutions in Phuket for examination of the remains. This is consistent with Dewey & Dewey (1915 as cited in Gentry, 1990, p. 10) who mentioned "learning by doing" and Sophocles (cited by Gentry, 1990, p. 9) who mentioned in 400 B.C. that "one must learn by doing the thing".

The coastal villagers' knowledge of dugong came from knowledge sharing at monthly meetings of the provincial small-scale fisher associations. The coastal villagers in each community who were members of the associations presented the current state of resources in their areas and together they analyzed and solved problems. Wang and Noe (2010, p. 117) said that knowledge sharing was information preparation and know-how that helped and involved

people in problem solving, new idea development, or new methods. Knowledge sharing could occur through written recording, face-to-face communication, or through expert networks.

The coastal villagers' knowledge of dugong could also come from external sources. For example, academics might inform coastal villagers about the causes of death or the number of dugong in the district or address a provincial meeting. In addition, the villagers could get information from the media, including official documents, newspapers, and other non-fiction documents. Jeong and Hmelo-Silver (2010, p. 84) mentioned that there were various learning resources, including teachers, knowledgeable people, printed resources, and the electronic media, among others.

Finally, these bodies of knowledge from the experiences of coastal villagers are accumulated and become traditional ecological knowledge (TEK).

1. Dugong morphology

The coastal villagers' TEK was clear regarding dugong morphology. Because the coastal villagers' way of life and their careers were spent in fishing in dugong habitat areas, they had many opportunities to observe dugongs first hand.

2. Dugong behavior

The coastal villagers' TEK was clear on the swimming, breathing, feeding, and social behavior and communication of dugongs, but was not explicit on breeding. Although both breathing and breeding behavior are more difficult to observe, the test result for breathing behavior shows that the proportion of TEK was equal to SEK, while the breeding proportion of TEK was not equal to SEK. Villagers supplied 57.14 percent correct answers on breathing. This implied that their knowledge was not definite in terms of the frequency of surface breathing, both during regular periods and seagrass feeding periods, which requires scientific knowledge. Moreover, the behavior of surface breathing would change if dugongs were disturbed by the villagers' presence. On the other hand, villagers supplied only 27.28 percent correct answers about breeding because this behavior requires scientific knowledge and continuous monitoring for adequate study, but the coastal villagers only occasionally saw different dugongs during their fishing activities. Boyd, Lockyer, and Marsh (1999, p. 243) noted that the breeding biology of dugongs was difficult to study. Methods of study included analyzing dugong carcasses, analyzing the life span of dugongs with longitudinal studies, or studying individual dugongs in captivity. Moreover, Vos and Reeves (2006, p. i) and Weilgart (2007, p. 159) also said that noise from human activities disturbed dugong breeding. Therefore, coastal villagers did not often see dugongs breeding or giving birth.

3. Social behavior and communication

The traditional ecological knowledge of coastal villagers was apparent in both social behavior and communication. For social behavior, dugongs were observed in a herd. While seagrass grazing, they could either be alone or in herd. Ripple (1999, p. 77) said that the individual dugongs separated from social groups because separation enhanced the ability to look for food, allowed breeding behavior, provided better environmental conditions, and relieved the pressure of being hunting in nature.

Coastal villagers knew that dugongs communicated by voice, similar to whales or dolphins, because the noises made by dugongs were audible to some villagers while they were swimming underwater to collect dog conch in the seagrass beds. They heard dugong blaring "eid" or “ard". Moreover, they compared dugong communication with other sea mammals, such as whales and dolphins. Villagers knew that mother and calf communicated through the use of body language. Dugong mothers attempt to use their flippers to pull their calves in much the same way as humans use their hands.

CONCLUSION AND RECOMMENDATIONS

The traditional ecological knowledge of coastal villagers of dugong morphology was clear. Moreover, their knowledge of dugong behavior was also clear with regard to swimming, breathing, feeding, parental care of calves, social behavior, and communication. However, they were unclear in their knowledge of dugong breeding.

The study results suggest that traditional ecological knowledge regarding dugongs directly influences dugong conservation with the dugong being an important indicator of the abundance of aquatic resources. Coastal villagers had to avoid any practice that disturbed dugong habitats and seagrass beds, which was a factor that changed some dugong behavior, including feeding and fragmenting of groups, among others. In addition, the use of traditional ecological knowledge not only empowered coastal villagers to participate in dugong conservation, but also supported their participation in dugong planning, because the coastal villagers were major stakeholders in the co-management.

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