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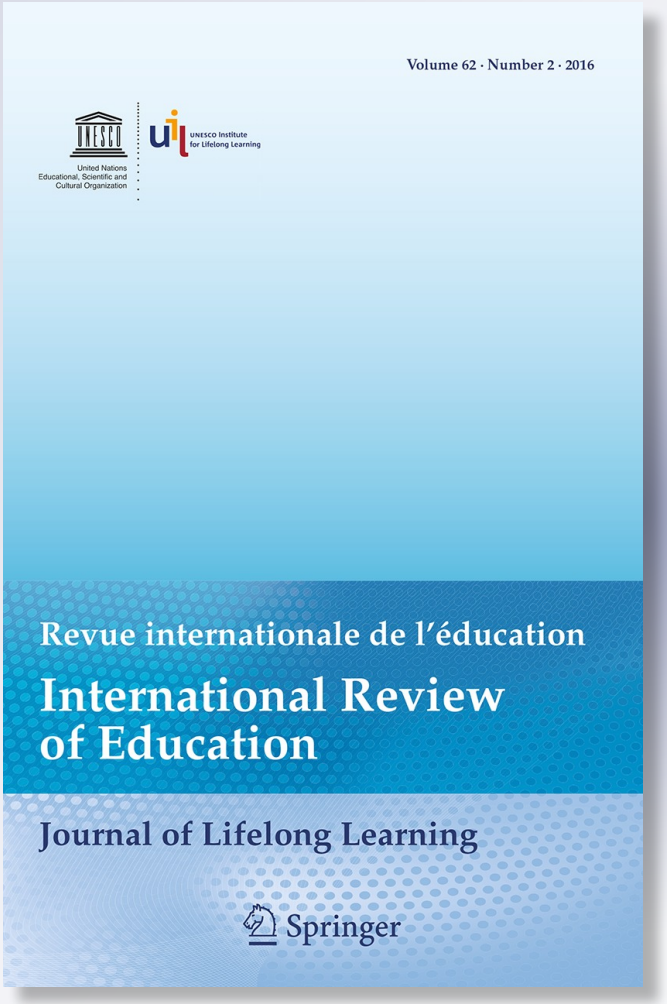

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ORIGINAL PAPER

Sustainable development of Philippine coastal resources: Subsidiarity in ethnoecology through inclusive participatory education

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Abstract The Philippines is an archipelago of more than 7,100 islands, with a population of over 100 million people dependent upon marine resources which are characterised by a decline in both biodiversity and abundance. The resultant large sector of fisherfolk is generally impoverished with limited education, which makes coastal adult education and lifelong learning a national priority. This article considers the Filipino fisherfolk community as a culture to identify potential input strategies regarding education development for marine science concepts. In a study piloting cultural consensus theory applications with a well-established fisherfolk organisation, the authors focus on the lack of dialogue engaging Philippine fisherfolk with standards of international marine science, bioregional resource partitioning and reflexive in-country education development. Cross-cultural strategies considered in this paper include exploring paraprofessional approaches to adult education, accommodating several dialects/languages and drawing on international

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science concepts. While earlier adult education initiatives aimed at fisherfolk may have had limited success in part due to a lack of cultural context, this pilot study is innovative in that it applies an existing Filipino form of *social artistry* to fisherfolk identity, expression and communication. *Siningbayan* [*Sining* = art, *bayan* = nation or town], or *art whose canvas is society* evolved through the Philippine history of organic networking and participation. Results confirm that a structured ethnoecological research design combined with *Siningbayan* appear effective for identifying education and curriculum specifics both for the fisherfolk sector of Filipino society and for professional marine science; their common goal being improved resource management. The authors place particular emphasis on subsidiarity, considering how best to transfer information to individual fisherfolk and their communities, as well as exploring their scaled-up role in leadership, organisational and professional development.

Keywords Artisanal fisherfolk · Cultural consensus · Ecocentric · Adult education · Bioregional marine science · Subsidiarity · *Siningbayan*

Résumé Développement durable des ressources côtières aux Philippines: subsidiarité en ethnoécologie à travers l'éducation inclusive et participative – La République des Philippines est constituée d'un archipel de plus de 7100 îles. Forte de plus de 100 millions d'habitants, sa population dépend des ressources marines, qui connaissent un déclin à la fois de la biodiversité et de l'abondance. L'important peuple marin du pays est globalement appauvri et peu instruit, ce qui explique que l'éducation des adultes et l'apprentissage tout au long de la vie dans les régions côtières sont devenus une priorité nationale. Les auteurs de cet article abordent la communauté des pêcheurs philippins en tant que culture, en vue d'en tirer d'éventuelles stratégies pour le développement de l'éducation sur les concepts des sciences marines. Lors d'une étude testant, avec le soutien d'une organisation de pêcheurs bien établie, des applications de la théorie du consensus culturel, les auteurs dénoncent le manque de dialogue pour familiariser les pêcheurs philippins avec les normes de la science marine internationale, le partage des ressources biorégionales et un développement réflectif de l'éducation à l'intérieur du pays. Les stratégies transculturelles envisagées dans cet article consistent à explorer les approches paraprofessionnelles de l'éducation des adultes, à tenir compte de plusieurs langues et dialectes, et à s'inspirer de concepts scientifiques internationaux. Alors que les initiatives antérieures d'éducation des adultes destinées aux pêcheurs ont rencontré un succès limité, dû en partie au manque de contexte culturel, cette étude pilote est innovante en ce qu'elle applique à l'identité, l'expression et la communication des pêcheurs une forme philippine d'art social. *Siningbayan* [*Sining* = art, *bayan* = nation ou ville], ou art dont la société est la toile, a évolué dans la tradition philippine des réseaux naturels et de la participation. Les résultats confirment que pour une étude ethnoécologique, une conception structurée associée au siningbayan se révèle efficace pour identifier les caractéristiques éducatives et curriculaires, tant pour le secteur halieutique de la société philippine que pour la science marine professionnelle, leur objectif commun étant une meilleure gestion des ressources. Les auteurs insistent particulièrement sur la subsidiarité, en étudiant

les meilleurs moyens de transmettre l'information aux pêcheurs individuels et à leurs communautés, tout en explorant leur rôle renforcé dans le développement organisationnel, professionnel et de l'encadrement.

Introduction

The Philippines, an archipelago of more than 7,100 islands (divided into six marine bioregions), has a population of over 100 million people and is more dependent upon marine fisheries than any other large country in Southeast Asia (Silvestre and Pauly 2004). Involving local fisherfolk in Philippine coastal resource management (CRM) began over twenty years ago through a focus on community-based education designs (Pajaro 1994; Pajaro and Nozawa 1996). This article explores how related sustainability and development might be maximised through the selection of scale (building upon local perceptions) or optimal subsidiarity[1] for education design and implementation. Globally, in the past two decades there has been an increasing emphasis on the logic of linking ecological and social systems to promote sustainability, social process and resilience (Berkes and Folke 1998), bringing ethnoecology or the relationship between society and resources to the forefront of education (Watts et al. 2010; Moffatt et al. 2011). Historically, educational development in the Philippines has been complicated by a heritage of isolated communities and three centuries of colonialism, perhaps enhancing the need for participatory strategies.

As well as the challenge of having a population spread across thousands of islands, the Philippines is also characterised by a complexity of languages[2] and a local focus on protecting self-determination and governance through the local government code of Republic Act 7160 (ROP 1991). The general goal to balance local independence with the global setting (Wilson 2012) through appropriate application of the subsidiarity principle may require a process which establishes culture not only as a historical resource, but also as a potential tool for change, an idea which is supported by the results of the pilot study presented in this paper. Another challenge is the paucity of Philippine marine scientists, related research and reflexive management activities (Pajaro et al. 2013a), a situation which further justifies efforts towards focused lifelong learning strategies which include broader issues such as gender equity (Pajaro et al. 2013a).

Today, Philippine fisherfolk interventions continue to evolve through participatory approaches (Pajaro 2010). Strategically, ongoing efforts are generated through catalytic action involving non-government organisations (NGOs) as a method of

[1] Briefly, the subsidiarity principle, central to this article, aims to ensure that decisions taken by higher-level governance authorities (top-down) are tailored as closely as possible to the situation of the citizens affected by them. Furthermore, constant reviews, taking those citizens' experience and expertise into account (bottom-up), aim to verify that action at government level is justified in light of the given conditions and possibilities at national, regional or local levels.

[2] While there are two official languages, namely Filipino (Tagalog) and English, more than 100 indigenous and local languages are spoken in the Philippines, most of which have Malayo-Polynesian roots.

supporting public participation which will influence future government and education policy decisions. The marine-NGO emphasis is on broadly involving those effected by marine-related education decisions, helping the beneficiaries define how they can best participate in a meaningful way, and focusing on the high end of the participatory scale though collaborative problem solving and agreement development (Creighton 2005).

This paper provides an initial assessment of participation utilising cultural consensus theory (CCT)[3] which has been applied elsewhere to the study of fisherfolk in freshwater settings (Medin et al. 2006). Statistical analysis within CCT was developed by A. Kimball Romney et al. (1986) as the "cultural consensus model". Our working hypothesis underlying the pilot study presented here is that long-term participatory research with Philippine fisherfolk enables facilitators to ask questions which reveal significant cultural aspects of the sector. Our pilot investigation supports the development of larger ecosystem or bioregional approaches (Pajaro et al. 2013a) through iterative Action Research and Learning Cycles[4] (Watts and Pajaro 2014). Developmental resource management involves consideration of two broad categories: best-practice transfer of known or accepted pedagogical paradigms; and remedial approaches designed for specific challenges. Many programmatic approaches involve some combination of the two, but in our pilot study, the focus is primarily on the latter – an approach for a specific challenge.

The challenge we focused on was the disconnect or lack of dialogue engaging Philippine fisherfolk with standards of international marine science and reflexive[5] in-country education development. Our methodology pertained to the principles of CCT, supplemented by a Filipino form of *social artistry* derived from the early work of Jean Houston.[6] We employed the Filipino *Siningbayan* (Ayala and Bautista 2014) approach as an entry point for one specific CCT intervention as a contribution to transformational steps on societal approaches to resource management. *Siningbayan* is a Filipino form of *social artistry* which emerged from the 2007 Philippine Congress on Good Citizenship and was subsequently piloted through a culturally sensitive capacity building partnership between the United Nations Development Programme and Bagong Lumad Artists Foundation Inc. We employed the Filipino *Siningbayan* [*Sining* = art, *bayan* = nation or town] approach as an entry point for

[3] In summary, cultural consensus theory (CCT), also central to this article, aims to identify, measure and evaluate cultural beliefs shared by a number of individuals. Consensus is verified by a variety of statistical methods.

[4] Action Research is participatory in that it is carried out by and for the target group with the aim of assisting its members in enhancing their actions. Learning Cycles operate on the principle of learning by doing, i.e. through experience.

[5] Reflexive education, another concept which is central to this article, operates on the principle that only learning content which is properly understood by learners will be retained in the long term and serve as a basis for them to build on. Further, it must respond specifically to a need.

[6] According to human capacities researcher Jean Houston, "Social Artistry is the art of enhancing human capacities in the light of social complexity. It seeks to bring new ways of thinking, being and doing to social challenges in the world […] Social Artists are leaders in many fields who bring the same order of passion and skill that an artist brings to his or her art form and to the canvas of our social reality." For more background information, see www.jeanhouston.org/Social-Artistry/social-artistry.html [accessed 10 January 2016].

one specific CCT intervention as a contribution to testing transformational steps on societal approaches to resource management. In 2011, we used *Siningbayan* during a preliminary fisherfolk leaders' workshop before applying Romney's (1986) cultural consensus approach when we set up our pilot study. Overall, our intent was to explore Filipino fisherfolk's cultural needs and opportunities for both adult education and in-country professional development relative to international marine science, including the consideration of bioregionality. Combining *Siningbayan* and CCT approaches as a new intervention, our aim was to co-produce knowledge as suggested generally by Derek Armitage et al. (2011), involving local expertise and, in this case, focusing on sectoral empowerment and improvements in the management of coastal Philippine resources.

There is also a related need within Southeast Asia to enhance consideration of (biodiversity-based or bioregional) marine spatial planning in line with current global management standards (Douvere and Ehler 2009; Ehler and Douvere 2009). Tens of millions of people in the Philippines alone are directly dependent upon shared bioregional fishery resources for their livelihoods and their food security. Although near-shore (*demersal*) fishing is significant, two of the six Philippine bioregions are located on the Pacific seaboard with enhanced bioregional considerations due to the dependence upon shared and highly migratory deeper water (*pelagic*) fish stocks. The Pacific seaboard includes both the Northern and Southern Philippine Sea Bioregions. The study we present here initiates application of quantitative cultural assessment (Bang and Medin 2010; Medin et al. 2007) to the development of local and bioregional programmes (Watts and Pajaro 2014). Institutionalised lifelong learning strategies for fisherfolk and bioregional professional expertise development (Pajaro et al. 2013a) are central to alleviating Philippine poverty and mitigating climate change. In this paper, we explore the cultural resources of a well-established national network of fisherfolk to contribute to determining reflexive bioregional strategies for lifelong learning, in part through best-practice transfer.

The study outlined here introduces an enhanced culturally relevant research design, integrating educational psychology approaches to help meet the challenges discussed above and promote related collaboration with government education and poverty alleviation authorities. We compare the culture of one national Filipino fisherfolk group to international marine fisheries science[7] and national coastal resource management concepts. For our pilot study, we picked a fisherfolk organisation called, in the Vasayan dialect, Pambansang Alyansa Ng Mga Maliliit Na Mangingisda at Komunidad na Nangangalaga ng Karagatan at Sanktwaryo sa Pilipinas (PAMANA).[8] PAMANA, an alliance of marine protected area (MPA) managers which was officially registered in 1999, is generally considered to be an *advanced* organisation in the fisheries sector based in part upon their international recognition (Anabieza et al. 2010). Our broad goal in involving PAMANA was to

[7] Marine fisheries science is an interdisciplinary academic field, involving various natural sciences as well as social sciences, economics and law.

[8] The English translation is "National Alliance of Small Fishers and Communities Managing the Coast and Marine Sanctuaries of the Philippines". For more information (in English) see http://pamana.50webs.com/ [accessed 10 January 2016].

clarify initial paraprofessional and cultural learning designs for adult education of fisherfolk which are also linked to specific professional training. This Action Research approach is ongoing (Watts and Pajaro 2014), with our pilot study representing a first step in elucidating and applying statistical understandings of fisherfolk culture through the application of public participation principles (Creighton 2005). Our long-term development strategy consists of an iterative design, i.e. a cyclic process of identifying specific challenges and defining participation-based remedial strategies. Although the concept of participatory strategies is not new (Burkey 1992), they are somewhat problematic on a larger scale unless supported by representative statistical evidence. More generally, our efforts can be considered as an exploration of cultural ecology or the relationship between the fisherfolk sector of Philippine society and their primary resources.

In the Philippines, public participation has in principle been identified as a priority strategy to promote Sustainable Development (SD) of coastal resources through Philippine Republic Act No. 8435 (ROP 1997; also known as the Agriculture and Fisheries Modernization Act). However, there is a systematic lack of scientific marine fisheries expertise at local government unit (LGU) levels (Pajaro et al. 2013a); mandated through Republic Act No. 7160 (ROP 1991; also known as the Local Government Code) to manage coastal resources out to the 15-kilometre limit. Further, there are virtually no reflexive Philippine educational programmes focused on filling that professional need. In sum, there is a paucity of (1) empowered stakeholders; (2) applied education programmes and (3) functional government agencies, all of which are required to appropriately address the coastal resource management challenges inclusive of public participation strategies. Thus, one significant catalyst role of NGOs may be the facilitation of the design and implementation of culturally relevant remedial institutional and governance paradigms. Our pilot study was an initial survey to explore the application of cultural consensus theory (CCT), based on existing knowledge levels regarding Philippine fisherfolk culture and several decades of collaborative research (Pajaro 1994; Pajaro and Nozawa 1996; Pajaro 2010; Anabieza et al. 2010; Pajaro et al. 2013a, b).

The difficulty of selecting questions which elucidate cultural agreement might be due to a need for further open-ended cultural research, or, considering subsidiarity, due to the fact that cultures function independently at a more local level. Our pre-study *Siningbayan* activities provided a cultural strengthening exercise which was carried out with the PAMANA leaders themselves, focused specifically on communication between scientists and fisherfolk leaders. *Siningbayan* seeks to bridge gaps between values and expression to establish enhanced sharing which supports naturally evolving self-governance capacity building. Through a process of validating both artistic and linguistic expression, *Siningbayan* also provides an authentic Philippine lens for cultural building, with one intent being to uncover aspects of prosperity which are sometimes hidden by purely monetary assessment. In our case, the goal was to bring paraprofessional and cultural pride more to the forefront for individual fisherfolk leaders as a form of validation; thus promoting expression and communication. The further development of fisherfolk empowerment can, in part, be seen as a challenge to build communication capacity as well as structured opportunities and advocacy strategies for expression within communities

and governance systems. This could include the promotion of top-down inputs to link fisherfolk to global resource sustainability concepts strategically in combination with bottom-up fisherfolk participation in local government development plans.

Although our pilot study focused on the Philippines, we suggest that broader application of the approach could also be of use in other Southeast Asian countries with significant small-scale traditional (artisanal) fisherfolk sectors. On a larger geographical scale, the approach might also be useful for cultural groups such as the Inuit People of Canada, who have been found to have a similar level of dependence upon marine resources (Koutouki et al. 2015). In general, small-scale coastal fisheries are a significant (in terms of size and contribution to global food security) unorganised international sector (PAMANA is a high-end exception) which need to be considered in efforts to alleviate global poverty. Additional cultural efforts, action and advocacy strategies are further justified and, indeed, urgently needed in view of the looming effects of climate change on coastlines and the fact that the nutritional health of many less developed nations is compromised by marine degradation (Brunner et al. 2008).

Our underlying hypothesis was that cross-cultural differences and potential linkages could be identified based upon two reference points. The first one is the historic, long-term educational engagement of the authors regarding Philippine coastal fisherfolk, and the second one is consideration of professional global approaches to marine science.

The pilot study discussed in this paper has already attracted the interest of the Philippine Technical Education and Skills Development Authority (TESDA) and the Department of Education. TESDA officials have indicated that there are related needs for both designing new Grade 11 and 12 specialty courses in formal school education[9] as well as standardising lifelong learning approaches to adult education of fisherfolk. Artisanal fisherfolk tend to operate according to traditional protocols and procedures which have evolved over generations, generally outside the banking, taxation and academic systems of the modern world. Iterative participatory consensus building and assessment can be grounded, even institutionalised, through community-based culture appreciation, thus supporting national and/or bioregional approaches to reflexive education for sustainable development which have previously been somewhat problematic.

Methods

The current paper presents a pilot study focused on the use of cultural consensus analytical design linked to a social artistry approach. The primary goal was to initiate and test a participation design which is manageable within the scale of the large Philippine fisherfolk sector. This involved facilitated leadership development of PAMANA members themselves. Recognising the need for enhanced communication

[9] The Philippine formal compulsory school system has three main sections. Elementary education comprises kindergarten and Grades 1–6; Junior high school comprises Grades 7–10, and Senior high school will comprise (as of 2016/2017) Grades 11 and 12.

skills, the cultural consensus study was preceded by the *Siningbayan* application of social artistry with a core group from PAMANA. For the pilot study reported on here, quantitative analysis is limited to the cultural consensus assessment as described in the next section. However, during the project it became increasingly clear that the *Siningbayan* workshop had contributed significantly to the quality of the results. Recognising this causal linkage in our development strategy, we have included a detailed description of the *Siningbayan* activity below following the section on cultural consensus methodology. To emphasise the significance of *Siningbayan* in a development context, the order is reversed in the narrative of the discussion.

Cultural consensus assessment

To identify perspectives on the linkage between human health and the ocean; resource sustainability and understanding of biodiversity, we drew on the principles of cultural consensus theory (Romney et al. 1986). Our survey was primarily based upon specific tenets of international marine science, as an initial starting point for identifying specifics of cross-cultural development which could include a focus upon fisherfolk poverty alleviation and resource sustainability. We designed our survey questions associated with marine and coastal developmental science in English and then translated into two Filipino languages, Tagalog and Vasayan.

One advancement in Educational Psychology in recent years is a result of approaches which look at cultural traits in terms of science cognition (Bang and Medin 2010; Medin et al. 2006, 2007), based upon the earlier work on CCT or the cultural consensus model by Romney et al. (1986). In this article, we report on initiating a process to explore the cultural ecology of the Philippine fisherfolk sector as an approach to supporting the development of paraprofessional adult education, new high school grade 11/12 specialty courses and tertiary education curriculum development.

Prior to the survey, we conducted one-on-one interviews translated into local dialects with trained survey supervisors (*enumerators*) to collect information and identify possible improvements of the survey tool. Subsequently, in response to our call for participation directed at accessible PAMANA members, 47 fisherfolk within 10 PAMANA member communities volunteered. Each question could be answered using a standard 5-point Likert scale. We asked a total of 58 questions, 46 of which resulted in consensus. We subdivided these into four topical areas:

(1) Relationship between people and environment;
(2) Concept of biodiversity and marine bioregions;
(3) Local perception of coastal resource management; and
(4) Local perception of marine science education and curriculum development.

We applied Principal Component Analysis (PCA) and factor loading (Abdi and Williams 2010), as well as a *scree test* (Cattell 1966)[10] to determine those survey

[10] Principal component analysis (PCA) is a statistical technique suitable for emphasising variation and bringing out strong patterns in a dataset. Factor loading is the correlation of a component from a variable. A scree test is a graphic representation of eigenvalues where a significant break or drop is examined which separates important from minor components. Combined, these analyses elucidate any cultural consensus in survey responses.

responses which represented cultural consensus (Romney et al. 1986). Our data were collected by trained fisherfolk scientists across the PAMANA sites; the information was then transcribed using a developed database in MS Access format. Several encoders were hired and trained on data entries to limit data entry errors. We then analysed for consensus in the responses to the questions through principal component analysis, following the conditions and requirements among eigenvalues, scree plots and factor loadings, using R Statistics version 3.1.1. While the results discussed below include aspects of the four topic areas, we focused this pilot study more on the approach and limited the discussion to individual points within two broad development topics: *Relationship between people and the resources* and *Biodiversity, marine bioregions and perception of science and education.* Several key responses are discussed under both headings. Future iterations to investigate cognitive science attributes regarding Philippine artisanal fisherfolk culture more deeply will be based in part upon the primary questions which were found to elicit a consensus response in the pilot survey presented here.

Siningbayan

Prior to our pilot study, a group of 20 PAMANA leaders were brought together for a fisherfolk forum in 2011 to discuss their challenges and approaches to positive change, or sustainable development. Critically, the work was carried out in the local dialects to maximise both comfort and comprehension on the part of the participants. The *Siningbayan* approach was adapted and expanded with a focus on the specific challenges fisherfolk are facing. To facilitate this initial workshop, emphasis was placed on the use of music which has a traditional and iconic status in the Philippines as a characteristic means of emotive expression. In this approach, guitars, singing and drawing materials are used almost like magic objects to help the participants focus on the premise that communication is everything. Literacy as a tool to obtain and apply information is thus redefined and linked more closely to communication and problem-based learning (PBL; see Wiers et al. 2002). A primary goal was to encourage fisherfolk to drive themselves through actually thinking on paper, which was a new experience for most, if not all. The setting was further used to help clarify their individual and group comprehension of the situation they were in, as fisherfolk. This process encompassed discussions regarding culture, values and the fisherfolk setting, through a dynamic approach to participatory facilitation. The *Siningbayan* workshop also focused participants on the development of individual mission statements and resource sharing, as steps towards an improved reality. Fisherfolk were challenged to express their positive and negative thoughts regarding their fisherfolk livelihoods. These perceptions were channelled through mind maps to document challenges and perceived roles for positive change. In summary, applied literacy was better defined through music, song and the written word so as to connect participants with their deeper cultural values; with personal and community goals. Following this social artistry workshop, we continued to prepare our pilot study to delve more deeply into fisherfolk culture. However, subsequent to the *Siningbayan* workshop it became clearer that the

PAMANA fisherfolk themselves could take on an expanded participatory role in the research itself.

To gather the information we targeted, we employed a quantitative survey format. We used a standard 5-point Likert scale ranging from –2 to 2 with strongly disagree (–2), disagree (–1), neither agree or disagree (0), agree (1), and strongly agree (2). We employed principal component analysis (Medin et al. 2007) to determine the presence of cultural consensus among fisherfolk on different PAMANA sites on each of the questions.

Results and discussion

The results of the analysis indicated that there was a high degree of consensus for the questions asked when considering the PAMANA leaders surveyed. These results indirectly indicate that the understanding of the fisherfolk culture based upon long-term study is sufficient and does not require further open-ended study to make development actions relevant. Table 1 shows where consensus was found on 46 of the survey questions.

Siningbayan

Initially the PAMANA leaders appeared unsure of their abilities to participate in the 2011 workshop. However, the linkage to both the challenges and the values of coastal people as expressed in the music and the *Siningbayan* approach gradually maximised their engagement. The *Siningbayan* exercise brought the PAMANA leaders to a higher level of self-awareness, with all participants subsequently developing their very first personal mission statement. PAMANA fisherfolk leaders were unanimous in indicating that they were encouraged to participate in further research as a result of the sectoral strengthening exercises from the *Siningbayan* workshop. In terms of the concept of subsidiarity, one of our goals was to impart sustainable development and problem-based learning strategies to these community leaders so that they themselves could advocate the concepts locally. Facilitation of organisational development continued through the research period which extended from 2012 to 2015, culminating in a restructuring of the PAMANA organisation to maximise external facilitation and internal action. Mentorship within and across the PAMANA communities and nationwide advocacy on the fisherfolk-led marine protection concept are ongoing.

The *Siningbayan* approach and the strategic development of individual mission statements by participating PAMANA leaders produced an enhanced perception of personal empowerment. Ongoing dialogue with participants has indicated that these positive impacts had a lasting effect, as demonstrated by their expression of appreciation for the event until the present time. *Siningbayan* appears to have significant application to the concept of lifelong learning for artisanal Philippine fisherfolk. The PAMANA leaders subsequently appeared to have a heightened capacity for participation; they were much more willing to explore the concept of *fisherfolk scientists* and to engage in new forms of advocacy and activity. The personal

Table 1 PAMANA fisherfolk survey results: questions and Likert-scale responses (translated from Filipino)

Questions	Likert scale*				
I. Relationship of people and environment	**–2**	**–1**	**0**	**1**	**2**
A. Relationship to marine resources, economy and ecology					
1. My life is connected to the sea				X	
2. My health is connected to the sea				X	
3. Every person in my community is connected to the sea				X	
4. The sea was created to provide income to people				X	
5. I am expecting that our children will depend on fishing as their primary source of income				X	
6. I will stop fishing if there is any alternative livelihood that has the same income as fishing				X	
B. Spatial and temporal perception					
1. Fish have their own territories				X	
2. When I go out fishing, the first thing on my mind is the food for my family for this day				X	
3. When I go out fishing, the first thing on my mind is the food for my children and grandchildren in the future				X	
4. Sunset and sunrise are important for fisherfolk				X	
5. Full moon or the light from the moon is important for fisherfolk				X	
II. Concept of biodiversity and marine bioregions	**–2**	**–1**	**0**	**1**	**2**
A. Local perception of biodiversity					
1. Every marine living being has its special place in the sea				X	
2. The bounty of different marine species in the sea is important for the health of my community				X	
3. The bounty of different marine species in the sea is important for the economy of my community				X	
4. The sea can provide inexhaustible resources for fisherfolk				X	
5. There are marine species which cannot be seen today				X	
6. The sea can take care of itself and does not need the help of people		X			
7. When I started fishing, I only caught one type of fish		X			
8. Today, I catch different types of fish				X	
9. I started fishing different types of fish because they can be bought and sold				X	
10. I started fishing different types of fish because there is a new method or technology to catch fish				X	
B. Perception on Marine Bioregion					
1. I prefer catching *pelagic* (deep-sea) fish to catching *demersal* (near-shore) fish				X	
2. My usual fishing ground is within my municipality				X	
3. My usual fishing ground is outside of my province		X			
4. My usual fishing ground is within Luzon		X			
5. My usual fishing ground is within Mindanao		X			
6. A good pelagic fish catch is dependent on proper fishing methods of my community				X	

Table 1 continued

Questions	Likert scale*				
7. A good pelagic fish catch is dependent on proper fishing methods of other communities				X	
8. A good demersal fish catch is dependent on proper fishing methods of my community				X	
9. A good demersal fish catch is dependent on proper fishing methods of other communities				X	
III. Local perception of coastal resource management	**–2**	**–1**	**0**	**1**	**2**
1. If the *barangay* is properly and effectively managing its marine resources, then all marine life will continue grow					X
[*barangay* = the smallest administrative division in the Philippines; also the native Filipino term for a village, district or ward]					
2. If the *barangay* is properly and effectively managing its marine resources, then it is enough to make the sea healthy					X
3. The sea can provide inexhaustible resources if fisherfolk use proper fishing methods					X
4. Fisherfolk should lead in taking care of the sea for the next generation					X
5. Managing marine resources for the community needs a joint effort between local government units, organisations and other institutions					X
6. Fishing communities can learn from each other to improve the status of the sea and the people					X
7. Leadership in the community can influence in building the *barangays* development plans					X
8. Fisherfolk in the community can contribute their knowledge to municipal development plans					X
9. Fisherfolk in the community can contribute their knowledge to provincial development plans					X
10. Fisherfolk in the community can contribute their knowledge to national development plans					X
11. Fisherfolk in the community can contribute their knowledge to international development plans					X
12. Fisherfolk culture is an important sector of Philippine culture					X
13. Networking and exchange of knowledge/ideas are important in building strategies for sustainable fisheries					X
IV. Local perception of marine science education and curriculum development	**–2**	**–1**	**0**	**1**	**2**
1. I will teach my children how to fish and the pass my knowledge of the sea on to them				X	
2. The fishing community can benefit from specific training sessions related to fishery					X
3. I would like one member of my family to study and have a diploma related to the sea				X	

* (–2) strongly disagree; (–1) disagree; (0) neither agree or disagree; (1) agree; (2) strongly agree

mission statements appeared to empower the participants to articulate concerns/possible action, particularly concerning food security, livelihoods and challenges associated with maintaining fishing gear as well as putting children through school.

The new attitudes emerging from the 2011 *Siningbayan* workshop formed our basis for further engaging a larger group of PAMANA representatives from 10 sites, linked by these leaders. Subsequently, we selected the core leader group from the *Siningbayan* workshop and other individuals to pilot and facilitate the use of CCT to explore needs, challenges and opportunities within the fisherfolk culture. Below, we discuss the results of our pilot study and consider potential reflexive educational approaches leading to improved coastal resource management.

Cultural consensus assessment

To determine the presence of cultural consensus amongst available fisherfolk across the 10 PAMANA sites, we used principal component analysis (Medin et al. 2007). The statistics showed that ratio between the first to second eigenvalue was 7.05. The high value of this ratio means that there was a single response pattern present in the data. This confirms that the consensus model represented the group responses with what is considered in this methodology as a *single set of answers* (Weller 2007) or, put another way, that they were in agreement as a culture. Another condition for cultural consensus is having a high percentage of the variance within the first eigenvalue. In this case, the first eigenvalue accounted for 53 per cent of the variability (Fig. 1), which is considered high. There were no negative factor loadings present, which is an additional criterion of consensus. The primary component analysis (Cattell 1966) indicated that we could further consider questions in F1 (the first consensus factor) in part due to the large *break* (or difference) between F1 and F2 (Fig. 1).

Almost 80 per cent of the questions in the survey generated consensus among the members selected from the PAMANA fisherfolk communities. This high level of consensus supports the hypothesis that the long-term development of cultural acuity regarding fisherfolk education (see, for example, Pajaro 1994, 2010) provides a basis for this approach to cultural analysis. Thus the pilot test discussed here demonstrates an ability to form specific questions which assist in translating differences, similarities and potential cultural linkages between marine science in several Filipino languages and international marine science in English. Although there can certainly be value in parallel open-ended ethnography research, the current

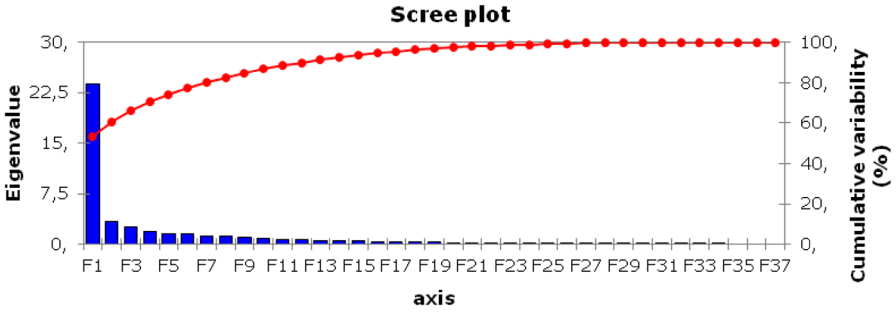

Fig. 1 Scree plot of variability (Cattell 1966) for PAMANA fisherfolk survey

results confirm that CCT can be used as a potential tool for defining education approaches through participatory representation from a large fisherfolk sector and subcultures across different Philippine coastlines.

In the evaluation, we considered the 46 survey questions (out of a total of 58) on which consensus was reached. We had to remove two respondents from the survey who had left more than half of the questions unanswered, which would have severely limited the application of principal component analysis on the data if they had been included. As a pilot study, the results provided an opportunity to test the methodology while obtaining initial cultural perspectives useful to the ongoing Action Research as outlined elsewhere (Watts and Pajaro 2014). While the results from the two individuals which were removed from the analysis had a large number of missing entries, other respondents had missing answers completely at random. We therefore used an established *pairwise deletion* method on the to compute the correlations per item pair using only those respondents who had observed scores (Van Ginkel et al. 2013).

Relationship between people and the resources

Fisherfolk see themselves and their health as being connected to the sea, which is similar to the perspective of the authors and other academics who have worked in similar tropical settings (Hatcher and Hatcher 2004). Our respondents expressed a belief that marine life is inexhaustible if fisherfolk use proper fishing methods and yet disagreed with the statement that the sea can take care of itself. These results elucidate a contradiction between the international concept of limits on marine ecosystem capacity and the idea that the sea is inexhaustible. The respondents generally accepted a high level of responsibility for the status of the marine environment, perhaps more than is warranted considering the overall status of the Philippine setting from a marine science perspective (DA-BFAR 2004). They also believe that fish have their own territory. These results imply an overall understanding of the territory associated with fish stocks and provide a reference for further linkages to management strategies. There appears to be a belief in current management status which is perhaps unwarranted and needs to be further examined, specifically regarding fisherfolk roles in a refocusing of coastal resource management towards an enhancement in sustainability.

Generally, there was consensus that all of the members of their communities are dependent upon the sea; that food for their families and their descendants is the first thing on their mind when they go fishing; that they would stop fishing if there was an alternative of equal pay; that fish could be caught any time of day, but that sunup, sunrise and moon cycles are important for fisherfolk (Table 1). Disconnecting the focus on food security from fishing practices may be an important goal for advocacy strategies as well as related professional and paraprofessional training development. Clearly, if people fish to survive and feed their children, limits placed upon fishing could translate directly into reduced wellbeing in the family. Thus, socio-economic interventions and related educational strategies need to be part of any form of resource partitioning or limits to fishing.

Biodiversity. marine bioregions and perception of science and education

Our PAMANA fisherfolk respondents expressed cultural consensus in *strongly agreeing* with thirteen statements on coastal resource management and agreeing on three statements regarding biodiversity considerations (Table 1). They consider that each marine species has a special place in the ocean ecosystem; that this diversity of life is important for the health and economy of their communities; that the sea can provide inexhaustible resources for fisherfolk; that they catch different types of fish depending on markets and new equipment; that some marine life has disappeared, implying extinction or scarcity; that they prefer catching pelagic fish over near-shore fish and that their usual fishing ground is within their municipal waters. Interestingly, they agreed that a good near-shore catch was dependent upon the fishing practices within and outside of their communities; that a good deep-sea catch was dependent upon the fishing practices of other communities, but *strongly agreed* that a good deep-sea catch was dependent upon the methods used within their community. This implies that they see inter-community linkages as important for near-shore fish stocks, but that they highlight the need for good community practices regarding deep-sea fisheries. Our respondents indicated that their primary fishing grounds were inside their home municipality or province. These results demonstrate a strong linkage between fisherfolk, local government units and municipal waters. Respondents *strongly disagreed* with the statement that the sea can take care of itself without the help of people. This realisation that people must be involved in marine management is encouraging, while the perspective that the sea is inexhaustible points to a need for specific awareness of ecosystem capacity as an educational goal.

Similarly, the responses on local perception of marine science and education and curriculum development were in strong agreement with idea of specific local trainings. This could include, but need not be limited to the sharing of resources across bioregions, or, put another way, the subsidiary of fish harvest partitioning. The respondents also agreed that they would teach their children how to fish, pass on their knowledge of the sea and that they would like a member of their family to study and attain a diploma related to the sea. These results will be helpful for the designing of broader national approaches to recognising underlying cultures of fisherfolk in a range of communities. In general, there was strong agreement on the role of communities in marine resource and biodiversity management, the need for co-management, as well as the need for education and strong linkages to local or local government unit development plans. Overall, the results were highlighted by a strong expression of community potential and a dedication to learning. However, the perception that the sea is inexhaustible does not fit in with an ecocentric paradigm and the need for biodiversity conservation, but is rather more of a human-centred ecosystem perspective. It has been suggested that the need to balance these two paradigms may be critical to global sustainability (Custer et al. 2014). This may specifically apply to Philippine and other small-scale fisheries of Southeast Asia; requiring specially tailored education strategies.

Culturally relevant design

Education programmes for fisherfolk communities

The need for lifelong learning in the Philippine fisherfolk sector needs to be focused on specific challenges regarding sustainability. Our own results obtained from artisanal fisherfolk as well as parallel findings regarding indigenous peoples in Australia (Wohling 2009), indicate that spatial concepts of directly resource-dependent communities may be generally limited to the region in which people are experienced. Although coastal fisheries are primarily a municipal mandate, larger-scale approaches are necessary to encompass biodiversity units or bioregions, particularly concerning highly migratory deep-sea fish. Our results identify and provide a targeted need for specific training on the relationship between fishing grounds, fish stock migratory ecology and related cognitive development linked to fisherfolk and education programmes for professionals. Specifically, adult education needs to focus on the fact that deep-sea or migratory fish stocks are a shared resource across marine bioregions as the primary unit for biodiversity conservation.

These results lend further weight to the conclusion that bioregions should be one unit of future coastal resource management education, with a partitioning of resources and mandates between local government units and other national authorities. The concepts that the sea is inexhaustible and that resources are created for human consumption are generally anthropocentric (human-centred) and this identifies a further line of cultural inquiry and professional facilitation regarding marine science from an ecocentric and international perspective. The *cultural mind* (Atan et al. 2005) of Philippine coastal fisherfolk is in transition, based upon changes to the environment, politics, economy and technology. Advanced fisherfolk groups such as those represented by PAMANA may have a broader leadership role to play in terms of advocacy and engaging less advanced artisanal fisherfolk in environmental management. Representative and in-depth analysis of cultural ecology across specific jurisdictions and ecological units or bioregions will help to elucidate the best path forward for education development. It is also clear that there is a significant professional role which is required for this process, for example focused on the need to help fisherfolk to better balance the ecocentric paradigm with the their perception of human and family needs.

There are strong indications that PAMANA fisherfolk have the potential to expand upon their current cultural ecology. The next steps on this research initiative should include a consideration of PAMANA fisherfolk across the 120 community membership and compare their perspectives to less developed communities and those sharing specific jurisdictions and bioregional areas. One heritage of the Philippines is that fisherfolk communities can be somewhat isolated and culturally independent. Modelling cultural ecology or the cultural mind (Atan et al. 2005) of fisherfolk and further development of Philippine coastal resource management strategies based upon both paraprofessional and professional education initiatives will require detailed work in small communities. The strategy for sharing limited professional marine expertise (Pajaro et al. 2013a) may best be augmented by a

focus on fisherfolk leadership. Thus, subsidiarity regarding adult education approaches may involve several tiers; one for fisherfolk leaders and additional levels of advocacy and training for individuals reaching down to the community level. There is also a need to engage individual jurisdictions in this ongoing process, focused in part upon best-practice transfer and local government unit mandates. Currently, a parallel culturally relevant process, based in the Philippine education system discipline of *Development Communication* has been initiated to create a pilot bioregional approach for the Northern Philippine Sea which embraces academic institutions and local government units (Pajaro et al. 2013a).

Philippine fisherfolk's cultural ecology

Most Filipinos are connected to the fisherfolk culture of the country, although so far, little has been written regarding the nature of this sector. In general, Filipinos have a strong cultural base which is often underestimated by foreigners (Jocano 1999), in part due to the predominance of English as one of the two official languages. The existing knowledge base indicates that Philippine fisherfolk communities develop through a process of allocating and distributing rights over specific resources and locations. These actions tend to *reconfigure divisions and alliances between and among village members and others who wager their interests on visions of community and conservation* (Guieb 2009). It is further recognised that fisherfolk range from autonomous individuals to advanced national alliances with significant international experience. As a starting point, our current pilot study considers a few key aspects of the cultural ecology associated with PAMANA, an advanced national alliance of fisherfolk marine protected area managers. Our results suggest that advocacy directed at fisherfolk concerning sustainability can best be initiated by existing fisherfolk leaders.

Globally, marine protected areas are considered a primary remedial approach to ocean and fisheries resource decline. The PAMANA organisation, initially developed in the 1990 s with the help of the Philippine Haribon Foundation[11]; is somewhat unique in that it is the fisherfolk themselves who have assumed a leadership role through their marine protected area activities. These highly developed attributes of responsibility have been internationally recognised through the alliance being considered as prototypical *Paraprofessional Ecohealth Practitioners* (PEP; Anabieza et al. 2010). This paper expands upon that linkage to investigate fisherfolk balance between ecocentrism and the human-centred ecosystem approach which has been identified as significant for global sustainability as well as within the Ecohealth paradigm (Custer et al. 2014; Watts et al. 2015). Paraprofessional ecohealth practitioner fisherfolk and others in the academic community (Hatcher and Hatcher 2004) share the perspective that local human nutrition and the productivity of coastal waters are inseparable. However, this perspective has not previously been supported by statistical cultural assessment.

[11] Named after the Philippine Eagle, *Haring Ibon*, the Haribon Foundation was founded in 1972 as the Philippines' pioneer environmental organisation. For more information, see https://goharibon.wordpress.com/ [accessed 10 January 2016].

The development of reflexive professional and adult education (Watts et al. 2010) requires a more concrete process for the understanding of cultural ecology within the Filipino fisherfolk sector. Reflexive programmes require an understanding of both the cognitive science objectives for professional training as well as cognition associated with the cultural ecology of the potential fisherfolk beneficiaries. The scope of the challenge for a national approach is daunting, in part due to the size of the sector and the limited communication systems. As a starting point, our pilot study has considered only fisherfolk leaders from accessible PAMANA communities.

Conclusions and recommendations

Although bioregional approaches to studying marine ecosystems were initially developed in the Philippines (Christensen and Pauly 1991), the communication and coordination challenges of the country have somewhat prevented local application of these concepts (Watts et al. 2010). Given this paradox, education for sustainable development of coastal communities needs to focus on localised communication strategies. These communication strategies need to consider a range of fisherfolk livelihood challenges, such as the lack of rural industry and a (fisherfolk) culture which is perhaps somewhat resistant to international and academic remediation. Currently, PAMANA is the only Filipino fisherfolk organisation linked specifically with scaling-up to the bioregional level (Tiburcio and Watts 2008). Further, the PAMANA organisation represents an inherent commitment to the ecocentric approach through their designation as Paraprofessional Ecohealth Practitioners (Anabieza et al. 2010). The challenge to focus on the bioregional level is considerable, at least in part due to the predominance of isolated traditional or artisanal fisherfolk cultures which are difficult to penetrate in terms of communication or sustainable socio-economic change for poverty alleviation. The outline of scale for Filipino fisheries presented below is intended to provide further insight into the nature of this challenge.

PAMANA represents several unique opportunities for the development of approaches to education policy and the actual delivery of related programmes through the general public, coastal high schools and fisherfolk themselves. Through their more than 100 member communities, PAMANA is based upon stewardship and the relationship between environment and human health. There is a national need to more clearly define and transfer these significant ecocentric perspectives through specific educational strategies which reach high school students and extend throughout the lives of fisherfolk themselves. Through fisherfolk-led inception and management of marine protected areas, the organisation represents a nationally leading example of sustainable development and direct beneficiary engagement. PAMANA currently involves a very small percentage of communities and fisherfolk when considering the whole country. Targeted education policies and programmes which are based upon the PAMANA vision can help prepare the country for future challenges and changes in climate, economy and coastal-community security. The study detailed here focused upon supporting the vision of these leading fisherfolk

for applications which include educational expansion of marine protected area protocols and strategies as well as new senior high school courses particularly aimed at coastal settings. The Philippines has a heritage of a strong artisanal fisherfolk culture operating somewhat outside governmental and financial systems. The sustainability process must be participatory for collaborative problem solving to elucidate and respond to the details of specific challenges which make this sector poverty stricken, in part as a result of a fisheries resource which is in decline. We suggest a reflexive development of education paradigms, policies and programmes which are based upon needs.

Clearly this archipelagic country is very much in need of new education designs which are reflexive and focused on primary coastal and national challenges (Pajaro et al. 2013a). The 100 million Filipino people are dependent upon fisherfolk to provide an annual 3 billion kilogrammes of marine fish for protein. Filipinos consume an average of 36 kg/person/year of marine fish; the highest rate for large Southeast Asian countries (Silvestre and Pauly 2004). As is well documented in the most recent milestone review, *In Turbulent Seas* (DA-BFAR 2004) the status of the Philippine marine resource sector is generally still considered to be in decline. This decline appears to encompass resource sustainability and the socio-economics of the fisherfolk themselves. The Philippines is arguably the most marine-dependent country in the world, with a coastline to land mass ratio exceeding 120 m/km^2 involving 80 per cent of the country's provinces. Although the provincial governments are often among the larger employers within individual provinces, they do not necessarily have the largest economic impact upon provincial economies. Preliminary calculations of provincial economic impact from marine fisheries (Dyck and Sumaila 2010) based upon landed fish worth (Philippine Bureau of Statistics 2011) indicate a local value which can be as much as ten times that of entire Provincial Government revenues (Pajaro et al. 2013a). Considering this economic significance of the Philippine fishing sector, it is somewhat ironic that fisherfolk themselves are continually considered to be the poorest sector in the country, having a poverty rate which has been estimated as high as 60 per cent, almost twice the national average (Israel 2004).

The results have established that a CCT approach, linked to *Siningbayan,* has considerable potential as an authentic culture building and assessment strategy for working with Filipino artisanal fisherfolk. In addition, the fact that our survey questions generated consistent consensus among the leaders is an indication that further open-ended cultural research is not required. The development of feedback loops between scientists and fisherfolk, based upon quantitative understandings of culture, can be used to develop shared knowledge systems and guidelines for curriculum in a collaborative manner. The approach both identifies and transcends Filipino intra-cultural barriers such as perception of poverty and language barriers to capture understanding of needs, gaps and potentials for sustainability in coastal fisheries. Fisherfolk partnerships with professionals can be an approach to participatory strategies which encompass the identified need to for technical expertise in resource management (Reed 2008). Although the mandate for fisheries resource management out to the 15 km limit lies with local government unit officials, particularly the municipalities; the size of the fishing sector demands the

direct engagement of fisherfolk themselves. Thus, subsidiarity for sustainability and education development should be linked to fisherfolk communities, municipalities, provinces and bioregions. Fisherfolk marine protected area managers (Anabieza et al. 2010) and the development of paraprofessional ecohealth practitioner skills provide a platform for this approach which needs to be developed as part of the much-needed renewal and expansion of related professional training (Pajaro et al. 2013a).

Critically, PAMANA fisherfolk demonstrated consensus in their commitment to be part of sustainability plans which can be directly translated into participatory education development design. The fisherfolk perception that they should not be limited to their own territories somewhat contradicts the desire to have some control over their resources. Partitioning of harvest rights and jurisdictional controls is an ongoing process in the Philippines. Some municipalities have limited fishing in their coastal waters to residents and registered fisherfolk, while others still allow open access. Given the challenges of poverty alleviation within the fisheries sector, impending climate change and population growth; there is likely to be a need for a national approach to defining the allocation of fisheries harvest territories and other related considerations. Thus, there is a likely need for a cultural and educational approach to transform the *open access* perception within the fisherfolk culture. *Siningbayan* may be an optimal approach to working through this and other contradictions. Prior to that there is a need to determine more details about Philippine fisherfolk culture across regions and beyond advanced organisations such as PAMANA.

Future steps include a broader examination of individual communities and comparisons involving several aggregations of communities, for example; bioregions and individual jurisdictions. Although the organisational approach through PAMANA described in this paper was positive, this represents only a preliminary approach to defining effective programme size or subsidiarity. Provincial and, optimally, municipal approaches are required to capture significant local culture which is inclusive of local governance strategies and status. Application of CCT at local levels will help to further determine the continuity of coastal fisherfolk culture. At the same time, efforts can be made to transcend groups within the fisherfolk culture such as young people and women. Women have been traditionally marginalised in Philippine coastal resource considerations (Pajaro 2010). Clearly, the challenges of fisherfolk extend to women and children in the families through poverty considerations and food security. Initial findings on women's leadership in fisherfolk communities have demonstrated a great potential for coastal improvements associated with gender equity facilitation (Pajaro et al. 2013b) and an inclusive approach which involves all members of fisherfolk families. Finally, the CCT approach could also be used to determine gaps, challenges and education opportunities by comparing fisherfolk within specific jurisdictions with those responsible for management of the jurisdictions. In building strategies for positive change involving the sustainability of Philippine fisheries and poverty alleviation, our pilot study demonstrates that CCT can be a valuable tool. The approach can provide evaluations on multiple cultural perceptions within a given survey. The use of the *Siningbayan* approach to communication enhancement builds capacity for a

transformational design to incorporate traditional ecological knowledge into management. Literacy is thus redefined based upon the shared understanding of the sea and livelihood experience. Working through an association such as PAMANA provides a network of leaders who are able to advocate sustainability and organisation within individual communities, which helps to mitigate the extreme shortage of professional expertise (Pajaro et al. 2013a). Results from our pilot study will be helpful in designing bioregion-specific policies for both adult learning and professional development.

The results of our survey also indicate that there are contradictions within this advanced fisherfolk culture, at least from an international perspective. While there is cultural consensus that the sea cannot look after itself without the help of people, there is also a somewhat contradictory perception that the sea is inexhaustible. These results indicate that even within PAMANA and their significantly ecocentric viewpoint there is a need for specific training on ecosystem capacity – particularly within biodiversity units or bioregions. It is expected that this need would be greater amongst less advanced fisherfolk communities. The focus of PAMANA members on their role in positive change indicates that education strategies might best concentrate on fisherfolk collaboration with local government law enforcement. There is a consensus perspective that these fisherfolk leaders strongly support training and the development of advanced scientific or academic training in their families. Subsequently, education policy could consider how best to support their involvement and expect a positive response from those efforts. The potential for fisherfolk engagement on positive change also requires emphasis at the education and training level for related government positions, likely focused on the municipal level since that is where the authority for coastal resource management is the strongest, making it the best jurisdictional entry point for resolving contradictions.

There is also a need for municipal employees in coastal resource management who can both appreciate biodiversity science as well as efforts to maximise relations with fisherfolk communities. This cross-over between social and biological science is not currently covered within the Philippine education system. Within the approach outlined in this paper, there is also an effort to develop the related tertiary education curriculum to support these needs (Pajaro et al. 2013a). However, education for local governance also needs to consider how to promote inter-municipal communication, cooperation and collaboration to extend governance out to the larger scale of bioregions. Recognising that fisherfolk are first and foremost thinking about the goal of feeding their family when they go out to sea, there is an imbedded need to include education and training on alternative and supplemental livelihoods which would help support a more sustainable approach to fisheries harvest in general. It is noteworthy that the Philippine Anti-Poverty Commission has expressed an interest in these participatory approaches as a means of responding to large-scale common problems across marine bioregions. Combining CCT with best-practice transfer has the potential to connect local fisherfolk to international ocean science, such as marine spatial planning (Ehler and Douvere 2009), as well as the strategic development of jurisdictions and educational designs.

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Joey Ayala multiple award-winning Philippine icon, is especially renowned for his musical contribution to Filipino consciousness and indigenous heritage. His reinvented Philippine National Anthem has gone viral. Joey's album entitled *Awit ng Magdaragat*, which he produced for fisherfolk in collaboration with the Bureau of Fisheries and Aquatic Resources; was developed into a play presented at Divine Word Colege, and subsequently into a modern ballet production at the University of the Philippines. He piloted *Siningbayan* governance capacity-building-through-the-arts for integrity, in collaboration withwith the United Nations Development Programme. The National Commission for Culture and the Arts produced the *PalayBigasKanin* project during his chairmanship (2008–2010), and was commended by UNESCO's Education for Sustainable Development (ESD) programme as being a "process and materials model for ESD's cultural dimension".

Pauline Bautista values-educator, arts manager and home economist, strategically managed and monitored the 2nd National Congress on Good Citizenship held in Quezon City in 2007. The conference was entitled "Promoting Good Citizenship Values Through Social Artistry" (University of the Philippines Center for Leadership, Citizenship and Democracy). The conferences was decisive in evolving *Siningbayan* with the United Nations Development Programme, also interphasing with the National Commission for Culture and the Arts *PalayBigasKanin* Project to deepen Filipino consciousness of integrity. She researches for the development of an Open Data Ecosystem at the local level (University of the Philippines Center for Local and Regional Governance), promoting integrity through effective open governance engagement. Pauline facilitates the expression of personal principles for individuals and organisations, helping build broader societal ethical concepts.

Marivic Pajaro's research over the past several decades and throughout much of her life has been focused on aspects of coastal and marine management. Marivic returned to school to complete her doctorate on the study of indicators and participation associated with marine protected area management through the University of British Columbia, Canada in 2009. Subsequently Dr Pajaro became a Philippine founding partner of the nongovernmental organization DALUHAY. Marivic also developed a community-based research programme through Aurora State College of Technology in the Philippines. In the course of her current work, Marivic has collaborated with the Research Department of the HARIBON Foundation for the Conservation of Natural Resources.

Mark Raquino is a biology graduate at the University of the Philippines-Baguio and is currently completing his Masters degree in Environmental Management at Aurora State College of Technology in the Philippines. After three years of serving as a community development assistant in coastal resource management at a municipal Environment and Natural Resources Office, he worked as a research assistant

for the Ecological Studies section under the Aurora Marine Research and Development Institute in 2012. Mark is now the Research Coordinator at DALUHAY, working with representatives from jurisdictional mandates provincially and nationally. His specialisations include statistical applications, bioregional analysis, collaboration strategies and Ethnoecology.

Paul Watts trained in classical energetics. Projects include quantification of polar bear reproductive energetics and food security for the Canadian Inuit culture. His work in Ethnoecology led to a programme on Hudson Bay, Canada; developing co-instructors from the four local indigenous cultures for university programming. Paul's large ecosystem focus is on bioregional analysis and planning for the marine environment in both the Arctic and the tropics. Projects involve Ecohealth and Philippine education development. As co-founder of the NGO DALUHAY (http://ecosystemics.info/), his focus is on balance between human and environmental health, climate change mitigation, consideration of ecocentric capacity and, most importantly, broad cross-sectoral transdisciplinary action.