**Diedrich, Amy, Benham, Claudia, Pandihau, Lina, and Sheaves, Marcus (2019)** ***Social capital plays a central role in transitions to sportfishing tourism in small-scale fishing communities in Papua New Guinea.*** **Ambio, 48 (4) pp. 385-396.**

# Social capital plays a central role in transitions to sportfishing tourism in small-scale fishing communities in Papua New Guinea

Amy Diedrich[1,2,3,4*], Claudia Benham[1,3,4], Lina Pandihau[5], Marcus Sheaves[1,2,3]

[1]College of Science and Engineering, James Cook University, Australia
[2]TropWATER, James Cook University, Australia
[3]Centre for Sustainable Tropical Fisheries and Aquaculture, James Cook University, Australia
[4]Livelihoods Lab, James Cook University, Australia
[5]National Fisheries Authority, Papua New Guinea

Word Count 6024

## Acknowledgments

This research was funded by the Papua New Guinea National Fisheries Authority (NFA) and the Australian Centre for International Agricultural Research (Project FIS/2013/015: Sustainable Management of Sportfisheries for Communities in Papua New Guinea). We would like to thank additional members of our research team Natalie Stoeckl, Marina Farr, and Murray Prideaux for their contributions to components of the survey that informed this analysis, the community members who contributed their time to the surveys, NFA colleagues, and Baia Sportfishing for facilitating the research. Finally, we would like to thank the anonymous reviewers for their contributions to improving this manuscript.

*Corresponding author contact details: Tel. +61 7 4781 4627; email: amy.diedrich@jcu.edu.au

Body

# Social capital plays a central role in the uptake of sportfishing tourism livelihoods in small-scale fishing communities in Papua New Guinea


## ABSTRACT

Growing concerns about pressures of global change on small-scale fishing communities have resulted in a proliferation of livelihood diversification initiatives linked to tourism. Where the focus is often on the role of financial, physical, and human capital in influencing the uptake of new opportunities, we argue for more consideration of the role of social capital. We implemented 157 household-level surveys in small-scale fishing communities in Papua New Guinea and modelled the influence of social and other capital assets on people's perceptions of how easy it would be to become involved in sportfishing tourism. Social capital had a stronger influence relative to other forms of capital, with perceptions of reciprocity and satisfaction with leadership being the most influential aspects. Based on these results, we stress the importance of developing strategies aimed at understanding, building, and maintaining social capital and related social dynamics when implementing livelihood diversification initiatives.



## KEY WORDS

Pacific Islands; Papua New Guinea; social capital; sportfishing; sustainable livelihoods; tourism

## INTRODUCTION

Island nations in the Pacific are facing increasing pressures from natural resource extraction, population growth, globalisation, and climate-related processes. These are affecting the livelihoods and survival of small-scale fishing communities (Lauer et al. 2013). Diminishing natural resources and intensifying rates of global change are making the diversification of livelihoods through the uptake of new and sustainable alternatives increasingly important for improving social and ecological resilience (Allison and Horemans 2006; Butler et al. 2014).

A livelihood comprises people, their capabilities and their means of living, including food, income, and assets (Chambers and Conway 1992). The Sustainable Livelihoods Framework is an established tool designed to understand complex dynamics of rural livelihoods (Scoones 1998). The framework suggests that people's ability to achieve sustainable livelihood outcomes is influenced by a combination of macro and micro scale factors. At the macro level, these include vulnerability (e.g. cycles, trends and shocks beyond local control) and broader scale governance including policies, institutions, and processes. At the micro or local level, people's livelihoods are governed in large part by their access to a combination of capital assets, which include social, human, natural, physical and financial capital (DFID 1999).

Growing concerns about poverty, food security, and vulnerability to climate change in Pacific Islands have resulted in a proliferation of initiatives aimed at diversifying livelihoods in fishing communities (Govan 2011; Wood et al. 2013). Social and cultural considerations often take a back seat to other factors such as infrastructure, education and financial needs in the implementation of these initiatives. However, social dynamics also play a crucial role in determining outcomes of economic development (O'Garra 2007; Curry and Koczberski 2013; McCormack and Barclay 2013). In practice, many alternative livelihood initiatives fail to achieve their intended outcomes

due to overly simplistic expectations of how communities will engage with new income earning opportunities and failure to consider the constraints faced by isolated, traditional communities in transitioning to more Westernised forms of economic activity (Gillet et al. 2008).

In small-scale fishing communities, people's livelihoods and well-being are intimately connected to marine resources and resource governance tends to be devolved to the community level (Berkes 2010). Thus, application of the Sustainable Livelihoods Framework in such communities has confirmed that local dynamics such as household level access to capital assets are central to influencing livelihood outcomes (Allison and Ellis 2001). Social capital is comprised of relationships of trust, reciprocity, social norms, rules and sanctions, and networks. Its importance can be accentuated in very isolated communities, where limited or negligible access to physical and financial capital means that social and natural capitals, including the interactions between them, play more central roles in people's livelihoods (Allison and Ellis 2001; Pretty 2003).

Many alternative livelihood initiatives are linked to tourism (Mowforth and Munto 2009; Tao and Wall 2009) and the potential role of community-based tourism as a complementary livelihood opportunity has explicit mention in international policy on small-scale fishery management (FAO 2015). Nature-based tourism is commonly considered to have the potential to support development and marine resource management in the Pacific (Gillet et al. 2008) and in Papua New Guinea (Imbal 2009). However, for similar reasons as those mentioned previously in the context of economic development, tourism initiatives often fail to deliver their intended benefits (Harrison 2010; Bennett et al. 2014) and have been met with resistance by local communities in Melanesia (e.g. Sofield 1996). In Papua New Guinea (PNG), it has been noted that successful tourism initiatives depend on local agency and engagement, and should not have extreme impacts on traditional ways of life, which are intimately tied to social and natural capital (Imbal 2009; Sakata and Prideaux 2013; Gabriel et al. 2017).

The early stages of tourism development are critical for shaping future outcomes (Morforth and Munt 2009). For isolated communities such as many of those in Melanesia, people are likely to be unfamiliar with the concept of tourism and the opportunities it brings with it. Understanding what influences their beliefs about their capacity to enter into this new livelihood venture is an important first step in the livelihood diversification process. Resident perceptions of tourism have been used repeatedly to study the dynamics of this transformation from the perspective of local communities (e.g. Harrill 2004). One of the main motivations for conducting such studies is that negative attitudes among residents can hinder the success and sustainability of tourism destinations (Diedrich and Garcia 2009).

In this study, we focused on factors that influenced people's perceived transitions to sportfishing tourism as an alternative livelihood in West New Britain, PNG, a place where livelihoods are heavily influenced by kinship and indigenous socio-economic values (Curry and Koczberski 2013; Curry et al. 2015). We used Classification and Regression Trees to explore the influence of five capital assets (social, natural, financial, physical, human) on how people perceive their potential transition into sportfishing and hypothesised that social capital would have the strongest influence on our dependent variable.

This research was part of a larger, interdisciplinary study that assessed ecological, social and economic implications of sportfishing tourism in PNG. Worldwide, up to 700 million people participate in sportfishing, spending over US$190 billion annually (World Bank 2012). Although most of the global expenditure is in developed countries, sportfishing tourism has the potential to promote conservation, diversify livelihoods, and generate resources to leverage sustainable development opportunities in tropical developing countries (Wood et al. 2013; Barnett et al. 2016). At the same time, sportfishing has the potential to generate environmental benefits by creating

incentives to conserve targeted species and their key habitats (Idechong and Graham 2001). At the national level, sportfishing can provide additional revenue streams and lessen dependence on extractive industries (Kauppila and Karjalainen 2012). Sportfishers' desires to fish for new and exotic species in 'pristine' locations is likely to extend fishing impacts to more isolated species, cultures and environments that have had little exposure to the influences of the developed world (ibid.), which has been the case for Black Bass fishing in PNG. Most of our understanding of how to achieve best practice in sportfishing tourism has been in the context of developed countries and there is a need to better understand the challenges specific to developing destinations (Wood et al. 2013; Barnett et al. 2015).

## MATERIALS AND METHODS

### Study Context

We carried out household level survey interviews in August 2015 in three communities in the Province of Western New Britain: Baia (inclusive of two settlements to the West of the main village called Silaleve and Loiloi), Vesse, and Somalani (Fig. 1, Table 1). These villages were selected as they are located in the vicinity of two sportfishing lodges; one at Baia and one on an island called Uluai, which is close to Vesse (3 minutes by boat) and Somalani (45 minutes by boat). All three communities relied predominantly on fishing and farming at the subsistence level (Table 1), and access to markets and basic infrastructure was very limited. None were accessible by paved road at the time this study was conducted. All communities had very limited access to health services (small facilities with several nursing practitioners) and access to education at the primary level. Baia was the most isolated community, located about 230 km north east of the regional centre of Kimbe. Besides a logging road only accessible by 4WD vehicles in the dry season, Baia was accessed by boat, which placed significant financial stress on those villagers wishing to access permanent markets or other facilities in the main town. At the time this research was conducted, the

main source of income in this village was the sale of marine products and bush materials (e.g. sago, betel nut) in neighbouring logging camps and markets.

**Figure 1.**

The other two villages were closer to Kimbe (between 3.5 – 10 km to the west), and were located on islands. Once on the mainland (about 30 minutes by boat), the villagers had access to infrequent public transport. Similar to Baia, the absence of a permanent market in the villages meant that locals must travel to Kimbe at considerable expense to sell their products. Most commercial products were crop or fish based, with some additional sources of cash being the sale of traditional mats, shell money and canoe making. Vesse had some engagement in logging and oil palm, which was an additional source of cash flow for some community members. Sportfishing, the only form of tourism, had been present for more than a decade in Baia and several years less in the other two villages. However, there were still relatively few households directly involved in the activity (Table 1). This was mostly due to the small-scale nature of the enterprise (e.g. lodge capacity of < 12 visitors in both locations) but was also representative of isolated communities in the early stages of tourism development. Despite the low level of direct participation in the industry, financial benefits were shared more extensively throughout the communities in the form of fees paid directly to village leaders by the tourism business. At the time this study was conducted, villagers in Somalani were building a sportfishing camp 1 km up the river from their village. Once complete, the camp will have the capacity to accommodate up to 24 tourists.

**Table 1**

## Survey Instrument

The household-level survey was designed to capture a broad range of social and economic factors related to people's livelihoods and experiences with Sportfishing tourism. The independent variables used for this analysis were derived primarily from likert-scale questions (0-10) to determine people's satisfaction and beliefs related to the five capital assets (Table 2). Our dependent variable was a 5-point ordinal scale question about the perceived ease of becoming more involved in sportfishing tourism. We also collected basic demographic data (e.g. age, education level, gender) and a checklist of household items and facilities (e.g. electricity, roof material, piped water, etc.) designed to measure the households' Material Style of Life (MSL).

The survey design was informed by a scoping study conducted in our study communities in 2015. It was translated into the local language, *Tok Pisin*, by the research team using a back-translation method and was piloted on *Tok Pisin* speaking students at the authors' home institution. Data collection was conducted in August – September 2015 by a team of researchers bilingual in *Tok Pisin* and English. As the communities were small (35 – 68 households) we aimed for a complete sample of households. Local assistants from each village were involved in facilitating the survey questionnaires, ensuring an almost complete household sample (Table 1). Surveys were implemented face-to-face with one member of each household over the age of 18.

**Table 2**

## Analysis

We interviewed one person from almost every household in participating villages resulting in a final sample of 157 households across the three villages (Table 1). We conducted our analysis using SPSS v.23.0.0 (2015). We attributed one variable, or combination of variables to each of the capital asset categories, resulting in five capital asset independent variables (Table 2). The composite

178 variables representing human, social, and natural capital were comprised primarily of subjective
179 measures. Basic infrastructure related to health and education services was relatively uniform and
180 very limited across all of the study communities. Thus, we considered people's satisfaction with the
181 different factors that make up human capital to be a more accurate measure of how access to (or
182 lack of) human capital might affect their potential involvement in sportfishing tourism. Similarly,
183 we considered people's satisfaction with environmental health and their ability to access food from
184 natural resources to be a more accurate predictor of potential outcomes than objective measures,
185 which would be hard to determine at the individual level. Social capital is notoriously complicated
186 to measure objectively (Durlauf 2002). Where social networks can be observed and measured, the
187 characteristics of the ties that link people together such as trust and reciprocity are more subjective
188 and difficult to define, with their interpretation varies among individuals. Thus, it is not uncommon
189 for studies on social capital to include subjective measures (Portela et al. 2013; Diedrich et al.
190 2017).
191
192 We used objective measures for physical and financial capital, as these are generally more tangible
193 than the other capital assets. Access to both of these assets as defined by DFID (1999) was
194 negligible across our study communities so we used two proxy variables to represent each of them.
195 In the case of physical infrastructure, we observed that people in the community were differentiated
196 largely by their access to or ownership of a boat (e.g. canoe, or with a motor). Boat access is an
197 important household level item affecting people's livelihoods in small-scale fishing communities
198 (Allison and Horemans 2006). For these reasons we used boat access as a measure of physical
199 capital. We used Material Style of Life (MSL) to represent people's financial capital (or wealth) as
200 using measures associate with the DFID definition (e.g. access to credit, savings accounts) was not
201 relevant to most of the households in our sample.
202
203 A Principal Component Analysis (Oblimin with Kaiser Normalization) of the items representing

Material Style of Life (MSL) revealed two main categories of households; those with 'higher MSL', characterized by more modern amenities such as access to a generator, TV, and electricity, and 'lower MSL', characterized by the household being constructed from traditional materials such as thatch roof and walls. 'Higher MSL' explained 22% of the variance in the data set and we used the factor score of this component as a proxy for financial capital.

We used Classification and Regression Trees (CART) to model the influence of our independent variables on our dependent variable. We used CART primarily because it accommodates data measured at multiple scales; does not rely on strict assumptions such as normality and homogeneity of variance; accommodates multiple interactions among variables; and is robust for use with categorical data with large numbers of categories (De'ath and Fabricius 2000). Our first model used the five capital asset variables as independent variables and our second model explored the influence of the disaggregated social capital asset variables on our dependent variable (Table 2).

A one way ANOVA test with post hoc Tukey-b showed that there were differences across the villages for our dependent variable ($F(4.2, 75.9) = 3.2$; $p = 0.044$). Baia residents perceived involvement as slightly easier ($M = 3.5$; $SD = 0.6$) than Vesse residents ($M = 3.2$; $SD = 1.0$) and Somalani ($M = 2.9$; $SD = 0.8$) scored lower than Vesse. However, 'village' was included in the CART model as an independent variable and did not influence any of the splits, suggesting that individual level characteristics were more important than those at the village level in influencing the dependent variable.

Finally, we used the Gini coefficient as a measure of equality of distribution of the different types of capital within the study communities and conducted independent sample Kruskal-Wallace tests to compare relative levels of each of capitals across the three villages. In order to help with the interpretation of our CART models, we ran a Pearson's correlation analysis for material style of life

230 (i.e. financial capital) and the total number of household occupations across all the villages, based
231 on the expectation that wealthier households had more diversified livelihood portfolios.
232
233 **RESULTS**
234
235 The means for all villages combined (Table 3) were highest for social, human and natural capital
236 (all < 7), lower for physical capital (< 6), and lowest for financial capital (< 4). The means for
237 social, human, and natural capital showed relatively minor variations across the villages (e.g. < 1.5
238 on a 10 point ordinal scale), with Baia scoring slightly higher with respect to social and human and
239 Vesse scoring slightly lower on natural in comparison to the other villages. Financial and physical
240 capital showed more variation (> 2), both of which were lower in Baia relative to the other two
241 villages. The Gini coefficients were mostly uniform and low for all of the capital assets across the
242 villages, suggesting negligible inequality in the distribution of human, social, and natural capitals
243 and minor inequality in distribution of financial and physical capitals. Although the correlation was
244 relatively weak, our results showed, as expected, that wealthier households had more diversified
245 livelihood portfolios ($n = 114$; $r = 0.3$; $p = 0.000$).
246
247
248 Seventy three percent of respondents confirmed that they or someone else in their would be
249 interested in becoming more involved in tourism, resulting in a sample of 114 responses for the
250 dependent variable for inclusion in our CART models. The first model (Fig. 2) showed perceived
251 ease of becoming involved in tourism was most strongly influenced by perceptions of social capital.
252 This first split suggests a small group of individuals who perceived the highest level of social
253 capital (e.g. > 51) mostly believed it would be very easy to become more involved in tourism. The
254 other much larger group had lower scores for social capital and were more varied in their responses;
255 notably, all of those who perceived it would not be easy were in this group. This group was further

split by financial capital; those with higher scores were more varied in their responses to the dependent variable, and generally perceived it to be a little harder than those in the other group. Those in the group that scored lower for financial capital were further split by natural capital; people with higher perceived access to natural capital tended to believe it was easier.

**Figure 2**

Our second model of the disaggregated social capital variables (ordinal scales of 0 – 10, except networks with was continuous) and the dependent variable showed that perceptions of reciprocity had the biggest influence on the perceived ease of being able to get more involved in tourism (Fig. 3). Those who scored higher were more likely to perceive it as 'very easy'. This group was further split by satisfaction with leadership in the community, with those who were more satisfied believing it to be easiest.

**Figure 3**

## DISCUSSION

The results confirmed that social capital had the strongest influence on people's perceptions of how easy it would be to become more involved in sportfishing tourism. Financial and natural capitals further mediated this relationship (Fig. 2). When the social capital variables were disaggregated, perceptions of reciprocity in the community followed by satisfaction with leadership were the most influential (Fig. 3). Inequality was low, and comparative values for the capital assets reflected communities in the early stages of development, where financial and physical capital are low relative to natural and social capital (Table 3; Bebbington and Perrault 1999).

283 Our results correspond with the literature suggesting that social capital is crucial in early stages of
284 development, as it helps to facilitate people's adaptation to associated changes (Butler et al. 2014;
285 Méndez-Lemus and Vieyra 2017). Moreover, studies in Melanesia have confirmed that social
286 factors such as self-organized stakeholder agency, cooperation, and social relationships influence
287 the ability of communities to cope with changes (Schwarz et al. 2011; Lauer et al. 2013) such as
288 new livelihood opportunities (O'Garra 2007; Curry and Koczberski 2013) and tourism (Sakata and
289 Prideaux 2013).
290
291 In a broader development context, positive livelihood outcomes are often equated with economic
292 growth, but it's important to note that simply creating opportunities to make money does not
293 necessarily lead to positive impacts. In the case of PNG and other indigenous economies, positive
294 outcomes will fail to arise if economic growth initiatives are not embedded in local customs, law
295 and morality (Curry and Koczberski 2013; McCormak and Barclay 2013). In our study, the
296 presence of social capital as a mediating factor in people's uptake of a new economic opportunity
297 reflects one facet of the importance of understanding local social dynamics in the early stages of
298 development initiatives (Curry and Koczberski 2013). By identifying potentially marginalised
299 groups (if combined with an assessment of equity as we did in this study) and the social factors that
300 influence people's perceptions of new opportunities (e.g. leadership, reciprocity in our study), it is
301 possible to lay foundations for monitoring the potential for social and subsequent economic
302 breakdown, which can occur in indigenous societies undergoing economic development (Barclay
303 and Kinch 2013).
304
305 Our study suggests a central role of leadership (Fig. 3), which has been shown to affect positive
306 outcomes at the community level in similar studies related to the success of natural resource
307 management in small-scale fishing communities (Govan 2011; Guitérrez et al. 2011), and
308 specifically in relation to the distribution of associated benefits (Diedrich et al. 2017). In many PNG

communities, and in our study villages, local leaders play a central role in determining the distribution of economic benefits linked to natural resource use, where the interaction between people and natural resources is governed primarily by customary management systems (Banks 2008). These are complex socio-political relationships of local land and sea tenure, which regulate the use, access, and transfer of natural resources, which are governed in large part by elements of social capital (Foale et al. 2011). Since sportfishing tourism is an economic opportunity that draws on the value of natural resources, it is not surprising that people would look their leaders for both approval and support in becoming involved in the activity. Moreover, the presence of reciprocity in our model (Fig. 3) is indicative of a more collective society, which would be expected in a Melanesian context (Curry and Koczberski 2013; McCormack and Barclay 2013). Given that physical and financial capital was so low across the communities, cash based activities such as storing and transporting fish to market relied on cooperation and asset sharing among numerous people. With the limited scope of tourism at the time of our study, it makes sense that people would rely on shared activities and assets to become more involved. For example, the lodge in Somalani was being built with widespread contributions of the villagers, with the agreement that the benefits would be shared throughout the community once it was complete.

Financial capital featured as the second most influential variable in our first model (Fig 2). Although there was not a highly discernable difference between the two groups, the results indicated that those with higher financial capital could be slightly more dubious of their ability to become involved in tourism. Given that our measure of financial capital is a proxy, we cannot draw any strong conclusions about the role of financial capital in this model but it's possible that because our results showed wealthier households to have more diversified livelihood portfolios, they had less time to engage in new economic activities. The time limitations faced by diversified households in engaging in new activities has been observed on other livelihood scenarios (e.g. Asfaw and Neka 2017) should be an important consideration for future research on tourism and alternative

livelihoods.

Albeit a relatively weak influence, our models also showed that higher perceived access to natural capital was a mediating factor for people in lower income houses and with lower perceptions of social capital (Fig. 2). One possible interpretation for this is that those households required less time to access food for the household and thus felt they had more time to dedicate to new economic activities. Given they were also less wealthy households, their livelihood portfolios would also be less diversified, which would also potentially give them more time to dedicate to other activities.

Overall, people in our study communities were enthusiastic about becoming more involved in sportfishing tourism. It is not uncommon for communities in the early stages of tourism development to be supportive of the new opportunities it presents (Diedrich and Aswani 2016). However, it is important to consider the limitation that our study only looked at perceptions of becoming involved in tourism, which may not translate directly into actual involvement. As demonstrated by other studies on tourism and alternative livelihoods in comparable locations, it is highly likely that training and other capacity needs will need to be fulfilled to facilitate the transition (O'Garra 2007; Sakata and Prideaux 2013). In fact, the isolation, low infrastructure, and low proportion of people involved in sportfishing despite its presence for a up to 10 years in our study communities suggests that factors beyond local volition are limiting people's engagement.

Another important consideration is that, where some research in small Pacific islands has suggested communities are relatively resilient to environmental change due to their accumulated experience of adapting to high environmental variability (Campbell 2009; Gough et al. 2010), studies have also shown that, due to their social isolation, they may be more vulnerable to recent changes brought about by economic development, tourism, and globalization (Lauer et al. 2013; Butler et al. 2014; Diedrich and Aswani 2016). Moreover, due to the presence of customary tenure, any form of local

361 alteration or redistribution of natural resource rights due to tourism or other activities could lead to
362 conflict and confrontations (Sofield 1996; Banks 2008; Aswani et al. 2015). The critical nature of
363 understanding the potential for socio-cultural tensions to arise in societies experiencing
364 modernisation, especially where markets are not developed and livelihoods are heavily influenced
365 by kinship and indigenous socio-economic values has been recognised in PNG (Curry and
366 Koczberski 2013; Curry et al. 2015).
367
368 Although our study did not reveal issues of inequality, it is important to recognise the potential for
369 these to arise as a result of economic development, including the mediating role of social capital in
370 this process. The importance of equality in community-based tourism initiatives is explicitly
371 mentioned in the Small Scale Fisheries Guidelines (FAO 2015). There is a paradox in that
372 additional sources of income can undermine social resilience through creating inequality but can
373 also build resilience through livelihood diversification and improved financial capital (Adger 2002).
374 Moreover, negative impacts on social capital such as inequality resulting from economic
375 development can lead to destructive negative feedbacks with natural capital (Dasgupta and Ehrlich
376 2013; Stoeckl et al. 2013). This has also been observed with respect to increases in physical capital.
377 For example, Cinner and Aswani (2007) suggested that increased technological efficiency leading
378 to less collaborative interactions with natural resources could diminish social factors that govern
379 sustainable use, thus resulting in negative environmental outcomes. Since livelihoods and
380 sportfishing tourism depends on a healthy natural environment, careful attention should be paid to
381 ensuring negative feedbacks from unequal or inequitable distribution of benefits do not arise.
382
383 **CONCLUSION**
384 Although the connection between social capital and positive livelihood outcomes in small-scale
385 fishing communities has been established in the context of natural resource management (Allison
386 and Ellis 2001; Guiterrez at al. 2011; Diedrich et al. 2017), to the best of our knowledge, few

studies have focused on the role of social capital in influencing the uptake of alternative livelihoods, particularly in relation to tourism. Our results present a clear argument for taking into account social capital and its role relative to other types of capital for transitioning to alternative livelihoods in rural coastal communities. This is crucial for ensuring critical, mediating factors are considered in the early stages of these initiatives, which may otherwise be overshadowed by pre-emptive interventions such as training programs and micro-financing. Where it is undeniable that building other types of capital is also crucial, we argue that comprehensive understanding and monitoring of locally defining characteristics and distribution of social capital should inform livelihood diversification initiatives.

Our study shows that social capital is more correlated than other forms of capital with people's perceptions of how easy it would be to become more involved in sportfishing tourism in three communities in PNG in the early stages of development. Although these results are case specific, they are supported by a relatively small but growing body of literature highlighting the critical role of social capital in shaping sustainable livelihood outcomes. More extensive research could build on our findings by evaluating the role of social capital and other forms of capital in transitions into alternative livelihoods in different geographical contexts and with respect to different livelihoods (e.g. aquaculture), including how this changes over the course of the development trajectory. Moreover, we argue that social capital considerations should become more central to tourism livelihood and business development policy within PNG and in the broader Pacific. Monitoring and building social capital is potentially more complicated and time consuming than other aspects of community development such as capacity building, infrastructure development, and financing. Thus, it will be important to develop complementary strategies that focus on building and maintaining social capital in project communities.

## LITERATURE CITED


Adger, W. N., P. M. Kelly, A. Winkels, L. Quang Huy, and C. Locke. 2002. Migration, remittances, livelihood trajectories, and social resilience. Ambio 31: 358-366.

Allison, E. H., and F. Ellis. 2001. The livelihoods approach and management of small-scale fisheries. Marine Policy 25: 377–388.

Allison, E. H., and B. Horemans. 2006. Putting the principles of the sustainable livelihoods approach into fisheries development policy and practice. Marine Policy 30: 757-766.

Asfaw, D., and M. Neka. 2017. Factors affecting adoption of soil and water conservation practices: The case of Wereillu Woreda (District), South Wollo Zone, Amhara Region, Ethiopia. International Soil and Water Conservation Research 5: 273-279

Banks, G. 2008. Understanding 'resource' conflicts in Papua New Guinea. Asia Pacific viewpoint 49(1): 23-34.

Barclay, F., and J. Kinch. 2013. Local capitalisms and sustainability in coastal fisheries: Cases from Papua New Guinea and Solomon Islands. Engaging with Capitalism: Cases from Oceania. F. McCormack and F. Barclay, Emerald Group Publishing Ltd. 33: 107-138.

Barnett, A., K. Abrantes, R. Baker, A. Diedrich, M. Farr, A. Kuilboer, T. Mahony, I. McLeod, et al. 2016. Sportfisheries, conservation and sustainable livelihoods: a multidisciplinary guide to developing best practice. Fish and Fisheries 17: 696-713.

439 Bebbington, A. and T. Perreault. 1999. Social capital, development, and access to natural resources
440 in Highland Ecuador. Economic Geography 75: 395-418.
441
442 Bennett, G., P. Cohen, A. M. Schwarz, J. Albert, S. Lawless, C. Paul, and Z. Hilly. 2014. Solomon
443 Islands: Western Province situation analysis. Project report: AAS-2014-15. CGIAR Research
444 Program on Aquatic Agricultural Systems, Penang, Malaysia.
445
446 Berkes F. 2010. Devolution of environment and resources governance: trends and future.
447 Environmental Conservation 37: 489-500.
448
449 Butler, J. R. A., W. Suadnya, K. Puspadi, Y, Sutaryono, R. M. Wis, T. D. Skewes, D. Kironon, E.
450 L. Bohensky, et al. 2014. Framing the application of adaptation pathways for rural livelihoods and
451 global change in eastern Indonesian islands. Global Environmental Change 28: 368 – 382.
452
453 Campbell, J. 2009. Islandness: Vulnerability and resilience in Oceania. Shima: The International
454 Journal of Research into Island Cultures 3: 85–97.
455
456 Chambers, R. and G. Conway. 1992. Sustainable rural livelihoods: practical concepts for the 21st
457 century. IDS Discussion Paper 296. Brighton, UK.
458
459 Curry, G. N., G. Koczberski, J. Lummani, R. Nailina, P. Esley, G. McNally, and O. Kuaimba. 2015.
460 A bridge too far? The influence of socio-cultural values on the adaptation responses of smallholders
461 to a devastating pest outbreak in cocoa. Global Environmental Change 35: 1-11.
462
463 Curry, G. and G. Koczberski. 2013. Development implications of the engagement with capitalism:
464 Improving the social returns of development. Engaging with Capitalism: Cases from Oceania. F.

McCormack and K. Barclay, Emerald Group Publishing Ltd. 33: 335-352.

Dasgupta, P. S., and P. R. Ehrlich. 2013. Pervasive Externalities at the Population, Consumption, and Environment Nexus. Science 340(6130): 324-328.

De'ath G., and K. E. Fabricius. 2000. Classification and Regression Trees: A powerful yet simple technique for ecological data analysis. Ecology 81: 3178–3192.

DFID (Department for International Development). 1999. Sustainable Livelihoods Guidance Sheets. DFID, London, UK.

Diedrich, A., and S. Aswani. 2016. Exploring the potential impacts of tourism development on social and ecological change in the Solomon Islands from a local perspective. Ambio 45: 808-818.

Diedrich, A. and E. Garcia-Buades. 2009. Local perceptions of tourism as indicators of destination decline. Tourism Management 30: 512-521.

Diedrich, A., N. Stoeckl, G. G. Gurney, M. Esparon, and R. Pollnac. 2017. Social Capital as a key determinant of perceived benefits of community-based marine protected areas. Conservation Biology 31: 311-321.

Durlauf, S. N. 2002. On the empirics of social capital. The Economic Journal 112: 459-479.

Foale, S., P. Cohen, S. Januchowski-Hartley, A. Wenger, and M. Macintyre. 2011. Tenure and taboos: Origins and implications for fisheries in the Pacific. Fish and Fisheries 12: 357–369.

FAO (Food and Agricultural Organisation of the United Nations). 2015. Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication. FAO, Rome.

Gabriel, J., C. Filer, M. Wood, and S. Foale. 2017. Tourist initiatives and extreme wilderness in the Nakanai mountains of New Britain. Shima. DOI: 10.21463/shima.11.1.11.

Gillett, R., G. Preston, W. Nash, H. Govan, T. Adams, and M. Lam. 2008. Livelihood diversifiction as a marine resource management tool in the Pacific Islands: Lessons learned. SPC Fisheries Newsletter 125 (April/June 2008): 32-38.

Gough, K.V., T. Bayliss-Smith, J. Connell, and O. Mertz. 2010. Small island sustainability in the Pacific: Introduction to the special issue. Singapore Journal of Tropical Geography 31: 1–9.

Govan, H. 2011. How can we support communities to build on what they have for a better life? Supplementary livelihoods in the Pacific. FSPI Reports. Suva, Fiji, Foundation of the Peoples of the South Pacific International.

Gutiérrez, N. L., R. Hilborn, and O. Defeo. 2011. Leadership, social capital and incentives promote successful fisheries. Nature 470: 386-389.

Harrill, R. 2004. Residents' attitudes toward tourism development: a literature review with implications for tourism planning. Journal of Planning Literature 18: 251–266.

Harrison,D. 2010. Tourism and development: Looking back and looking ahead –More of the same?. In D.G. Pearce & R.W. Butler (Eds.), Tourism research: A 20–20 vision. Oxford: Goodfellow.

Idechong, N., and Graham, T. 2001 Developing Inshore Sport-fishing in Palau. In Miller, M.L., Daxboeck, C.D., Kelly, K., and P.Dalzell (eds.) Proceedings of the 1998 Pacific Island Gamefish Tournament Symposium – Facing the Challenges of Resource Conservation, Sustainable Development, and the Sport-fishing Ethics. Kailua Kona, Hawaii, pp.73-83

Imbal, J. 2009. Developing the tourism potential of Papua New Guinea. Contemporary PNG Studies: DWU Research Journal 1: 26-39.

Kauppila, P. and Karjalainen, T.P. 2012. A process model to assess the regional economic impacts of fishing tourism: A case study in northern Finland. Fisheries Research 127:88-97

Lauer, M., S. Albert, S. Aswani, B. S. Halpem, L. Campanella, and D. La Rose. 2013. Globalization, Pacific Islands, and the paradox of resilience. Global Environmental Change 23: 40-50.

McCormack, F. and F. Barclay. 2013. Insights on capitalism from Oceania. Engaging with Capitalism: Cases from Oceania. F. McCormack and K. Barclay, Emerald Group Publishing Ltd. 33: 1-27.

Méndez-Lemus, Y., and A. Vieyra. 2017. How social capital enables or restricts the livelihoods of poor pei-urban farmers in Mexico. Development in Practice 27: 301-315.

Mowforth,M., and I. Munt. 2009. Tourism and sustainability: Development and new tourism in Third World (3rd ed.). Abingdon: Routledge

543 O'Garra, T. 2007. Supplementary Livelihood Options for Pacific Island Communities: A Review of
544 Experiences, Foundation of the Peoples of the South Pacific International. May 2007.
545
546 Portela, M., I. Neira, and M. Salinas-Jiménez. 2013. Social Capital and Subjective Wellbeing in
547 Europe: A New Approach on Social Capital. Social Indicators Research 114: 493-511.
548 Pretty J. 2003. Social Capital and the Collective Management of Resources. Science 302:1912
549 1914.
550
551 Sakata, H. and B. Prideaux. 2013. An alternative approach to community-based ecotourism: a
552 bottom-up locally initiated non-monetised project in Papua New Guinea. Journal of Sustainable
553 Tourism 21(6): 880-899.
554
555 Schwarz, A., C. Béné, G. Bennett, D. Boso, Z. Hilly, C. Paul, R. Posala, S. Sibiti, and N. Andrew.
556 2011. Vulnerability and resilience of remote rural communities to shocks and global changes:
557 Empirical analysis from Solomon Islands. Global Environmental Change 21(3): 1128-1140.
558
559 Scoones, I. 1998. Sustainable rural livelihoods: a framework for analysis. IDS Working Paper, No.
560 72. Institute of Development Studies, Sussex, UK.
561
562 Sofield, T. 1996. Anuha Island Resort, Solomon Islands: A case study of failure. In: Tourism and
563 Indigenous Peoples, ed. R. Butler, and T. Hinch, 176–202. International Thomson Business Press,
564 Boston, MA, USA.
565
566 Stoeckl, N., S. Jackson, F. Pantus, M. Finn, M. J. Kennard, and B. J. Pusey. 2013. An integrated
567 assessment of financial, hydrological, ecological and social impacts of 'development' on Indigenous
568 and non-Indigenous people in northern Australia. Biological Conservation 159: 214-221.

569

570 Tao, T.C.H., and G. Wall. 2009. Tourism as a sustainable livelihood strategy. Tourism Management
571 30: 90–98.

572

573 Wood, A. L., J. R. A. Butler, M. Sheaves, and J. Wani. 2013. Sport fisheries: Opportunities and
574 challenges for diversifying coastal livelihoods in the Pacific. Marine Policy 42(0): 305-314.

575

576 World Bank. 2012. Hidden Harvest; the Global Contribution of Capture Fisheries. Report 66469-
577 GLB. Washington, DC, USA.

## Figure Legends

**Figure 1.** Location of the Sportfishing Lodges neighbouring the study villages in West New Britain, Papua New Guinea. Vessa and Somalani are associated with the Lodge at Uluai and Baia is associated with the lodge to the East of Kimbe, the main commercial centre in the province.

**Figure 2:** Classification Tree on the influence of capital assets (social, physical, financial, natural, human) on villagers' perceived ease of becoming more involved in sportfishing tourism. Each of the three splits (nonterminal node) is labelled with the variable that determines the distribution of the observed variables in the subsequent terminal nodes. The misclassification (resubstitution) risk for the model was 33% (SE .044). The criteria were set to a limit of 3 sample folds, with a minimum of 20 cases nonterminal node and 10 cases per terminal node.

**Figure 3.** Classification Tree on the influence of the disaggregated social capital variables (trust, reciprocity, satisfaction with family/friends relationship, satisfaction with relationship with other villagers, satisfaction with leadership, and social networks, see Table 1) on villagers' perceived ease of becoming more involved in sportfishing tourism. Each of the three splits (nonterminal node) is labelled with the variable that determines the distribution of the observed variables in the subsequent terminal nodes. The misclassification (resubstitution) risk for the model was 33% (SE .044). The criteria were set to a limit of 3 sample folds, with a minimum of 20 cases nonterminal node and 10 cases per terminal node.

Figure 1

Click here to download Figure Figure 1.jpg

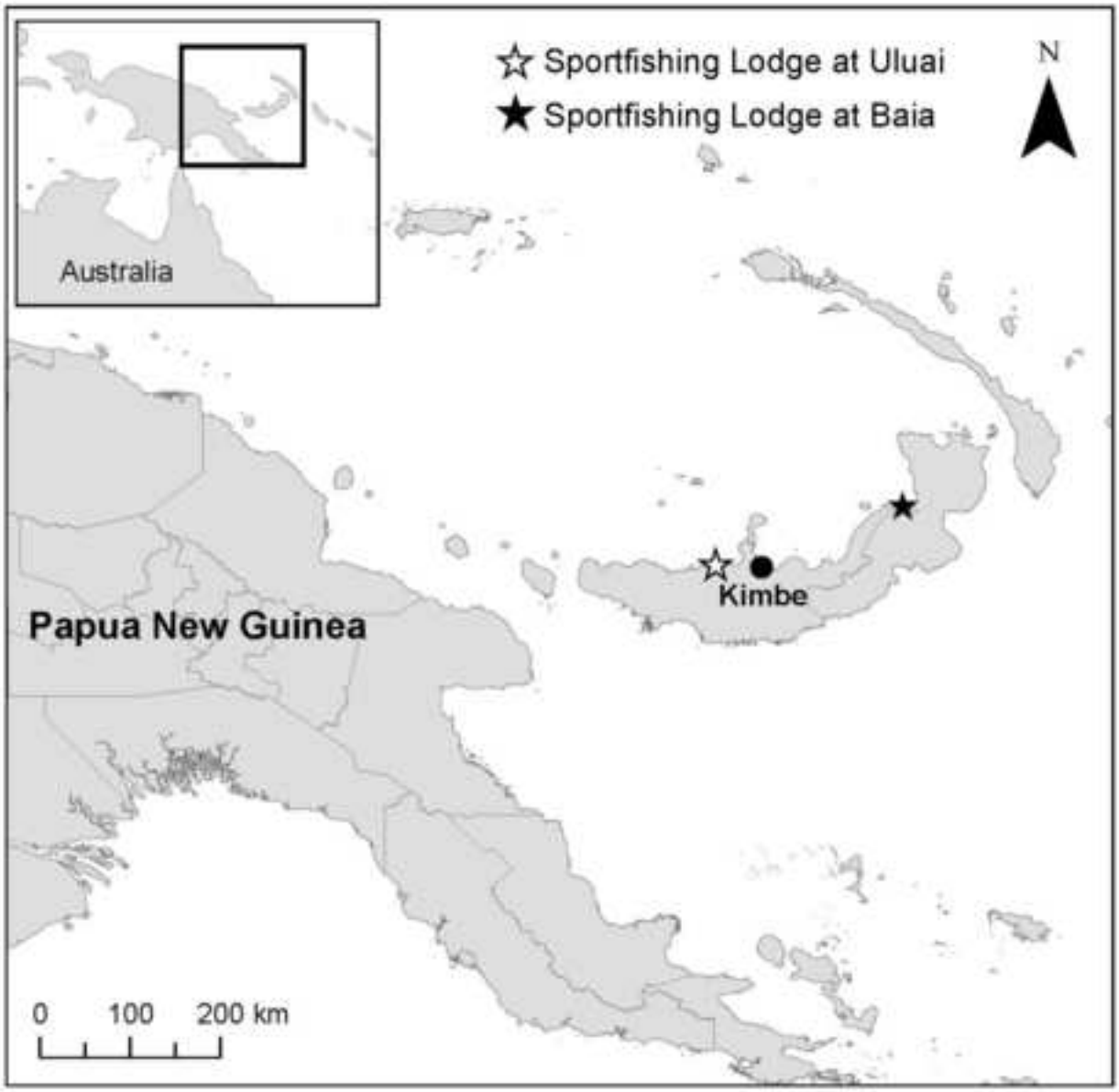

Figure 2

Click here to download Figure Figure 2.jpg

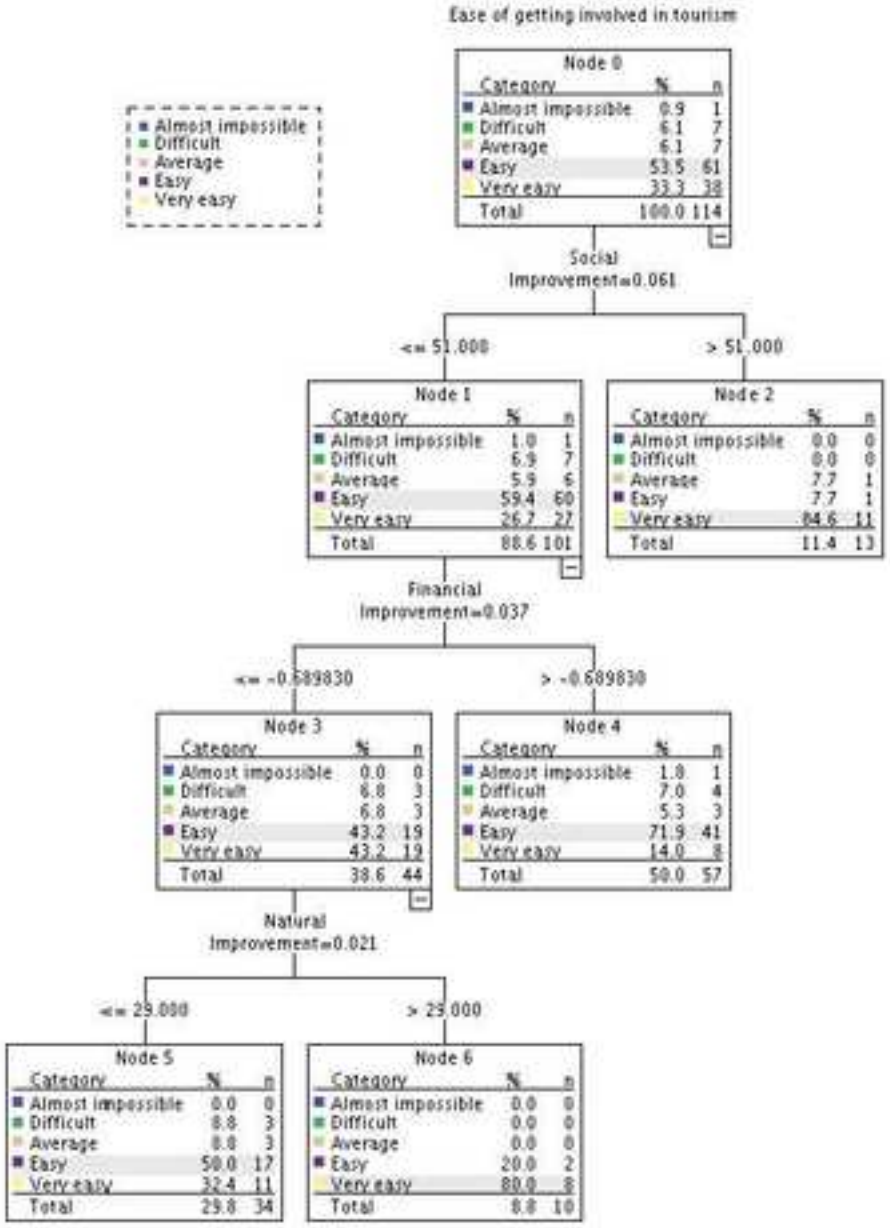

Figure 3

Click here to download Figure Figure 3.jpg

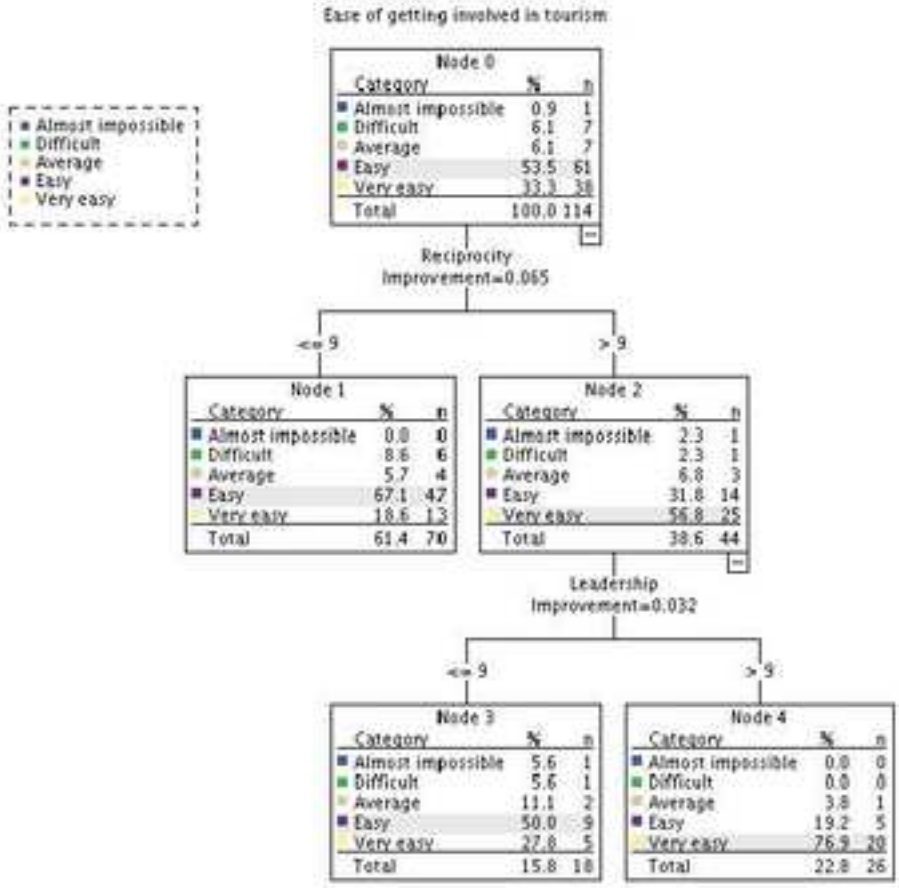

**Table 1. Demographic characteristics of respondents in 3 villages surveyed (n = 157)**

| Characteristic | Baia | Somalani | Vesse |
|---|---|---|---|
| Number of households interviewed | 34 | 68 | 55 |
| Percent of households interviewed | 97% | 100% | 100% |
| Percent of male respondents | 65% | 75% | 76% |
| Age of respondents | | | |
| *Under 21 years old* | 12 % | 4 % | 2 % |
| *21-30 years old* | 30 % | 21 % | 22 % |
| *31-40 years old* | 30 % | 25 % | 30 % |
| *41-50 years old* | 9 % | 19 % | 23 % |
| *Over 50 years old* | 18 % | 31 % | 24 % |
| Average grade respondent completed education | 7 (SD 3.3) | 8 (SD 3) | 8 (SD 2.5) |
| Subsistence level[1] | 1.9 (SD 0.4) | 2.1 (SD 0.8) | 2.1 (SD 0.8) |
| Average # occupations per household | 5 | 6 | 6 |
| Number of households with at least one member directly involved in sportfishing | 4 | 1 | 3 |

[1] 4-point ordinal scale of % fish and crops sold in market (4 is 100% sold at market)

**Table 2.** Definition of Capital Asset Variables

| Capital Asset Variables[1] | Variable(s) | Measure |
|---|---|---|
| **Human** | | |
| Skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives (sheet 2.3.1). | Satisfaction with personal and family health<br>Satisfaction with personal and family education level and access<br>Satisfaction with ability to find employment | Composite ordinal scale (0 – 32) |
| **Social** | | |
| Social resources upon which people draw in pursuit of their livelihood objectives (sheet 2.3.2). | Trust of other village members<br>Perceptions of reciprocity in village<br>Satisfaction with relationship with family and friends<br>Satisfaction with relationship with people in village<br>Satisfaction with leadership in the village<br>Networks (# community organisations belonged to rescaled 0 -10) | Composite ordinal scale (0 – 65) |
| **Physical** | | |
| Infrastructure and producer goods needed to support livelihoods (sheet 2.3.4). | Household Boat Access | Ordinal scale (4-point scale; none – owns boat with motor) |
| **Natural** | | |
| Natural resource stocks from which resource flows and services (e.g. nutrient cycling, erosion protection) useful for livelihoods are derived (sheet 2.3.3). | Satisfaction with access to food in sea & river<br>Satisfaction with access to food from other sources<br>Satisfaction with environmental health | Composite ordinal scale (0 – 32) |
| **Financial** | | |
| Financial resources that people use to achieve their livelihood objectives (sheet 2.3.5). | Household Material Style of Life | Factor score |

[1] Definitions sourced from DFID (1999)

**Table 3.** Mean values and Gini coefficients for capital asset variables in the study villages

| Variable[†, ‡] | Baia | | Somalani | | Vesse | | All villages | |
|---|---|---|---|---|---|---|---|---|
| | Mean (SD) | Gini | Mean (SD) | Gini | Mean (SD) | Gini | Mean (SD) | Gini |
| Human Capital | 8.7[§] (1.5) | 0.1 | 7.9 (1.8) | 0.1 | 7.6 (1.8) | 0.1 | 8.0 (1.8) | 0.1 |
| Social Capital | 7.9[§] (1.4) | 0.1 | 6.8 (1.4) | 0.1 | 7.0 (1.7) | 0.1 | 7.1 (1.5) | 0.1 |
| Physical Capital | 4.5[§] (2.5) | 0.3 | 6.0 (2.6) | 0.3 | 6.6 (2.9) | 0.3 | 5.9 (2.9) | 0.3 |
| Natural Capital | 8.4 (1.5) | 0.1 | 8.4 (1.5) | 0.1 | 7.4[§] (2.0) | 0.2 | 8.1 (1.7) | 0.1 |
| Financial Capital | 1.8[§] (1.4) | 0.2 | 4.3 (3.2) | 0.2 | 4.1 (3.5) | 0.2 | 3.7 (3.2) | 0.2 |

[†] All capital variables have been recoded to 10-point ordinal scales to facilitate comparison of the means

[‡] Kruskal-Wallace test $p < 0.05$ for all variables

[§] Posthoc test showed village to be significantly different to both of the other villages (all $p < 0.05$)

**Response to Reviewers**

Social capital plays a central role in transitions to sportfishing tourism in small-scale fishing communities in Papua New Guinea AMBI-D-18-00126

**Reviewer #1:**

GENERAL COMMENTS:

The paper presents empirical data and an interesting analytical approach about a central topic of Small Scale Fisheries socio-environmental processes. Tourism, specifically sportfishing activities, plays a central role in coastal communities livelihood diversification, and the focus on social capital it's a contribution to advance in a more integral understanding of socio-environmental transformations in the specific context of the study and abroad.

The paper shows rigour, a good treatment of the data and a solid analysis.

I only suggest enhance the conclusions, highlighting the key findings and advancing in possible policy tools applicable to PNG and Polynesia.

- *We have strengthened our concluding statements (lines 388-392) and included a statement relevant to development policy in our final paragraph (line 405-406).*

SPECIFIC COMMENTS:

Line 86-87. Introduce in the footnotes information about the "large, interdisciplinary project". Details as name, financial sources, institutions engaged will be useful to a better comprehension of the context of the research.

*The details of the project are included in the acknowledgements, which may not have been visible due to the blind review.*

**Reviewer #2:**

GENERAL COMMENTS:

I thank the authors for this interesting manuscript comparing the importance of different forms of capital on the perceived ease of livelihood diversification. The work detailed within this manuscript potentially sheds some light on this important avenue of research. However, I have some concerns with the manuscript in its current form, particularly in regards to the analysis and interpretation of the results.

SPECIFIC COMMENTS:

The three villages included in the study had different characteristics, in terms of levels of capital, demographics, and current levels of involvement with the sports-fishing trade. However, households across villages were pooled for CART analyses. Although levels of capital are presented by village (Table 3), the results for the dependent variable are not. As such, the reader is unable to determine whether differences between villages influence the correlations between capital and the dependent variable. For example, current levels of involvement in the sport-fishing trade differ markedly between study villages (>10% for Baia, ~5% for Vesse, ~1% for Somalani). These

differences could markedly affects the perceived ease of involvement in the sports-fishing trade. Social capital is highest in Baia. If perceived ease of involvement is also highest in Baia, this correlation may be confounded by other differences in other variables between villages such as length of involvement with, or ease of access to, the trade.

*This is a good point that required clarification in our analysis. We have added an analysis of differences in the dependent variable across villages and included an explanation as to why these differences did not feature/were not relevant to our overall analysis in lines 218-224 (see added text below):*

*"A one way ANOVA test with post hoc Tukey-b showed that there were differences across the villages for our dependent variable ($F(4.2, 75.9) = 3.2$; $p = 0.044$). Baia residents perceived involvement as slightly easier ($M = 3.5$; $SD = 0.6$) than Vesse residents ($M = 3.2$; $SD = 1.0$) and Somalani ($M = 2.9$; $SD = 0.8$) scored lower than Vesse. However, 'village' was included in the CART model as an independent variable and did not influence any of the splits, suggesting that individual level characteristics were more important than those at the village level in influencing the dependent variable."*

You present the results of a (albeit weak) correlation between financial capital and livelihood diversification. If you hypothesise that social capital is more influential that financial capital in responding to new livelihood activities, then social capital should also correlate with current livelihood diversity. Have you investigated this potential correlation, or can you explain why this is not the case?

*Interesting point. There was no correlation between financial and social capital. In our article, we explain the somewhat counter-intuitive relationship between financial capital and our dependent variable as follows (lines 327-332):*

*"Although there was not a highly discernable difference between the two groups, the results indicated that those with higher financial capital could be slightly more dubious of their ability to become involved in tourism. Given that our measure of financial capital is a proxy, we cannot draw any strong conclusions about the role of financial capital in this model but it's possible that because our results showed wealthier households to have more diversified livelihood portfolios, they had less time to engage in new economic activities."*

*From a causality perspective, it seems possible that, it is involvement in new activities that increases financial capital as opposed to the other way around. Thus, social capital may have an indirect effect on financial capital, mediated by livelihood diversification. This would be hard to detect statistically with such a small sample, but something that would be interesting for further analysis. As such, we have added the following text to the discussion section (lines 332-335):*

*"The time limitations faced by diversified households in engaging in new activities has been observed on other livelihood scenarios (e.g. Asfaw and Neka 2017) should be an important consideration for future research on tourism and alternative livelihoods."*

I'm relatively unfamiliar with CART, but I understand that the formation of trees can be heavily affected by parameters such as maximum sample folds and minimum cases per node. Can you please explain why you used the parameters that you did, or how changing these parameters affects the results?

*The chosen number of sample folds and minimum cases per node reflect the size of the original*

*sample. A minimum of 20 cases per non-terminal node and 10 per terminal meant that potential variations predicted at/within the village level could be picked up in the analysis. Anything higher than this and we may not have picked up influences relevant to the scale of our analysis. The limit of three sample folds was placed to lower the risk of overfitting the tree; again, this limit was considered necessary given the relatively small sample size. Moreover, the influence of any variables appearing beyond the third split would be too marginal to be relevant from practical perspective.*

Were correlations between demographic characteristics and the dependent variable assessed? As the dependent variable is subjective, factors such as age and education level could have a significant effect (even though respondents are answering for their entire households).

*This is a valid point, but we consider that looking at demographic factors is outside of the scope of this paper, and one that would require a different approach to data collection (e.g as the reviewer suggested, not at the household level). Our research question was whether the different capital assets had an influence, and we were able to produce viable models to reflect this. This suggests that, regardless of demographic factors, people's perceptions of capital assets play an important role. Subsequent analysis on how demographic factors affect these perceptions and, hence, the relative role of demographic variables in influencing people's transitions to alternative livelihoods would be a logical and necessary way to build on this work (although the analysis would need to be conducted at the individual rather than the household level for interpretability).*

MINOR EDITS:
Line 7: 'if' should read 'is'
Line 57: 'norm' should read 'norms'
*Done*

Figure 1: This map should show only the area of interest. Also please add village locations.

*We consider the scale to be relevant in order to show the location of our province relative the main island of PNG. The villages are adjacent to the marked sportfishing lodges (as noted in the legend).*

Table 1: Villages are names in this table, but referred to by number throughout the rest of the document. Please assign numbers at the first reference to the villages [e.g. 'Baia (Village 1)'] and refer to them by number throughout, or refer to them by name throughout.
Table 1: Ages are binned, but referred to as averages

*Done*

Line 240: Although CARTs allow investigation of the relative correlation between independent variables measured on different scales, these scales should not be directly compared. The comparison of means here (e.g. mean satisfaction with health vs. mean household boat access) is meaningless and should be removed.

*We normalized the means for comparative purposes (see footnote table 3). We considered it relevant to compare relative values across communities*.

Line 419: This study shows a correlation between social capital and people's perception of ease of becoming more involved with the sports-fishing trade, which is different from demonstrating the central role of social capital in influencing people's perceptions. I agree with your following point that this study provides a foundation to further research exploring the role of social capital in

transitions to sustainable livelihoods, but further (longitudinal) studies are needed before concluding that social capital is central in influencing people's perceptions.

*Ok, we have changed the text to (lines 397-399): "Our study shows that social capital is more correlated than other forms of capital with people's perceptions of how easy it would be to become more involved in sportfishing tourism …".*

Lines 427-432: I strongly agree that the difficulty in measuring and building social capital, along with the growing evidence (which this study contributes to) of the importance of social capital, demonstrates the importance of complementary strategies that include a focus on social capital. On a practical note, practitioners in the field certainly already recognise this.

*True, we hope that this comment will orientate people towards putting more emphasis figuring out how to address the challenge.*

**Reviewer #3:**

GENERAL COMMENTS:
This paper demonstrates the importance of social capital in the initiation of new tourism-based industries in remote developing nation communities. The approach and conclusions are sound, and the caveats on the results are clearly discussed. It is a significant contribution to the surprisingly scant body of research that addresses the development of sustainable livelihoods in remote developing nation communities.

SPECIFIC COMMENTS:
The use of perceptions as the output criteria is justified by the stated theory that the initial conditions are important for any new industry to survive. However, this could be fleshed out a little more. i.e. How important are perceptions in the initial survival of a new tourism enterprise, and what about the influence on the longer-term viability. Although briefly discussed, there could be more discussion on why it hasn't already happened in this case.

Agreed this is a point that requires emphasis. We have added the following text (lines 78-82):

*"Resident perceptions of tourism have been used repeatedly to study the dynamics of this transformation from the perspective of local communities (e.g. Harrill 2004). One of the main motivations for conducting such studies is that negative attitudes among residents can hinder the success and sustainability of tourism destinations (Diedrich and Garcia 2009, Diedrich and Aswani 2016)."*

The relationship is between the communities and the existing fishing lodges could also be quantified a little more. While only a low number of households are directly involved, the paper states that "benefits were shared more extensively throughout the communities in the form of fees paid directly to village leaders by the tourism business." Do these benefits influence their perceptions of tourism? And therefore, potentially their responses. In some ways this could be a positive thing as they have some knowledge of the operations and potential benefits.

*Agreed. Unfortunately, we have no way of evaluating whether the distribution of fees influences their perceptions, addressing this comment is outside of the scope of our paper.*

The discussion could benefit by outlining how to promote the application of social capital to tourism ventures. What are some of the business structures and instruments that could be used to

build tourism ventures.

*It is outside of the realm of our expertise to suggest business strategies for building social capital. However, we have strengthen our point about the need for this consideration in the conclusion (line … ).*

MINOR EDITS:
Line 195 - how access to (or lack of) [what?]

*Added "to human capital"*

**Reviewer #4:**

GENERAL COMMENTS:
Overall the paper 'Social capital plays a central role in the uptake of sport fishing tourism livelihoods in small-scale fishing communities in Papua New Guinea' makes a valid contribution to the emergent research area which investigates the role that social dynamics in remote rural communities play in the implementation of development initiatives, including alternative livelihoods. Alternative livelihoods are increasingly proposed as interventions to improve the resilience of communities in remote rural areas and the sustainability of their livelihoods.The paper found that social capital is the strongest amongst the five capitals in influencing the uptaking of alternative livelihoods interventions. Within social capital, perception of reciprocity in the community and satisfaction with leadership were the most important factors in influencing people's perceptions of the ease of becoming involved in sportfishing tourism. These findings add an interesting piece of information about the factors which facilitate the implementation of alternative livelihoods and can help practitioners in the design of appropriate interventions for transforming the livelihoods of remote communities. The paper is concise and easy to read. Its content is based on systematic research and full methodological details are provided in a manner that makes it easy to replicate.

SPECIFIC COMMENTS:

I do not have any major comments on the content and structure of the paper.

MINOR EDITS:

Title: double 'in' after '... fishing communities'

Line 7: I think it should be 'IS' and not if.

There are 2 'Figure 1'. Change the second Figure to Figure 2 and then change the numbering consequently. Change the numbering within the text accordingly.

Line 343: 'of a' is repeated twice, delete the second.

Line 392: Should read '... the mediating role that social capital HAS in the process'?

*All addressed*