BULETIN PSP ISSN: 0251-286X
Volume 20 No. 1 Edisi Maret 2012
Hal. 15-34

IDENTIFICATION OF POOR FISHING-DEPENDENT COMMUNITIES IN MAINLAND WEST SUMATRA

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ABSTRACT

Indonesia has some of the world's most diverse coral reefs in need of protection. These biodiversity hotspots have attracted international attention and are well described in the literature. However, they are home to only a small portion of the fishing communities in this country. The state of many of the other communities has yet to be studied in depth. As a step in that direction, this paper focuses on fishing communities in mainland West Sumatera and, using data collected by government agencies, defines two indicators that will be useful nationally. The first is a measure of the communities' dependency on fishing as a source of livelihood, the second a measure of poverty that is appropriate to Indonesian fishing communities. For mainland West Sumatera these parameters identify five areas that are highly dependent on fishing (> 10% employment in fishing) with two of these containing large numbers of fisher households in a state of poverty. These two are Sei Beremas and Sasak Ranah Pasisie in the regency Pasaman Barat. Neither of these are located at well investigated hotspots and further work will be required to identify the underlying reasons for the combination of dependency and poverty found in these places. The methodology described in this paper is applicable to the ongoing implementation of the national marine spatial planning program.

Keywords: fisheries, Indonesia, poverty

INTRODUCTION

Indonesia contains some of the world's most biologically diverse coral reef habitats. Biodiversity hotspots like Bunaken and Wakatobi have become hubs not only for tourism but for scientific research. This research has generated a significant contribution to the scientific literature, predominantly written from a conservation angle. Where these hotspots overlap with significant fishing communities the relationship between fisheries and conservation has been reported (e.g. Cassels *et al.*, 2005). But outside of these research hotspots, peer-reviewed published research exploring poverty in Indonesian fisheries is limited. Much of the published research available since 2005 can be divided into a response to the Asian tsunami (e.g. Tewfik *et al.*, 2008; Garces *et al.*, 2010), global overviews of fisheries that touch on Indonesia (e.g. Allison *et al.*, 2009; Stobutzki *et al.,* 2006; Thorpe *et al.,* 2006) and lessons learned from Integrated Coastal Zone Management in Indonesia and the Philippines (e.g. White *et al.*, 2005; Sievanen *et al.,* 2005). There is a great wealth of research that remains unpublished or published in the Indonesian language, however even within national programs the socio-economic aspects of fishers form only a minor contribution. The marine spatial planning process is one example of this. In response to National Law No. 27 Year 2007 on Coastal and

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Small Islands Management a program of marine mapping and zonation is underway in Indonesia. Comprehensive research reports are already available for three *Kabupatens* (regencies) in West Sumatra (BPSPL 2010a,b,c). While these documents are thorough in covering the physical and chemical oceanography, their socio-economic coverage is limited. Moreover, there is no reference in any of these documents to poverty despite these data being readily available. Phillipson (2000) argues that part of the problem is a separation between different disciplines of policy and administration using different data traditions and frameworks and that "there has been little progress in relating fisheries data to the socio-economic characteristics of coastal regions." With some 2 million small scale fishers scattered across the Indonesian archipelago a more systematic method is needed to ensure that locations that are socially and economically important receive the attention they deserve. Identifying these areas, typically referred to as fisheries dependent regions, is an important first step. This current study uses both a fisheries dependency index, based on routine fisheries statistics, and a poverty index, based on the Indonesian Government's definition of poor households, to explore fisheries dependency and deprivation in coastal communities of mainland West Sumatra. Fisheries dependence is analyzed at three different spatial levels to ensure that fisheries dependent communities are neither overlooked nor artificially highlighted (Phillipson, 2000).

Phillipson (2000) writes that a fisheries dependent region is one where "the industry provides an essential backbone to its economic or social structure" and where fisheries makes a major contribution to employment the case for regional dependency is strong. Symes (2000) argues that however fishing dependency is defined there will also be an arbitrary component to it where a line is drawn at a certain threshold to signify inclusion or exclusion. Lindkvist (2000) proposes that 5% of the working population should be employed in fisheries to constitute fisheries dependence where Symes (2000) refers to 10%. Other authors emphasize the socio-cultural component of fisheries as "a way of life" that characterize the community and that contribute much more than a source of revenue alone (van Ginkel, 2001; Jacob *et al.*, 2001). Having weighed up the different approaches Brookfield *et al.* (2005) define a fisheries-dependent community as "a population in a specific territorial location which relies upon the fishing industry for its continued economic, social and cultural success". The value in this looser definition is that it 1) explicitly includes cultural aspects, 2) highlights the reliance of fisheries for 'success', therefore hinting that a community may survive without fishing and 3) is not tied to a specific percentage of employment in the industry. The downside for decision makers is that there is no absolute cut-off point in such a definition to specify whether a community is objectively dependent on fishing or not. While the Authors agree that the cultural component of the fisheries community is an important consideration, the pragmatic availability of data limits the degree to which this can be included in the present comparative study. Indeed, the purpose of this current research is to compare the fishing communities in one specific geographical area (mainland West Sumatra) to identify those, using socio-economic criteria, where fishing indeed provides a backbone to the communities' economic or social structure. In this respect all communities will be placed on a continuum and will be compared to each other rather than a predefined cut-off point. However fishing dependency is defined, many authors agree in the need to couple fisheries statistics with social indicators (e.g. Phillipson, 2000; Anon, 2010). The Scottish Government write "basic data on direct employment, first and sales value of landings and the fishing fleet are adequate. What is missing is the array of social data on demographics, housing, education, health and social exclusion that can help to describe the varying economic and social circumstances in which fisheries dependence may occur. Such data exists but often with different spatial formatting (Anon, 2010)."

Having limited the scope of the study to socio-economics, how does one determine the criteria for selecting fishing dependent areas? Phillipson (2000) outlines a two step approach used by the European Union. This framework firstly identifies fisheries dependent areas using absolute and relative fishing activity rates (employment, landings and fleet data) to determine the activity level and regional distribution of the fishing areas. The second stage is economic and social profiling to highlight those areas particularly vulnerable to a decline in fisheries activity by using a wide range of indicators including demography, health, education and housing. The framework was designed to develop a fisheries dependence index which includes the contribution of fishing employment to the total employment of an area, the absolute activity rate and the economic significance of fishing within the regional economy. Symes (2000) suggests that economic criteria for defining fisheries dependent areas should be based on employment, added value and the contribution of fisheries to the regional economy because they are the most accessible and straight forward. Certainly this concept of accessibility, or availability, of data is important. Criteria must be selected that meaningfully describe fisheries dependence but that are available at the scale of the analysis. Too often there are complete data sets at a macro-level which hide fisheries dependent communities. More localized studies have the advantage of highlighting the dependency of discrete areas but the disadvantage that data may be sporadic. Phillipson (2000) agrees and identifies the scale of the analysis as critical. He writes "too fine a spatial mesh may suggest an extraordinary level of dependency, may be cumbersome and could also introduce greater difficulties in obtaining data". Because of this tension between being able to get the data and being at the right spatial scale this paper investigates fisheries dependence at three spatial scales using data readily available. The intention is to proceed at an increasing detailed scale to ensure smaller communities are not masked by macro-analyses. Whatever criteria are selected Symes (2000) argues for a combination of both absolute and relative values in the index of fisheries dependence otherwise important components of the fishing industry may be hidden. Relative numbers for example tend to focus on the stereotypical more remote, sparsely populated, rural fisheries dependent regions but ignore the existence of important concentrations of fishing activity in the more populous urban settings.

MATERIALS AND METHODS

Indonesia is politically structured into provinces (*Provinsi*), regencies (*Kabupaten*), districts (*Kecamatan*) and sub-district (*Kelurahan*). Fisheries statistics are annually collected at the provincial and regency level by the Department for Fisheries (DKP). These are collated by the centre for statistics (BPS) and made available in annual reports of each regency *Kabupaten/Kecamatan dalam angka.* Up until 2005 data pertaining to poverty was sporadically collected. However, beginning in 2005 a program of social-economic census began (*Pendataan Sosial Ekonomi Penduduk*). This was formalized into the social protection program in 2008 and was intended to be repeated in 2011 (BPS, 2011). Because 2008 was the latest available poverty data, fisheries statistics were also used from 2008 in this present paper. Despite universal guidelines for the type of data requested each year by the BPS, it was not possible to achieve a full data set from the *Kecamatan dalam angka* alone. In order to fill data gaps, direct requests were made to regional fisheries offices to complete data sets for the year 2008. Even then, fisheries dependence data was not always available at the level of the sub-district because data was only available at the level of the District and could not be disaggregated, for example in Padang and Padang Pariaman.

Internal inconsistency of fisheries statistics was a challenge. For some locations data from the BPS differed from that obtained directly from the DKP even though the original source of data for both was the DKP. Typically these errors were less than 5% but in one

situation (Lengayang) the number of fishers was recorded in one source as 4 times what it was in another. To overcome this, where there were anomalies in the data for 2008, these data were cross-checked with data from 2007 and 2009 and the data consistent with adjacent years was chosen.

Generating the fisheries dependence index

Inadequacy of data has been identified as a serious obstacle for the calculation of fisheries dependence (Phillipson, 2000). The challenge is to identify indicators of fisheries dependence that 1) meaningfully indicate dependence on the fishing industry and 2) that are universally available. In this analysis we selected the following:

1) **Total number of fishers**. This refers to the total number of fishers employed both full and part time directly in the fishing industry. It does not include those who work in related businesses such as boat building or in fish processing or marketing. One shortcoming of using total fishers is that it gives no indication of how much time part-time fishers are spending on fishing. Occupational multiplicity is a feature of many small-scale fisheries and this is true in West Sumatra. The most recent fisheries statistics separate fishers into three groups, full-time, part-time major and part-time minor. This will make future analyses more robust but because in 2008 these data were unavailable and the only compete data set was for total fishers these data were used as the first indicator.

2) **The percentage of the adult population working as fishers**. This indicator was intended to show the proportion of the working population that were actively employed as fishers. Many fishers in West Sumatra do not graduate high school but start fishing as a teenager. Consequently, an age of 15 or above was chosen to represent adulthood. Because many fishers continue to fish in a part-time capacity into old age there was no upper age limit to the working population.

3) **The total production of fish and shellfish**. While the previous two indicators emphasized the importance of fishing as an employer, estimates of production and value give an indication of the wider importance of the fishing industry and how significant a certain location is in the fishing industry of the province as a whole. Production means the total weight of fish and shellfish landed into a particular area.

4) **The total value of catch landed**. High value species such as shrimp may be overlooked by only measuring volume so it was necessary to include catch value in the present analysis. Both production and total value data are more likely to be accurate at larger ports than the small-scale dispersed landing sites (Pers. Comm. Zein, 2011).

There are other criteria that could be included in an analysis such as this. The direct and indirect contribution of marine fisheries compared to other economic sectors would be a clear indicator of how important the fisheries sector really was to the regional economy. Similarly, the downstream effects of the fishing industry through the processing and retail sectors are important multipliers of the catching sector that are part of fishing dependency. However although these indicators would meaningfully indicate dependence on the fishing industry they were unavailable at the scale of the district and sub-district.

Simply converting these data to ordinal data and ranking their position would have hidden the degree of difference between each district and made a composite index less precise. Instead the data were normalized using the following equation:

$$Z = (X - u)/S$$

Where X is the data (e.g. total fishers in one district), u is the mean and S is the standard deviation. This normalized data for the four indicators was used to calculate a composite

statistic, the mean of the individual normalized data. Each individual indicator was weighted evenly and districts were ranked according to fisheries dependency. Using this method a positive value ranked the location above the mean and a negative value below the mean.

Generating the Poverty in fishing communities index

The dual criteria of meaningfully indicating poverty and universal availability were also used in the development of a poverty index. There have been localized poverty studies in West Sumatra but for universal availability the only option is the social economic census. According to BPS (2011) poor households (*Rumah Tangga Miskin*) are identified based on the following 14 criteria:

1) Floor space in the house is less than 8 m^2 per person;
2) The floor is made from earth, bamboo or cheap wood;
3) The walls are made from bamboo, poor quality wood or blocks without plaster;
4) There is no toilet in the house or one shared with someone else;
5) There are no electric lights;
6) Drinking water comes from a well, river or rainwater;
7) Cooking fuel is wood, kerosene or charcoal;
8) Only eats red meat, chicken or milk once per week;
9) Only buys one set of clothes per year;
10) Only eats once or twice a day;
11) Not able to pay for medicine at the local healthcare clinic;
12) The head of the household works as a farmer with land less than 0.5 ha, farm labourer, fisher, building labourer or other employment that brings in less than Rp. 600,000 per month;
13) The highest education level achieved by the head of the household was only primary school; and
14) They have no savings or assets above Rp. 500,000 that can be sold quickly such as motorbikes, livestock, gold, boats or others.

If a household meets all 14 of these criteria they are classified as very poor, if they fulfill 11-13 of the criteria they are poor, 9-10 criteria means approaching poverty and less than 8 of the criteria means not poor. The BPS data used in this study only identified one category, that of households in a state of poverty. This referred to all households that fulfilled 9 or more of the criteria. Several authors comment on the need for a broad range of social indicators to accompany research into fisheries dependence (e.g. Phillipson, 2000; Symes, 2000; Anon, 2010). The advantage of the BPS methodology is that it incorporates elements of healthcare, sanitation, education, shelter, nutrition as well as income to generate a composite understanding of poverty.

However, there are three further qualifications with the available poverty data. Some of the criteria used to measure poverty above are less appropriate for fishing communities. Fishers typically prioritize their catching assets (boats and gear) rather than their houses so criteria 1-5 may not be clear measures of poverty in coastal communities. Similarly, criteria 8 specifies the eating of red meat or chicken but does not mention fish, a high source of protein easily obtainable by fishers. But other criteria such as the availability of capital assets, ability to pay for medicine, income and education would be appropriate indicators of poverty for fishers. Poverty data segregated poor households on the basis of the head of the household's main employment. Fisheries data did not distinguish between marine capture, freshwater capture or fish farming hence the number of poor fisheries dependent households could theoretically include a large proportion of freshwater fish farmers. There are lakes in West Sumatra where fish farming is a major employer, however these are not located in coastal regencies and staff at

the provincial DKP agreed that to make the assumption that all poor fisheries households from coastal areas were marine fishers was valid because the number of freshwater fishfarmers in coastal District*s* would be negligible. Fisheries statistics are based on the number of individual fishers where as the poverty data is based on *household* poverty and the main source of income of the head of the household. Therefore a single household in theory could contain two or three individual fishers (including brothers, older children, elderly parents) but would only register as one household. Proportions of poverty calculated below were based on the number of poor households divided by the total number of fishers in that area and are consequently a conservative estimate of total fishers in a state of poverty.

The composite poverty index comprised two indicators. The first of these was the total absolute number of households in a state of poverty where the main income source was fisheries. This measure was used to give an indication of where most poor fishers are concentrated in West Sumatra. The second indicator was the percentage of total fishers in a state of poverty. This measure was used to identify areas that did not necessarily contain the most poor fishers but that contained higher than average proportions of poor fishers. As for fisheries dependency above, these two indicators were normalized and weighted evenly to generate a composite index of poverty in fisheries households.

RESULTS

Fisheries dependence and poverty at the Regency (*Kabupaten*) level

Just over 1% of the population of mainland West Sumatra are sea fishers. More than 90% of them are found in just four regencies (Table 1) but more than 85% of catch by value is landed in just three of these. Production and value of the catch is not distributed proportionately relative to the number of fishers. Pasaman Barat and, to a lesser extent, Padang Pariaman land more catch by value than might be expected from their proportion of the fishers whereas Pesisir Selatan and, to a lesser extent, Padang land less catch by value than might be expected from the proportion of fishers in these regencies. The contribution of Agam and Pariaman in terms of both number of fishers and production is small compared to the other regencies although they also show this disproportionate distribution of fishers and catch. A fleet of fishing vessels that comprised mainly traditional vessels that are highly labour dependent might contribute to such an imbalance but this is not the case (Table 2). Pasaman Barat has a higher proportion of vessels without a motor than any other regency.

Table 1. Number of sea fishers, production and value of the catch in West Sumatra

Regency	Population	Fishers		Production		Value of Catch	
		person	(%)	(ton)	(%)	IDR (billions)	(%)
Pesisir Selatan	442,257	13,325	43	29,549	16	448	15
Padang Pariaman	390,226	4081	13	51,054	27	633	22
Agam	445,387	2312	7	2,451	1	31	1
Pasaman Barat	333,192	5475	18	77,617	41	1,426	49
Padang	856,815	5364	17	19,411	10	234	8
Pariaman	78,474	602	2	8,927	5	162	6
Total	2,546,351	31,159	100	189,009	100	2,933	100

Table 2. Mechanisation of the catching sector. The percentages in the first 3 columns indicate the proportion of boats in each regency. The final column indicates the percentage of total boats in a regency

Regency	Propulsion						Total boats	
	No motor	(%)	Outboard motor	(%)	Inboard motor	(%)		(%)
Pesisir Selatan	1,034	45	794	35	465	20	2,293	29
Padang Pariaman	5	0	1,193	99	12	1	1,210	15
Agam	369	54	167	24	146	21	682	9
Pasaman Barat	893	62	324	23	222	15	1,439	18
Padang	284	16	1,147	66	295	17	1,726	21
Pariaman	84	17	279	55	142	28	505	6
Total	2,669	-	3,904	-	1,282	-	7,855	100

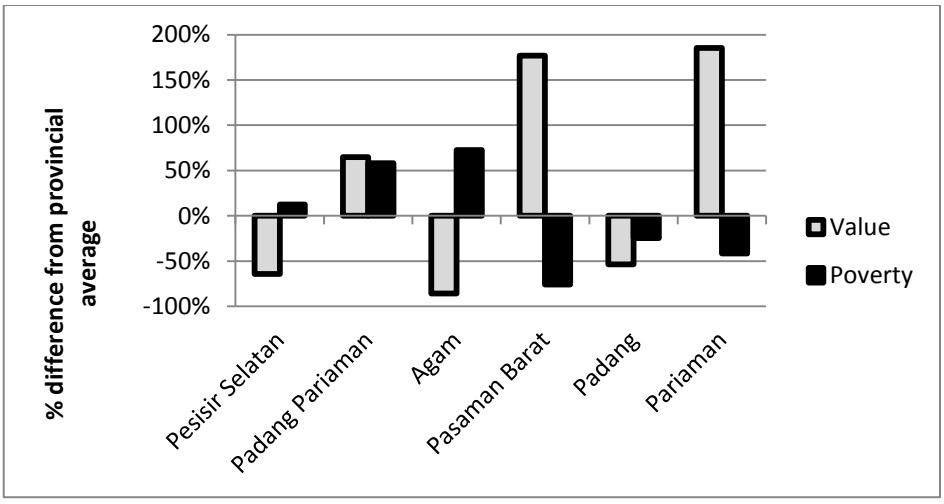

Figure 1 Comparing value of catch with poverty.

The overall picture from Table 3 is disappointing for the DKP and other departments seeking to improve the welfare of fishing households. Despite programs targeted at alleviating poverty, there were more poor fisher households in 2008 compared to 2005 in every regency except Agam. The increase in poverty in Pasaman Barat was particularly noticeable (47%). The fact that most poor fishers live in Pesisir Selatan (37%) is not surprising because most fishers in the province live in Pesisir Selatan.

Comparing value of catch with poverty (Figure 1) shows that while in both Pesisir Selatan and Agam the average value of the catch per fisher is worse than the provincial average the proportion of poor fishers is, surprisingly, better than average. The reverse is true in Pasaman Barat and Pariaman. Of all the regencies Pasaman Barat lands the most fish (Table 1) and the value of the catch per fisher is better than average (Figure 1) but Pasaman Barat performs the worst of the regencies in terms of the proportion of poor households. The distribution of the wealth generated from fishing in Pasaman Barat is an issue in this regency where one in every three fishers is classified as poor. Both Padang and Padang Pariaman

perform more predictably with the direction of relative catch value and poverty being the same. This is what would be expected in an equitable system. In Padang, value per fisher and the proportion of poor households is slightly worse than the provincial average and in Padang Pariaman considerably better.

Table 3. Poverty amongst households dependent on fisheries in West Sumatra in 2008

Regency	Fishers	Poor fisher households	Change since 2005 census	Poor fishing households in mainland West Sumatra	Poor fishers
			(%)	(%)	(%)
Pesisir Selatan	13,325	2,325	+26	37	17
Padang Pariaman	4,081	342	+14	6	8
Agam	2,312	127	-43	2	5
Pasaman Barat	5,475	1,918	+47	31	35
Padang	5,364	1,332	+9	21	25
Pariaman	602	170	+18	3	28
Total	31,159	6,214	+24	100	20

Fisheries dependence and poverty at the district (*Kecamatan*) level

The 31 districts that border the coastline in West Sumatra were ranked according to their degree of fisheries dependence on the basis of the composite normalized statistic defined in this paper (Table 4). Three broad groups of districts were identified.

Firstly, there were those districts where fishing was *not* an important activity. These ranked low for each of the indicators and scored a composite normalized statistic (Dependence Index) of less than -0.50. This group included Lunang Silaut, Nan Sabaris and Koto KP Dalam where less than 50 full-time fishers operated. At Pancung Soal there are just 105 full-time fishers and the three districts of Pariaman had a total combined fisher population of 600. The absence of production and value data for the Padang sites leads to some uncertainty about the fisheries dependence of Padang Barat and Utara.

Secondly there were the districts where fishing was a significant activity (a composite normalized statistic (Dependence Index) of more than -0.05). This group include the "top five" of Ulakan Tapakis, Sungai Limau, Tanjung Mutiara, Sei Beremas and Sasak Ranah Pasisie. In each of these five districts more than 10% of the adult population was employed in sea fishing. Sei Beremas and Sasak Ranah Pasisie stand out as two highly fishing dependent areas. Not only do one in five of the adult population work as fishers, but together these two districts are responsible for landing 39% of the total catch from all six regencies (73, 579 tons). The contribution of Agam to total marine landings from the six regencies was just 1% (Table 1) but this figure masks the importance of marine fisheries to the single district in Agam, Tanjung Mutiara, where almost 13% of the adult population are employed as fishers. This fishing dependent group also includes Tarusan, Sutera, Jurai, Ranah Pesisir, Linggo Sari Baganti and Lengayang from Pesisir Selatan, Batang Gasan from Padang Pariaman and Teluk Bungus and

Koto Tangah from Padang. These districts all contained more than 1000 fishers (except Batang Gasan) and these fishers comprised between 5 and 10% of the adult population. The two exceptions to this were Koto Tangah and Lengayang. For Koto Tangah, the geographical area of the district is so large that the coastal fishing population is dwarfed by an adult population of 117,858, which reduced the proportion of fishers to below 2%. For this reason Koto Tangah is an example of the necessity of using a composite measure to calculate fishing dependence that incorporates total fishers rather than relying solely on the percentage of fishers in an area. Lengayang is almost precisely on the mean of the fisheries dependence index and was placed in the fisheries dependent group on the basis that it exhibits similar characteristics to Linggo Sari Baganti. Together these fourteen districts included 76% of the total fishers in the six regencies.

The third category was the "marginally fishing dependent" (a composite normalized statistic (Dependence Index) of less than -0.05 but more than -0.50). They include the four remaining districts in the city of Padang for two reasons. Firstly, disaggregated data for catches is unavailable at the district level in Padang and secondly because of the high population density, the importance of fisheries at the district level is dwarfed by other industries. A detailed analysis at the sub-district level is needed to elucidate whether specific locations in Padang are indeed fisheries dependent. This group also included Batang Kapas and Bayang from Pesisir Selatan and Kinali and Koto Balingka from Pasaman Barat.

Despite poverty relief efforts, the number of fisheries households living in poverty has increased over the time frame of this study. Eighteen districts recorded an increase in poor fisheries households between 2005 and 2008 (Table 5). The largest increases in poverty where fishing was a significant contribution to employment were in Sei Beremas (454 households added, 79% increase) and Tarusan (281 households added, 109% increase). Elsewhere, the decrease in poverty in Tanjung Mutiara was particularly significant with recorded poor households almost halving from 223 in 2005 to 123 in 2008. While further work is needed to identify the social, economic and environmental factors that might have contributed to these changes, correlation analysis of the data showed that there is no significant linear correlation between the fisheries dependency index and the poverty index.

Regency	District	Fisheries statistics				Normalized statistics for:				Dependence index	Overall rank
		Total fishers	% Adult fishers	Production (ton)	Value (billion rp)	Total fishers	% Adult fishers	Production	Value	Composite statistic	
Pasaman Barat	Sei Beremas	2,192	17.65	52,180	na	1.54	2.75	3.36	na	2.55	1
Pasaman Barat	Sasak Ranah Pasisie	1,698	20.52	21,399	na	0.90	3.32	1.04	na	1.75	2
Padang Pariaman	Ulakan Tapakis	1,171	10.31	24,384	291.8	0.22	1.32	1.27	2.27	1.27	3
Padang Pariaman	Sungai Limau	1,733	10.51	19,679	258.1	0.95	1.36	0.92	1.97	1.30	4
Agam	Tanjung Mutiara	2,312	12.82	3,780	na	1.70	1.81	-0.28	na	1.08	5
Pesisir Selatan	Tarusan	2,650	7.55	4,570	50.3	2.14	0.78	-0.22	0.10	0.70	6
Pesisir Selatan	Sutera	2,214	7.55	3,942	43.4	1.57	0.78	-0.27	0.03	0.53	7
Padang	Bungus Teluk Kabang	1,196	7.19	na	na	0.25	0.71	na	na	0.48	8
Padang	Koto Tangah	1,870	1.59	na	na	1.13	-0.39	na	na	0.37	9
Pesisir Selatan	Jurai	1,613	5.58	6,120	67.3	0.79	0.39	-0.10	0.25	0.33	10
Pesisir Selatan	Ranah Pesisir	1,625	7.61	1,439	15.8	0.81	0.79	-0.46	-0.21	0.23	11
Pesisir Selatan	Linggo Sari Baganti	1,620	5.85	2,285	25.1	0.80	0.45	-0.39	-0.13	0.18	12
Padang Pariaman	Batang Gasan	512	7.98	4,361	88.9	-0.64	0.86	-0.24	0.44	0.11	13
Pesisir Selatan	Lengayang	1,250	3.49	3,097	34.1	0.32	-0.02	-0.33	-0.05	-0.02	14
Pesisir Selatan	Batang Kapas	1,009	4.76	1,395	15.3	0.01	0.23	-0.46	-0.22	-0.11	15
Pesisir Selatan	Bayang	1,136	3.89	1,277	14.0	0.17	0.06	-0.47	-0.23	-0.12	16
Pasaman Barat	Koto Balingka	630	4.28	902	na	-0.49	0.14	-0.50	na	-0.28	17
Padang	Lubuk Begalung	915	1.31	na	na	-0.12	-0.44	na	na	-0.28	18
Pasaman Barat	Kinali	635	1.82	881	na	-0.48	-0.34	-0.50	na	-0.44	19
Padang	Padang Selatan	614	1.43	na	na	-0.51	-0.42	na	na	-0.46	20
Padang Pariaman	Batang Anai	385	1.54	1,277	20.3	-0.81	-0.40	-0.47	-0.17	-0.46	21
Pasaman Barat	Sungai Aur	320	1.79	833	na	-0.89	-0.35	-0.50	na	-0.58	22
Padang Pariaman	Koto KP Dalam	244	1.90	304	4.5	-0.99	-0.33	-0.54	-0.32	-0.54	23
Kota Pariaman	Pariaman Utara	221	1.44	280	3.1	-1.02	-0.42	-0.54	-0.33	-0.58	24
Pesisir Selatan	Pancung Soal	155	0.69	1,187	13.1	-1.11	-0.57	-0.47	-0.24	-0.60	25
Kota Pariaman	Pariaman Tengah	225	0.94	188	3.2	-1.02	-0.52	-0.55	-0.33	-0.60	26

Kota Pariaman	Pariaman Selatan	156	1.16	185	4.4	-1.11	-0.47	-0.55	-0.32	-0.61	27
Padang	Padang Barat	388	0.83	na	na	-0.80	-0.54	na	na	-0.67	28
Padang	Padang Utara	381	0.61	na	na	-0.81	-0.58	na	na	-0.70	29
Pesisir Selatan	Lunang Silaut	53	0.29	264	2.9	-1.24	-0.64	-0.54	-0.33	-0.69	30
Padang Pariaman	Nan Sabaris	36	0.24	96	1.3	-1.26	-0.65	-0.56	-0.35	-0.70	31

Table 4. District fishing dependency. The raw data has been transformed through statistical normalization and the individual and composite scores are shown.

Table 5. Poor households where the main income is from fisheries. All data for 2008 unless indicated otherwise.

Regency	District	2008 Poor house-holds	% Change from 2005 census	% fishers who are poor 2008	Rank total fishers	Rank total poor	Rank % total poor fishers
Pasbar	Sei Beremas	1027	+79	47	4	1	3
Pessel	Tarusan	539	+109	20	1	2	17
Pessel	Sutera	407	+28	18	3	3	18
Pasbar	Sasak	373	-6	22	7	4	13
Pasbar	Kinali	359	+68	57	17	5	1
Padang	Koto Tangah	328	-22	18	5	6	20
Padang	Lubuk Begalung	314	+85	34	16	7	6
Pessel	Lengayang	297	+10	24	11	8	11
Pessel	Linggo S. Baganti	290	-12	18	9	9	19
Padang	Bungus Tel. Kab	286	+51	24	12	10	10
Pessel	Batang Kapas	277	+47	27	15	11	9
Pessel	Jurai	271	+36	17	10	12	21
Pessel	Bayang	163	-3	14	14	13	23
Padpar	Sungai Limau	146	+28	8	6	14	26
Padang	Padang Barat	142	-18	37	21	15	4
Padang	Padang Selatan	139	-11	23	19	16	12
Agam	Tanjung Mutiara	127	-43	5	2	17	29

Padang	Padang Utara	123	+11	32	23	18	7
Pasbar	Koto Balingka	93	+13	15	18	19	22
Par.man	Pariaman Utara	78	+47	35	27	20	5
Padpar	Ulakan Tapakis	69	-4	6	13	21	28
Padpar	Batang Gasan	69	-8	13	20	22	24
Pasbar	Sungai Aur	66	+89	21	24	23	16
Par.man	Pariaman Tengah	49	-14	22	26	24	15
Par.man	Pariaman Selatan	43	+26	28	28	25	8
Pessel	Ranah Pesisir	40	-25	2	8	26	31
Pessel	Pancung Soal	34	-35	22	29	27	14
Padpar	Batang Anai	21	+163	5	22	28	30
Padpar	Nan Sabaris	20	-23	56	31	29	2
Padpar	Koto KP Dalam	17	+240	7	25	30	27
Pessel	Lunang Silaut	7	+133	13	30	31	25

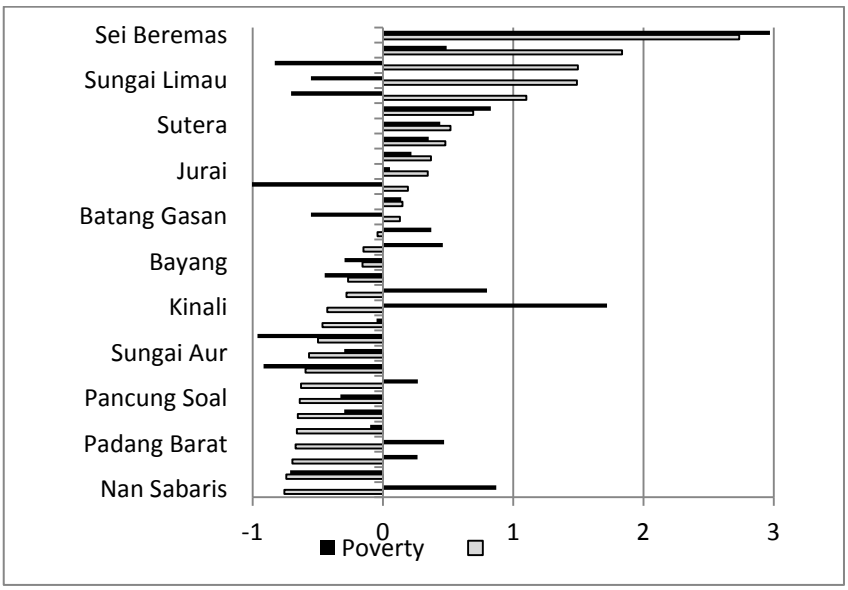

Figure 2 Fishing dependency and poverty of coastal districts in mainland West Sumatra. Districts are ranked using composite indexes transformed through statistical Normalization.

If poor households were evenly distributed throughout the population one would expect that the districts that contain most fishers would also contain most poor fishers. This is generally the case with Sei Beremas, Tarusan, Sutera, Sasak Ranah Pasisie, Koto Tangah and Linggo Sari Baganti ranking in the top ten for both total number of fishers and total number of poor fishers (Table 5). What is striking, however, is the degree to which Sei Beremas dominates the other districts in terms of total numbers of poor fishers. One in every six poor fisher households throughout the mainland province of West Sumatra is in Sei Beremas and almost half of the fishers in Sei Beremas are registered as poor. Tarusan and Sei Beremas together account for 25% of the poor fisher households in the six regencies. However there are some exceptions to the rule that more total fishers equals more poor fishers in both directions. Some districts, such as Tanjung Mutiara, Sungai Limau, Ranah Pesisir and Ulakan Tapakis, are highly fisheries dependent but rank much lower on the poverty index (Figure 2). Indeed, these are the only four districts containing significant numbers of fishers where the percentage of poor fisher households is in single digits. Ranah Pesisir has 40 fisher households in a state of poverty compared to the adjacent district Linggo Sari Baganti which has 290 households (Table 5). What makes this statistic surprising is that Ranah Pesisir actually contains marginally more fishers than Linggo Sari Baganti and that Linggo Sari Baganti is actually performing better than then average percentage of poor fisher households for all six regencies. In the opposite direction are the districts that rank relatively low in terms of total fishers but high in terms of the total number of poor fishers. Of these, Kinali is the most striking example (Figure 2). There are reportedly 359 poor fisher households in Kinali out of a total of just 635 fishers. This means that 57% of fisher households are in a condition of poverty, and this statistic could even be higher if more than one of the total fishers live in the same household. In Padang, the district Lubuk Begalung also has significantly more than average poor fishing households.

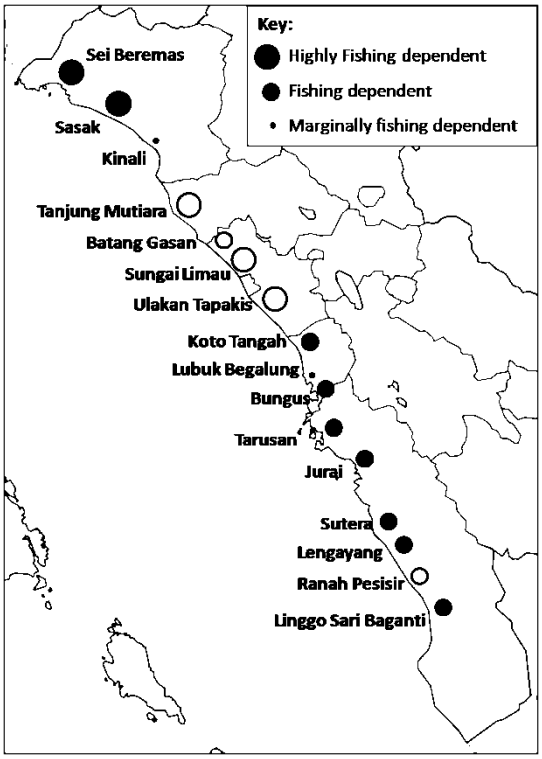

Figure 3 Fishing dependency and poverty of coastal districts in mainland West Sumatra. Solid black circles indicate districts that are both fishing dependent and contain above average poor households. Black rings indicate districts that are just fishing dependent.

The geographical spread of these fishing dependent districts highlights that the poorest fishing areas are generally at the north and the south ends of the province in Pasaman Barat and Pesisir Selatan (Figure 3). The group of four districts in Agam and Padang Pariaman that have lower than average poverty provokes the question of what is causing the differences in the proportion of poor fisher households between these and other districts?

Fisheries dependence and poverty at the sub-district (*Kelurahan)* level

Analysis of the sub-district data is limited by the availability of disaggregated data. The total adult population and number of fishing households in a state of poverty is available for each sub-district from 2008. Total numbers of fishers at the sub-district level are available for Pesisir Selatan, Agam and Pasaman Barat. No data for production or catch value was available at the sub-district level. Consequently the fisheries dependency index relied solely on the total fishers employed and proportion of fishers employed criteria. Even these data were not available for all sub-districts. There was a complete set of poverty data so the calculation of the poverty index remained the same as for the district analysis.

Table 6. Fishers and poor fishing household statistics at the Sub-district level. Three types of ranked data are also included. A composite rank using the first four columns of data, a number of fishers rank based on the first two columns of data and a poverty rank based on the last two columns of data. NA means no available data.

Regency	District[1]	Sub-district	Total Fishers	% Fishers of adult	Total Poor fisher households	% Poor fisher of total adult	Rank Fishers	Rank Poverty
Pasbar	Sei Beremas	Air Bangis[3]	2,192	17.64	1,027	8.3	1	1
Pasbar[2]	Kinali	Nagari Kat./Mandi.	635	24.57	358	13.9	5	2
Pessel	Tarusan	Sungai Pinang	415	46.52	143	16.0	2	3
Pasbar	Sasak	Nagari Sasak[3]	1,698	20.52	373	4.5	3	4
Padang	Lubuk Begalung	Gates Nan XX	915	18.71	287	5.9	6	5
Pessel	Tarusan	Ambang Pulai	637	10.05	214	3.4	14	6
Pessel	Batang Kapas	IV Koto Hilir	na	na	255	2.2	-	7
Pessel	Sutera	Ampiang Parak	632	12.27	166	3.2	10	8
Padang	Bungus Tel. Kab.	Teluk Kabung Utara	na	na	105	4.3	-	9
Padang	Koto Tangah	Pasir Nan Tigo	na	na	180	1.9	-	10
Pessel	Lengayang	Lakitan	837	5.49	192	1.3	15	11
Pessel	Linggo S. Bag.	Punggasan	742	5.53	185	1.4	17	12
Padang	Bungus Tel. Kab.	Bungus Selatan	na	na	80	3.0	-	13
Pessel	Jurai	Salido	719	6.17	157	1.3	16	14
Pessel	Bayang	Pasar Baru	na	nA	123	1.4	-	15
Pessel	Sutera	Surantiah	1,184	6.17	152	0.8	8	16
Pessel	Sutera	Taratak	418	9.34	89	2.0	19	17
Padang	Bungus Tel. Kab.	Teluk Kab. Tengah	na	na	49	2.6	-	18
Padang	Padang Selatan	Batang Arau	na	na	72	2.1	-	19
Pessel	Jurai	Painan	894	7.96	111	1.0	9	20
Pessel	Tarusan	Nanggalo	250	5.54	75	1.7	21	21
Padang	Padang Selatan	Air Manis	na	na	26	2.4	-	22
Pessel	Tarusan	Kapuh	409	9.55	63	1.5	18	23
Agam	Tanjung Mut.	Tiku Selatan	1,356	16.94	84	1.0	4	24
Pessel	Linggo S. Bag.	Aia Haji	896	5.64	104	0.7	12	25
Pessel	Lengayang	Kambang	413	1.89	105	0.5	22	26

Regency	District[1]	Sub-district	Total Fishers	% Fishers of adult	Total Poor fisher households	% Poor fisher of total adult	Rank Fishers	Rank Poverty
Pasbar	Koto Balingka	Nagari Parik[3]	630	4.28	91	0.6	20	27
Padpar	Sungai Limau	Nagari Pilubang	na	na	76	0.9	-	28
Pasbar	Sungai Aur	Nagari Sungai Aur[3]	320	1.79	86	0.5	23	29
Padpar	Sungai Limau	Nagari Kuranji Hilir	na	na	70	0.7	-	30
Padang	Padang Barat	Purus	na	na	61	0.9	-	31
Padpar	Ulakan Tapakis	Ulakan	na	na	65	0.7	-	32
Padpar	Batang Gasan	Nagari Malai V Suku	na	na	39	1.1	-	33
Padang	Bungus Tel. Kab.	Bungus Barat	na	na	40	0.8	-	34
Padang	Padang Utara	Ulak Karang Selatan	na	na	53	0.6	-	35
Padang	Padang Barat	Rimbo Kaluang	na	na	33	1.0	-	36
Agam	Tanjung Mut.	Tiku V Jorong	803	14.88	41	0.8	7	37
Padang	Padang Barat	Berok Nipah	na	na	38	0.8	-	38
Padpar	Batang Gasan	Nagari Gas. Gadang	na	na	30	0.9	-	39
Padang	Padang Utara	Air Tawar Barat	na	na	54	0.4	-	40
Pessel	Bayang	Gurun Panjang	na	na	35	0.7	-	41
Padang	Koto Tangah	Parupuk Tabing	na	na	54	0.3	-	42
Pessel	Batang Kapas	Taluak	na	na	21	0.8	-	43
Pessel	Ranah Pesisir	Sungai Tunu	628	11.15	17	0.3	11	44
Pessel	Ranah Pesisir	Palangai	888	5.55	22	0.1	13	45
Padang	Padang Utara	Lolong Belanti	na	na	14	0.2	-	46
Padang	Padang Selatan	Taluak Bayua	na	na	6	0.3	-	47
Padang	Padang Utara	Ulak Karang Utara	na	na	10	0.1	-	48
Padang	Bungus Tel. Kab.	Teluk Kab. Selatan	na	na	3	0.2	-	49
Padang	Padang Barat	Olo	na	na	6	0.1	-	50
Padpar	Ulakan Tapakis	Tapakis	na	na	4	0.1	-	51
Padang	Padang Selatan	Bukit Gado-Gado	na	na	1	0.1	-	52
Pessel	Jurai	Lumpo	12	0.17	2	0.0	24	53
Padang	Padang Selatan	Belakang Pondok	na	na	0	0.0	-	54
Padang	Padang Barat	Belakang Tangsi	na	na	0	0.0	-	55

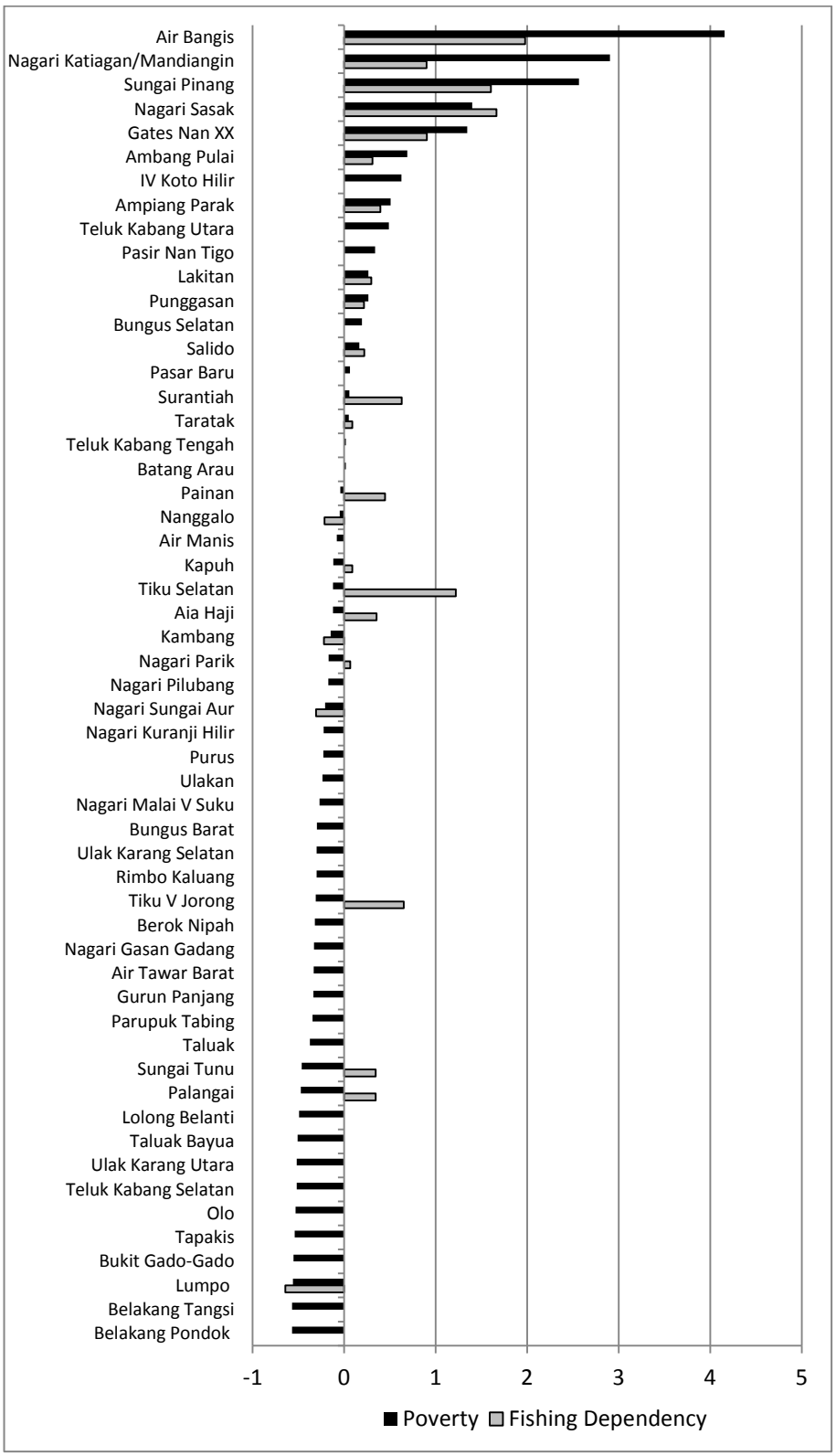

Figure 4 Fishing dependency and poverty of coastal sub-districts in mainland West Sumatra. Sub-districts are ranked using composite indices transformed through statistical Normalization.

In Pasaman Barat, where poverty is much more frequent than might be expected from the value of the catch, there are three sub-districts (Air Bangis, Nagari Sasak and Nagari Katiagan/Mandiangin) in the top 4 positions for both fisheries dependence and poverty (Table 6) Two of them (Air Bangis and Nagari Sasak) are in districts that scored highly in both the poverty and dependency indices whereas the other (Nagari Katiagan/Mandiangin) is part of the district Kinali, which was not fisheries dependent at the district level. Because the analysis has moved to an increasingly detailed spatial scale it becomes apparent that the coastal sub-district of Kinali is highly fisheries dependent. This effect is apparent for other sub-districts too. Sungai Pinang is a relatively isolated village with a total population of 1396. Although the 415 fishers are fewer than many other sub-districts, almost one out of two adults works in fishing, and one in six households in Sungai Pinang is a poor fishing household. Highly fishing dependent areas such as these only begin to stand out as the level of spatial resolution becomes increasingly detailed (Figure 4).

Tiku Selatan and Palangai rank highly for the total number of fishers and much lower on the poverty index. This is significant because it demonstrates that in the absence of fisheries dependence data, the complete fisheries poverty index alone may not be an accurate predictor of the fisheries dependence. This highlights the need for fisheries statistics to be maintained in their disaggregated form to permit analysis of the data at the subdistrict level and to fill in the many gaps in the data set.

CONCLUTION

Using the dual filters of 1) fisheries dependency and 2) poverty amongst households dependent on fisheries, this analysis has identified that three regencies, Pesisir Selatan, Pasaman Barat and Padang, contain 78% of the total fishers and 89% of poor fishers' households in mainland West Sumatra. Five districts were highly fisheries dependent where more than 10% of the adult population was employed in sea fishing. Of these only Sei Beremas and Sasak Ranah Pasisie also contained high proportions of poor fishers. Seven sub-districts were identified as both highly fisheries dependent (> 10% employment in fisheries) and containing significant proportions of poor fisher households (> 3% of total adult population). These were Air Bangis, Nagari Katiagan/Mandiangin, Nagari Sasak (Pasaman Barat), Gates Nan XX (Padang), Sungai Pinang, Ambang Pulai and Ampiang Parak (Pesisir Selatan). Conducting this analysis has highlighted several areas where data can be improved in consistency and accuracy.

Universal availability was one of two criteria for the selection of indicators to measure fisheries dependence. Despite selecting four indicators that should be routinely collected by the DKP there were gaps in the data, particularly for catch value and production. After contacting staff at the DKP it was clear that in some situations these data were not collected and this needs to be addressed in future years.

Aggregation of data created problems as the analysis moved to the Sub-district level. Even total numbers of sea fishers was not available in some Sub-districts despite the large numbers of poor fisher households that indicated the importance of fisheries to the area. Not only would disaggregation enable the veracity of the data to be checked more readily but would also permit more comprehensive analysis without any further data collection requirements. For example, if poverty data were disaggregated to include the original categories of very poor, poor and approaching poor, the mapping of poverty and fisheries dependence as highlighted in this paper would identify those areas most needing interventions to prevent poverty.

Both Symes (2000) and Phillipson (2000) argue the case for an estimate of the **importance of fisheries to the Regional economy.** Although the employment statistics used as the basis for the fisheries dependence index in this present study are part of the contribution to the regional economy the fisheries dependence index described in this paper does not indicate how fisheries compares to other sectors in terms of Gross Regional Product, total employment in all economic sectors, total unemployment and the other economic sectors that fishers are engaged in when they work part time. Currently this type of information is only universally available at the macro-scale but if the DKP together with BPS can work in a more integrated manner to collect census data the occupational multiplicity aspect of livelihoods could be included in future analyses.

This paper has outlined an approach designed to identify the most deprived fisheries dependent areas from routinely collected fisheries statistics and census data. This methodology could be readily incorporated into marine spatial planning to provide a much needed poverty dimension to this process.

ACKNOWLEDGEMENT

The authors wish to express gratitude to staff at BPS Padang, the provincial and regional offices of the DKP and members of staff at Bung Hatta University for their help.

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