

Social Network Analysis of Honduran Spiny Lobster Initiative

Final Report

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1. Summary

This report details the social network analysis (SNA) of survey data collected by the Spiny Lobster Initiative (SLI) over the course of several years in Honduras. The data were collected at four events: a Whole System in the Room event in June 2009, the First Spiny Lobster Symposium in May 2010, The Global Fish Alliance (GFISH) Network Census in Winter 2011, and The Fourth Spiny Lobster Symposium in May 2013. The goal of the following analysis is to explore the dynamics of the network structure and key actors over the course of the SLI.

There are two ways to think about the possible changes associated with a collaborative process such as Whole System in the Room and other events associated with the Global Fish Alliance, such as the Spiny Lobster Symposiums. First, there could be a change in the intensity of the overall levels of collaboration, for example an increase in the total number of realized collaborative relationships out of the possible ties that could be made. While this is perhaps the most intuitive expectation, it should be remembered that creating and maintaining social relationships is costly and requires investments in resources. Hence an increase in social connectivity is only expected if the benefits of additional ties outweigh the costs of creating and maintaining them.

A second way that networks may evolve is to change the distribution of ties across individual stakeholders, or sectors/groups of stakeholders. In this case, the total number of ties might remain the same but the distribution of ties changes across the network. For example, ties that might have just gone to a government agency could change to another stakeholder sector. In GFISH Honduras, some of the targets were to increase the involvement of artisanal fishing groups and diving boats/crew, which means reshaping some relationships. One way to think of this is creating “bridging” social capital among groups and actors that were not previously connected.

The **bottom line of this analysis** is that while there is limited evidence of increasing intensity of collaboration among spiny lobster fishery stakeholders, there is substantial evidence of a redistribution of social relationships in ways that make the network less hierarchical, increase the representation of marginal groups, and break out of sector-based “silos”. While there is no consensus on how different changes in network structure are related to overall levels of cooperation or sustainability, there are plenty of theoretical arguments that suggest the types of changes observed in the SLI network are supportive of cooperation. This hypothesis is further corroborated by stakeholders’ largely positive perceptions of the effectiveness of the Spiny Lobster Initiative for achieving short-term process goals such as information and trust. However, there is a more moderate view of how well the SLI has achieved some of the longer-term substantive goals suggesting that much of the short-term changes have been in process, relationships, and information. Fully-achieving some of the longer term goals will likely require sustained cooperation among stakeholders. The following bullets summarize the findings:

- The overall network structure in terms of density and number of ties has remained fairly stable over time.
- Within the overall groups, there is a slight trend towards decreased average path length coupled with decreased subgroup formation. This is consistent with more boundary spanning within the network. Communication relationships have experienced more increases in intensity, while collaboration relationships have experienced a decreased tendency to form subgroups.
- There is fairly clear evidence that the distribution of ties is becoming more equitable across sectors. By Wave 3, there is no single sector type that dominates the center of the network.
- Throughout the process, the most central sectors are government direct, divers/crew, and donors/cooperants. A number of specific organizations have experienced changes in centrality over time, and more field knowledge is necessary to better interpret these changes.
- The network is becoming less hierarchical and centralized over time over time, with more connections going from core actors to peripheral actors over time instead of being concentrated mostly within a small set of core actors.
- More bridging social capital is being created over time as indicated as more external ties between sectors. The creation of more external ties is especially strong among divers/crew, processors/exporters, government direct, and environment stakeholders.
- Stakeholders have a mostly positive perception of how well the Spiny Lobster Initiative has increased cooperation, trust, representation, and information availability. The most positive change was for information availability, with the least for interest representation.
- Stakeholders have a mostly positive but more moderate view of how well the Spiny Lobster Initiative has achieved a number of long-term goals. Education/awareness, regional integration, and use of conservation management tools receive the highest scores on goal achievement. Market expansion, integration of La Moskita, and interdisciplinary management receive some of the lowest scores.

The rest of this report will provide more detailed information about these basic findings. Note that we think the most important message of the analysis is the breaking down of silos and subgroups, and the decrease in hierarchy. We have placed an asterisk (*) in the headings of tables and figures that we think would be best for inclusion in your full report.

2. Methodology

2.1 Administering the Survey

The data used in the following SNA analyses was collected using the same survey instrument each of the four events. In cases where more than one representative from a given organization filled out a survey, only the survey from the most senior representative was included in the sample. Table 1 below shows the total number of candidate contacts given on the survey, the total number of survey respondents, and the total network size (respondents and those receiving connections from respondents) during each wave of data collection. As will be explained later, we analyzed three levels of networks: a “full” network where all actors involved in a relationship at a given time were included, a “core” network that included only actors involved in a social relationship during all three periods, and a “respondent core” network including only actors who responded to the survey in all three times. The network became more dense at each level of “coreness”.

Table 1. Summary of Network Size and Respondents

	Date	Event	Appearing on Survey	Respondents	Full Network Size	Core Network	Respondents Core
Wave 1	June 2009	Time 1: WSR	68	44	123	90	15
	May 2010	Time 2: Spiny Lobster Symposium	119	48			
Wave 2	Winter 2011	Time 3: GFISH Network Census	73	38	114	90	15
Wave 3	May 2013	Time 4: Spiny Lobster Symposium IV	113	55	119	90	15

Survey respondents rated a list of stakeholders according to the following three questions:

- I. How would you describe the relationship between YOUR ORGANIZATION and the other organizations? *(This is the Relationship question; 1-5 response scale)*

LEAVE BLANK. We have not heard of this organization

1. We have heard this name but we don't have a relationship
2. We occasionally have contact and exchange information
3. We frequently have contact and exchange information
4. Sometimes we work together on activities or projects.
5. We have a contract or memorandum of understanding

- II. How frequently do you have contact or communicate with this organization?*(This is the Communication question; 1-4 response scale)*

LEAVE BLANK. We don't have contact or communicate with this organization (coded 0)

1. We communicate occasionally - once or twice a year
2. With some frequency - multiple times a year
3. Regularly - monthly
4. Very frequently - weekly or more

- III. If your organization needs information or advice, would you feel comfortable contacting this organization? (*This is the Contact question; {Yes, No, I don't know}, responses coded {1,0,0}*)

Question III was omitted from the foregoing analysis due to low response rate.

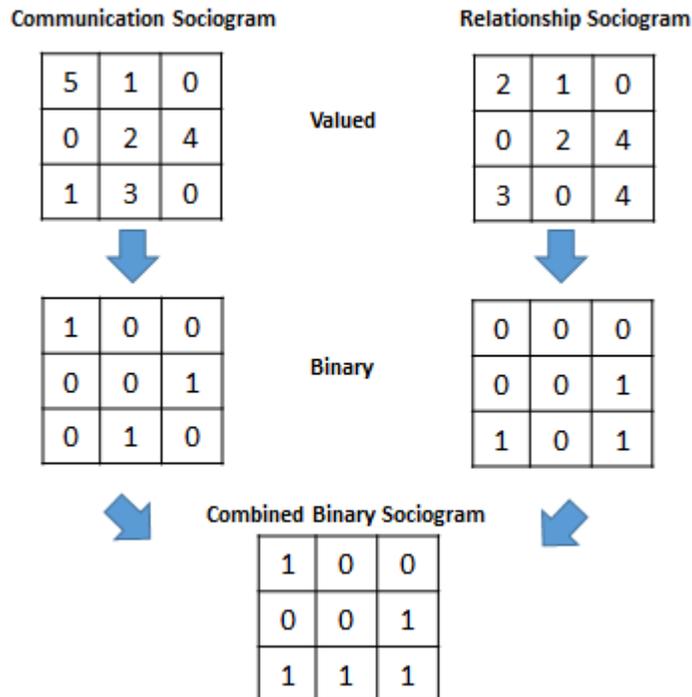
2.2 Constructing the Sociograms

For each time point, the response data took the form of square matrices with each column and row corresponding an organization appearing on the survey at that time point. Such matrices are known as *sociograms*. We took the valued data (ranging from 1-5 from the relationship question and 1-4 on the contact question) and converted it to dichotomous data using the rules depicted in Table 2.

Table 2. Scheme for dichotomizing valued data

Dichotomization of Data		
	Original Response	New Coding
Relationship question responses	0,1,2	0
	3,4	1
Communication question responses	0,1,2	0
	3,4,5	1

Figure 1. Constructing the combined binary sociogram



2.3 List of

networks used for

analyses

Full/aggregated network: Composed of all the organizations present in a network at a given time. The response data is dichotomized and combined across the two questions. This is a combined, binary sociogram.

Core/aggregated network: Composed of the 90 core organizations. The response data is dichotomized and combined across the two questions. This is a combined, binary sociogram.

Respondents/aggregated core: Composed of the 15 organizations that filled out a survey during all waves of data collection. This is a combined, binary sociogram.

Full communication network: Composed of all the organizations present in a network at a given time. Takes responses to the communication question only.

Core communication network: Composed of the 90 core organizations. Takes responses to the communication question only.

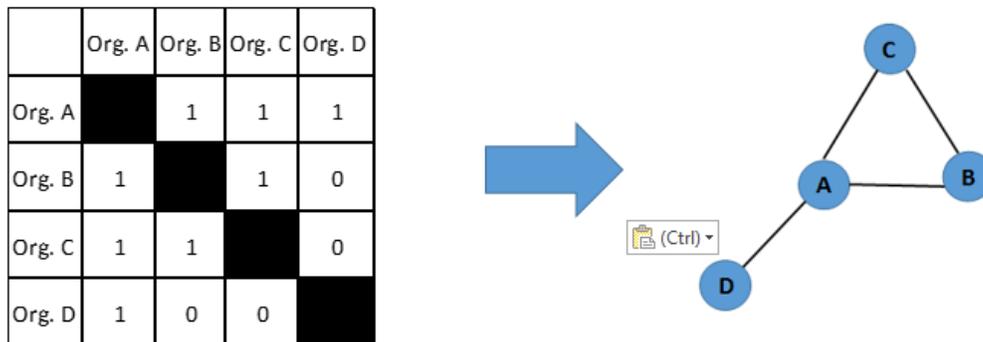
Full relationship type network: Composed of all the organizations present in a network at a given time. Takes responses to the relationship question only.

Core relationship type network: Composed of the 90 core organizations. Takes responses to the relationship question only.

2.4 Constructing the Network Diagram

Figure 2 depicts the conversion of a sociogram to a corresponding network diagram. Two organization nodes are linked together if at least one of the organizations nominated the other organization on the question used for the given matrix

Figure 2. Converting sociogram to network diagram



3. Network Visualization

Figures 3-5 show the full network graphs for each of the three data collection waves. The nodes are scaled by in-degree centrality, with the more central nodes appearing larger. The node color corresponds to the sector in which that organization operates as categorized by Jimmy Andino of the Spiny Lobster Initiative. A given pair of organizations is linked if either one filled out a survey and responded with a binarized value greater than zero when prompted with the other organization's name. For example, if organization X responded to the survey and mentioned organization Y, then there would be a link between X and Y even if organization Y did not fill out the survey. The node size is scaled by in-degree centrality, so larger in-degree centrality values correspond to larger nodes. In-degree centrality in this case is proportional to the number of times an organization is mentioned by other organizations; a reputational measure.

As mentioned earlier, the clearest changes are in the distribution of ties across sectors and the network becoming less hierarchical. There was not much of an increase in the overall density of ties, which would be more visible. But the network diagrams still give an idea of what types of actors are at the center of the network over time.

Figures 6-8 show the respondent core networks at each of the three data collection waves, using the same sector-based coding scheme as the full network graphs.

Figure 3. Wave 1 Full/Aggregated Network

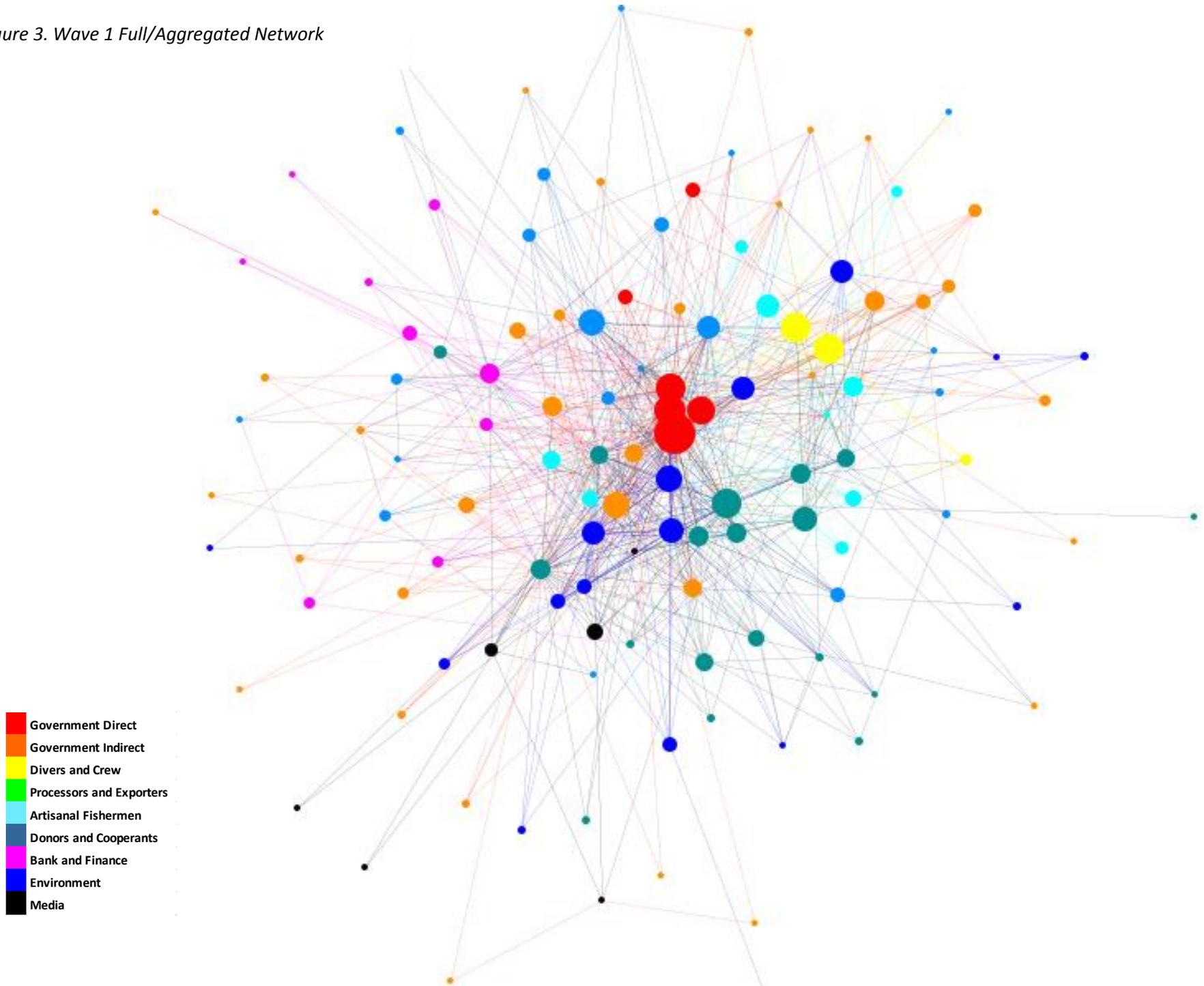


Figure 4. Wave 2 Full/Aggregated Network

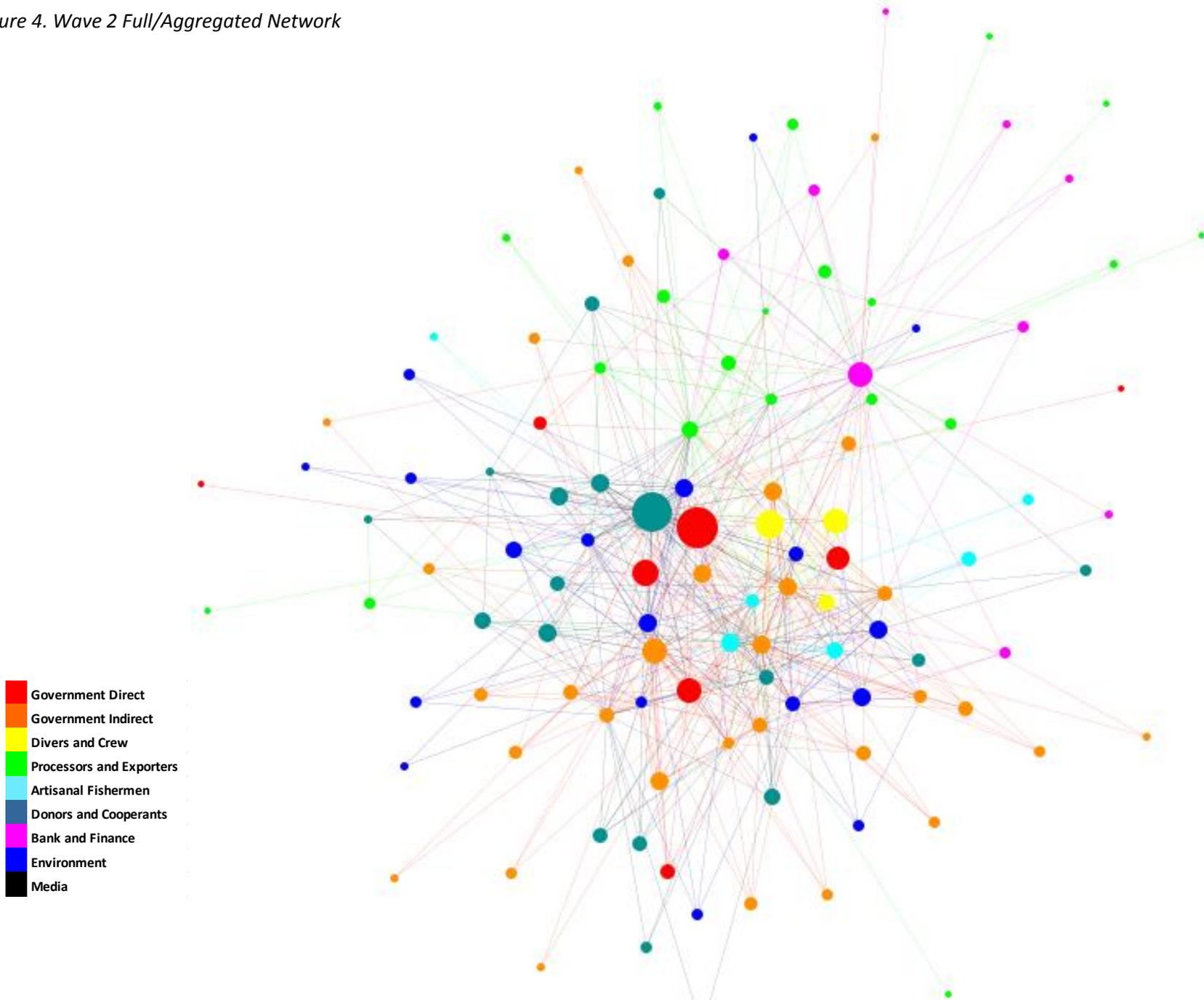


Figure 5. Wave 3 Full/Aggregated Network

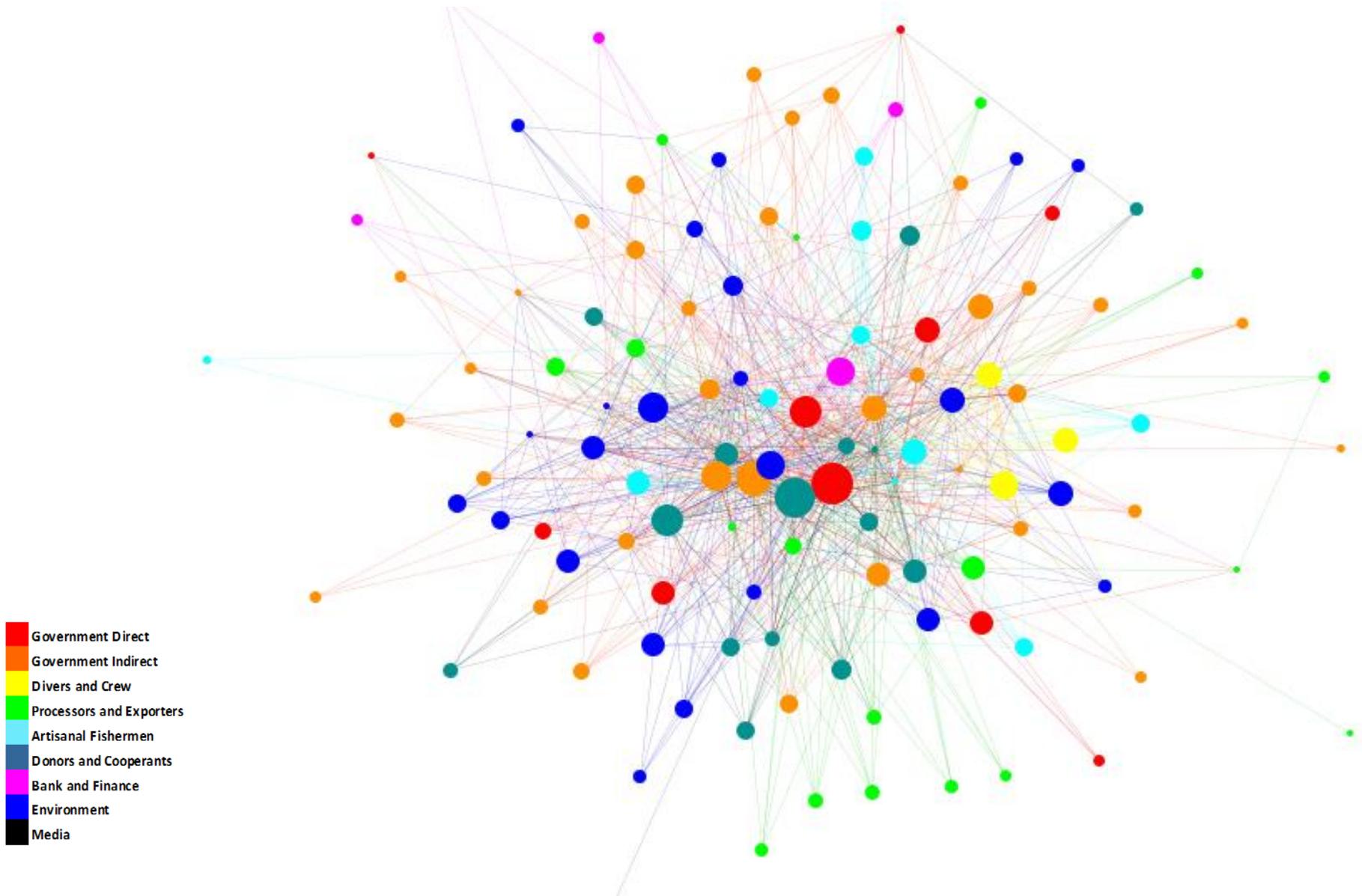


Figure 6. Wave 1 Respondent Core Network

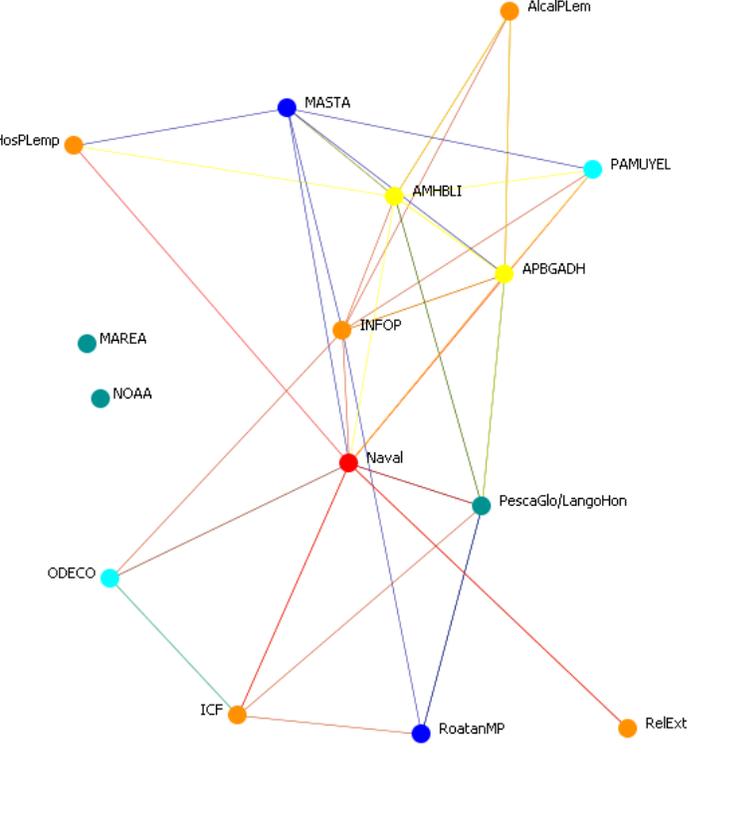


Figure 8. Wave 3 Respondent Core Network

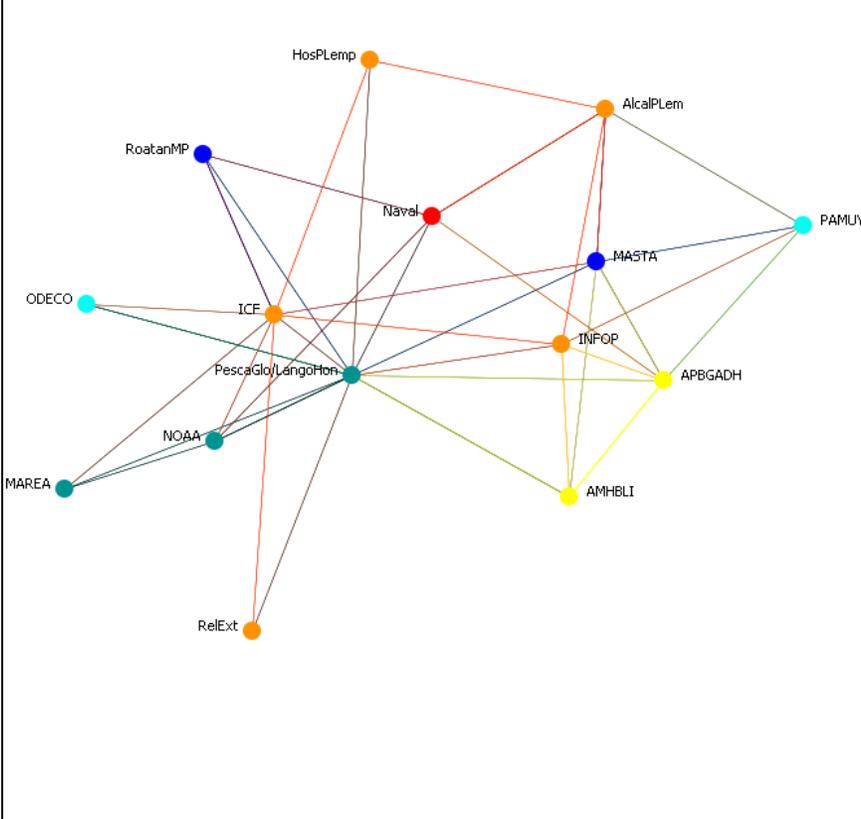
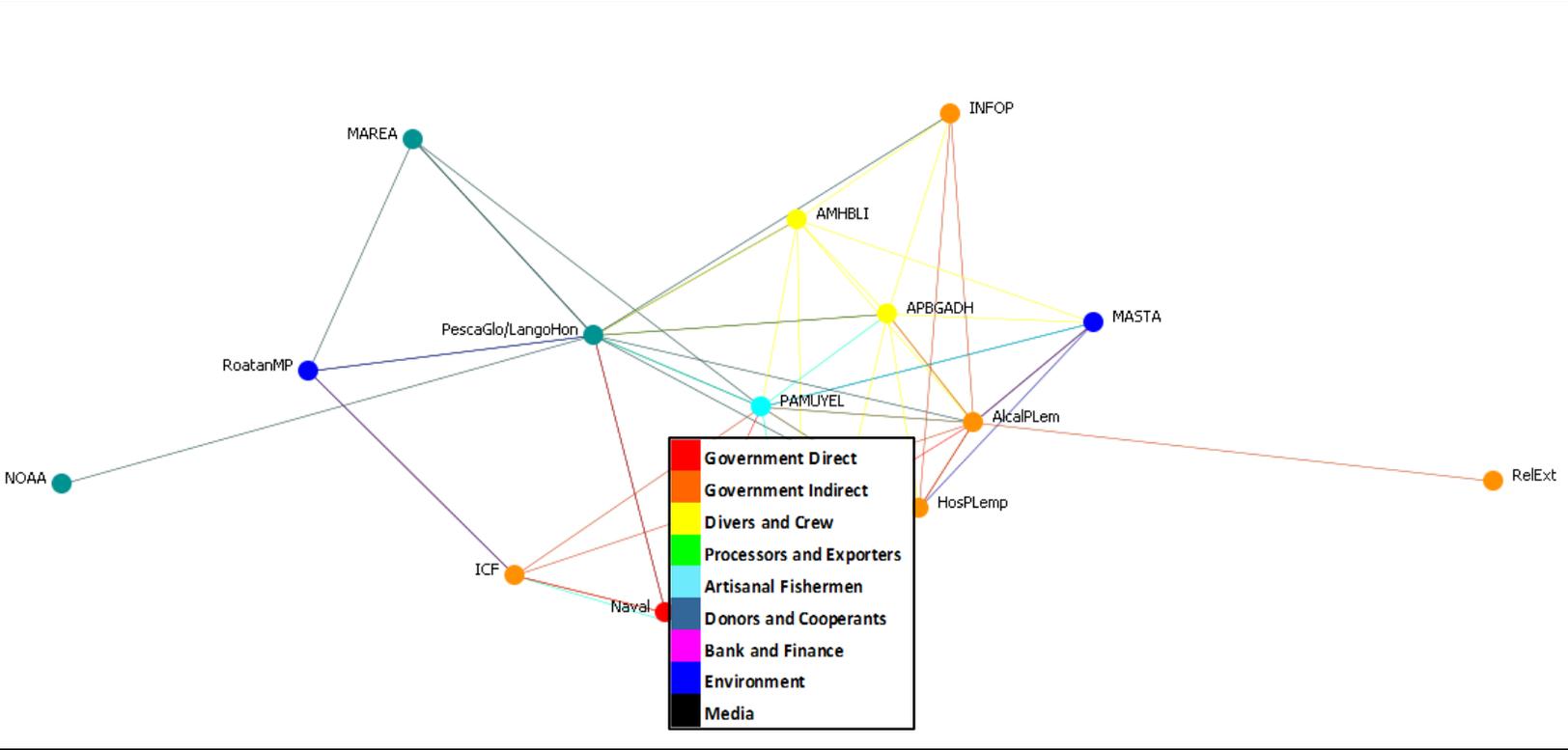


Figure 7. Wave 2 Respondent Core Network



4. Comparison of Network Level Measures

4.1 Definition of Measures

- **Density** is the ratio of observed ties to all possible ties. Binary network density ranges from 0 to 1. For a valued network where ties have a range of values, it is the total of all values divided by the number of possible ties. Density is identical to the average tie value and the maximum density equals the maximum tie value. High-density scores reflect more ties, which is generally interpreted as a more connected network.
- **Reciprocity** is a measurement of the proportion of adjacent nodes that have edges going both ways. An adjacent dyad means there is at least a single, one-way connection between two nodes. Reciprocity is defined similarly for a valued network; a relationship is reciprocal if both edges are greater than zero. For example, if the Global Fish Alliance indicates a communication score of "3" for USAID, and USAID indicates communication scores of "2" for Global Fish Alliance, then it still counts as a reciprocal tie. So the reciprocity score should be identical for valued and binary networks. Reciprocity is one of the key relationships supporting the evolution of cooperation in a community.
- **Transitivity** captures the basic notion of "a friend of yours is a friend of mine", which is sometimes described as "closure" in a network. A certain level of transitivity allows for reputational effects such that groups of people can self-monitor cooperation, and thus a general increase in transitivity is expected if cooperation is low to start with.
- **Clustering Coefficient** calculates the average density of ties between nodes directly adjacent (local neighborhood) to a focal node (ego), excluding the ties to the node itself. Clustering coefficients are usually higher for networks with high density. A high clustering coefficient relative to overall density indicates the network is clustering into subgroups. It is not entirely clear from a theoretical perspective whether clustering increases the success of SCALE projects because is it possible for clustering to create fragmentation. SCALE may want to reduce fragmentation, but not necessarily at the cost of eroding cooperation in local network neighborhoods.
- **Average distance** calculates the average shortest path length between each pair of nodes in the network.
- **In-degree centrality** is the number of connections received and relates to the popularity of an actor. Because this type of centrality is reputation-based and the most robust in the current context in which relatively few actors have filled out the survey.
- **Out-degree centrality** is the number of connections sent to others and relates more to the expansiveness of an actor.

- **Total degree centrality** is a combination of in-and out-degree centrality and shows the total extent to which an actor is connected to others in the network.

3.2 Overall Network-Level Measures Over Time

Table 3 below shows the network-level measures at each wave of data collection for the full, core, and respondent core networks. The central finding from the overall network statistics is that the basic level of connectivity is not changing very much over time in these networks. This is particularly obvious for the measures of density, average distance, and average degree. For all three levels of the network, these measures show no dramatic trends. The average distance is slightly decreasing, which suggests a slight increase in connectivity. Reciprocity does generally decline, which is consistent with a general tendency to reorganize ties rather than strengthen commitments to previous relationships.

The most important trend in the overall network is a general decline in the transitivity and clustering coefficient, with the pattern being most clear for transitivity. Both of these statistics are associated with the tendency of the network to form cohesive subgroups. Networks that form cohesive subgroups are more likely to fragment into competing interests. By reducing that tendency, there is more integration across subgroups or in the case of SLI the different sectors of stakeholders.

Another clear pattern in the data is the increase in connectivity across different levels of the network. The full network has the least amount of connectivity, with an increase for the core network, and a very high level of connectivity for the respondent network. This is not surprising because people who continually show up to the meetings or fill out the survey each time are exhibiting a higher level of participation. While this increasing connectivity across different levels of the network is not itself indicative of change over time, the basic trends in the other network statistics are apparent across all levels of the network.

Our interpretation of this overall pattern of a stable intensity of interaction coupled with changes in subgroup formation is that new entrants are playing an important role in the evolution of the network. We know substantively that many actors are entering and leaving this network over time. Some people come early on and then do not come again; other people show up for the first time at later meetings after they hear about the project from others. Hence, actors in the core network who are constantly involved with the process are being exposed to new actors as they enter, and lose opportunities to interact with actors who leave. The core network actors are constantly evaluating the benefits of maintaining versus dissolving ties that are formed in earlier periods. As they dissolve less useful ties, they look for opportunities to collaborate with new entrants into the network. Hence the core is slowly declining in reciprocity, while the overall full networks are seeing some increase in connectivity and decrease in subgroup formation due to opportunistic connections with new entrants.

**Table 3. Network level measures for aggregated networks across all three waves.*

	FULL			CORE			RESPONDENT CORE		
	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave3	Wave 1	Wave 2	Wave3
Density	0.058	0.045	0.069	0.087	0.066	0.078	0.231	0.271	0.222
Reciprocity	0.161	0.127	0.078	0.203	0.144	0.094	0.424	0.326	0.216
Transitivity	0.380	0.356	0.335	0.417	0.375	0.345	0.453	0.477	0.256
Clustering Coefficient	0.344	0.336	0.283	0.329	0.360	0.344	0.347	0.386	0.344
Average Distance	2.392	2.182	2.072	2.168	2.114	2.068	1.826	2.011	2.013
Average In-degree	8.563	5.310	8.260	7.844	5.900	7.033	3.467	3.800	3.333
Average Out-degree	8.563	5.310	8.260	7.844	5.900	7.033	3.467	3.800	3.333
Average Total	16.900	10.620	16.520	15.489	11.800	13.870	6.600	7.600	6.333

In light of the findings from the full/aggregated network, it is important to see if these basic trends are occurring in the two separate types of relations. Hence, we repeat the above analysis focusing separately on the communication and relationship type question, for the full and core networks. We do not include the respondent network here because the results are similar. The results are shown in Tables 4 and 5.

Although it is not dramatic, there is some suggestion of an interesting difference between the communication network and the relationship network. The communication network appears to be experiencing a greater increase in the intensity of network connections. For example, the density of the full communication network is highest in Wave 3 while the average distance is the lowest in Wave 3. The relationship network, on the other hand, exhibits no evidence at all of an increase in the intensity of collaboration. One interpretation of this is that because communication is relatively cheap, it is easier to increase the intensity in comparison to more expensive collaborative relationships.

On the other hand, the decrease in transitivity and clustering is more dramatic in the relationship network, and less dramatic in the communication network. This suggests that a lot of the reduction in subgroup formation is concentrated in new relationships being built across sectors, rather than an overall increase in the levels of collaboration relationships. An intriguing hypothesis from these patterns is that the balance between creating new social relationships versus redistributing resources committed to existing relationships depends on the costs of establishing a particular type of tie. Communication is relatively cheap and it is easier to increase communication intensity without dissolving other ties. Relationships are relatively costly and thus more constrained by resource scarcity, and thus it is difficult to increase the overall intensity of relationships and thus more of an incentive to strategically dissolve less beneficial ties and replace them with more beneficial relationships. As mentioned earlier, new entrants to the network over time might be one source of opportunities for creating more beneficial collaborative relationships.

Table 4. Network-level measures by question across all waves for the full network.

	Full Network					
	Communication			Relationship		
	Wave 1	Wave 2	Wave3	Wave 1	Wave 2	Wave 3
Density	0.040	0.024	0.047	0.058	0.043	0.054
Reciprocity	0.152	0.101	0.058	0.161	0.123	0.053
Transitivity	0.377	0.334	0.300	0.380	0.340	0.291
Clustering Coefficient	0.273	0.181	0.287	0.344	0.325	0.218
Average Distance	2.542	2.735	2.368	2.274	2.198	2.314
Average In Degree	5.087	2.900	5.642	7.333	5.100	6.475
Average Out Degree	5.087	2.900	5.642	7.333	5.100	6.475
Average Total	10.008	5.800	11.125	14.476	10.200	12.808

Table 5. Network-level measures by question across all waves for the core network.

One possibility is that while the number of network connections over time do not increase, the strength of the existing relationships increases. The dichotomized networks reported earlier can possibly hide the intensification of relationships. To test this possibility, we examined the valued response networks for both the communication and relationship questions. Table 6 shows the average response values to the two questions across the three waves. For each question, the average value is calculated by summing all of the non-zero responses to the question across all survey respondents and dividing by the number of responses. There is no evidence of intensification of relationships over time, with average response values for communication staying relatively constant, but levels of relationships actually dropping over time. Waves 1.1 and 1.2 correspond to the WSR and First Spiny Lobster Initiative, respectively.

Table 6. Average response values by question across waves

	Core Network					
	Communication			Relationship		
	Wave 1	Wave 2	Wave3	Wave 1	Wave 2	Wave 3
Density	0.058	0.034	0.048	0.083	0.056	0.061
Reciprocity	0.183	0.088	0.050	0.187	0.116	0.066
Transitivity	0.401	0.375	0.301	0.407	0.359	0.294
Clustering Coefficient	0.298	0.189	0.307	0.317	0.293	0.269
Average Distance	2.429	2.963	2.776	2.184	2.277	2.375
Average In Degree	5.200	3.011	4.356	7.478	5.022	5.522
Average Out Degree	5.200	3.011	4.356	7.478	5.022	5.522
Average Total	10.400	6.022	8.533	14.760	10.044	10.865

	Wave 1.1	Wave 1.2	Wave 2	Wave 3
Average Value on Communication Question	2.080	2.064	1.840	2.078
Average Value on Relationship Question	2.005	1.860	1.101	1.195

5. Centrality Analysis

5.1 Most central actors in each wave

Tables 7 and 8 below show the ten most central (in-degree centrality) actors in each wave in the full/aggregated network and the core/aggregated network, respectively. The most central actors hold relatively constant over time. They mostly consist of stakeholders from the Donors and Cooperants, Government Direct, and Divers and Crew sectors. PescaGlo/LangoHon has a central position in the network as the primary convener of the process. DIGEPESC is important as the fisheries agency. We urge you to [ask Jimmy Andino and other people with field experience](#) to provide more insight on the specific roles of these individual actors. This will be important for your full report, as well as helping our team develop a better substantive understanding of full range of stakeholders.

Table 7. Most central actors in each wave in the full/aggregated network.

WAVE 1				WAVE 2				WAVE 3			
Rank	Organization	Value	Links	Rank	Organization	Value	Links	Rank	Organization	Value	Links
1	DIGEPESC	0.278	35	1	DIGEPESC	0.218	26	1	DIGEPESC	0.225	27
2	PecaGlo/LangoHon	0.206	26	2	PecaGlo/LangoHon	0.21	25	2	PecaGlo/LangoHon	0.217	26
3	AMHBLI	0.198	25	3	APBGADH	0.134	16	3	ICF	0.183	22
4	Naval	0.198	25	4	SAG	0.126	15	4	Naval	0.167	20
5	SAG	0.198	25	5	AMHBLI	0.118	14	5	USAIDHon	0.167	20
6	APBGADH	0.19	24	6	ICF	0.118	14	6	FunCAYO	0.15	18
7	MarMerca	0.175	22	7	BancAtla	0.109	13	7	SERNA	0.15	18
8	DIBIO	0.159	20	8	Naval	0.109	13	8	AMHBLI	0.142	17
9	WWF	0.159	20	9	MarMerca	0.101	12	9	BancAtla	0.142	17
10	Apesca	0.151	19	10	AlcalPLem	0.084	10	10	CME	0.142	17

Table 8. Most central actors in each wave in the combined core/aggregated network.

WAVE 1				WAVE 2				WAVE 3			
Rank	Organization	Value	Links	Rank	Organization	Value	Links	Rank	Organization	Value	Links
1	DIGEPESC	0.356	32	1	DIGEPESC	0.27	24	1	PescaGlo/LangoHon	0.244	22
2	Naval	0.267	24	2	PescaGlo/LangoHon	0.27	24	2	DIGEPESC	0.2	18
3	SAG	0.267	24	3	APBGADH	0.157	14	3	ICF	0.178	16
4	PescaGlo/LangoHon	0.256	23	4	AMHBLI	0.146	13	4	Naval	0.178	16
5	AMHBLI	0.244	22	5	ICF	0.146	13	5	AMHBLI	0.167	15
6	MarMerca	0.244	22	6	SAG	0.146	13	6	USAIDHon	0.156	14
7	APBGADH	0.233	21	7	BancAtla	0.135	12	7	APBGADH	0.144	13
8	Apesca	0.222	20	8	Naval	0.124	11	8	BancAtla	0.144	13
9	DIBIO	0.211	19	9	AlcalPLem	0.112	10	9	ApesGDio	0.133	12
10	TNC	0.2	18	10	Dakni	0.112	10	10	Asesor	0.133	12

5.2 In-degree Centrality by Sector

Figure 9 shows how the average in-degree centrality for each sector changes across the three waves of data collection. In Wave 1, the two sectors with the highest average centrality scores are clearly the Divers and Crew sector and the Government Direct sector. Wave 2 shows basically the same pattern, with reduced centrality across the board. Interestingly, in Wave 3, the Divers and Crew and Government Direct sectors remain the most central, but overall the scores for each sector are more even, with the low-centrality groups showing increased centrality. This pattern is consistent with the reduced tendency to form subgroups, with some of the underrepresented sectors forming more bridging ties over time.

Figure 10 shows the change in average in-degree centrality by sector over time. While it is hard to see any specific dramatic trend, especially because Wave 2 has lower centrality for everybody, the aspect of the graph to look at is how close the lines are together at each time. Consistent with Figure 6, in Waves 1 and 2, Government Direct and Divers and Crew are much higher than the other sectors. But by Wave 3, all of the groups are much closer together again suggesting a break down in the subgroup formation and hierarchical aspects of the network.

*Figure 9. Average In-degree centrality scores by sector for full/aggregate network

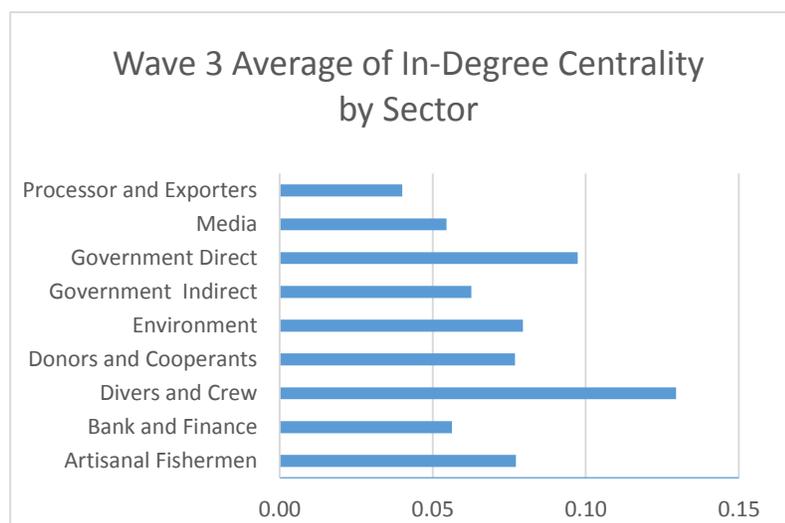
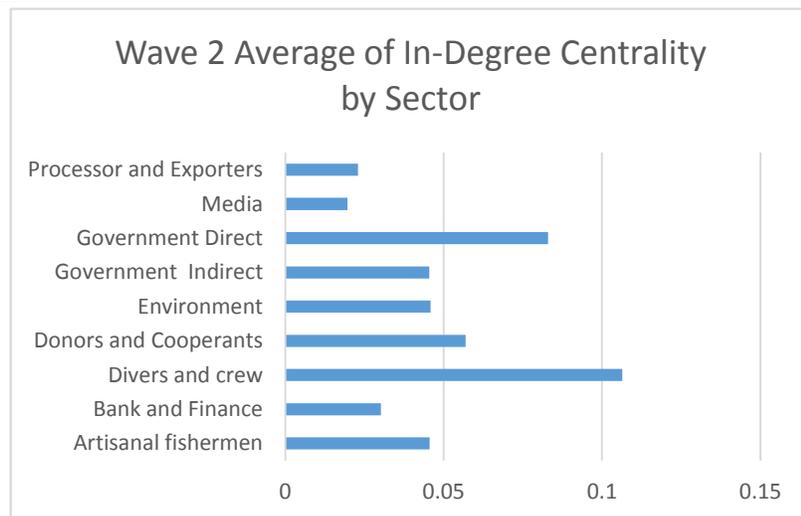
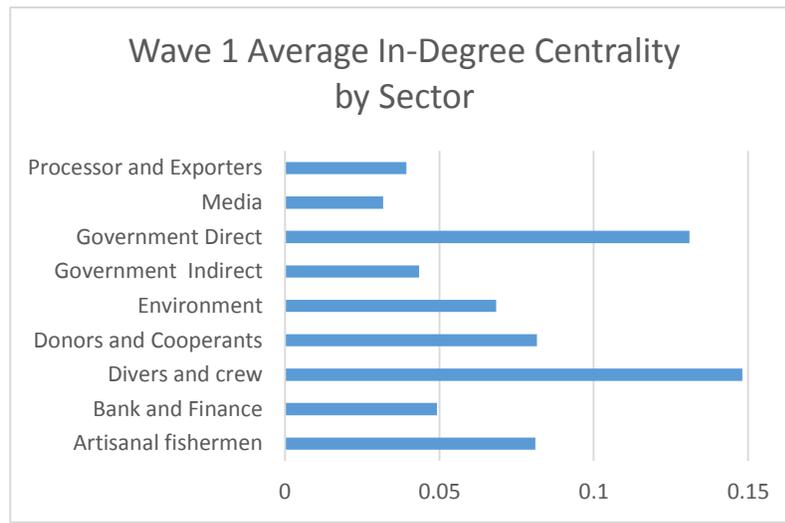
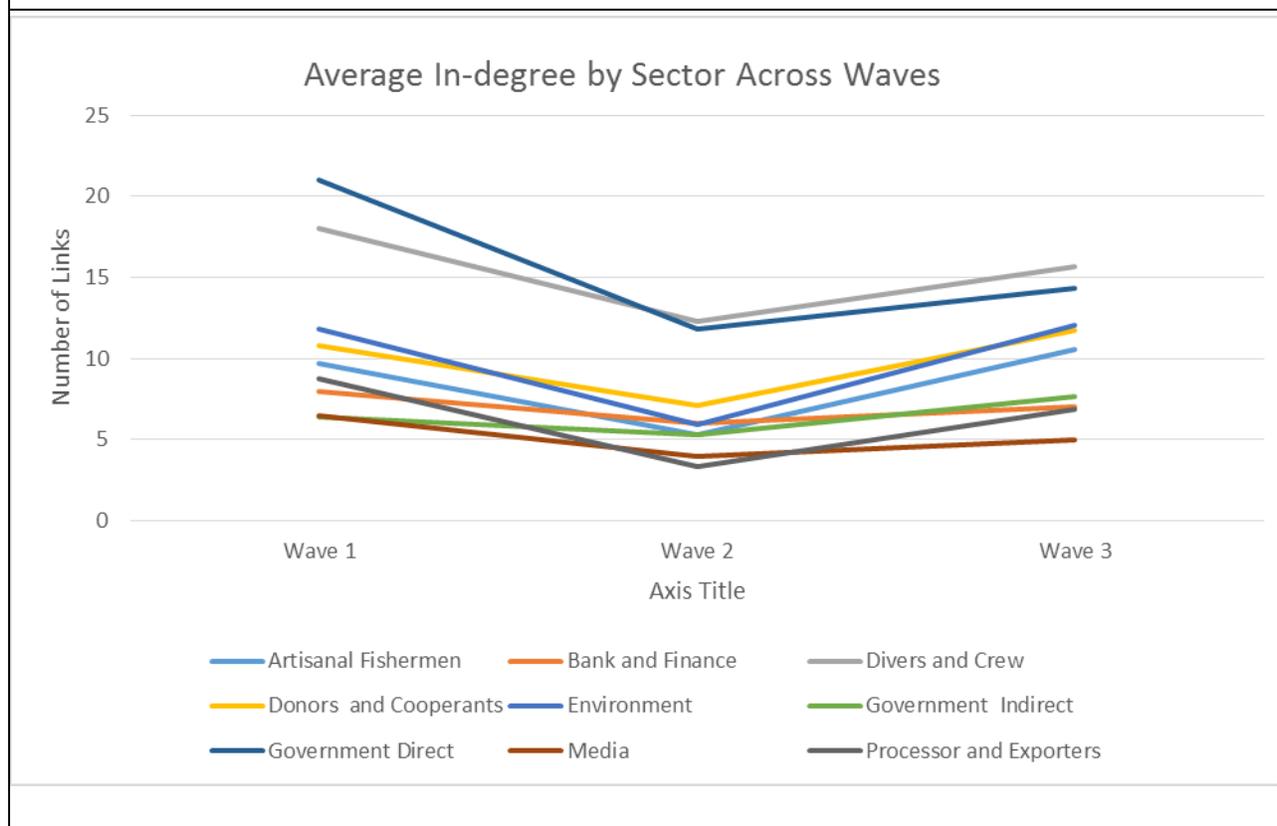


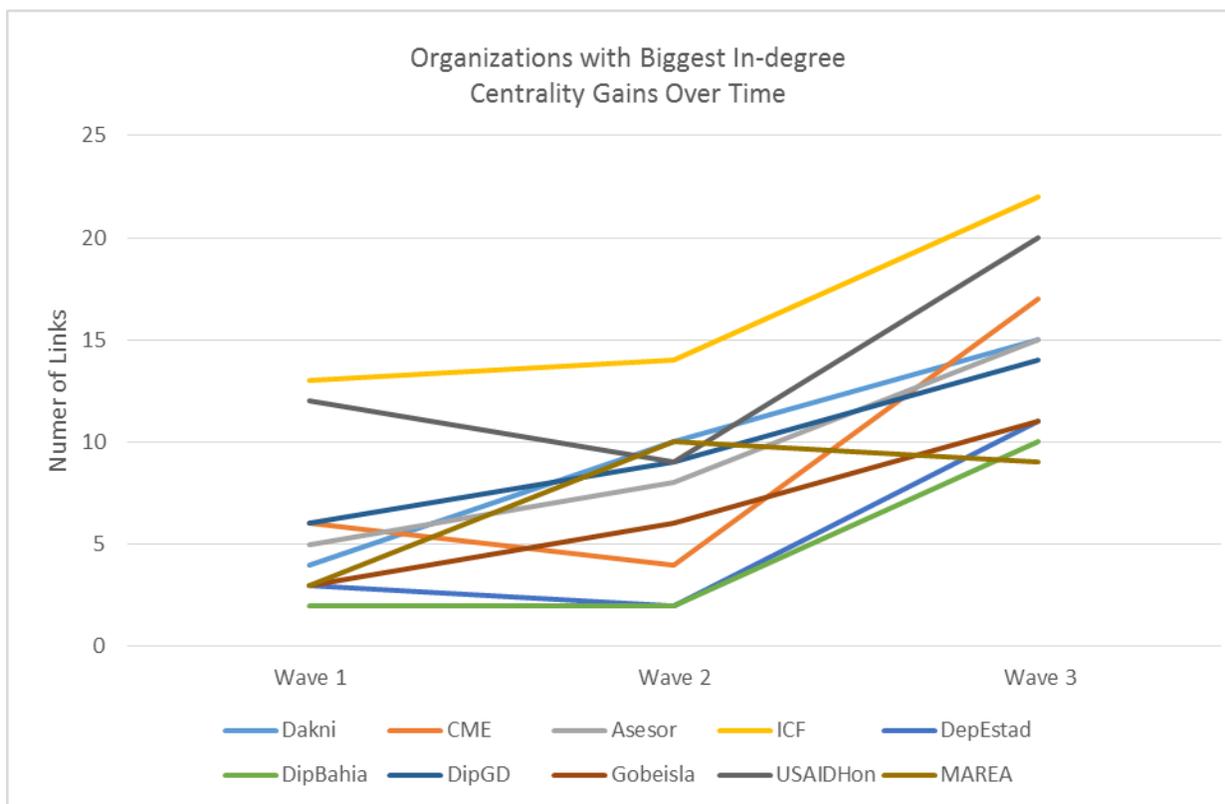
Figure 10. Change in average unscaled in-degree (number of links received) of organizations in each sector in the core/aggregate network.



5.3 In-degree Centrality Increase by Organization

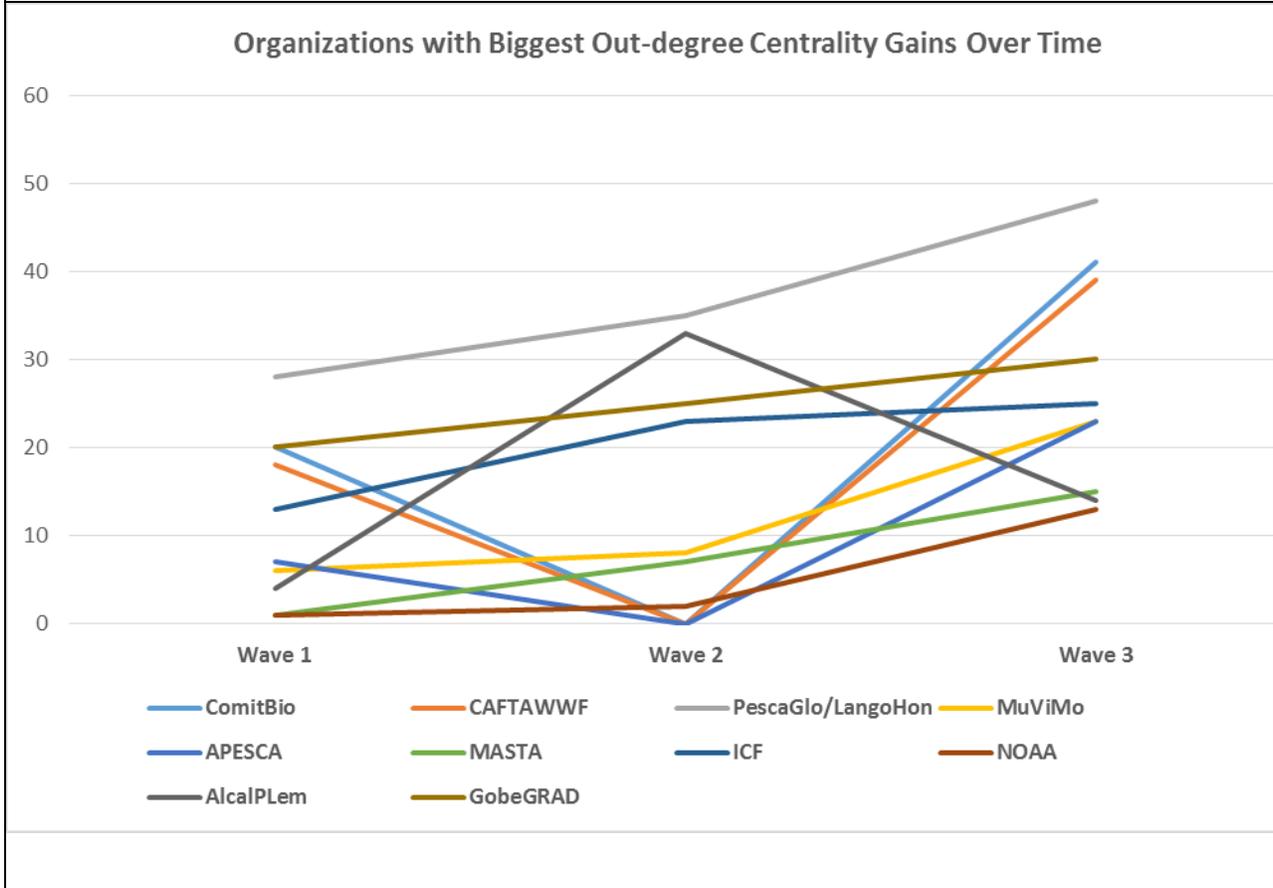
Figures 11 and 12 display the organizations with the biggest centrality gains over time, both for in-degree centrality (nominations received) and out-degree centrality (number of connections mentioned). We again urge you to consult Jimmy Andino and other field analysts to provide more substantive interpretation of the role of each of these individual organizations.

Figure 11. Organizations in the core/aggregate network with the most increase in in-degree centrality from the first to the third wave.



Legend	
Dakni	Dakni Tak Aslika (Organización de Organizaciones)
CME	Utila Center for Marine Ecology/Centro de Estudios Marinos (CME)
Asesor	Asesor AMHBLI - APBGAD
ICF	Instituto de Conservación Forestal / Departamento Áreas Protegidas
DepEstad	Departamento de Estado EEUA
DipBahia	Diputado de Islas de la Bahía
DipGD	Diputado de Gracias a Dios
Gobeisla	Gobernador Islas de la Bahía
USAIDHon	USAID Honduras
MAREA	Programa de Manejo de Recursos Acuáticos Y Alternativas Econ.

Figure 12. Organizations in the core/aggregate network with the most increase in out-degree centrality from the first to the third wave.



Legend	
ComitBio	Comité Interinstitucional de Biodiversidad
Apesca	Asociación de Pesca del Caribe
AlcalPlemp	Alcalde Municipal de Puerto Lempira
CAFTA WWF	USAID Proyecto CAFTA WWF
MASTA	Organización Miskito MASTA
GobeGRAD	Gobernacion de Gracias a Dios
PescaGlo/LangoHon	Spiny Lobster Initiative
Gobeisla	Gobernador Islas de la Bahia
USAIDHon	USAID Honduras
MAREA	Programa de Manejo de Recursos Acuaticos Y Alternativas Economicas

6. Core Periphery Analysis

Given the more even distribution of network relationship types across categories, one possible process that may be occurring is the decentralization of the network. In other words, network ties are becoming more evenly distributed across the network rather than concentrated on a few core actors. To test this possibility, we conducted a core-periphery analysis that calculates the correlation between the observed networks and an idealized network structure that fits a perfect core-periphery structure. A perfect core-periphery structure is a very highly centralized network where all social relationships occur between the core actors and the peripheral actors are left out. If the correlation between the actual observed network and the hypothetical perfect core-periphery structure is high, then the observed network is more centralized around a core group of actors. Table 9 shows a clear, across-the-board decline in the core-periphery structure of the network. This suggests the network is becoming less hierarchical over time.

<i>*Table 9: Correlations with Idealized Core-Periphery Structure</i>			
	Wave 1	Wave 2	Wave 3
Aggregated Network			
Full	.552	.507	.454
Core	.589	.511	.492
Respondent Core	.694	.504	.452
Communication Network			
Full	.499	.433	.422
Core	.523	.476	.445
Respondent Core	.483	.478	.478
Relationship Network			
Full	.547	.496	.400
Core	.572	.496	.476
Respondent Core	.720	.441	.378

7. Silo Analysis and Bridging Social Capital

Fragmentation across subgroups and stakeholder types is one of the most frequent criticisms of local environmental policies. When stakeholders only maintain relationships within their own subgroups or “silos”, they are more likely to form competing factions who distrust one another and fight over resources rather than find ways to cooperate for future benefits. A major goal of collaborative policy is to build social relationships that cross subgroup boundaries, which has been called “bridging” social capital in contrast to the “bonding” social capital that keeps subgroups inwardly cohesive.

To analyze the incidence of external and internal ties, we calculated the E/I index for each subgroup, which measures the ratio of internal to external ties. The E/I index measures the degree to which different sectors are siloed off and isolated from the others. An E/I index score of -1 for a sector indicates that the organizations within that sector have links only to organizations outside that sector. Conversely, an E/I index score of positive 1 indicates that organizations within that sector are only connected to organizations within the sector. The formula for the index is, where I=internal ties and E=external ties:

$$SI_d = \frac{(I - E)}{(E + I)}$$

Table 10 displays the results of the analysis, which focuses on the full/aggregate networks. Four sectors—Media, Processors/Exporters, Environment, and Government Direct show an increasing externalization of their contacts. This suggests that these sectors are the ones most responsible for the breaking down of the subgroups. The Donors and Cooperants sector remains essentially unchanged, while the Government Indirect and Artisan Fishermen sectors show some increasing internalization of their ties. However, the Bank/Finance and Media sectors have very few observations so it is difficult to make a strong statement about their changing relationships. One way to interpret an increase in internal ties is better within-sector cohesion. For example, there are many indirect government actors involved in the SLI who previously were not communicating very well despite engaging in relevant policy activities. Hence some increased cohesiveness among these actors could be beneficial. A similar point could be made for artisanal fishermen, who may have become better organized among themselves in order to provide a more unified voice for disadvantaged communities within the SLI process.

Figures 13-15 provides a visualization of the connection between each of the different sectors, where thicker lines represent more intense connections between sectors. Although it is not easy to see visually, the thick lines are concentrated among a smaller set of sectors in Wave 1, for example between divers/crew and government direct. As more relationships build across sectors, the concentration of relationships is spread among more of the sectors. In Wave 2 for example, both Government Indirect and Artisan Fishermen have stronger relationships with Government Direct and with Divers and Crew. By Wave 3, the distribution of cross-sectoral relationships appears much more evenly distributed. Again, all of this is consistent with the distribution of ties in the network becoming less fragmented, less confined to subgroups, and less hierarchical. Instead, the network is undergoing a redistribution of collaborative relationships to form more bridging social capital and flatter, more egalitarian structure.

<i>Table 10. E/I Index scores for full/aggregate networks</i>				
	Wave 1	Wave 2	Wave 3	Trend
Bank and Finance	-0.805	-0.719	-1	Small N
Media	-0.81	-0.941	-1	Small N
Processor and Exporters	-0.606	-0.63	-0.709	More external
Environment	-0.721	-0.729	-0.798	More external
Government Direct	-0.864	-0.928	-0.916	More external
Divers and Crew	-0.876	-0.897	-0.909	More external
Donors and Cooperants	-0.681	-0.721	-0.664	Unclear
Government Indirect	-0.687	-0.523	-0.601	More internal
Artisanal fishermen	-0.917	-0.888	-0.792	More internal

Figure 13. Wave 1 full/aggregate network diagram of sector-level connections

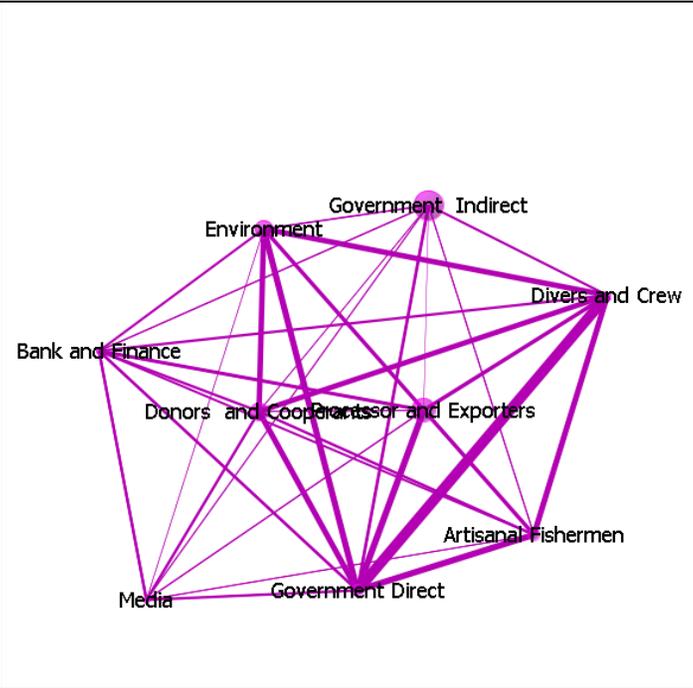


Figure 14. Wave 2 full/aggregate network diagram of sector-level connections

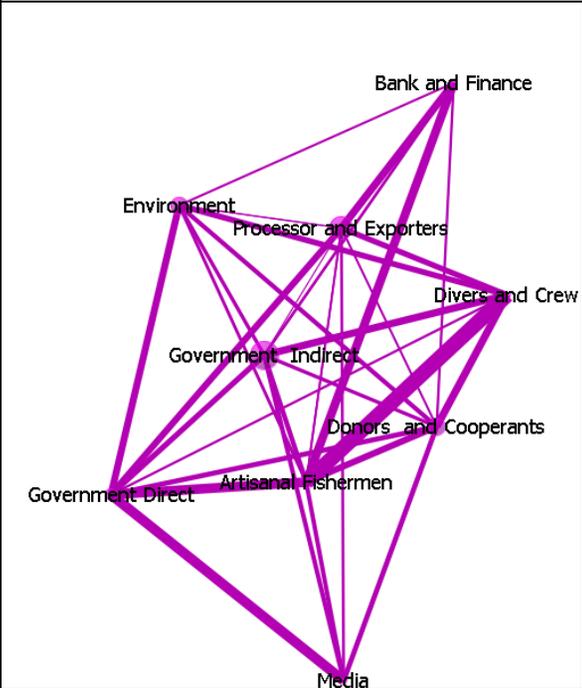
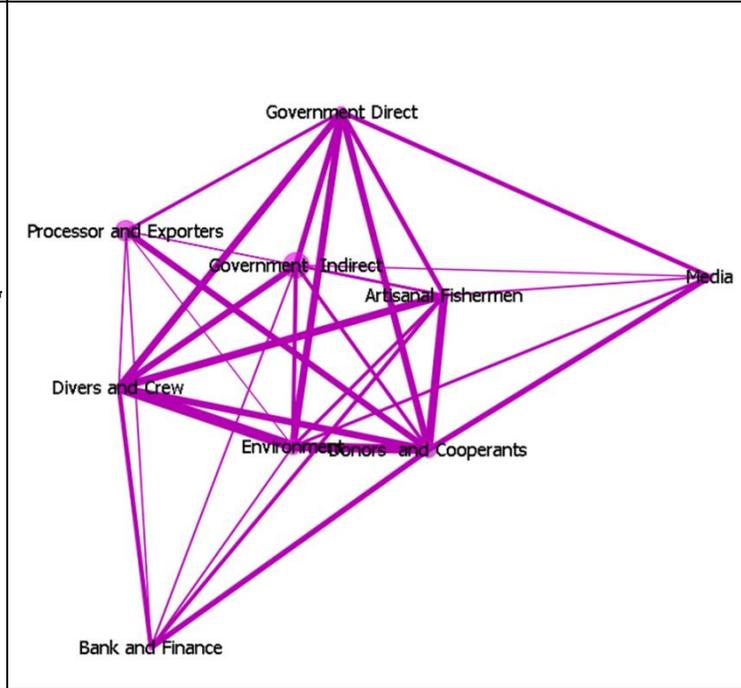


Figure 15. Wave 3 full/aggregate network diagram of sector-level connections

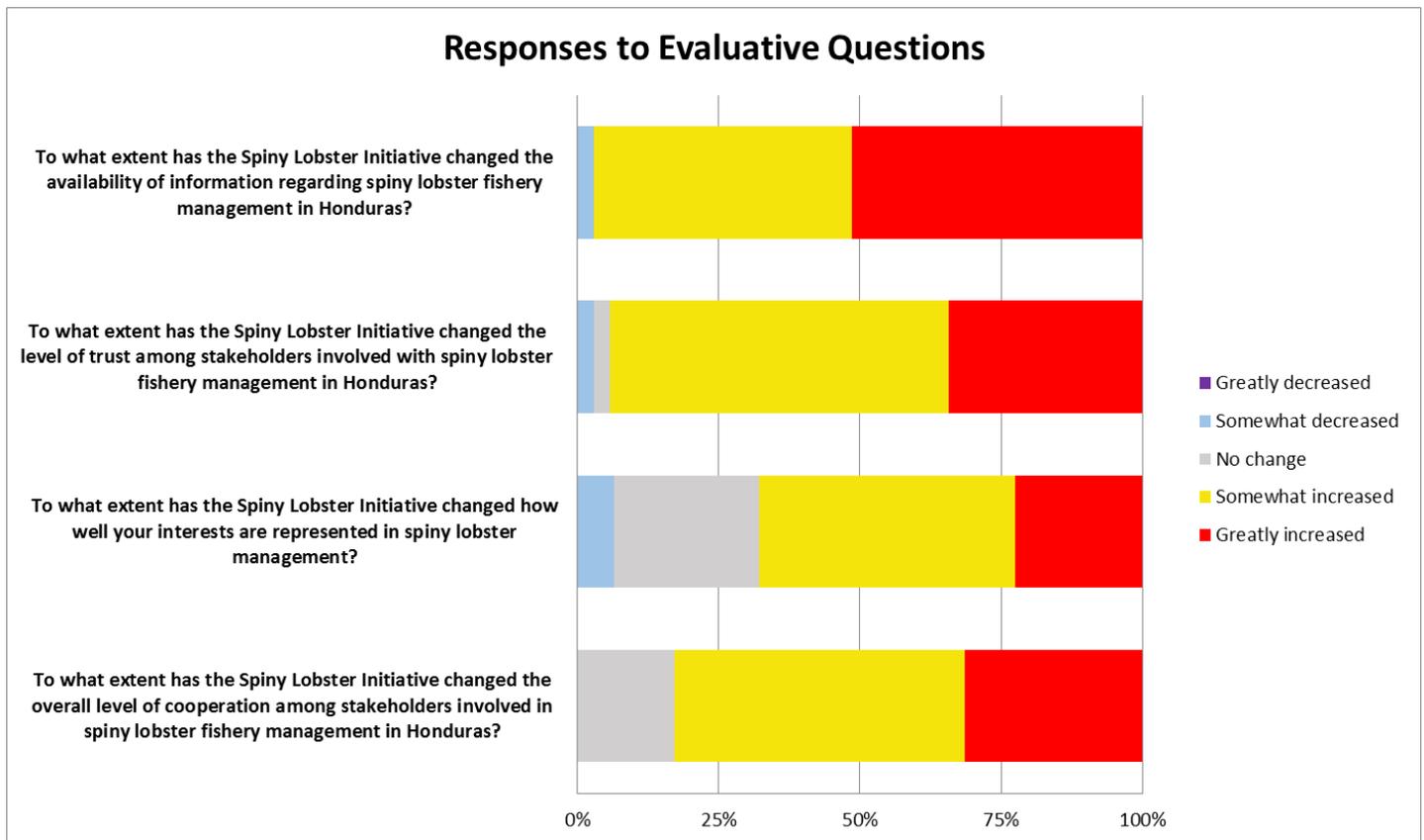


8. Qualitative Survey Results

8.1 Spiny Lobster Initiative Evaluative Questions

Figure 16 shows responses to questions evaluating the effectiveness of the Spiny Lobster Initiative along several dimensions. Participants responded very positively to these items, with availability of information being the thing most affected by the initiative. The least positive response was on the extent to which the stakeholders felt their own interests had been represented, but the average response on this item was still positive. In general, these questions suggest that the observed changes in the network are correlated with positive changes in short-term attitudes. It is fair to call these “process” changes more than outcomes or outputs. Note that we did check to see if these results varied across sectors, and found no meaningful differences. This is partly because some sectors were represented by very few respondents.

Figure 16. Breakdown of responses to evaluative questions



8.2 Common Ground Goals Evaluative Questions

The survey asked respondents to evaluate how well a range of goals have been achieved, where the goals were developed by the SLI planning process. On average, respondents indicated that the 11 Common Ground Goals have been achieved to a moderate degree. Figure 17 shows that the average responses all fall into the range of 2.0-2.61 out of 5. The highest goal achievement was for awareness and education, while the lowest was for market expansion. Many of these are the more long-term goals of the SLI rather than the shorter-term process goals in the above section. It will take longer and more sustained cooperation among SLI stakeholder to achieve these goals. Unfortunately, while the network has shown some increased capacity for cross-stakeholder interaction, we cannot definitely say how long such interaction will continue once the SLI funding disappears. There is no magic bullet to solve this “exit strategy” problem that faces all development projects. It could be that the cross-stakeholder bridging social capital will endure when funding goes away. But another possibility is that the previous patterns of fragmentation and conflict will reappear. The SLI has moved things in a positive direction, but it is hard to know whether the direction will be self-sustaining once SLI’s foot is off the gas pedal.

Figure 17. Average response scores for questions evaluating the degree to which the Common Ground Goals have been achieved.

