Summary Statistics from the 2014 Oil Spill Science Social Network Analysis

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Background

In 2014, the Gulf of Mexico Research Initiative, which is administered through the Gulf of Mexico Alliance, supported a new oil spill outreach program that the four Sea Grant College Programs based in the Gulf of Mexico are administering. The purpose of the program is to increase the use of oil spill science by people whose livelihoods depend on a healthy Gulf. An initial phase of this new outreach effort is to understand the current network and flow of oil spill science information among the people the Sea Grant programs serve.

Social network analysis (SNA) is a tool for evaluating relationships and connectivity. Typically through a survey of respondents, the SNA maps the relationships among people to show how information flows and illustrate which people within a network are essential to network's connectivity and information flow. In addition, the SNA reveals important attributes of the network, such as insights into who the leaders and connectors are, clusters of connectivity, who is on the periphery or isolated and who is unconnected from the network entirely. The purpose conducting an SNA was to understand how credible, relevant and timely oil spill science information flowed through a network of people from specific target groups in the Gulf of Mexico, which included:

- Commercial fishers
- Recreational fishers
- For-Hire fishers
- Elected officials
- Emergency responders
- Environmental non-profit staff members
- GoMRI outreach specialists
- Ports and harbors employees
- Public health officials
- Natural resource managers
- Sea Grant outreach specialists
- Tourism specialists
- University scientists

This study offers an understanding of the extent of communication across Gulf of Mexico states, and across professions as it relates to the efforts of GoMRI.

Methods

The primary purpose of the 2014 Oil Spill Science Social Network Analysis was to identify the degree to which individuals from specific target groups received oil spill information over a 12-month period, from whom they received information, and what online resources they used to gather oil spill science information. Additional questions focused on 1) identifying organizations that respondents believed provided credible, relevant and timely oil spill science-related information and 2) oil spill science topics respondents were interested in.

Three rounds of invitations were sent to potential respondents. GoMRI and the four Sea Grant college programs that border the Gulf of Mexico identified the contacts for round one. Each Sea Grant program provided contacts for its state, and a GoMRI communications leader provided a list of GoMRI outreach contacts. The first round included approximately four people from each Gulf of Mexico state in each of the target groups.

The survey was administered in three rounds. When the first round of the survey closed, many of the people who completed the survey had identified one or more individuals that gave them credible, relevant and timely oil spill science-related information. The individuals named in the survey responses were contacted in round two (if they were not previously contacted in round one). This process was repeated another time so that round-three contacts were people who were named by survey respondents in round two but not contacted in rounds one or two. Round one of the survey was released on May 6, 2014, and round three closed on June 20, 2014.

Response Statistics

The response rate for each round is included in Table 1. The response rates ranged from 41.7 percent to 62.4 percent, which is quite high for an online survey.

Table 1. Response rates for each of the three survey rounds administered for the 2014 Oil Spill Science Social Network Analysis survey.

Round	Number contacted	Number responded*	Response rate
Round 1	333	139	41.7%
Round 2	85	53	62.4%
Round 3	56	30	53.6%
Total	**474**	**222**	**46.8%**

*Number responded is indicated if the person completed at least a portion of the survey.

Most of the 222 people that completed the survey could be categorized by target group and the state they primarily worked. Eight of the 13 target groups had a dozen or more responses with the most responses from people associated with universities (Table 2). The Gulf of Mexico states were evenly represented with a range from 21 respondents indicating Mississippi as their primary location of work to 31 people noting Florida as their primary location of work. Several people skipped this question or noted that they worked in more than one of the states, which partially explains the high number in the “did not answer or not in Gulf” category.

Table 2. Summary of respondents by target group and state of primary work.

Target Group	State of Primary Work					Did not answer or not in Gulf*	Total
	AL	FL	LA	MS	TX		
University	7	9	7	5	7	23	**58**
Sea Grant outreach	0	3	6	8	3	6	**26**
Resource management	4	1	1	1	3	10	**20**
Environmental non-profit	3	3	2	0	2	9	**19**
Emergency response	2	2	3	1	2	8	**18**
GoMRI outreach	0	3	3	3	2	7	**18**
Commercial fishing	2	2	1	0	1	7	**13**
For-Hire fishing	2	1	2	1	1	5	**12**
Recreational fishing	0	1	1	0	1	4	**7**
Tourism	3	2	1	1	0	2	**9**
Public health	1	2	0	1	0	2	**6**
Elected official	3	0	0	0	0	2	**5**
Ports and harbors	1	0	2	0	0	0	**3**
Other	0	2	0	0	0	6	**8**
Total	**28**	**31**	**29**	**21**	**22**	**91**	**222**

*Some people indicated their target group but did not indicate the state they primarily worked in.

Social Network Analysis Sociogram Interpretation and Results

The visual output of a SNA is called a sociogram. Nodes (circles) and ties (lines) are the main features. Nodes represent people, and ties show relationships between them. For the data displayed in this report, generally speaking, the larger a node's size, the more important the person is to the network; more distant nodes indicate people that are less connected.

The following sociogram depicts 227 "active" nodes (i.e., nodes that have at least one connection/tie to another). There are 270 ties among the nodes within this network. Each node represents a unique individual (actor) that either 1) responded to the survey, or 2) was identified by a survey respondent as someone who provides credible, relevant and timely oil spill science information. It is easy to observe a central core network of communication, several branches extending from the central core, and a small number of subgroups that are disconnected from the greater network (Figure 1). Additionally, nodes are colored according to a respondent's self-reported state affiliation. There are a number of gray nodes. These individuals did not indicate their state affiliation. However, based on anecdotal information, it is speculated that many of these individuals have a multi-state/regional focus and were unable to identify a single state in which they serve. In general, there are observable pockets of state communication (indicated by the close positioning of groups of similarly colored nodes).

However, there is a moderate degree of color distribution, as well, which indicates a certain level of communication taking place across Gulf States.

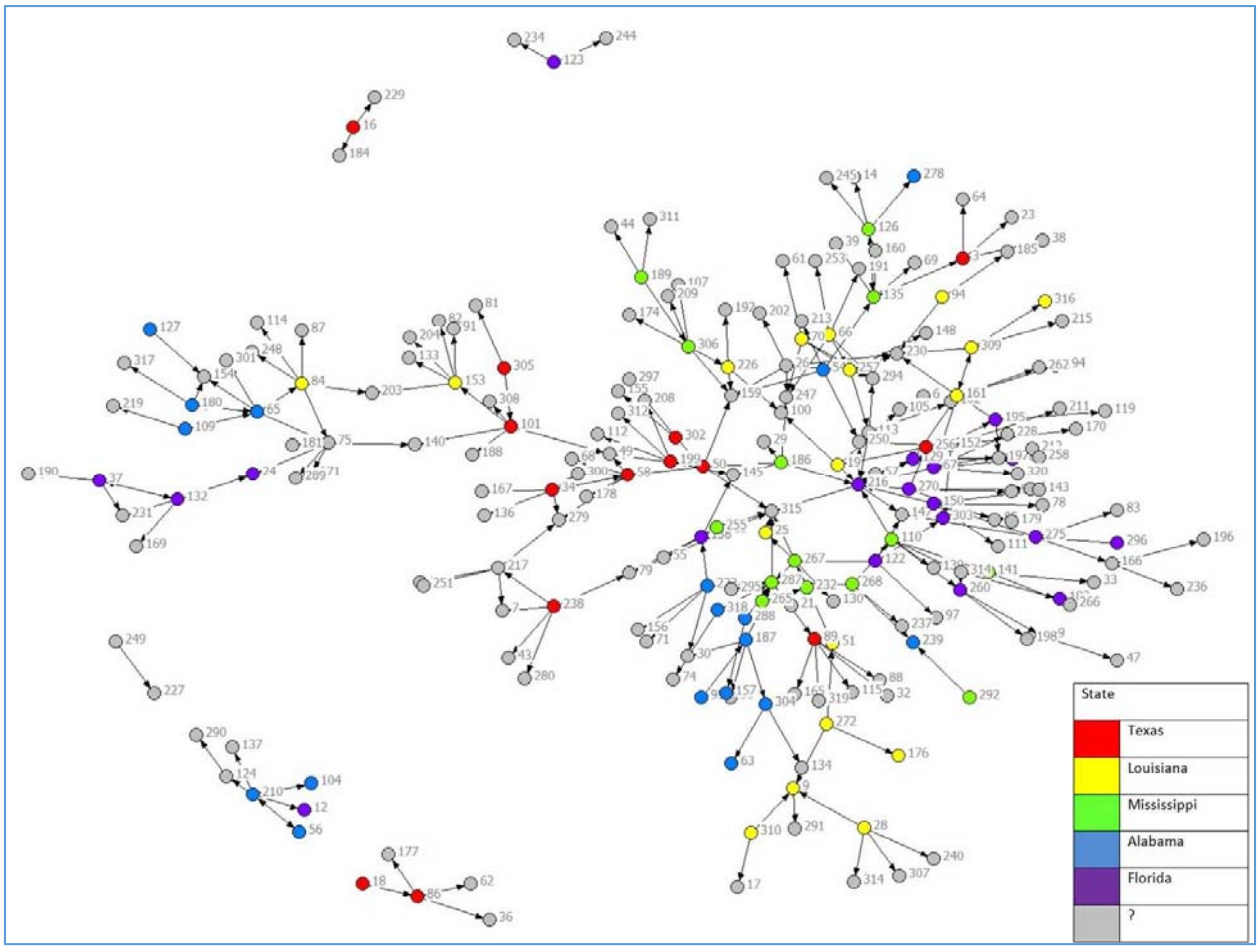

Figure 1. Sociogram depicting linkages between people who provide credible, relevant and timely oil spill science information (based on survey data) and associated state affiliation (node color).

Social network analysis uses various measures of centrality to identify the most important people within a network. Arguably the simplest centrality measure, though quite informative, is degree centrality. Degree centrality is the number of links to a node, or put simply the number of connections a person possesses. In the case of a directed network, where ties have direction, two separate measures of degree centrality are usually defined: indegree and outdegree. Indegree is a count of the number of ties directed ***to*** the node whereas outdegree is the number of ties leaving a node. Indegree centrality is often interpreted as a form of popularity. Figure 2 displays each person's relative indegree score by node size. The larger the node, the higher the respective indegree score (the more incoming ties one possesses). Survey respondents more frequently identified the larger nodes as individuals that provide credible, reliable and timely oil spill science information.

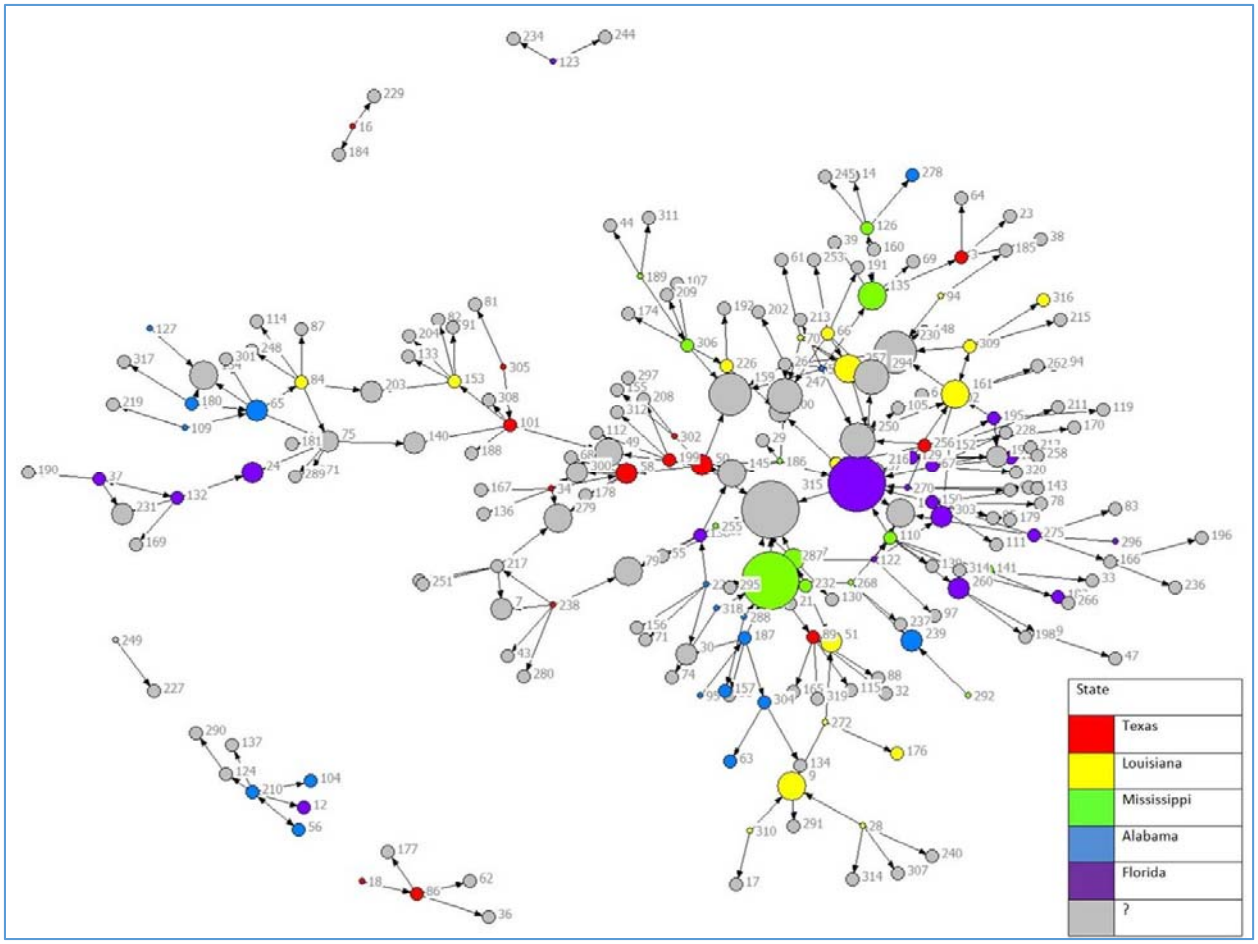

Figure 2. Sociogram depicting the indegree centrality (node size) of people who provide credible, relevant and timely oil spill science information, and associated state affiliation (node color).

Another type of centrality is betweenness centrality, which quantifies the number of times a node acts as a bridge along the shortest path between two other nodes. The people that serve as primary connectors (bridges) of information within the network and are critical in developing effective communications strategies. Nodes 101 and 112 that are circled in Figure 3, highlight the importance of those possessing high betweenness centrality. The respective sizes of these nodes are much greater based on betweenness centrality than indegree centrality. While the nodes do not possess high numbers of ties, they are in a critical position within the network to bridge communication from one side of the network to the other.

Defining SNA Terms
Indegree centrality: number of ties directed to the node (popularity)
Betweenness centrality: number of times a node acts as a bridge along the shortest path between two other nodes (primary connector for the network)

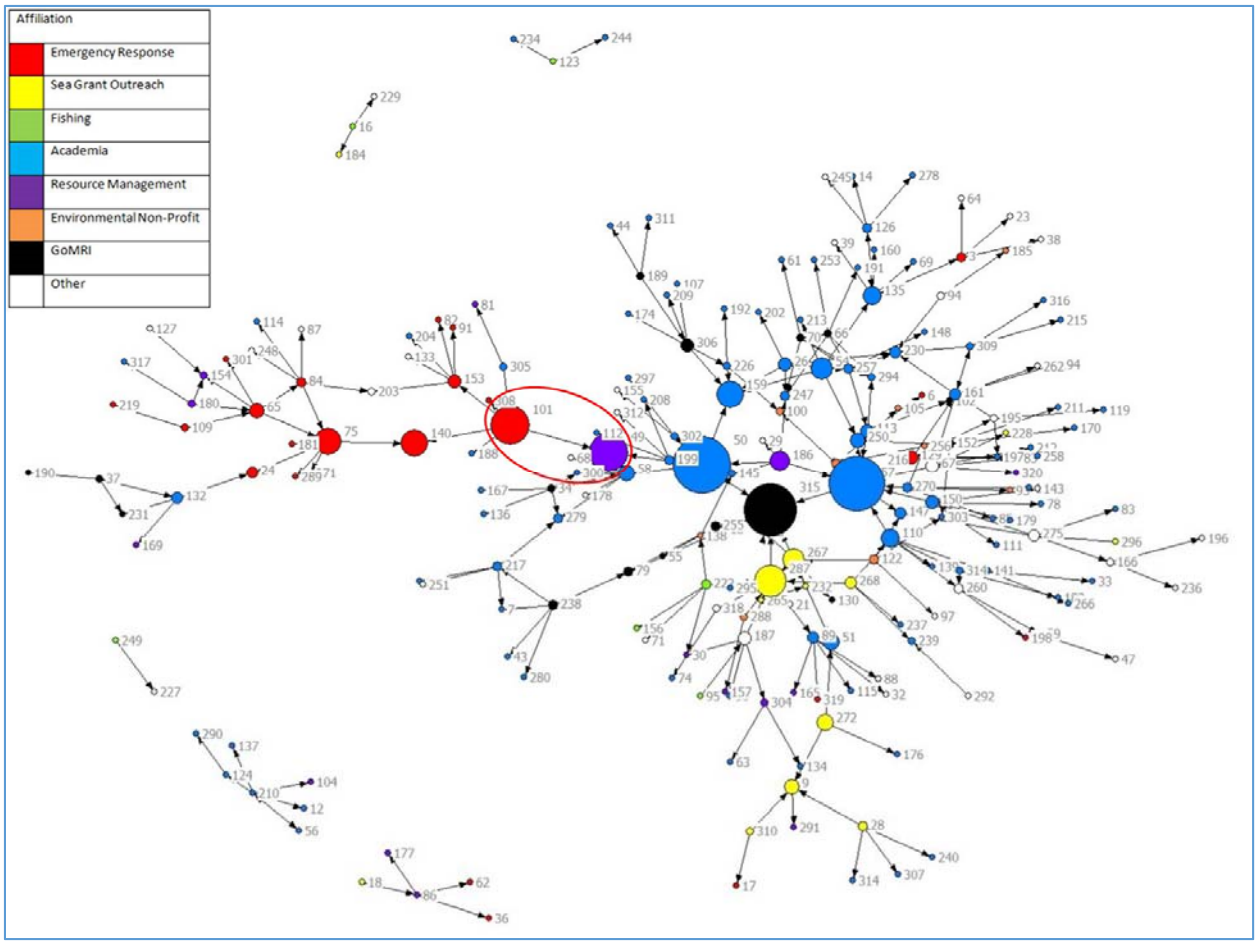

Figure 3. Sociogram depicting the betweenness centrality (node size) of people that provide credible, relevant and timely oil spill science information, and associated professional affiliation (node color).

Additional sociograms of the same SNA were developed based on people's affiliation to GoMRI. They include sociograms on indegree centrality and betweenness centrality and are included in Appendix I.

Other Survey Results

Most survey respondents (219 out of 222) indicated whether they did or did not receive oil spill information in the past 12 months, and the majority indicated that they had (79.9 percent). Sixty-percent or more of the respondents in 10 of the 13 target groups indicated they received oil spill information in the last 12 months (Table 3). People associated with GoMRI, universities and emergency response had the top three highest percentages.

Table 3. Number of people by target group that indicated if they received oil spill information in the past 12 months and percentage that indicated they did.

Target group	N	Received oil spill information in last 12 months?		Percent indicated "yes"
		Yes	No	
University	57	52	5	91.2%
Sea Grant outreach	26	20	6	76.9%
Resource Management	20	15	5	75.0%
Environmental Non-profit	19	15	4	78.9%
Emergency Response	17	15	2	88.2%
GoMRI outreach	18	18	0	100.0%
Commercial Fishing	13	9	4	69.2%
For-Hire Fishing	12	5	7	41.7%
Recreational Fishing	6	3	3	50.0%
Tourism	9	6	3	66.7%
Public Health	6	5	1	83.3%
Elected Official	5	3	2	60.0%
Ports and Harbors	3	1	2	33.3%
Other	8	8	0	100.0%
Total	**219**	**175**	**44**	**79.9%**

People were asked how frequently they used certain oil spill-related websites. The number of responses for each website question ranged from 136 to 139. The most frequently visited websites were GoMRI, NOAA Gulf restoration and the NOAA Gulf Science Program websites, based on the input from those who answered the question (Figure 4).

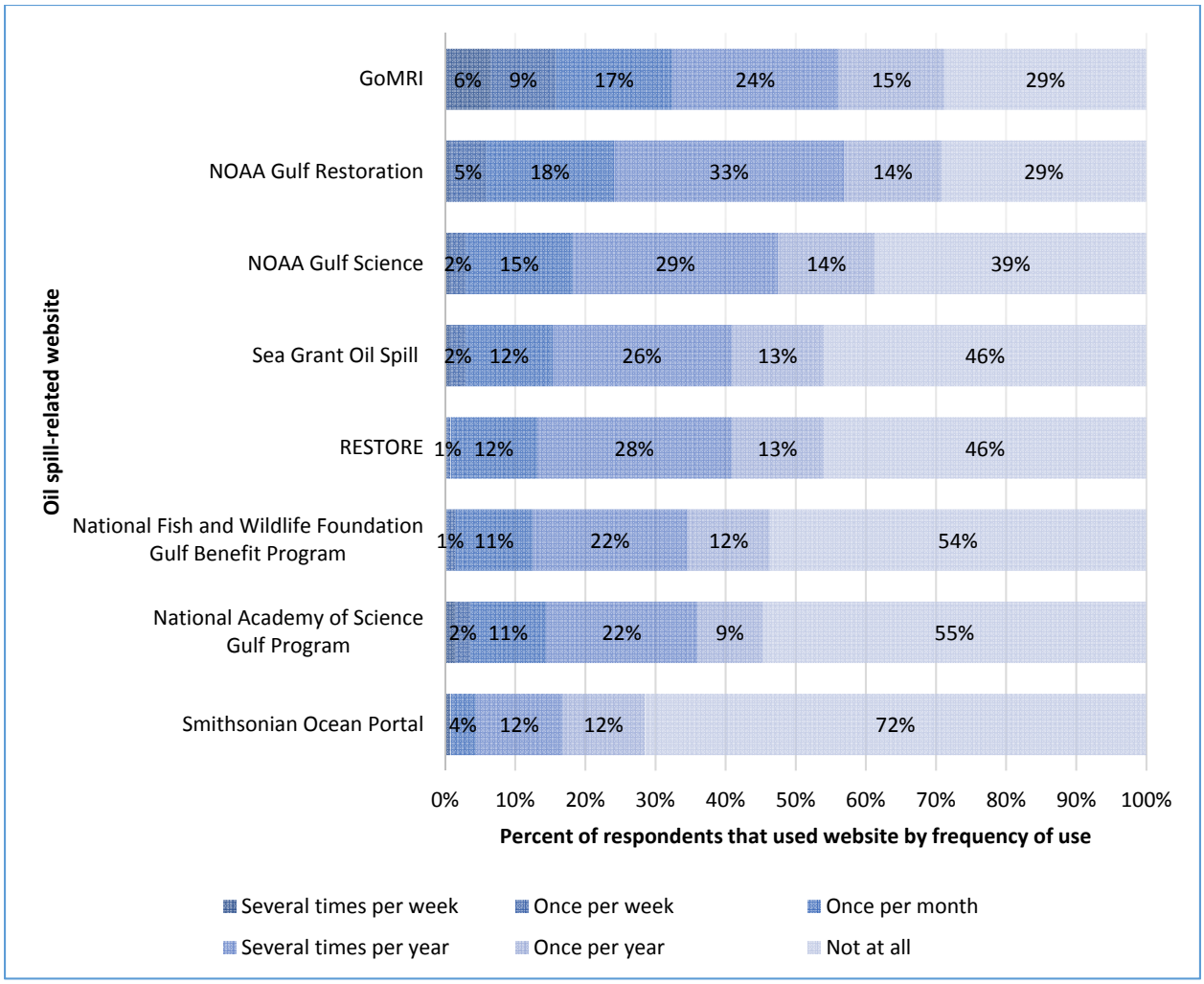

Figure 4. Frequency that survey respondents visited a select group of oil spill-related websites.

Survey respondents were asked to identify up to five organizations that they believe provide credible, relevant and timely oil spill science-related information. Table 4 displays the organizations with the most mentions and number of people from each target group that identified that organization. NOAA was most frequently cited, followed by universities and Sea Grant. GoMRI was mentioned 24 times, and GoMRI affiliates, which were GoMRI consortia, were mentioned seven times.

Finally, there was an open-ended survey question that asked respondents to identify up to three oil spill science topics they wanted to learn more about. Ninety of the 222 (40.5%) respondents identified one or more topics, and a total of 233 topics were identified. The top three broad topics most frequently mentioned were ecological topics followed by dispersants and fate and transport of oil (Table 5).

Table 4. Number of times target groups identified different organizations as providing credible, relevant and timely oil-spill science information.

Target group	Number of Times the Organization was Identified by Target group									Total
	NOAA	Other federal agency*	Univ.	Sea Grant	GoMRI	State agency	NGO	GoMRI affiliate	Others	
University	18	13	9	6	8	5	2	3	15	**79**
Sea Grant outreach	12	4	6	12	7	3		1	1	**46**
Emergency response	7	4	2			3			7	**23**
Environmental non-profit	3	5	2	1	1		2		5	**19**
GoMRI	3			2	5		1	3	4	**18**
Resource management	3	1	2		2	2	1		2	**13**
Tourism	2		4	2		1	2		1	**12**
Commercial fishing	2	2		2		1			4	**11**
Public health	2	2	1	1	1				1	**8**
Elected official		3					1		1	**5**
Recreational fishing	1		1	2		1				**5**
For Hire fishing		1				1				**2**
Ports and harbors							1		1	**2**
Other	1		2	1			1		1	**6**
Total	**54**	**35**	**29**	**29**	**24**	**17**	**11**	**7**	**43**	**249**

*Other federal agencies included U.S. Environmental Protection Agency (9 times), U.S. Coast Guard (8 times), U.S. Geological Survey (4 times), and U.S. Food and Drug Administration (4 times) and other federal agencies.

Table 5. Number of times a broad oil-spill science topic was mentioned by survey respondents arranged by target group.

Target group	Broad Oil Spill Science Topic Mentioned by Respondents							Total
	Ecological	Dispersants	Fate and transport	Human health	Spill response	Oil industry-related	Other	
University	19	11	16	3	2	2	12	**65**
Sea Grant outreach	9	7	4	6	1	1	6	**34**
GoMRI	3	6	9	1	0	1	4	**24**
Environmental Non-profit	8	4	2	0	2	1	3	**20**
Emergency Response	6	3	6	1	2	0	1	**19**
Resource Management	8	3	3	0	1	0	2	**17**
Tourism	7	2	0	0	0	2	1	**12**
Public Health	3	2	1	3	0	0	1	**10**
Elected Official	6	1	0	0	0	0	1	**8**
Commercial Fishing	4	3	1	0	0	0	0	**8**
Recreational Fishing	0	0	0	0	0	2	2	**4**
For-Hire Fishing	2	0	0	1	0	0	0	**3**
Other	1	4	1	0	1	0	2	**9**
Total	**76**	**46**	**43**	**15**	**9**	**9**	**35**	**233**

Conclusions

The SNA revealed that there is a large network of individuals that share credible, relevant and timely oil spill science information. This network includes some key members that serve as primary sources for this information and/or link disparate parts of the network together. There appears to be good communication across states, and individuals appear to seek information from others within their defined target group. Response rates were relatively low for some target groups. This could be due to previous lack of engagement between the target group members and the people who administered this survey or a lack of interest in oil spill science information. More work will be needed to engage with these groups.

People who completed the survey appear to seek credible, relevant and timely oil spill science information mostly from federal based agencies (especially NOAA) and from universities and Sea Grant. This indicates that these groups may be most trusted for this information and may be the best conduits to share emerging science results. Respondents also were most interested in ecological impacts, dispersant information, and the fate and transport of oil and dispersants. Addressing these topics should be an initial focus of the Sea Grant oil spill outreach program.

In 2016, a second SNA survey will be administered and will include all people that were contacted in this SNA. The second SNA survey will help illustrate how the network has changed over time. It may also reveal if people are still seeking oil spill science information, what resources they use to find information and if there are still oil spill science topics that they are interested in learning more about.

Acknowledgements

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Appendix I: Sociograms Based on GoMRI Affiliation

The following sociograms are based on the same data shared in the body of the report, however people were identified based on how they were affiliated with GoMRI, if they were affiliated at all. GoMRI affiliates were divided into three categories, which were GoMRI-funded scientist, GoMRI consortia outreach leader or other GoMRI affiliate (e.g. data manager, program manager, administrator).

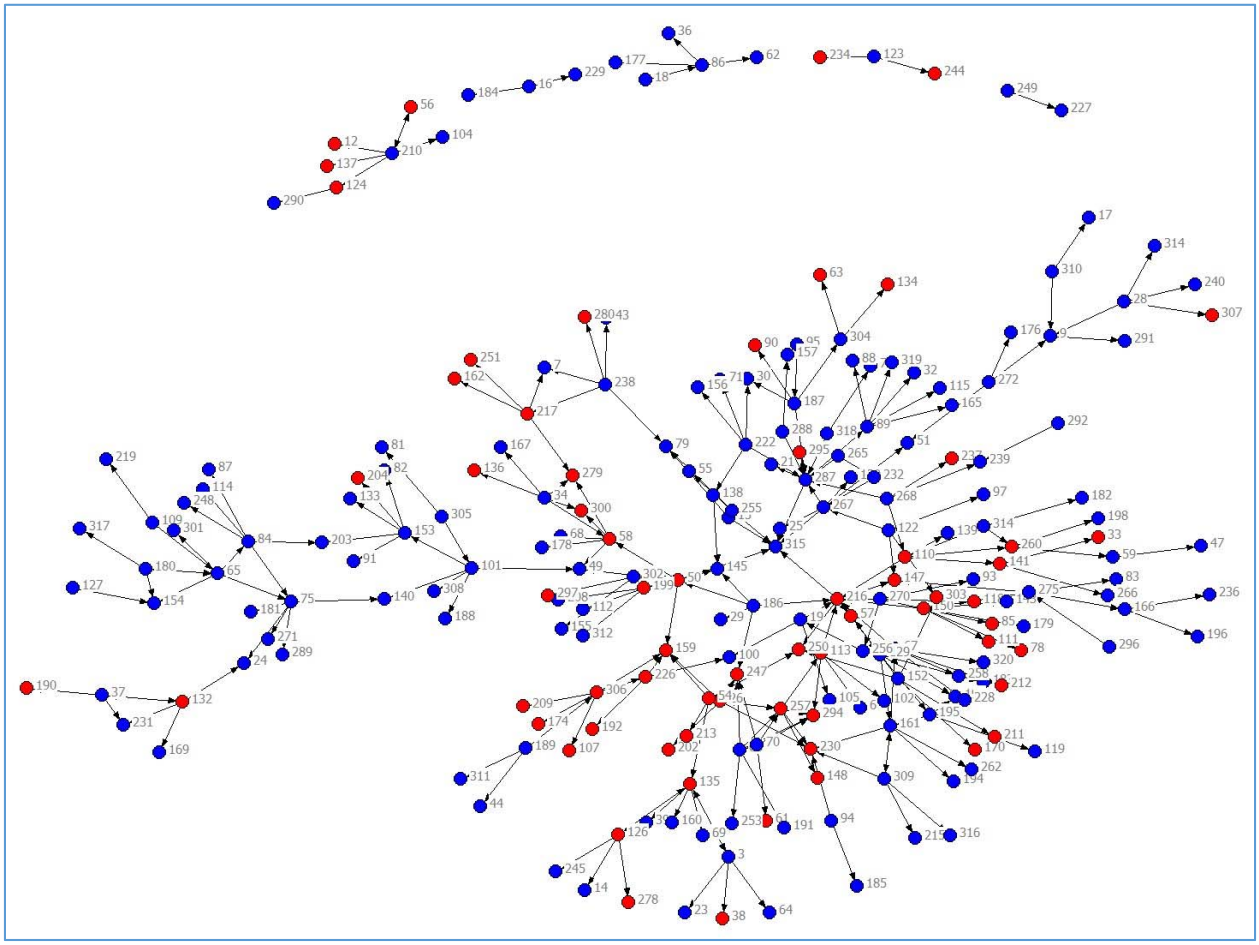

Figure 1. GoMRI-funded scientists (red nodes) that were present in the SNA. (Blue nodes indicate not a GoMRI-funded scientist.)

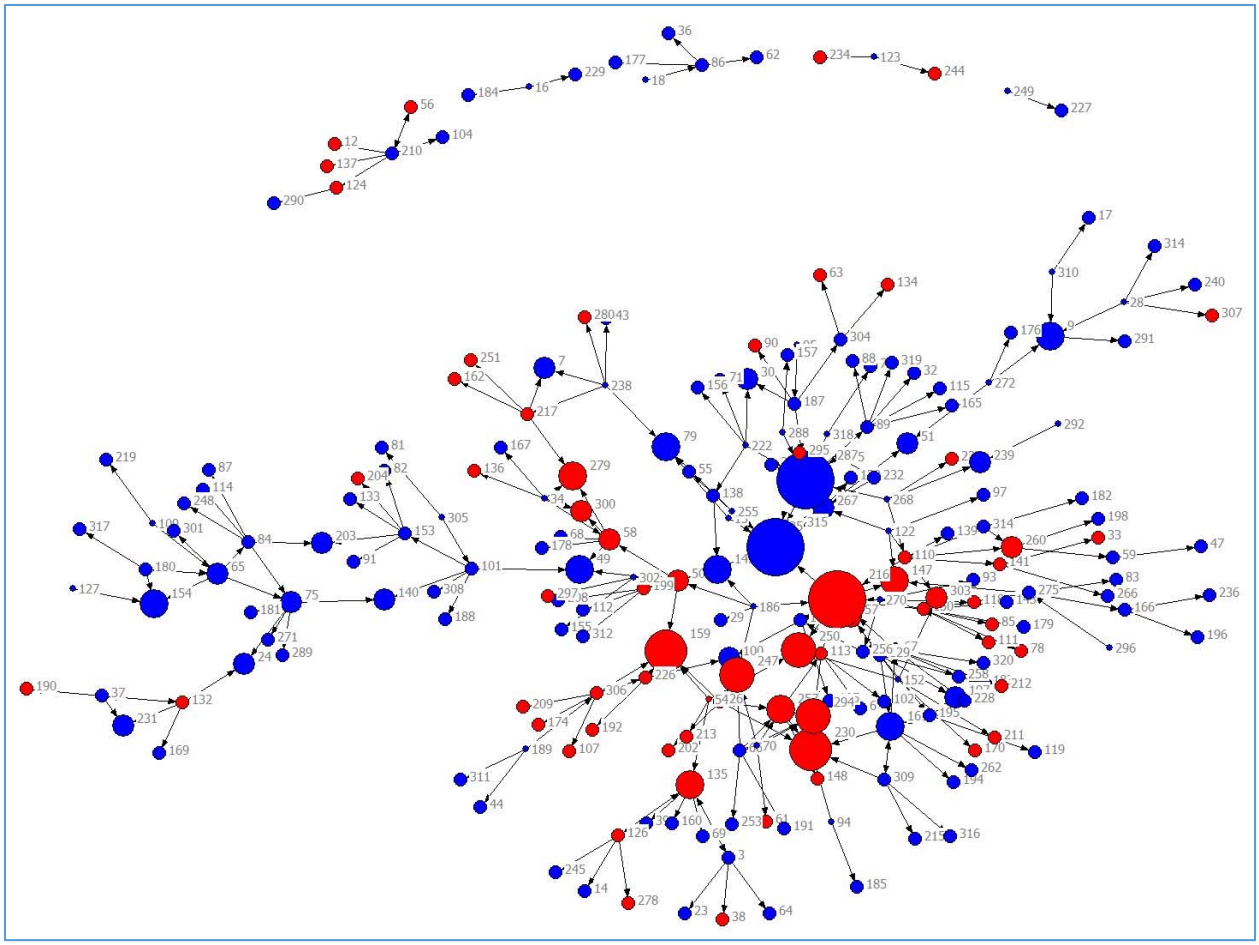

Figure 2. Indegree centrality of GoMRI-funded scientists (red nodes) that were present in the SNA. (Blue nodes indicate not a GoMRI-funded scientist.)

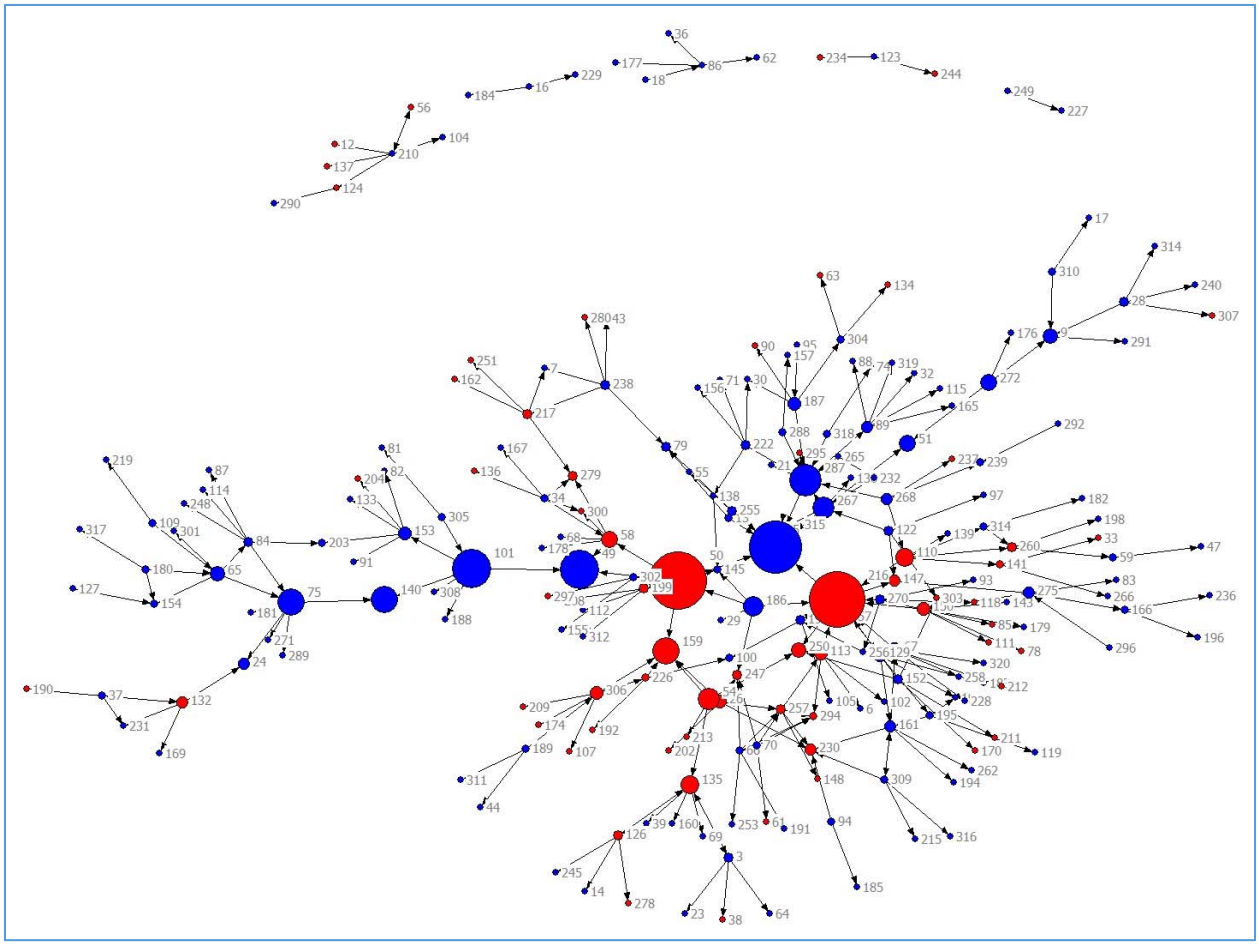

Figure 3. Betweenness centrality of GoMRI-funded scientists (red nodes) that were present in the SNA. (Blue nodes indicate not a GoMRI-funded scientist.)

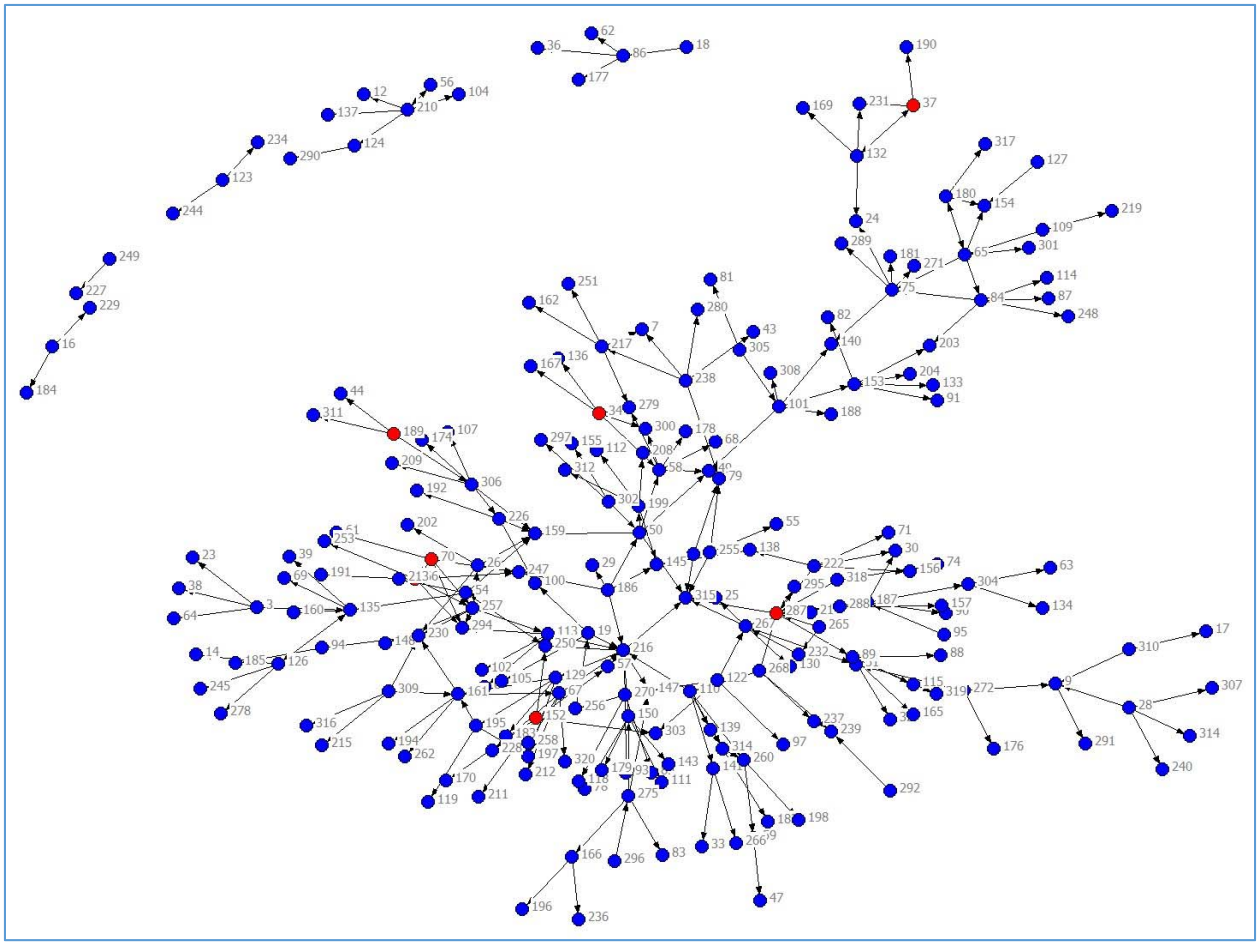

Figure 4. GoMRI consortia outreach leaders (red nodes) that were present in the SNA. (Blue nodes indicate not a GoMRI consortia outreach leader.)

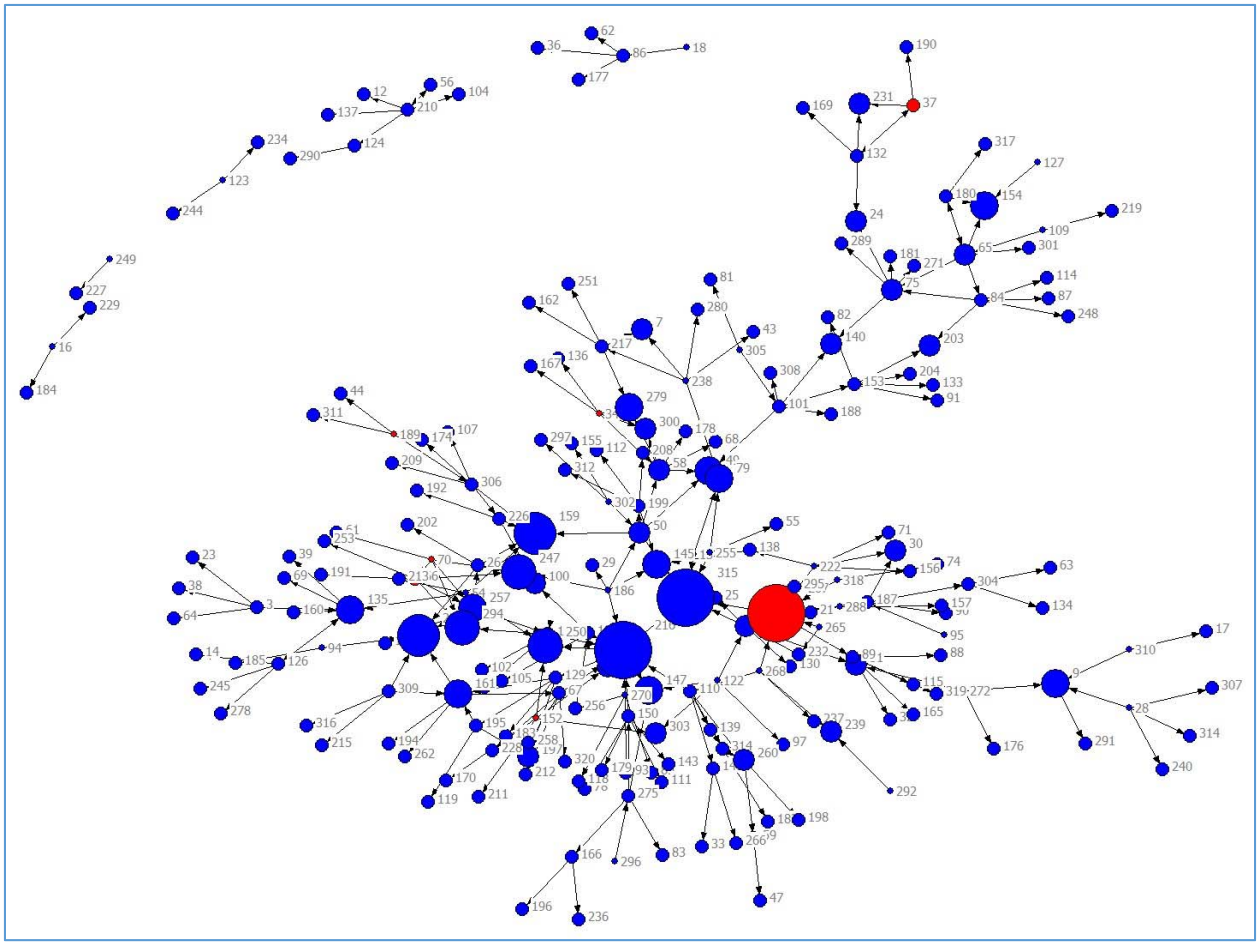

Figure 5. Indegree centrality of GoMRI consortia outreach leaders (red nodes) that were present in the SNA. (Blue nodes indicate not a GoMRI consortia outreach leader.)

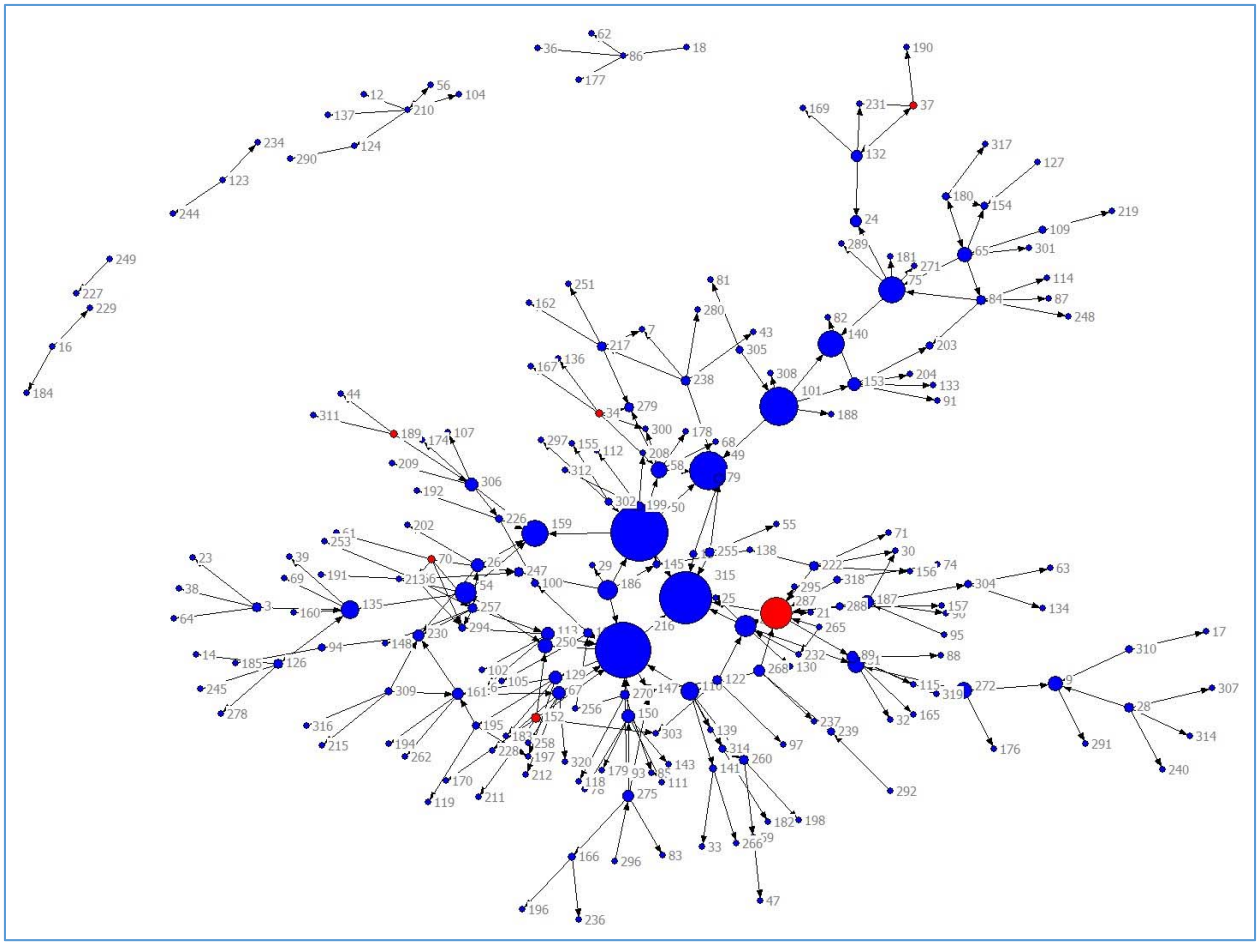

Figure 6. Betweenness centrality of GoMRI consortia outreach leaders (red nodes) that were present in the SNA. (Blue nodes indicate not a GoMRI consortia outreach leader.)

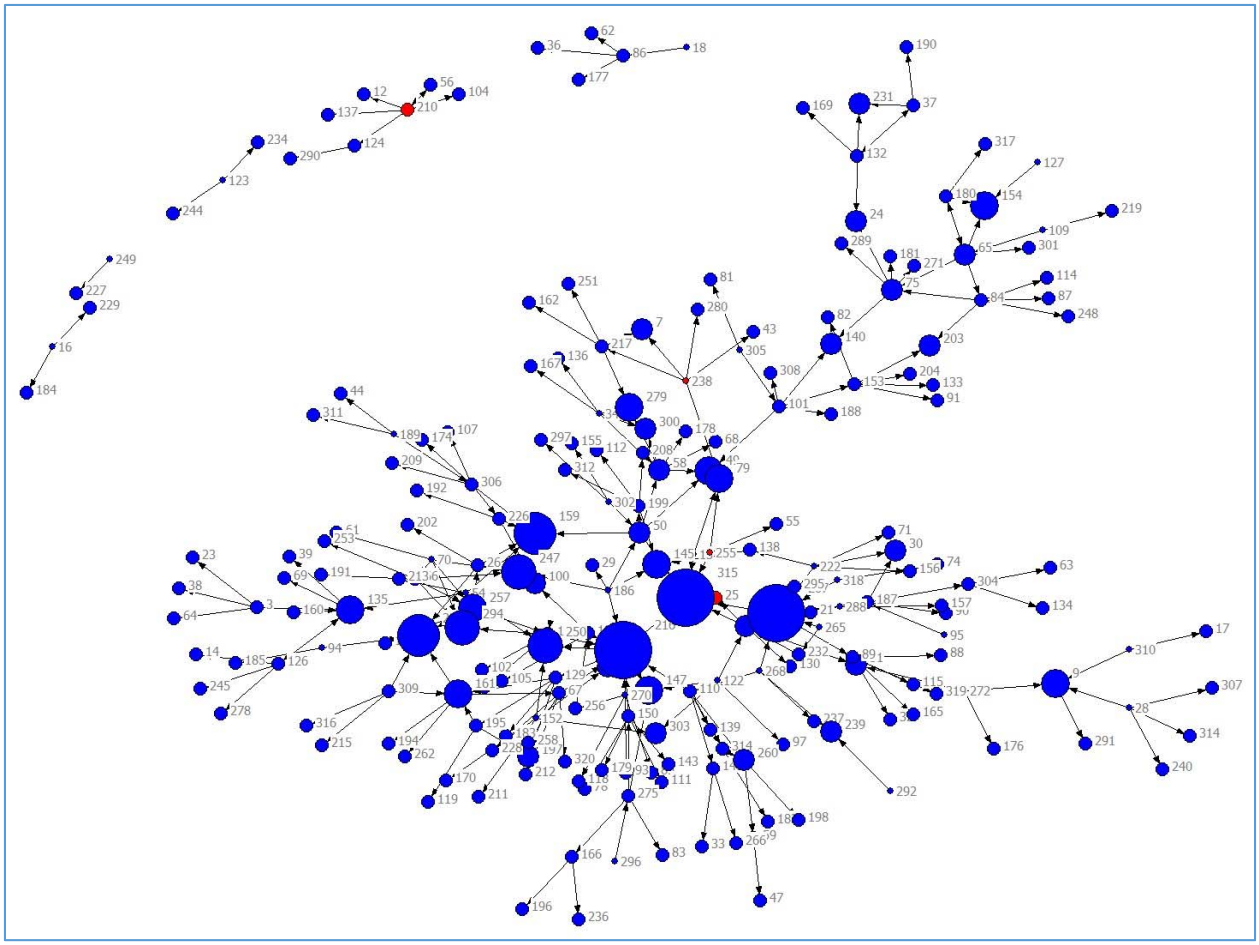

Figure 7. Indegree centrality of other GoMRI affiliates (red nodes) that were present in the SNA. (Blue nodes indicate not an “other GoMRI affiliate.”)

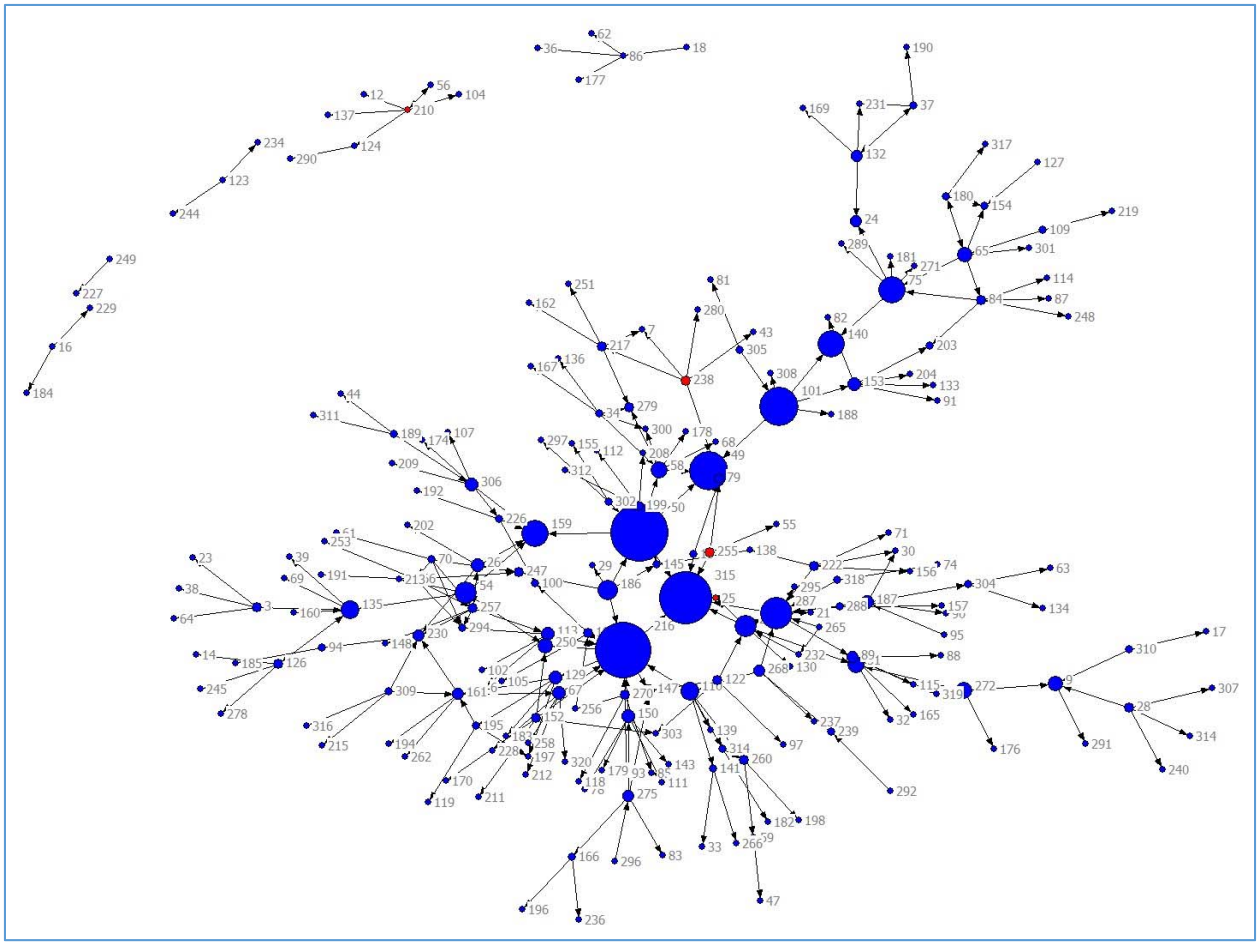

Figure 8. Betweenness centrality of Other GoMRI affiliates (red nodes) that were present in the SNA. (Blue nodes indicate not an “other GoMRI affiliate.”)