Social Network Analysis of Catch Shares Markets

Kari MacLauchlin
Knauss Fellow, NMFS Office of Policy

School of Natural Resources and Environment
UF UNIVERSITY of FLORIDA

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Overview of the Presentation

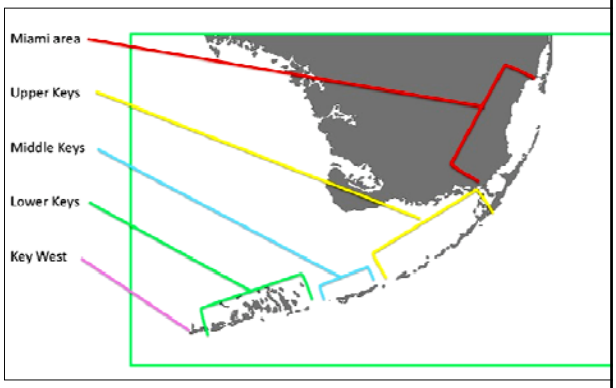
- Markets for catch shares (or effort shares, tradable permits, etc)
- My dissertation research- context
- Social Network Analysis- what is it good for
- Examples from my research
- Experimental SNA- New England Sectors

Markets

- Newly created by the program
- Market activity reflects value of the share
- Consolidation and concentration happen
- Transaction costs
- Information
- **The data are available!**

Florida's Commercial Spiny Lobster Fishery

Spiny Lobster
Panulirus argus



Majority of landings reported from Florida Keys and the Miami Area

Latino and non-Latino groups

Florida Lobster Trap Certificate Program

- Started in 1993
- Overall Goal: Reduce the number of traps
- Active and passive reductions
- **2,402** transactions involving 749,368 certificates

Data

- Transfer data from Florida Wildlife Conservation Commission
  - Buyer and Seller Info
  - Price and Quantity
- Enter information into UciNet
  - Generate a matrix
  - Generate a visualization
  - Calculate network metrics and identify groups

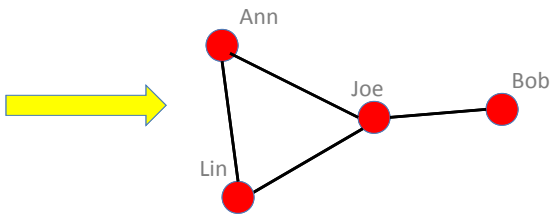
Background on Social Network Analysis

How people are connected:

-who they know
-who they are related to
-who they collaborate with
-who they are involved with in an exchange
-things they have in common

Uses data entered into an adjacency matrix

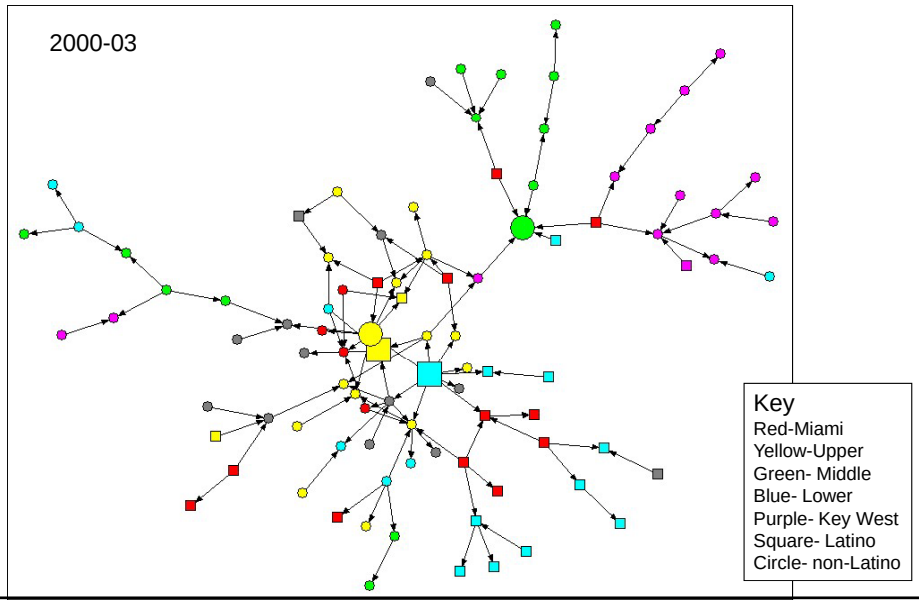
	Bob	Joe	Ann	Lin
Bob	1	1	0	0
Joe	1	1	1	1
Ann	0	1	1	1
Lin	0	1	1	1



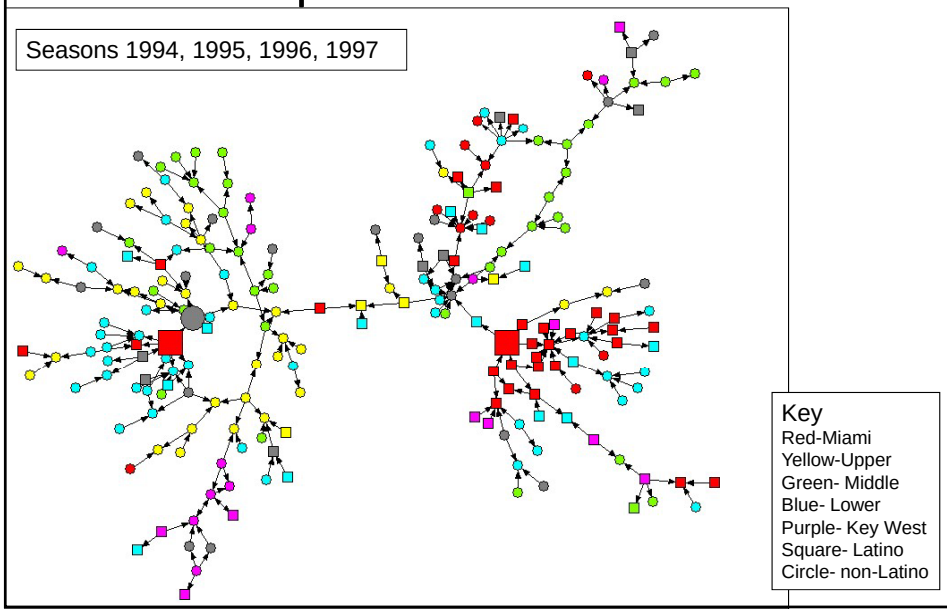
Social Network Analysis

- Network metrics
  - Centrality- number of transactions
  - Betweenness- fall on geodesic path between 2 nodes
  - Structural Holes- more options, power
- Research Questions
  - Who is buying/selling more?
  - Are quota becoming concentrated?
  - Are there brokers (or individuals in a broker position)?

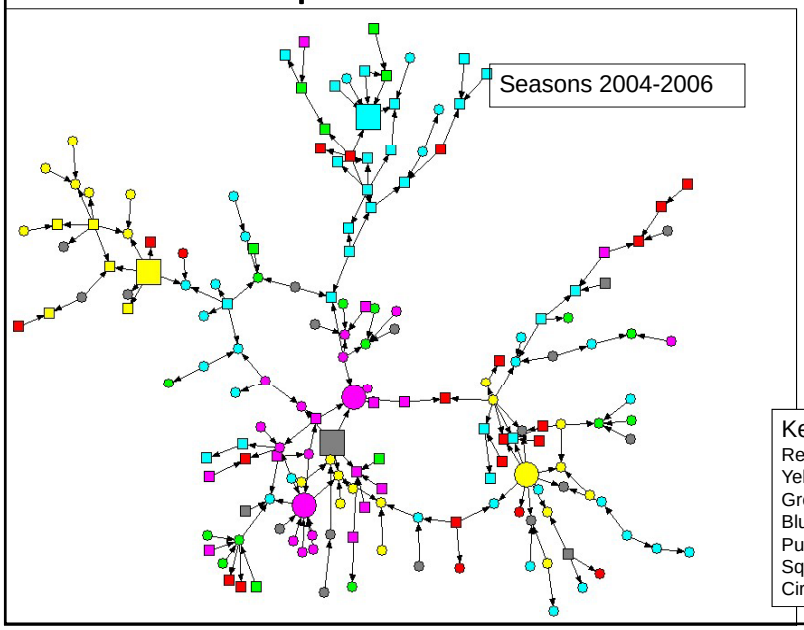
Examples: Betweenness



Examples: Structural Holes



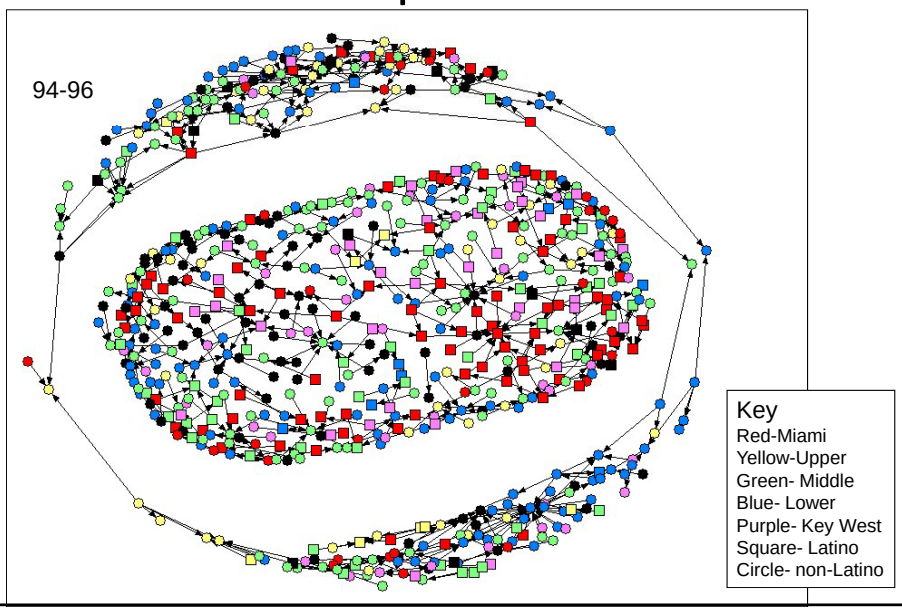
Examples: Structural Holes



Social Network Analysis

- Groups
  - Components- separated groups
  - Cliques- dense groups
  - Factions- ideal dense groups (to test for correlation)
- Research Questions
  - Is the market fragmented or dense?
  - Are sub-groups based on geography, social, cultural factors?

Components



Factions

Region		Faction Number 1	2	3	4	5	6	Total N
Miami	Observed	24	8	11	12	19	8	82
	Expected	18.9	8.9	11.8	21.3	10.4	10.8	
	% within Faction	15.9%	11.3%	11.7%	7.1%	22.9%	9.3%	
Upper Keys	Observed	20	8	8	42	7	2	87
	Expected	20.1	9.4	12.5	22.6	11	11.4	
	% within Faction	13.2%	11.3%	8.5%	24.7%	8.4%	2.3%	
Middle Keys	Observed	28	10	23	16	24	41	142
	Expected	32.7	15.4	20.4	36.9	18	18.6	
	% within Faction	18.5%	14.1%	24.5%	9.4%	28.9%	47.7%	
Lower Keys	Observed	32	21	16	39	8	5	121
	Expected	27.9	13.1	17.4	31.4	15.3	15.9	
	% within Faction	21.2%	29.6%	17%	22.9%	9.6%	5.8%	
Key West	Observed	8	10	11	15	3	4	51
	Expected	11.8	5.5	7.3	13.2	6.5	6.7	
	% within Faction	5.3%	14.1%	11.7%	8.8%	3.6%	4.7%	
Outside	Observed	39	14	25	46	22	26	172
	Expected	39.7	18.6	24.7	44.6	21.8	22.6	
	% within Faction	25.8%	19.7%	26.6%	27.1%	26.5%	30.2%	

6 factions; $\chi 2$=114.533 and p=0.000

SNA in the Larger Project

- Direction for Interview Questions
- Interpretation of Price Analysis

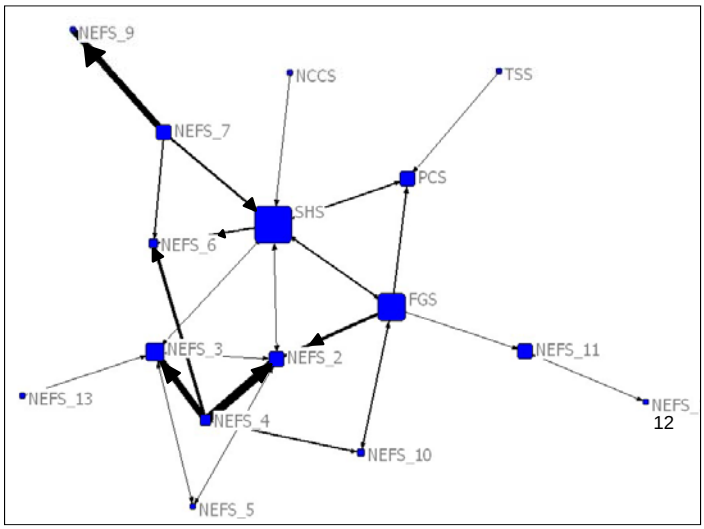
Experimental Part: New England Sector Program

- 17 sectors
  - 12 Sister sectors
- 16 allocated stocks
- Data for Inter-sector transfers
- 266 transfers (or 57 bulk)
- >6 Million lbs traded

FGS	-603,000
NEFS_10	167,300
NEFS_11	8,649
NEFS_12	41,351
NEFS_13	-12,726
NEFS_2	1,792,312
NEFS_3	973,729
NEFS_4	-2,937,117
NEFS_5	-26,241
NEFS_6	756,217
NEFS_7	-1,540,497
NEFS_9	1,054,788
PCS	1,840
SHS	428,654
TSS	-51,857
NCCS	-9,991

Stock	Lbs Traded	Total ACE to Sectors	Percent of ACE Traded
CC/GOM_Ytail	131438	1649000	7.97%
GB Cod East	33227	723000	4.60%
GB Cod West	659858	6611000	9.98%
GB Haddock East	617518	26297000	2.35%
GB Haddock West	996553	62413000	1.60%
GB Winter Flounder	178236	4026000	4.43%
GB Ytail	163437	2079000	7.86%
GOM Cod	954696	9676000	9.87%
GOM Haddock	170259	1790000	9.51%
GOM Winter	24264	305000	7.96%
Plaice	257599	6123000	4.21%
Pollock	1133489	5955000	19.03%
Redfish	187934	14961000	1.26%
SNE/MA Ytail	11044	544000	2.03%
White Hake	381010	5560000	6.85%
Witch Flounder	122134	1837000	6.65%
TOTALTraded	6022696	150549000	4.00%

Sectors



Two-Mode SNA

- Ties are based on things in common- affiliation
- Two levels of analysis

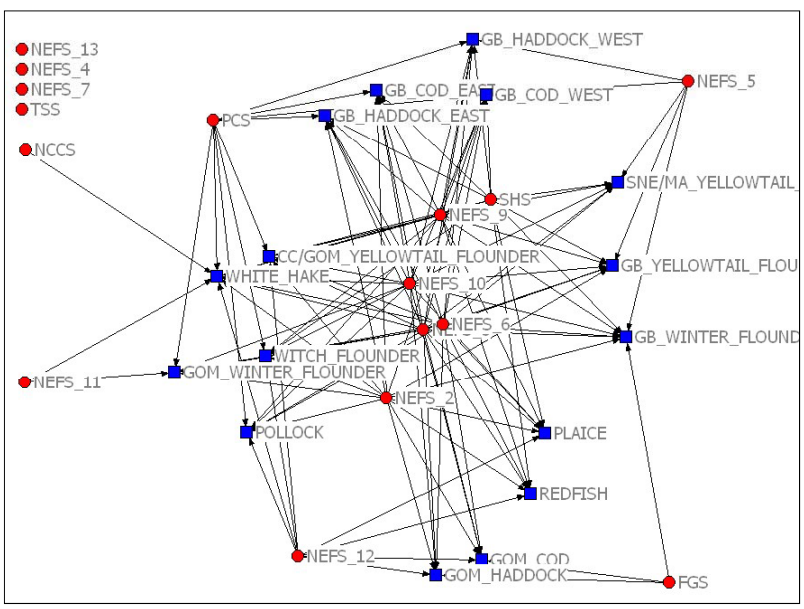
-Shows relationships/ties/groups of sectors based on common +/- of stocks

-The meaning of the stock depends on who is leasing

	CC/GOM_YELLOW	GB_COD_EAST	GB_COD_WEST	GB_HADDOCK_EAST	GB_HADDOCK_WEST	GB_WINTER
FGS	-5000	-7500	-343000	0	0	300
NEFS_10	26812	220	42009	10899	25867	191
NEFS_11	-800	0	0	0	0	0
NEFS_12	800	0	0	0	0	0
NEFS_13	0	0	0	0	0	0
NEFS_2	47232	10029	241000	196000	0	7511
NEFS_3	36817	164	9816	4113	41	1127
NEFS_4	-101158	-13021	-127637	-302523	-243324	-16353
NEFS_5	-13232	0	6951	0	226	1489
NEFS_6	8813	3666	33540	130927	310742	27576
NEFS_7	-8154	-9650	-88303	-311705	-745194	-160092
NEFS_9	7629	8061	73762	202390	485747	115633

[there's more to this matrix]

Two mode network



Factor Analysis

eigenvalues

1	9.946
2	3.502
3	1.364
4	0.678
5	0.216
6	0.143
7	0.098
8	0.027
9	0.014
10	0.008
11	0.003
12	0.001
13	0
14	0
15	0

1

GB_WINTER	0.442
SNE/MA_YTAII	0.478
GB_YTAIL	0.5
GB_HADD_WE	0.561
G0M_HADD	0.656
GB_COD_WES	0.66
WH_HAKE	0.779
GOM_COD	0.85
GB_HADD_EA	0.878
GB_COD_EAS	0.89
GOM_WINTER	0.891
POLLOCK	0.914
REDFISH	0.915
CC/GOM_YTAI	0.933
WITCH	0.954
PLAICE	0.976

2

GB_WINTER	-0.853
GB_YTAIL	-0.812
GB_HADD_WE	-0.794
SNE/MA_YTAII	-0.51
GB_HADD_EA	-0.43
GB_COD_EAS	-0.337
GB_COD_WES	-0.15
WH_HAKE	0.097
PLAICE	0.141
WITCH	0.213
REDFISH	0.24
CC/GOM_YTAI	0.292
POLLOCK	0.35
GOM_WINTER	0.375
GOM_COD	0.428
G0M_HADD	0.49

3

GB_COD_WES	-0.62
WH_HAKE	-0.557
GB_COD_EAS	-0.261
SNE/MA_YTAII	-0.177
REDFISH	-0.111
POLLOCK	-0.038
WITCH	-0.03
CC/GOM_YTAI	0.098
GOM_WINTER	0.104
PLAICE	0.107
GB_HADD_EA	0.131
GB_HADD_WE	0.194
GB_WINTER	0.233
GB_YTAIL	0.266
GOM_COD	0.279
G0M_HADD	0.515

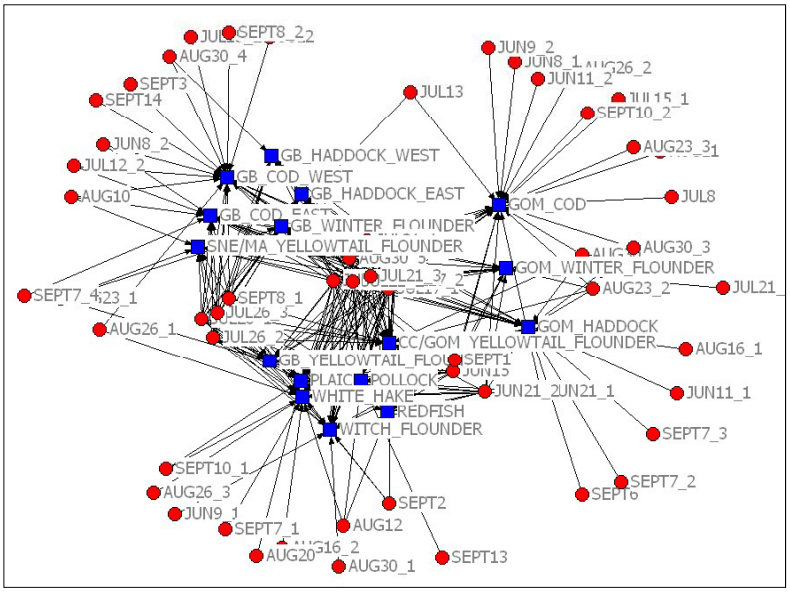
Block Model

Starting fitness: 0.363
Final fitness: 0.652

Blocked Adjacency Matrix

		5	4	3	8	12	1	7	2	9	6	11	10	13	14	15	16
		GB_HADD	GB_HADD	GB_COD_	GOM_COD	POLLOCK	CC/GOM_	GB_YELL	GB_COD_	GOM_HAD	GB_WINT	PLAICE	GOM_WIN	REDFISH	SNE/MA_	WHITE_H	WITCH_F
7	NEFS_3	41	4113	9816	343466	387505	36817	2898	164	86312	1127	56222	7866	8697	35	28243	8407
6	NEFS_2		196000	241000	348109	550000	47232	11374	10029	56183	7511	95146	8971	93000	-792	73949	54600
12	NEFS_9	485747	282390	73762		21438	7629	102020	8061		115633	27922		148	1702	778	7558
1	FGS			-343000	109700	-250000	-5000		-7500	20000	300			-10000		-106000	-11500
5	NEFS_13				-12726												
2	NEFS_10	25867	10899	42009	34105	910	26812	7	220	381	191	2716	6335		2435	1000	13413
3	NEFS_11				-27211	-443	-800			-2948		-5974	35	-384		49415	-3041
8	NEFS_4	-243324	-302523	-127637	-667189	-766340	-101158	-25030	-13021	-92090	-16353	-184888	-21991	-130089	-2640	-162327	-80517
9	NEFS_5	226		6951	-19960		-13232	776		-1298	1489		-1985		792		
10	NEFS_6	310742	130927	33540	18595	78338	8813	34947	3666	961	27576	39709	838	40355	1608	15231	10371
11	NEFS_7	-745194	-311705	-88303	-386	-22424	-8154	-137628	-9650	-14	-160092	-38916		-2360	-3204	-1287	-11180
4	NEFS_12				27211	443	800			2948		5974	-35	384		585	3041
13	PCS	7440	3135	11277	-41841	30459	2300	-3	1232	-1969	-2	-4463	1	-21010	-4402	13937	5749
14	SHS	166264	69899	153140	-89346	-10834	499	10639	8171	-68465	22920	15948	-10	22323	4469	121235	1802
15	TSS	-7440	-3135	-12555	-120	-6010	-2558		-1372	-1		-9396	-25	-1064	-3	-1475	-6703
16	NCCS				-22407	-13042										25458	

2-mode with Dates



1	9.124
2	2.241
3	0.936
4	0.799
5	0.583
6	0.481
7	0.351
8	0.282
9	0.263
10	0.229
11	0.197
12	0.173
13	0.128
14	0.107
15	0.067
16	0.04

Factor Analysis

	1
GOM_COD	0.329
GOM_HADDOCK	0.497
GB_COD_WEST	0.564
GOM_WINTER	0.578
SNE/MA_YTAIL	0.708
WHITE_HAKE	0.74
REDFISH	0.751
GB_COD_EAST	0.759
GB_HADDOCK_WES	0.776
GB_WINTER	0.804
GB_YTAIL	0.848
WITCH	0.866
POLLOCK	0.875
GB_YTAIL	0.892
PLAICE	0.896
GB_HADDOCK_EAST	0.919

	2
GB_COD_WES	-0.512
SNE/MA_YTAII	-0.474
GB_HADDOCK	-0.365
GB_COD_EAS	-0.363
GB_HADDOCK	-0.208
GB_YTAIL	-0.121
GB_WINTER	-0.11
WHITE_HAKE	0.037
WITCH	0.056
PLAICE	0.058
POLLOCK	0.091
GB_YTAIL	0.206
REDFISH	0.373
GOM_HADDOC	0.615
GOM_WINTER	0.646
GOM_COD	0.653

Questions, comments, suggestions?

Kari MacLauchlin
kari.maclauchlin@noaa.gov
karimac@ufl.edu

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