PELAGIC LONGLINE BYCATCH

J. Cramer

Southeast Fisheries Science Center
Sustainable Fisheries Division
75 Virginia Beach Drive
Miami, Florida

SUMMARY

Dead discard estimates for swordfish, billfish, large coastal and pelagic sharks were made using mandatory reports from longline vessels, and reports from the National Marine Fisheries Service Observer program.

RÉSUMÉ

Les estimations des rejets de poissons morts concernant l'espadon, les istiophoridés, les grands requins côtiers et pélagiques ont été réalisées en utilisant les déclarations obligatoires des palangriers et les déclarations du programme d'observateurs du National Marine Fisheries Service.

RESUMEN

Se realizaron estimaciones de descartes muertos de pez espada, marlines, y grandes tiburones pelágicos y costeros a partir de informes obligatorios de los barcos palangreros, y de informes del Programa de National Marine Fisheries Service.

INTRODUCTION

Billfish, large coastal and pelagic sharks are frequently caught and discarded by longline vessels targeting swordfish or tuna. Earlier studies have indicated that catch which is discarded is often not reported as accurately as landed catch(Cramer et al,1997). In this paper, longline observer records are used to estimate discard rates for longline effort targeting swordfish or tuna. Estimates of the weight of dead discards from other types of gear or effort reported to the pelagic logbook were based on the numbers reported in the logbook.

METHODS

Description of data sources used.

Large pelagic logbook (LPL):

U.S. Atlantic, Caribbean and Gulf of Mexico fishing vessels which land swordfish have been

required to provide daily records of effort and catch since October 1986. Undersized swordfish, billfish, large coastal and pelagic sharks are caught as bycatch, and in the case of sharks, less frequently as targeted catch by these vessels. Although a variety of gear types are represented, the predominant gear type (90% of vessels reporting) is longline gear. Records from longline gear targeting swordfish or tuna were separated from records containing longline gear with targets other than swordfish and gear other than longline. Locations of sets reported in 1998 are shown in figure 2.

NMFS Observer (NMFSO):

Two hundred and eighty seven longline sets were observed and recorded in the NMFSO in 1998. Numbers of swordfish, billfish, and sharks discarded dead and some measured or estimated lengths were available by species. Locations of sets observed in 1998 are shown in figure 2.

Weight Estimates:

Metric ton estimates were calculated by multiplying the average weight (median weight in the case of swordfish and billfish) by the estimated number (longline gear) or reported number(other gear) of dead discards (table 1, Appendix 1 and 2). Weight frequency charts for each species measured are shown in Appendix 4. Lengths of fish reported discarded dead in 1997 NMFSO records were used to estimate average or median weights of dead discards for each area, quarter, and species or group. When less than 30 lengths were available from an area and quarter, the average or median weight for the year was used. The length to weight conversions (Kohler et al 1995, Scott, 1996) may be found in (Cramer and Adams, 1998).

Number Estimates:

Calculations were done separately for the species (swordfish, blue marlin, white marlin, sailfish, blue sharks, silky sharks, night sharks, and dusky sharks), or close relatives (hammerhead sharks) when at least 10 dead discards from that group had been observed in NMFSO. The species with limited representation were grouped into pelagic sharks (mako, oceanic whitetip, porbeagle, thresher, and unidentified pelagic sharks) and coastal sharks (bignose shark, blacktip shark, sandbar shark, tiger shark, white shark, spinner shark, and unidentified coastal sharks).

For longline gear targeting swordfish or tuna, catch and effort files were prepared from the NMFSO and from the LPL data. Hooks set and numbers of sharks reported discarded dead in each species group were summed by area, and quarter. Catch rates were obtained for each area, quarter and species group by dividing the number of dead discards in the group by the number of hooks set and multiplying by 1,000.

General Linear Models (GLM) were run to obtain an estimate of observer catch rate for areas and quarters where there had been limited observer coverage in 1997. Observed catch rates were applied in areas and quarters where at least 10 sets were observed. In areas and quarters having 1 to 10 observed sets the GLM estimated catch rate was applied. In cases where no sets were observed the reported catch rate was accepted. GLM output for model CPUE based on observed and reported CPUE may be found in appendix 3.

GLM Model:

Ln(catch rate) = area/quarter source

Variable description:

catch rate = dead discards/hooks*1,000

area/quarter = unique identifier for each area and quarter combination
source = NMFSO or LPL
Areas:

The areas used for these analyses are those typically used domestically. These areas are smaller than the ICCAT areas and are thought to correspond to different types of fishing areas and fishing effort. A map showing these areas is presented in figure 1. The final number estimates and weight estimates are reported by ICCAT areas. Dead discards estimated when area was unknown were distributed across areas in proportion to estimated dead discards within gear (longline or other). Dead discards reported for other gear were combined with longline dead discards in all areas except ICCAT area 92. Because LPL reports of gears other than longline are more frequent in ICCAT area 92 than in the other ICCAT areas, the dead discards from other gear in area 92 were reported in the unclassified gear category.

RESULTS AND DISCUSSION

The estimated numbers and weights of dead discards are reported in table 1. Compared to the estimates for 1997(Cramer and Adams, 1998), the total estimated dead discards of swordfish, sailfish, blue marlin, and white marlin decreased. However estimates of dead discards were higher in 1998 for swordfish, white marlin, and blue marlin in the Northwest Atlantic (ICCAT area 92). The numbers of sharks discarded dead decreased with the exception of dusky sharks in the Northwest Atlantic and coastal sharks in the Caribbean. Overall effort and discard estimates decreased in area South Atlantic, south of 5^{o} south latitude.

REFERENCES

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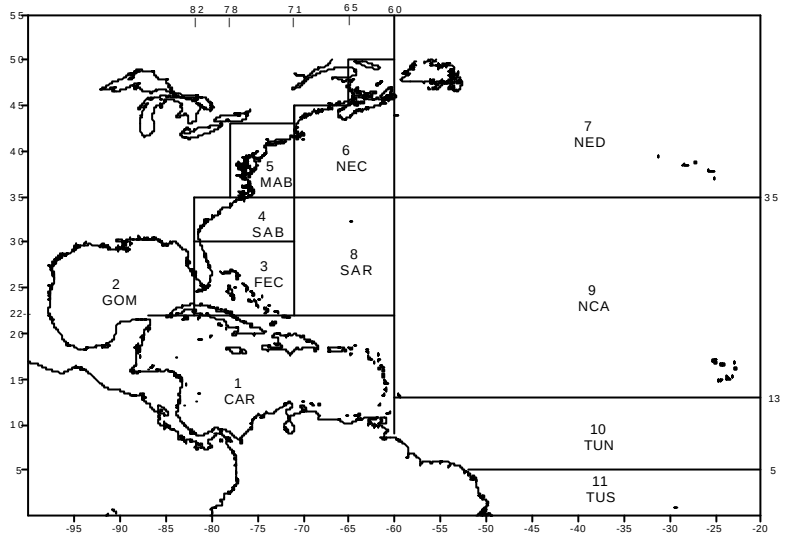
Figure 1: Areas used in analyses.



ICCAT Area	Area (domestic)
93	1 Caribbean
91	2 Gulf of Mexico
92	3 Florida East Coast
92	4 South Atlantic Bight
92	5 MidAtlantic Bight
92	6 Northeast Coastal

ICCAT Area	Area (domestic)
94	7 Northeast Distant
93	8 Sargasso
93	9 North Central Atlantic
93	10 Tuna North
96	11 Tuna South
99	0 unknown area

Table 1. The following tables show the number of estimated dead discards (DEAD_D), the estimated whole weight in kg (MT_DEAD) in each ICCAT area for longline (LL) and other gear(OTH).

AREA	GEAR	DEAD_D	MT_DEAD
Swordfish			
91	LL	5027	56.90
92	LL	20583	324.51
93	LL	980	14.54
94	LL	1688	27.02
96	LL	609	9.76
92	OTH	580	9.13
Sailfish			
91	LL	848	16.95
92	LL	317	6.35
93	LL	11	0.22
94	LL	38	0.77
96	LL	133	2.67
92	OTH	3	0.06
Blue Marlin			
91	LL	330	18.47
92	LL	416	23.31
93	LL	41	2.32
94	LL	108	6.05
96	LL	29	1.64
92	OTH	11	0.62
White Marlin			
91	LL	591	11.83

92	LL	767	15.34
93	LL	63	1.25
94	LL	140	2.81
96	LL	45	0.91
92	OTH	35	0.70

Pelagic Shark

91	LL	69	8.25
92	LL	275	33.02
93	LL	60	7.16
94	LL	277	33.26
96	LL	17	2.06
92	OTH	9	1.08

Blue Shark

91	LL	0	0
92	LL	2158	79.16
93	LL	68	2.50
94	LL	2374	87.85
96	LL	96	3.55
92	OTH	599	22.19

Hammerhead

91	LL	3	0.23
92	LL	481	39.93
93	LL	1	0.08
94	LL	0	0
96	LL	0	0
92	OTH	80	6.66

Night Shark

91	LL	23	0.51
92	LL	885	19.46
93	LL	0	0
94	LL	0	0
96	LL	0	0
92	OTH	13	0.28

AREA GEAR DEAD_D MT_DEAD

Coastal Shark

91	LL	384	2.68
92	LL	91	0.64
93	LL	2	0.01
94	LL	0	0
96	LL	0	0
92	OTH	75	0.53

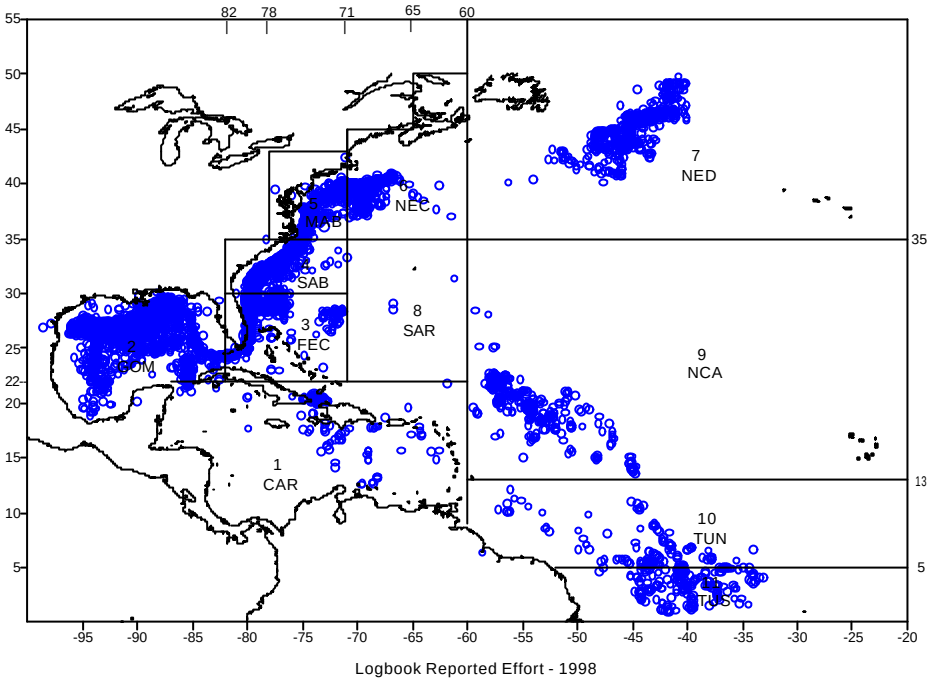
Dusky Shark

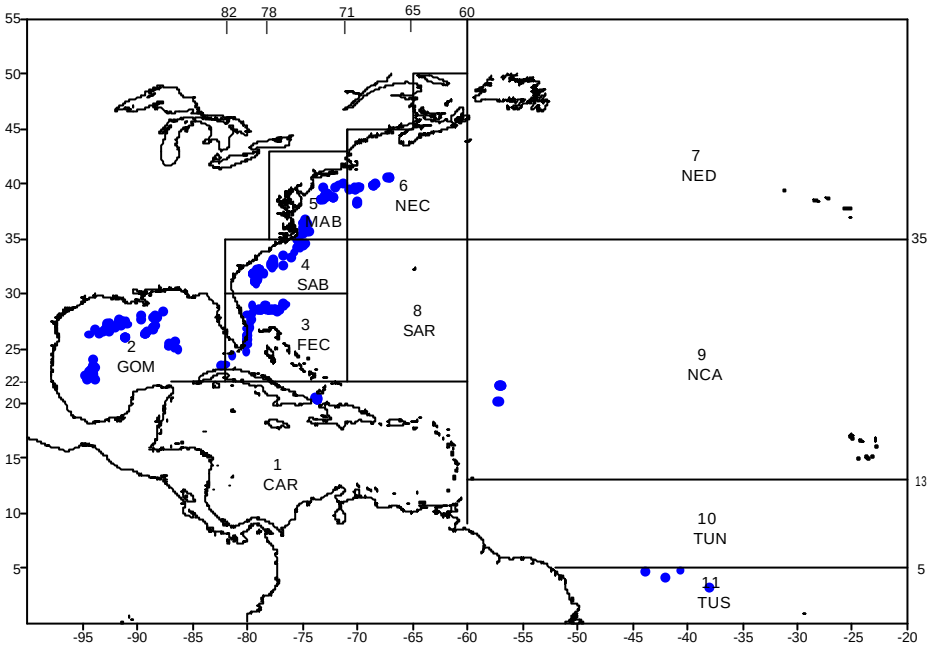
91	LL	47	1.37
92	LL	1147	31.01
93	LL	2	0.06
94	LL	1	0.03
96	LL	49	1.43
92	OTH	19	0.56

Silky Shark

91	LL	219	2.41
92	LL	826	9.09
93	LL	1	0.01
94	LL	0	0
96	LL	0	0
92	OTH	4	0.04

Figure 2. Locations of effort reported to the large pelagic logbook in 1998 and 1998 observed set locations.





Observed Effort - 1998

Appendix 1. The following tables show the number estimated divided by the number reported in LPL (RATIO), the number estimated (ESTNO), the estimated weight in kg (ESTWT), the number observed in NMFSO (NMFSO), the number reported in LPL (LPL), the number of hooks reported in LPL (HOOKS), the catch rate (CR), the median weight in kg (MEDIAN), and the number of fish measured (MEAS) for each species group in each area and quarter.

SWORDFISH

AREA	QUARTER	ER	ESTNO	ESTKG	NO	LBNO	HOOKS	CR	MEDIAN
0	1	2	83	1328	.	50	18560	4.49	16
0	2	8	47	752	.	6	14831	3.2	16
0	3	1	87	1392	.	67	19554	4.45	16
0	4	4	73	1168	.	17	12210	5.99	16
1	1	1	245	3920	.	245	189303	.	16
1	2	1	90	1440	.	90	13924	.	16
1	4	4	554	7756	101	158	33219	16.67	14
2	1	2	1351	16212	61	570	521420	2.59	12
2	2	4	940	15040	20	214	573893	1.64	16
2	3	4	643	10288	17	150	566018	1.14	16
2	4	7	1610	9660	38	237	498183	3.23	6
3	1	3	1438	25884	54	445	127687	11.26	18
3	2	0	335	5360	10	717	246729	1.36	16
3	3	4	2830	45280	34	726	94043	30.09	16
3	4	2	1337	20055	77	764	99814	13.4	15
4	1	3	2086	39634	132	787	148409	14.06	19
4	2	3	2211	39798	159	660	212536	10.4	18
4	3	1	634	10144	.	634	74153	.	16
4	4	4	3233	51728	216	851	83980	38.5	16
5	1	2	622	11818	117	387	74280	8.37	19
5	2	4	167	2672	15	47	85240	1.96	16
5	3	4	1321	14531	51	360	364861	3.62	11
5	4	2	1023	16368	2	455	422624	2.42	16
6	2	1	19	304	.	19	42000	.	16
6	3	4	2492	29904	37	711	520753	4.79	12
6	4	3	624	7488	47	201	155851	4	12
7	2	1	40	640	.	40	41700	.	16
7	3	1	845	13520	.	845	345672	.	16
7	4	1	249	3984	.	249	99407	.	16
8	1	1	5	80	.	5	13795	.	16
8	2	1	1	16	.	1	2000	.	16
8	4	.	0	0	.	0	2500	.	16
9	1	3	346	5536	12	115	190623	1.81	16
9	2	1	7	112	.	7	2400	.	16
9	4	1	19	304	.	19	47814	.	16
10	1	1	97	1552	.	97	81973	.	16
10	2	1	24	384	.	24	19866	.	16
10	3	1	2	32	.	2	2902	.	16
11	1	1	30	480	.	30	38230	.	16
11	2	3	573	9168	14	171	136295	4.2	16

SAILFISH

AREA	QUARTER	ER	ESTNO	ESTKG	NO	LBNO	HOOKS	CR	MEDIAN
0	1	.	1	20	.	0	18560	0.03	20
0	2	.	4	80	.	0	14831	0.25	20
0	3	9	9	180	.	1	19554	0.46	20
0	4	.	0	0	.	0	12210	0	20
1	1	1	6	120	.	6	190553	.	20
1	2	1	5	100	.	5	13924	.	20
1	4	0	0	0	0	1	33219	0	20
2	1	0	0	0	0	6	521420	0	20
2	2	5	94	1880	2	19	573893	0.16	20
2	3	10	719	14380	19	72	566018	1.27	20
2	4	0	0	0	0	8	497873	0	20
3	1	0	0	0	0	1	127687	0	20
3	2	2	67	1340	2	37	246729	0.27	20
3	3	9	137	2740	0	16	94043	1.46	20
3	4	0	0	0	0	1	99814	0	20
4	1	.	0	0	0	0	148409	0	20
4	2	9	56	1120	4	6	212536	0.26	20
4	3	1	11	220	.	11	74153	.	20
4	4	0	0	0	0	1	83980	0	20
5	1	.	0	0	0	0	74280	0	20
5	2	.	0	0	0	0	85240	.	20
5	3	26	26	520	1	1	364861	0.07	20
5	4	.	0	0	0	0	422624	.	20
6	2	.	0	0	.	0	42000	.	20
6	3	9	17	340	0	2	520753	0.03	20
6	4	.	0	0	0	0	155851	0	20
7	2	.	0	0	.	0	41700	.	20
7	3	.	0	0	.	0	345672	.	20
7	4	.	0	0	.	0	99407	.	20

8	1	.	0	0	.	0	13795	.	20
8	2	.	0	0	.	0	2000	.	20
8	4	.	0	0	.	0	2500	.	20
9	1	9	17	340	0	2	189873	0.09	20
9	2	.	0	0	.	0	2400	.	20
9	4	.	0	0	.	0	47814	.	20
10	1	1	17	340	.	17	81973	.	20
10	2	1	1	20	.	1	19866	.	20
10	3	1	3	60	.	3	2902	.	20
11	1	1	6	120	.	6	38230	.	20
11	2	13	126	2520	4	10	136295	0.92	20

BLUE MARLIN

AREA	QUARTER	ER	ESTNO	ESTKG	NO	LBNO	HOOKS	CR	MEDIAN
0	1	2	2	112	.	1	18560	0.1	56
0	2	3	3	168	.	1	14831	0.19	56
0	3	.	4	224	.	0	19554	0.22	56
0	4	.	0	0	.	0	12210	0.01	56
1	1	1	15	840	.	15	190553	.	56
1	2	1	21	1176	.	21	13924	.	56
1	4	3	5	280	1	2	33219	0.17	56
2	1	4	22	1232	1	5	521420	0.04	56
2	2	4	47	2632	1	11	573893	0.08	56
2	3	6	189	10584	5	34	566018	0.33	56
2	4	0	0	0	0	9	497873	0	56
3	1	0	0	0	0	1	127687	0	56
3	2	7	134	7504	4	18	246729	0.54	56
3	3	8	53	2968	0	7	94043	0.56	56
3	4	0	0	0	0	1	99814	0	56
4	1	0	0	0	0	2	148409	0	56
4	2	4	28	1568	2	7	212536	0.13	56
4	3	1	5	280	.	5	74153	.	56
4	4	0	0	0	0	4	83980	0	56
5	1	.	0	0	0	0	74280	0	56
5	2	.	0	0	0	0	85240	.	56
5	3	26	52	2912	2	2	364861	0.14	56
5	4	.	0	0	0	0	422624	.	56
6	2	.	0	0	.	0	42000	.	56
6	3	14	127	7112	3	9	520753	0.24	56
6	4	13	13	728	1	1	155851	0.09	56
7	2	.	0	0	.	0	41700	.	56
7	3	.	0	0	.	0	345672	.	56
7	4	.	0	0	.	0	99407	.	56
8	1	.	0	0	.	0	13795	.	56
8	2	.	0	0	.	0	2000	.	56
8	4	.	0	0	.	0	2500	.	56
9	1	8	83	4648	0	11	189873	0.44	56
9	2	.	0	0	.	0	2400	.	56
9	4	.	0	0	.	0	47814	.	56
10	1	1	13	728	.	13	81973	.	56
10	2	1	11	616	.	11	19866	.	56
10	3	.	0	0	.	0	2902	.	56
11	1	1	6	336	.	6	38230	.	56
11	2	8	23	1288	0	3	136295	0.17	56

WHITE MARLIN

AREA	QUARTER	ER	ESTNO	ESTKG	NO	LBNO	HOOKS	CR	MEDIAN
0	1	3	3	60	.	1	18560	0.16	20
0	2	.	6	120	.	0	14831	0.43	20
0	3	.	6	120	.	0	19554	0.31	20
0	4	1	1	20	.	1	12210	0.06	20
1	1	1	16	320	.	16	190553	.	20
1	2	1	13	260	.	13	13924	.	20
1	4	5	33	660	6	7	33219	0.99	20
2	1	4	44	880	2	12	521420	0.08	20
2	2	8	47	940	1	6	573893	0.08	20
2	3	24	416	8320	11	17	566018	0.74	20
2	4	0	0	0	0	7	497873	0	20
3	1	.	27	540	1	0	127687	0.21	20
3	2	8	302	6040	9	38	246729	1.22	20
3	3	.	0	0	0	0	94043	.	20
3	4	0	0	0	0	1	99814	0	20
4	1	16	32	640	2	2	148409	0.21	20
4	2	12	139	2780	10	12	212536	0.65	20
4	3	1	1	20	.	1	74153	.	20
4	4	.	0	0	0	0	83980	0	20
5	1	.	0	0	0	0	74280	0	20
5	2	10	19	380	2	2	85240	0.22	20
5	3	5	78	1560	3	16	364861	0.21	20
5	4	7	7	140	0	1	422624	0.02	20

6	2	.	0	0	.	0	42000	.	20
6	3	5	114	2280	1	24	520753	0.22	20
6	4	10	40	800	3	4	155851	0.26	20
7	2	.	0	0	.	0	41700	.	20
7	3	1	2	40	.	2	345672	.	20
7	4	1	1	20	.	1	99407	.	20
8	1	1	4	80	.	4	13795	.	20
8	2	.	0	0	.	0	2000	.	20
8	4	.	0	0	.	0	2500	.	20
9	1	3	75	1500	1	28	189873	0.39	20
9	2	.	0	0	.	0	2400	.	20
9	4	1	1	20	.	1	47814	.	20
10	1	1	26	520	.	26	81973	.	20
10	2	1	30	600	.	30	19866	.	20
10	3	.	0	0	.	0	2902	.	20
11	1	1	4	80	.	4	38230	.	20
11	2	7	41	820	0	6	136295	0.3	20

Appendix 2. The following tables show the number estimated divided by the number reported in LPL (RATIO), the number estimated (ESTNO), the estimated weight in kg (ESTWT), the number observed in NMFSO (NMFSO), the number reported in LPL (LPL), the number of hooks reported in LPL (HOOKS), the catch rate (CR), the average weight in kg (KG), and the number of fish measured (MEAS) for each species group in each area and quarter.

PELAGIC SHARKS

AREA	QUARTER	RATIO	ESTNO	ESTWT	NMFSO	LPL	HOOKS	KG	CR
0	1	.	2	240	.	0	18560	0.1	120
0	2	.	1	120	.	0	14831	0.09	120
0	3	4	4	480	.	1	19554	0.18	120
0	4	.	1	120	.	0	12210	0.05	120
1	1	1	53	6360	.	53	190553	.	120
1	2	1	1	120	.	1	13924	.	120
1	4	0	5	600	1	22	33219	0.17	120
2	1	4	66	7920	3	16	521420	0.13	120
2	2	0	0	0	0	10	573893	0	120
2	3	0	0	0	0	15	566018	0	120
2	4	0	0	0	0	57	497873	0	120
3	1	0	0	0	0	1	127687	0	120
3	2	0	0	0	0	7	246729	0	120
3	3	3	27	3240	0	10	94043	0.28	120
3	4	0	0	0	0	18	99814	0	120
4	1	0	0	0	0	4	148409	0	120
4	2	0	0	0	0	10	212536	0	120
4	3	1	4	480	.	4	74153	.	120
4	4	2	30	3600	2	15	83980	0.36	120
5	1	0	0	0	0	4	74280	0	120
5	2	3	107	12840	0	40	85240	1.25	120
5	3	1	26	3120	1	50	364861	0.07	120
5	4	3	21	2520	0	8	422624	0.05	120
6	2	.	0	0	.	0	42000	.	120
6	3	5	44	5280	1	9	520753	0.08	120
6	4	2	13	1560	1	6	155851	0.09	120
7	2	.	0	0	.	0	41700	.	120
7	3	1	262	31440	.	262	345672	.	120
7	4	.	0	0	.	0	99407	.	120
8	1	.	0	0	.	0	13795	.	120
8	2	.	0	0	.	0	2000	.	120
8	4	.	0	0	.	0	2500	.	120
9	1	3	5	600	0	2	189873	0.03	120
9	2	.	0	0	.	0	2400	.	120
9	4	.	0	0	.	0	47814	.	120
10	1	1	7	840	.	7	81973	.	120
10	2	.	0	0	.	0	19866	.	120
10	3	.	0	0	.	0	2902	.	120
11	1	1	6	720	.	6	38230	.	120
11	2	11	11	1320	1	1	136295	0.08	120

BLUE SHARKS

AREA	QUARTER	RATIO	ESTNO	ESTWT	NMFSO	LPL	HOOKS	CR	KG
0	1	3	5	185	.	2	18560	0.29	37
0	2	0	12	444	.	30	14831	0.82	37
0	3	4	14	518	.	4	19554	0.72	37
0	4	0	13	481	.	80	12210	1.05	37
1	1	1	61	2257	.	61	190553	.	37
1	2	1	1	37	.	1	13924	.	37
1	4	0	5	185	1	19	33219	0.17	37
2	1	.	0	0	0	0	521420	0	37
2	2	.	0	0	0	0	573893	0	37
2	3	.	0	0	0	0	566018	0	37
2	4	0	0	0	0	1	497873	0	37

3	1	2	27	999	1	13	127687	0.21	37
3	2	3	168	6216	5	51	246729	0.68	37
3	3	1	8	296	0	12	94043	0.08	37
3	4	0	0	0	0	1	99814	0	37
4	1	0	16	592	1	49	148409	0.11	37
4	2	1	28	1036	2	52	212536	0.13	37
4	3	.	0	0	.	0	74153	.	37
4	4	0	0	0	0	2	83980	0	37
5	1	0	144	5328	27	643	74280	1.93	37
5	2	1	240	8880	0	366	85240	2.82	37
5	3	1	130	4810	5	213	364861	0.36	37
5	4	1	508	18796	0	774	422624	1.2	37
6	2	1	13	481	.	13	42000	.	37
6	3	0	164	6068	1	518	520753	0.32	37
6	4	1	691	24876	52	879	155851	4.43	36
7	2	1	598	22126	.	598	41700	.	37
7	3	1	1090	40330	.	1090	345672	.	37
7	4	1	305	11285	.	305	99407	.	37
8	1	1	1	37	.	1	13795	.	37
8	2	.	0	0	.	0	2000	.	37
8	4	.	0	0	.	0	2500	.	37
9	1	1	26	962	0	39	189873	0.13	37
9	2	.	0	0	.	0	2400	.	37
9	4	1	5	185	.	5	47814	.	37
10	1	1	96	3552	.	96	81973	.	37
10	2	1	14	518	.	14	19866	.	37
10	3	1	18	666	.	18	2902	.	37
11	1	1	27	999	.	27	38230	.	37
11	2	1	68	2516	3	51	136295	0.5	37

COASTAL SHARKS

AREA	QUARTER	RATIO	ESTNO	ESTWT	NMFSO	LPL	HOOKS	CR	KG	0	1	.
0	0	.	0	18560	0	7						
0	2	1	1	7	.	1	14831	0.09	7			
0	3	0	1	7	.	4	19554	0.07	7			
0	4	.	2	14	.	0	12210	0.14	7			
1	1	1	2	14	.	2	190553	.	7			
1	2	.	0	0	.	0	13924	.	7			
1	4	.	0	0	0	0	33219	0	7			
2	1	0	0	0	0	12	521420	0	7			
2	2	12	94	658	2	8	573893	0.16	7			
2	3	9	113	791	3	12	566018	0.2	7			
2	4	6	169	1183	4	30	497873	0.34	7			
3	1	0	0	0	0	2	127687	0	7			
3	2	0	0	0	0	14	246729	0	7			
3	3	4	14	98	0	4	94043	0.15	7			
3	4	0	0	0	0	4	99814	0	7			
4	1	0	0	0	0	2	148409	0	7			
4	2	0	14	98	1	37	212536	0.07	7			
4	3	1	15	105	.	15	74153	.	7			
4	4	2	30	210	2	15	83980	0.36	7			
5	1	0	0	0	0	1	74280	0	7			
5	2	4	14	98	0	4	85240	0.16	7			
5	3	0	0	0	0	7	364861	0	7			
5	4	.	0	0	0	0	422624	.	7			
6	2	.	0	0	.	0	42000	.	7			
6	3	3	3	21	0	1	520753	0.01	7			
6	4	0	0	0	0	1	155851	0	7			
7	2	.	0	0	.	0	41700	.	7			
7	3	.	0	0	.	0	345672	.	7			
7	4	.	0	0	.	0	99407	.	7			
8	1	.	0	0	.	0	13795	.	7			
8	2	.	0	0	.	0	2000	.	7			
8	4	.	0	0	.	0	2500	.	7			
9	1	.	0	0	0	0	189873	.	7			
9	2	.	0	0	.	0	2400	.	7			
9	4	.	0	0	.	0	47814	.	7			
10	1	.	0	0	.	0	81973	.	7			
10	2	.	0	0	.	0	19866	.	7			
10	3	.	0	0	.	0	2902	.	7			
11	1	.	0	0	.	0	38230	.	7			
11	2	.	0	0	0	0	136295	.	7			

DUSKY SHARKS

AREA	QUARTER	RATIO	ESTNO	ESTWT	NMFSO	LPL	HOOKS	CR	KG
0	1	.	0	0	.	0	18560	0.02	29
0	2	10	10	290	.	1	14831	0.69	29
0	3	.	1	29	.	0	19554	0.05	29

0	4	.	1	29	.	0	12210	0.11	29
1	1	1	2	58	.	2	190553	.	29
1	2	.	0	0	.	0	13924	.	29
1	4	.	0	0	0	0	33219	0	29
2	1	0	0	0	0	5	521420	0	29
2	2	47	47	1363	1	1	573893	0.08	29
2	3	0	0	0	0	1	566018	0	29
2	4	0	0	0	0	2	497873	0	29
3	1	14	27	783	1	2	127687	0.21	29
3	2	7	101	2929	3	15	246729	0.41	29
3	3	9	9	261	0	1	94043	0.1	29
3	4	0	0	0	0	1	99814	0	29
4	1	0	0	0	0	5	148409	0	29
4	2	13	751	19526	54	60	212536	3.53	26
4	3	1	10	290	.	10	74153	.	29
4	4	2	75	2175	5	35	83980	0.89	29
5	1	.	0	0	0	0	74280	0	29
5	2	.	0	0	0	0	85240	.	29
5	3	5	26	754	1	5	364861	0.07	29
5	4	9	82	2378	0	9	422624	0.19	29
6	2	.	0	0	.	0	42000	.	29
6	3	9	55	1595	0	6	520753	0.11	29
6	4	0	0	0	0	2	155851	0	29
7	2	.	0	0	.	0	41700	.	29
7	3	.	0	0	.	0	345672	.	29
7	4	.	0	0	.	0	99407	.	29
8	1	.	0	0	.	0	13795	.	29
8	2	1	1	29	.	1	2000	.	29
8	4	.	0	0	.	0	2500	.	29
9	1	.	0	0	0	0	189873	.	29
9	2	.	0	0	.	0	2400	.	29
9	4	.	0	0	.	0	47814	.	29
10	1	.	0	0	.	0	81973	.	29
10	2	.	0	0	.	0	19866	.	29
10	3	.	0	0	.	0	2902	.	29
11	1	1	3	87	.	3	38230	.	29
11	2	9	46	1334	1	5	136295	0.34	29

SILKY SHARKS

AREA	QUARTER	RATIO	ESTNO	ESTWT	NMFSO	LPL	HOOKS	CR	KG
0	1	.	0	0	.	0	18560	0.02	11
0	2	4	4	44	.	1	14831	0.24	11
0	3	2	3	33	.	2	19554	0.14	11
0	4	.	3	33	.	0	12210	0.27	11
1	1	1	1	11	.	1	190553	.	11
1	2	.	0	0	.	0	13924	.	11
1	4	.	0	0	0	0	33219	0	11
2	1	0	0	0	0	17	521420	0	11
2	2	.	141	1551	3	0	573893	0.25	11
2	3	.	76	836	2	0	566018	0.13	11
2	4	0	0	0	0	12	497873	0	11
3	1	1	27	297	1	49	127687	0.21	11
3	2	1	67	737	2	95	246729	0.27	11
3	3	1	12	132	0	9	94043	0.13	11
3	4	2	35	385	2	21	99814	0.35	11
4	1	0	0	0	0	1	148409	0	11
4	2	1	83	913	6	66	212536	0.39	11
4	3	1	35	385	.	35	74153	.	11
4	4	6	359	3949	24	62	83980	4.28	11
5	1	.	0	0	0	0	74280	0	11
5	2	.	40	440	3	0	85240	0.47	11
5	3	.	155	1705	6	0	364861	0.43	11
5	4	.	0	0	0	0	422624	.	11
6	2	.	0	0	.	0	42000	.	11
6	3	1	5	55	0	4	520753	0.01	11
6	4	.	0	0	0	0	155851	0	11
7	2	.	0	0	.	0	41700	.	11
7	3	.	0	0	.	0	345672	.	11
7	4	.	0	0	.	0	99407	.	11
8	1	.	0	0	.	0	13795	.	11
8	2	.	0	0	.	0	2000	.	11
8	4	.	0	0	.	0	2500	.	11
9	1	.	0	0	0	0	189873	.	11
9	2	.	0	0	.	0	2400	.	11
9	4	.	0	0	.	0	47814	.	11
10	1	.	0	0	.	0	81973	.	11
10	2	.	0	0	.	0	19866	.	11
10	3	.	0	0	.	0	2902	.	11
11	1	.	0	0	.	0	38230	.	11
11	2	.	0	0	0	0	136295	.	11

HAMMERHEAD SHARKS

AREA	QUARTER	RATIO	ESTNO	ESTWT	NMFSO	LPL	HOOKS	KG	CR	
0	1	.	1	83	.	0	18560	0.04		83
0	2	.	4	332	.	0	14831	0.24		83
0	3	.	1	83	.	0	19554	0.03		83
0	4	.	0	0	.	0	12210	0.02		83
1	1	.	0	0	.	0	190553	.		83
1	2	1	1	83	.	1	13924	.		83
1	4	.	0	0	0	0	33219	0		83
2	1	0	0	0	0	1	521420	0		83
2	2	.	0	0	0	0	573893	0		83
2	3	0	0	0	0	2	566018	0		83
2	4	.	0	0	0	0	497873	0		83
3	1	0	0	0	0	5	127687	0		83
3	2	0	0	0	0	41	246729	0		83
3	3	2	10	830	0	5	94043	0.11		83
3	4	2	17	1411	1	10	99814	0.17		83
4	1	1	16	1328	1	11	148409	0.11		83
4	2	5	250	20750	18	54	212536	1.18		83
4	3	1	1	83	.	1	74153	.		83
4	4	.	0	0	0	0	83980	0		83
5	1	1	37	3071	7	47	74280	0.5		83
5	2	2	82	6806	7	35	85240	0.96		83
5	3	3	52	4316	2	17	364861	0.14		83
5	4	2	10	830	0	5	422624	0.02		83
6	2	.	0	0	.	0	42000	.		83
6	3	.	0	0	0	0	520753	.		83
6	4	.	0	0	0	0	155851	0		83
7	2	.	0	0	.	0	41700	.		83
7	3	.	0	0	.	0	345672	.		83
7	4	.	0	0	.	0	99407	.		83
8	1	.	0	0	.	0	13795	.		83
8	2	.	0	0	.	0	2000	.		83
8	4	.	0	0	.	0	2500	.		83
9	1	.	0	0	0	0	189873	.		83
9	2	.	0	0	.	0	2400	.		83
9	4	.	0	0	.	0	47814	.		83
10	1	.	0	0	.	0	81973	.		83
10	2	.	0	0	.	0	19866	.		83
10	3	.	0	0	.	0	2902	.		83
11	1	.	0	0	.	0	38230	.		83
11	2	.	0	0	0	0	136295	.		83

NIGHT SHARKS

AREA	QUARTER	RATIO	ESTNO	ESTWT	NMFSO	LPL	HOOKS	CR	KG
0	1	.	5	110	.	0	18560	0.27	22
0	2	4	4	88	.	1	14831	0.3	22
0	3	.	1	22	.	0	19554	0.05	22
0	4	.	0	0	.	0	12210	0.01	22
1	1	.	0	0	.	0	190553	.	22
1	2	.	0	0	.	0	13924	.	22
1	4	.	0	0	0	0	33219	0	22
2	1	2	22	484	1	11	521420	0.04	22
2	2	.	0	0	0	0	573893	0	22
2	3	.	0	0	0	0	566018	0	22
2	4	.	0	0	0	0	497873	0	22
3	1	**	320	7040	12	1	127687	2.5	22
3	2	0	0	0	0	2	246729	0	22
3	3	10	20	440	0	2	94043	0.21	22
3	4	.	0	0	0	0	99814	0	22
4	1	32	32	704	2	1	148409	0.21	22
4	2	8	417	9174	30	51	212536	1.96	22
4	3	1	71	1562	.	71	74153	.	22
4	4	1	15	330	1	28	83980	0.18	22
5	1	.	0	0	0	0	74280	0	22
5	2	.	0	0	0	0	85240	.	22
5	3	.	0	0	0	0	364861	0	22
5	4	.	0	0	0	0	422624	.	22
6	2	.	0	0	.	0	42000	.	22
6	3	.	0	0	0	0	520753	.	22
6	4	.	0	0	0	0	155851	0	22
7	2	.	0	0	.	0	41700	.	22
7	3	.	0	0	.	0	345672	.	22
7	4	.	0	0	.	0	99407	.	22
8	1	.	0	0	.	0	13795	.	22
8	2	.	0	0	.	0	2000	.	22
8	4	.	0	0	.	0	2500	.	22
9	1	.	0	0	0	0	189873	.	22

9	2	.	0	0	.	0	2400	.	22
9	4	.	0	0	.	0	47814	.	22
10	1	.	0	0	.	0	81973	.	22
10	2	.	0	0	.	0	19866	.	22
10	3	.	0	0	.	0	2902	.	22
11	1	.	0	0	.	0	38230	.	22
11	2	.	0	0	0	0	136295	.	22

Appendix 3. GLMS from catch rate calculations.

swordfish GLM

General Linear Models Procedure

Dependent Variable: LCR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	75.8284746	2.1665278	13.36	0.0001
Error	19	3.0815199	0.1621853		
Corrected Total	54	78.9099945			

R-Square	C.V.	Root MSE	LCR Mean
0.960949	45.85276	0.40272	0.87829

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AQ	34	63.9226020	1.8800765	11.59	0.0001
SOURCE	1	11.9058726	11.9058726	73.41	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AQ	34	56.2953560	1.6557458	10.21	0.0001
SOURCE	1	11.9058726	11.9058726	73.41	0.0001

Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		1.436263108 B	4.92	0.0001	0.29180003
AQ	11	-0.053789585 B	-0.11	0.9150	0.49732536
	12	1.521072941 B	3.06	0.0065	0.49732536
	14	1.295996526 B	3.22	0.0045	0.40272231
	21	-0.370193728 B	-0.92	0.3695	0.40272231

General Linear Models Procedure

Dependent Variable: LCR

Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
AQ	22	-1.137187917 B	-2.82	0.0108	0.40272231
	23	-1.490905213 B	-3.70	0.0015	0.40272231
	24	-0.675394267 B	-1.68	0.1099	0.40272231
	31	0.944362684 B	2.34	0.0300	0.40272231
	32	-0.203697928 B	-0.51	0.6188	0.40272231
	33	1.968056568 B	4.89	0.0001	0.40272231
	34	1.424413461 B	3.54	0.0022	0.40272231
	41	1.265013517 B	3.14	0.0054	0.40272231
	42	0.846854704 B	2.10	0.0490	0.40272231
	43	1.800795669 B	3.62	0.0018	0.49732536
	44	2.092587637 B	5.20	0.0001	0.40272231
	51	0.997086282 B	2.48	0.0229	0.40272231
	52	-0.763570987 B	-1.90	0.0733	0.40272231
	53	-0.253970529 B	-0.63	0.5358	0.40272231
	54	-0.552589263 B	-1.37	0.1860	0.40272231
	62	-1.138353398 B	-2.29	0.0337	0.49732536
	63	0.129207401 B	0.32	0.7518	0.40272231
	64	-0.069747411 B	-0.17	0.8643	0.40272231
	72	-0.386744434 B	-0.78	0.4464	0.49732536
	73	0.548723519 B	1.10	0.2837	0.49732536
	74	0.573107603 B	1.15	0.2635	0.49732536
	81	-1.359991055 B	-2.73	0.0132	0.49732536

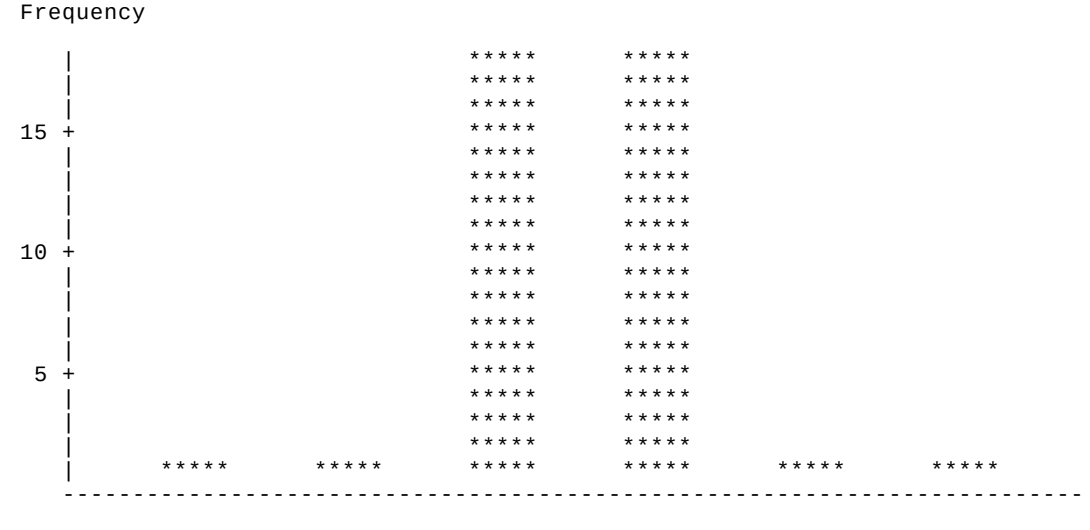
	82	-1.038269940 B	-2.09	0.0505	0.49732536
	91	-0.838531088 B	-2.08	0.0511	0.40272231
	92	0.725318652 B	1.46	0.1611	0.49732536
	94	-1.268002264 B	-2.55	0.0196	0.49732536
	101	-0.176801706 B	-0.36	0.7261	0.49732536
	102	-0.156078657 B	-0.31	0.7571	0.49732536
	103	-0.717375733 B	-1.44	0.1655	0.49732536
AQ	111	-0.587545925 B	-1.18	0.2520	0.49732536
	112	0.000000000 B	.	.	.
SOURCE	1	-1.091140349 B	-8.57	0.0001	0.12735198
	2	0.000000000 B	.	.	.

General Linear Models Procedure
Least Squares Means

AQ	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
11	0.83690335	0.40772526	0.0541
12	2.41176587	0.40772526	0.0001
14	2.18668946	0.28476767	0.0001
21	0.52049921	0.28476767	0.0833
22	-0.24649498	0.28476767	0.3975
23	-0.60021228	0.28476767	0.0486
24	0.21529867	0.28476767	0.4589
31	1.83505562	0.28476767	0.0001
32	0.68699501	0.28476767	0.0261
33	2.85874950	0.28476767	0.0001
34	2.31510639	0.28476767	0.0001
41	2.15570645	0.28476767	0.0001
42	1.73754764	0.28476767	0.0001
43	2.69148860	0.40772526	0.0001
44	2.98328057	0.28476767	0.0001
51	1.88777922	0.28476767	0.0001
52	0.12712195	0.28476767	0.6604
53	0.63672240	0.28476767	0.0376
54	0.33810367	0.28476767	0.2497
62	-0.24766046	0.40772526	0.5508
63	1.01990033	0.28476767	0.0020
64	0.82094552	0.28476767	0.0095
72	0.50394850	0.40772526	0.2315
73	1.43941645	0.40772526	0.0022
74	1.46380054	0.40772526	0.0020
81	-0.46929812	0.40772526	0.2640
82	-0.14757701	0.40772526	0.7214
91	0.05216185	0.28476767	0.8566
92	1.61601159	0.40772526	0.0008
94	-0.37730933	0.40772526	0.3664
101	0.71389123	0.40772526	0.0961
102	0.73461428	0.40772526	0.0875
103	0.17331720	0.40772526	0.6756
111	0.30314701	0.40772526	0.4663
112	0.89069293	0.28476767	0.0055

SOURCE	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
1	0.42780436	0.06807249	0.0001
2	1.51894471	0.10763206	0.0001

swordfish catch rate residuals



-3.0 -1.8 -0.6 0.6 1.8 3.0

RESID Midpoint

blue_marlin GLM
General Linear Models Procedure

Dependent Variable: LCR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	23	58.6188817	2.5486470	7.35	0.0033
Error	8	2.7741115	0.3467639		
Corrected Total	31	61.3929932			

R-Square	C.V.	Root MSE	LCR Mean
0.954814	-20.90034	0.58887	-2.81750

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AQ	22	40.2804021	1.8309274	5.28	0.0102
SOURCE	1	18.3384796	18.3384796	52.88	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AQ	22	46.2148700	2.1006759	6.06	0.0065
SOURCE	1	18.3384796	18.3384796	52.88	0.0001

Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		-1.797492525 B	-2.76	0.0246	0.65101659
AQ	11	1.274329196 B	1.53	0.1645	0.83278322
	12	4.227117833 B	5.08	0.0010	0.83278322
	14	0.501256221 B	0.68	0.5142	0.73444576
	21	-1.096186005 B	-1.49	0.1739	0.73444576
AQ	22	-0.421550546 B	-0.57	0.5818	0.73444576
	23	0.852613566 B	1.16	0.2792	0.73444576
	24	-0.196911082 B	-0.24	0.8190	0.83278322
	31	-1.033372591 B	-1.24	0.2498	0.83278322
	32	1.193348544 B	1.62	0.1429	0.73444576
	33	1.218367390 B	1.46	0.1816	0.83278322
	34	-0.787099088 B	-0.95	0.3723	0.83278322
	41	-0.490615430 B	-0.59	0.5720	0.83278322
	42	0.083355229 B	0.11	0.9124	0.73444576
	43	1.119516752 B	1.34	0.2157	0.83278322
	44	0.771925051 B	0.93	0.3811	0.83278322
	53	-0.772244302 B	-1.05	0.3238	0.73444576
	63	0.385874542 B	0.53	0.6136	0.73444576
	64	-0.948929786 B	-1.29	0.2324	0.73444576
	91	0.967749211 B	1.16	0.2787	0.83278322
	101	1.974768798 B	2.37	0.0452	0.83278322
	102	3.225094911 B	3.87	0.0047	0.83278322
	111	1.964348287 B	2.36	0.0460	0.83278322
	112	0.000000000 B	.	.	.
SOURCE	1	-2.018716841 B	-7.27	0.0001	0.27759441
	2	0.000000000 B	.	.	.

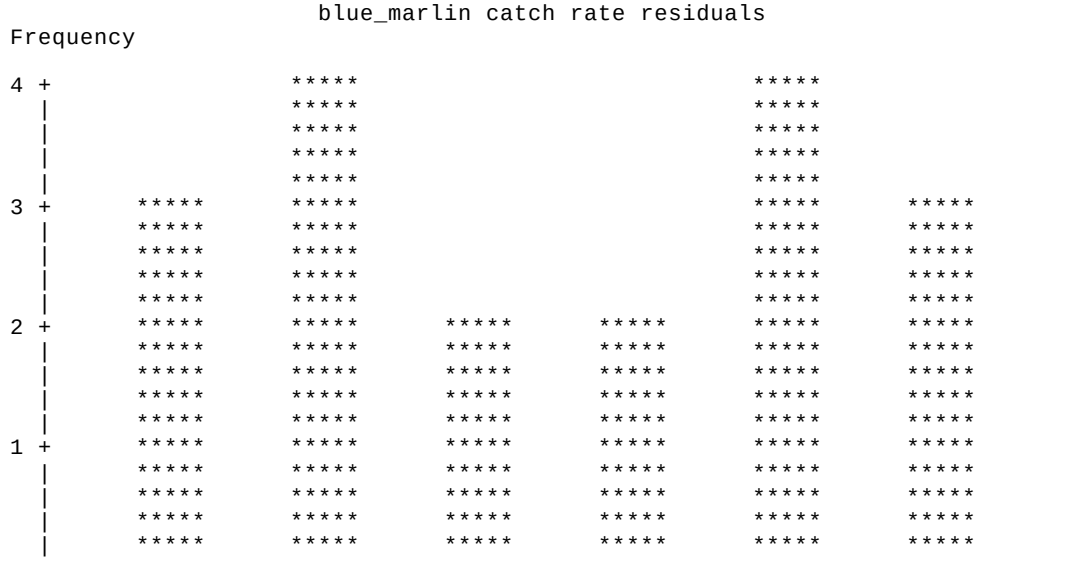
General Linear Models Procedure
Least Squares Means

AQ	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
11	-1.53252175	0.60500298	0.0351
12	1.42026689	0.60500298	0.0469
14	-2.30559472	0.41639161	0.0005
21	-3.90303695	0.41639161	0.0001
22	-3.22840149	0.41639161	0.0001
23	-1.95423738	0.41639161	0.0016
24	-3.00376203	0.60500298	0.0011
31	-3.84022354	0.60500298	0.0002
32	-1.61350240	0.41639161	0.0047
33	-1.58848356	0.60500298	0.0304
34	-3.59395003	0.60500298	0.0003
41	-3.29746637	0.60500298	0.0006

42	-2.72349572	0.41639161	0.0002
43	-1.68733419	0.60500298	0.0236
44	-2.03492589	0.60500298	0.0099
53	-3.57909525	0.41639161	0.0001
63	-2.42097640	0.41639161	0.0004
64	-3.75578073	0.41639161	0.0001
91	-1.83910173	0.60500298	0.0161
101	-0.83208215	0.60500298	0.2063
102	0.41824397	0.60500298	0.5089
111	-0.84250266	0.60500298	0.2012
112	-2.80685095	0.60500298	0.0017

SOURCE	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
1	-3.20695907	0.12278719	0.0001
2	-1.18824223	0.24896177	0.0014

blue_marlin catch rate residuals



white_marlin GLM

General Linear Models Procedure

Dependent Variable: LCR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	27	95.6632716	3.5430841	9.79	0.0002
Error	11	3.9800008	0.3618183		
Corrected Total	38	99.6432724			

R-Square	C.V.	Root MSE	LCR Mean
0.960058	-24.14008	0.60151	-2.49176

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AQ	26	73.4521737	2.8250836	7.81	0.0005
SOURCE	1	22.2110979	22.2110979	61.39	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AQ	26	66.3685381	2.5526361	7.06	0.0008
SOURCE	1	22.2110979	22.2110979	61.39	0.0001

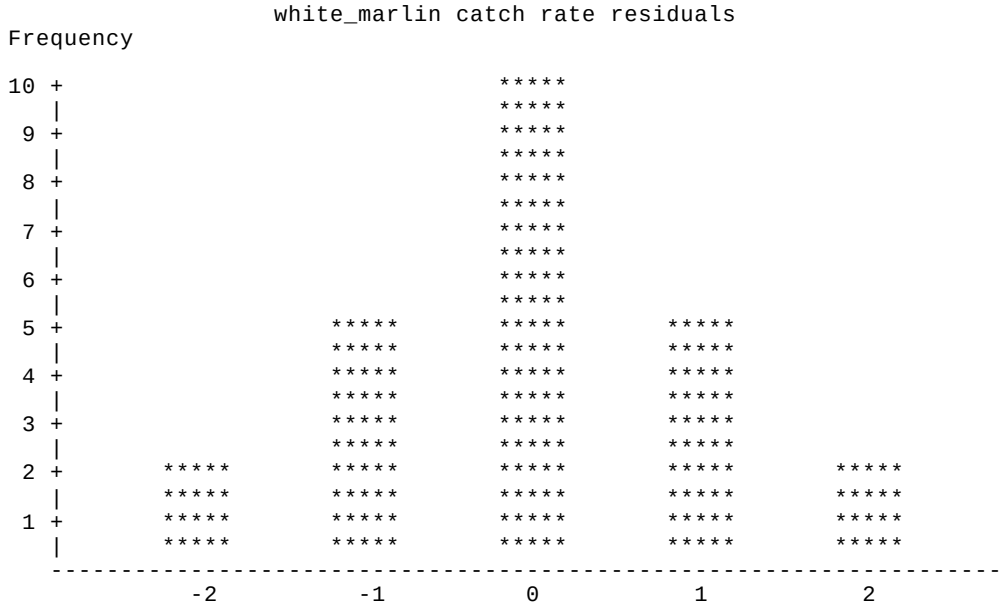
Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		-1.199043045 B	-1.85	0.0920	0.64970862
AQ	11	0.645720536 B	0.76	0.4638	0.85066827
	12	3.054397573 B	3.59	0.0042	0.85066827

	14	1.377719110	B	1.84	0.0922	0.74686220
	21	-0.957676377	B	-1.28	0.2261	0.74686220
AQ	22	-1.370416778	B	-1.83	0.0937	0.74686220
	23	0.254470325	B	0.34	0.7397	0.74686220
	24	-1.141372690	B	-1.34	0.2067	0.85066827
	31	-0.368322091	B	-0.42	0.6854	0.88540361
	32	1.326622522	B	1.78	0.1033	0.74686220
	34	-1.480246269	B	-1.74	0.1097	0.85066827
	41	-0.765608839	B	-1.03	0.3273	0.74686220
	42	0.511774105	B	0.69	0.5074	0.74686220
	43	-1.183068341	B	-1.39	0.1918	0.85066827
	52	-0.297777159	B	-0.40	0.6977	0.74686220
	53	-0.175589307	B	-0.24	0.8184	0.74686220
	54	-2.923420710	B	-3.44	0.0056	0.85066827
	63	-0.318815307	B	-0.43	0.6777	0.74686220
	64	-0.352274792	B	-0.47	0.6464	0.74686220
	73	-2.029280983	B	-2.39	0.0361	0.85066827
	74	-1.476160349	B	-1.74	0.1106	0.85066827
	81	1.885050338	B	2.22	0.0487	0.85066827
	91	0.264397327	B	0.35	0.7300	0.74686220
	94	-0.744256299	B	-0.87	0.4003	0.85066827
	101	1.974768798	B	2.32	0.0405	0.85066827
	102	3.535249839	B	4.16	0.0016	0.85066827
	111	0.865735998	B	1.02	0.3307	0.85066827
	112	0.000000000	B	.	.	.
SOURCE	1	-1.924019140	B	-7.84	0.0001	0.24556678
	2	0.000000000	B	.	.	.

General Linear Models Procedure
Least Squares Means

AQ	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
11	-1.51533208	0.61391694	0.0312
12	0.89334496	0.61391694	0.1736
14	-0.78333351	0.42533414	0.0926
21	-3.11872899	0.42533414	0.0001
22	-3.53146939	0.42533414	0.0001
23	-1.90658229	0.42533414	0.0009
24	-3.30242531	0.61391694	0.0002
31	-2.52937471	0.61391694	0.0017
32	-0.83443009	0.42533414	0.0756
34	-3.64129888	0.61391694	0.0001
41	-2.92666145	0.42533414	0.0001
42	-1.64927851	0.42533414	0.0026
43	-3.34412096	0.61391694	0.0002
52	-2.45882977	0.42533414	0.0001
53	-2.33664192	0.42533414	0.0002
54	-5.08447332	0.61391694	0.0001
63	-2.47986792	0.42533414	0.0001
64	-2.51332741	0.42533414	0.0001
73	-4.19033360	0.61391694	0.0001
74	-3.63721296	0.61391694	0.0001
81	-0.27600228	0.61391694	0.6617
91	-1.89665529	0.42533414	0.0010
94	-2.90530891	0.61391694	0.0006
101	-0.18628382	0.61391694	0.7672
102	1.37419722	0.61391694	0.0468
111	-1.29531662	0.61391694	0.0586
112	-2.16105262	0.61391694	0.0048

SOURCE	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
1	-3.11892810	0.12031641	0.0001
2	-1.19490896	0.20859251	0.0001



RESID Midpoint

sailfish GLM

General Linear Models Procedure

Dependent Variable: LCR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	22	75.5665391	3.4348427	7.54	0.0168
Error	5	2.2768250	0.4553650		
Corrected Total	27	77.8433641			

R-Square	C.V.	Root MSE	LCR Mean
0.970751	-24.65274	0.67481	-2.73725

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AQ	21	61.7203991	2.9390666	6.45	0.0238
SOURCE	1	13.8461400	13.8461400	30.41	0.0027

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AQ	21	54.9143789	2.6149704	5.74	0.0307
SOURCE	1	13.8461400	13.8461400	30.41	0.0027

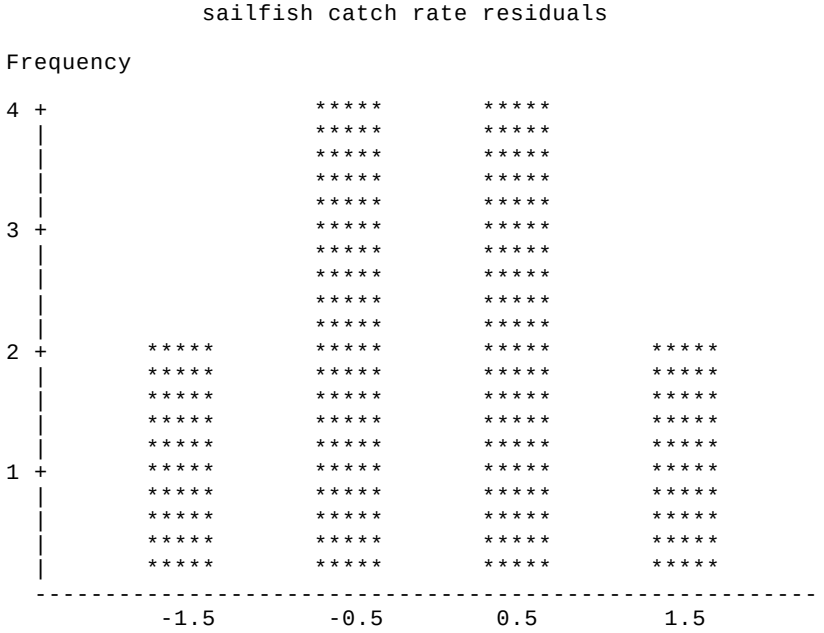
Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		-0.081056006 B	-0.16	0.8812	0.51539265
AQ	11	-1.228771344 B	-1.45	0.2075	0.84911400
	12	1.205223500 B	1.42	0.2150	0.84911400
	14	-1.273722443 B	-1.50	0.1939	0.84911400
	21	-2.235396832 B	-2.63	0.0464	0.84911400
AQ	22	-1.453328266 B	-2.15	0.0839	0.67480738
	23	0.243643733 B	0.36	0.7328	0.67480738
	24	-1.901503925 B	-2.24	0.0753	0.84911400
	31	-2.620182399 B	-3.09	0.0273	0.84911400
	32	-0.444575132 B	-0.66	0.5391	0.67480738
	33	0.458236156 B	0.54	0.6126	0.84911400
	34	-2.373908896 B	-2.80	0.0382	0.84911400
	42	-1.298769684 B	-1.92	0.1123	0.67480738
	43	0.321164304 B	0.38	0.7208	0.84911400
	44	-2.201179117 B	-2.59	0.0487	0.84911400
	53	-3.117014645 B	-4.62	0.0057	0.67480738
	63	-3.332729103 B	-3.92	0.0111	0.84911400
	91	-2.323808689 B	-2.74	0.0410	0.84911400
	101	0.656222977 B	0.77	0.4746	0.84911400
	102	-0.759610170 B	-0.89	0.4120	0.84911400
	103	2.262611692 B	2.66	0.0446	0.84911400
	111	0.377538479 B	0.44	0.6752	0.84911400
	112	0.000000000 B	.	.	.
SOURCE	1	-2.148343551 B	-5.51	0.0027	0.38960022
	2	0.000000000 B	.	.	.

Least Squares Means

AQ	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
11	-2.38399913	0.70236179	0.0194
12	0.04999572	0.70236179	0.9460
14	-2.42895023	0.70236179	0.0181
21	-3.39062461	0.70236179	0.0048
22	-2.60855605	0.47716088	0.0028
23	-0.91158405	0.47716088	0.1143
24	-3.05673171	0.70236179	0.0073
31	-3.77541018	0.70236179	0.0030
32	-1.59980291	0.47716088	0.0203
33	-0.69699163	0.70236179	0.3666
34	-3.52913668	0.70236179	0.0040
42	-2.45399747	0.47716088	0.0036
43	-0.83406348	0.70236179	0.2884
44	-3.35640690	0.70236179	0.0050
53	-4.27224243	0.47716088	0.0003
63	-4.48795688	0.70236179	0.0014
91	-3.47903647	0.70236179	0.0043

101	-0.49900480	0.70236179	0.5092
102	-1.91483795	0.70236179	0.0415
103	1.10738391	0.70236179	0.1757
111	-0.77768930	0.70236179	0.3186
112	-1.15522778	0.47716088	0.0600

SOURCE	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
1	-3.18575682	0.14386942	0.0001
2	-1.03741327	0.36206343	0.0352



General Linear Models Procedure

Dependent Variable: LCR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	29	126.908500	4.376155	7.54	0.0017
Error	9	5.223774	0.580419		
Corrected Total	38	132.132274			

R-Square	C.V.	Root MSE	LCR Mean
0.960466	-89.76768	0.76185	-0.84869

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AQ	28	126.022064	4.500788	7.75	0.0015
SOURCE	1	0.886436	0.886436	1.53	0.2478

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AQ	28	126.896578	4.532021	7.81	0.0015
SOURCE	1	0.886436	0.886436	1.53	0.2478

Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		-0.694975981 B	-1.23	0.2499	0.56500498
AQ	11	-0.865135391 B	-0.91	0.3855	0.94849879
	12	-2.359692854 B	-2.49	0.0345	0.94849879
	14	-0.695500277 B	-0.91	0.3851	0.76185256
	24	-5.936423908 B	-6.26	0.0001	0.94849879
AQ	31	-1.441550319 B	-1.89	0.0910	0.76185256
	32	-0.496755140 B	-0.65	0.5307	0.76185256

	33	-1.784924359 B	-1.88	0.0925	0.94849879
	34	-4.329387338 B	-4.56	0.0014	0.94849879
	41	-1.189449937 B	-1.56	0.1529	0.76185256
	42	-1.236380383 B	-1.62	0.1391	0.76185256
	44	-3.463510379 B	-3.65	0.0053	0.94849879
	51	1.892919245 B	2.48	0.0347	0.76185256
	52	1.731083642 B	1.83	0.1013	0.94849879
	53	-0.302428840 B	-0.40	0.7006	0.76185256
	54	0.879010095 B	0.93	0.3782	0.94849879
	62	-0.898799145 B	-0.95	0.3681	0.94849879
	63	-0.459458667 B	-0.60	0.5613	0.76185256
	64	2.093682125 B	2.75	0.0225	0.76185256
	72	2.937010741 B	3.10	0.0128	0.94849879
	73	1.422363743 B	1.50	0.1680	0.94849879
	74	1.395010359 B	1.47	0.1754	0.94849879
	81	-2.350385092 B	-2.48	0.0351	0.94849879
	91	-1.308872665 B	-1.38	0.2009	0.94849879
	94	-1.983959455 B	-2.09	0.0660	0.94849879
	101	0.431879383 B	0.46	0.6597	0.94849879
	102	-0.076031282 B	-0.08	0.9379	0.94849879
	103	2.098892719 B	2.21	0.0542	0.94849879
	111	-0.073862566 B	-0.08	0.9396	0.94849879
	112	0.000000000 B	.	.	.
SOURCE	1	0.421054865 B	1.24	0.2478	0.34071082
	2	0.000000000 B	.	.	.

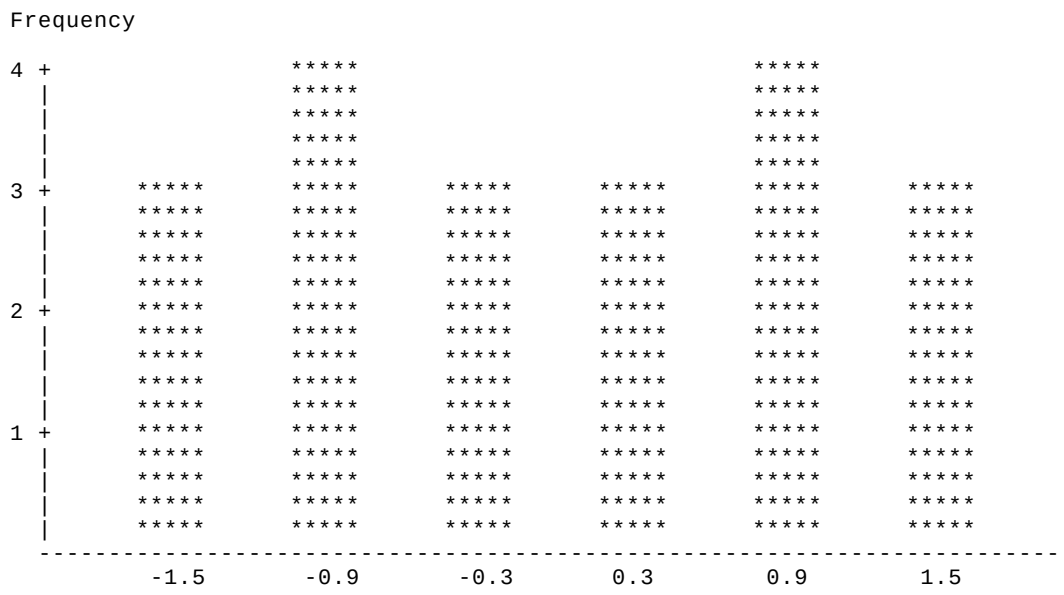
General Linear Models Procedure
Least Squares Means

AQ	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
11	-1.34958394	0.78066656	0.1179
12	-2.84414140	0.78066656	0.0054
14	-1.17994883	0.53871111	0.0562
24	-6.42087246	0.78066656	0.0001
31	-1.92599887	0.53871111	0.0060
32	-0.98120369	0.53871111	0.1019
33	-2.26937291	0.78066656	0.0174
34	-4.81383589	0.78066656	0.0002
41	-1.67389849	0.53871111	0.0126
42	-1.72082893	0.53871111	0.0109
44	-3.94795893	0.78066656	0.0007
51	1.40847070	0.53871111	0.0281
52	1.24663509	0.78066656	0.1448
53	-0.78687739	0.53871111	0.1781
54	0.39456155	0.78066656	0.6254
62	-1.38324769	0.78066656	0.1102
63	-0.94390722	0.53871111	0.1137
64	1.60923358	0.53871111	0.0153
72	2.45256219	0.78066656	0.0119
73	0.93791519	0.78066656	0.2602
74	0.91056181	0.78066656	0.2734
81	-2.83483364	0.78066656	0.0055
91	-1.79332121	0.78066656	0.0472
94	-2.46840800	0.78066656	0.0115
101	-0.05256917	0.78066656	0.9478
102	-0.56047983	0.78066656	0.4910
103	1.61444417	0.78066656	0.0686
111	-0.55831111	0.78066656	0.4926
112	-0.48444855	0.53871111	0.3919

Least Squares Means

SOURCE	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
1	-0.83842649	0.14147247	0.0002
2	-1.25948136	0.30995065	0.0028

blue_shark catch rate residuals



pelagic_shark GLM

General Linear Models Procedure

Dependent Variable: LCR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	26	40.2601091	1.5484657	1.02	0.5399
Error	6	9.0811752	1.5135292		
Corrected Total	32	49.3412843			

R-Square	C.V.	Root MSE	LCR Mean
0.815952	-47.59006	1.23026	-2.58511

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AQ	25	36.8904093	1.4756164	0.97	0.5681
SOURCE	1	3.3696999	3.3696999	2.23	0.1863

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AQ	25	35.4917891	1.4196716	0.94	0.5914
SOURCE	1	3.3696999	3.3696999	2.23	0.1863

Dependent Variable: LCR

Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		-2.509062937 B	-2.70	0.0357	0.92998593
AQ	11	2.210633624 B	1.43	0.2017	1.54220719
	12	0.856658112 B	0.56	0.5987	1.54220719
	14	1.893020421 B	1.54	0.1748	1.23025574
	21	0.227512108 B	0.18	0.8594	1.23025574
	22	-0.559585793 B	-0.36	0.7292	1.54220719
	23	-0.140303597 B	-0.09	0.9305	1.54220719
	24	1.322978325 B	0.86	0.4239	1.54220719
	31	-1.359309875 B	-0.88	0.4120	1.54220719
	32	-0.072108337 B	-0.05	0.9642	1.54220719
	33	1.249105050 B	0.81	0.4489	1.54220719

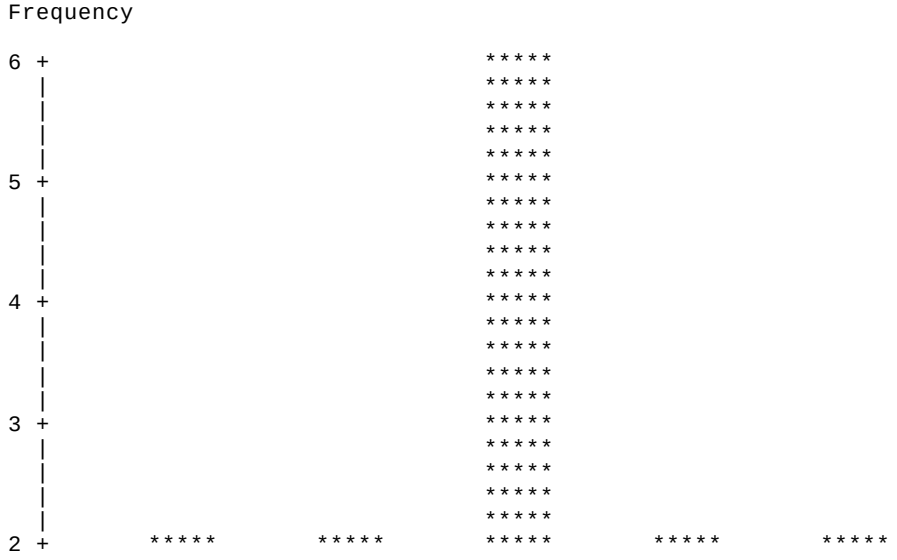
	34	1.777335386	B	1.15	0.2930	1.54220719
	41	-0.123405533	B	-0.08	0.9388	1.54220719
	42	0.433745789	B	0.28	0.7880	1.54220719
	43	0.570435917	B	0.37	0.7242	1.54220719
	44	1.622701503	B	1.32	0.2353	1.23025574
	51	0.568724707	B	0.37	0.7250	1.54220719
	52	2.733680729	B	1.77	0.1267	1.54220719
	53	0.683436584	B	0.56	0.5986	1.23025574
	54	-0.476769271	B	-0.31	0.7677	1.54220719
	63	0.029384961	B	0.02	0.9817	1.23025574
	64	0.139766512	B	0.11	0.9133	1.23025574
	73	3.213126237	B	2.08	0.0823	1.54220719
	91	-1.062936165	B	-0.69	0.5164	1.54220719
	101	1.029792306	B	0.67	0.5291	1.54220719
	111	1.638411003	B	1.06	0.3289	1.54220719
	112	0.000000000	B	.	.	.
SOURCE	1	-0.981209145	B	-1.49	0.1863	0.65759936
	2	0.000000000	B	.	.	.

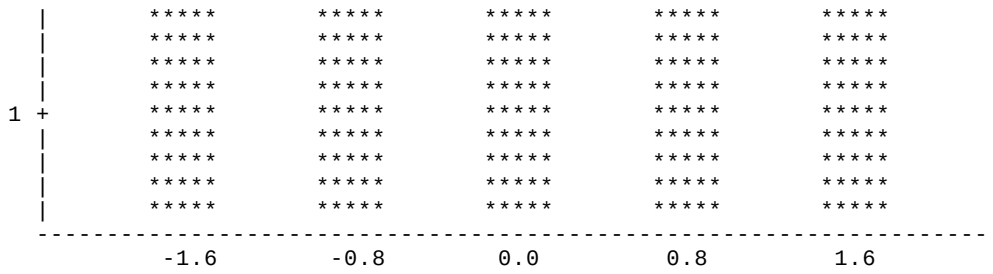
Least Squares Means

AQ	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
11	-0.78903388	1.27343568	0.5583
12	-2.14300940	1.27343568	0.1434
14	-1.10664709	0.86992218	0.2504
21	-2.77215540	0.86992218	0.0189
22	-3.55925330	1.27343568	0.0314
23	-3.13997111	1.27343568	0.0487
24	-1.67668918	1.27343568	0.2360
31	-4.35897738	1.27343568	0.0141
32	-3.07177585	1.27343568	0.0524
33	-1.75056246	1.27343568	0.2184
34	-1.22233212	1.27343568	0.3742
41	-3.12307304	1.27343568	0.0496
42	-2.56592172	1.27343568	0.0905
43	-2.42923159	1.27343568	0.1051
44	-1.37696601	0.86992218	0.1645
51	-2.43094280	1.27343568	0.1049
52	-0.26598678	1.27343568	0.8415
53	-2.31623092	0.86992218	0.0374
54	-3.47643678	1.27343568	0.0342
63	-2.97028255	0.86992218	0.0142
64	-2.85990100	0.86992218	0.0167
73	0.21345873	1.27343568	0.8724
91	-4.06260367	1.27343568	0.0188
101	-1.96987520	1.27343568	0.1729
111	-1.36125651	1.27343568	0.3262
112	-2.99966751	0.86992218	0.0137

SOURCE	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
1	-2.78234782	0.24127300	0.0001
2	-1.80113868	0.61173871	0.0258

pelagic_shark catch rate residuals





dusky GLM

General Linear Models Procedure

Dependent Variable: LCR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	20	95.0844874	4.7542244	10.47	0.0039
Error	6	2.7247613	0.4541269		
Corrected Total	26	97.8092487			

R-Square	C.V.	Root MSE	LCR Mean
0.972142	-22.16173	0.67389	-3.04078

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AQ	19	77.9334228	4.1017591	9.03	0.0059
SOURCE	1	17.1510646	17.1510646	37.77	0.0009

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AQ	19	58.6938683	3.0891510	6.80	0.0126
SOURCE	1	17.1510646	17.1510646	37.77	0.0009

Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		-1.088117021 B	-2.14	0.0766	0.50941248
AQ	11	-1.255003105 B	-1.49	0.1879	0.84476503
	21	-1.345337861 B	-1.59	0.1624	0.84476503
	22	-2.232400575 B	-3.31	0.0162	0.67388937
	23	-3.036845795 B	-3.59	0.0114	0.84476503
AQ	24	-2.215417759 B	-2.62	0.0395	0.84476503
	31	-0.666951403 B	-0.99	0.3605	0.67388937
	32	0.346444337 B	0.51	0.6256	0.67388937
	33	-1.241972039 B	-1.47	0.1919	0.84476503
	34	-1.301528369 B	-1.54	0.1743	0.84476503
	41	-0.088753978 B	-0.11	0.9197	0.84476503
	42	2.193588476 B	3.26	0.0174	0.67388937
	43	1.298234652 B	1.54	0.1753	0.84476503
	44	1.699776843 B	2.52	0.0451	0.67388937
	53	-1.272574918 B	-1.89	0.1079	0.67388937
	54	-0.547478232 B	-0.65	0.5409	0.84476503
	63	-1.161736287 B	-1.38	0.2182	0.84476503
	64	-1.053973157 B	-1.25	0.2586	0.84476503
	82	2.608632905 B	3.09	0.0214	0.84476503
	111	0.756771826 B	0.90	0.4048	0.84476503
	112	0.000000000 B	.	.	.
SOURCE	1	-2.213663064 B	-6.15	0.0009	0.36020902
	2	0.000000000 B	.	.	.

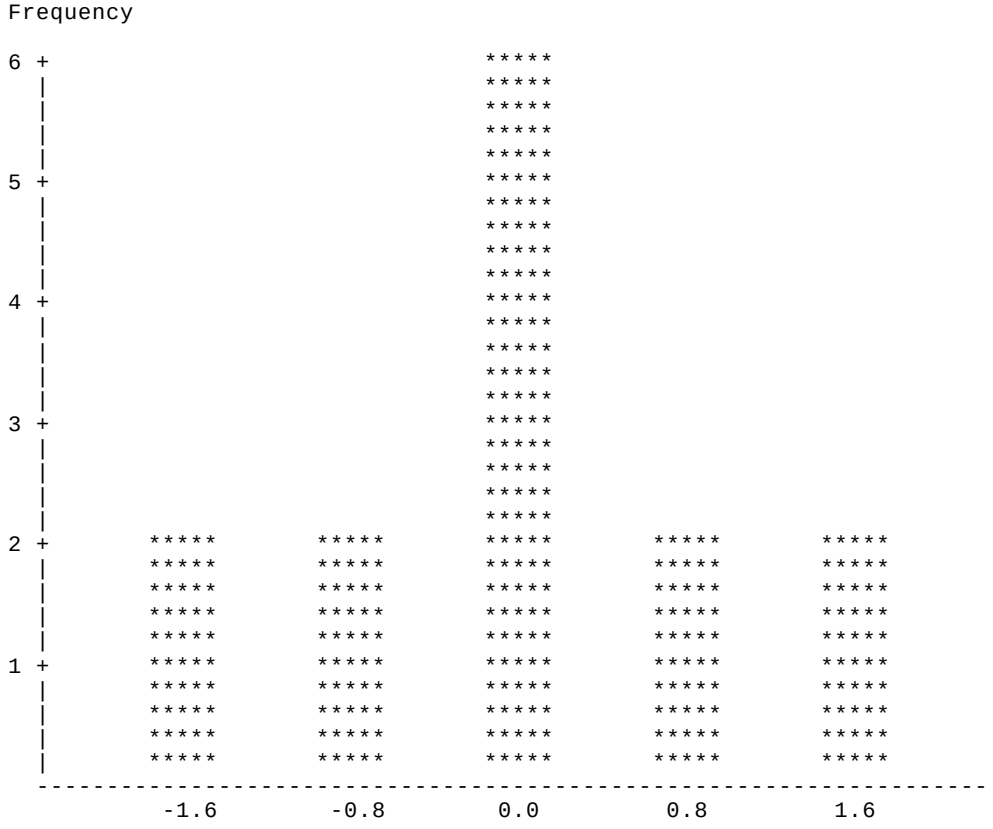
Least Squares Means

AQ	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
11	-3.44995166	0.69754177	0.0026
21	-3.54028641	0.69754177	0.0023
22	-4.42734913	0.47651174	0.0001
23	-5.23179435	0.69754177	0.0003
24	-4.41036631	0.69754177	0.0007
31	-2.86189996	0.47651174	0.0010
32	-1.84850422	0.47651174	0.0082

33	-3.43692059	0.69754177	0.0026
34	-3.49647692	0.69754177	0.0024
41	-2.28370253	0.69754177	0.0170
42	-0.00136008	0.47651174	0.9978
43	-0.89671390	0.69754177	0.2460
44	-0.49517171	0.47651174	0.3388
53	-3.46752347	0.47651174	0.0003
54	-2.74242679	0.69754177	0.0077
63	-3.35668484	0.69754177	0.0030
64	-3.24892171	0.69754177	0.0035
82	0.41368435	0.69754177	0.5748
111	-1.43817673	0.69754177	0.0848
112	-2.19494855	0.47651174	0.0037

SOURCE	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
1	-3.72760631	0.15068624	0.0001
2	-1.51394324	0.32717609	0.0036

dusky catch rate residuals



RESID Midpoint

hammerhead GLM

General Linear Models Procedure

Dependent Variable: LCR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	14	57.5580239	4.1112874	21.09	0.0017
Error	5	0.9746318	0.1949264		
Corrected Total	19	58.5326557			

R-Square	C.V.	Root MSE	LCR Mean
0.983349	-18.27579	0.44150	-2.41579

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AQ	13	56.0126708	4.3086670	22.10	0.0015
SOURCE	1	1.5453531	1.5453531	7.93	0.0373

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AQ	13	41.8825768	3.2217367	16.53	0.0030
SOURCE	1	1.5453531	1.5453531	7.93	0.0373

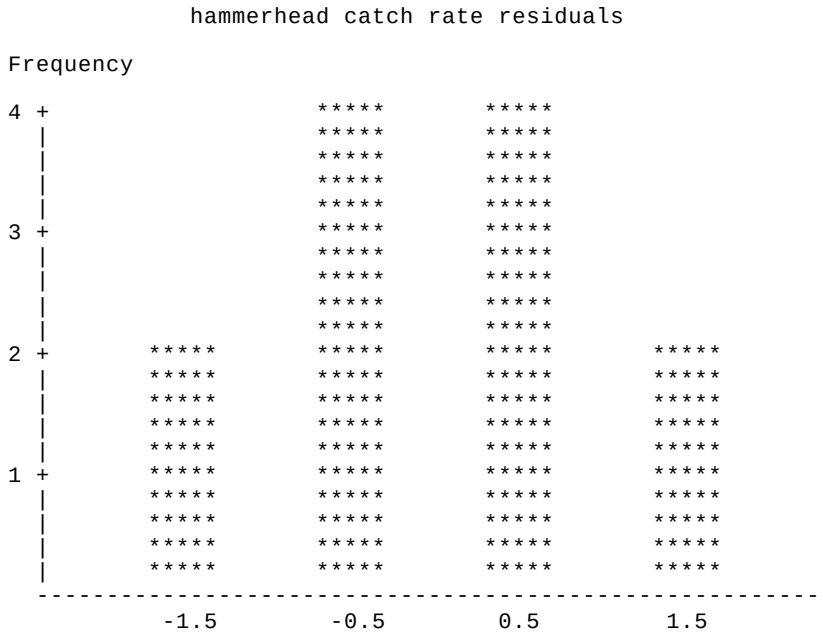
Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		-3.719327976 B	-7.30	0.0008	0.50980567
AQ	12	1.803431012 B	2.89	0.0343	0.62438188
	21	-1.819510877 B	-2.91	0.0332	0.62438188
	23	-1.208433717 B	-1.94	0.1107	0.62438188
	31	1.196900938 B	1.92	0.1134	0.62438188
AQ	32	2.642326481 B	4.23	0.0082	0.62438188
	33	1.502730770 B	2.41	0.0611	0.62438188
	34	2.053398815 B	3.70	0.0141	0.55554785
	41	1.657325481 B	2.98	0.0307	0.55554785
	42	3.474840000 B	6.25	0.0015	0.55554785
	43	0.130914456 B	0.21	0.8422	0.62438188
	51	3.503695256 B	6.31	0.0015	0.55554785
	52	3.676838630 B	6.62	0.0012	0.55554785
	53	1.569124314 B	2.82	0.0369	0.55554785
	54	0.000000000 B	.	.	.
SOURCE	1	-0.717717007 B	-2.82	0.0373	0.25490283
	2	0.000000000 B	.	.	.

hammerhead GLM

General Linear Models Procedure
Least Squares Means

AQ	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
12	-2.27475547	0.45953262	0.0043
21	-5.89769736	0.45953262	0.0001
23	-5.28662020	0.45953262	0.0001
31	-2.88128554	0.45953262	0.0015
32	-1.43586000	0.45953262	0.0261
33	-2.57545571	0.45953262	0.0025
34	-2.02478766	0.31219094	0.0013
41	-2.42086100	0.31219094	0.0006
42	-0.60334648	0.31219094	0.1111
43	-3.94727202	0.45953262	0.0004
51	-0.57449122	0.31219094	0.1251
52	-0.40134785	0.31219094	0.2549
53	-2.50906217	0.31219094	0.0005
54	-4.07818648	0.45953262	0.0003

SOURCE	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
1	-2.99536059	0.11799708	0.0001
2	-2.27764358	0.22594721	0.0002



night GLM

General Linear Models Procedure

Dependent Variable: LCR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	40.8258810	5.1032351	1.67	0.3269
Error	4	12.2560544	3.0640136		
Corrected Total	12	53.0819354			

R-Square	C.V.	Root MSE	LCR Mean
0.769111	-76.40915	1.75043	-2.29087

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AQ	7	27.8397489	3.9771070	1.30	0.4227
SOURCE	1	12.9861321	12.9861321	4.24	0.1086

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AQ	7	26.5995819	3.7999403	1.24	0.4415
SOURCE	1	12.9861321	12.9861321	4.24	0.1086

Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		-0.271895325 B	-0.20	0.8508	1.35587911
AQ	21	-2.097345828 B	-1.20	0.2970	1.75043240
	31	-0.554557779 B	-0.32	0.7672	1.75043240
	32	-2.264113829 B	-1.02	0.3643	2.21414131
	33	-1.299575385 B	-0.59	0.5888	2.21414131
AQ	41	-1.861772602 B	-1.06	0.3475	1.75043240
	42	1.034949568 B	0.59	0.5861	1.75043240
	43	2.507578910 B	1.13	0.3207	2.21414131
	44	0.000000000 B	.	.	.
SOURCE	1	-2.279134234 B	-2.06	0.1086	1.10707066
	2	0.000000000 B	.	.	.

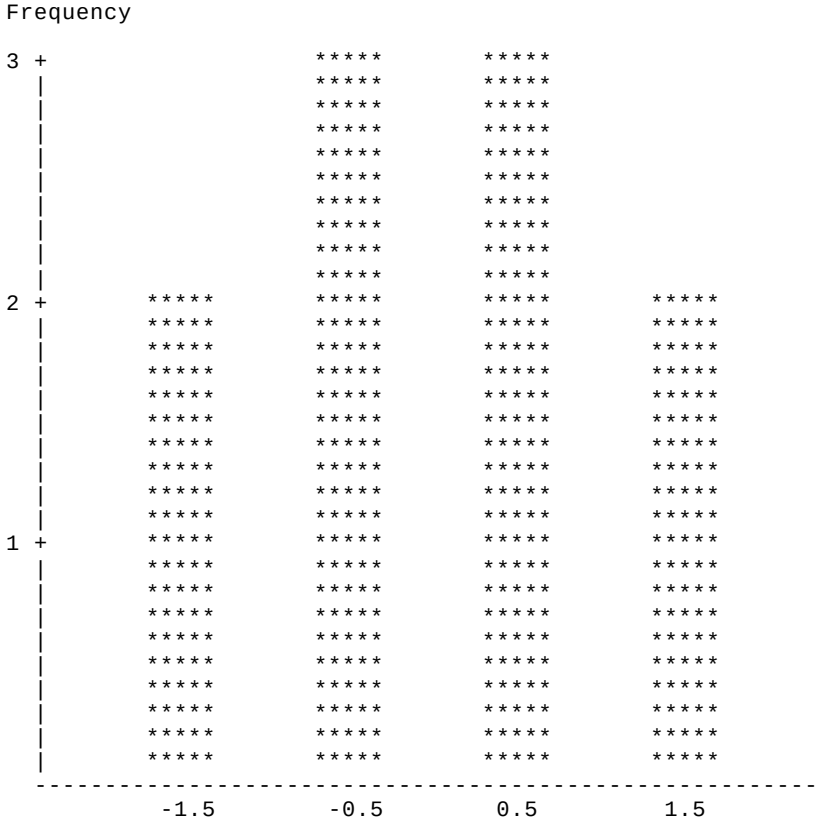
Least Squares Means

AQ	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
21	-3.50880827	1.23774262	0.0471
31	-1.96602022	1.23774262	0.1874
32	-3.67557627	1.83586899	0.1158
33	-2.71103783	1.83586899	0.2138

41	-3.27323504	1.23774262	0.0573
42	-0.37651287	1.23774262	0.7761
43	1.09611647	1.83586899	0.5826
44	-1.41146244	1.23774262	0.3178

SOURCE	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
1	-3.11788418	0.61887131	0.0073
2	-0.83874994	0.91793450	0.4126

night catch rate residuals



silky GLM

General Linear Models Procedure

Dependent Variable: LCR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	16	56.0419789	3.5026237	8.21	0.0274
Error	4	1.7075167	0.4268792		
Corrected Total	20	57.7494957			

R-Square	C.V.	Root MSE	LCR Mean
0.970432	-35.41243	0.65336	-1.84500

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AQ	15	55.8057776	3.7203852	8.72	0.0247
SOURCE	1	0.2362014	0.2362014	0.55	0.4983

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AQ	15	43.0667895	2.8711193	6.73	0.0393
SOURCE	1	0.2362014	0.2362014	0.55	0.4983

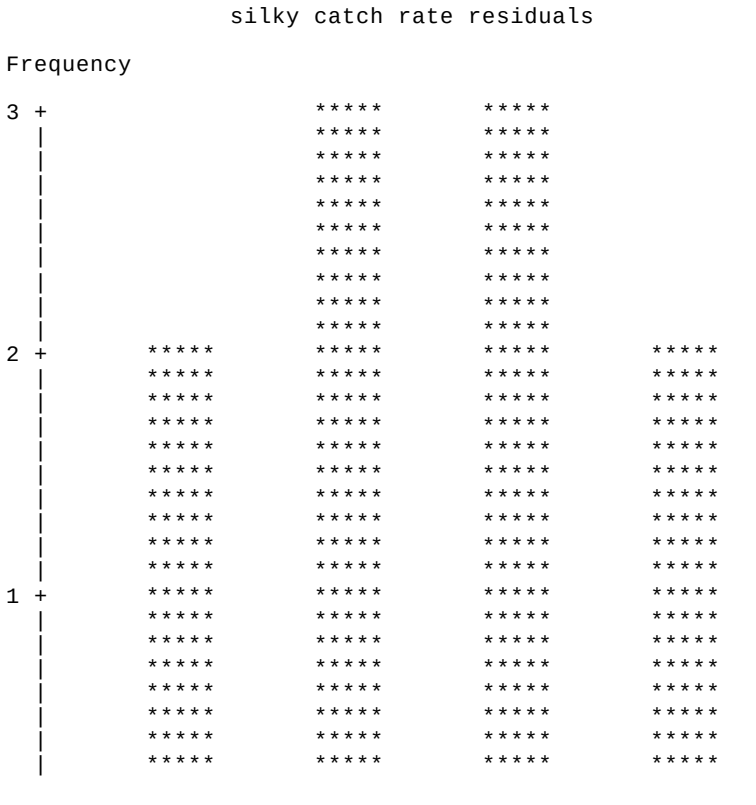
	T for H0:	Pr > |T|	Std Error of

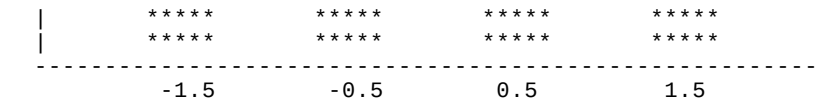
Parameter		Estimate		Parameter=0		Estimate
INTERCEPT		-4.561604602	B	-5.90	0.0041	0.77306588
AQ	11	-0.380948891	B	-0.41	0.7013	0.92399046
	21	1.445638965	B	1.56	0.1927	0.92399046
	22	3.157961602	B	3.12	0.0355	1.01218084
	23	2.549104466	B	2.52	0.0655	1.01218084
AQ	24	1.143543105	B	1.24	0.2835	0.92399046
	31	3.452729643	B	4.18	0.0139	0.82644219
	32	3.586969616	B	4.34	0.0123	0.82644219
	33	2.522453933	B	2.73	0.0524	0.92399046
	34	3.408047639	B	4.12	0.0146	0.82644219
	41	-0.130990496	B	-0.14	0.8941	0.92399046
	42	3.662975765	B	4.43	0.0114	0.82644219
	43	4.118199015	B	4.46	0.0112	0.92399046
	44	5.290322451	B	6.40	0.0031	0.82644219
	52	3.801733789	B	3.76	0.0198	1.01218084
	53	3.708395675	B	3.66	0.0215	1.01218084
	63	0.000000000	B	.	.	.
SOURCE	1	-0.307376878	B	-0.74	0.4983	0.41322110
	2	0.000000000	B	.	.	.

Least Squares Means

AQ	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
11	-5.09624193	0.68524967	0.0017
21	-3.26965408	0.68524967	0.0088
22	-1.55733144	0.68524967	0.0855
23	-2.16618858	0.68524967	0.0341
24	-3.57174994	0.68524967	0.0065
31	-1.26256340	0.46199523	0.0523
32	-1.12832343	0.46199523	0.0710
33	-2.19283911	0.68524967	0.0329
34	-1.30724540	0.46199523	0.0474
41	-4.84628354	0.68524967	0.0021
42	-1.05231728	0.46199523	0.0850
43	-0.59709403	0.68524967	0.4327
44	0.57502941	0.46199523	0.2812
52	-0.91355925	0.68524967	0.2533
53	-1.00689737	0.68524967	0.2157
63	-4.71529304	0.68524967	0.0023

SOURCE	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
1	-2.28547296	0.22514863	0.0005
2	-1.97809608	0.28758971	0.0023





RESID Midpoint

coastal_shark GLM

General Linear Models Procedure

Dependent Variable: LCR

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	18	37.4671656	2.0815092	2.09	0.2492
Error	4	3.9879057	0.9969764		
Corrected Total	22	41.4550712			

R-Square	C.V.	Root MSE	LCR Mean
0.903802	-31.49466	0.99849	-3.17034

Source	DF	Type I SS	Mean Square	F Value	Pr > F
AQ	17	33.6803674	1.9811981	1.99	0.2661
SOURCE	1	3.7867982	3.7867982	3.80	0.1231

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AQ	17	22.7109619	1.3359389	1.34	0.4262
SOURCE	1	3.7867982	3.7867982	3.80	0.1231

Parameter		Estimate		T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		-3.818161100	B	-3.23	0.0319	1.18142583
AQ	11	0.492117232	B	0.35	0.7450	1.41207395
	21	1.277251213	B	0.90	0.4169	1.41207395
	22	1.392475994	B	1.10	0.3321	1.26299733
	23	1.703153632	B	1.35	0.2488	1.26299733
AQ	24	2.489752149	B	1.97	0.1200	1.26299733
	31	0.892465646	B	0.63	0.5617	1.41207395
	32	2.179667184	B	1.54	0.1976	1.41207395
	33	1.891442659	B	1.34	0.2515	1.41207395
	34	1.831886330	B	1.30	0.2643	1.41207395
	41	0.742075627	B	0.53	0.6270	1.41207395
	42	2.195965336	B	1.74	0.1571	1.26299733
	43	3.450820097	B	2.44	0.0709	1.41207395
	44	3.056564755	B	2.42	0.0728	1.26299733
	51	0.741058686	B	0.52	0.6275	1.41207395
	52	1.989723977	B	1.41	0.2316	1.41207395
	53	1.095294113	B	0.78	0.4813	1.41207395
	63	-1.206375418	B	-0.85	0.4411	1.41207395
	64	0.000000000	B	.	.	.
SOURCE	1	-1.230739323	B	-1.95	0.1231	0.63149867
	2	0.000000000	B	.	.	.

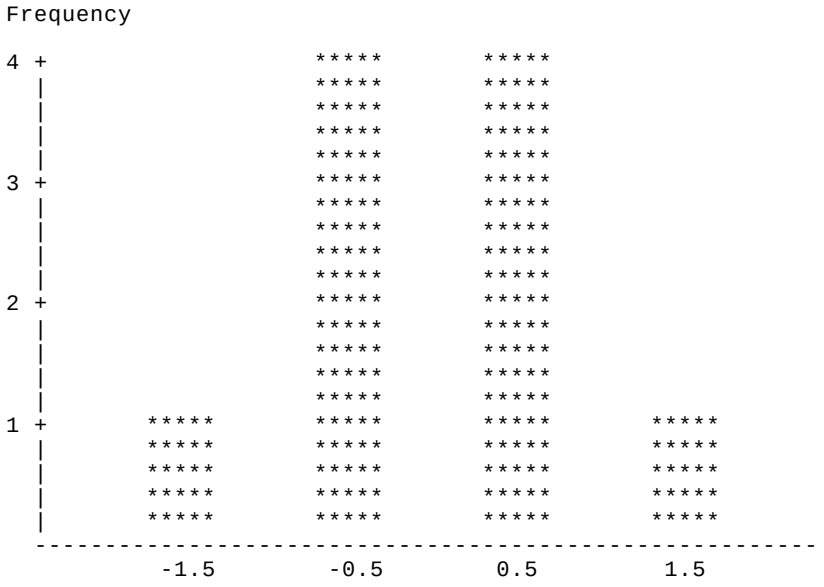
Least Squares Means

AQ	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
11	-3.94141353	1.04722207	0.0197
21	-3.15627955	1.04722207	0.0394
22	-3.04105477	0.70603697	0.0126
23	-2.73037713	0.70603697	0.0180
24	-1.94377861	0.70603697	0.0512
31	-3.54106511	1.04722207	0.0277
32	-2.25386358	1.04722207	0.0977
33	-2.54208810	1.04722207	0.0722
34	-2.60164443	1.04722207	0.0679
41	-3.69145513	1.04722207	0.0243
42	-2.23756542	0.70603697	0.0339
43	-0.98271066	1.04722207	0.4012
44	-1.37696601	0.70603697	0.1229
51	-3.69247208	1.04722207	0.0243
52	-2.44380678	1.04722207	0.0799
53	-3.33823665	1.04722207	0.0333

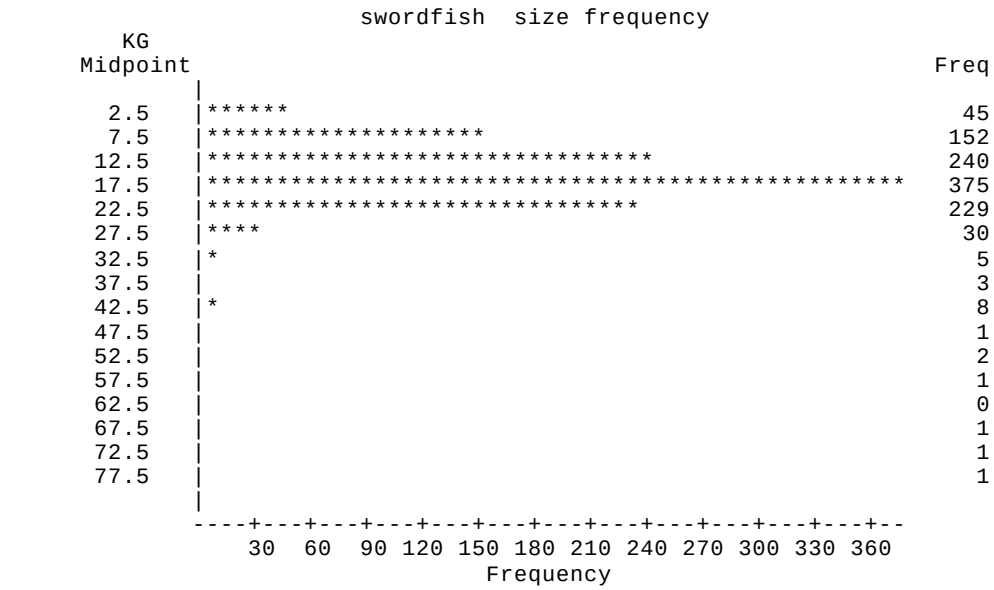
63	-5.63990618	1.04722207	0.0057
64	-4.43353076	1.04722207	0.0133

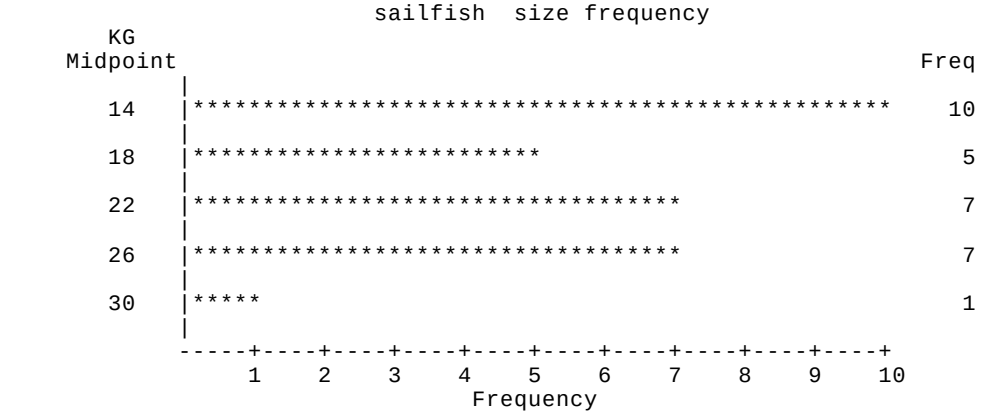
SOURCE	LCR LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
1	-3.59249269	0.23534566	0.0001
2	-2.36175337	0.58600596	0.0157

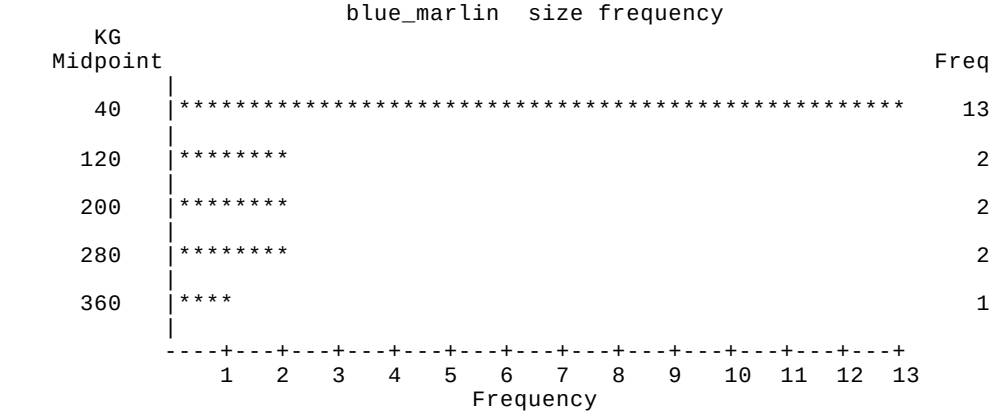
coastal_shark catch rate residuals

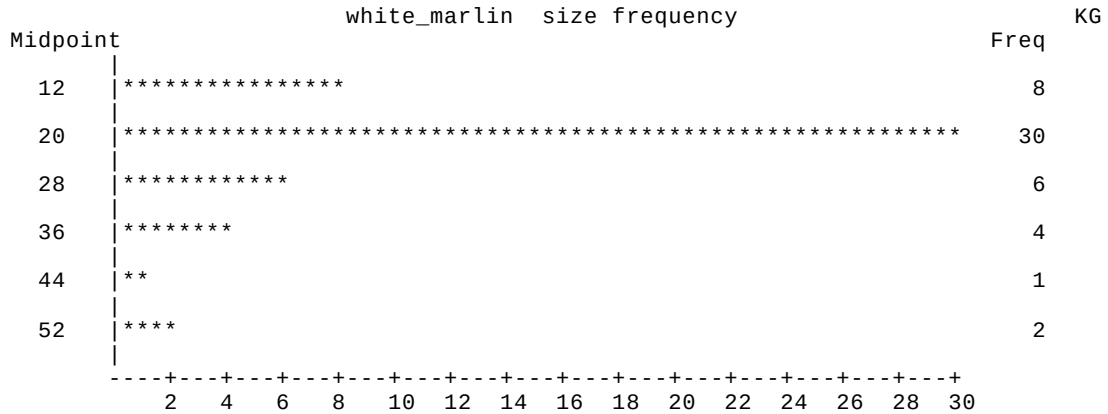


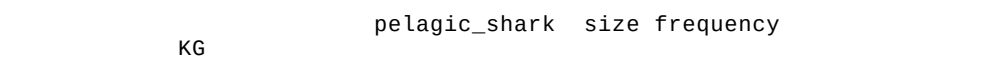
Appendix 4. Size frequencies from observed dead discards by species group.

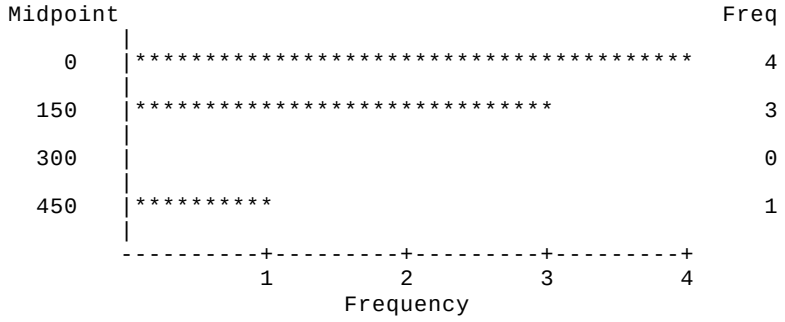




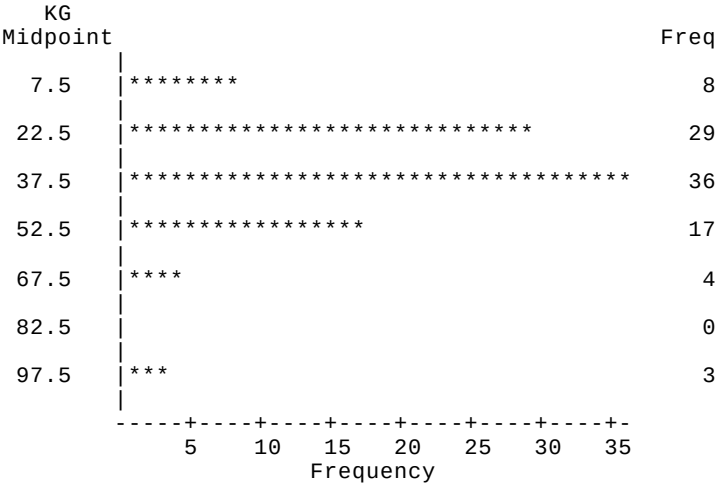




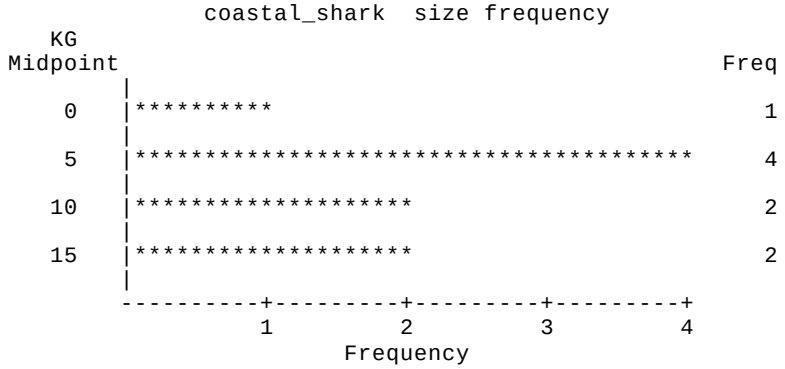




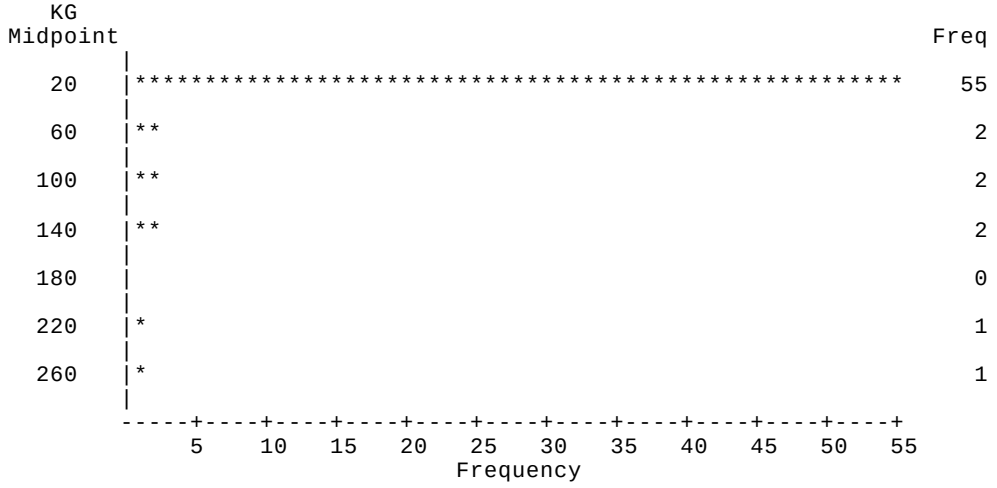
blue_shark size frequency



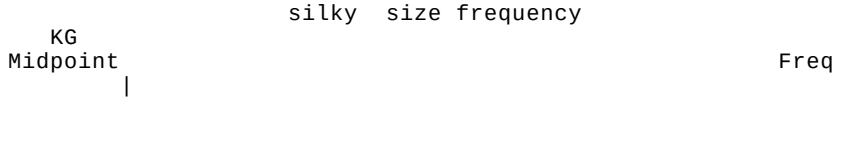
coastal_shark size frequency

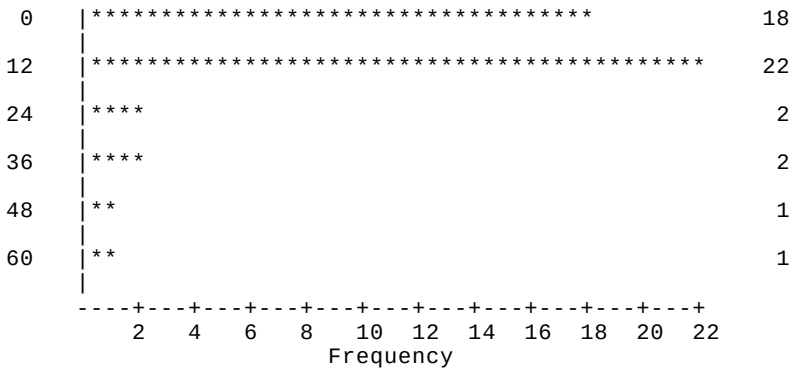


dusky size frequency

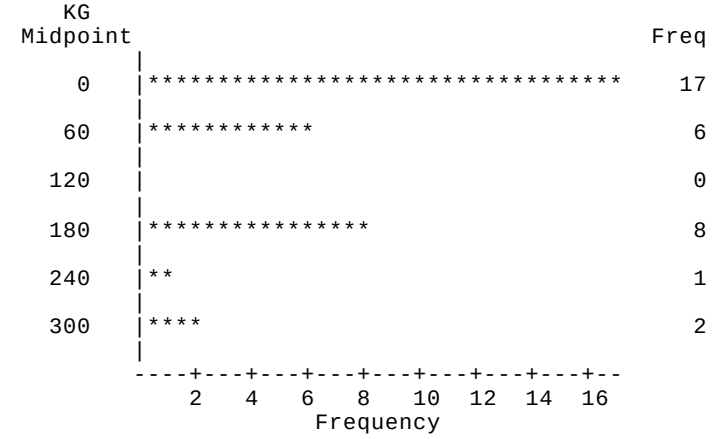


silky size frequency





hammerhead size frequency



night size frequency