Shark Research Institute – Expedition Report
Manta, Ecuador, June 24-26, 2004
Survey of Sharks Landed

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Abstract

A small, investigative expedition was completed by SRI staff and volunteers to survey the shark catch of a small artisanal fishery in Manta, Ecuador. Sharks were visually identified and if possible, measured so that abundance and size estimates could be determined for the shark landings in this fishery. Over a two-day period, 296 sharks from ten species were recorded as being landed. The data set can hopefully serve as a baseline for comparison against future surveys so that trends in shark abundance and size can be determined. The sharks landed at Manta suffer from a lack of protective legislation off mainland Ecuador. This allows for a polarized comparison with the abundant shark populations of the Galapagos Islands offshore, who benefit from marine reserve protection.

Introduction

The Shark Research Institute (SRI), a nonprofit 501 (c)(3) organization based in Princeton, New Jersey, is dedicated to promoting shark conservation worldwide. In an effort to reach their goals, SRI has initiated several research projects whose aims include gathering information on sharks to better manage and conserve them as a living resource. Non-government organizations (including SRI) have sufficient public backing to influence development of national and international policy and legislation at the government level or to enable the funding of elasmobranch conservation and research initiatives (Fowler 1999). Elasomobranch conservation and research are needed more than ever according to a recent study (Baum et al 2003). That study has shown the status of most shark species remains uncertain, with large, rapid declines in large coastal and oceanic shark populations. The cornerstone of SRI's work has been their ongoing research "Operation Whale Shark", involving the tagging of whale sharks (*Rhincodon typus)* in Honduras, Mexico, and the Galapagos Islands of Ecuador. Most of the Galapagos is a marine reserve and sharks are protected from fishing. However, sharks off the coast of mainland Ecuador are not protected by any sort of legislation or restrictions. Increasing demand by commercial fishing, artisanal fisheries and coastal development have a direct and cumulative impact on the future of shark stocks worldwide (Fowler 1999). Manta is a perfect example of a location where this may show a decrease in shark stocks. The small fishing village of Manta is located in the central coast, to the northwest of Guayaquil (Figure 1). A small SRI group visited Manta last November and recorded approximately 400 sharks landed in one day (Alex Antoniou, pers. comm.). The intensive fishing pressures off the mainland have caused fishermen to demand the Galapagos be opened for harvest. This is cause for great alarm, as the Galapagos is one of the last "oases" where sharks can be seen in relative abundance. The main goal of this expedition is to get data that can be used as a baseline to compare future surveys to, and ultimately track trends in shark abundance and size off mainland Ecuador. This monitoring program may aid SRI in lobbying for continued protection of the Galapagos or even fishing restrictions off the mainland coast of Ecuador.

Figure 1. Map of Ecuador including Manta

Expedition participants:
Alex Antoniou (director of field operations – SRI), Eric Cheng (photographer, San Francisco), Matthew Potenski (marine biologist, Ft. Lauderdale), Carlos Villon (Universidad de Guayaquil), Claire Davies (bank employee, New York), Suzanne Allman (research supervisor, Pheonix), Natalie Piszek (student, Philadelphia).

Fieldwork /Research

A simple survey was conducted to determine the species that were being landed by the artisanal fishery in Manta, Ecuador. The survey was conducted according to the precedent of Bard and Konan 1993. When a shark was observed to come off a boat (Figure 2), it was visually identified and it species recorded (Figure 3).

Figure 2. Shark being landed from a panga.

Figure 3. An example of visual Identification – *Sphyraena lewini* has four scallops on head while *Sphyraena zygaena* three smooth ridges.

Additional data was taken if possible. This includes recording sex, two length measurements in cm (standard or precaudal length and total length) (Figures 5,6), and determining sexual maturity via clasper calcification in males or existence of embryos in females. Figures 4 and 5 depict measurement of caught sharks. In many cases the sharks were missing heads, tails or both, in which length measurements were impossible to determine. Any additional conditions of note were recorded as general field comments.

Figure 4. Measurement of standard length of a hammerhead

Figure 5. Measurement of total length of a silky shark.

Results

Over the course of the two-day survey 296 sharks from seven genera and 10 species were recorded (Table 1). There was a similar amount of sharks landed on each individual day (day 1 n=140, day 2 n=156).

Table 1. Distribution and Abundance of sharks landed

Genus	Species	Common Name	Number Recorded	Number Measured
Alopias	*pelagios*	Pelagic Thresher	59	13
Alopias	*supercilias*	Bigeye Thresher	12	9
Carcharhinus	*faclciformis*	Silky	16	16
Carcharhinus	*leucas*	Bull	1	1
Isurus	*oxyrinchus*	Mako	5	1
Mustelis	*dorsalis*	Dogfish	8	7
Prionae	*glauca*	Blue	95	88
Squatina	*californica*	Pacific Angel	1	1
Sphyraena	*lewini*	Scalloped Hammerhead	21	21
Sphyraena	*zygaena*	Smooth Hammerhead	78	75
Totals			**296**	**232**

Blue sharks were the most abundant species found (n=95), comprising roughly a third of the sharks landed. Blues were followed by smooth hammerheads (n=78) and pelagic threshers (n=59) and these three species accounted for 78% of the total shark catches. The bull and Pacific angel sharks were each only represented by one specimen.
A total of 232 sharks were measured for at least standard length (PCL). Table 2 shows the mean PCL values for each species recorded with standard error. Upper and lower 95% length is also shown to give a general range of lengths for each species.

Table 2. Mean PCL and 95% Length range for sharks measured by species

Genus	Species	Number Measured	Mean PCL (cm)	Stand error	Lower 95%	Upper 95%
Alopias	*pelagios*	13	148.308	6.749	135.01	161.61
Alopias	*supercilias*	9	146.111	8.111	130.13	162.09
Carcharhinus	*faclciformis*	16	130.188	6.083	118.20	142.18
Carcharhinus	*leucas*	1	212.000	24.332	164.05	259.95
Isurus	*oxyrinchus*	1	134.000	24.332	86.05	181.95
Mustelis	*dorsalis*	7	81.143	9.197	63.02	99.27
Prionae	*glauca*	88	185.523	2.594	180.41	190.63
Squatina	*californica*	1	82.000	24.332	34.05	129.95
Sphyraena	*lewini*	21	97.095	5.310	86.63	107.56
Sphyraena	*zygaena*	75	91.427	2.810	85.89	96.96

Four out of the ten species had a mean PCL below 1m, while the larger, pelagic sharks averaged 1.3-1.5m and above. Three of the species (*C. leucas, I. oxyrinchus, & S. californica*) were only represented by 1 specimen. Dismissing the mean PCL of the bull shark because of the low sample size (n=1) allows for the blue shark to be the largest shark caught on average with a mean PCL of approximately 185.5 cm. The blue shark therefore comprised the most sharks landed and largest average size, equating to a significant portion of the total shark biomass landed. Pelagic threshers averaged just below a meter and a half (146 cm) and therefore also had a considerable biomass. The smooth hammerhead averaged below a meter (91.4 cm) and would contribute a lot less biomass to the total catch than either the blue or pelagic thresher.

Administration

Equipment list

- Video and still cameras for documentation
- Measuring tapes (metric) of at least 10m
- Pencils, Clipboards, and Data Sheets

Permits

No specific permits were needed to work with the landed sharks. Fishing for sharks from mainland Ecuador is not regulated or restricted. Permission of local fishermen to measure their respective catches should be attained before handling their sharks.

Travel/transport

Travel was accomplished via a 4-hour van ride from Guayaquil to Manta as arranged through the Grand Hotel Guayaquil and Galapagos Adventures.

Food/accommodation

The trip participants lodged at Las Gaviotas hotel, right near the beach where the fishermen landed their catches. The hotel was economical with few amenities, but was clean and had air conditioning. The hotel staff provided us with a special breakfast service at an early 5 am. There are many small restaurants in the area, which serve local dishes at inexpensive prices. Manta also has a mall with a food court, which can be reached via a short cab ride.

Risks

The trip participants did not encounter any problems with the local fishermen but were warned on numerous occasions to avoid specific areas, especially with photo-equipment, to prevent potential robbery.

Photo/video

Photographic documentation was accomplished primarily through the efforts of Eric Cheng, with supporting materials from Matthew Potenski, Suzanne Allman, and Claire Davies. Videography was completed by Alex Antoniou. A trip diary is available online thanks to Eric Cheng at www.echeng.com/travel/manta/.

Conclusion

Manta serves as a complete foil to the Galapagos Islands. In the span of a week and a half, the trip participants witnessed both the piles of dead sharks on the beaches of Manta and the abundance of living sharks concentrated in Galapagos. A serious argument can be made for the success of consistent existence of large numbers of sharks in Galapagos being a direct result of the protection from fishing afforded by the marine reserve. According to local fishermen in Manta, both the numbers and size of sharks being caught has been declining, while the fishing effort has increased. By continuing to monitor the activity in Manta, some hard data to support theses trends can be acquired. This data can then be used to try to get protective or restrictive legislation in place for sharks off of mainland Ecuador, or at the very least serve as an example of why the Galapagos marine reserve need to remain in place with shark fishing continuing to be banned. To conclude, the future of sharks in Ecuador will either continue to decline (Figure 6) or continued research can work to preserve them as living resources (Figure 7).

Figure 6. Sharks processed for sale, Manta

Figure 7. Silky shark school, Galapagos (courtesy S. Allman)

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Appendices

A - Contact information

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Natalie Piszek – sky71022@aol.com

B – Raw Field Data

Shark Species

Common Name	Scientific Name	Letter Code	ID
Angel Shark	Squatina californica	SC	Flat, broad, almost skate like
Blacktip Shark	Carcharhinus limbatus	CL	Requim shark. Dark black on all fin tips
Blue Shark	Prionae glauca	PG	Blue color, long pectoral fins
Bull Shark	Carcharhinus leucas	CB	Requiem shark, large, broad "comoperro" ="dogeater"
Dogfish	Mustelus dorsalis	MD	Small size, different eye
Scalloped Hammerhead	Sphyraena lewini	SL	4 scallops on leading edge of hammer
Smooth Hammerhead	Sphyraena zygaena	SZ	3 divisions on leading edge of hammer
Mako	Isurus oxyrinchus	IO	Color, pronounced caudal keels before tail
Silky Shark	Carcharhinus falciformis	CF	Requim shark. Smooth gray, without black tips. Long snout
Bigeye Thresher	Alopias supercilias	AS	Large eye, forehead notch, large teeth, long, crescent anal fins
Pelagic Thresher	Alopias pelagios	AP	Small teeth, lack of notch, short, blunt anal fins
Tiger shark	Galeocerdo cuvier	GC	Large, broad squared off nose, sometimes stripes, cockscomb teeth

MISC

Common Name	Scientific Name	Letter Code	ID
Diamond Stingray	Dasyatis brevis	DB	Typical stingray, brown color, angular "diamond" head

Shark Species	Date	Sex	Headless	PCL	TL	Tail Cut	Reproductive State	Comments
2 Letter Code		M or F		cm	cm		Mature, Juvenile, Undetermined	
AP	6/25/2004	F	Y			Y	U	
AP	6/25/2004	F	Y			Y	U	
AP	6/25/2004	F	Y			Y	U	
AP	6/25/2004	F	Y				U	
AP	6/25/2004	F	Y				J	
AP	6/25/2004	F	Y			Y	M	
AP	6/25/2004	F	Y			Y	U	
AP	6/25/2004	F	Y			Y	U	
AP	6/25/2004	F	Y			Y	J	
AP	6/25/2004	F	Y			Y	U	
AP	6/25/2004	F	Y			Y	U	
AP	6/25/2004	F	Y			Y	U	
AP	6/25/2004	F		139		Y	U	
AP	6/25/2004	F		146		Y	U	

AP	6/25/2004	F	Y			Y	U
AP	6/25/2004	F		160		Y	U
AP	6/25/2004	F	Y				U
AP	6/25/2004	F	Y				U
AP	6/25/2004	M	Y			Y	M
AP	6/25/2004	M	Y			Y	M
AP	6/25/2004	M	Y			Y	M
AP	6/25/2004	M	Y				J
AP	6/25/2004	M	Y				M
AP	6/25/2004	M	Y			Y	M
AP	6/25/2004	M		173		Y	M
AP	6/25/2004	M		162		Y	M
AP	6/25/2004	M		170		Y	M
AS	6/25/2004	F		180	250		U
AS	6/25/2004	M		185	332		M
AS	6/25/2004	M		174		Y	M
AS	6/25/2004	M	Y			Y	M
AS	6/25/2004	M		174		Y	M
CF	6/25/2004	F		104	154		U
CF	6/25/2004	F		120	161		U
CF	6/25/2004	M		133	179		J
CF	6/25/2004	M		127		Y	J
CF	6/25/2004	M		114	154		J
CF	6/25/2004	M		165	220		M
IO	6/25/2004	F		134	158		U
IO	6/25/2004	F	Y				U
IO	6/25/2004	F	Y				U
IO	6/25/2004	F	Y				J
MD	6/25/2004	F		86	106		U
MD	6/25/2004	M		75	92		J
MD	6/25/2004	M		82	102		M
MD	6/25/2004	M		90	110		M
MD	6/25/2004	M		78	96		J
PG	6/25/2004	F		154	205		U
PG	6/25/2004	F		168	220		U
PG	6/25/2004	F		190	251		U
PG	6/25/2004	F		180	239		U
PG	6/25/2004	F		198	258		U
PG	6/25/2004	F		183	242		U
PG	6/25/2004	F		166	219		U
PG	6/25/2004	F	Y				J
PG	6/25/2004	F	Y			Y	U
PG	6/25/2004	F		159	205		U
PG	6/25/2004	F		169	226		U
PG	6/25/2004	F		176	230		U
PG	6/25/2004	F		172	224		U
PG	6/25/2004	M		192	251		M

PG	6/25/2004	M	Y			Y	M	
PG	6/25/2004	M		173	230		M	
PG	6/25/2004	M		211	277		M	
PG	6/25/2004	M		187	246		M	
PG	6/25/2004	M		146	194		M	
PG	6/25/2004	M		195	254		M	
PG	6/25/2004	M		205	271		M	
PG	6/25/2004	M		180	236		M	
PG	6/25/2004	M		175	232		M	
PG	6/25/2004	M		192	256		M	
PG	6/25/2004	M		182	243		M	
PG	6/25/2004	M		189	250		M	
PG	6/25/2004	M		213	284		M	
PG	6/25/2004	M		199	263		M	
PG	6/25/2004	M		192	254		M	
PG	6/25/2004	M		192	249		M	
PG	6/25/2004	M		173	230		M	
PG	6/25/2004	M		152	202		M	
PG	6/25/2004	M		194	260		M	
PG	6/25/2004	M		174	231		M	
PG	6/25/2004	M	Y				M	
PG	6/25/2004	M		179	233		U	
PG	6/25/2004	M		168	225		M	
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PG	6/25/2004	M		193	254		M	
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PG	6/25/2004	M		148	194		M	
PG	6/25/2004	M		192	257		M	
PG	6/25/2004	M		176	235		M	
PG	6/25/2004	M		190	248		M	
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PG	6/25/2004	M		177	237		M	
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PG	6/25/2004	M		180	242		M	
PG	6/25/2004	M		207	272		M	
PG	6/25/2004	M		200	242		M	End of tail bit off
PG	6/25/2004	M		176	235		M	
PG	6/25/2004	M		208	274		M	
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PG	6/25/2004	M		166	223		M	

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AS	6/26/2004	F		156	275		U	
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CB	6/26/2004	M		212	279		M	
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CF	6/26/2004	M		127	169		J	
CF	6/26/2004	M		132	175		J	
CF	6/26/2004	M		157	208		M	
CF	6/26/2004	M		100	133		J	
CF	6/26/2004	M		136	184		M	
CF	6/26/2004	M		135	178		J	
IO	6/26/2004	M	Y				U	
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MD	6/26/2004	M		73	93		M	
MD	6/26/2004						U	Taken away too quickly
PG	6/26/2004	F		175	232		M	
PG	6/26/2004	F		161	211		U	
PG	6/26/2004	F		161	212		U	
PG	6/26/2004	F		165	218		U	
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PG	6/26/2004	M		180	234		M	
PG	6/26/2004	M	Y			Y	M	
PG	6/26/2004	M		199	262		M	

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PG	6/26/2004	M		204	267		M
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PG	6/26/2004	M		202	266		M
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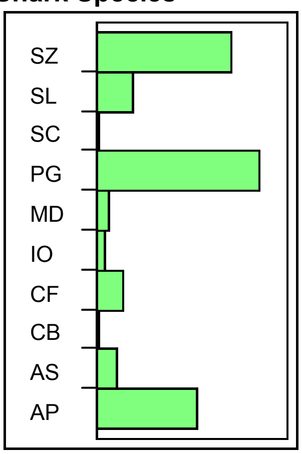
PG	6/26/2004	M		184	243		M
PG	6/26/2004	M		198	259		M
PG	6/26/2004	M	Y				U
SZ	6/26/2004	F		87	121		J
SZ	6/26/2004	F		83	116		U
SZ	6/26/2004	F		91	126		U
SZ	6/26/2004	F		110	153		U
SZ	6/26/2004	F		108	150		J
SZ	6/26/2004	F		74	104		J
SZ	6/26/2004	F		88	123		J
SZ	6/26/2004	F		92	136		U
SZ	6/26/2004	F		71	100		J
SZ	6/26/2004	F		88	124		U
SZ	6/26/2004	F		96	132		U
SZ	6/26/2004	F		92	129		U
SZ	6/26/2004	F		89	123		U
SZ	6/26/2004	F		96	133		U
SZ	6/26/2004	F		92	127		U
SZ	6/26/2004	F	Y			Y	U
SZ	6/26/2004	F		89	122		U
SZ	6/26/2004	F		107	146		U
SZ	6/26/2004	F		88	122		U
SZ	6/26/2004	F		125	171		U
SZ	6/26/2004	F		153	210		U
SZ	6/26/2004	F		125	171		U
SZ	6/26/2004	F		99	135		U
SZ	6/26/2004	F		157	215		U
SZ	6/26/2004	F		92	127		U

SZ	6/26/2004	M	82	113	J	
SZ	6/26/2004	M	89	124	J	
SZ	6/26/2004	M	83	120	J	
SZ	6/26/2004	M	92	129	J	
SZ	6/26/2004	M	73	108	J	
SZ	6/26/2004	M	70	96	J	
SZ	6/26/2004	M	69	95	J	
SZ	6/26/2004	M	90	127	J	
SZ	6/26/2004	M	162	231	U	
SZ	6/26/2004	M	75	104	U	
SZ	6/26/2004	M	89	123	U	
SZ	6/26/2004	M	69	95	J	
SZ	6/26/2004	M	89	124	U	
SZ	6/26/2004	M	101	139	J	
SZ	6/26/2004	M	89	126	J	
SZ	6/26/2004	M	92	120	J	
SZ	6/26/2004	M	98	135	J	
SZ	6/26/2004	M	93	121	J	
SZ	6/26/2004	M	87	122	J	
SZ	6/26/2004	M	90	123	J	
SZ	6/26/2004	M	89	136	J	
SZ	6/26/2004	M	86	121	J	
SZ	6/26/2004	M	89	125	J	
SZ	6/26/2004	M	95	133	J	
SZ	6/26/2004	M	89	122	J	
SZ	6/26/2004	M	92	129	U	
SZ	6/26/2004	M	88	123	U	
SZ	6/26/2004	M	97	134	U	
SZ	6/26/2004	M	70	97	J	
SZ	6/26/2004	M	73	100	J	
SZ	6/26/2004	M	102	139	J	
SZ	6/26/2004	M	94	131	J	
SZ	6/26/2004	M	63	89	J	
SZ	6/26/2004	M	73	103	J	
SZ	6/26/2004	M	72	100	U	
SZ	6/26/2004				U	Taken from boat and
SZ	6/26/2004				U	went straight away
SC	6/26/2004	M	82	94	U	
SL	6/26/2004	F	54	76	J	
SL	6/26/2004	F	55	77	U	
SL	6/26/2004	F	116	165	U	
SL	6/26/2004	F	75	104	U	
SL	6/26/2004	M	113	161	J	
SL	6/26/2004	M	115	161	J	
SL	6/26/2004	M	72	101	J	
SL	6/26/2004	M	66	91	J	
SL	6/26/2004	M	79	111	J	

Species	Date	Sex	Headless	PCL	TL	Tail Cut	Reproductive State	Comments
		M or F		cm	cm		Mature, Juvenile, Undetermined	
Dasyatis brevis	6/25/2004	M			92*		M	*All stingray
Dasyatis brevis	6/25/2004	F			107*			measurements
Dasyatis brevis	6/25/2004	F			104*			Ventral DW
Dasyatis brevis	6/25/2004	F			116*			
Dasyatis brevis	6/25/2004	F			NA			
Dasyatis brevis	6/25/2004	F			NA			
Dasyatis brevis	6/25/2004	F			NA			
Dasyatis brevis	6/25/2004	F			NA			

C – Statistical Analysis of Shark Catches (Via JMP Software)

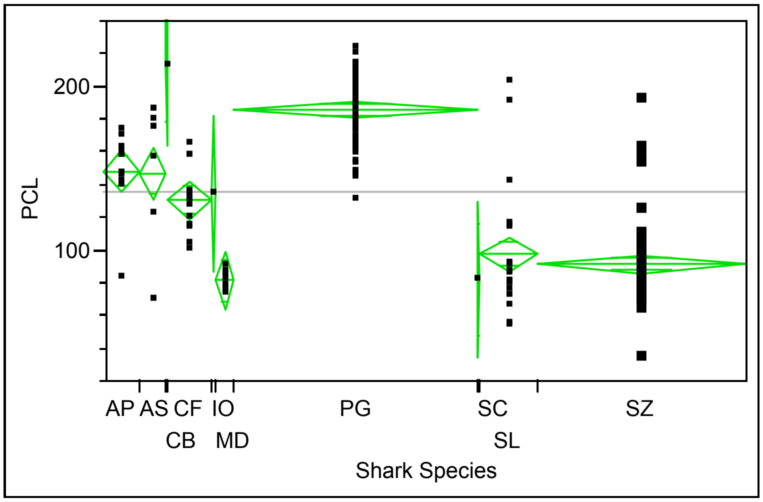
Distributions
Shark Species



Frequencies

Level	Count	Prob
AP	59	0.19932
AS	12	0.04054
CB	1	0.00338
CF	16	0.05405
IO	5	0.01689
MD	8	0.02703
PG	95	0.32095
SC	1	0.00338
SL	21	0.07095
SZ	78	0.26351
Total	296	1.00000

Oneway Analysis of PCL By Shark Species



Oneway Anova
Summary of Fit

Rsquare	0.765813
Adj Rsquare	0.756319
Root Mean Square Error	24.33207
Mean of Response	135.9655
Observations (or Sum Wgts)	232

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Shark Species	9	429804.66	47756.1	80.6623	<.0001
Error	222	131435.06	592.0		
C. Total	231	561239.72			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
AP	13	148.308	6.749	135.01	161.61
AS	9	146.111	8.111	130.13	162.09
CB	1	212.000	24.332	164.05	259.95
CF	16	130.188	6.083	118.20	142.18
IO	1	134.000	24.332	86.05	181.95
MD	7	81.143	9.197	63.02	99.27
PG	88	185.523	2.594	180.41	190.63
SC	1	82.000	24.332	34.05	129.95
SL	21	97.095	5.310	86.63	107.56
SZ	75	91.427	2.810	85.89	96.96

Std Error uses a pooled estimate of error variance