Predator / Prey Detection

Predator

① Probability of detection of prey that has not moved.

② Probability of detection of prey that has initiated escape given distance from predator.

③ Subsequent reaction by predator given a prey ~~=~~ detection
~~=~~ :- dependant on detection strength ?

Prey

① Probability that prey detects approach of predator and initiates movement.

② distance at which movement is initiated

Summation of above events will lead to following outcome events.

① Prey not detected —— a) no movement b) movement by prey.
② Prey detected and captured — a) and b) above.
③ Prey detected and not captured — given escape by prey.
   a) without attack and a.r.s.
   b) with attack and a.r.s.

Data available from old tracks

① Frequency of capture without prey movement.
② Distances at which prey initiate escape behavior + directions and distances moved.
③ Given a movement by prey and distance from predator whether this caused change in track parameters.
④ Frequency of A1 → A3, P and conditions, and subsequent behav of predator.

8th April 85

Preliminary test of reactive distance. Used small stick and prodded snail gently at 45° to direction of snail

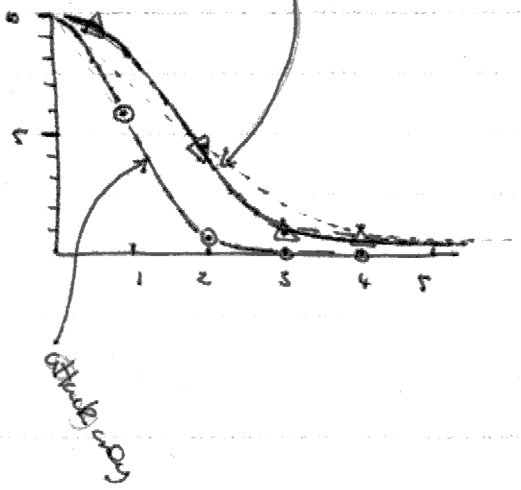
ie 

1cm			2cm		
1	↘	strong react	1	↘	
2	↘	"	2	?	indefinite
3	↘	"	3	↘	stopped turn & A
4	↘	"	4	↘	— " —
5	↘	"	5	⊗	stopped but cont on
6	⊗	stopped but turned away	6	↘	stopped & turned
7	⊗	stopped	7	⊗	stopped but cont on
8	↘	strong	8	x	no reaction
9	x		9	↘	stopped & no further react
10	x	turned away	10	↘	turned stopped & cont on.

3cm			4cm		
1	x	no react	1	x	
2	?	pass turn towards	2	?	turn toward
3	↘	some react	3	?	stopped
4	↘	turned & burrowed	4	?	stopped
5	x		5	x	
6	x		6	x	
7	x		7	x	
8	x		8	x	
9	x		9	x	
10	x		10	?	turn ?

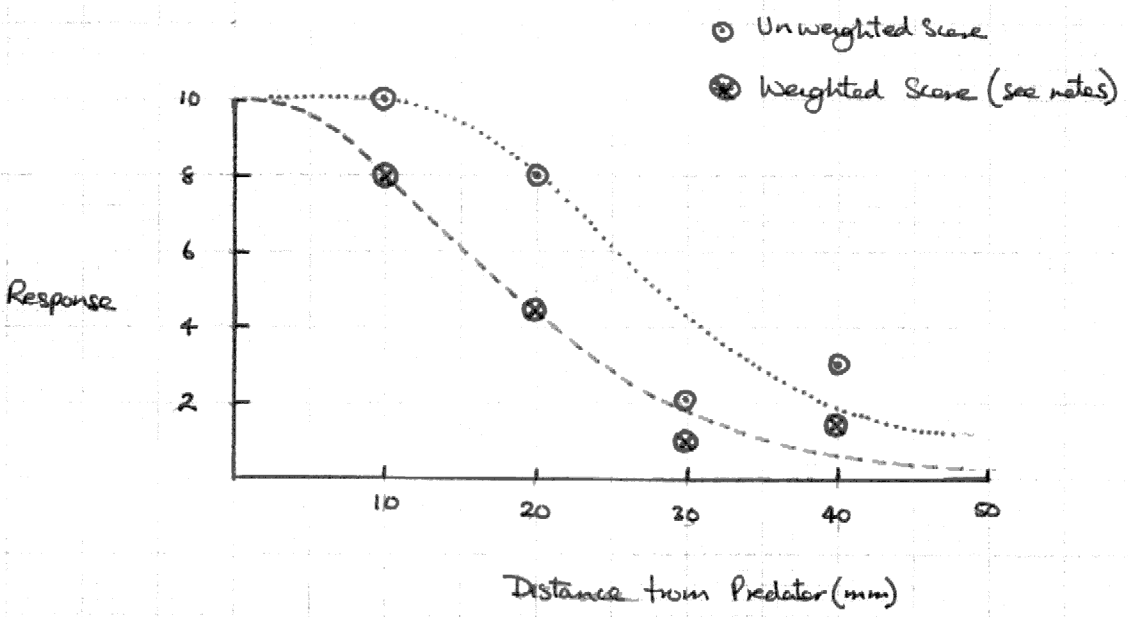
	1cm	2cm	3cm	4cm.	
strong	6	1	0	0	Score 1.0
stopped & turned					
stopped	4	7	2	3	Score 0.5
turned away	1				

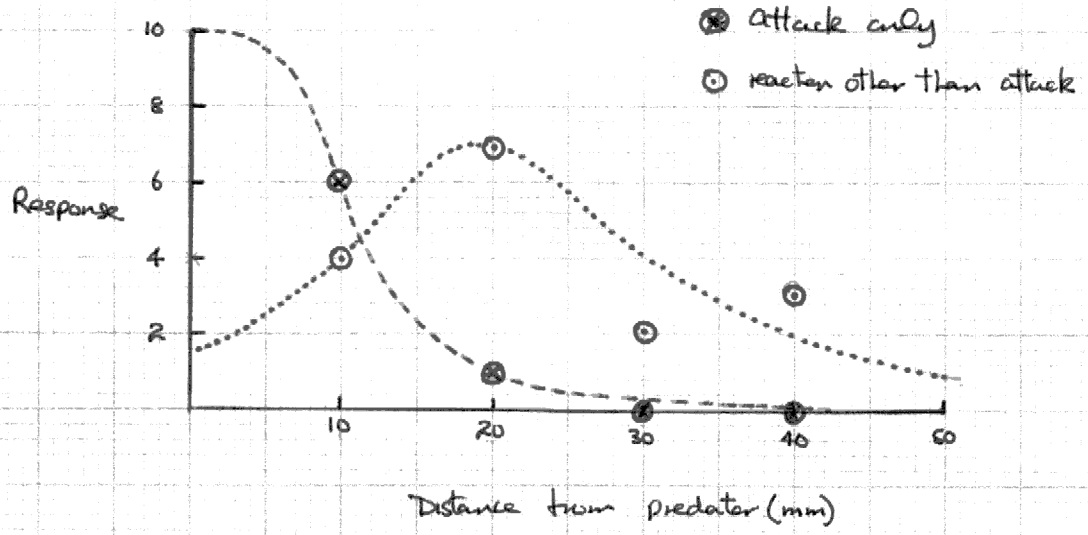
8 4½ 1 1½



Prey detection response by P. concus 08/04/85

Response to mechanical stimulus





Prey detection and escape from Polinices sp by Isanda coronata

Data obtained from all tracks where start of prey movement clearly recorded with respect to predators position. Re-encounters between the same prey item and predator are not included.

KEY

DATE	date of track
TS	time track started
TF	time track finished
PPL	predator prey location
TP	track position
D1	distance from predator prey commenced moving (mm)
A1	angle from direction of movement of predator
B1	beeline distance from predator position to end of prey track
B2	beeline direction " " " " " " " "
T1	total distance moved by prey
T2	total time taken to move T1
DS	depth of search by predator
PD	possible detection of prey by predator
PS	prey speed overall T1/T2

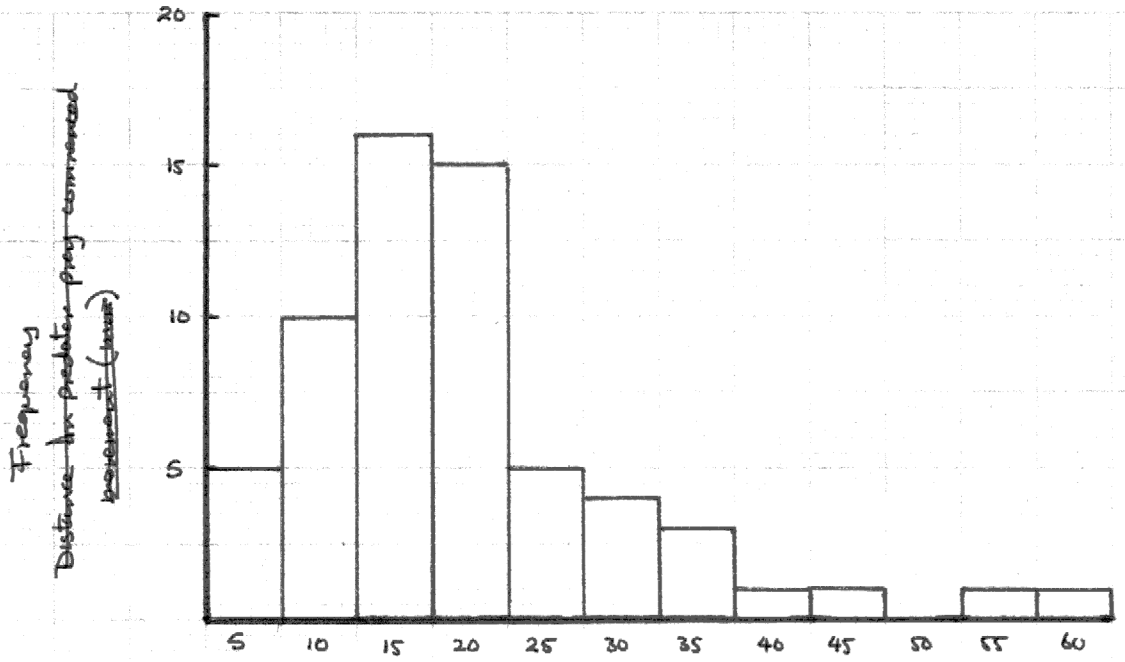
DATE	TS	TF	PPL	TP	D1	A1	B1	B2	T1	T2	DS	PD	PS
201084	1010	1100	111	122	11	353	-1	-1	-1	-1	-1	0	-1
221084	1145	1155	111	11	5	68	-1	-1	-1	-1	-1	1	-1
241084	1253	1309	111	17	12	312	-1	-1	-1	-1	-1	1	-1
061184	1353	1401	112	13	21	11	42	349	24	-1	-1	1	-1
061184	1304	1332	112	93	33	30	-1	-1	-1	-1	4	0	-1
061184	1304	1332	112	95	23	354	-1	-1	-1	-1	4	0	-1
061184	1304	1332	112	97	18	4	-1	-1	-1	-1	4	0	-1
061184	1114	1126	112	30	11	113	-1	-1	-1	-1	-1	1	-1
091184	1532	1546	112	51	28	22	-1	-1	-1	-1	5	0	-1
091184	1532	1546	112	26	11	309	-1	-1	-1	-1	-1	1	-1
101184	1453	1515	112	23	23	317	26	230	44	-1	2	1	-1
101184	1453	1515	112	3	16	32	110	309	155	-1	-1	1	-1
101184	1453	1515	112	39	22	48	56	37	46	-1	2	1	-1
101184	1453	1515	112	46	55	33	97	327	218	-1	3	1	-1
101184	1453	1515	112	58	60	76	-1	-1	-1	-1	2	0	-1
101184	1453	1515	112	63	16	42	-1	-1	-1	-1	2	0	-1
101184	1453	1515	112	-1	29	329	43	16	34	-1	4	0	-1
101184	1453	1515	112	-1	28	46	64	52	38	-1	4	0	-1
101184	1453	1515	112	-1	17	0	40	340	49	-1	4	0	-1
111184	1024	1039	112	4	3	12	-1	-1	-1	-1	0	1	-1

DATE	TS	TF	PPL	TP	DI	A1	B1	B2	T1	T2	DS	PD	PS
111184	1024	1039	112	33	16	355	-1	-1	-1	-1	-1	1	-1
220285	1418	1429	112	32	12	284	97	331	177	-1	2	1	-1
140385	1314	1331	112	36	13	348	-1	-1	-1	-1	4	1	-1
140385	1314	1331	112	39	14	50	-1	-1	-1	-1	2	0	-1
150385	0901	0928	112	14	18	350	46	89	200	-1	3	1	-1
150385	1108	1134	112	-1	13	0	-1	-1	-1	-1	-1	1	-1
150385	1219	1310	112	1	-1	-1	198	-1	298	135	-1	1	2.2
150385	1219	1310	112	58	18	324	-1	-1	106	75	-1	1	1.4
150385	1219	1310	112	72	12	40	66	118	71	60	3	1	1.2
150385	1219	1310	112	143	18	349	15	224	53	30	4	1	1.8
150385	0927	0940	112	14	18	87	107	326	134	-1	1	1	-1
160385	1231	1303	112	33	16	324	-1	-1	50	30	0	1	1.7
160385	1231	1303	112	58	11	288	61	177	73	60	0	1	1.2
160385	1151	1203	112	10	24	303	51	341	40	90	4	0	0.4
160385	1216	1221	112	1	11	-1	26	-1	29	15	-1	1	1.9
160385	1205	1212	112	14	35	303	50	299	15	15	4	0	1.0
030485	1238	1243	111	16	25	134	-1	-1	104	45	2	0	2.3
030485	1214	1226	111	38	8	290	-1	-1	262	60	-1	1	4.4
030485	1248	1259	111	34	19	316	-1	-1	183	90	-1	1	2.0
050485	1214	1236	111	33	16	339	-1	-1	480	225	2	1	2.1
040485	1150	1204	111	24	31	271	-1	-1	15	15	2	1	1.0
060485	1336	1409	111	76	13	330	-1	-1	57	75	2	1	0.8
060485	1336	1409	111	117	43	305	31	20	48	15	2	0	3.2
060485	1246	1256	111	13	13	0	-1	-1	211	45	-1	1	4.7
070485	1332	1346	111	31	13	81	27	34	22	15	3	1	1.5
010585	1208	1220	111	19	6	237	87	233	120	75	1	1	1.6
010585	1121	1132	211	4	7	286	80	220	231	180	0	0	1.3
010585	1133	1141	211	5	11	24	-1	-1	380	210	0	0	1.8
010585	1133	1141	211	6	7	240	-1	-1	-1	-1	0	0	-1
030585	1215	1222	211	19	21	227	52	5	78	60	3	1	1.3
030585	1242	1256	211	43	33	302	92	289	84	45	3	0	1.9
040585	1247	1303	111	54	18	87	-1	-1	32	45	3	1	0.7
040585	1247	1303	111	12	27	309	181	323	162	105	4	1	1.5
040585	1216	1234	111	63	18	249	23	3	39	30	-1	1	1.3
040585	1147	1153	111	3	21	229	118	320	123	75	0	0	1.6
040585	1321	1345	111	76	15	12	88	35	90	75	3	1	1.2
050585	1332	1344	111	15	17	9	151	18	148	75	3	1	2.0
050585	1332	1344	111	14	16	6	55	317	204	120	-1	1	1.7
050585	1250	1259	111	17	21	28	74	354	60	30	3	0	2.0
050585	1232	1238	111	6	18	275	32	240	20	15	0	0	1.3
050585	1232	1238	111	10	41	316	69	305	31	15	3	0	2.1
050585	1301	1324	111	80	13	28	82	93	109	45	-1	0	2.4
050585	1301	1324	111	87	20	320	-1	-1	105	60	-1	0	1.7

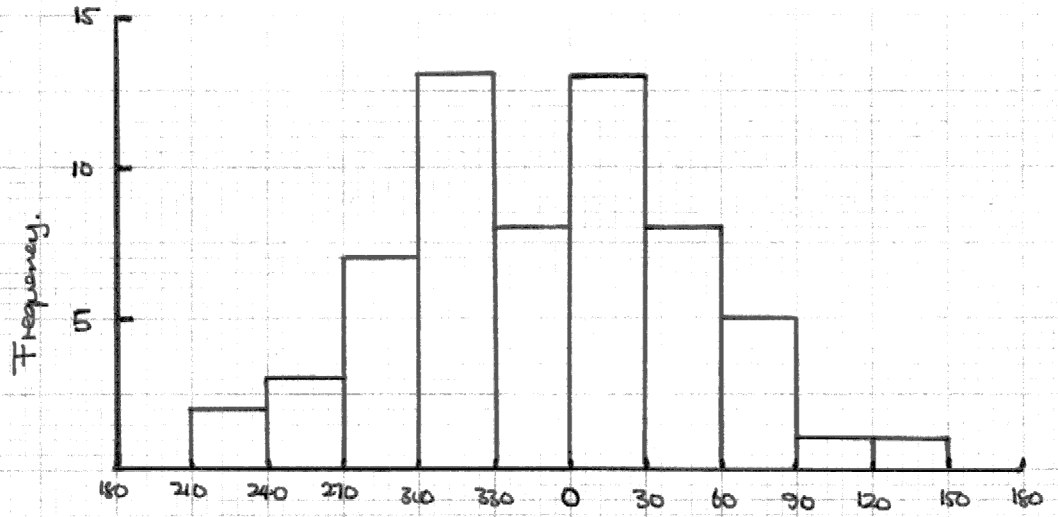
PS

Escape response by Iscuda coronata

fm 600 tracks 201084 – 050585



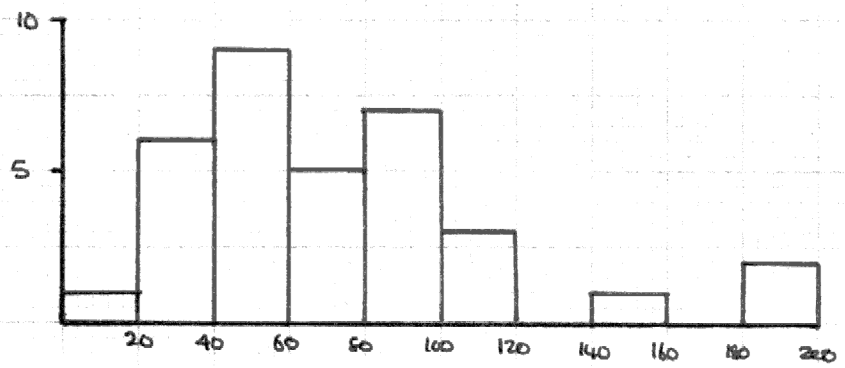
~~Frequency~~ Distance fm predator prey commenced movement (mm)



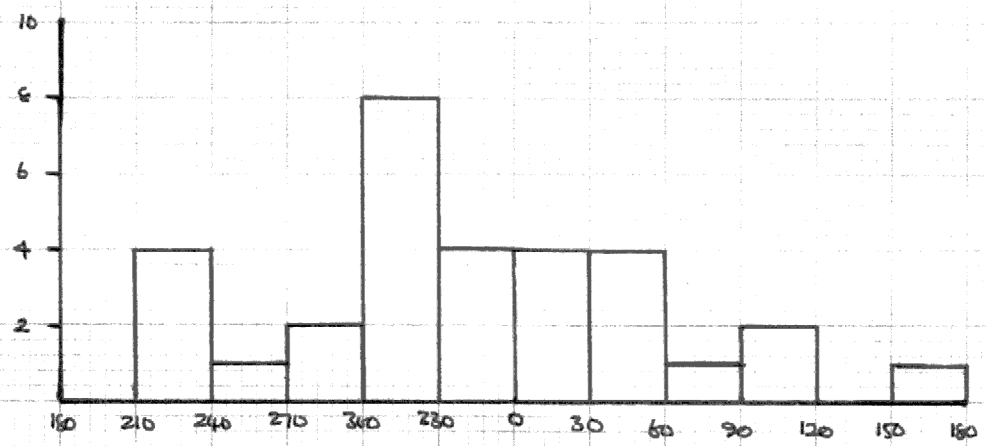
Angle fm direction of movement of predator at which prey commenced movement.

Escape response by Isundra coronata

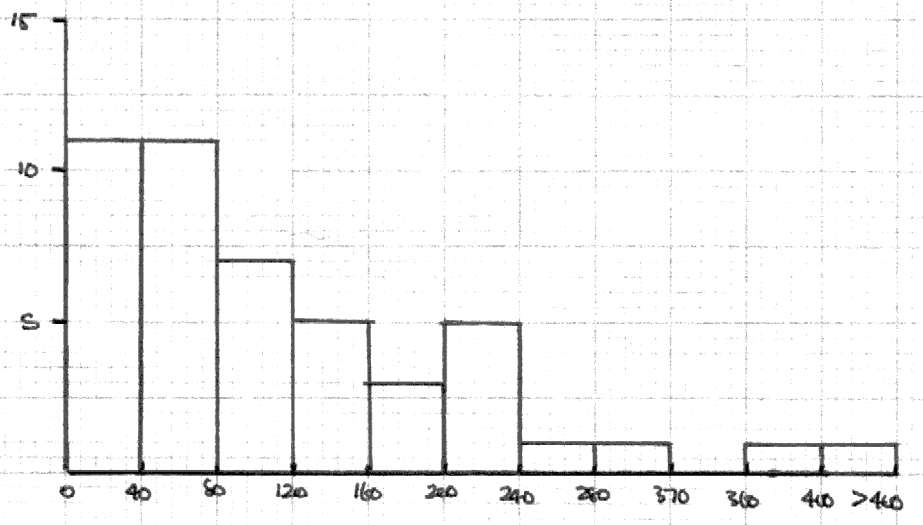
Trades 201084 – 050585



Baseline distance moved by prey (from predator initial posn) (mm)



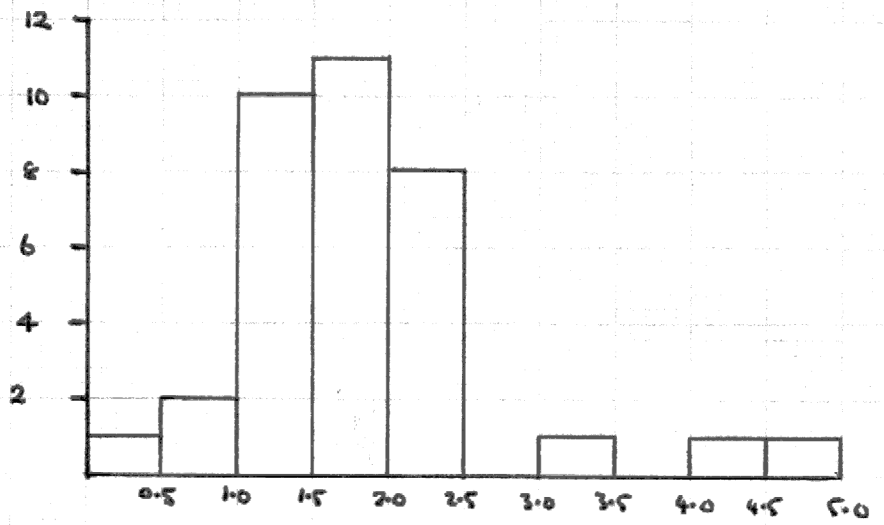
Baseline direction from predator posn



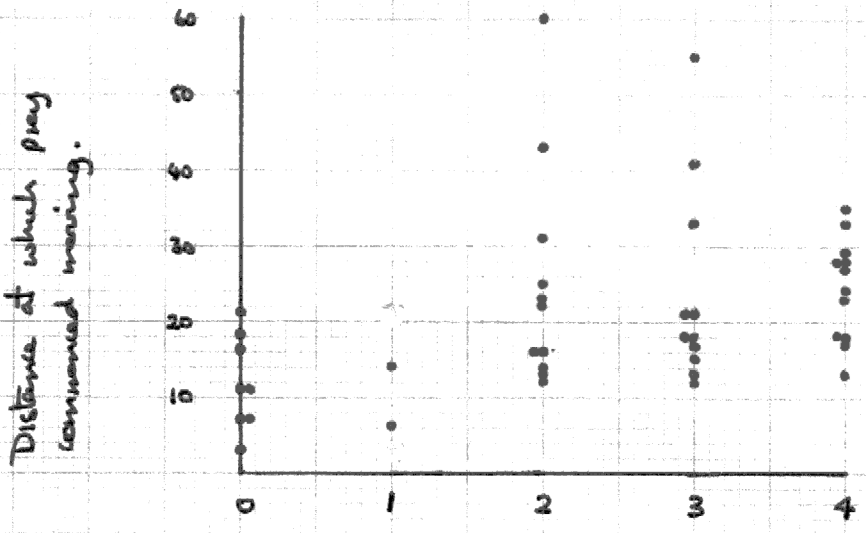
Total distance moved by prey (mm)

Escape response by Isunder coronata

trucks 201084 – 050585



Prey speed mm s^{-1} (over entire track)



Depth of search by predator

TATTACK.DAT

Date	Pred sp	Pred size	Prey sp	Prey size	Captured	Time
20/04/85	2	11.17	1	3.17	0	38.4
20/04/85	2	11.17	1	3.90	1	105.2
20/04/85	2	11.05	1	2.65	0	15.0*
20/04/85	2	13.45	1	2.64	0	28.4
20/04/85	2	13.45	1	3.95	1	83.6
20/04/85	2	13.45	1	2.42	2	39.0
20/04/85	1	9.05	1	3.25	0	42.0
20/04/85	1	9.05	1	2.12	1	40.2
20/04/85	1	9.05	1	3.47	2	50.2
20/04/85	1	7.83	1	2.69	0	18.9
20/04/85	1	7.83	1	3.90	1	32.0
20/04/85	1	8.76	1	3.35	0	33.2
20/04/85	1	8.76	1	2.30	1	26.2
20/04/85	1	8.76	1	3.64	2	39.2
20/04/85	1	10.18	1	3.36	1	38.2
20/04/85	1	9.81	1	3.43	0	68.6
20/04/85	1	9.81	1	3.24	1	48.8
15/05/85	1	7.40	1	3.75	0	63.6
15/05/85	1	9.10	1	4.16	0	40.6
15/05/85	1	6.55	1	3.5	0	64.2
15/05/85	1	10.00	1	3.23	0	64.4
15/05/85	1	9.70	1	3.69	0	39.6
15/05/85	1	8.40	1	3.36	0	42.2
15/05/85	1	6.86	1	3.36	0	44.0
15/05/85	1	7.91	1	4.11	0	83.8
16/05/85	1	7.41	1	3.71	0	46.8
16/05/85	1	10.41	1	3.16	0	82.6
16/05/85	1	8.30	1	4.84	0	35.6
16/05/85	1	10.18	1	3.36	0	29.2
16/05/85	1	8.42	1	3.35	0	40.2
16/05/85	1	8.47	1	3.05	0	46.2
16/05/85	1	7.56	1	2.75	0	36.8
16/05/85	1	7.02	1	3.31	0	30.4
16/05/85	1	9.25	1	3.58	0	49.8
16/05/85	1	10.82	1	2.55	0	65.0
16/05/85	1	9.31	1	3.24	0	33.4
16/05/85	1	10.62	1	4.62	0	29.6
16/05/85	1	8.86	1	3.12	0	49.0
16/05/85	1	10.34	1	4.3	0	36.8
16/05/85	1	6.0	1	3.95	0	103.0
16/05/85	1	8.6	1	4.25	0	71.0
16/05/85	1	8.8	1	3.76	0	69.2
16/05/85	1	7.08	1	3.39	0	40.8
16/05/85	1	7.45	1	2.66	0	46.6
16/05/85	1	8.0	1	2.67	0	47.0

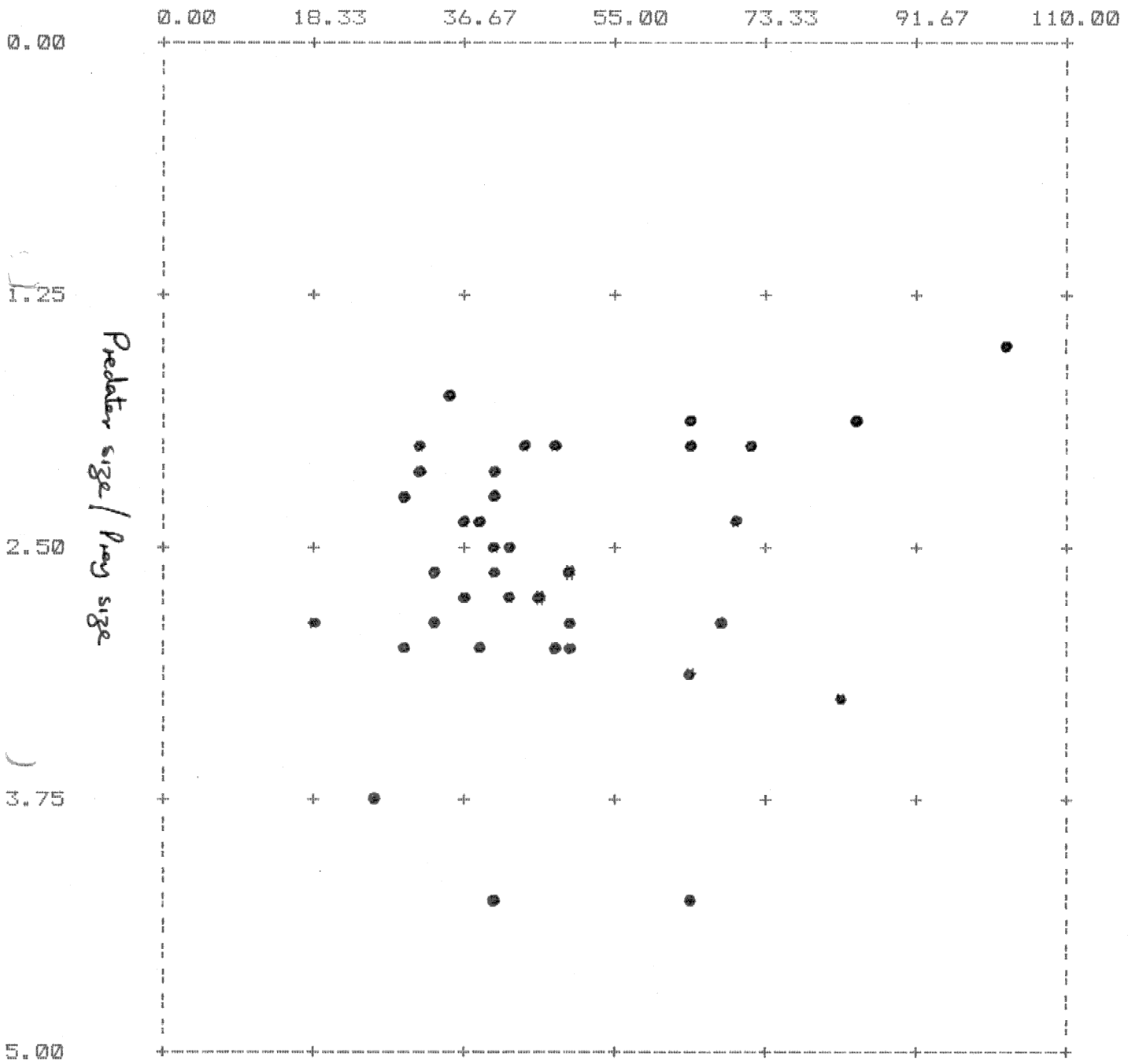
Notes: Pred species 1. P. conicus
2. P. sordidus
3. P. incei

Prey species 1. Isanda coronata
2. Mesodesma alternata

ID: EVALUATION TIME P. conicus Date: 16/5/85

DX = .125 DY = 1.83333 COLLISION SYMBOL: #

FILES: ATTACK4.DAT(1,4)=*



Apparently no relationship between prey – pred size and evaluation time.

Marcoola beach surf club 17/06/85. Pipi Escape response.

over sand		burrowing		beeline	
Dir	Dist(mm)	Dir	Dist(mm)	Dir	Dist(mm)
300	41	-	-	-	-
238	106	-	-	-	-
220	123	-	-	-	-
188	33	244	26	213	53
358	36	321	38	338	70
242	37	252	26	246	62
015	74	-	-	-	-
189	58	-	-	-	-
335	138	-	-	-	-
208	48	193	26	231	62
178	65	-	-	-	-
212	58	251	38	227	91

Marcoola beach surf club 18/06/85. Measurement of Pipi escape response elicited by overflying jet aircraft.

over sand		burrowing		beeline	
Dir	Dist(mm)	Dir	Dist(mm)	Dir	Dist(mm)
165	27	240	2	169	28
118	62	54	7	112	66
273	56	200	8	266	59
84	222	-	-	-	-
238	98	-	-	-	-
82	82	148	27	92	95
290	72	247	37	275	102
106	110	154	8	111	119
233	62	121	8	221	58
83	91	-	-	-	-
186	42	146	33	169	71
277	72	291	9	279	81
344	85	330	6	343	90
303	104	288	34	299	137
359	78	301	7	355	81

Sizes of pipi's measured

7.46
10.03
8.55
5.44
7.30
7.71
8.75
8.64
7.58
6.69
10.48
10.71

10.28
7.74
17.38

n=15 Mean=8.95 s.d.=2.76

Escape response of pipi's to incoming aircraft 19/06/85.

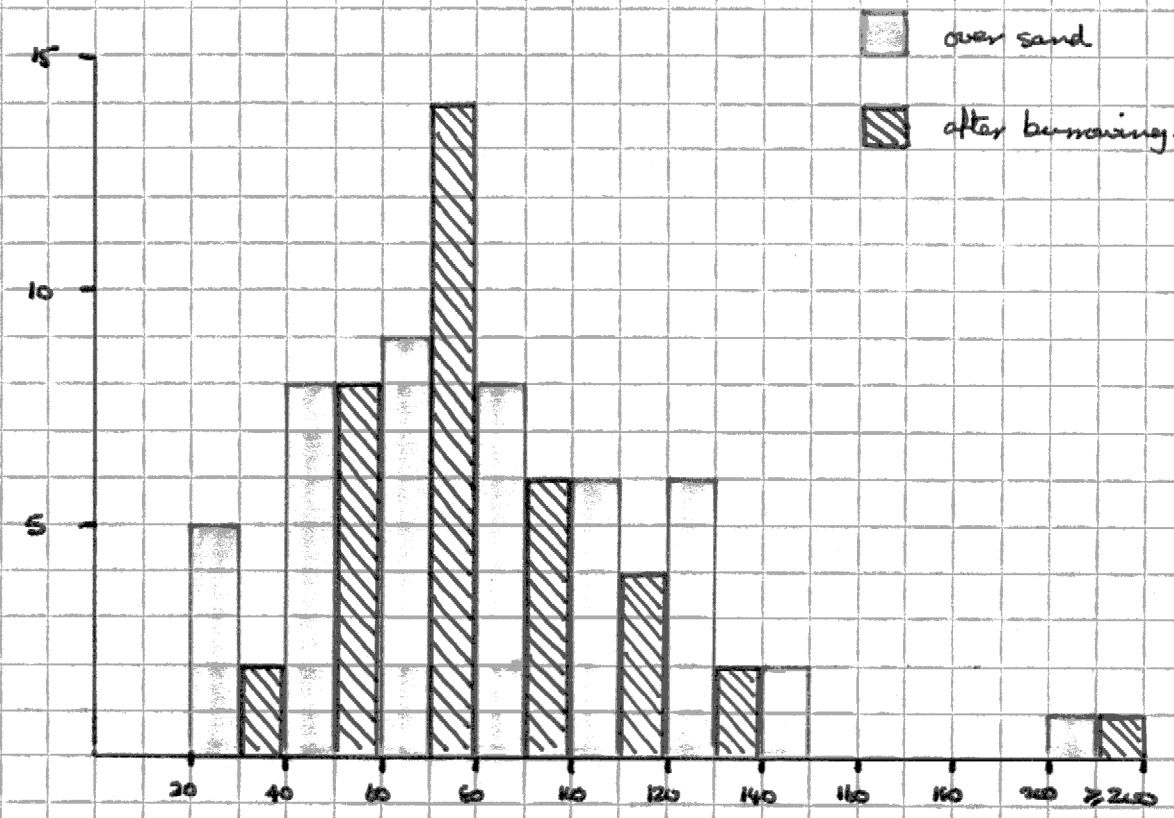
over sand		burrowing		beeline	
Dir	Dist(mm)	Dir	Dist(mm)	Dir	Dist(mm)
269	125	119	24	261	106
226	98	287	6	229	101
171	112	208	5	172	116
345	146	256	9	341	146
143	95	33	8	135	91
38	128	150	10	43	125
192	83	-	-	-	-
10	108	131	44	33	92
348	124	86	45	9	27
352	83	82	5	356	84
334	56	60	8	342	57
196	39	93	42	141	52
338	64	10	3	339	67
116	120	310	24	112	97
209	75	236	17	213	90
62	150	318	48	45	148
230	49	320	25	257	56
110	102	3	18	100	97

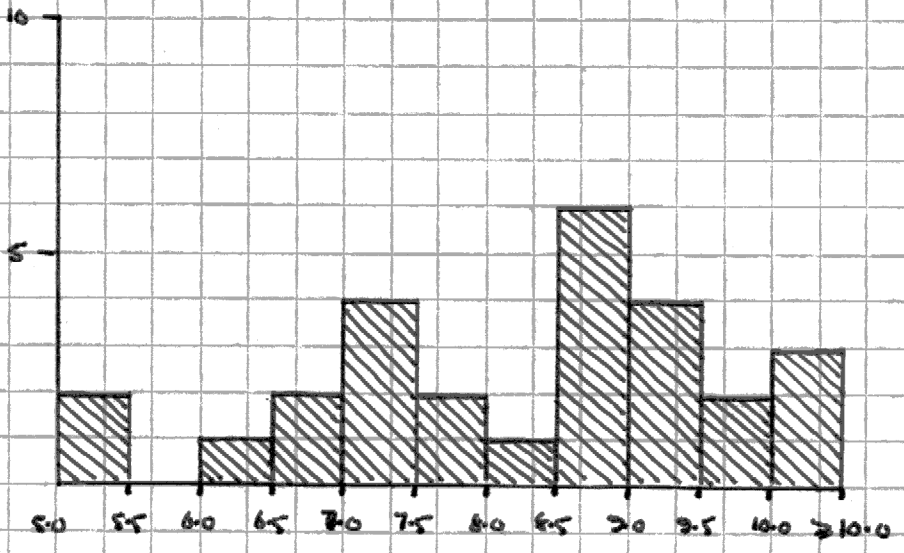
Sizes of pipi's measured.

9.46
8.25
9.44
7.24
7.15
9.04
9.88
6.70
6.06
5.28
8.76
8.64
9.80
9.06
8.72

Mean=8.23 s.d.=1.42 n=15

Pipi escape response to overflying aircraft





Pipi escape response 170685 ϕϕϕ = antenny.

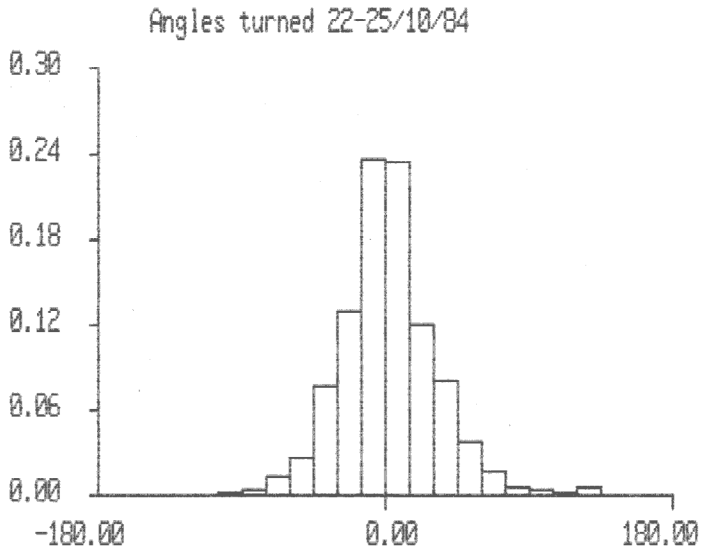
over sand		below sand		beeline	
DIR (°)	DIST (mm)	DIR (°)	DIST (mm)	DIR (°)	DIST (mm)
300	41	–	–	–	–
238	106	–	–	–	–
220	123	–	–	–	–
188	33	244	26	213	53
358	36	321	38	338	70
242	37	252	26	246	62
015	74	–	–	–	–
189	58	–	–	–	–
335	138	–	–	–	–
208	48	193	26	231	62
178	65	–	–	–	–
212	58	251	38	227	91

Pip1 escape response 180685 ϕϕϕ = arbitary.

over sand		below sand		baseline	
DIR	DIST	DIR	DIST	DIR	DIST
165	27	240	2	169	28
118	62	054	7	112	66
273	56	200	8	266	59
084	222	-	-	-	-
238	98	-	-	-	-
082	82	148	27	092	95
290	72	247	37	275	102
106	110	154	8	111	119
233	62	121	8	221	58
063	91	-	-	-	-
186	42	146	33	169	71
277	72	291	9	279	81
344	85	330	6	343	90
303	104	288	34	299	137
359	78	301	7	355	81

Pipi escape response 190685 Sea = ϕϕϕ

over sand		below sand		beeline	
DIR	DIST (mm)	DIR	DIST (mm)	DIR	DIST (mm)
269	125	119	24	261	106
226	98	287	6	229	101
171	112	208	5	172	116
345	146	256.5	9	341.5	146
143.5	95	033	8	135.5	91
038	128	150	10	043	125
192	83	-	-	-	-
010	108	131	44	083.5	92
348	124	086	45	009	127
352	83	082.5	5	356	64
334	56	060	8	342	57
196	39	093	42	141	52
338	64	010	3	339	67
116	120	310	24	112	97
209	75	236	17	213	90
062	150	318	48	045	148
230	49	320	25	257	56
110	102	003	18	100	97



No. of data points 534
Size class width 15.

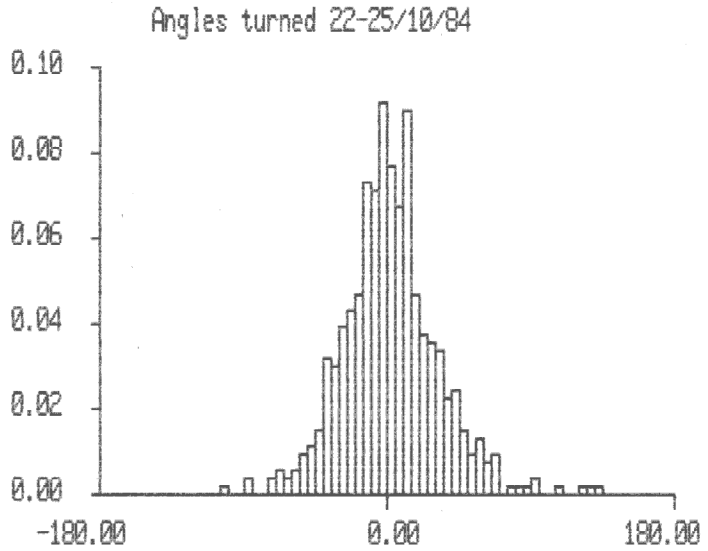
Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
-172.50 :	0.00	-157.50 :	0.00	-142.50 :	0.00
-127.50 :	0.00	-112.50 :	0.00	-97.50 :	0.18
-82.50 :	0.37	-67.50 :	1.32	-52.50 :	2.64
-37.50 :	7.73	-22.50 :	13.01	-7.50 :	23.77
7.50 :	23.58	22.50 :	12.07	37.50 :	8.11
52.50 :	3.77	67.50 :	1.69	82.50 :	0.56
97.50 :	0.37	112.50 :	0.18	127.50 :	0.56
142.50 :	0.00	157.50 :	0.00	172.50 :	0.00

Normal statistics

Mean = 22.47 N = 530
Varience = 412.56
Std. Dev = 20.31
Proportion of +ve turns = 0.5094

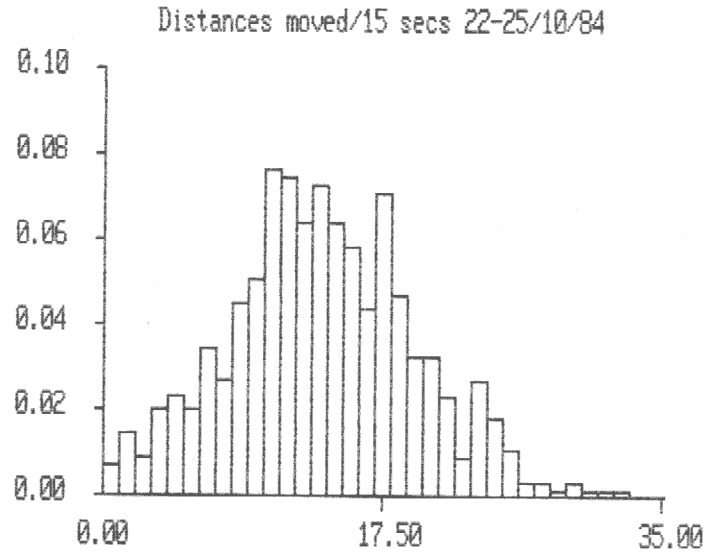
Circular Statistics

Mean Angle = 1.67 N = 530
Directionality = 0.87
Angular Deviation = 29.56



No. of data points 534
Size class width 5.

Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
-177.50 :	0.00	-172.50 :	0.00	-167.50 :	0.00
-162.50 :	0.00	-157.50 :	0.00	-152.50 :	0.00
-147.50 :	0.00	-142.50 :	0.00	-137.50 :	0.00
-132.50 :	0.01	-127.50 :	0.02	-122.50 :	0.04
-117.50 :	0.04	-112.50 :	0.02	-107.50 :	0.01
-102.50 :	0.19	-97.50 :	0.00	-92.50 :	0.00
-87.50 :	0.37	-82.50 :	0.00	-77.50 :	0.00
-72.50 :	0.37	-67.50 :	0.56	-62.50 :	0.37
-57.50 :	0.56	-52.50 :	0.94	-47.50 :	1.13
-42.50 :	1.50	-37.50 :	3.20	-32.50 :	3.01
-27.50 :	3.96	-22.50 :	4.33	-17.50 :	4.71
-12.50 :	7.35	-7.50 :	7.16	-2.50 :	9.24
2.50 :	7.73	7.50 :	6.79	12.50 :	9.05
17.50 :	4.71	22.50 :	3.77	27.50 :	3.58
32.50 :	3.39	37.50 :	2.26	42.50 :	2.45
47.50 :	1.50	52.50 :	0.94	57.50 :	1.32
62.50 :	0.75	67.50 :	0.94	72.50 :	0.00
77.50 :	0.18	82.50 :	0.18	87.50 :	0.18
92.50 :	0.37	97.50 :	0.00	102.50 :	0.00
107.50 :	0.18	112.50 :	0.00	117.50 :	0.00
122.50 :	0.18	127.50 :	0.18	132.50 :	0.18
137.50 :	0.00	142.50 :	0.00	147.50 :	0.00
152.50 :	0.00	157.50 :	0.00	162.50 :	0.00
167.50 :	0.00	172.50 :	0.00	177.50 :	0.00

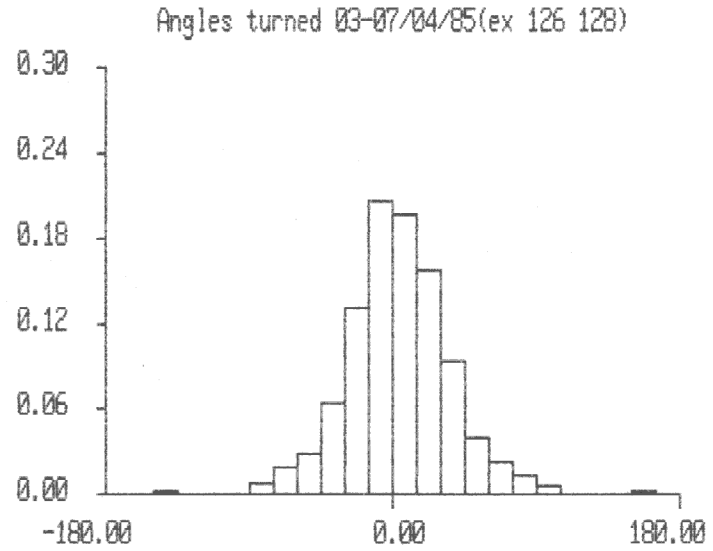


No. of data points 548
Size class width 1.

Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
0.50 :	0.72	1.50 :	1.45	2.50 :	0.91
3.50 :	2.00	4.50 :	2.37	5.50 :	2.00
6.50 :	3.46	7.50 :	2.73	8.50 :	4.56
9.50 :	5.10	10.50 :	7.66	11.50 :	7.48
12.50 :	6.38	13.50 :	7.29	14.50 :	6.38
15.50 :	5.83	16.50 :	4.37	17.50 :	7.11
18.50 :	4.74	19.50 :	3.28	20.50 :	3.28
21.50 :	2.37	22.50 :	0.91	23.50 :	2.73
24.50 :	1.82	25.50 :	1.09	26.50 :	0.36
27.50 :	0.36	28.50 :	0.18	29.50 :	0.36
30.50 :	0.18	31.50 :	0.18	32.50 :	0.18
33.50 :	0.00	34.50 :	0.00		

Normal statistics

Mean = 13.69 N = 548
Varience = 34.07
Std. Dev = 5.83



No. of data points 540
Size class width 15.

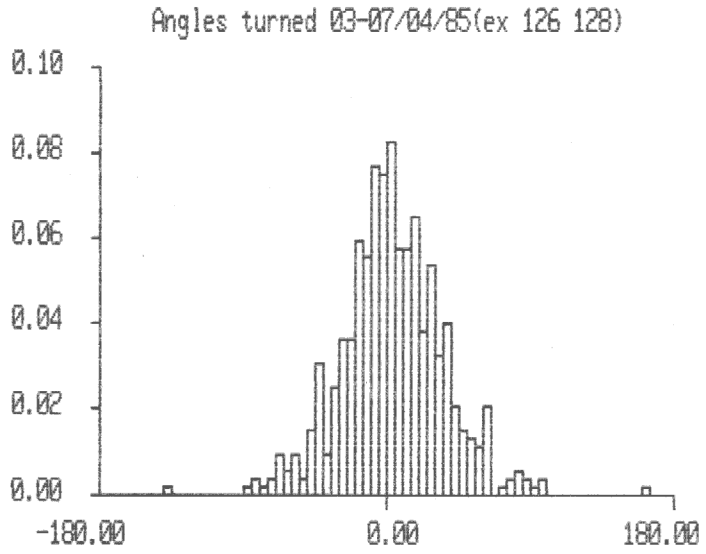
Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
-172.50 :	0.00	-157.50 :	0.00	-142.50 :	0.19
-127.50 :	0.00	-112.50 :	0.00	-97.50 :	0.00
-82.50 :	0.77	-67.50 :	1.92	-52.50 :	2.89
-37.50 :	6.55	-22.50 :	13.29	-7.50 :	20.80
7.50 :	19.84	22.50 :	15.79	37.50 :	9.44
52.50 :	4.04	67.50 :	2.31	82.50 :	1.34
97.50 :	0.57	112.50 :	0.00	127.50 :	0.00
142.50 :	0.00	157.50 :	0.19	172.50 :	0.00

Normal statistics

Mean = 24.32 N = 519
Varience = 454.41
Std. Dev = 21.31
Proportion of +ve turns = 0.5356

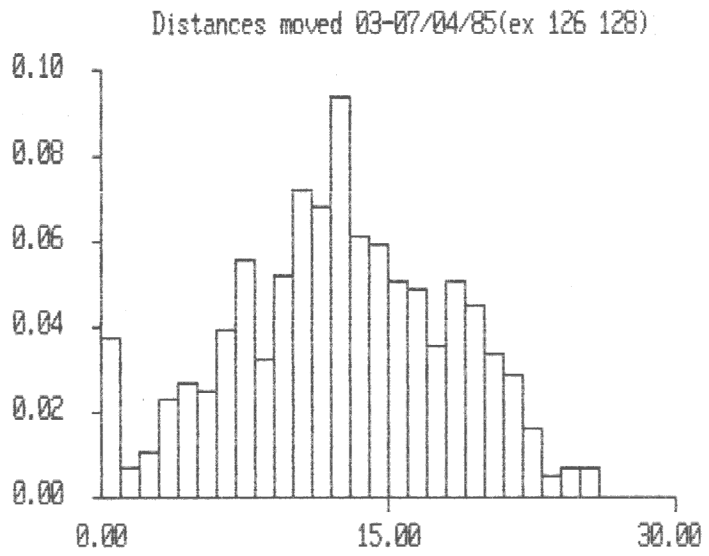
Circular Statistics

Mean Angle = 3.23 N = 519
Directionality = 0.86
Angular Deviation = 31.46



No. of data points 540
Size class width 5.

Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
-177.50 :	0.00	-172.50 :	0.00	-167.50 :	0.00
-162.50 :	0.00	-157.50 :	0.00	-152.50 :	0.00
-147.50 :	0.00	-142.50 :	0.00	-137.50 :	0.19
-132.50 :	0.01	-127.50 :	0.02	-122.50 :	0.04
-117.50 :	0.03	-112.50 :	0.03	-107.50 :	0.01
-102.50 :	0.00	-97.50 :	0.00	-92.50 :	0.00
-87.50 :	0.19	-82.50 :	0.38	-77.50 :	0.19
-72.50 :	0.38	-67.50 :	0.96	-62.50 :	0.57
-57.50 :	0.96	-52.50 :	0.38	-47.50 :	1.54
-42.50 :	3.08	-37.50 :	0.96	-32.50 :	2.50
-27.50 :	3.66	-22.50 :	3.66	-17.50 :	5.97
-12.50 :	5.58	-7.50 :	7.70	-2.50 :	7.51
2.50 :	8.28	7.50 :	5.78	12.50 :	5.78
17.50 :	6.55	22.50 :	3.85	27.50 :	5.39
32.50 :	3.27	37.50 :	4.04	42.50 :	2.11
47.50 :	1.54	52.50 :	1.34	57.50 :	1.15
62.50 :	2.11	67.50 :	0.00	72.50 :	0.19
77.50 :	0.38	82.50 :	0.57	87.50 :	0.38
92.50 :	0.19	97.50 :	0.38	102.50 :	0.00
107.50 :	0.00	112.50 :	0.00	117.50 :	0.00
122.50 :	0.00	127.50 :	0.00	132.50 :	0.00
137.50 :	0.00	142.50 :	0.00	147.50 :	0.00
152.50 :	0.00	157.50 :	0.00	162.50 :	0.19

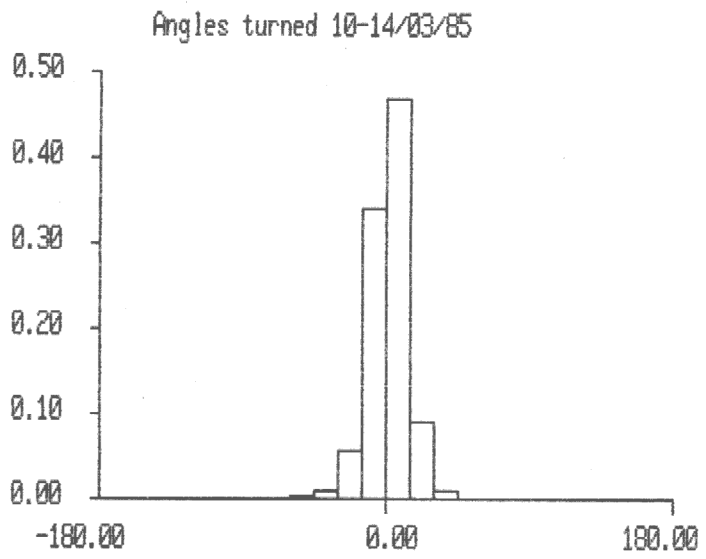


No. of data points 553
Size class width 1.

Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
0.50 :	3.79	1.50 :	0.72	2.50 :	1.08
3.50 :	2.35	4.50 :	2.71	5.50 :	2.53
6.50 :	3.97	7.50 :	5.60	8.50 :	3.25
9.50 :	5.24	10.50 :	7.23	11.50 :	6.87
12.50 :	9.40	13.50 :	6.14	14.50 :	5.96
15.50 :	5.06	16.50 :	4.88	17.50 :	3.61
18.50 :	5.06	19.50 :	4.52	20.50 :	3.43
21.50 :	2.89	22.50 :	1.62	23.50 :	0.54
24.50 :	0.72	25.50 :	0.72	26.50 :	0.00
27.50 :	0.00	28.50 :	0.00	29.50 :	0.00

Normal statistics

Mean = 12.45 N = 553
Varience = 32.56
Std. Dev = 5.70



No. of data points 1348
Size class width 15.

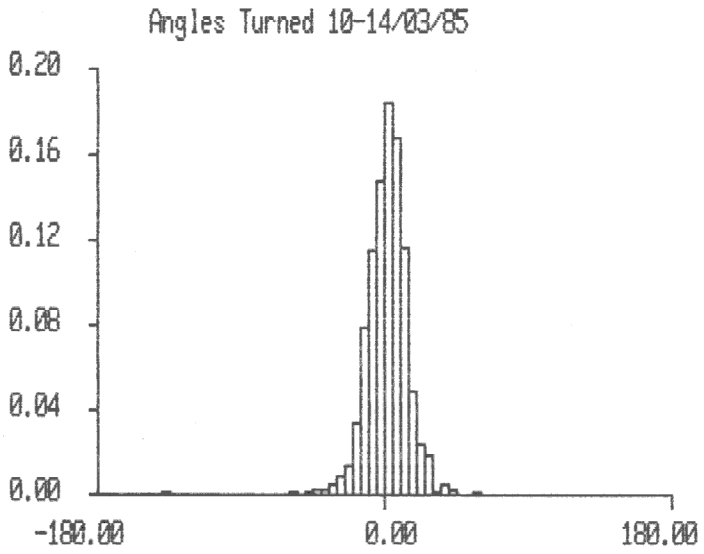
Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
-172.50 :	0.00	-157.50 :	0.07	-142.50 :	0.14
-127.50 :	0.00	-112.50 :	0.07	-97.50 :	0.00
-82.50 :	0.00	-67.50 :	0.07	-52.50 :	0.44
-37.50 :	1.19	-22.50 :	5.82	-7.50 :	34.30
7.50 :	47.01	22.50 :	9.34	37.50 :	1.12
52.50 :	0.22	67.50 :	0.07	82.50 :	0.07
97.50 :	0.00	112.50 :	0.00	127.50 :	0.00
142.50 :	0.00	157.50 :	0.00	172.50 :	0.00

Normal statistics

Mean = 10.23 N = 1338
Varience = 129.68
Std. Dev = 11.38
Proportion of +ve turns = 0.5769

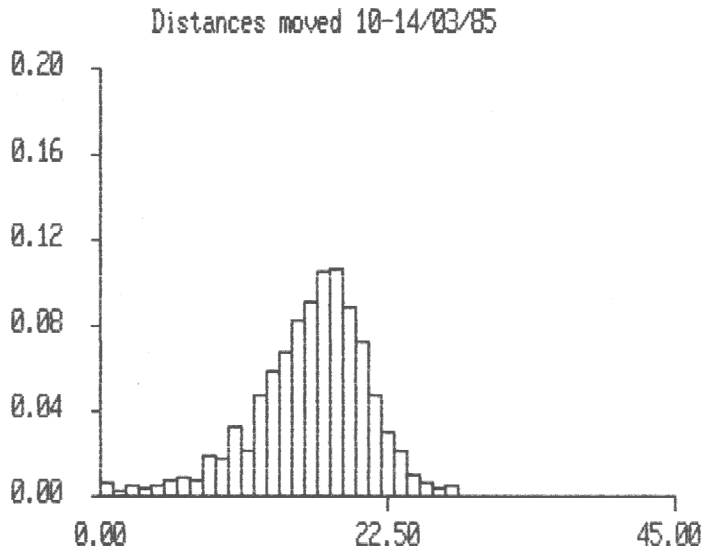
Circular Statistics

Mean Angle = 1.50 N = 1338
Directionality = 0.96
Angular Deviation = 14.39



No. of data points 1348
Size class width 5.

Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
-177.50 :	0.00	-172.50 :	0.00	-167.50 :	0.00
-162.50 :	0.07	-157.50 :	0.00	-152.50 :	0.00
-147.50 :	0.00	-142.50 :	0.00	-137.50 :	0.14
-132.50 :	0.00	-127.50 :	0.00	-122.50 :	0.02
-117.50 :	0.03	-112.50 :	0.00	-107.50 :	0.07
-102.50 :	0.00	-97.50 :	0.00	-92.50 :	0.00
-87.50 :	0.00	-82.50 :	0.00	-77.50 :	0.00
-72.50 :	0.00	-67.50 :	0.07	-62.50 :	0.00
-57.50 :	0.14	-52.50 :	0.07	-47.50 :	0.22
-42.50 :	0.29	-37.50 :	0.29	-32.50 :	0.59
-27.50 :	0.97	-22.50 :	1.42	-17.50 :	3.43
-12.50 :	7.99	-7.50 :	11.50	-2.50 :	14.79
2.50 :	18.46	7.50 :	16.81	12.50 :	11.73
17.50 :	4.93	22.50 :	2.46	27.50 :	1.94
32.50 :	0.22	37.50 :	0.52	42.50 :	0.37
47.50 :	0.00	52.50 :	0.07	57.50 :	0.14
62.50 :	0.07	67.50 :	0.00	72.50 :	0.00
77.50 :	0.00	82.50 :	0.07	87.50 :	0.00
92.50 :	0.00	97.50 :	0.00	102.50 :	0.00
107.50 :	0.00	112.50 :	0.00	117.50 :	0.00
122.50 :	0.00	127.50 :	0.00	132.50 :	0.00
137.50 :	0.00	142.50 :	0.00	147.50 :	0.00
152.50 :	0.00	157.50 :	0.00	162.50 :	0.00
167.50 :	0.00	172.50 :	0.00	177.50 :	0.00

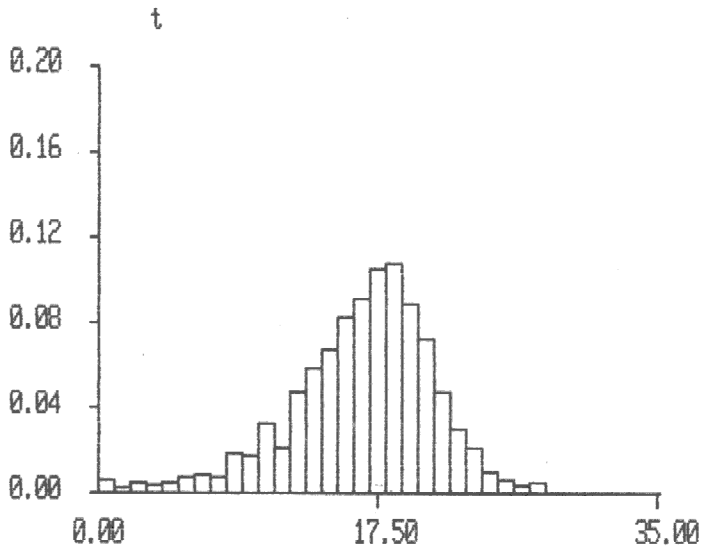


No. of data points 1387
Size class width 1.

Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
0.50 :	0.72	1.50 :	0.28	2.50 :	0.57
3.50 :	0.43	4.50 :	0.50	5.50 :	0.79
6.50 :	0.93	7.50 :	0.86	8.50 :	1.94
9.50 :	1.80	10.50 :	3.31	11.50 :	2.23
12.50 :	4.83	13.50 :	5.91	14.50 :	6.77
15.50 :	8.29	16.50 :	9.15	17.50 :	10.52
18.50 :	10.74	19.50 :	8.94	20.50 :	7.28
21.50 :	4.83	22.50 :	3.02	23.50 :	2.16
24.50 :	1.08	25.50 :	0.72	26.50 :	0.43
27.50 :	0.50	28.50 :	0.07	29.50 :	0.07
30.50 :	0.07	31.50 :	0.07	32.50 :	0.00
33.50 :	0.00	34.50 :	0.00	35.50 :	0.00
36.50 :	0.00	37.50 :	0.00	38.50 :	0.00
39.50 :	0.00	40.50 :	0.00	41.50 :	0.07
42.50 :	0.00	43.50 :	0.00	44.50 :	0.00

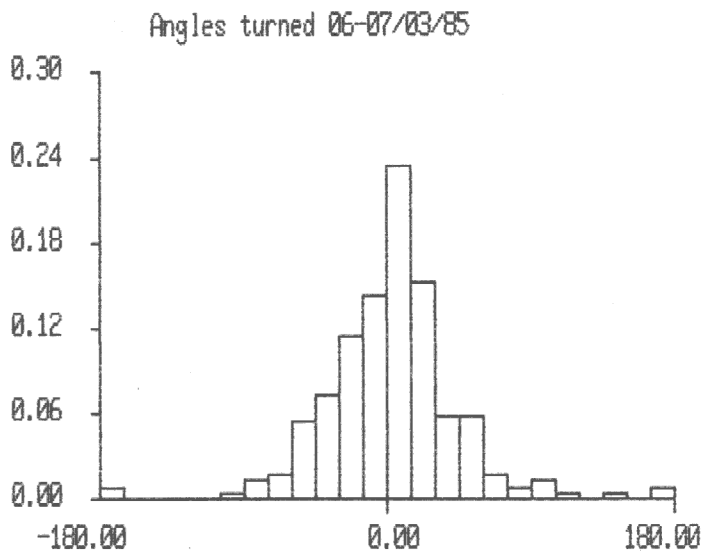
Normal statistics

Mean = 16.45 N = 1387
Varience = 22.41
Std. Dev = 4.73



No. of data points 1387
Size class width 1.

Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
0.50 :	0.72	1.50 :	0.28	2.50 :	0.57
3.50 :	0.43	4.50 :	0.50	5.50 :	0.79
6.50 :	0.93	7.50 :	0.86	8.50 :	1.94
9.50 :	1.80	10.50 :	3.31	11.50 :	2.23
12.50 :	4.83	13.50 :	5.91	14.50 :	6.78
15.50 :	8.29	16.50 :	9.16	17.50 :	10.53
18.50 :	10.75	19.50 :	8.94	20.50 :	7.28
21.50 :	4.83	22.50 :	3.03	23.50 :	2.16
24.50 :	1.08	25.50 :	0.72	26.50 :	0.43
27.50 :	0.50	28.50 :	0.07	29.50 :	0.07
30.50 :	0.07	31.50 :	0.07	32.50 :	0.00
33.50 :	0.00	34.50 :	0.00		



No. of data points 235
Size class width 15.

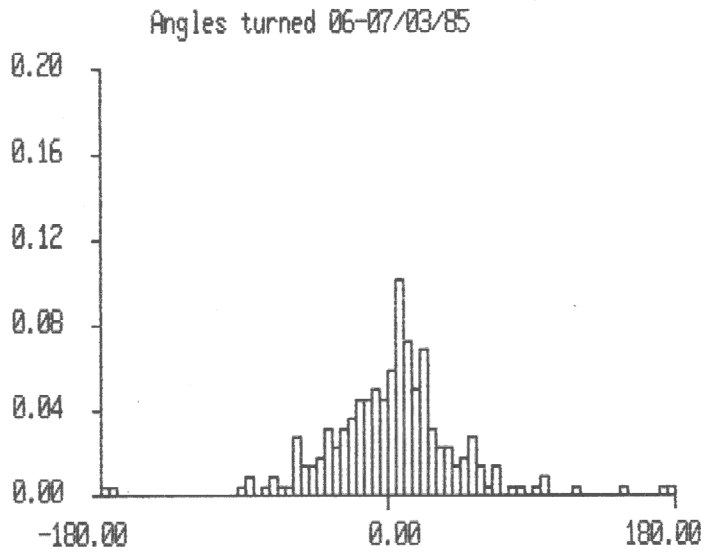
Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
-172.50 :	0.92	-157.50 :	0.00	-142.50 :	0.00
-127.50 :	0.00	-112.50 :	0.00	-97.50 :	0.46
-82.50 :	1.38	-67.50 :	1.84	-52.50 :	5.52
-37.50 :	7.37	-22.50 :	11.52	-7.50 :	14.28
7.50 :	23.50	22.50 :	15.20	37.50 :	5.99
52.50 :	5.99	67.50 :	1.84	82.50 :	0.92
97.50 :	1.38	112.50 :	0.46	127.50 :	0.00
142.50 :	0.46	157.50 :	0.00	172.50 :	0.92

Normal statistics

Mean = 30.45 N = 217
Varience = 977.24
Std. Dev = 31.26
Proportion of +ve turns = 0.5668

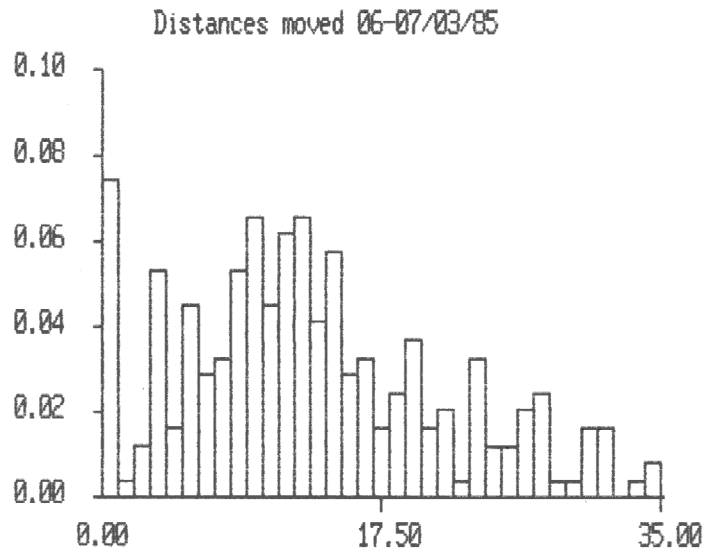
Circular Statistics

Mean Angle = 2.28 N = 217
Directionality = 0.78
Angular Deviation = 39.53



No. of data points 235
Size class width 5.

Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
-177.50 :	0.46	-172.50 :	0.46	-167.50 :	0.00
-162.50 :	0.00	-157.50 :	0.00	-152.50 :	0.00
-147.50 :	0.00	-142.50 :	0.00	-137.50 :	0.02
-132.50 :	0.03	-127.50 :	0.05	-122.50 :	0.06
-117.50 :	0.10	-112.50 :	0.07	-107.50 :	0.02
-102.50 :	0.02	-97.50 :	0.00	-92.50 :	0.46
-87.50 :	0.92	-82.50 :	0.00	-77.50 :	0.46
-72.50 :	0.92	-67.50 :	0.46	-62.50 :	0.46
-57.50 :	2.76	-52.50 :	1.38	-47.50 :	1.38
-42.50 :	1.84	-37.50 :	3.22	-32.50 :	2.30
-27.50 :	3.22	-22.50 :	3.68	-17.50 :	4.60
-12.50 :	4.60	-7.50 :	5.06	-2.50 :	4.60
2.50 :	5.99	7.50 :	10.13	12.50 :	7.37
17.50 :	5.06	22.50 :	6.91	27.50 :	3.22
32.50 :	2.30	37.50 :	2.30	42.50 :	1.38
47.50 :	1.84	52.50 :	2.76	57.50 :	1.38
62.50 :	0.46	67.50 :	1.38	72.50 :	0.00
77.50 :	0.46	82.50 :	0.46	87.50 :	0.00
92.50 :	0.46	97.50 :	0.92	102.50 :	0.00
107.50 :	0.00	112.50 :	0.00	117.50 :	0.46
122.50 :	0.00	127.50 :	0.00	132.50 :	0.00
137.50 :	0.00	142.50 :	0.00	147.50 :	0.46
152.50 :	0.00	157.50 :	0.00	162.50 :	0.00
167.50 :	0.00	172.50 :	0.46	177.50 :	0.46



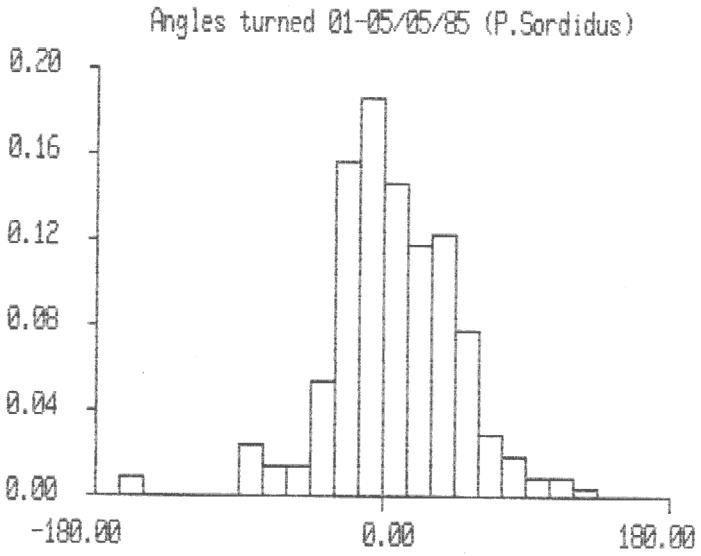
No. of data points 242
Size class width 1.

Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
0.50 :	7.43	1.50 :	0.41	2.50 :	1.23
3.50 :	5.37	4.50 :	1.65	5.50 :	4.54
6.50 :	2.89	7.50 :	3.30	8.50 :	5.37
9.50 :	6.61	10.50 :	4.54	11.50 :	6.19
12.50 :	6.61	13.50 :	4.13	14.50 :	5.78
15.50 :	2.89	16.50 :	3.30	17.50 :	1.65
18.50 :	2.47	19.50 :	3.71	20.50 :	1.65
21.50 :	2.06	22.50 :	0.41	23.50 :	3.30
24.50 :	1.23	25.50 :	1.23	26.50 :	2.06
27.50 :	2.47	28.50 :	0.41	29.50 :	0.41
30.50 :	1.65	31.50 :	1.65	32.50 :	0.00
33.50 :	0.41	34.50 :	0.82		

Normal statistics

Mean = 13.15 N = 242
Varience = 68.36
Std. Dev = 8.26

Track Nos
132
133
137
144
146
148



No. of data points 211
Size class width 15.

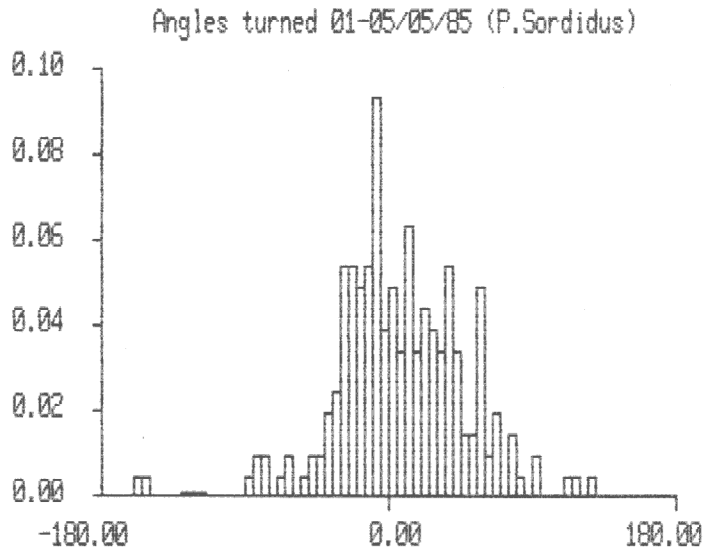
Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
-172.50 :	0.00	-157.50 :	0.98	-142.50 :	0.00
-127.50 :	0.00	-112.50 :	0.00	-97.50 :	0.00
-82.50 :	2.45	-67.50 :	1.47	-52.50 :	1.47
-37.50 :	5.39	-22.50 :	15.68	-7.50 :	18.62
7.50 :	14.70	22.50 :	11.76	37.50 :	12.25
52.50 :	7.84	67.50 :	2.94	82.50 :	1.96
97.50 :	0.98	112.50 :	0.98	127.50 :	0.49
142.50 :	0.00	157.50 :	0.00	172.50 :	0.00

Normal statistics

Mean = 31.08 N = 204
Varience = 734.84
Std. Dev = 27.10
Proportion of +ve turns = 0.5392

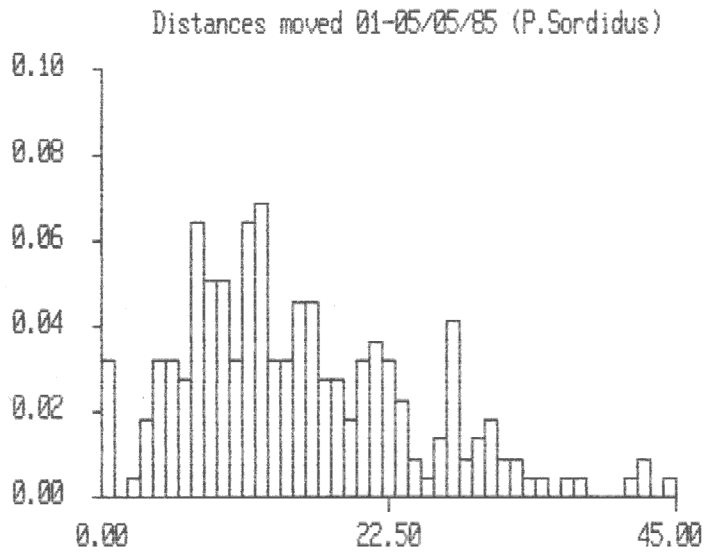
Circular Statistics

Mean Angle = 7.51 N = 204
Directionality = 0.79
Angular Deviation = 39.05



No. of data points 211
Size class width 5.

Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
-177.50 :	0.00	-172.50 :	0.00	-167.50 :	0.00
-162.50 :	0.00	-157.50 :	0.49	-152.50 :	0.49
-147.50 :	0.01	-142.50 :	0.00	-137.50 :	0.00
-132.50 :	0.02	-127.50 :	0.07	-122.50 :	0.09
-117.50 :	0.07	-112.50 :	0.05	-107.50 :	0.06
-102.50 :	0.03	-97.50 :	0.01	-92.50 :	0.00
-87.50 :	0.49	-82.50 :	0.98	-77.50 :	0.98
-72.50 :	0.00	-67.50 :	0.49	-62.50 :	0.98
-57.50 :	0.00	-52.50 :	0.49	-47.50 :	0.98
-42.50 :	0.98	-37.50 :	1.96	-32.50 :	2.45
-27.50 :	5.39	-22.50 :	5.39	-17.50 :	4.90
-12.50 :	5.39	-7.50 :	9.31	-2.50 :	3.92
2.50 :	4.90	7.50 :	3.43	12.50 :	6.37
17.50 :	3.43	22.50 :	4.41	27.50 :	3.92
32.50 :	3.43	37.50 :	5.39	42.50 :	3.43
47.50 :	1.47	52.50 :	1.47	57.50 :	4.90
62.50 :	0.98	67.50 :	1.96	72.50 :	0.00
77.50 :	1.47	82.50 :	0.49	87.50 :	0.00
92.50 :	0.98	97.50 :	0.00	102.50 :	0.00
107.50 :	0.00	112.50 :	0.49	117.50 :	0.49
122.50 :	0.00	127.50 :	0.49	132.50 :	0.00
137.50 :	0.00	142.50 :	0.00	147.50 :	0.00
152.50 :	0.00	157.50 :	0.00	162.50 :	0.00
167.50 :	0.00	172.50 :	0.00	177.50 :	0.00



No. of data points 217
Size class width 1.

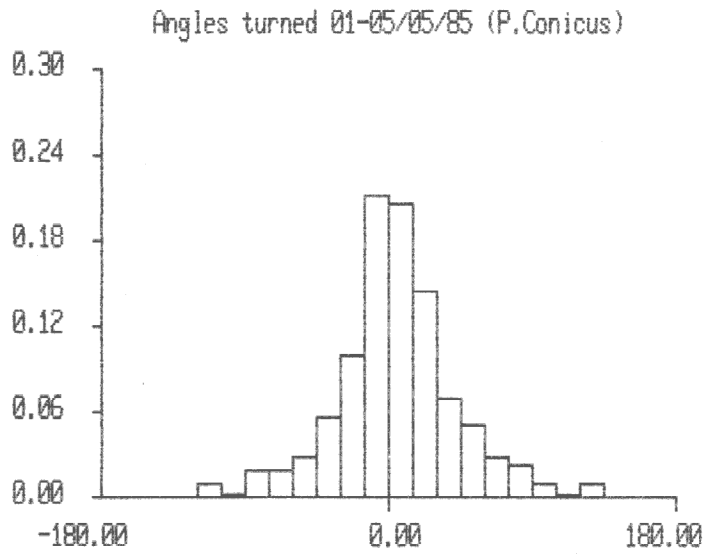
Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
0.50 :	3.22	1.50 :	0.00	2.50 :	0.46
3.50 :	1.84	4.50 :	3.22	5.50 :	3.22
6.50 :	2.76	7.50 :	6.45	8.50 :	5.06
9.50 :	5.06	10.50 :	3.22	11.50 :	6.45
12.50 :	6.91	13.50 :	3.22	14.50 :	3.22
15.50 :	4.60	16.50 :	4.60	17.50 :	2.76
18.50 :	2.76	19.50 :	1.84	20.50 :	3.22
21.50 :	3.68	22.50 :	3.22	23.50 :	2.30
24.50 :	0.92	25.50 :	0.46	26.50 :	1.38
27.50 :	4.14	28.50 :	0.92	29.50 :	1.38
30.50 :	1.84	31.50 :	0.92	32.50 :	0.92
33.50 :	0.46	34.50 :	0.46	35.50 :	0.00
36.50 :	0.46	37.50 :	0.46	38.50 :	0.00
39.50 :	0.00	40.50 :	0.00	41.50 :	0.46
42.50 :	0.92	43.50 :	0.00	44.50 :	0.46

Normal statistics

Mean = 15.49 N = 217
Varience = 80.53
Std. Dev = 8.97

Track No.s

135
139
142
150
152
154
156
158



No. of data points 312
Size class width 15.

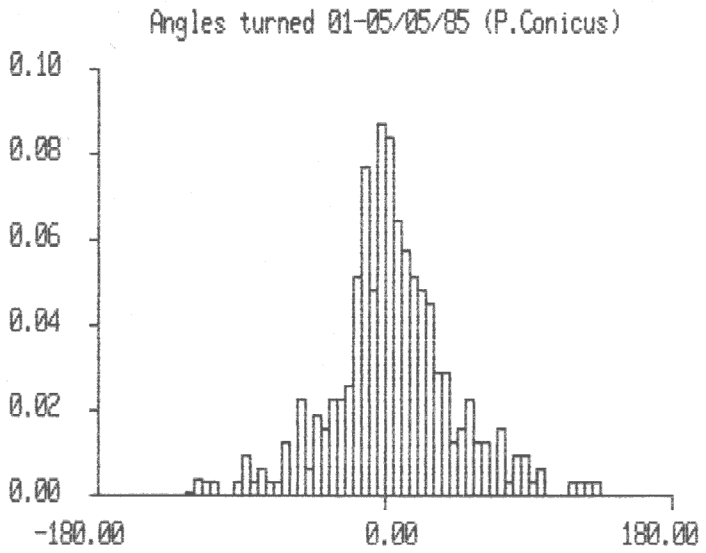
Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
-172.50 :	0.00	-157.50 :	0.00	-142.50 :	0.00
-127.50 :	0.00	-112.50 :	0.96	-97.50 :	0.32
-82.50 :	1.93	-67.50 :	1.93	-52.50 :	2.90
-37.50 :	5.80	-22.50 :	10.00	-7.50 :	21.29
7.50 :	20.64	22.50 :	14.51	37.50 :	7.09
52.50 :	5.16	67.50 :	2.90	82.50 :	2.25
97.50 :	0.96	112.50 :	0.32	127.50 :	0.96
142.50 :	0.00	157.50 :	0.00	172.50 :	0.00

Normal statistics

Mean = 27.85 N = 310
Varience = 727.68
Std. Dev = 26.97
Proportion of +ve turns = 0.5483

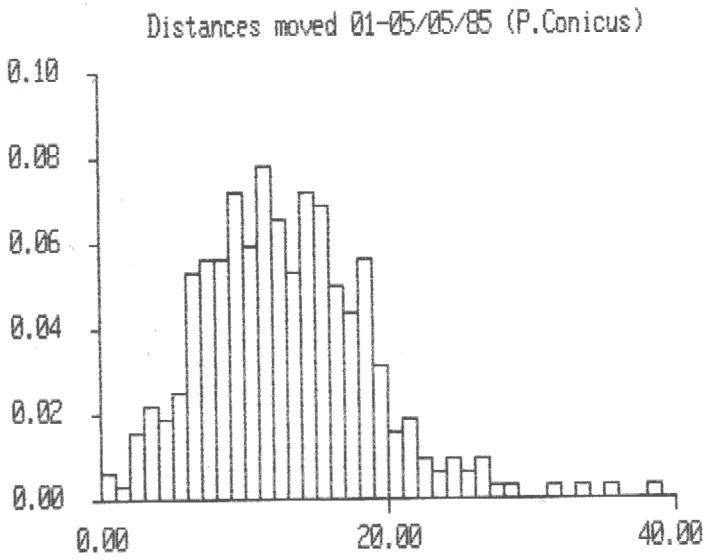
Circular Statistics

Mean Angle = 4.50 N = 310
Directionality = 0.80
Angular Deviation = 37.37



No. of data points 312
Size class width 5.

Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
-177.50 :	0.00	-172.50 :	0.00	-167.50 :	0.00
-162.50 :	0.00	-157.50 :	0.00	-152.50 :	0.00
-147.50 :	0.00	-142.50 :	0.00	-137.50 :	0.00
-132.50 :	0.01	-127.50 :	0.03	-122.50 :	0.06
-117.50 :	0.38	-112.50 :	0.36	-107.50 :	0.34
-102.50 :	0.01	-97.50 :	0.00	-92.50 :	0.32
-87.50 :	0.97	-82.50 :	0.32	-77.50 :	0.64
-72.50 :	0.32	-67.50 :	0.32	-62.50 :	1.29
-57.50 :	0.00	-52.50 :	2.25	-47.50 :	0.64
-42.50 :	1.93	-37.50 :	1.61	-32.50 :	2.25
-27.50 :	2.25	-22.50 :	2.58	-17.50 :	5.16
-12.50 :	7.74	-7.50 :	4.83	-2.50 :	8.70
2.50 :	8.38	7.50 :	6.45	12.50 :	5.80
17.50 :	5.16	22.50 :	4.83	27.50 :	4.51
32.50 :	2.90	37.50 :	2.90	42.50 :	1.29
47.50 :	1.61	52.50 :	2.25	57.50 :	1.29
62.50 :	1.29	67.50 :	0.00	72.50 :	1.61
77.50 :	0.32	82.50 :	0.96	87.50 :	0.96
92.50 :	0.32	97.50 :	0.64	102.50 :	0.00
107.50 :	0.00	112.50 :	0.00	117.50 :	0.32
122.50 :	0.32	127.50 :	0.32	132.50 :	0.32
137.50 :	0.00	142.50 :	0.00	147.50 :	0.00
152.50 :	0.00	157.50 :	0.00	162.50 :	0.00
167.50 :	0.00	172.50 :	0.00	177.50 :	0.00



No. of data points 320
Size class width 1.

Size Class	Freq(%)	Size Class	Freq(%)	Size Class	Freq(%)
0.50 :	0.62	1.50 :	0.31	2.50 :	1.56
3.50 :	2.18	4.50 :	1.87	5.50 :	2.50
6.50 :	5.31	7.50 :	5.62	8.50 :	5.62
9.50 :	7.18	10.50 :	5.93	11.50 :	7.81
12.50 :	6.56	13.50 :	5.31	14.50 :	7.18
15.50 :	6.87	16.50 :	5.00	17.50 :	4.37
18.50 :	5.62	19.50 :	3.12	20.50 :	1.56
21.50 :	1.87	22.50 :	0.93	23.50 :	0.62
24.50 :	0.93	25.50 :	0.62	26.50 :	0.93
27.50 :	0.31	28.50 :	0.31	29.50 :	0.00
30.50 :	0.00	31.50 :	0.31	32.50 :	0.00
33.50 :	0.31	34.50 :	0.00	35.50 :	0.31
36.50 :	0.00	37.50 :	0.00	38.50 :	0.31
39.50 :	0.00				

Normal statistics

Mean = 13.00 N = 320
Varience = 35.25
Std. Dev = 5.93