Appendix A Appended Tables

Table A 5-1 Marine Fish and Shrimps Catches for Commercial Use by Species in Pakistan (1976 – 1978)

(Quantity in Metric Tons.)

Local Name	English Popular Name	Scientific Name	1976	1977	1978
Surmai	Mackerel	Cybium Commersoni	3,731	5,512	6,003
Poplet	Promfret	Pampus argenteus	4,405	6,053	3,919
Rawas	Thread fin	Polynemus sextarius	645	489	568
Dangri	Beckti	Lates calcarifer	583	680	644
Palla	Indian Shad	Hilsa ilisha	9,545	9,129	4,813
Dawan	Tuna	Euthynnus affinis	13,575	12,129	7,066
Sua	Jew Fish	Johnius coibor	9,115	8,000	12,127
Dother	Grunter	Pomadasys hasta	3,960	3,669	2,479
Dandia	Black Bream	Acanthopagrus beida	2,478	2,215	2,416
Aal	Leather Skin	Chorinemus lysan	6,083	7,598	5,477
Hira	Red Snapper	Lutianus argentimaculatus	2,048	2,385	2,241
Sangro	Butter Fish	Rachycentron canadus	965	890	1,282
Gisser	Rock-cod	Epinephelus diacanthus	354	792	1,183
Sole	Flat Fish	Cynoglossus spp.	917	910	1,015
Khagga	Cat Fish	Artius thalassinus	16,616	28,642	24,099
Lady Fish	Lady Fish	Sillago sihama	321	580	248
Tarli	Sardine	Sardinella longiceps	5,739	13,729	71,365
Boi	Mullets	Mugil spp.	4,931	8,768	7,647
Karli	Silver-bar-fish	Chirocentrus dorab	3,390	5,625	2,318
Mangra	Shark	Scoliodon spp.	22,347	34,317	30,913
Pittan	Rays (Sting Rays)	Himantura spp.	17,993	29,812	41,035
Other fishes	N.E.S.	–	25,153	32,769	9,549
Jhinga	Prawn	Penaeus spp.	21,995	19,896	19,177
Kikat	Lobsters	Panilurus spp.	279	227	222
		Total	177,168	234,816	257,806

Source: "Hand Book of Fisheries Statistics of Pakistan 1977" and "1978"
Marine Fisheries Department, Government of Pakistan.

Table A 5-2 Commercial and Industrial Production of Fish (1959 – 1978)

(Quantity in Metric Tons)

Year	Marine			Inland	Grand Total
	Karachi and Sind Coasts	Baluchistan Coast	Total		
1959	35,561	15,707	51,268	18,000	69,268
1960	45,824	16,333	62,157	18,500	80,657
1961	48,410	16,469	64,879	19,000	83,879
1962	50,179	16,787	66,966	19,800	86,766
1963	58,074	17,150	75,224	20,100	95,324
1964	66,104	17,331	83,435	21,000	104,435
1965	72,138	17,694	89,832	22,000	111,832
1966	100,494	18,148	118,642	22,550	141,192
1967	97,945	18,711	116,656	23,290	139,946
1968	98,417	19,173	117,590	28,000	145,590
1969	100,667	35,151	135,818	28,220	164,038
1970	102,418	37,385	139,803	18,740	158,543
1971	101,955	35,316	137,271	18,028	155,299
1972	131,741	41,481	173,222	18,022	191,244
1973	158,892	37,722	196,614	17,617	214,231
1974	110,220	39,790	150,010	19,092	169,102
1975	113,000	41,124	154,124	20,015	174,139
1976*	127,795	49,373	177,168	28,491	205,659
1977*	165,968	68,848	234,816	33,138	267,954
1978*	189,460	68,346	257,806	35,223	293,029
	(64.7%)	(23.3%)	(88.0%)	(12.0%)	(100%)

* Includes Subsistence Catch (1976, 1977 and 1978)

Source: "Hand Book of Fisheries Statistics of Pakistan 1978"
Marine Fisheries Department, Government of Pakistan.

Table A 5-3 Utilization of Commercial and Industrial Catch for Human Consumption and Industrial Purposes (1976 – 1978)

Quantity in Metric Tons.

Utilization/Commodity	1976	1977	1978
Total	205,659 (100%)	267,954 (100%)	293,029 (100%)
1) Edible (Human Consumption)	127,056 (61.8)	151,309 (56.5)	142,029 (48.5)
a) Fish	106,382 (51.7)	132,844 (49.6)	124,630 (42.5)
b) Shrimp	20,674 (10.1)	18,465 (6.9)	17,399 (6.0)
2) Inedible (Industrial Purposes)	78,603 (38.2)	116,645 (43.5)	151,000 (51.5)
a) Trash Fish	77,003 (37.4)	114,595 (42.8)	149,000 (50.8)
b) Trash Shrimp	1,600 (0.8)	2,050 (0.7)	2,000 (0.7)
1) Fish	183,385 (100)	247,439 (100)	273,630 (100)
a) Edible	106,382 (58.0)	132,844 (53.7)	124,630 (45.5)
b) Inedible	77,003 (42.0)	114,595 (46.3)	149,000 (54.5)
2) Shrimp	22,274 (100)	20,515 (100)	19,399 (100)
a) Edible	20,674 (92.8)	18,465 (90)	17,399 (90)
b) Inedible	1,600 (7.2)	2,050 (10)	2,000 (10)

Source: "Hand Book of Fisheries Statistics of Pakistan 1977" and "1978"
Marine Fisheries Department, Government of Pakistan.

Table A 5-4 Channels of Disposition of Commercial and Industrial Catch (1976 – 1978)

(Quantity in Metric Tons.)

Channels of Disposition	Marine						Inland			Total		
	Karachi & Sind Coasts			Baluchistan Coast								
	1976	1977	1978	1976	1977	1978	1976	1977	1978	1976	1977	1978
Total	(100%) 127,795	(100%) 165,968	(100%) 189,460	(100%) 49,373	(1005) 68,848	(100%) 68,346	28,491	33,138	35,223	205,659	267,954	293,029
Marketed as fresh (Local consumption)	(17.5) 22,300	(14.4) 23,900	(13.2) 25,009	(10.8) 5,352	(22.6) 15,542	(23.6) 16,120	21,191	25,558	27,126	48,843	65,000	68,255
Freezing	(6.7) 8,530	(4.5) 7,520	(2.9) 5,586	(8.2) 4,051	(8.0) 5,530	(3.0) 2,037	–	–	–	12,581	13,050	7,623
Canning	(6.3) 8,055	(4.1) 6,715	(3.9) 7,415	–	–	–	–	–	–	8,055	6,715	7,415
Curing	(6.2) 7,960	(4.1) 6,810	(2.4) 4,550	(57.8) 28,517	(46.2) 31,807	(36.3) 24,818	–	–	–	36,477	38,617	29,368
Reduction to fish meal	(55.5) 70,950	(66.4) 110,223	(71.8) 136,000	(15.5) 7,653	(9.3) 6,422	(21.9) 15,000	–	–	–	78,603	116,645	151,000
Other purposes	–	–	–	–	(7.3) 5,047	(10.4) 7,121	–	–	–	–	5,047	7,121
Subsistence	(7.8) 10,000	(6.5) 10,800	(5.8) 10,900	(7.7) 3,800	(6.6) 4,500	(4.8) 3,250	7,300	7,580	8,097	21,100	22,880	22,247

Source: "Hand Book of Fisheries Statistics of Pakistan 1977" and "1978"
Marine Fisheries Department, Government of Pakistn.

Table A 5-5 Local Consumption and Exportable Surplus of Nominal Catch (Commercial, Industrial and Subsistence Catch) (1976 – 1978)

Quantity in Metric Tons.

Area	Commercial, Industrial and Subsistence Catch			Local consumption			Exportable surplus		
	1976	1977	1978	1976	1977	1978	1976	1977	1978
Pakistan	(100%) 205,659	(100%) 267,954	(100%) 293,029	(44.4%) 91,243	(52.8%) 141,416	(60.3%) 176,842	(55.6%) 114,416	(47.2%) 126,538	(39.7%) 116,187
Marine	177,168	234,816	257,806	62,752	108,278	141,619	114,416	126,538	116,187
i) Karachi & Sind coasts	127,795	165,968	189,460	*53,600	*80,188	*82,928	74,195	85,780	106,532
ii) Baluchistan coast	49,373	68,848	68,346	9,152	28,090	58,691	40,221	40,758	9,655
Inland	28,491	33,138	35,223	28,491	33,138	35,223	–	–	–

* denotes local consumption including fish marketed for human consumption and utilized in production of fishmeal for local use in poultry feed.

Source: "Hand Book of Fisheries Statistics of Pakistan 1977" and "1978"
Marine Fisheries Department, Government of Pakistan

Table A 5-6 Fishing Crafts (1959 – 1978)

(Unit: in number of vessels)

Year	Marine												Inland	Total
	Karachi & Sind Coasts						Baluchistan Coast							
	Trawlers	Gill-netter	Mechanized cum Sail-Boats	Motorized vessel Sub-total	Sail Boats	Total	Trawlers	Gill-netter	Mechanized cum Sail-Boats	Motorized vessel Sub-total	Sail Boats	Total	Sail Boats	
1959	33	135	–	168	1,065	1,233	–	2	–	2	1,550	1,552	1,670	4,455
1960	86	146	–	232	1,100	1,332	–	14	–	14	1,961	1,975	1,700	5,007
1961	113	253	–	366	1,100	1,466	–	14	–	14	2,000	2,014	2,000	5,480
1962	141	301	–	442	1,198	1,640	2	17	–	19	2,005	2,024	2,500	6,164
1963	176	359	–	535	1,367	1,902	2	16	–	18	1,915	1,933	2,500	6,335
1964	224	422	–	646	2,644	3,290	2	16	–	18	1,915	1,933	2,500	7,723
1965	258	490	–	748	2,794	3,542	2	20	–	22	1,933	1,955	2,500	7,997
1966	292	506	–	798	2,891	3,689	4	54	–	58	2,475	2,533	2,500	8,722
1967	316	559	–	875	3,029	3,904	4	54	–	58	2,475	2,533	2,500	8,937
1968	356	593	–	949	3,127	4,076	7	61	–	68	2,500	2,568	8,699	15,343
1969	388	627	–	1,015	3,206	4,221	7	61	–	68	2,500	2,568	8,707	15,496
1970	443	659	–	1,102	3,339	4,441	–	48	–	48	2,004	2,052	4,933	11,426
1971	668	559	–	1,227	3,389	4,616	–	48	–	48	2,004	2,052	5,012	11,680
1972	745	618	–	1,363	3,567	4,930	–	48	–	48	2,004	2,052	5,863	12,845
1973	922	691	–	1,613	3,967	5,580	–	60	–	60	2,200	2,260	6,431	14,271
1974	1,076	731	–	1,807	4,130	5,937	–	60	–	60	2,200	2,260	7,164	15,361
1975	1,098	752	230	2,080	3,978	6,058	–	63	–	63	2,249	2,312	7,431	15,801
1976	1,130	825	250	2,205	4,000	6,205	–	40	158	198	2,070	2,268	7,972	16,445
1977	1,151	840	267	2,258	4,152	6,410	–	42	330	372	2,014	2,386	8,107	16,903
1978	1,270	859	327	2,456	4,191	6,647	–	42	677	719	1,673	2,392	8,487	17,526

Source: "Hand Book of Fisheries Statistics of Pakistan 1978" Marine Fisheries Department, Government of Pakistan.

Table A 5-7 Export of Fish, Shell-fish and Fish Products from Pakistan, 1977 and 1978

Commodities	Quantity in Metric tons		Value in '000 Rupees		Unit Price in Rs/Kg	
	1977	1978	1977	1978	1977	1978
Shell-fish						
Shrimps Frozen	4,450	4,229	240,365	250,466	54.0	59.2
Shrimps Canned	1,343	1,260	55,456	52,136	41.3	41.4
Shrimps Dried	256	232	5,175	6,867	20.2	29.6
Shrimps Smoked	2	–	77	–	38.5	–
Lobsters Frozen	85	81	5,699	5,576	67.0	68.8
Sub Total	6,136 (20.4%)	5,802 (19.9%)	306,772 (75.0%)	315,045 (75.7%)		
Fish						
Dry Salted	5,876	4,649	34,103	26,629	5.8	5.7
Frozen	195	468	3,534	5,127	18.1	11.0
Chilled	105	41	1,467	435	14.0	10.6
Wet Salted	20	–	234	–	11.7	–
Dehydrated	5	–	80	–	16.0	–
Sub Total	6,201 (20.6%)	5,158 (17.7%)	39,418 (9.6%)	32,191 (7.7%)		
Fish Products						
Fishmeal	17,264	17,801	49,187	48,230	2.8	2.7
Fish Maws	175	207	6,255	12,342	35.7	59.6
Sharks Fins	169	200	5,537	7,929	32.8	39.6
Fish Preparations	106	18	1,921	613	18.1	34.1
Sub Total	17,714 (59.0%)	18,226 (62.4%)	62,900 (15.4%)	69,114 (16.6%)		
Others						
Froglegs Frozen	*	–	20	–		
Sub Total			20 (0.0%)			
Total	30,051 (100%)	29,186 (100%)	409,110 (100%)	416,350 (100%)		

Source: "Hand Book of Fisheries Statistics of Pakistan 1978"
Marine Fisheries Department, Government of Pakistan

Note: * negligible quantity

Table A 5-8 Export of Mechanically Processed Fishery Products (1976–1978)

Type of Plant	Quantity in Metric tons			Value in '000 Rupees		
	1976	1977	1978	1976	1977	1978
Freezing	5,302	4,730	4,778	273,819	249,618	261,169
Canning	1,611	1,343	1,260	56,185	55,456	52,136
Fishmeal	11,025	17,264	17,801	22,597	49,187	48,230
Total	17,938	23,337	23,839	352,601	354,261	361,535

Source: "Hand Book of Fisheries Statistics of Pakistan 1977" and "1978"
Marine Fisheries Department, Government of Pakistan

Table A 5-9 Export of Frozen Products by Commodity in 1977

Commodity	Quantity in Metric Tons		Percentage		Value in '000 Rs		Percentage	
	1977	1978	1977	1978	1977	1978	1977	1978
Shrimps	4,450	4,229	94.09	88.51	240,365	250,466	96.29	95.90
Lobster	85	81	1.79	1.70	5,699	5,576	2.28	2.14
Fish	195	468	4.12	9.79	3,534	5,127	1.43	1.96
Frog Legs	*	–	0.00	–	20	–	0.00	–
Total	4,730	4,778	100	100	249,618	261,169	100	100

Note: * negligible quantity.
Source: "Hand Book of Fisheries Statistics of Pakistan 1978"
Marine Fisheries Department, Government of Pakistan

Table A 5-10 Export of Fish, Shell-fish and Fish Products from Pakistan in 1977 and 1978

Countries	Quantity in Metric Tons		Value in '000 Rupees	
	1977	1978	1977	1978
Export of Dry Salted Fish				
Sri Lanka	5,788	4,595	32,237	25,676
Kuwait	45	3	381	30
Others	43	51	1,485	923
Total	5,876	4,649	34,103	26,629
Export of Frozen Fish				
France	107	70	2,125	1,354
West Germany	29	37	576	556
Kuwait	18	229	243	262
Oman	41	1	590	9
Others	–	131	–	2,946
Total	195	468	3,534	5,127
Export of Frozen Shrimps (Prawns)				
Japan	3,659	3,501	211,355	226,466
U.S.A.	430	181	17,389	5,943
France	114	233	2,393	4,682
U.K.	54	45	2,372	1,897
Hong Kong	87	59	1,806	1,077
Others	106	210	5,050	10,401
Total	4,450	4,229	240,365	250,466
Export of Canned Shrimps				
France	488	472	21,028	18,753
U.K.	357	289	13,704	11,491
West Germany	195	218	7,944	9,301
Others	303	281	12,820	12,591
Total	1,343	1,260	55,496	52,136
Export of Dried Shrimps				
Dubai	54	–	972	–
U.K.	28	15	850	329
Hong Kong	48	28	829	612
Kuwait	44	69	781	1,609
Others	82	120	1,743	4,317
Total	256	232	5,175	6,867
Export of Frozen Lobster				
U.S.A.	59	18	4,451	1,464
France	23	17	1,140	904
Others	3	46	108	3,208
Total	85	81	5,699	5,576
Export of Chilled Fish				
Kuwait	105	31	1,467	228
Others	–	10	–	207
Total	105	41	1,467	435
Export of Fish Meal				
West Germany	14,144	13,810	39,901	37,800
Others	3,120	3,991	9,286	10,430
Total	17,264	17,801	49,187	48,230
Export of Fish-Maws				
Hong Kong	92	124	3,126	7,381
Singapore	41	45	1,568	2,552
Others	42	38	1,561	2,409
Total	175	207	6,255	12,342
Export of Shark Fins				
Singapore	104	168	3,233	6,460
Hong Kong	63	32	2,202	1,425
Others	2	*	102	44
Total	169	200	5,537	7,929

* = Less than a metric ton

Source: "Hand Book of Fisheries Statistics of Pakistan 1977" and 1978"
Marine Fisheries Department, Government of Pakistan

Table A 5-11 Export of Canned Fishery Products by Country (1976 – 1978)

Quantity in Metric Tons.
Value in thousand Rupees.

Countries	Quantity			Value		
	1976	1977	1978	1976	1977	1978
France	656	488	472	24,699	21,028	18,753
U.K.	328	357	289	11,296	13,704	11,491
West-Germany	358	195	218	10,937	7,944	9,301
Holland	134	94	158	4,539	3,817	6,864
Belgium	35	65	43	1,333	2,885	1,832
Newzealand	27	41	24	1,252	2,048	1,150
U.S.A.	29	41	12	759	1,706	1,034
Africa	19	31	16	507	1,032	507
Greece	9	13	5	358	549	218
U.A.E	5	–	*	168	–	13
Italy	4	–	8	139	–	338
Abu Dhabi	3	–	3	55	–	122
Malta	1	–	2	50	–	68
Australia	1	–	–	39	–	–
Dubai	1	13	9	33	474	371
Lesotho	1	–	–	21	–	–
Spain	–	5	–	–	254	–
Saudi Arabia	–	*	1	–	15	67
Japan	–	–	–	–	–	7
TOTAL:	1,611	1,343	1,260	56,185	55,456	52,136

Source: "Hand Book of Fisheries Statistics of Pakistan 1977" and "1978"
Marine Fisheries Department, Government of Pakistan

Note: * negligible quantity

Table A 5-12 Export of Fishmeal by Country (1976 – 1978)

Quantity in Metric Tons
Value in thousand Rupees.

Countries	Quantity			Value		
	1976	1977	1978	1976	1977	1978
West Germany	5,680	14,144	13,810	9,108	39,901	37,800
Iran	5,318	1,820	1,059	13,418	4,637	2,889
Italy	–	1,200	2,932	–	4,268	7,541
Kuwait	27	100	–	71	381	–
Grand Total	11,025	17,264	17,801	22,597	49,187	48,230

Source: "Hand Book of Fisheries Statistics of Pakistan 1977" and "1978"
Marine Fisheries Department, Government of Pakistan

Table A5-13 Disposal of Fish and Fish Products on Baluchistan Coast in 1977 and 1978

(Unit: in metric tons)

Commodities	Year	Gwadar	Jiwani	Pasni	Ormara	Sonmiani	Total
Dry Salted Fish Exported to Sri Lanka	1977	1,647	976	1,857	2,159	–	6,639
	1978	1,463	–	1,291	1,597	–	4,351
Dry Salted Fish Sent to Karachi	1977	125	–	262	27	–	414
	1978	130	–	88	53	–	271
Dry Salted Fish Sent to Turbat & up towns	1977	146	–	61	–	–	207
	1978	270	–	145	80	–	495
Wet Salted Fish Sent to Karachi	1977	339	–	268	150	1,501	2,258
	1978	–	–	310	339	1,152	1,801
Wet Salted Fish Sent to Turbat & up towns	1977	3,654	380	1,317	–	–	5,351
	1978	3,646	336	1,192	266	–	5,440
Iced Prawn Sent to Karachi	1977	196	–	398	–	510	1,104
	1978	400	–	416	1	400	1,217
Iced Lobster Sent to Karachi	1977	112	5	33	19	30	199
	1978	135	6	28	31	33	233
Iced Fish Sent to Karachi	1977	–	–	272	–	7,610	7,882
	1978	1,861	1,259	1,756	431	6,531	11,838
Iced Fish Sent to Turbat & up towns	1977	11	–	358	–	–	369
	1978	115	–	270	–	–	385
Dried Prawn Sent to Karachi	1977	58	–	100	–	–	158
	1978	2	–	80	–	–	82
Dried Prawn Sent to Turbat & up towns	1977	11	–	11	–	–	22
	1978	–	–	24	–	–	24
Fish Maws & Sharks fins Sent to Karachi	1977	70	61	50	48	79	308
	1978	50	36	26	16	73	201
Fish Meal Sent to Karachi	1977	1,092	393	418	382	941	3,226
	1978	2,107	428	458	530	1,000	4,523
Local Consumption	1977	1,970	540	1,546	1,238	792	6,086
	1978	2,020	623	1,605	1,434	880	6,562
Total in Dried Weight	1977	9,431	2,355	6,951	4,023	11,463	34,223
	1978	12,199	2,688	7,689	4,778	10,069	37,423
Total in Fresh Weight	1977	19,898	5,599	14,221	9,425	15,205	64,348
	1978	24,125	3,958	13,551	9,962	13,500	65,096

Source: Directorate of Fisheries, Government of Baluchistan

Table A 5-14 Fishing Crafts on Baluchistan Coast by Area (1976 to 1978)

(Unit: in number of crafts)

Type of Fishing Crafts	Year	Jiwani Area	Gwadar Area	Pasni Area	Ormara Area	Sonmiani Area	Total
Mechanically propelled gillnetters	1976	9	31	–	–	–	40
	1977	9	33	–	–	–	42
	1978	9	33	–	–	–	42
Trawlers	1976	–	–	–	–	–	–
	1977	–	–	–	–	–	–
	1978	–	–	–	–	–	–
Sailboats motorized with externally fitted with long tailed engine	1976	–	–	–	–	158	158
	1977	12	125	17	11	165	330
	1978	70	343	44	14	206	677
Sailboats under 1 ton	1976	–	–	–	–	–	–
	1977	21	278	196	69	80	644
	1978	18	189	183	69	61	520
Sailboats 1–5 tons	1976	–	–	–	–	–	–
	1977	40	73	120	121	81	435
	1978	37	50	127	120	90	424
Sailboats 6–15 tons	1976	–	–	–	–	–	–
	1977	88	258	149	184	163	842
	1978	40	166	150	188	137	681
Sailboats 16–25 tons	1976	–	–	–	–	–	–
	1977	6	29	11	6	4	56
	1978	5	26	13	–	4	48
Non-motorized sailboats total	1976	163	735	476	391	305	2070
	1977	155	638	476	380	328	1977
	1978	100	431	473	377	292	1673
Motorized ratio to the total sailboats	1976	–	–	–	–	34.13	7.09
	1977	7.19	16.38	3.45	2.81	33.47	14.30
	1978	41.18	44.32	8.51	3.58	41.37	28.80
Motorized ratio to the Grand total	1976	5.23%	4.05	–	–	34.13	8.73
	1977	11.93%	19.85	3.45	2.81	33.47	15.84
	1978	44.13%	46.59	8.51	3.58	41.37	30.06
Grand Total	1976	172	766	476	391	463	2268
	1977	176	796	493	391	493	2349
	1978	179	807	517	391	498	2392

Source: Directorate of Fisheries, Baluchistan Government

Table A 5-15 Size of Fishing Crafts

Chracteristics	Local Name			
	Katti	Yakdar	Rachin	Charpuk
Length in feet	($4.6-6.1^m$) 15′–20′	($6.1-9.1^m$) 20′–30′	($9.1-12.2^m$) 30′–40′	(over 12.2^m) over 40′
Breadth in feet	($0.8-0.9^m$) 2.5′–3′	($0.9-1.5^m$) 3′–5′	($1.5-2.4^m$) 5′–8′	(over 2.4^m) over 8′
Draft in feet	($0.5-0.6^m$) 1.5′–2′	($0.8-0.9^m$) 2.5′–3′	($1.1-1.2^m$) 3.5′–4′	(over 1.2^m) over 4′
Range in miles	up to 3	3–30	30–100	over 100
Tonnage	up to 1/4	1/4–3/4	3/4–2	over 2
Trip in days	1/2–1	1–2	7	8–15
Numbers of crew	1	3–4	4–5	6–8
Surveyed at Gwadar				
Length in feet	(6.0^m) 19′8″	(8.4^m) 27′7″	(11.4^m) 37′4″	
Breadth in feet	(0.8^m) 2′9″	(1.5^m) 4′10″	(2.8^m) 9′4″	
Depth in feet	(0.6^m) 1′10″	(1.0^m) 3′4″	(1.6^m) 5′3″	
Remarks	Small	Standard	Large	Large

Note: ( ) denotes length in meter

Source: Ports and Shipping Wing, Government of Pakistan

Table A 6-1 Wind at Gwadar

Months:	Percentage No. of Days of Wind from:									Mean Wind Speed M.P.H.:
	N:	NE:	E:	SE:	S:	SW:	W:	NW:	Calm:	
Jan.	23	13	6	3	3	0	10	19	23	6.6
Feb.	15	15	7	4	0	4	22	15	19	6.4
Mar.	10	10	10	3	0	6	35	13	13	6.5
Apr.	3	6	13	3	3	13	42	6	10	7.2
May	0	10	17	3	0	17	47	3	3	7.3
Jun.	0	10	27	10	7	14	21	3	7	6.2
Jul.	0	13	30	17	10	10	10	0	10	5.8
Aug.	0	10	23	23	13	13	10	0	7	5.3
Sep.	0	14	14	11	3	14	32	3	7	5.7
Oct.	3	7	7	7	0	7	38	10	21	5.6
Nov.	7	10	10	0	0	3	23	17	30	4.0
Dec.	16	16	6	3	3	0	13	23	19	5.2

Table A 6-2 Wind at Pasni

(Lat. 25°16′ N., Long. 63°27′ E.) (1918–1947) 3m Height above Sea Level

Month	Rain Fall		Wind Direction																		Mean Wind Velocity		
	Mean Amount	No. of Days of Rain Fall over 2.5mm	Observation Time 08^h00^m Percentage of No. of Days of Wind from									Observation Time 16^h00^m Percentage of No. of Days of Wind from									kt	No. of Days of Wind Speed over 22 knot	
			N	NE	E	SE	S	SW	W	NW	Calm	N	NE	E	SE	S	SW	W	NW	Calm		08^h00^m	16^h00^m
	mm																						
Jan.	5	2	26	12	14	1	1	1	8	22	15	4	3	16	25	17	20	11	4	0	5	–	0
Feb.	36	2	14	7	14	3	0	1	11	28	22	3	1	11	14	23	27	16	4	1	5	–	1
Mar.	13	0.5	12	6	7	3	0	1	19	27	25	3	1	2	7	19	42	24	2	0	5	–	2
Apr.	10	0.5	7	4	4	5	2	4	38	29	7	1	1	0	3	17	50	28	0	0	6	–	2
May	0	0.1	2	2	14	6	1	11	41	16	7	0	0	1	4	16	46	29	4	0	7	–	5
Jun.	8	0.2	1	2	18	12	3	14	33	12	5	0	0	1	6	19	49	24	1	0	6	–	4
Jul.	13	1	0	0	13	17	8	18	25	8	11	0	0	1	10	31	45	12	1	0	5	–	3
Aug.	5	0.3	0	2	15	13	5	21	28	6	10	0	0	3	9	24	47	17	0	0	5	–	3
Sep.	0	0.1	4	1	15	7	3	9	32	17	12	0	0	1	3	19	55	22	0	0	6	–	2
Oct.	0	0.0	11	10	12	4	2	2	20	23	16	1	2	3	8	24	45	17	0	0	5	–	2
Nov.	3	0.2	18	11	4	0	0	1	11	32	23	3	1	4	18	28	36	9	1	0	4	–	1
Dec.	20	2	19	12	8	3	0	0	8	27	23	5	3	15	25	20	20	9	3	0	4	–	3
Mean	–	–	9	6	11	6	2	7	23	21	15	2	1	5	11	21	40	18	2	0	5	–	–
Total	157	9	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	28
Number of Observated Years	30	18	8									7–9									20	–	2–3

(From The Sea Pilot)

Table A6-3 Monthly Rain Fall

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total	
Pasni	43	32	8	6	2	0	12	3	1	0	2	12	127	1931–1960
Karachi	7	11	6	2	0	1	96	50	15	2	2	6	204	1931–1960

Table A8-1 Trade Volume by Value

Year	Total (Mil-US$)	Export (Mil-US$)	Import (Mil-US$)
1969	1,716	681	1,035
1970	1,894	723	1,171
1971	1,592	666	926
1972	1,345	679	666
1973	1,920	951	969
1974	2,835	1,097	1,738
1975	3,193	1,035	2,158
1976	3,278	1,144	2,134
(Jan-Sept)	(2,435)	(871)	(1,564)
1977			
(Jan-Sept)	(2,664)	(862)	(1,802)

Sources: Monthly Bulletin of Statistics, UN. Feb. 1978

Table A8-2 (1) Simulation

TIME	POP	GDP1	GDP2	GDP3	GDP
E+00	E+05	E+07	E+07	E+07	E+08
1976.0	734.3	1395.1	808.2	1802.9	400.6
1977.0	756.3	1423.9	855.1	1944.0	422.3
1978.0	777.5	1458.0	919.4	2088.4	445.6
1979.0	797.7	1482.2	978.9	2228.8	469.0
1980.0	816.9	1503.4	1038.6	2374.6	491.7
1981.0	834.9	1521.5	1098.4	2524.5	514.4
1982.0	851.6	1536.0	1158.0	2677.9	537.2
1983.0	872.9	1552.3	1219.9	2837.0	560.9
1984.0	894.7	1565.4	1285.8	3004.3	585.6
1985.0	917.0	1579.3	1356.5	3182.3	611.8
1986.0	940.0	1594.7	1433.0	3372.9	640.1
1987.0	963.5	1612.1	1516.5	3578.5	670.7
1988.0	987.6	1632.0	1608.3	3801.3	704.2
1989.0	1012.2	1655.1	1710.1	4043.9	740.9
1990.0	1037.5	1681.8	1823.7	4309.0	781.4
1991.0	1063.5	1712.6	1950.9	4599.8	826.3
1992.0	1090.1	1748.0	2094.2	4919.9	876.2
1993.0	1117.3	1788.5	2256.1	5273.1	931.8
1994.0	1145.3	1834.6	2439.8	5663.9	993.8
1995.0	1173.9	1886.9	2649.1	6097.6	1063.4
1996.0	1203.2	1946.3	2888.3	6580.0	1141.5
1997.0	1233.3	2013.3	3162.7	7118.0	1229.4
1998.0	1264.1	2088.9	3478.7	7719.6	1328.7
1999.0	1295.8	2174.0	3843.8	8393.7	1441.2
2000.0	1328.1	2269.9	4267.5	9151.3	1568.9
2001.0	1361.4	2377.9	4761.3	10005.2	1714.4
2002.0	1395.4	2499.5	5339.4	10970.4	1880.9
2003.0	1430.3	2636.8	6019.4	12064.8	2072.1
2004.0	1466.0	2791.9	6823.4	13309.8	2292.5
2005.0	1502.7	2967.6	7779.5	14731.3	2547.8
2006.0	1540.2	3167.2	8923.0	16360.7	2845.1

Basic input / Assumption

1. GDP at constant factor Cost based on 1959/60 (Rupees)
2. Annual GDP growth ratio 4.64%
3. Max. Fish Catches Potential 400,000 M/T Annum.
4. POP : Total Population
5. GDP 1 : Primary Industry (mainly Agro-Industry)
6. " 2 : Manufacturing Industry
7. " 3 : Tertiary Industry
8. GDP : GDP Total
9. Motorized Vessels 20% shared up to 1983/84

TIME	GDP1C	GDP2C	GDP3C	GDPC
E+00	E+08	E+08	E+09	E+09
1976.0	435.1	292.0	60.1	132.8
1977.0	494.3	324.1	70.7	152.6
1978.0	559.7	383.7	83.4	177.7
1979.0	629.3	449.8	97.6	205.5
1980.0	706.0	525.3	114.1	237.2
1981.0	790.2	611.7	133.0	273.2
1982.0	882.3	710.1	154.8	314.0
1983.0	986.1	823.5	179.9	360.9
1984.0	1099.9	955.7	209.0	414.6
1985.0	1227.3	1110.1	242.9	476.6
1986.0	1370.6	1291.1	282.4	548.6
1987.0	1532.4	1504.4	328.7	632.3
1988.0	1715.9	1756.6	383.0	730.2
1989.0	1924.6	2056.5	446.9	845.1
1990.0	2162.9	2414.5	522.4	980.2
1991.0	2436.0	2843.9	611.8	1139.8
1992.0	2749.8	3361.0	717.8	1328.9
1993.0	3111.7	3986.6	844.0	1553.9
1994.0	3530.3	4746.7	994.5	1822.2
1995.0	4016.0	5674.4	1174.5	2143.6
1996.0	4581.4	6811.6	1390.4	2529.7
1997.0	5241.4	8212.1	1650.0	2995.3
1998.0	6014.7	9944.8	1963.0	3558.9
1999.0	6923.4	12098.5	2341.4	4243.6
2000.0	7995.0	14788.8	2800.4	5078.8
2001.0	9263.0	18166.5	3358.7	6101.6
2002.0	10769.0	22429.8	4039.9	7359.8
2003.0	12564.6	27840.3	4873.9	8914.4
2004.0	14713.9	34746.6	5898.4	10844.4
2005.0	17297.8	43616.0	7161.6	13253.0
2006.0	20418.2	55080.2	8725.2	16275.0

Sectoral GDP

1. GDP at current factor cost in relation with Baluchistan's GRDP (Gross Regional Domestic Product or Gross Provincial Product)
2. GDP 1C : Primary Industry
3. " 2C : Manufacturing Industry
4. " 3C : Tertiary Industry
5. " C : GDP Total

TIME	BPOP	BGPP1	BGPP2	BGPP3	BGPP
E+00	E+03	E+05	E+04	E+04	E+05
1976.0	2742.6	101.9	297.0	882.7	219.9
1977.0	2864.7	116.2	313.1	955.3	243.1
1978.0	2986.5	132.1	352.2	1035.9	270.9
1979.0	3107.3	149.2	392.2	1115.7	299.9
1980.0	3226.8	168.0	435.2	1199.7	331.5
1981.0	3344.3	188.8	481.4	1287.2	355.7
1982.0	3459.3	211.6	530.8	1378.0	402.5
1983.0	3595.8	237.5	584.9	1473.4	443.3
1984.0	3737.7	266.0	644.8	1574.7	487.9
1985.0	3885.1	297.9	711.6	1683.4	537.4
1986.0	4038.4	334.1	786.2	1800.8	592.8
1987.0	4197.7	375.0	870.2	1928.2	654.8
1988.0	4363.3	421.6	965.4	2067.1	724.8
1989.0	4535.5	474.7	1073.6	2219.3	804.0
1990.0	4714.4	535.7	1197.5	2386.7	894.1
1991.0	4900.4	605.7	1339.9	2571.3	996.8
1992.0	5093.8	686.5	1504.4	2775.6	1114.5
1993.0	5294.7	779.9	1695.2	3002.4	1249.7
1994.0	5503.6	888.4	1917.5	3254.8	1405.6
1995.0	5720.7	1014.7	2177.7	3535.4	1586.1
1996.0	5946.4	1162.1	2483.4	3851.4	1795.6
1997.0	6181.0	1334.9	2844.3	4204.8	2039.8
1998.0	6424.9	1538.0	3272.2	4602.3	2325.4
1999.0	6678.4	1777.4	3781.8	5050.4	2660.6
2000.0	6941.9	2060.7	4391.6	5557.2	3055.6
2001.0	7215.7	2397.1	5124.0	6131.8	3522.8
2002.0	7500.4	2797.9	6011.2	6785.5	4077.6
2003.0	7796.3	3277.5	7088.1	7531.3	4739.5
2004.0	8103.9	3853.5	8404.2	8385.3	5532.5
2005.0	8423.6	4548.4	10021.9	9366.6	6487.2
2006.0	8756.0	5390.3	12023.3	10498.7	7642.5

Baluchistan's GRDP

1. BPOP : Regional Population
2. BGPP 1 : Regional Primary Industry
3. " 2 : " Manufacturing Industry
4. " 3 : " Tertiary Industry
5. BGPP : GRDP

TIME	MPOP	GPOP
E+00	E+02	E+00
1976.0	3672.4	18738.
1977.0	3880.5	19727.
1978.0	4092.4	20729.
1979.0	4307.6	21740.
1980.0	4525.2	22755.
1981.0	4744.5	23771.
1982.0	4964.8	24765.
1983.0	5220.7	25967.
1984.0	5489.8	27206.
1985.0	5772.7	28505.
1986.0	6079.3	29865.
1987.0	6363.1	31290.
1988.0	6712.1	32783.
1989.0	7058.1	34348.
1990.0	7421.9	35987.
1991.0	7804.4	37704.
1992.0	8206.7	39503.
1993.0	8629.6	41388.
1994.0	9074.4	43363.
1995.0	9542.1	45432.
1996.0	10033.9	47609.
1997.0	10551.1	49872.
1998.0	11094.9	52252.
1999.0	11666.8	54745.
2000.0	12268.1	57358.
2001.0	12909.4	60035.
2002.0	13565.3	62762.
2003.0	14264.5	65367.
2004.0	14999.7	69115.
2005.0	15772.8	72413.
2006.0	16585.7	75868.

Coastal Population

1. MPOP : Baluchistan Coast
2. GPOP : Gwadar

*** プリント リスト ***

Fisherman / Labour Forces

TIME	FM	BFM	XFM	TFM	AGLF	LF
E+00	E+02	E+00	E+02	E+02	E+04	E+04
1976.0	928.7	17636.	752.3	2172.9	2844.2	4939.6
1977.0	1068.4	20409.	864.3	2499.8	2918.1	5068.0
1978.0	1128.5	20994.	918.5	2685.9	2988.2	5189.6
1979.0	1191.8	21583.	975.9	2886.3	3053.9	5303.7
1980.0	1258.6	22190.	1036.7	3102.3	3115.0	5409.9
1981.0	1329.1	22814.	1100.9	3335.2	3171.2	5507.4
1982.0	1403.4	23456.	1168.9	3586.1	3222.0	5595.7
1983.0	1498.0	25739.	1240.6	3872.8	3289.7	5713.2
1984.0	1580.2	26389.	1316.3	4164.1	3358.8	5833.2
1985.0	1666.7	27056.	1396.2	4478.1	3429.3	5955.7
1986.0	1757.8	27742.	1480.4	4816.6	3501.3	6080.8
1987.0	1853.5	28445.	1569.0	5181.6	3574.9	6208.5
1988.0	1954.1	29167.	1662.4	5575.1	3650.0	6338.9
1989.0	2059.6	29908.	1760.5	5999.5	3726.6	5472.1
1990.0	2170.4	30669.	1863.7	6457.1	3804.9	6608.0
1991.0	2286.6	31450.	1972.1	6950.6	3884.8	6746.8
1992.0	2408.3	32251.	2085.8	7482.9	3966.4	6888.5
1993.0	2535.7	33072.	2205.0	8057.1	4049.7	7033.2
1994.0	2669.1	33916.	2329.9	8676.5	4134.7	7180.9
1995.0	2808.6	34780.	2460.8	9344.8	4221.6	7331.7
1996.0	2954.3	35667.	2597.6	10065.9	4310.2	7485.7
1997.0	3106.5	36577.	2740.7	10844.2	4400.8	7642.9
1998.0	3239.2	37509.	2864.2	11658.1	4493.2	7803.4
1999.0	3337.4	38465.	2952.8	12497.4	4587.6	7967.3
2000.0	3438.5	39445.	3044.1	13404.9	4683.9	8134.6
2001.0	3542.7	40450.	3138.2	14386.4	4782.3	8305.5
2002.0	3649.9	41479.	3235.1	15448.2	4882.7	8479.9
2003.0	3760.4	42534.	3335.0	16597.3	4985.3	8658.0
2004.0	3874.1	43614.	3438.0	17641.1	5090.0	8839.9
2005.0	3991.2	44721.	3544.0	19187.7	5196.9	9025.5
2006.0	4111.9	45854.	3653.3	20646.1	5306.0	9215.1

1. FM : Marine Fishermen in Federal's Total
2. BFM : Marine Fisherman in Baluchistan Coast
3. XFM : Fisherman excluding Baluchistan Coast
4. TFM : Federal's Total Fishermen (Marine and inland)
5. AGLF : Federal's Total Agricultural Forces
6. LF : Federal's Total Labour Forces

Fishing Vessels

TIME	FB	BFB	BMOTS	BMOT	XFB	XMOTS	XMOT	SAIL	TFB
E+00	E+00	E+00	E+00	E+00	E+00	E+00	E+00	E+00	E+00
1976.0	8473.	2268.2	0.08730	198.0	6205.	0.35500	2202.7	7972.	16445.
1977.0	8795.	2385.0	0.15590	371.8	6410.	0.35198	2256.2	11025.	19820.
1978.0	9051.	2440.8	0.16401	400.3	6610.	0.37030	2447.8	12127.	21179.
1979.0	9314.	2496.5	0.17254	430.7	6817.	0.38956	2655.6	13340.	22654.
1980.0	9584.	2553.5	0.18151	463.5	7030.	0.40982	2881.1	14674.	24258.
1981.0	9862.	2611.8	0.19095	498.7	7250.	0.43113	3125.6	16142.	26003.
1982.0	10148.	2671.4	0.20087	536.6	7476.	0.45355	3390.8	17756.	27903.
1983.0	10442.	2732.4	0.41132	1123.9	7709.	0.47713	3678.4	19531.	29973.
1984.0	10745.	2794.8	0.42230	1180.2	7950.	0.50194	3990.4	21485.	32229.
1985.0	11056.	2858.6	0.43386	1240.2	8198.	0.52804	4328.7	23633.	34689.
1986.0	11377.	2923.8	0.44602	1304.1	8453.	0.55550	4695.7	25996.	37373.
1987.0	11707.	2990.6	0.45882	1372.1	8716.	0.58439	5093.7	28596.	40303.
1988.0	12046.	3058.8	0.47228	1444.6	8987.	0.61477	5525.3	31456.	43502.
1989.0	12396.	3128.6	0.48643	1521.9	9267.	0.64674	5993.4	34601.	46997.
1990.0	12755.	3200.1	0.50133	1604.3	9555.	0.68037	6501.0	38061.	50816.
1991.0	13125.	3273.1	0.51700	1692.2	9852.	0.71575	7051.5	41867.	54992.
1992.0	13506.	3347.8	0.53348	1786.0	10158.	0.75297	7648.6	46054.	59560.
1993.0	13897.	3424.2	0.55082	1886.1	10473.	0.79213	8296.0	50660.	64557.
1994.0	14300.	3502.4	0.56907	1993.1	10798.	0.83332	8998.1	55726.	70026.
1995.0	14715.	3582.3	0.58826	2107.3	11133.	0.87665	9759.5	61298.	76013.
1996.0	15142.	3664.1	0.60845	2229.4	11478.	0.92224	10585.1	67428.	82570.
1997.0	15581.	3747.7	0.62969	2359.9	11833.	0.97019	11480.4	74171.	89752.
1998.0	16033.	3833.3	0.65203	2499.4	12199.	1.00000	12199.5	81588.	97620.
1999.0	16498.	3920.8	0.67554	2648.6	12577.	1.00000	12576.9	89746.	106244.
2000.0	16976.	4010.3	0.70026	2808.3	12966.	1.00000	12965.8	98721.	115697.
2001.0	17468.	4101.8	0.72628	2979.1	13367.	1.00000	13366.6	108593.	126062.
2002.0	17975.	4195.5	0.75364	3161.9	13780.	1.00000	13779.6	119453.	137428.
2003.0	18496.	4291.2	0.78243	3357.6	14205.	1.00000	14205.1	131398.	149894.
2004.0	19033.	4389.2	0.81272	3567.2	14644.	1.00000	14643.5	144538.	163570.
2005.0	19585.	4489.4	0.84458	3791.6	15095.	1.00000	15095.3	158991.	178576.
2006.0	20153.	4591.8	0.87810	4032.1	15561.	1.00000	15560.8	174891.	195043.

1. FB : Federal's Total Marine Fishing Vessels, Mannual and Motorized (Number)
2. BFB : Marine Fishing Vessels in Baluchistan, Mannual and Motorized (Number)
3. BMOTS : Motorized Marine Fishing Vessels in Baluchistan (Share, %)
4. BMOT : Motorized Fishing Vessels in Baluchistan (Number)
5. XFB : Marine Fishing Vessels in Karachi and Sind Coasts Mannual and Motorized (Number)
6. XMOTS : Motorized Marine Vessels in Karachi and Sind Coasts(Share, %)
7. XMOT : Motorized Marine Vessels in Karachi and Sind Coasts(Number)
8. SAIL : Inland Vessels (Number)
9. TFB : Federal's Total Vessels Marine and inland (Number)

Fish Catches Production

TIME	MT	BMT	XMT	SMT	TMT	GDPF
E+00	E+02	E+02	E+02	E+02	E+02	E+06
1976.0	1772.0	493.8	1278.2	284.9	2056.9	512.2
1977.0	2153.3	688.1	1465.2	331.4	2484.7	679.8
1978.0	2300.0	722.0	1578.0	364.6	2664.5	779.0
1979.0	2457.6	757.6	1700.0	401.0	2858.6	892.9
1980.0	2627.4	795.4	1832.0	441.1	3068.5	1024.2
1981.0	2810.4	835.7	1974.7	485.2	3295.6	1175.3
1982.0	3007.7	878.7	2129.0	533.7	3541.4	1349.5
1983.0	3711.4	1415.4	2296.1	587.1	4298.5	1750.2
1984.0	3952.1	1475.2	2476.8	645.8	4597.9	2000.3
1985.0	4211.0	1538.6	2672.4	710.4	4921.4	2287.7
1986.0	4489.7	1605.7	2884.1	781.5	5271.2	2618.2
1987.0	4789.9	1676.7	3113.1	859.6	5649.4	2998.2
1988.0	5113.1	1752.0	3361.1	945.6	6058.6	3435.7
1989.0	5461.3	1831.8	3629.6	1040.1	6501.4	3939.3
1990.0	5836.6	1916.4	3920.2	1144.1	6980.7	4519.4
1991.0	6241.0	2006.2	4234.8	1258.5	7499.5	5187.9
1992.0	6677.0	2101.6	4575.4	1384.4	8061.4	5958.6
1993.0	7147.2	2202.9	4944.3	1522.8	8670.1	6847.5
1994.0	7654.4	2310.6	5343.7	1675.1	9329.5	7873.0
1995.0	8201.4	2425.1	5776.3	1842.6	10044.0	9056.6
1996.0	8791.7	2546.9	6244.8	2026.9	10818.6	10423.2
1997.0	9428.7	2676.6	6752.1	2229.6	11658.3	12001.7
1998.0	9977.0	2814.7	7162.3	2452.5	12429.5	13672.1
1999.0	10345.6	2961.7	7383.9	2697.8	13043.4	15330.2
2000.0	10730.7	3118.4	7612.3	2967.6	13698.2	17202.6
2001.0	11133.0	3285.5	7847.6	3264.3	14397.3	19319.1
2002.0	11553.6	3463.6	8090.0	3590.7	15144.3	21713.5
2003.0	11993.5	3653.7	8339.8	3949.8	15943.3	24424.9
2004.0	12453.7	3856.5	8597.2	4344.8	16798.5	27497.9
2005.0	12935.5	4073.1	8862.5	4779.3	17714.8	30984.1
2006.0	13440.0	4304.3	9135.7	5257.2	18697.3	34942.6

1. Metric Ton at Catch-basis
2. Maximum Capacity of Catch Potential 400,000 M/T Per Annum at Baluchistan Coast
3. MT : Federal's Marine Fish Catches (M/T)
4. BMT : Baluchistan's Marine Fish Catches (M/T)
5. XMT : Marine Fish Catches excluding Baluchistan Coast (M/T)
6. SMT : Inland Fish Catches (M/T)
7. TMT : Federal's Total Fish Catches, Marine and Inland (M/T)
8. GDPF : Gross Fishery Product (Rupees at Current factor Cost)

Table A8-2 (2) Simulation-I

DYNAMO (REV.1) MINIPORT

PAGE 1

TIME	POP	GDP1	GDP2	GDP3	GDP
E+00	E+05	E+07	E+07	E+07	E+08
1976.0	734.3	1395.1	808.2	1802.9	400.6
1977.0	756.3	1423.9	855.1	1944.0	422.3
1978.0	777.5	1458.0	919.4	2088.4	446.6
1979.0	797.7	1482.2	978.9	2228.8	469.0
1980.0	816.9	1503.4	1038.6	2374.6	491.7
1981.0	834.9	1521.5	1098.4	2524.5	514.4
1982.0	851.6	1536.0	1158.0	2677.9	537.2
1983.0	872.9	1554.2	1220.3	2837.5	561.2
1984.0	894.7	1567.6	1286.6	3005.5	586.0
1985.0	917.0	1581.8	1357.7	3184.0	612.4
1986.0	940.0	1597.4	1434.5	3375.2	640.7
1987.0	963.5	1614.9	1518.3	3581.2	871.4
1988.0	987.6	1635.0	1610.5	3804.4	705.0
1989.0	1012.2	1658.2	1712.6	4047.4	741.8
1990.0	1037.5	1685.0	1826.4	4312.9	782.4
1991.0	1063.5	1715.8	1953.9	4604.1	827.4
1992.0	1090.1	1751.2	2097.4	4924.5	877.3
1993.0	1117.3	1791.7	2259.6	5278.0	932.9
1994.0	1145.3	1837.9	2443.6	5669.2	995.1
1995.0	1173.9	1890.3	2653.2	6103.2	1064.7
1996.0	1203.2	1949.6	2892.7	6586.0	1142.8
1997.0	1233.3	2016.6	3167.4	7124.3	1230.8
1998.0	1264.1	2092.2	3483.7	7726.2	1330.2
1999.0	1295.8	2177.4	3849.2	8400.7	1442.7
2000.0	1328.1	2273.3	4273.3	9158.7	1570.5
2001.0	1361.4	2381.2	4767.6	10013.0	1716.2
2002.0	1395.4	2502.9	5346.2	10978.6	1882.8
2003.0	1430.3	2640.2	6026.8	12073.5	2074.0
2004.0	1466.0	2795.3	6831.5	13319.1	2294.6
2005.0	1502.7	2971.1	7788.3	14741.2	2550.1
2006.0	1540.2	3170.7	8932.8	15371.2	2847.5

Notes for SIM-1

1. Without limitting Max. Fish Catches Potential 400,000 M/T Annum.
2. Motorized Vessels 30 shared up to 1983/84

DYNAMO (REV.1) MINIPORT

PAGE 2

TIME	GDP1C	GDP2C	GDP3C	GDPC
E+00	E+08	E+08	E+09	E+09
1976.0	435.1	292.0	60.1	132.8
1977.0	494.3	324.1	70.7	152.6
1978.0	559.7	383.7	83.4	177.7
1979.0	629.3	449.8	97.6	205.5
1980.0	706.0	525.3	114.1	237.2
1981.0	790.2	611.7	133.0	273.2
1982.0	882.3	710.1	154.8	314.0
1983.0	987.4	823.8	180.0	361.1
1984.0	1101.5	956.4	209.1	414.9
1985.0	1229.2	1111.1	243.0	477.0
1986.0	1372.9	1292.5	282.6	549.1
1987.0	1535.1	1506.2	328.9	633.0
1988.0	1719.0	1759.0	383.3	731.1
1989.0	1928.2	2059.5	447.3	846.1
1990.0	2167.0	2418.1	522.9	981.4
1991.0	2440.5	2848.2	612.4	1141.3
1992.0	2755.0	3366.2	718.5	1330.6
1993.0	3117.5	3992.8	844.8	1555.8
1994.0	3536.7	4754.1	395.4	1824.5
1995.0	4023.1	5683.1	1175.6	2146.2
1996.0	4589.2	6821.9	1391.6	2532.8
1997.0	5250.1	8224.2	1651.4	2998.9
1998.0	6024.3	9959.1	1964.7	3563.0
1999.0	6934.1	12115.4	2343.4	4248.3
2000.0	8006.8	14808.9	2302.7	5084.2
2001.0	9276.2	18130.4	3361.3	6108.0
2002.0	10783.6	22458.2	4042.9	7367.1
2003.0	12560.8	27874.3	4877.4	8922.9
2004.0	14732.0	34787.5	5902.5	10854.4
2005.0	17318.0	43665.5	7165.4	13254.7
2006.0	20440.9	55140.5	8730.8	16288.9

DYNAMO (REV.1) MINIPORT PAGE 3

TIME	BPOP	BGPP1	BGPP2	BGPP3	BGPP
E+00	E+03	E+05	E+04	E+04	E+05
1976.0	2742.6	101.9	297.0	882.7	219.9
1977.0	2864.7	116.3	313.1	955.3	243.1
1978.0	2986.5	132.1	352.2	1035.9	270.9
1979.0	3107.3	149.2	392.2	1115.7	299.9
1980.0	3226.8	168.0	435.2	1199.7	331.5
1981.0	3344.3	188.8	481.4	1287.2	365.7
1982.0	3459.3	211.6	530.8	1378.0	402.5
1983.0	3595.8	237.8	585.1	1473.7	443.7
1984.0	3737.7	266.3	645.2	1575.3	488.4
1985.0	3885.1	298.4	712.2	1684.3	538.1
1986.0	4038.4	334.6	787.0	1801.9	593.5
1987.0	4197.7	375.7	871.3	1929.6	655.8
1988.0	4363.3	422.3	966.7	2068.8	725.9
1989.0	4535.5	475.6	1075.2	2221.3	805.3
1990.0	4714.4	536.7	1199.3	2388.9	895.5
1991.0	4900.4	606.8	1342.0	2573.7	998.4
1992.0	5093.8	687.8	1506.8	2778.2	1116.3
1993.0	5294.7	781.4	1697.9	3005.2	1251.7
1994.0	5503.6	890.0	1920.5	3257.8	1407.8
1995.0	5720.7	1016.4	2181.0	3539.6	1588.5
1996.0	5946.4	1164.1	2487.1	3854.9	1798.3
1997.0	6181.0	1337.1	2848.5	4208.5	2042.8
1998.0	6424.9	1540.4	3276.9	4606.2	2328.7
1999.0	6678.4	1780.1	3787.1	5054.6	2664.3
2000.0	6941.9	2063.8	4397.5	5561.6	3059.7
2001.0	7215.7	2400.5	5131.6	6136.6	3527.3
2002.0	7500.4	2801.7	6018.8	6790.6	4082.7
2003.0	7796.3	3281.8	7096.8	7536.8	4745.1
2004.0	8103.9	3858.3	8414.1	8391.1	5538.8
2005.0	8423.6	4553.7	10033.3	9372.9	6494.3
2006.0	8756.0	5396.3	12036.5	10505.5	7650.5

DYNAMO (REV.1) MINIPORT PAGE 4

TIME	MPOP	GPOP
E+00	E+02	E+00
1976.0	3672.4	18738.
1977.0	3880.5	19727.
1978.0	4092.4	20729.
1979.0	4307.6	21740.
1980.0	4525.2	22755.
1981.0	4744.5	23771.
1982.0	4964.8	24785.
1983.0	5220.7	25967.
1984.0	5489.8	27206.
1985.0	5772.7	28505.
1986.0	6070.3	29865.
1987.0	6383.1	31290.
1988.0	6712.1	32783.
1989.0	7058.1	34348.
1990.0	7421.9	35987.
1991.0	7804.4	37704.
1992.0	8206.7	39503.
1993.0	8629.6	41388.
1994.0	9074.4	43363.
1995.0	9542.1	45432.
1996.0	10033.9	47600.
1997.0	10551.1	49872.
1998.0	11094.9	52252.
1999.0	11666.8	54745.
2000.0	12268.1	57358.
2001.0	12900.4	60035.
2002.0	13565.3	62962.
2003.0	14264.5	65967.
2004.0	14999.7	69115.
2005.0	15772.8	72413.
2006.0	16585.7	75868.

Table A8-2 (3) Simulation-2

DYNAMO (REV.1) MINIPORT | PAGE 8

TIME	POP	GDP1	GDP2	GDP3	GDP
E+00	E+05	E+07	E+07	E+07	E+08
1976.0	734.3	1395.1	808.2	1802.9	400.6
1977.0	756.3	1423.9	855.1	1944.0	422.3
1978.0	777.5	1458.0	919.4	2088.4	446.6
1979.0	797.7	1482.2	978.9	2228.8	469.0
1980.0	816.9	1503.4	1038.6	2374.6	491.7
1981.0	834.9	1521.5	1098.4	2524.5	514.4
1982.0	851.6	1536.0	1158.0	2677.9	537.2
1983.0	872.9	1556.1	1220.7	2838.1	561.5
1984.0	894.7	1569.9	1287.4	3006.7	586.4
1985.0	917.0	1584.3	1358.9	3185.7	612.9
1986.0	940.0	1600.1	1436.1	3377.4	641.3
1987.0	963.5	1617.8	1520.2	3583.9	672.2
1988.0	987.6	1638.0	1612.6	3807.5	705.8
1989.0	1012.2	1661.3	1715.0	4050.9	742.7
1990.0	1037.5	1688.1	1829.1	4316.8	783.4
1991.0	1063.5	1719.0	1956.9	4608.3	828.4
1992.0	1090.1	1754.5	2100.7	4929.1	878.4
1993.0	1117.3	1795.0	2263.1	5282.9	934.1
1994.0	1145.3	1841.2	2447.4	5674.5	996.3
1995.0	1173.9	1893.6	2657.2	6108.8	1066.0
1996.0	1203.2	1952.9	2897.0	6591.9	1144.2
1997.0	1233.3	2020.0	3172.0	7130.6	1232.3
1998.0	1264.1	2095.6	3488.7	7732.8	1331.7
1999.0	1295.8	2180.7	3854.5	8407.7	1444.3
2000.0	1328.1	2276.6	4279.1	9166.1	1572.2
2001.0	1361.4	2384.6	4773.8	10020.8	1717.9
2002.0	1395.4	2506.3	5352.9	10986.9	1884.6
2003.0	1430.3	2643.6	6034.1	12082.2	2076.0
2004.0	1466.0	2798.6	6839.5	13328.3	2296.6
2005.0	1502.7	2974.0	7797.0	14750.8	2552.2
2006.0	1540.2	3173.2	8942.1	16381.1	2849.6

Notes for SIM-2

1. Without limitting Max. Fish-Catches Potential 400,000 M/T Annum.
2. Motorized Vessels 40% shared up to 1983/84

DYNAMO (REV.1) MINIPORT | PAGE 9

TIME	GDP1C	GDP2C	GDP3C	GDPC
E+00	E+08	E+08	E+09	E+09
1976.0	435.1	292.0	60.1	132.8
1977.0	494.3	324.1	70.7	152.6
1978.0	559.7	383.7	83.4	177.7
1979.0	629.3	449.8	97.6	205.5
1980.0	706.0	525.3	114.1	237.2
1981.0	790.2	611.7	133.0	273.2
1982.0	882.3	710.1	154.8	314.0
1983.0	988.6	824.1	180.0	361.3
1984.0	1103.1	957.0	209.2	415.2
1985.0	1231.2	1112.1	243.1	477.5
1986.0	1375.2	1293.9	282.8	549.7
1987.0	1537.8	1508.1	329.2	633.7
1988.0	1722.1	1761.4	383.6	732.0
1989.0	1931.8	2062.4	447.7	847.1
1990.0	2171.0	2421.7	523.4	982.7
1991.0	2445.1	2852.6	612.9	1142.7
1992.0	2760.1	3371.4	719.2	1332.3
1993.0	3123.2	3999.0	845.6	1557.8
1994.0	3543.0	4761.5	996.4	1826.8
1995.0	4030.1	5591.8	1176.7	2148.9
1996.0	4597.1	6832.2	1392.9	2535.8
1997.0	5258.8	8236.3	1652.9	3002.4
1998.0	6034.0	9973.4	1966.3	3567.1
1999.0	6944.8	12132.4	2345.3	4253.0
2000.0	8018.7	14828.9	2804.9	5089.7
2001.0	9289.3	18214.3	3363.9	6114.3
2002.0	10798.2	22486.7	4046.0	7374.5
2003.0	12597.1	27908.4	4880.9	8931.5
2004.0	14749.3	34828.4	5906.6	10864.4
2005.0	17334.9	43714.1	7171.1	13276.0
2006.0	20456.9	55197.6	8736.1	16301.6

DYNAMO (REV.1) MINIPORT PAGE 5

TIME	FM	BFM	XFM	TFM	AGLF	LF
E+00	E+02	E+00	E+02	E+02	E+04	E+04
1976.0	928.7	17636.	752.3	2172.9	2844.2	4939.6
1977.0	1068.4	20409.	864.3	2499.8	2918.1	5068.0
1978.0	1128.5	20994.	918.5	2685.9	2988.2	5189.6
1979.0	1191.8	21583.	975.9	2886.3	3053.9	5303.7
1980.0	1258.6	22190.	1036.7	3102.3	3115.0	5409.9
1981.0	1329.1	22814.	1100.9	3335.2	3171.2	5507.4
1982.0	1403.4	23456.	1168.9	3586.1	3222.0	5595.7
1983.0	1502.9	26230.	1240.6	3877.7	3289.7	5713.2
1984.0	1585.1	26876.	1316.3	4168.9	3358.8	5833.2
1985.0	1671.6	27539.	1396.2	4482.9	3429.3	5955.7
1986.0	1762.6	28219.	1480.4	4821.4	3501.3	6080.8
1987.0	1858.2	28917.	1569.0	5186.3	3574.9	6208.5
1988.0	1958.7	29633.	1662.4	5579.8	3650.0	6338.9
1989.0	2064.2	30368.	1760.5	6004.1	3726.6	6472.1
1990.0	2174.9	31122.	1863.7	6461.6	3804.9	6608.0
1991.0	2291.0	31895.	1972.1	6955.1	3884.8	6745.8
1992.0	2412.7	32688.	2085.8	7487.3	3966.4	6888.5
1993.0	2540.0	33502.	2205.0	8061.4	4049.7	7033.2
1994.0	2673.3	34337.	2329.9	8680.7	4134.7	7180.9
1995.0	2812.7	35192.	2460.8	9348.9	4221.6	7331.7
1996.0	2958.3	36070.	2597.6	10070.0	4310.2	7485.7
1997.0	3110.4	36970.	2740.7	10848.1	4400.8	7642.9
1998.0	3243.1	37893.	2864.2	11661.9	4493.2	7803.4
1999.0	3341.2	38839.	2952.8	12501.1	4587.6	7967.3
2000.0	3442.2	39809.	3044.1	13408.5	4683.9	8134.6
2001.0	3546.2	40803.	3138.2	14389.9	4782.3	8305.5
2002.0	3653.3	41822.	3235.1	15451.6	4882.7	8479.9
2003.0	3763.7	42866.	3335.0	16600.6	4985.3	8658.0
2004.0	3877.3	43935.	3438.0	17844.3	5090.0	8839.9
2005.0	3994.3	45031.	3544.0	19190.8	5196.9	9025.5
2006.0	4114.9	46154.	3653.3	20649.1	5306.0	9215.1

DYNAMO (REV.1) MINIPORT PAGE 6

TIME	FB	BFB	BMOTS	BMOT	XFB	XMOTS	XMOT	SAIL	TFB
E+00	E+00	E+00	E+00	E+00	E+00	E+00	E+00	E+00	E+00
1976.0	8473.	2268.2	0.08730	198.0	6205.	0.35500	2202.7	7972.	16445.
1977.0	8795.	2385.0	0.15590	371.8	6410.	0.35198	2256.2	11025.	19820.
1978.0	9051.	2440.8	0.16401	400.3	6610.	0.37030	2447.8	12127.	21179.
1979.0	9314.	2496.5	0.17254	430.7	6817.	0.38956	2655.6	13340.	22654.
1980.0	9584.	2553.5	0.18151	463.5	7030.	0.40982	2881.1	14674.	24258.
1981.0	9862.	2611.8	0.19095	498.7	7250.	0.43113	3125.6	16142.	26003.
1982.0	10148.	2671.4	0.20087	536.6	7476.	0.45355	3390.8	17756.	27903.
1983.0	10442.	2732.4	0.51132	1397.1	7709.	0.47713	3678.4	19531.	29973.
1984.0	10745.	2794.8	0.52230	1459.7	7950.	0.50194	3990.4	21485.	32229.
1985.0	11056.	2858.6	0.53386	1526.1	8198.	0.52804	4328.7	23633.	34689.
1986.0	11377.	2923.8	0.54602	1596.5	8453.	0.55550	4695.7	25996.	37373.
1987.0	11707.	2990.6	0.55882	1671.2	8716.	0.58439	5093.7	28596.	40303.
1988.0	12046.	3058.8	0.57228	1750.5	8987.	0.61477	5525.3	31456.	43502.
1989.0	12396.	3128.6	0.58643	1834.7	9267.	0.64674	5993.4	34601.	46997.
1990.0	12755.	3200.1	0.60133	1924.3	9555.	0.68037	6501.0	38061.	50816.
1991.0	13125.	3273.1	0.61700	2019.5	9852.	0.71575	7051.5	41867.	54992.
1992.0	13506.	3347.8	0.63348	2120.8	10158.	0.75297	7648.6	46054.	59560.
1993.0	13897.	3424.2	0.65082	2228.6	10473.	0.79213	8296.0	50660.	64557.
1994.0	14300.	3502.4	0.66907	2343.3	10798.	0.83332	8998.1	55726.	70026.
1995.0	14715.	3582.3	0.68826	2465.6	11133.	0.87665	9759.5	61298.	76013.
1996.0	15142.	3664.1	0.70845	2595.8	11478.	0.92224	10585.1	67428.	82570.
1997.0	15581.	3747.7	0.72969	2734.7	11833.	0.97019	11480.4	74171.	89752.
1998.0	16033.	3833.3	0.75203	2882.7	12199.	1.00000	12199.5	81588.	97620.
1999.0	16498.	3920.8	0.77554	3040.7	12577.	1.00000	12576.9	89746.	106244.
2000.0	16976.	4010.3	0.80026	3209.3	12966.	1.00000	12965.8	98721.	115697.
2001.0	17468.	4101.8	0.82628	3389.2	13367.	1.00000	13366.6	108593.	126062.
2002.0	17975.	4195.5	0.85364	3581.4	13780.	1.00000	13779.6	119453.	137428.
2003.0	18496.	4291.2	0.88243	3786.7	14205.	1.00000	14205.1	131398.	149894.
2004.0	19033.	4389.2	0.91272	4006.1	14644.	1.00000	14643.5	144538.	163570.
2005.0	19585.	4489.4	0.94458	4240.6	15095.	1.00000	15095.3	158991.	178576.
2006.0	20153.	4591.8	0.97810	4491.3	15551.	1.00000	15560.8	174891.	195043.

TIME	MT	BMT	XMT	SMT	TMT	GDPF
E+00	E+02	E+02	E+02	E+02	E+02	E+06
1976.0	1772.0	493.8	1278.2	284.9	2056.9	512.2
1977.0	2153.3	688.1	1465.2	331.4	2484.7	679.8
1978.0	2300.0	722.0	1578.0	364.6	2664.5	779.0
1979.0	2457.6	757.6	1700.0	401.0	2858.6	892.9
1980.0	2627.4	795.4	1832.0	441.1	3068.5	1024.2
1981.0	2810.4	835.7	1974.7	485.2	3295.6	1175.3
1982.0	3007.7	878.7	2129.0	533.7	3541.4	1349.5
1983.0	3956.9	1660.9	2296.1	587.1	4544.0	1850.1
1984.0	4203.2	1726.4	2476.8	645.8	4849.0	2109.5
1985.0	4467.8	1795.5	2672.4	710.4	5178.3	2407.1
1986.0	4752.4	1868.4	2884.1	781.5	5533.9	2748.6
1987.0	5058.6	1945.4	3113.1	859.6	5918.1	3140.9
1988.0	5387.9	2026.8	3361.1	945.6	6333.5	3591.5
1989.0	5742.4	2112.9	3629.6	1040.1	6782.5	4109.6
1990.0	6124.1	2203.9	3920.2	1144.1	7268.2	4705.6
1991.0	6535.1	2300.3	4234.8	1258.5	7793.6	5391.4
1992.0	6977.8	2402.4	4575.4	1384.4	8362.2	6181.0
1993.0	7454.9	2510.6	4944.3	1522.8	8977.7	7090.5
1994.0	7969.0	2625.3	5343.7	1675.1	9644.1	8138.5
1995.0	8523.3	2747.0	5776.3	1842.6	10365.9	9346.8
1996.0	9120.9	2876.2	6244.8	2026.9	11147.8	10740.4
1997.0	9765.4	3013.3	6752.1	2229.6	11995.0	12348.3
1998.0	10321.4	3159.1	7162.3	2452.5	12773.9	14050.9
1999.0	10697.9	3314.0	7383.9	2697.8	13395.7	15744.2
2000.0	11091.0	3478.7	7612.3	2967.6	14058.5	17655.1
2001.0	11501.5	3654.0	7847.6	3264.3	14765.9	19813.6
2002.0	11930.6	3840.6	8090.0	3590.7	15521.3	22254.0
2003.0	12379.0	4039.2	8339.8	3949.8	16328.9	25015.5
2004.0	12848.1	4250.9	3597.2	4344.8	17192.9	28143.5
2005.0	13338.9	4476.4	8862.5	4779.3	18118.1	31689.6
2006.0	13852.6	4716.9	9135.7	5257.2	19109.8	35713.7

DYNAMO (REV.1) MINIPORT PAGE 10

TIME	BPOP	BGPP1	BGPP2	BGPP3	BGPP
E+00	E+03	E+05	E+04	E+04	E+05
1976.0	2742.6	101.9	297.0	882.7	219.9
1977.0	2864.7	116.2	313.1	955.3	243.1
1978.0	2986.5	132.1	352.2	1035.9	270.9
1979.0	3107.3	149.2	392.2	1115.7	299.9
1980.0	3226.8	168.0	435.2	1199.7	331.5
1981.0	3344.3	188.8	481.4	1287.2	365.7
1982.0	3459.3	211.6	530.8	1378.0	402.5
1983.0	3595.8	238.1	585.3	1474.0	444.0
1984.0	3737.7	266.7	645.7	1576.0	488.9
1985.0	3885.1	298.9	712.8	1685.2	538.7
1986.0	4038.4	335.2	787.9	1803.1	594.3
1987.0	4197.7	376.3	872.4	1931.0	656.7
1988.0	4363.3	423.1	968.0	2070.5	727.0
1989.0	4535.5	476.5	1076.7	2223.2	806.5
1990.0	4714.4	537.7	1201.1	2391.0	896.9
1991.0	4900.4	608.0	1344.0	2576.1	1000.0
1992.0	5093.8	689.0	1509.1	2780.8	1118.0
1993.0	5294.7	782.8	1700.5	3008.0	1253.7
1994.0	5503.6	891.6	1923.5	3260.8	1410.0
1995.0	5720.7	1018.2	2184.3	3542.9	1591.0
1996.0	5946.4	1166.1	2490.9	3858.4	1801.0
1997.0	6181.0	1339.3	2852.7	4212.2	2045.8
1998.0	6424.9	1542.9	3281.6	4610.2	2332.1
1999.0	6678.4	1782.9	3792.4	5058.8	2668.0
2000.0	6941.9	2066.8	4403.5	5566.1	3063.8
2001.0	7215.7	2403.9	5138.3	6141.4	3531.9
2002.0	7500.4	2805.5	6026.4	6795.7	4087.7
2003.0	7796.3	3286.0	7105.5	7542.2	4750.8
2004.0	8103.9	3862.8	8424.0	8396.9	5544.9
2005.0	8423.6	4558.1	10044.5	9379.0	6500.5
2006.0	8756.0	5400.5	12049.0	10511.8	7656.6

DYNAMO (REV.1) MINIPORT PAGE 11

TIME	MPOP	GPOP
E+00	E+02	E+00
1976.0	3672.4	18738.
1977.0	3880.5	19727.
1978.0	4092.4	20729.
1979.0	4307.6	21740.
1980.0	4525.2	22755.
1981.0	4744.5	23771.
1982.0	4964.8	24785.
1983.0	5220.7	25967.
1984.0	5489.8	27206.
1985.0	5772.7	28505.
1986.0	6070.3	29865.
1987.0	6383.1	31290.
1988.0	6712.1	32783.
1989.0	7058.1	34348.
1990.0	7421.9	35987.
1991.0	7804.4	37704.
1992.0	8206.7	39503.
1993.0	8629.6	41388.
1994.0	9074.4	43363.
1995.0	9542.1	45432.
1996.0	10033.9	47600.
1997.0	10551.1	49872.
1998.0	11094.9	52252.
1999.0	11666.8	54745.
2000.0	12268.1	57358.
2001.0	12900.4	60095.
2002.0	13565.3	62962.
2003.0	14264.5	65967.
2004.0	14999.7	69115.
2005.0	15772.8	72413.
2006.0	16585.7	75868.

DYNAMO (REV.1) MINIPORT

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TIME	FM	BFM	XFM	TFM	AGLF	LF
E+00	E+02	E+00	E+02	E+02	E+04	E+04
1976.0	928.7	17636.	752.3	2172.9	2844.2	4939.6
1977.0	1068.4	20409.	864.3	2499.8	2918.1	5068.0
1978.0	1128.5	20994.	918.5	2685.9	2988.2	5189.6
1979.0	1191.8	21583.	975.9	2886.3	3053.9	5303.7
1980.0	1258.6	22190.	1036.7	3102.3	3115.0	5409.9
1981.0	1329.1	22814.	1100.9	3335.2	3171.2	5507.4
1982.0	1403.4	23456.	1168.9	3586.1	3222.0	5595.7
1983.0	1506.7	26607.	1240.6	3881.5	3289.7	5713.2
1984.0	1588.8	27252.	1316.3	4172.7	3358.8	5833.2
1985.0	1675.3	27913.	1396.2	4486.6	3429.3	5955.7
1986.0	1766.3	28590.	1480.4	4825.1	3501.3	6080.8
1987.0	1861.9	29285.	1569.0	5190.0	3574.9	6208.5
1988.0	1962.4	29998.	1662.4	5583.4	3650.0	6338.9
1989.0	2067.8	30729.	1760.5	6007.7	3726.6	6472.1
1990.0	2178.5	31479.	1863.7	6465.2	3804.9	6608.0
1991.0	2294.6	32248.	1972.1	6958.6	3884.8	6746.8
1992.0	2416.1	33037.	2085.8	7490.8	3966.4	6888.5
1993.0	2543.5	33846.	2205.0	8064.8	4049.7	7033.2
1994.0	2676.7	34675.	2329.9	8684.1	4134.7	7180.9
1995.0	2816.0	35525.	2460.8	9352.3	4221.6	7331.7
1996.0	2961.6	36397.	2597.6	10073.2	4310.2	7485.7
1997.0	3113.6	37291.	2740.7	10851.3	4400.8	7642.9
1998.0	3246.2	38207.	2864.2	11665.1	4493.2	7803.4
1999.0	3344.2	39146.	2952.8	12504.2	4587.6	7967.3
2000.0	3445.2	40109.	3044.1	13411.5	4683.9	8134.6
2001.0	3549.1	41096.	3138.2	14392.8	4782.3	8305.5
2002.0	3656.2	42107.	3235.1	15454.5	4882.7	8479.9
2003.0	3766.5	43144.	3335.0	16603.4	4985.3	8658.0
2004.0	3879.7	44174.	3438.0	17846.7	5090.0	8839.9
2005.0	3995.9	45182.	3544.0	19192.3	5196.9	9025.5
2006.0	4115.4	46213.	3553.3	20649.7	5306.0	9215.1

DYNAMO (REV.1) MINIPORT

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TIME	FB	BFB	BMOTS	BMOT	XFB	XMOTS	XMOT	SAIL	TFB
E+00	E+00	E+00	E+00	E+00	E+00	E+00	E+00	E+00	E+00
1976.0	8473.	2268.2	0.08730	198.0	6205.	0.35500	2202.7	7972.	16445.
1977.0	8795.	2385.0	0.15590	371.8	6410.	0.35198	2256.2	11025.	19820.
1978.0	9051.	2440.8	0.16401	400.3	6610.	0.37030	2447.8	12127.	21179.
1979.0	9314.	2496.5	0.17254	430.7	6817.	0.38956	2655.6	13340.	22654.
1980.0	9584.	2553.5	0.18151	463.5	7030.	0.40982	2881.1	14674.	24258.
1981.0	9862.	2611.8	0.19095	498.7	7250.	0.43113	3125.6	16142.	26003.
1982.0	10148.	2671.4	0.20087	536.6	7476.	0.45355	3390.8	17756.	27903.
1983.0	10442.	2732.4	0.61132	1670.4	7709.	0.47713	3678.4	19531.	29973.
1984.0	10745.	2794.8	0.62230	1739.2	7950.	0.50194	3990.4	21485.	32229.
1985.0	11056.	2858.6	0.63386	1811.9	8198.	0.52804	4328.7	23633.	34689.
1986.0	11377.	2923.8	0.64602	1888.9	8453.	0.55550	4695.7	25996.	37373.
1987.0	11707.	2990.6	0.65882	1970.2	8716.	0.58439	5093.7	28596.	40303.
1988.0	12046.	3058.8	0.67228	2056.4	8987.	0.61477	5525.3	31456.	43502.
1989.0	12396.	3128.6	0.68643	2147.6	9267.	0.64674	5993.4	34601.	46997.
1990.0	12755.	3200.1	0.70133	2244.3	9555.	0.68037	6501.0	38061.	50816.
1991.0	13125.	3273.1	0.71700	2346.8	9852.	0.71575	7051.5	41867.	54992.
1992.0	13506.	3347.8	0.73348	2455.6	10158.	0.75297	7648.6	46054.	59560.
1993.0	13897.	3424.2	0.75082	2571.0	10473.	0.79213	8296.0	50660.	64557.
1994.0	14300.	3502.4	0.76907	2693.6	10798.	0.83332	8998.1	55726.	70026.
1995.0	14715.	3582.3	0.78826	2823.8	11133.	0.87665	9759.5	61298.	76013.
1996.0	15142.	3664.1	0.80845	2962.2	11478.	0.92224	10585.1	67428.	82570.
1997.0	15581.	3747.7	0.82969	3109.5	11833.	0.97019	11480.4	74171.	89752.
1998.0	16033.	3833.3	0.85203	3266.1	12199.	1.00000	12199.5	81588.	97620.
1999.0	16498.	3920.8	0.87554	3432.8	12577.	1.00000	12576.9	89745.	106244.
2000.0	16976.	4010.3	0.90026	3610.3	12966.	1.00000	12965.8	98721.	115697.
2001.0	17468.	4101.8	0.92628	3799.4	13367.	1.00000	13366.6	108593.	126062.
2002.0	17975.	4195.5	0.95364	4001.0	13780.	1.00000	13779.6	119453.	137428.
2003.0	18496.	4291.2	0.98243	4215.8	14205.	1.00000	14205.1	131398.	149894.
2004.0	19033.	4389.2	1.00000	4389.2	14644.	1.00000	14643.5	144538.	163570.
2005.0	19585.	4489.4	1.00000	4489.4	15095.	1.00000	15095.3	158991.	178576.
2006.0	20153.	4591.8	1.00000	4591.8	15561.	1.00000	15560.8	174891.	195043.

TIME	MT	DMT	XMT	SMT	TMT	GDPF
E+00	E+02	E+02	E+02	E+02	E+02	E+06
1976.0	1772.0	493.8	1278.2	284.9	2056.9	512.2
1977.0	2153.3	668.1	1465.2	331.4	2484.7	679.8
1978.0	2300.0	722.0	1578.0	364.6	2664.5	779.0
1979.0	2457.6	757.6	1700.0	401.0	2858.6	892.9
1980.0	2627.4	795.4	1832.0	441.1	3068.5	1024.2
1981.0	2810.4	835.7	1974.7	485.2	3295.6	1175.3
1982.0	3007.7	878.7	2129.0	533.7	3541.4	1349.5
1983.0	4202.4	1906.4	2296.1	587.1	4789.6	1950.1
1984.0	4454.3	1977.5	2476.8	645.8	5100.1	2218.8
1985.0	4724.7	2052.3	2672.4	710.4	5435.1	2526.5
1986.0	5015.1	2131.1	2884.1	781.5	5796.6	2879.1
1987.0	5327.2	2214.1	3113.1	859.6	6186.8	3283.5
1988.0	5662.7	2301.6	3361.1	945.6	6608.3	3747.4
1989.0	6023.5	2394.0	3629.6	1040.1	7063.6	4279.9
1990.0	6411.6	2491.4	3920.2	1144.1	7555.7	4891.7
1991.0	6829.2	2594.4	4234.8	1258.5	8087.7	5594.8
1992.0	7278.6	2703.2	4575.4	1384.4	8663.0	6403.3
1993.0	7762.6	2818.2	4944.3	1522.8	9285.4	7333.4
1994.0	8283.7	2940.0	5343.7	1675.1	9958.8	8404.1
1995.0	8845.2	3068.9	5776.3	1842.6	10587.8	9637.1
1996.0	9450.1	3205.4	6244.8	2026.9	11477.0	11057.6
1997.0	10102.2	3350.1	6752.1	2229.6	12331.7	12695.0
1998.0	10665.8	3503.5	7162.3	2452.5	13118.3	14429.8
1999.0	11050.2	3666.3	7383.9	2697.8	13747.9	16158.2
2000.0	11451.3	3839.0	7512.3	2967.6	14418.9	18107.6
2001.0	11870.1	4022.5	7847.6	3264.3	15134.4	20308.1
2002.0	12307.5	4217.5	8090.0	3590.7	15898.3	22794.4
2003.0	12764.6	4424.8	8339.8	3949.8	16714.4	25606.2
2004.0	13192.3	4595.1	8597.2	4344.8	17537.1	28706.9
2005.0	13552.4	4700.0	8852.5	4779.3	18341.7	32030.6
2006.0	13943.0	4807.2	9135.7	5257.2	19200.2	35882.5

Table A8-2(4) Simulation-3

TIME	POP	GDP1	GDP2	GDP3	GDP
E+00	E+05	E+07	E+07	E+07	E+08
1976.0	734.3	1395.1	808.2	1802.9	400.6
1977.0	756.3	1423.9	855.1	1944.0	422.3
1978.0	777.5	1458.0	919.4	2088.4	446.6
1979.0	797.7	1482.2	978.9	2228.8	469.0
1980.0	816.9	1503.4	1038.6	2374.6	491.7
1981.0	834.9	1521.5	1098.4	2524.5	514.4
1982.0	851.6	1536.0	1158.0	2677.9	537.2
1983.0	872.9	1558.0	1221.1	2838.7	561.8
1984.0	894.7	1572.1	1288.3	3007.9	586.8
1985.0	917.0	1586.8	1360.1	3187.4	613.4
1986.0	940.0	1602.7	1437.6	3379.6	642.0
1987.0	963.5	1620.6	1522.0	3586.5	672.9
1988.0	987.6	1641.0	1614.8	3810.6	706.6
1989.0	1012.2	1664.4	1717.5	4054.4	743.6
1990.0	1037.5	1691.3	1831.8	4320.7	784.4
1991.0	1063.5	1722.2	1959.9	4612.6	829.5
1992.0	1090.1	1757.8	2103.9	4933.7	879.5
1993.0	1117.3	1798.3	2266.6	5287.9	935.3
1994.0	1145.3	1844.5	2451.2	5679.7	997.5
1995.0	1173.9	1896.9	2661.3	6114.4	1067.3
1996.0	1203.2	1956.3	2901.4	6597.9	1145.5
1997.0	1233.3	2023.3	3176.7	7136.8	1233.7
1998.0	1264.1	2098.9	3493.7	7739.4	1333.2
1999.0	1295.8	2184.1	3859.9	8414.7	1445.9
2000.0	1328.1	2280.0	4284.9	9173.5	1573.8
2001.0	1361.4	2387.6	4780.0	10028.5	1719.5
2002.0	1395.4	2508.9	5359.4	10994.8	1886.3
2003.0	1430.3	2645.8	6040.9	12090.2	2077.7
2004.0	1466.0	2800.5	6846.4	13336.2	2298.3
2005.0	1502.7	2975.8	7804.1	14758.7	2553.9
2006.0	1540.2	3175.0	8949.4	16389.0	2851.3

Notes for SIM-3

1. Without limitting Max. Fish Catches Potential 400,000 M/T Annum.
2. Motorized Vessels 50% shared up to 1983/84

TIME	GDP1C	GDP2C	GDP3C	GDPC
E+00	E+06	E+08	E+09	E+09
1976.0	435.1	292.0	60.1	132.8
1977.0	494.3	324.1	70.7	152.6
1978.0	559.7	383.7	83.4	177.7
1979.0	629.3	449.8	97.6	205.5
1980.0	706.0	525.3	114.1	237.2
1981.0	790.2	611.7	133.0	273.2
1982.0	882.3	710.1	154.8	314.0
1983.0	989.8	824.4	180.0	361.4
1984.0	1104.6	957.6	209.3	415.5
1985.0	1233.1	1113.1	243.3	477.9
1986.0	1377.5	1295.3	282.9	550.2
1987.0	1540.6	1509.9	329.4	634.4
1988.0	1725.3	1763.7	383.9	732.8
1989.0	1935.3	2065.3	448.1	848.2
1990.0	2175.1	2425.3	523.9	983.9
1991.0	2449.7	2856.9	613.5	1144.2
1992.0	2765.2	3376.7	719.9	1334.0
1993.0	3128.9	4005.2	846.4	1559.8
1994.0	3549.4	4768.8	997.3	1829.1
1995.0	4037.2	5700.5	1177.8	2151.5
1996.0	4604.9	6842.5	1394.2	2538.9
1997.0	5267.5	8248.5	1654.3	3005.9
1998.0	6043.6	9987.8	1968.0	3571.2
1999.0	6955.4	12149.3	2347.3	4257.7
2000.0	8030.5	14849.0	2807.2	5095.1
2001.0	9301.1	18237.9	3366.5	6120.4
2002.0	10809.5	22514.0	4048.9	7381.2
2003.0	12607.6	27939.6	4884.1	8938.9
2004.0	14759,3	34863.6	5910.1	10872.4
2005.0	17345.5	43753.9	7174.9	13284.8
2006.0	20468.2	55243.2	8740.3	16311.5

DYNAMO (REV.1) MINIPORT

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TIME	BPOP	BGPP1	BGPP2	BGPP3	BGPP
E+00	E+03	E+05	E+04	E+04	E+05
1976.0	2742.6	101.9	297.0	882.7	219.9
1977.0	2864.7	116.2	313.1	955.3	243.1
1978.0	2986.5	132.1	352.2	1035.9	270.9
1979.0	3107.3	149.2	392.2	1115.7	299.9
1980.0	3226.8	168.0	435.2	1199.7	331.5
1981.0	3344.3	188.8	481.4	1287.2	365.7
1982.0	3459.3	211.6	530.8	1378.0	402.5
1983.0	3595.8	238.4	585.5	1474.3	444.4
1984.0	3737.7	267.1	646.1	1576.6	489.4
1985.0	3885.1	299.4	713.4	1686.1	539.3
1986.0	4038.4	335.8	788.7	1804.3	595.1
1987.0	4197.7	377.0	873.4	1932.5	657.6
1988.0	4363.3	423.9	969.2	2072.2	728.0
1989.0	4535.5	477.4	1078.2	2225.1	807.7
1990.0	4714.4	538.7	1202.9	2393.2	898.3
1991.0	4900.4	609.1	1346.1	2578.5	1001.6
1992.0	5093.8	690.3	1511.4	2783.4	1119.8
1993.0	5294.7	784.2	1703.1	3010.8	1255.6
1994.0	5503.6	893.2	1926.4	3263.9	1412.2
1995.0	5720.7	1020.0	2187.7	3546.1	1593.4
1996.0	5946.4	1168.1	2494.6	3861.8	1803.7
1997.0	6181.0	1341.5	2856.9	4215.9	2048.8
1998.0	6424.9	1545.3	3286.3	4614.1	2335.4
1999.0	6678.4	1785.6	3797.7	5063.0	2671.7
2000.0	6941.9	2069.8	4409.5	5570.6	3067.9
2001.0	7215.7	2406.9	5145.0	6146.1	3536.0
2002.0	7500.4	2808.5	6033.8	6800.5	4091.9
2003.0	7796.3	3288.7	7113.4	7547.2	4754.8
2004.0	8103.9	3865.4	8432.5	8401.9	5548.9
2005.0	8423.6	4560.9	10053.6	9384.0	6504.7
2006.0	8756.0	5403.5	12058.9	10516.9	7661.1

DYNAMO (REV.1) MINIPORT

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TIME	MPOP	GPOP
E+00	E+02	E+00
1976.0	3672.4	18738.
1977.0	3880.5	19727.
1978.0	4092.4	20729.
1979.0	4307.6	21740.
1980.0	4525.2	22755.
1981.0	4744.5	23771.
1982.0	4964.8	24785.
1983.0	5220.7	25967.
1984.0	5489.8	27206.
1985.0	5772.7	28505.
1986.0	6070.3	29865.
1987.0	6383.1	31290.
1988.0	6712.1	32783.
1989.0	7058.1	34348.
1990.0	7421.9	35987.
1991.0	7804.4	37704.
1992.0	8206.7	39503.
1993.0	8629.6	41388.
1994.0	9074.4	43363.
1995.0	9542.1	45432.
1996.0	10033.9	47600.
1997.0	10551.1	49872.
1998.0	11094.9	52252.
1999.0	11666.8	54745.
2000.0	12268.1	57358.
2001.0	12900.4	60095.
2002.0	13565.3	62962.
2003.0	14264.5	65967.
2004.0	14999.7	69115.
2005.0	15772.8	72413.
2006.0	16585.7	75868.

TIME	FM	BFM	XFM	TFM	AGLF	LF
E+00	E+02	E+00	E+02	E+02	E+04	E+04
1976.0	928.7	17636.	752.3	2172.9	2844.2	4939.6
1977.0	1068.4	20409.	864.3	2499.8	2918.1	5068.0
1978.0	1128.5	20994.	918.5	2685.9	2988.2	5189.6
1979.0	1191.8	21583.	975.9	2886.3	3053.9	5303.7
1980.0	1258.6	22190.	1036.7	3102.3	3115.0	5409.9
1981.0	1329.1	22814.	1100.9	3335.2	3171.2	5507.4
1982.0	1403.4	23456.	1168.9	3586.1	3222.0	5595.7
1983.0	1509.6	26906.	1240.6	3884.5	3289.7	5713.2
1984.0	1591.8	27550.	1316.3	4175.7	3358.8	5833.2
1985.0	1678.3	28210.	1396.2	4489.6	3429.3	5955.7
1986.0	1769.2	28887.	1480.4	4828.1	3501.3	6080.8
1987.0	1864.8	29581.	1569.0	5192.9	3574.9	6208.5
1988.0	1965.3	30292.	1662.4	5586.4	3650.0	6338.9
1989.0	2070.8	31021.	1760.5	6010.6	3726.6	6472.1
1990.0	2181.4	31769.	1863.7	6468.1	3804.9	6608.0
1991.0	2297.4	32535.	1972.1	6961.5	3884.8	6746.8
1992.0	2419.0	33321.	2085.8	7493.6	3966.4	6888.5
1993.0	2546.3	34127.	2205.0	8067.6	4049.7	7033.2
1994.0	2679.5	34953.	2329.9	8686.9	4134.7	7180.9
1995.0	2818.8	35799.	2460.8	9355.0	4221.6	7331.7
1996.0	2964.3	36667.	2597.6	10075.9	4310.2	7485.7
1997.0	3116.3	37557.	2740.7	10854.0	4400.6	7642.9
1998.0	3248.8	38469.	2864.2	11667.7	4493.2	7803.4
1999.0	3346.8	39403.	2952.8	12506.8	4587.6	7967.3
2000.0	3447.7	40361.	3044.1	13414.0	4683.9	8134.6
2001.0	3551.0	41282.	3138.2	14394.7	4782.3	8305.5
2002.0	3657.4	42224.	3235.1	15455.7	4882.7	8479.9
2003.0	3766.9	43188.	3335.0	16603.8	4985.3	8658.0
2004.0	3879.7	44174.	3438.0	17846.7	5090.0	8839.9
2005.0	3995.9	45182.	3544.0	19192.3	5196.9	9025.5
2006.0	4115.4	46213.	3653.3	20549.7	5306.0	9215.1

TIME	FB	BFB	BMOTS	BMOT	XFB	XMOTS	XMOT	SAIL	TFB
E+00	E+00	E+00	E+00	E+00	E+00	E+00	E+00	E+00	E+00
1976.0	8473.	2268.2	0.08730	198.0	6205.	0.35500	2202.7	7972.	16445.
1977.0	8795.	2385.0	0.15590	371.8	6410.	0.35198	2256.2	11025.	19820.
1978.0	9051.	2440.8	0.16401	400.3	6610.	0.37030	2447.8	12127.	21179.
1979.0	9314.	2496.5	0.17254	430.7	6817.	0.38956	2655.6	13340.	22654.
1980.0	9584.	2553.5	0.18151	463.5	7030.	0.40982	2881.1	14674.	24256.
1981.0	9862.	2611.8	0.19095	498.7	7250.	0.43113	3125.6	16142.	26003.
1982.0	10148.	2671.4	0.20087	536.6	7476.	0.45355	3390.8	17756.	27903.
1983.0	10442.	2732.4	0.71132	1943.6	7709.	0.47713	3678.4	19531.	29973.
1984.0	10745.	2794.8	0.72230	2018.7	7950.	0.50194	3990.4	21485.	32229.
1985.0	11056.	2858.6	0.73386	2097.8	8198.	0.52804	4328.7	23633.	34689.
1986.0	11377.	2923.8	0.74602	2181.2	8453.	0.55550	4695.7	25996.	37373.
1987.0	11707.	2990.6	0.75882	2269.3	8716.	0.58439	5093.7	28596.	40303.
1988.0	12046.	3058.8	0.77228	2362.3	8987.	0.61477	5525.3	31456.	43502.
1989.0	12396.	3128.6	0.78643	2460.5	9267.	0.64674	5993.4	34601.	46997.
1990.0	12755.	3200.1	0.80133	2564.3	9555.	0.68037	6501.0	38061.	50816.
1991.0	13125.	3273.1	0.81700	2674.1	9852.	0.71575	7051.5	41867.	54992.
1992.0	13506.	3347.8	0.83348	2790.3	10158.	0.75297	7648.6	45054.	59560.
1993.0	13897.	3424.2	0.85082	2913.4	10473.	0.79213	8296.0	50660.	64557.
1994.0	14300.	3502.4	0.86907	3043.8	10798.	0.83332	8998.1	55726.	70026.
1995.0	14715.	3582.3	0.88826	3182.0	11133.	0.87665	9759.5	61298.	76013.
1996.0	15142.	3664.1	0.90845	3328.6	11478.	0.92224	10585.1	67428.	82570.
1997.0	15581.	3747.7	0.92969	3484.2	11833.	0.97019	11480.4	74171.	89752.
1998.0	16033.	3833.3	0.95203	3649.4	12199.	1.00000	12199.5	81588.	97620.
1999.0	16498.	3920.8	0.97554	3824.9	12577.	1.00000	12576.9	89746.	106244.
2000.0	16976.	4010.3	1.00000	4010.3	12966.	1.00000	12965.8	98721.	115697.
2001.0	17468.	4101.8	1.00000	4101.8	13367.	1.00000	13366.6	108593.	126062.
2002.0	17975.	4195.5	1.00000	4195.5	13780.	1.00000	13779.6	119453.	137428.
2003.0	18496.	4291.2	1.00000	4291.2	14205.	1.00000	14205.1	131398.	149894.
2004.0	19033.	4389.2	1.00000	4389.2	14644.	1.00000	14643.5	144538.	163570.
2005.0	19585.	4489.4	1.00000	4489.4	15095.	1.00000	15095.3	158991.	178576.
2006.0	20153.	4591.8	1.00000	4591.8	15561.	1.00000	15560.8	174891.	195043.

TIME	MT	BMT	XMT	SMT	TMT	GDPF
E+00	E+02	E+02	E+02	E+02	E+02	E+07
1976.0	1772.0	493.8	1278.2	284.9	2056.9	51.2
1977.0	2153.3	688.1	1465.2	331.4	2484.7	68.0
1978.0	2300.0	722.0	1578.0	364.6	2664.5	77.9
1979.0	2457.6	757.6	1700.0	401.0	2858.6	89.3
1980.0	2627.4	795.4	1832.0	441.1	3068.5	102.4
1981.0	2810.4	835.7	1974.7	485.2	3295.6	117.5
1982.0	3007.7	878.7	2129.0	533.7	3541.4	134.9
1983.0	4447.9	2151.9	2296.1	587.1	5035.1	205.0
1984.0	4705.4	2228.6	2476.8	645.8	5351.2	232.8
1985.0	4981.5	2309.1	2672.4	710.4	5691.9	264.6
1986.0	5277.8	2393.8	2884.1	781.5	6059.3	301.0
1987.0	5595.9	2482.8	3113.1	859.6	6455.5	342.6
1988.0	5937.6	2576.5	3361.1	945.6	6883.1	390.3
1989.0	6304.6	2675.1	3629.6	1040.1	7344.7	445.0
1990.0	6699.1	2779.0	3920.2	1144.1	7843.2	507.8
1991.0	7123.3	2888.5	4234.8	1258.5	8381.8	579.8
1992.0	7579.4	3004.0	4575.4	1384.4	8963.8	662.6
1993.0	8070.2	3125.9	4944.3	1522.8	9593.0	757.6
1994.0	8598.4	3254.7	5343.7	1675.1	10273.5	867.0
1995.0	9167.0	3390.7	5776.3	1842.6	11009.6	992.7
1996.0	9779.3	3534.6	6244.8	2026.9	11806.2	1137.5
1997.0	10438.9	3686.8	6752.1	2229.6	12568.5	1304.2
1998.0	11010.2	3847.9	7162.3	2452.5	13462.7	1480.9
1999.0	11402.4	4018.5	7383.9	2697.8	14100.2	1657.2
2000.0	11810.7	4198.4	7612.3	2967.6	14778.2	1855.9
2001.0	12141.8	4294.2	7847.6	3254.3	15406.1	2067.3
2002.0	12482.3	4392.3	8090.0	3590.7	15973.0	2304.5
2003.0	12832.3	4492.5	8339.8	3949.8	16782.2	2571.0
2004.0	13192.3	4535.1	8597.2	4344.8	17537.1	2870.7
2005.0	13562.4	4700.0	8862.5	4779.3	18341.7	3208.1
2006.0	13943.0	4807.2	9135.7	5257.2	19200.2	3588.3

Table A8-3 Referencial Figure – 1

● Reference data – 1 Fishermen (Unit: in persons)

Year	Baluchistan (except Gwadar)	Gwadar
1976	17,868 (12,197)	5,671
1977	17,636 (11,139)	6,297

● Reference data – 2 Vessel, sailing & w/motor (Unit: in boats)

1976	2,268 (1,502)	766
1977	2,340 (1,544)	796

● Reference data – 3 Vessel, by Tonnage (Unit: in boats)

	(~ 1^t	1 ~ 5	6 ~ 15	16 ~ 25	w/motor)	(~ 1	1 ~ 5	6 ~ 15	16 ~ 25	w/motor)
1976			n.a.		198 (167)			n.a.		31
1977	644	435	842	56	363 (205)	278	73	258	29	158

● Reference data – 4 Fish Catches (Unit: in M.T.)

	Total	Comm./Industrial)	(Total	Comm./Industrial)
1976	49,373 (n.a.)	45,573 (31,511)	n.a.	14,062
1977	68,848 (47,980)	64,348 (44,450)	20,868	19,898

● Reference data – 5 Fish production by dispositions at Comm./Industrial basis (Unit: in M.T.)

	(Total	Freez	Can	Meal	Curing)	(Total	Freez	Can	Meal	Curing)
1976	45,573	4,051	non	7,653	28,517	14,062	493	non.	1,328	10,606
1977	64,348	5,530	non	6,422	31,807	19,898	320	non	1,092	9,431

● Reference data – 6 Export of dry-salted fish among curings to Sri Lanka (Unit: in M.T.)

	(Curing Total	Export)	(Curing Total	Export)
1976	28,517	15,682	10,606	n.a.
1977	31,807	6,639	9,431	1,647

Note: Baluchistan means "Baluchistan coast", and this applies also up to appended Table A 8-6. Numerals in parentheses indicate those for Baluchistan coast excluding Gwadar.

Table A8-4 Referencial Figures – 2

● Production Fluctuation (Unit: MT)

Processing	Federal 1976	Federal 1977	Federal Fluct (%)	Baluchistan 1976	Baluchistan 1977	Baluchistan Fluct (%)
Freeze	12,581	13,050	3.7	4,051	5,930	46.4
Canning	8,055	6,715	△16.6		non.	
Curing	36,477	38,617	5.9	28,517	31,807	11.5
Fish Meal	78,603	97,187	23.6	7,653	6,422	△16.1

● Export Fluctuation, Federal Base

	1976 Volume, MT	1976 Value, mil. Rs.	1977 MT (Fluct. %)	1977 mil. Rs (Fluct. %)
Fish-Processed				
Dry-Salted	4,448	35.95	5,876 (32.10)	34.10 (△ 5.15)
Freeze	412	6.21	195 (△52.67)	3.53 (△43.16)
Chilled	non.		105	1.47
Wet-Salted	non.		20	0.23
Dehydrate	non.		5	0.08
Shell-Fish				
Shrimp	6,855	323.51	6.051 (△11.73)	301.07 (△ 6.94)
Freeze.Shrimp	4,095	218.90	4,450 (8.67)	240.37 (9.81)
Can. Shrimp	1,611	56.18	1,343 (△16.64)	55.46 (△ 1.30)
Dried Shrimp	408	3.40	256 (△37.25)	5.17 (52.06)
Smoked Shirmp	non.		2	0.08
Lobster	54	3.67	85 (57.41)	5.70 (55.33)
Fish-Products				
Meal	11,025	22.60	17,264 (56.59)	49.19 (117.67)
Maws	32	1.63	175 (446.88)	6.23 (282.21)
Shark-Fins	167	1.63	169 (1.20)	5.54 (239.88)
Preparation	negli.		106	1.92
Grand Total	29,107	673.68	36,102 (24.03)	710.14 (5.41)

Table A8-5 Estimated Productivity – 1

- **Correlation between Fishermen, Vessel and Fish Catches**

  Fixed condition: Fishermen by vessel tonnage-classified

Tonnage	less 1	1 ~ 5	6 ~ 15	16 ~ 25	W/Motor
No. Crew/per Vessel	2 ~ 4	– 6 ~ 8[1]	–	10 ~ 12	12 ~ 23[2]

Notes: 1) Based on 15 metre's "Rachin" class sailing vessel. Sources from "Assessment of the Problems & Needs of Small Scale Fisheries on Baluchistan Coast in Pakistan" PAS/74/031 – Working Paper No. 5. Appendix 2, 8, and 9.

2) Relatively Broad A.M. caused from unclassified Size of W/Motor Vessel.

- Estimates Disposition of Fishermen/Vessel in 1977

Tonnage	less 1	1 ~ 5	6 ~ 15	16 ~ 25	W/Motor	Total
Baluchistan						
Vessel	644	1,277		56	363	2,340
Crew	1,288~2,576	7,622~10,216		560~672	4,172~8,126	17,636
Gwadar						
Vessel	278	331		29	158	796
Crew	556~1,112	1,986~2,648		290~348	2,189~3,465	6,297

- Estimated Catches by Type of Vessel

  Assumption Case-1: Basic Figure 3.6 MT/Fisherman per Head/Year, model-drawn from Total Catches/Total Fishermen.

  Case-2: Basic Figures 45 MT/per Vessel/Year in the Base of 15 metre's "Rechin" sailing vessel and 130 MT/per Vessel/Year in the same type W/Motor, model-drawn from the sources of RAS/74/031, Fishing-days 180/per vessel/Year.

- Case-1 (as an example in Baluchistan Total-Average)

MT/per Head	3.6	3.6	3.6	3.6	Approx. Total
Total Catch	4,637~9,274	27,439~36,778	2,072~2,419	15,877~30,200	64,348
Per Vessel	7.2~14.4	21.5~28.8	37.0~43.2	43.7~83.2	

- Case-2 (as an example in Baluchistan Total-Average)

MT/by Tonnage per Vessel	20	45 (Fishing days Ratio 49.3%)	60 (Fishing days Ratio 53.4%)	130 (Fishing days Ratio 57.5%)	Approx. Total
Total Catch	7,109	28,330	1,794	27,134	64,348
Per Fisherman	2.8~5.5	2.8~3.7	2.7~3.2	3.3~6.5	

Table A8-6 Estimated Productivity – 2

- Correlation between Production, Vessel and Fisherman

Fixed Condition: 1) Rs 1, 509, 996, 155 : MT 64,348 in Baluchistan
Rs 2,347 per MT.
2) Rs 42, 630, 583 : MT 19,898 in Gwadar
Rs 2,142 per MT.

- Estimate for Production by Vessel Tonnage-classified, based on Case-2 with 1)

	less 1	1 ~ 5	6 ~ 15	16 ~ 25	W/Motor	Approx. Total
T. Amount	16,684,823	– 66,490,510 –		4,210,518	63,683,498	151,024,756
Per Vessel	25,908	52,068		75,188	175,437	
Per Crew	6,571~12,909	6,572~8,684		6,337~7,510	7,745~15,256	

- Export Contribution as for Dry Salted Fish-Products, mainly for Sri Lanka

	Baluchistan			Gwadar		
	Volume, MT	Value, Rs	Per Ton	Volume, MT (Share)	Value, Rs (Share)	Per Ton
1973	9,481	23,600,162	2,489	5,107 (53.9)	13,236,463 (56.1)	2,592
1974	7,026	18,718,405	2,664	3,706 (52.8)	9,869,148 (52.7)	2.663
1975	7,913	21,212,164	2,681	3,684 (46.6)	9,407,449 (44.4)	2.554
1976	15,682	n.a.			n.a.	
1977	6,639	24,479,392	3,687	1,647 (24.8)	5,802,736 (23.7)	3,523

- Production Forecast, Federal/Baluchistan/Gwadar

MT/Year	Federal Inland & Marine	Federal Marine	Baluchistan Marine	Gwadar Marine
1977	248,470 (248,496)	215,330 (215,358)	68,810 (68,848)	21,277 (20,868)
1978	266,450	230,000	72,200	25,218
1983	429,850	371,140	141,540	62,758
1990	698,070	583,660	191,640	91,344
1995	1,004,400	820,140	242,510	121,643
2000	1,369,820	1,073,070	311,840	157,406
Rs 1,000/Year				
1977	679,800 (680,000)	589,057	188,237 (151,025)	58,205 (42,622)
1978	779,000	672,313	211,048	73,715
1983	1,750,200	1,510,985	780,205	255,500
1990	4,519,400	3,778,556	1,240,658	591,352
1995	9,056,600	7,395,120	2,186,688	1,096,843
2000	17,202,600	13,475,271	3,916,243	1,976,783

Table A8-7 Trade Forecast by Value

Year	Import (10^8 Rs.)	Export (10^8 Rs.)	Total Trade (10^8 Rs.)
1976	230.1	113.0	343.1
1977	296.3	131.1	427.4
1978	329.5	160.8	490.3
1979	363.2	192.7	555.9
1980	399.2	228.6	627.8
1981	437.6	268.7	706.3
1982	478.4	313.1	791.5
1983	528.0	349.5	877.5
1984	582.7	389.9	972.6
1985	643.6	435.0	1078.6
1986	711.8	485.8	1197.6
1987	788.4	543.1	1331.5
1988	874.8	608.3	1483.1
1989	972.9	682.5	1655.4
1990	1084.5	767.4	1851.9
1991	1211.9	864.9	2076.8
1992	1358.0	977.1	2335.1
1993	1525.9	1106.7	2632.6
1994	1719.5	1256.8	2976.3
1995	1943.6	1431.0	3374.6
1996	2203.6	1634.0	3837.6
1997	2506.3	1871.1	4377.4
1998	2859.9	2148.9	5008.8
1999	3274.4	2475.5	5749.9
2000	3761.9	2860.6	6622.5
2001	4337.6	3316.4	7654.0
2002	5019.9	3857.9	8877.8
2003	5832.0	4503.7	10335.7
2004	6803.0	5277.2	12080.2
2005	7969.5	6208.0	14177.5
2006	9378.1	7333.7	16711.8

Table A8-8 Forecasts for Economic Indices

Year	Wholesale Price Growth Rate (%)	Consumer Price Growth Rate (%)	Foreign Economic Assistance (10^6 Rs.)	Currency in Circulation (10^7 Rs.)
1976	0.11266	0.09232	1142.3	1384.9
1977	0.10436	0.08452	1501.5	1616.3
1978	0.10978	0.08962	1528.5	1633.7
1979	0.10945	0.08930	1541.1	1641.8
1980	0.10741	0.08739	1542.5	1642.7
1981	0.10464	0.08478	1530.4	1634.9
1982	0.10153	0.08186	1502.8	1617.1
1983	0.09950	0.07995	1601.6	1680.8
1984	0.09934	0.07979	1709.2	1750.1
1985	0.10034	0.08074	1827.2	1826.2
1986	0.10217	0.08246	1957.1	1909.9
1987	0.10464	0.08478	2100.8	2002.4
1988	0.10764	0.08760	2260.4	2105.3
1989	0.11108	0.09083	2438.5	2220.0
1990	0.11489	0.09442	2637.9	2348.5
1991	0.11901	0.09830	2862.1	2492.9
1992	0.12342	0.10244	3115.2	2656.0
1993	0.12807	0.10681	3401.9	2840.7
1994	0.13293	0.11138	3728.0	3050.8
1995	0.13799	0.11614	4100.3	3290.7
1996	0.14324	0.12107	4526.9	3565.6
1997	0.14866	0.12617	5017.7	3881.8
1998	0.15425	0.13143	5584.7	4247.1
1999	0.16003	0.13686	6242.3	4670.8
2000	0.16599	0.14246	7008.3	5164.3
2001	0.17216	0.14826	7904.6	5741.8
2002	0.17855	0.15428	8958.0	6420.5
2003	0.18521	0.16053	10202.2	7222.2
2004	0.19215	0.16706	11679.3	8173.8
2005	0.19942	0.17390	13442.2	9309.7
2006	0.20709	0.18111	15558.5	10673.2

Table A8-9 Consumption and Investment

Year	Private Consumption (10^7 Rs.)	Gross Fixed Capital Formation (10^7 Rs.)
1976	3354.6	761.2
1977	3620.5	772.9
1978	3870.8	825.3
1979	4092.7	875.3
1980	4315.6	924.4
1981	4534.2	974.2
1982	4745.4	1025.0
1983	4951.7	1079.5
1984	5162.9	1139.7
1985	5385.4	1205.2
1986	5623.9	1276.6
1987	5882.8	1354.7
1988	6166.6	1440.8
1989	6480.1	1536.1
1990	6828.5	1642.3
1991	7217.4	1761.2
1992	7653.2	1894.9
1993	8143.4	2045.8
1994	8696.4	2216.7
1995	9322.0	2411.1
1996	10031.7	2633.1
1997	10839.1	2887.3
1998	11760.5	3179.7
1999	12815.2	3517.2
2000	14026.7	3908.4
2001	15423.3	4363.7
2002	17039.7	4896.0
2003	18918.4	5521.3
2004	21112.4	6259.3
2005	23687.5	7135.2
2006	26726.9	8180.7

Table A8-10 Subsistence Catch per Capita

Marine Karachi and Sind Coasts

Year	Fish Catch (A) (tons)	Susbistence Catch (B) (tons)	B/A (%)	Numbers of Fishermen (persons)	Subsistence Catch per Capita (kg)
1976	127,795	10,000	7.83	74,100	135.0
1977	165,968	10,800	6.51	75,200	143.6
1978	189,460	10,900	5.75	80,800	134.9
Mean					137.8

Marine Baluchistan Coast

Year	Fish Catch (A) (tons)	Susbistence Catch (B) (tons)	B/A (%)	Numbers of Fishermen (persons)	Subsistence Catch per Capita (kg)
1976	49,373	3,800	7.70	17,868	212.7
1977	68,848	4,500	6.54	17,636	255.2
1978	68,346	3,250	4.76	17,427	186.5
Mean					218.1

Inland

Year	Fish Catch (A) (tons)	Susbistence Catch (B) (tons)	B/A (%)	Numbers of Fishermen (persons)	Subsistence Catch per Capita (kg)
1976	28,491	7,300	25.62	113,903	64.1
1977	33,138	7,580	22.87	124,337	61.0
1978	35,223	8,097	22.99	130,183	62.2
Mean					62.4

Source: Fisheries Department, Government of Pakistan

Table A9-1 Fish Catches in Baluchistan Coast (1976 to 1978)

(Quantity in Metric tons)

Month		Quantity	Two Consecutive Months Total
1976	Jan.	5,984	
	Feb.	2,692	8,676
	Mar.	2,760	5,452
	Apr.	4,890	7,650
	May	3,320	8,210
	Jun.	1,738	5,058
	Jul.	2,407	4,145
	Aug.	4,626	7,033
	Sep.	5,688	10,314
	Oct.	4,649	10,337
	Nov.	3,769	8,418
	Dec.	3,050	6,819
Sub Total		45,573	
1977	Jan.	3,655	6,705
	Feb.	3,046	6,701
	Mar.	4,815	7,861
	Apr.	5,520	10,335
	May	5,357	10,877
	Jun.	2,919	8,276
	Jul.	2,248	5,167
	Aug.	6,777	9,025
	Sep.	7,896	14,673
	Oct.	8,569	16,465
	Nov.	7,386	15,955
	Dec.	6,160	13,546
Sub Total		64,348	
1978	Jan.	3,305	9,465
	Feb.	4,379	7,684
	Mar.	5,212	9,591
	Apr.	6,513	11,725
	May	6,003	12,516
	Jun.	2,565	8,568
	Jul.	3,418	5,983
	Aug.	6,632	10,050
	Sep.	7,471	14,103
	Oct.	8,635	16,106
	Nov.	6,080	14,715
	Dec.	4,883	10,963
Sub Total		65,096	
Grand Total		175,017	
Monthly Mean			
	1976	3,798	
	1977	5,362	
	1978	5,425	

Source: Fisheries Department, Government of Baluchistan

Table A9-2 Fish and Prawn/Lobster for Freezing

(In Metric Tons)

Name of Species	Fish Products	
	1976	1977
Sharks	1,930	2,758
Skates	74	89
Rays	1,328	1,078
Sardine	433	1,311
Hilsa	327	290
Silver bar Fish	456	372
Other clupeide	112	1,825
Cat Fish	531	990
Eels	27	25
Mullets	48	103
Threadfin Fish	67	32
Barracuda	326	287
Groupers	94	333
Rockcod	171	239
Butter Fish	219	97
Leather Jacket	1,050	1,576
Trevally	440	833
Jumper	221	38
Dolphin Fish	62	53
Snapper	300	713
Grunter	318	280
Seabrean	226	57
Jew Fish	715	1,138
Croakers	312	590
King Mackeral	582	844
Mackeral	365	276
Tuna	1,948	1,949
Bill Fish	185	332
Pomfrets	586	603
Flat Fish	55	71
Prawn	526	489
Lobster	28	227
Total	14,062	19,898

Source: Directorate of Fisheries; Government of Baluchistan

Note:

(1) Fish for cold storage

	1976 tons	1977 tons
Hilsa	327	290
King Mackeral	582	844
Mackeral	365	276
Tuna	1,948	1,949
Pomfrets	586	603
Total	3,808	3,962

Ratio of fish for storage to total of fish catch $= \frac{3{,}808 + 3{,}962}{14{,}062 + 19{,}898} = \frac{7{,}770}{33{,}960} = 0.23$

(2) Prawn/lobster for freezing

	1976	1977
Prawn	526	489
Lobster	28	227
Total	554	716

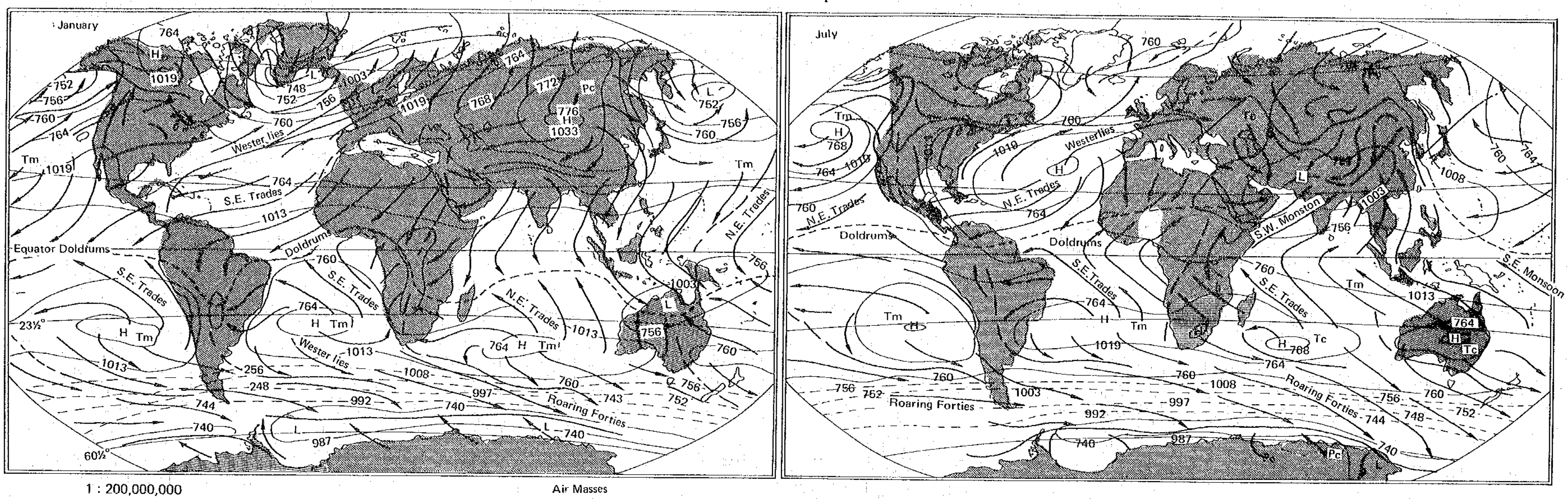
Ratio of Prawn/lobster for freezing to the total of fish catch $= \frac{554 + 716}{33{,}960} = \frac{1{,}270}{33{,}960} = 0.037$

Table A 9-3 Computation of Water Supplies

Classification	Water Supply per Day	Maximum Water Supply per Hours
Water Supplied to Fishing Crafts		
Gill Netter (Large)	20 crewmen X 100 litre/day X 36 ships = 72 tons	104 tons ÷ 12 hours ≑ 9 tons
Small Fishing Crafts	6 crewmen X 25 litre/day X 210 ships = 32 tons	
Ice making and Freezing Facilities	50 tons	50 tons ÷ 24 hours ≑ 2 tons
Others	46 tons	46 tons ÷ 12 hours ≑ 4 tons
Total	200 tons/day	15 tons/hour

Appendix B Appended Figures

Fig. A6-1 Climatic Fronts and Atmospheric Pressure



1 : 200,000,000

Air Masses

P:Polar
c:continental
m:maritime
T:Tropical

—— Arctic, Antarctic, Polar Frontal Zones
- - - Inter- & Subtropical Convergence Zones

Prevailing Surface Winds
H.L High and Low Pressure Centres
756/1008 Mean Sea Level Pressure (mm/mb)

Fig. A6-2 Atmospheric Low Pressures
(From The Times Atlas of The World)

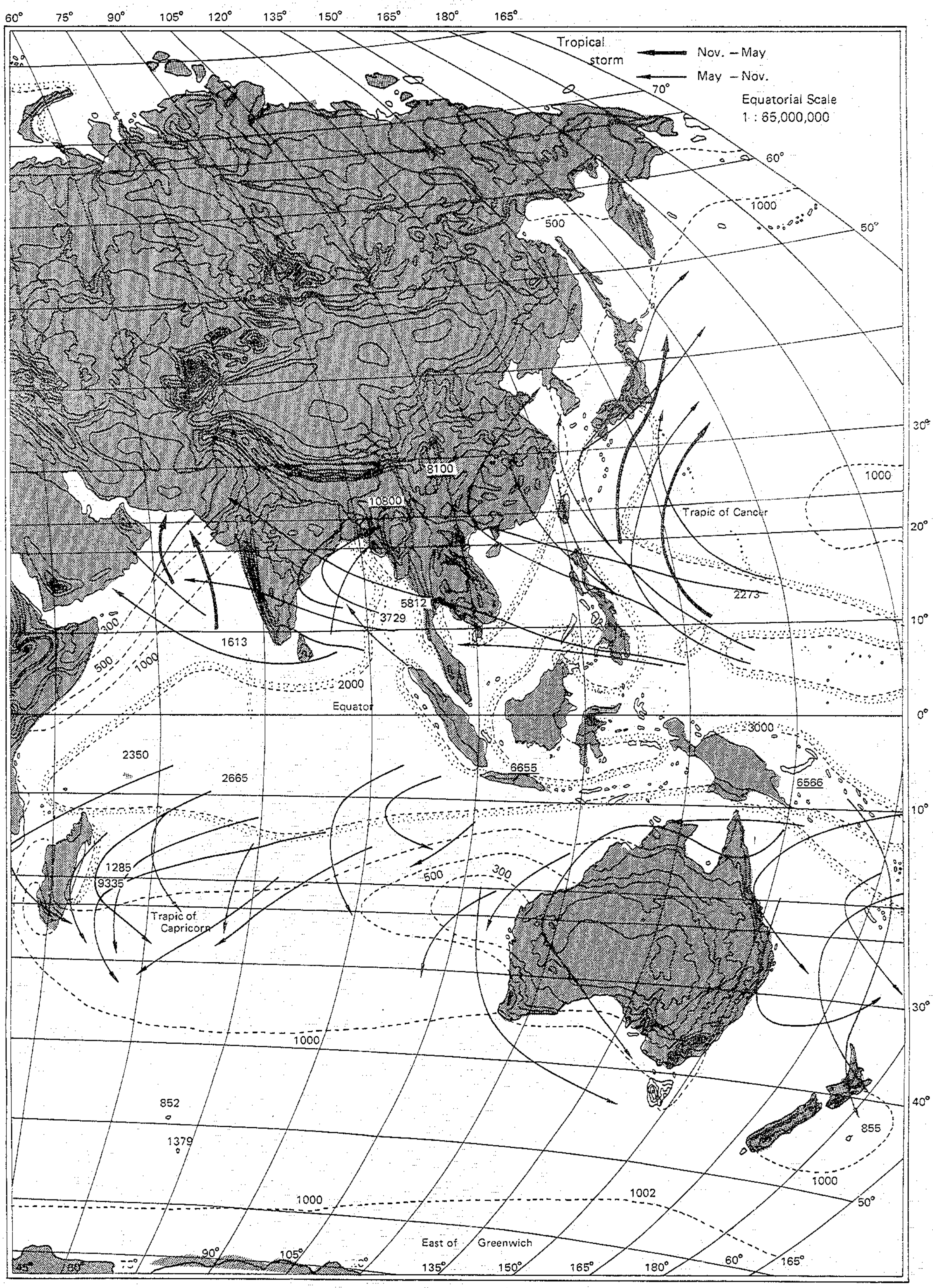


Fig. A6-3 Wind at Gwadar

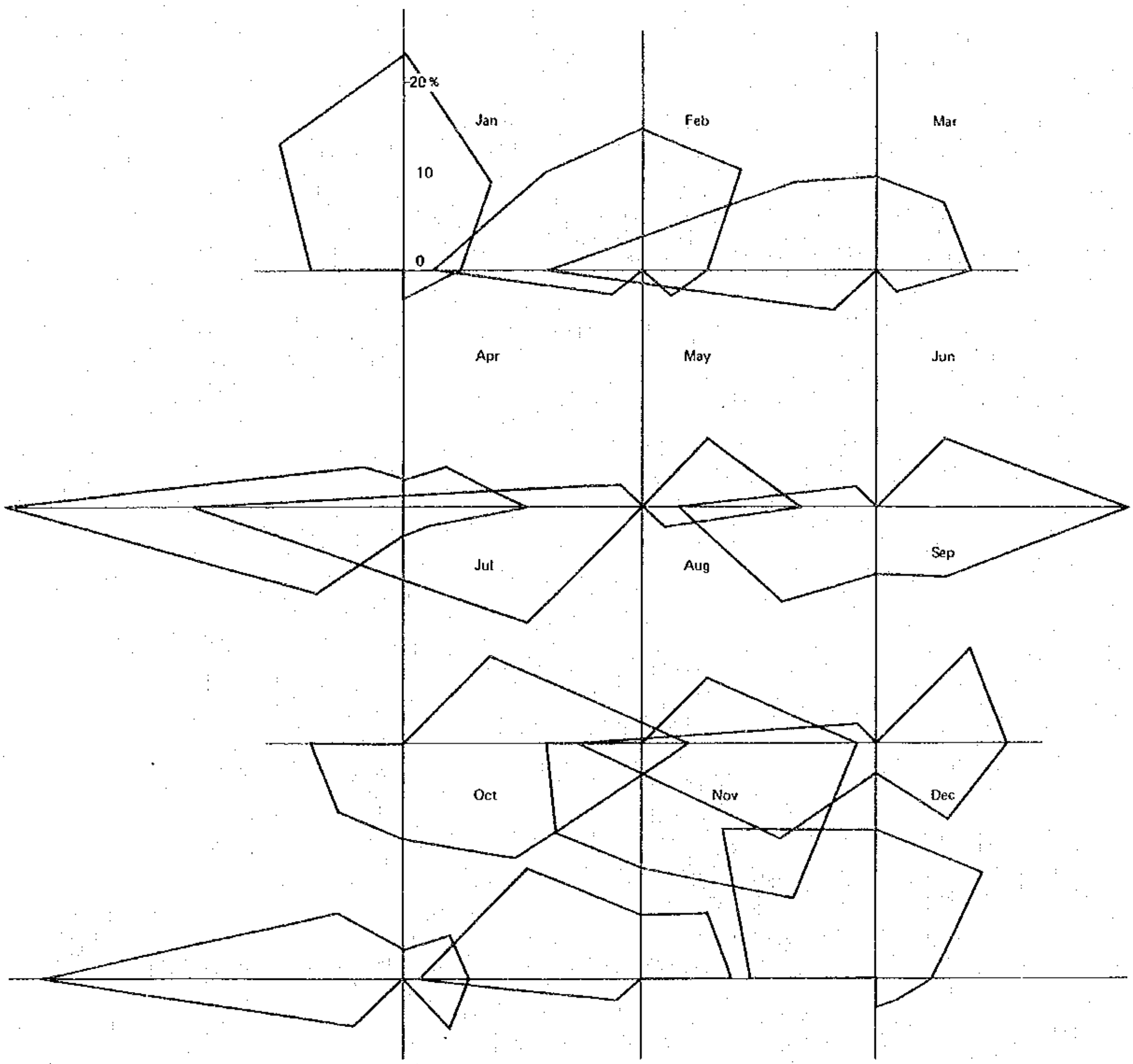


Fig. A6-4 Wind at Pasni

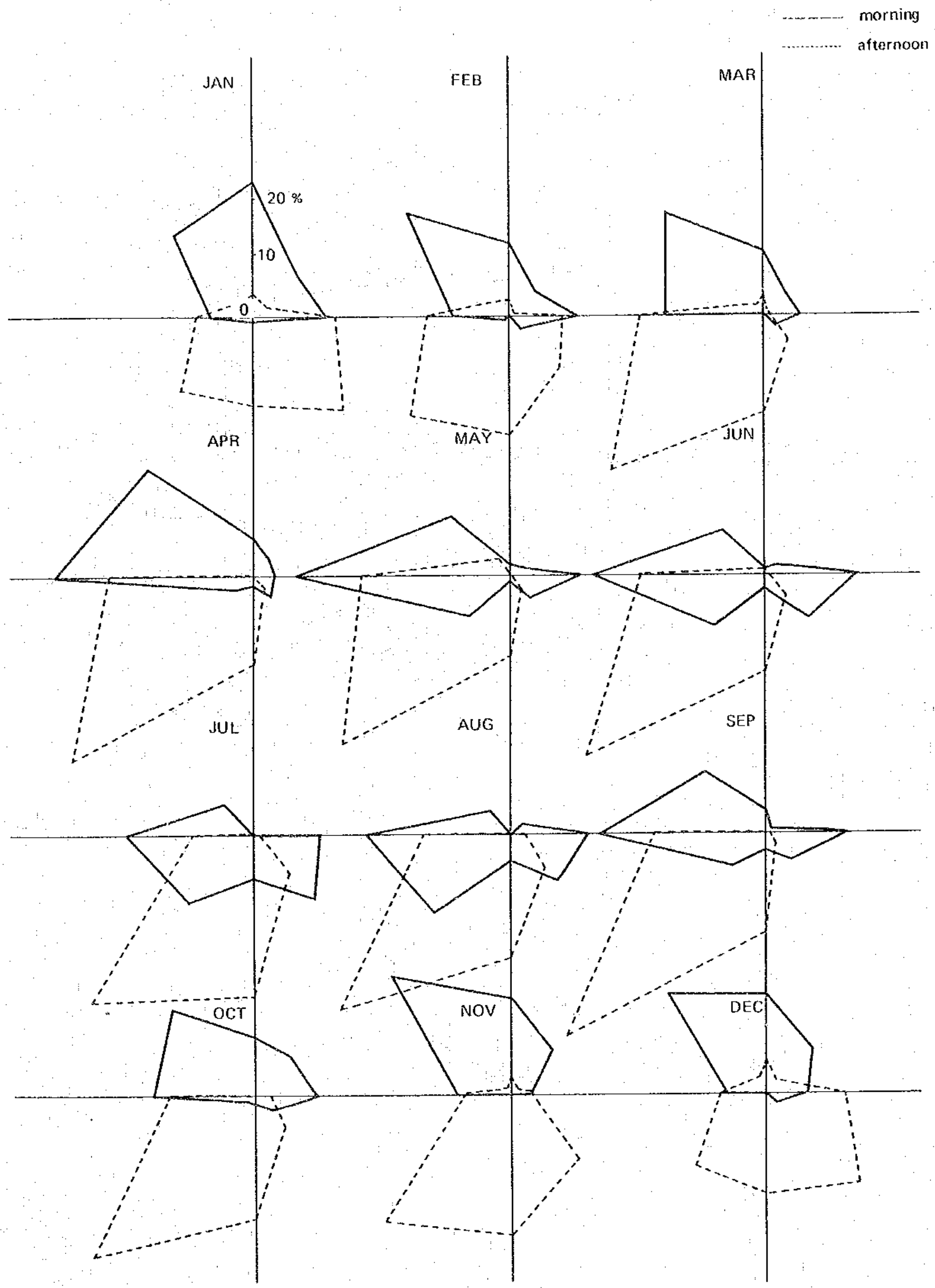
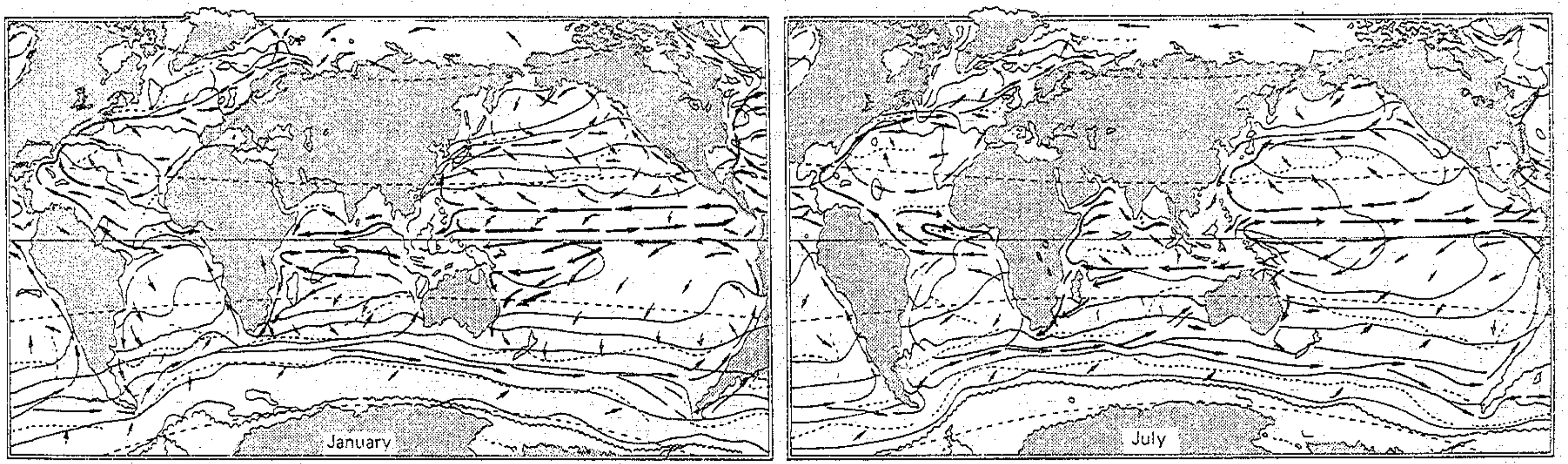


Fig. A6-5 Ocean Current
(From The Times Atlas of The World)

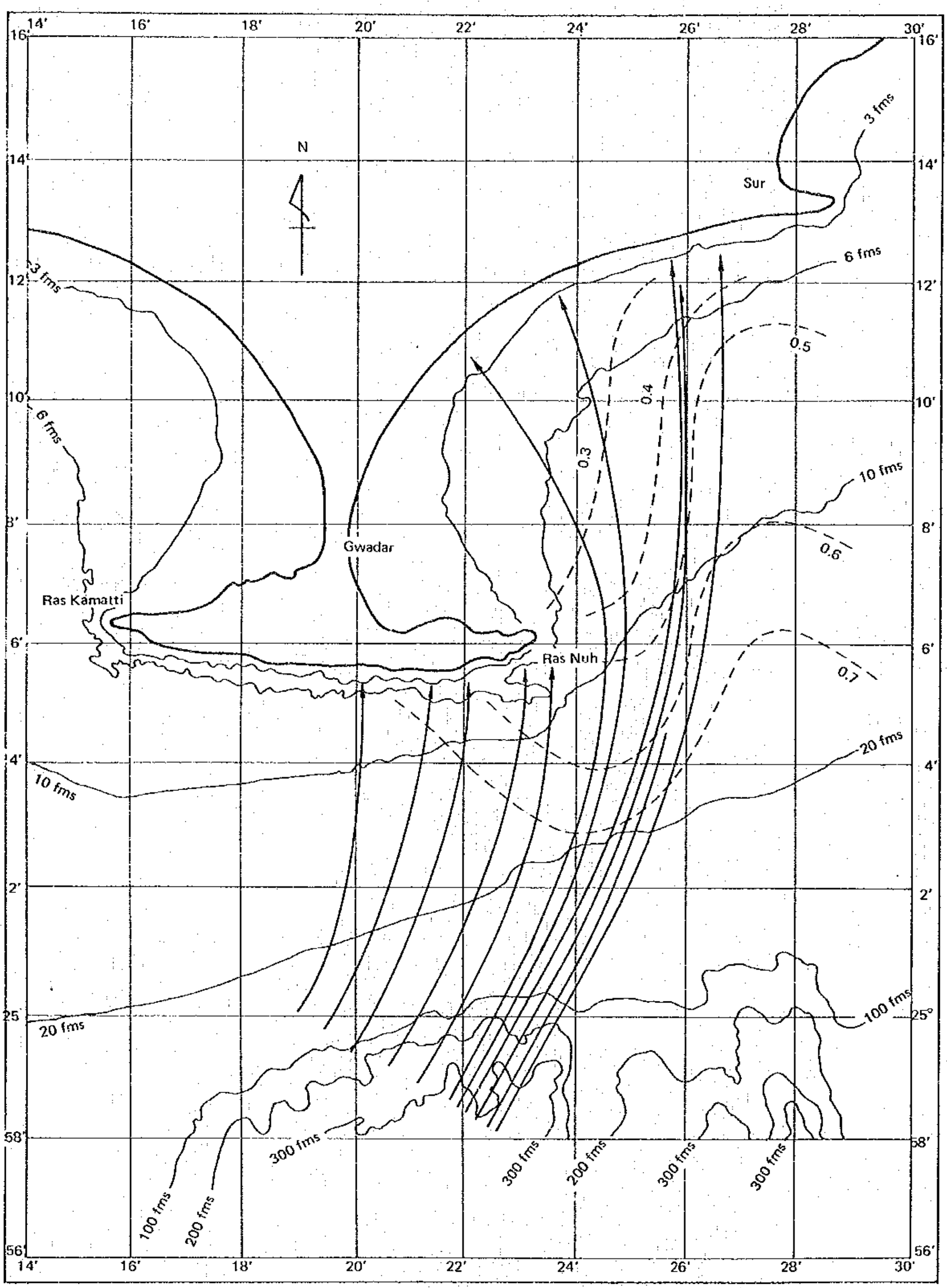


Warmer Currents
Colder Currents

The thickness of the arrows is on indication of the relative flow of respective currents, which can exceed 3 knots.

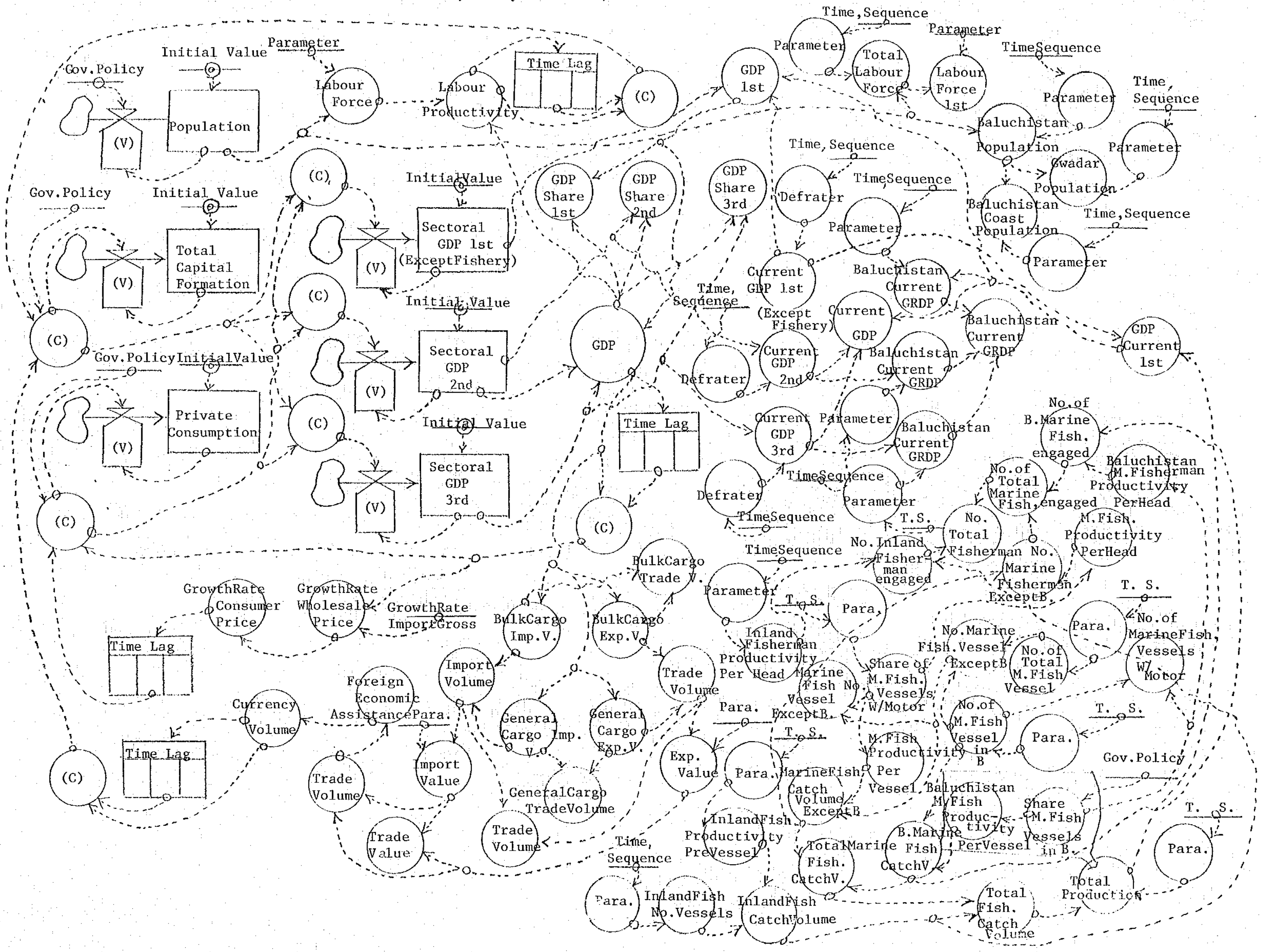
Convergence (Sinking)
Divergence(Up-welling)
Limit of Drift Ice

Fig. A6-6 Wave Refraction Diagram
Direction 210° Period 12.5 Sec.



(From NESPAK Report 1977)

Fig. A8-1 Baluchistan Province, System Dynamic Model, Flow Sheet



Appendix C Scope of Work

SCOPE OF WORK
FOR THE STUDY OF CONSTRUCTION PROJECT
OF A "MINI-PORT" IN GWADAR,
THE ISLAMIC REPUBLIC OF PAKISTAN

I. Introduction

In response to the agreement reached between the Government of Pakistan and the Government of Japan concerning the implementation of the Study of Construction Project of a "Mini-Port" in Gwadar, Baluchistan Province of the Islamic Republic of Pakistan, Japan International Cooperation Agency (hereinafter referred to as JICA) will send a study team of Japanese experts to Pakistan to carry out study.

The Government of Pakistan entrusts the guidance and coordination of the study to Directorate General of Ports and Shipping (hereinafter referred to as DGP&S) in cooperating with Japanese experts.

The present document sets forth the Scope of Work for out the study.

II. Objective

The objective of the study is to formulate a port development plan including illustration on Gwadar harbour of Baluchistan Province in Pakistan, since at the existing harbour lacking in mooring/landing facilities, the landing operation has to carried out manually.

III. Outline of the Study

The study will be carried out in two phases of survey works, namely general study at the 1st-phase and conclusive study at the 2nd-phase.

1. 1st-phase

The study would be concentrated on the following six aspects as a preparatory work within 1978.

1) Tentative selection for a possible site of a "Mini-Port".
2) Tentative estimation of the port scale.
3) Tentative drawing of the port layout.
4) Tentative cost estimation for the technical survey at the 2nd-phase as well as for the construction of the port.
5) Tentative evaluation of the economic effect of the development.
6) Other related matters for implementing the 2nd-phase survey including timing, duration and manpower.

The study at this stage, therefore, be concentrated in the site of Gwadar area, but can be extended to other areas when necessary.

2. 2nd-phase

The study would be concentrated on the site of Gwadar and on the continuation of the strictly technical and technological aspects of survey/examination of the 1st-phase. The 2nd-phase survey/examination would cover the following seven aspects and will be completed within 1979.

1) Tide-water survey
2) Current-flow survey
3) Sound monitoring and chart figuring
4) Sub-soil condition scanning, by sonic prospecting and boring
5) More detailed cost estimation for the construction of the port
6) More detailed evaluation of the economic effect of the port
7) Other necessary survey/examination which are strictly and directly related to the above six items.

The duration of the survey at the 2nd-phase can be extended to a substantially long period, since careful observation of monsoon season is necessary.

IV. Schedule

(Refer to the attachment)

V. Reports

JICA will prepare and submit the following reports to the Government of Pakistan, through DGP&S.

1. Progress Report

JICA will prepare and submit twenty (20) copies of the Progress Report at the end of the 1st-phase and the 2nd-phase of the survey.

2. Draft Final Report

JICA will prepare and submit fifty (50) copies of the draft final report within six months after the completion of the 2nd-phase study.

3. Final Report

JICA will prepare and submit fifty (50) copies of complete-set of the Study Report within two months after receiving official comments of Pakistani authorities concerned through DGP&S for the draft final report, if no serious/fundamental changes might be arose.

VI. Measures to be taken by the Government of Pakistan

1. The Government would exempt the Japanese Study Team and its members from the payment of custom duties and other charges of any kind imposed on or in connection with the importation of machinery, equipment and materials necessary for the survey as well as personal effects belonging to the members of the Team.
2. The Government would exempt the Team's members from income tax and charges of any kind imposed on or in connection with the living allowance remitted from abroad.

3. The Government would grant necessary approvals for the special field/spot survey work upon the request of the Japanese Study Team.

4. The Government would provide to the members of the Japanese Study Team necessary accommodation and other necessary facilities, such as vehicles with drivers, boats/vessels with crews and an office and/or laboratory furnished with necessary equipments in/or vicinities of the survey/study area.

5. The Government would, during the study period, assign counter-part personnel to the Japanese Study Team, arrange meetings with personnels and experts of Pakistan and arrange, if necessary, assistants and/or labourers.

6. The Government would provide the Japanese Study Team with the relevant data, information and materials necessary for the study. The Government would also make necessary arrangement for the Team to bring these items back to Japan for the preparation to the reports.

(End)

Attachment of Scope of Work

SCHEDULE

Remarks:
Negotiable, according to weather/climate condition

Year & month	Phase	Contents
1978 September		1. Definite preparation for the 1st-phase, in Japan
	1st-phase, in the site	1. Definite survey works on 6 aspects. Pl. refer to the text III - 1.
October		
	1st-phase, finished	1. Progress Report
November December	Appraising & materializing for the works of the 1st-phase	
1979 January	"	1. Preparation for the 2nd-phase, mostly in Japan but could be in Pakistan partially.
February	"	
March	"	2. Purchase/arrangment of necessary equipments.
April	"	3. Shipping the equipments for Pakistan.
	2nd-phase, in the site	1. Definite survey works on 7 aspects. Pl. refer to the text III - 2.
May	"	
June	"	
July	2nd-phase, finished	1. Progress Report 2. Bringing the equipments back to Japan.
August	Conclusive works, in Japan	
September	"	
October	"	
November	"	
December		1. Materializing the Report.

Appendix D
Report on Field Survey of Natural Conditions

Report on Field Survey of Natural Conditions

1. General

Japanese Study Team conducted the 1st survey in 1st phase at Gwadar from September 30 to October 10, 1978, and 2nd survey from January 7 to 16, 1979.

The 1st survey included sampling of sea water, sampling of bed materials, topographical survey of the seashore, sampling of sand along the shoreline and survey of the erosion of cliffs around the Headland. The 2nd survey was carried out on the meteorological and oceanographic conditions in the northeast monsoon season when the movement of sand on the sea bottom is active, following the southwest monsoon season.

The 1st survey in 2nd phase was carried out in May through June 1979 as a preliminary step for the 2nd survey which was conducted from the end of June to that of July in the same year. In addition to the current meter, which were already brought in at the 2nd survey in 1st phase, wave gauge and tide gauge were used at the 2nd survey in 2nd phase.

2. Details of the Survey

2-1 1st Survey

(1) Marking of target points along the seashore

There were chosen 11 target points along the east coast of the Gwadar sand spit (Points e to p; See Fig. 1; Same in the following) and 6 points along the west coast (Points q to v). At each point, a pole having a red cloth attached was erected, and using a sextant and through measurement with a mountain or cape taken as a target, their positions were determined.

(2) Sea water temperature and specific gravity survey

First determining the position of the survey boat in reference to the target points along the seashroe and the surrounding mountains and capes, sampling of the sea water was made total 72 times at 23 points (Points 1 to 22, 37) in the East Bay and total 43 times at 12 points (Points 23 to 34) in the West Bay and also 2 times at 2 points (Points 35, 36) in the ocean on the south side of the Headland. Then, the water temperature and specific gravity were measured, and the salinity was calculated.

(3) Survey of suspended materials in sea water

Determination of the suspended materials was made with 14 samples among the samples collected as above through filtration with a filter paper.

(4) Sampling and testing of bed materials

After the sea water sampling according to (2) above, the bed materials were collected by a bottom sampler at the same points. The sampling was made at 23 points in the East Bay and 12 points in the West Bay, and the samples were subjected to grain size analysis at a laboratory.

(5) Coastline profile measurement

Determination of the longitudinal profile of the coastline was made at 10 points along the

Fig. 1 (1) Location of Field Survey (1)

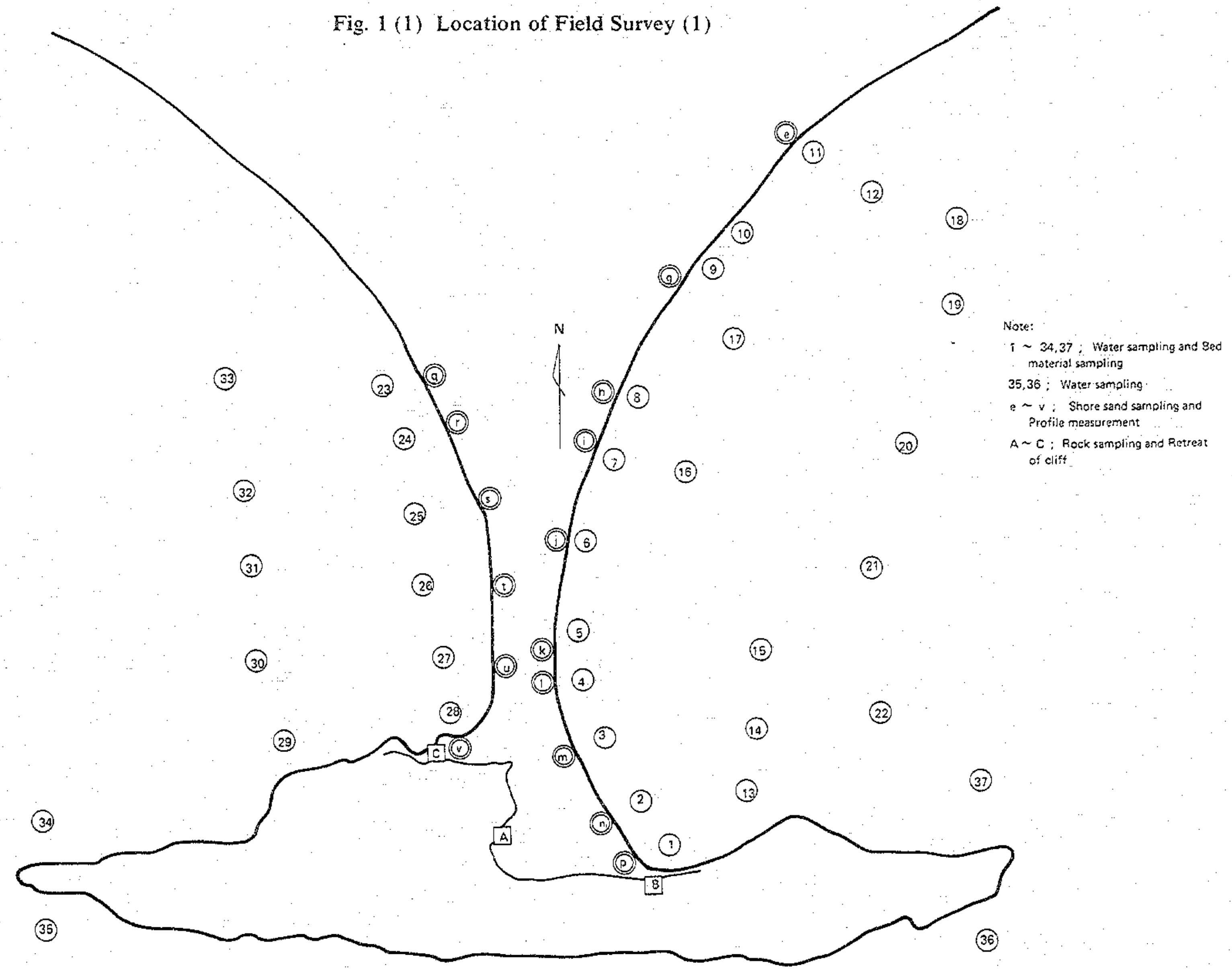
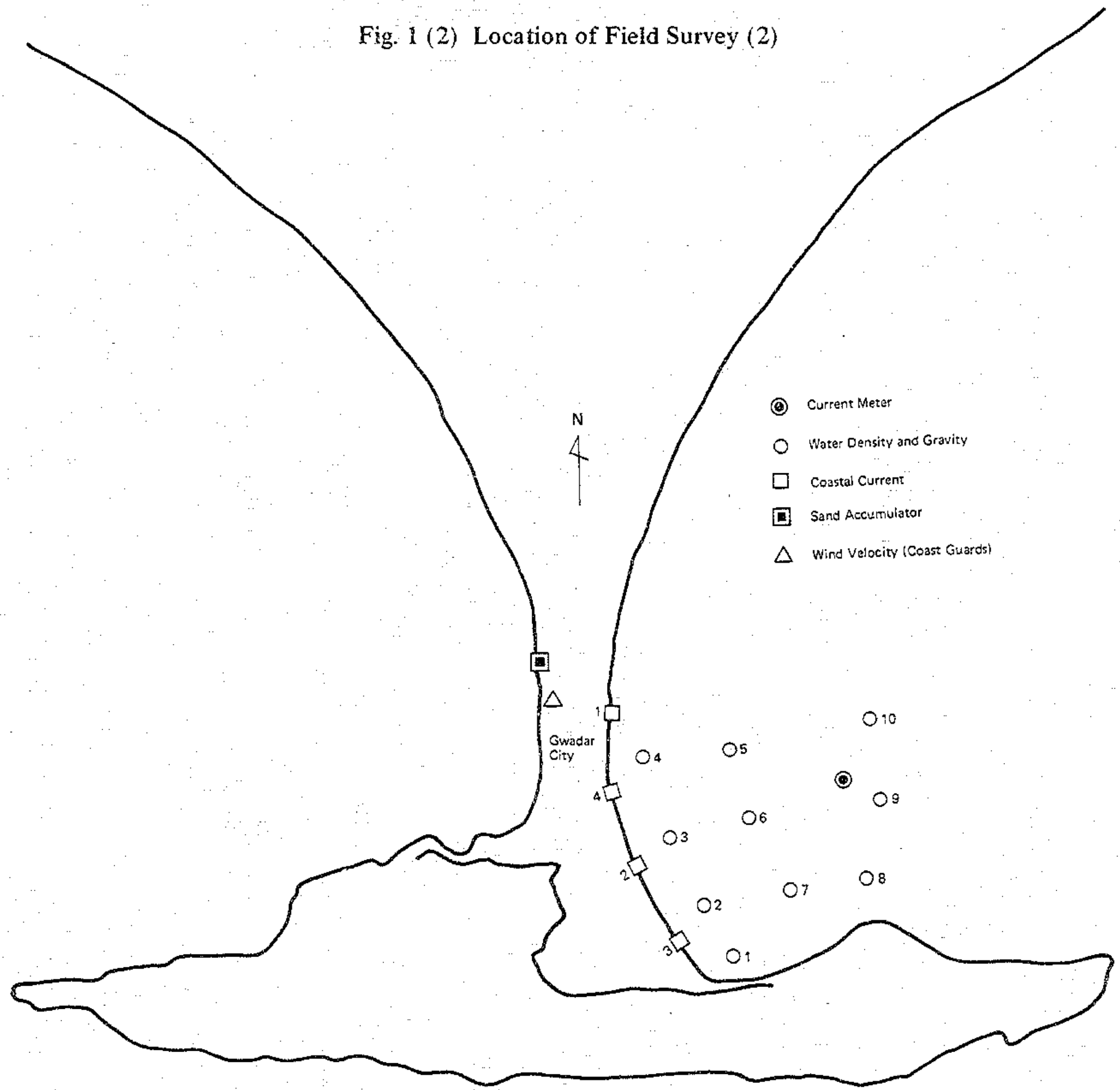


Fig. 1 (2) Location of Field Survey (2)



east coast (Points e to p) and 6 points along the west coast (Points q to v), each of the points of marking according to (1) above.

(6) Sampling and testing of sand along the shoreline

There were collected 29 samples of shoreline sand in the East Bay (Points e to p) and 21 samples in the West Bay (Points q to v), and they were subjected to grain size analysis as in (4) above.

(7) Survey at the Headland

For investigation of the state of erosion of the cliffs in the Headland, measuring piles were driven at 3 points (Points A to C) for examination of the erosion at the stages of the 1st phase (1st survey) and 2nd phase.

Collecting typical five samples of rocks, they were subjected to testing of the strength.

(8) Other survey

Collecting suspended sand in the wave breaking area, analysis of the concentration and grain size of suspended sand was made.

(Note) Grain size analysis of the sand and strength test of the rocks were made at the "Soil Mechanics and Hydraulics Laboratory, Karachi."

2-2 Results of 1st Survey

(1) Sea Levels

Sea levels observed in the Port of Karachi during the period of the field survey are shown in Fig. A 1 and Table A 1. The sea levels at Gwadar were estimated from the sea levels in the reference port of Karachi through correction for the ratio of ranges and time difference of tide.

(2) Sea Water Temperature and Specific Gravity

Sampling the sea water, the values of water temperature and specific gravity were measured at the site. In Table A 2 are shown the values of standard specific gravity upon conversion to the standard temperature of 15°C.

The sea water in the East Bay is of lower temperature and higher specific gravity than in the West Bay (see Figs. 2 and 3). However, in terms of the standard specific gravity, it is decreasing in the order of the West Bay, the Headland offshore and the East Bay (see Fig. 4 and Table A 3).

The West Bay is very shallow, with the shallow water area extending over a wide range, so that evaporation of sea water by solar radiation is active, tending to cause the increase of salinity. On the other hand, the East Bay has a depth as great as about 10m maximum, and the shore is of relatively steep with a narrow range of shallow water area so that elevation of the water temperature due to solar radiation is slow. Little decrease of the specific gravity may thus be accounted for by the low temperature (see Table A 4).

However, the value of standard specific gravity shown in Fig. 4 is given lower than that of the water off the Headland due possibly to the effect of dilution by fresh water or waste water. In fact, the sampled surface water of the East Bay was apparently polluted by domestic wastes.

At it is assumed that the sea water temperature and atmospheric temperature have a considerable correlationship, the water temperature during in Fig. 5. As the atmospheric

Fig. 2 Water Temperature (Observed)
1m below water surface

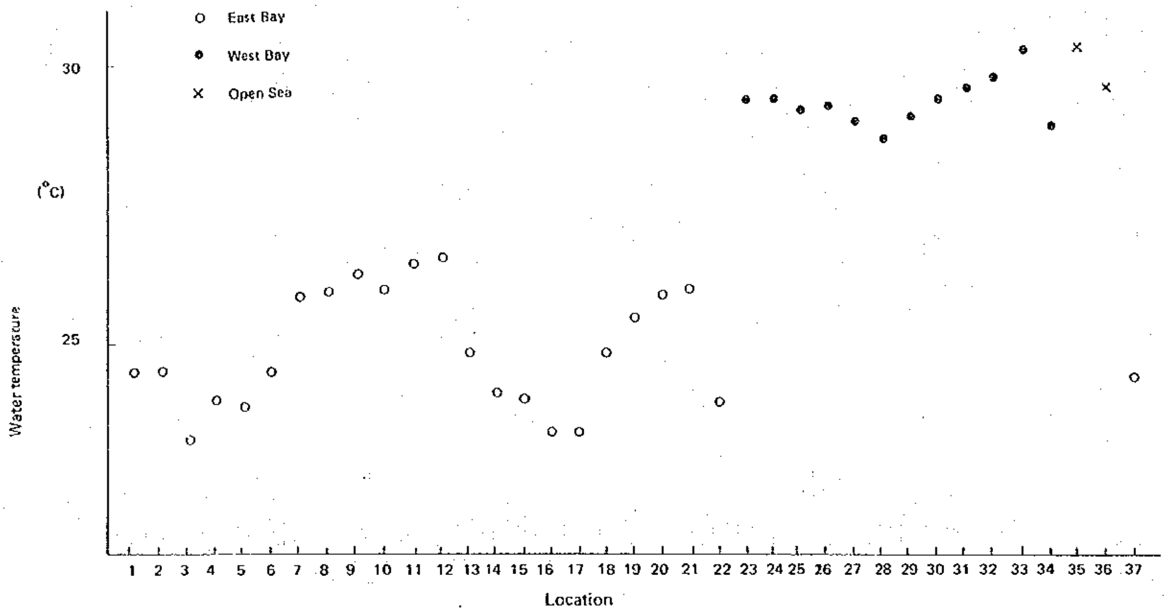


Fig. 3 Specific Gravity (Observed)
1m below water surface

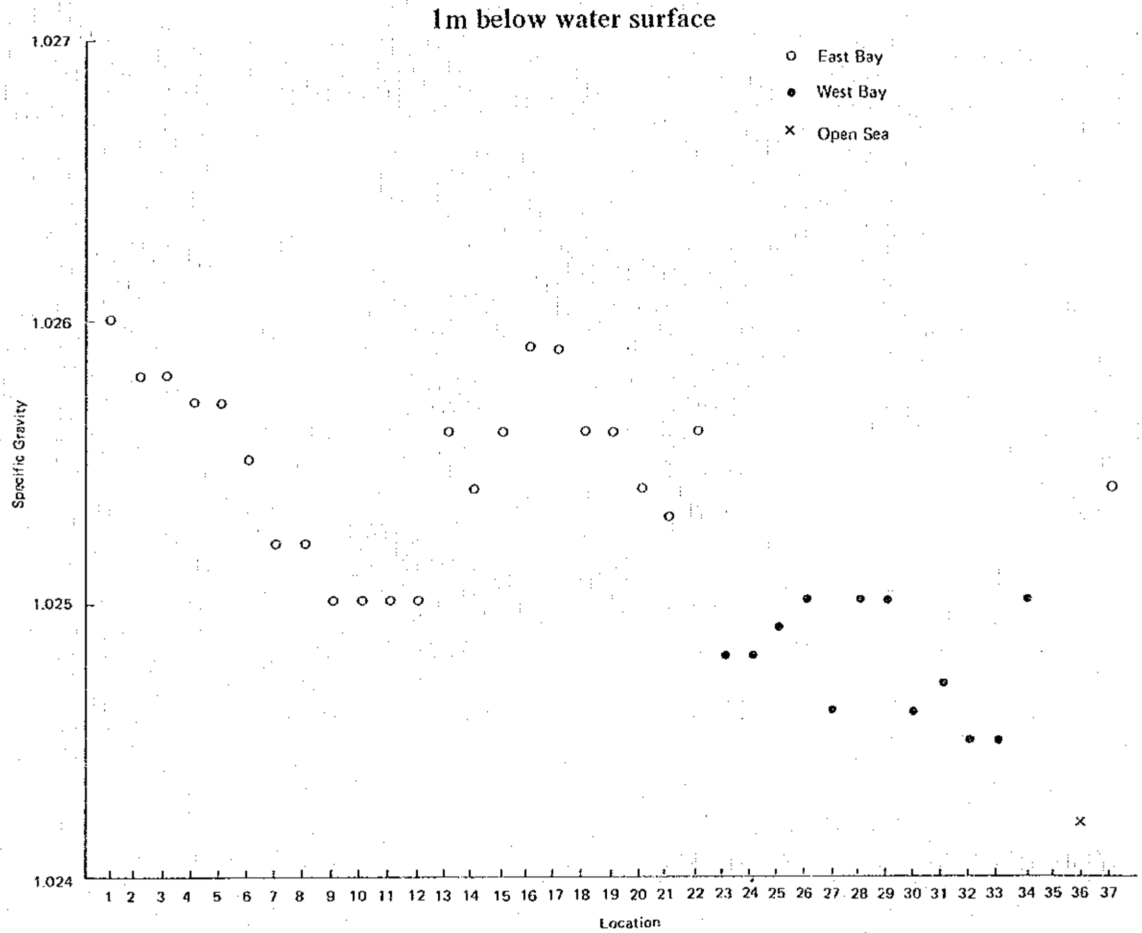


Fig. 4 Specific Gravity (15°C)
1m below water surface

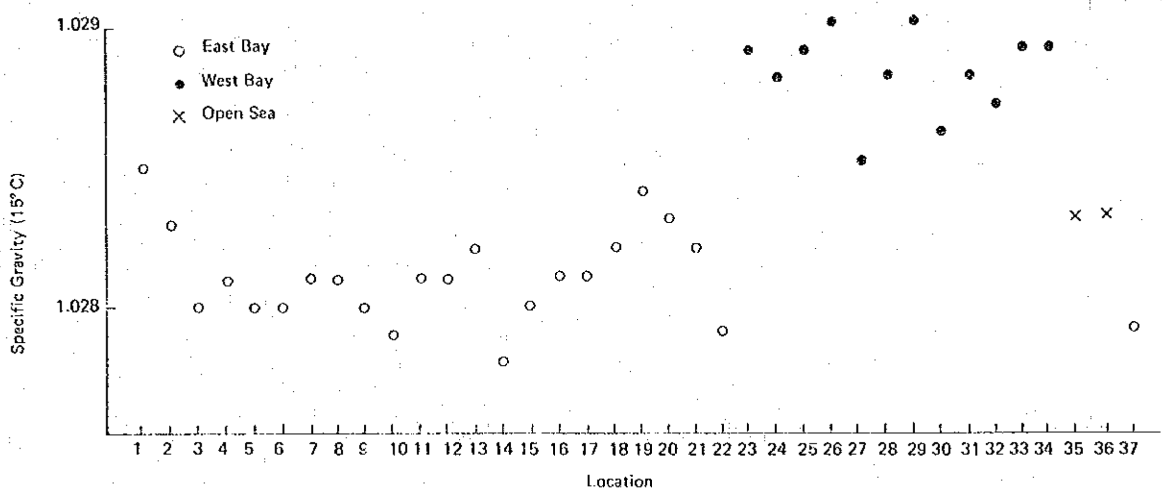
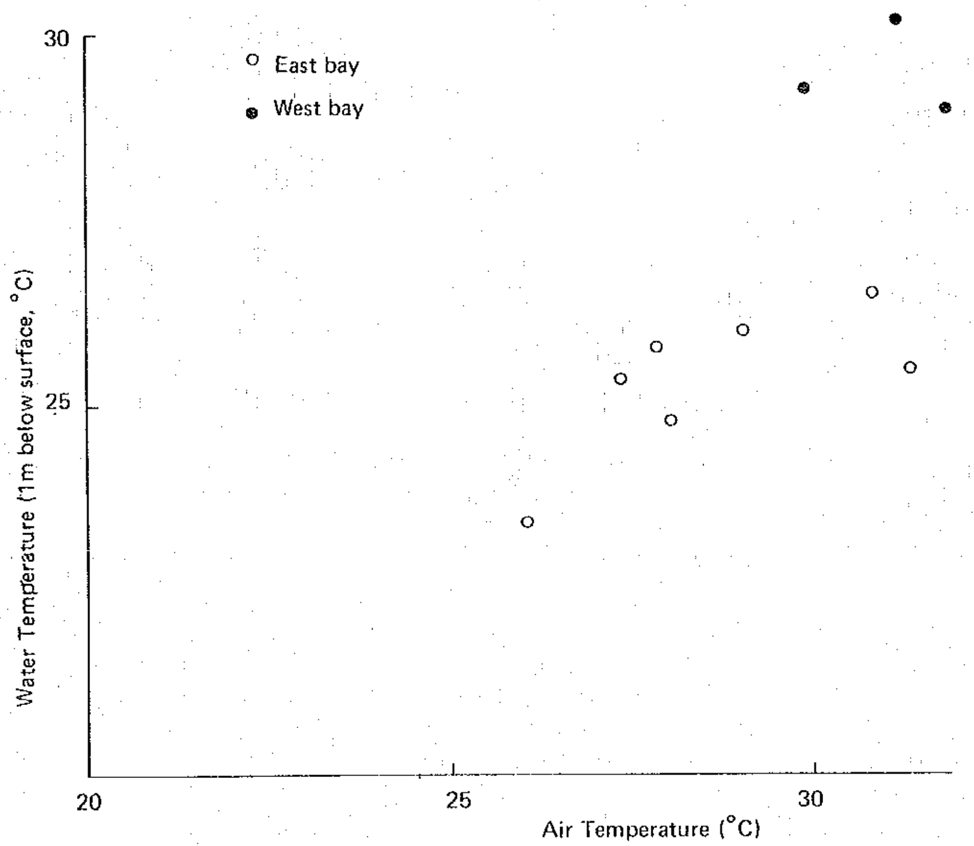


Fig. 5 Relation between Air and Water Temperature



temperature rises, the water temperature (at 1m beneath the surface) increases with certainty. However, it will be seen that the difference between the sea water temperatures of the East and West Bays is due to the water temperature being influenced by the factors other than the effect of atmospheric temperature (such as, for example, solar radiation stated above) (see Table A 4).

In Fig. A 2 are shown vertical distributions of the water temperature and specific gravity. In the East Bay, a layer of discontinuity of the temperature is formed at about 2 to 4m beneath the surface or a depth of about 1/3 of the water depth, giving two layers, upper and lower, of temperature. The specific gravity is smaller in the upper layer and increasing slightly in the lower layer similarly, but the discontinuity is not definite. The standard specific gravity is nearly equal in the upper and lower layers and is thus equalized by mixture of sea water in the bay as a whole and interchange with the open sea. Whereas, in the West Bay, the water temperature is nearly the same in the upper and lower layers, and no layer of discontinuity is seen.

(3) Bed Materials

According to the result of grain size analysis made with the samples, the sea bed materials have the following characteristics. The number of samples is 23 for the East Bay and 12 for the West Bay or total 35 (see Fig. 6).

1) Effective grain size D_{10}: Less than 80 microns with 33 samples among the 35 samples (see Fig. A 3).

2) Median grain size D_{50}: Extending over a wide range of from 30 microns to 220 microns.

3) Coefficient of uniformity Uc: Less than 2.0 with 21 samples or 60% of the 35 samples, and less than 3.0 with 28 samples or 80% of the total samples (see Fig. A 4).

4) Soil classification: Classified as below of the 35 samples.

Table 1 Bed Materials in Both Bays

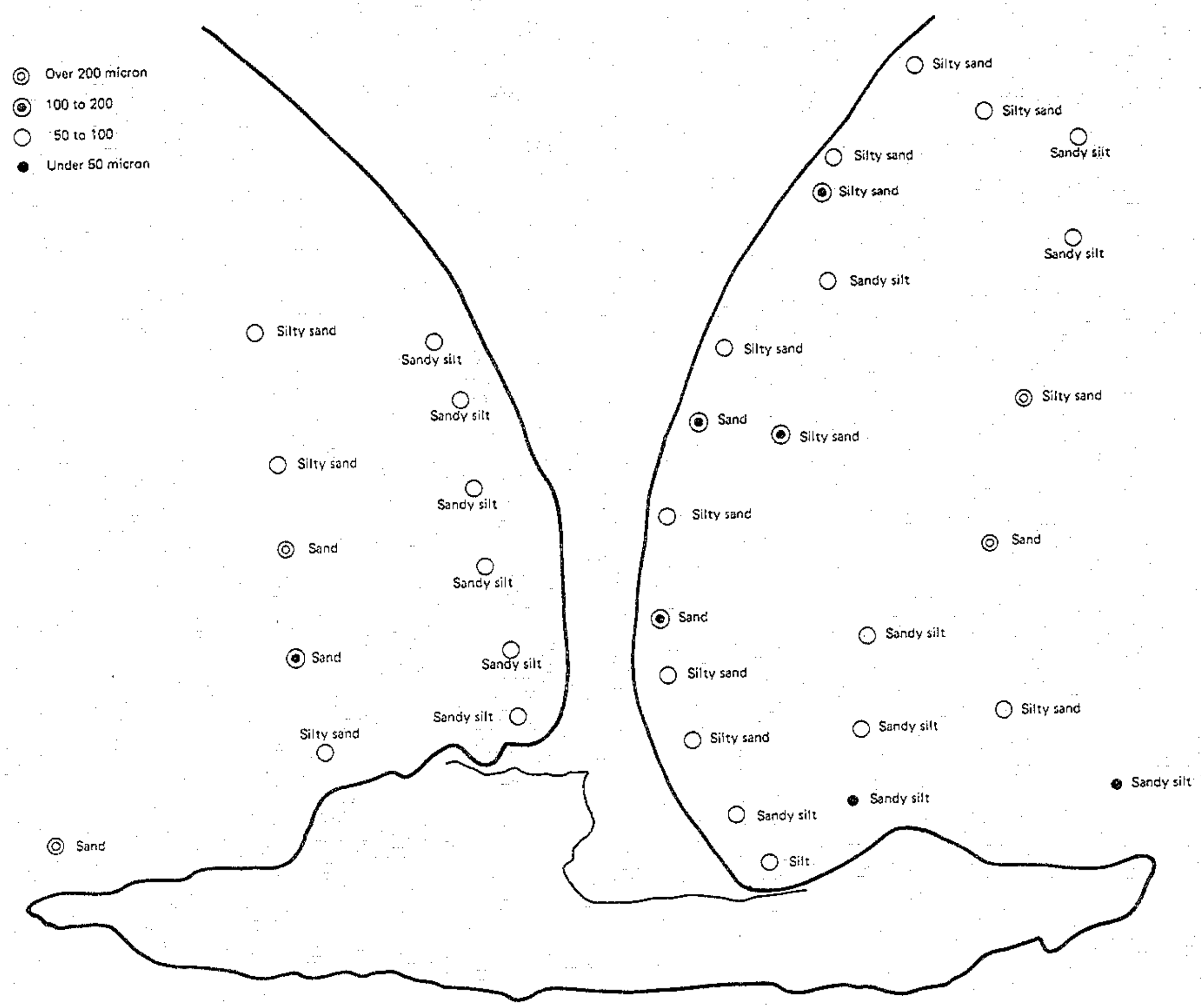
Soil	East Bay	West Bay	Total
Sand	3	3	6
Silty sand	11	3	14
Sandy silt	8	6	14
Silt	1	0	1
Total	23	12	35

In general, the bed is composed of sandy silt or silty sand of fine grain size (see Fig. 6).

5) No clear difference is observed in the bed materials between the East and West Bays. In the north and south of the respective bays, no distinction is observed in the features. Provided, in the East Bay, silts of particularly small grain size are seen greatly near the Headland.

6) Grain size percentage curves of typical bed materials are shown in Fig. A 5.

Fig. 6 Distribution of Median Grain Size (D_{50}) of Sea Bed Material



(4) Beach Sand

Grain size analysis was made upon sampling at 10 sections, 29 points in the East Bay and 6 sections, 21 points in the West Bay. Generally, there are many fine pieces of shells present, and their effect is apparent in the result of the grain size analysis so that it is difficult to grasp of the features of the sand. But, generally speaking, the sand is of an effective diameter of 100 to 200 microns and of a coefficient of uniformity less than 2.5.

(5) Profile of Shore

Longitudinal slope of the shore is relatively sharp at about 1/10 to 1/7 in the East Bay (Fig. A 6). On the other hand, the West Bay is of shallow water close in shore so that the slope is gentle at about 1/100 to 1/50. Both bays are sloping gentle toward north and sharp close to the southern end (close to the Headland).

If the sand spit where the city of Gwadar is situated, is assumed to be a tombolo (funnel-shaped configuration of ground formed by sand deposited in a calm water area in the back of an island or cape), it is presumed that the sand spit has extended its tongue from the northern part to south. At the southern end of the bar which is located in the sheltered area by the Headland, the wave energy is small so that the southerly movement of sand is limited very close to the shoreline and does not extend to the deep water area, thus resulting in such a sharp slope of the shore.

In the West Bay, the beach consists of the so-called foreshore, backshore, dune and the desert in the back. In the East Bay, the backshore is not well developed generally, and the foreshore seems to be connected to the dune.

(6) Retreat of Cliff

The Headland is composed of relatively soft sedimentary rocks and is, therefore, subject to erosion by rain, waves, currents and tides. Thus, for measurement of the retreat of the cliff forming the periphery of the Headland, measuring piles were provided as shown in Fig. A 7. These piles are used for measurement of the speed of retreat of the cliff hereafter.

(7) Quality of the Rocks of Headland

According to the results of compression tests, the soft rocks collected at the Headland show a value within the range of $4kg/cm^2$ to $84kg/cm^2$ as shown in Table A 5.

2-3 2nd Survey

(1) Current observation;
(2) Measurement of water temperature and specific gravity (East Bay);
(3) Observation of eolian sand by sand accumulator;
(4) Observation of wind direction and speed; and
(5) Measurement of the retreat of cliff (see Fig. A 7).

2-4 Results of 2nd Survey

(1) Tide Levels

The tide during field survey period is shown in Table A 6. The moon was full on the midnight of Jan. 13th, when there were two full tides a day with the same heights. The main purpose of the observation is to grasp the current conditions of spring tide during the northeast monsoon season. Table A 6 indicates the estimated tide at Karachi, the standard port. The tide of Gwadar must be converted in terms of ratio of ranges and time difference of tide.

To make a comparison with the tide of Karachi Port, a visual tide observation was carried out in the West Bay on January 13. Fluctuations in the water level were observed due to surges, and the relations to the height of the datum level were unknown, but the tide level was practically the same as that of Karachi Port.

(2) Water Quality

At the 10 points shown in Fig. 1 (2), water sampling was conducted and water temperature and gravity were measured. The results are shown in Table A 7.

(3) Spatial Distribution of Winds

At several points in the East Bay, the wind direction and velocity were measured while the anemometer moved from one place to another. At the time of observation, east-northeast winds blew at 3 to 4.5 m. At least when easterly winds blew, the influences from the cape and other topographic features were insignificant in the area from the southern tip of the East Bay to the site for the port, and winds was spatially uniform.

(4) Spatial Distribution of Current

During the period when hourly changes in the current were observed at the fixed points with a current meter, floats were cast at several points for supplementary observation to realize the spatial distribution of the current at a regular interval. In the northeast monsoon season, easterly wind waves, a little less than 1 m in height, were generated. The floats were fluctuated and washed away by the waves, making it difficult to correctly grasp the current conditions.

In the shallow area, less than 5 m in depth, of the southern part of the East Bay, the current speed was generally slow with the exception of the wave breaking zone, the depth standing at less than 0.1 m/sec (at 9 to 10 a.m., January 14).

(5) Current in Wave Breaking Zone

In the coastal area, wave breaking takes place near the beach due to wind waves coming from E and ENE. Breaking waves cause to arise bed materials and stir up considerable quantity of suspended sand.

At the point of the current meter, northerly currents of 0.1 to 0.15 m/sec running against the waves were observed in the wave breaking zone of the beach in the southern part of the East Bay during the hours when currents were generated in the ESE direction in the duration of ebb tide (9 to 11 a.m., January 11, see Fig. A 8).

(6) Hourly Changes of Current

An observation was made with a current meter at the fixed point. The hourly changes thus observed are scheduled to be compared with those of the results of 2nd phase survey. Here, an attempt is made to introduce a few examples (see Fig. A 9).

At these positions, a permanent current generally moves in the southeast direction, and a current flowing in the west-northwest direction seems to be generated during a certain period of the flood tide. The current speed reaches 0.2 to 0.3 m/sec near the surface layer.

The siltation which will possibly be generated in the access channel and basin after the construction of the Mini-Port will be influenced by the activity of bed materials which are arisen or moved on the seabed due to bedload transport during the southwest monsoon season, when waves are most developed, and also by the current conditions after the construction of a groin and other port structures, so that the siltation will be a major subject of study in 2nd phase.

3. Results of 2nd Phase Survey (1st Survey)

3-1 Outline

To make preparations for the 2nd survey in the southwesterly season which would extend from the end of June to that of July in 1979, observation points were determined for currents, tides and waves, temporary BM and SOP were established, and preliminary surveys, such as bed material sampling and water temperature observation were carried out. The schedule of the survey is shown in the Table A 8.

3-2 Content of the Survey

(1) Preparation of measurement

To determine locations at sea, some remarkable structures and topography were selected according to the chart (PAK No.11), and structures on land and others were positioned with a sextant and then plotted on the chart (see Fig. 7).

(2) Determination of Stations

To determine the stations for wave observation in 2nd survey in the southeasterly season, SOP was decided. Then three courses of traverse were selected at every kilometer in the north-to-south direction on the sea area with the SOP at their center, and a total of nine stations, three on each course of traverse, were selected. It was decided to conduct the wave observation at each station in 2nd survey.

(3) Study on Distribution and Installation of Instruments (Wave, Current and Tide Observation)

Locations and methods for the installation of self-recording instruments for use in 2nd survey were determined. For tide observation, incidentally, it was decided to use the old tide station, and the preparation for the block as a sinker and the present situation of the old tide station were checked (See Fig. A 10).

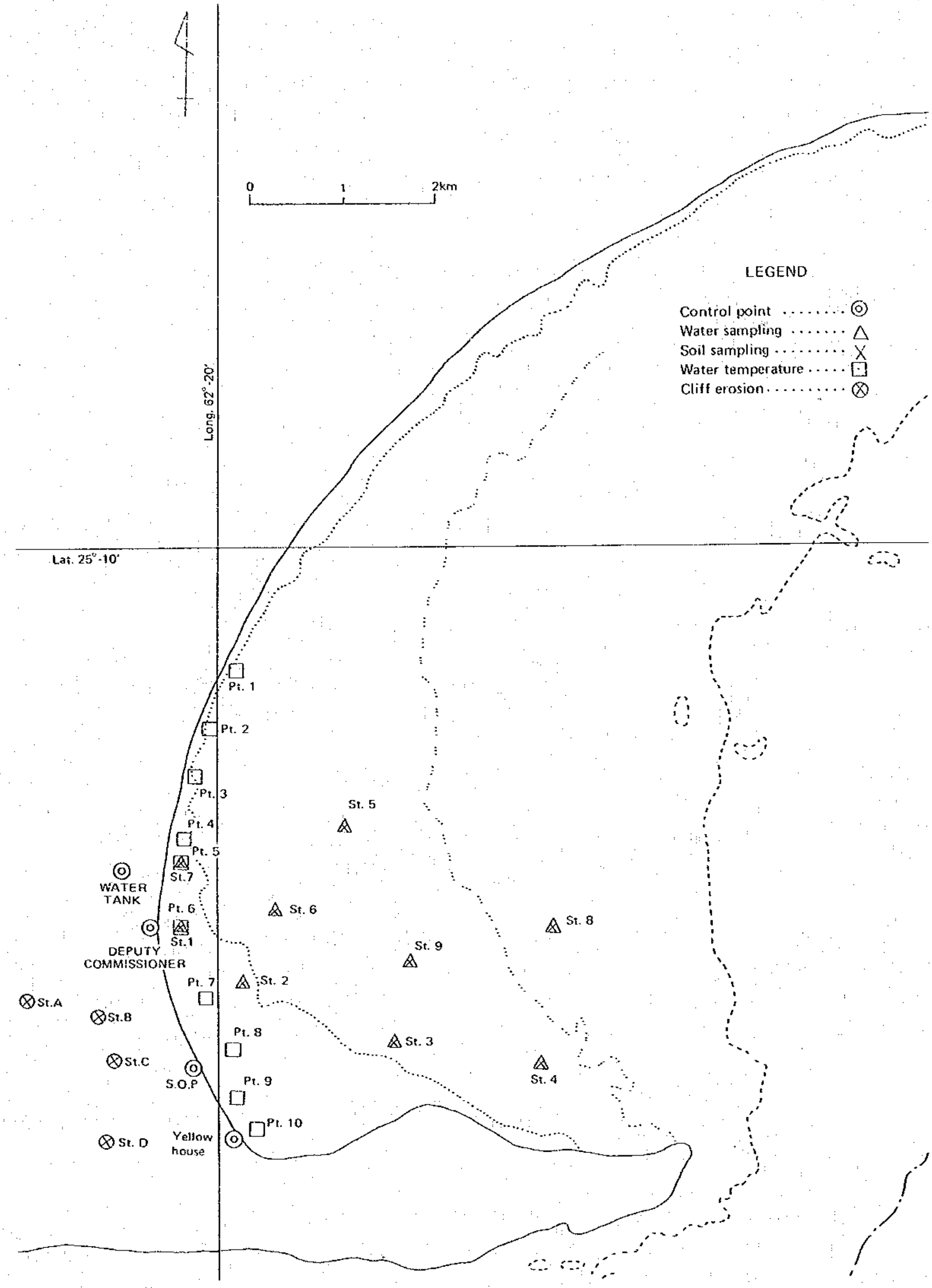
(4) Installation of Temporary BM

Near the old tide station, a temporary BM and a water level staff was fixed and an attempt was made to compare with the tide level computed from that of Karachi Port.

(5) Measurement of Water Temperature and Specific Gravity

At nine stations, the thermometer (Model ET5) were used in measuring the vertical distribution of seawater temperatures. Seawater was sampled in each layer and the specific gravity was measured to compute the salinity (See Fig. A 11).

Fig. 7 Locations of 2nd Survey



(6) Sampling of Bottom Sediments

At the same stations, bed materials were sampled and classified (See Fig. 8).

(7) Inspection of Measuring Instruments and Equipment.

Measuring instruments and equipment maintained at Gwadar were inspected. In addition, a study was conducted on the local procurability of other survey materials.

(8) Establishment of Stations for Observation of Retreat of Cliffs

To have a grip of the situation in which the cliffs around the Headland are eroded, four places (St. A to D) were selected to fix measuring rods. Two or three steel rods (25 mm in diameter and 60 cm in length) were driven in parallel into the cliff side of the four stations (St. A to D) and the configuration of the cross-section was measured for a future survey on the erosion (See Fig. A 12).

(9) Data Collection

In Karachi, a copy of the 1979 Edition of the Pakistan Tide Tables was obtained (See Tables A 9 and A 10).

Upon return to Japan, a table of estimated tide values was prepared for July 1969, in which the 2nd survey would be conducted, on the basis of the harmonic constants at Gwadar.

4. Results of 2nd phase survey (2nd Survey)

4-1 Outline

The 2nd survey was carried out from July 2 to 31, 1979, to observe waves at Gwadar during the southeasterly season.

In the wave observation, nine stations (St. 1 to 9) were established in the 1st survey. Together with current, tide and wave observation, with self-recording gauges, visual observations were conducted with a survey boat moving among the stations repeatedly during the season to collect data on tide, wave direction, wave height, period, surface current speed and direction.

4-2 Schedule of the Survey

Refer to the Table A 11 and Fig. A 13.

4-3 Content of the Survey

(1) Installation of Measuring Station (See Fig. 9)

On the basis of the results of the 1st survey, nine stations (St. 1 to 9) were distributed in a mesh of about one square kilometer within the sea area. At each station, a survey flag was attached to put up a bamboo pole with a buoy and a sinker block during the season. The locations of each station are indicated in Table 2.

(2) Current Observation

The stations were selected related to the proposed groin and channel. Observation records for 15 consecutive days at St. 5 and 25-hour observation records at four stations (St. 1, 3, 7 and 9) were obtained. For these stations, current meter was installed one meter above the seabed to

Fig. 8 Distributions of Sea Bed Material

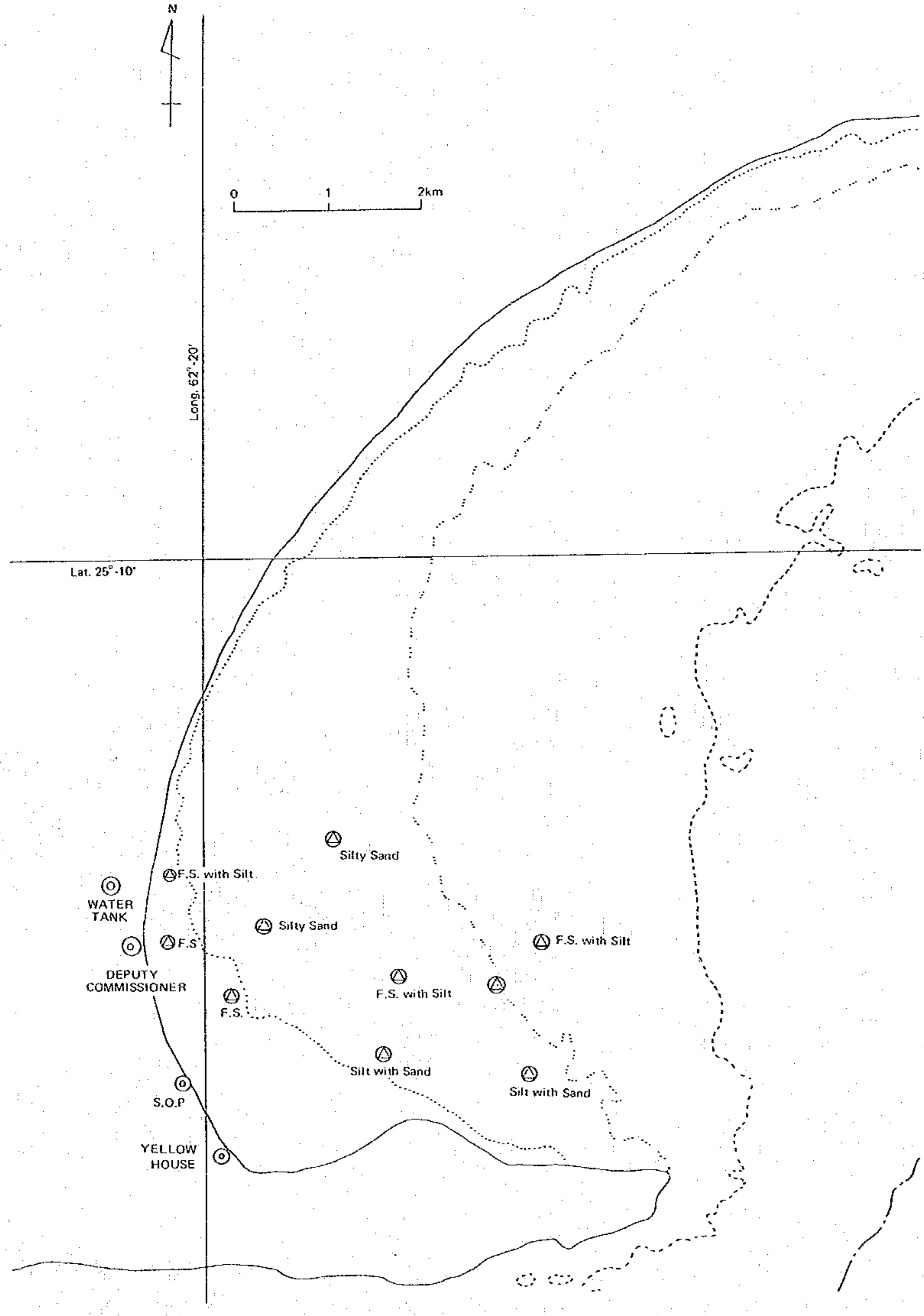
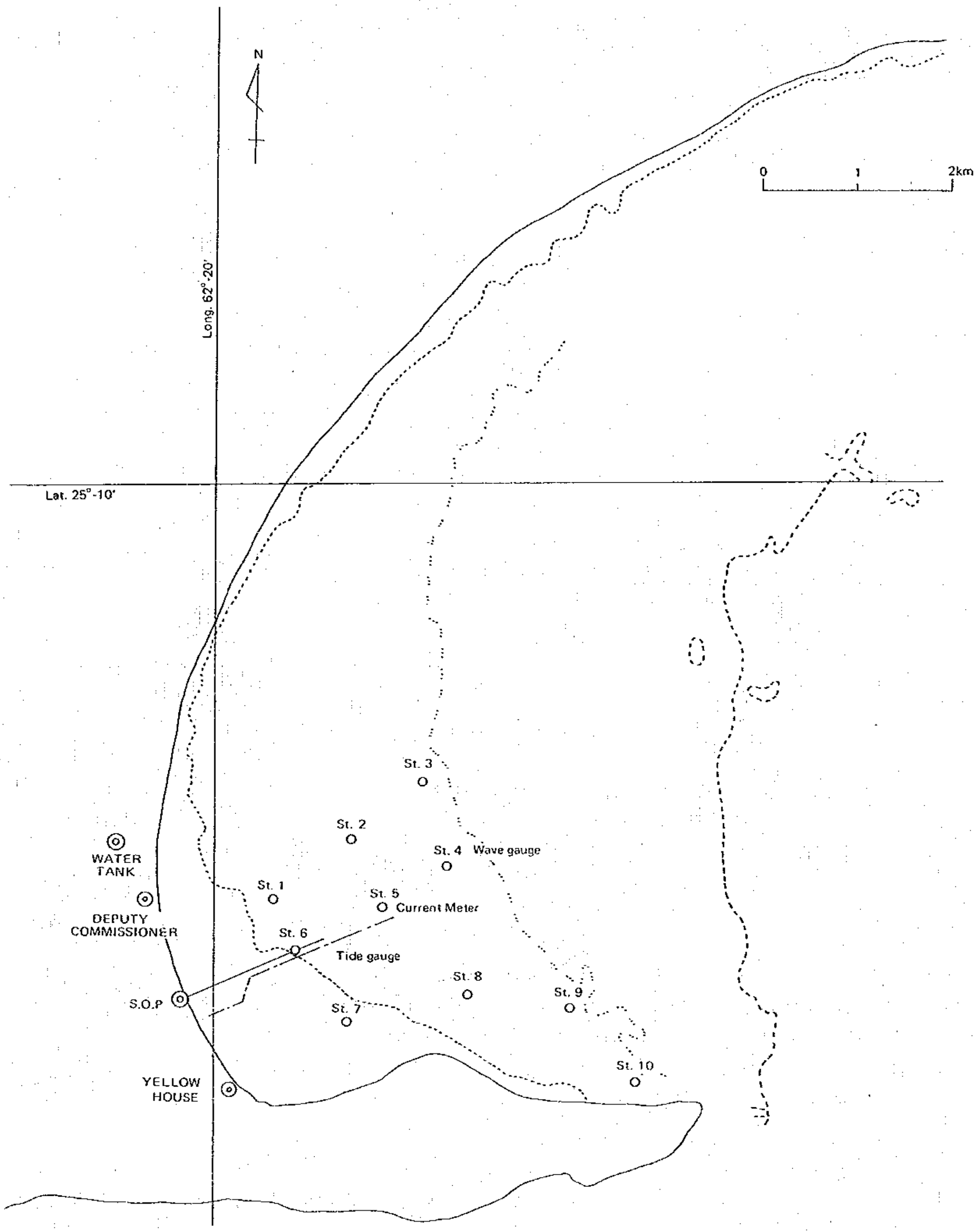


Fig. 9 Locations of 2nd Survey



have a grip of siltation.

Table 2. Locations of Measuring Points

St. No.	Lat.	Long
1	25°-07-30N	62°-20-22E
2	25°-07-50N	62°-20-53E
3	25°-08-10N	62°-21-19E
4	25°-07-40N	62°-21-28E
5	25°-07-27N	62°-21-04E
6	25°-07-10N	62°-21-31E
7	25°-06-45N	62°-20-49E
8	25°-06-54N	62°-21-38E
9	25°-06-48N	62°-22-17E

Incidentally, St. 5 was located at the same point as in the case of the northeasterly season in 1st phase.

Specifications of the NC-Type Current Meter (NC-2)

Range measurable:	A-type propeller 0.07 to 1.12 m/sec
Overall length:	0.95
Weight in the water:	27 kg
Weight in the air:	33 kg
Recording period:	Approx. one month in succession (See Fig. 10)

(3) Tide Observation

On the basis of the harmonic constants collected at Gwadar in the 1st survey, converted tide for the month of July in 1979 was prepared. Moreover, the tide was observed with a tide gauge of water pressure type to compare both values at all times.

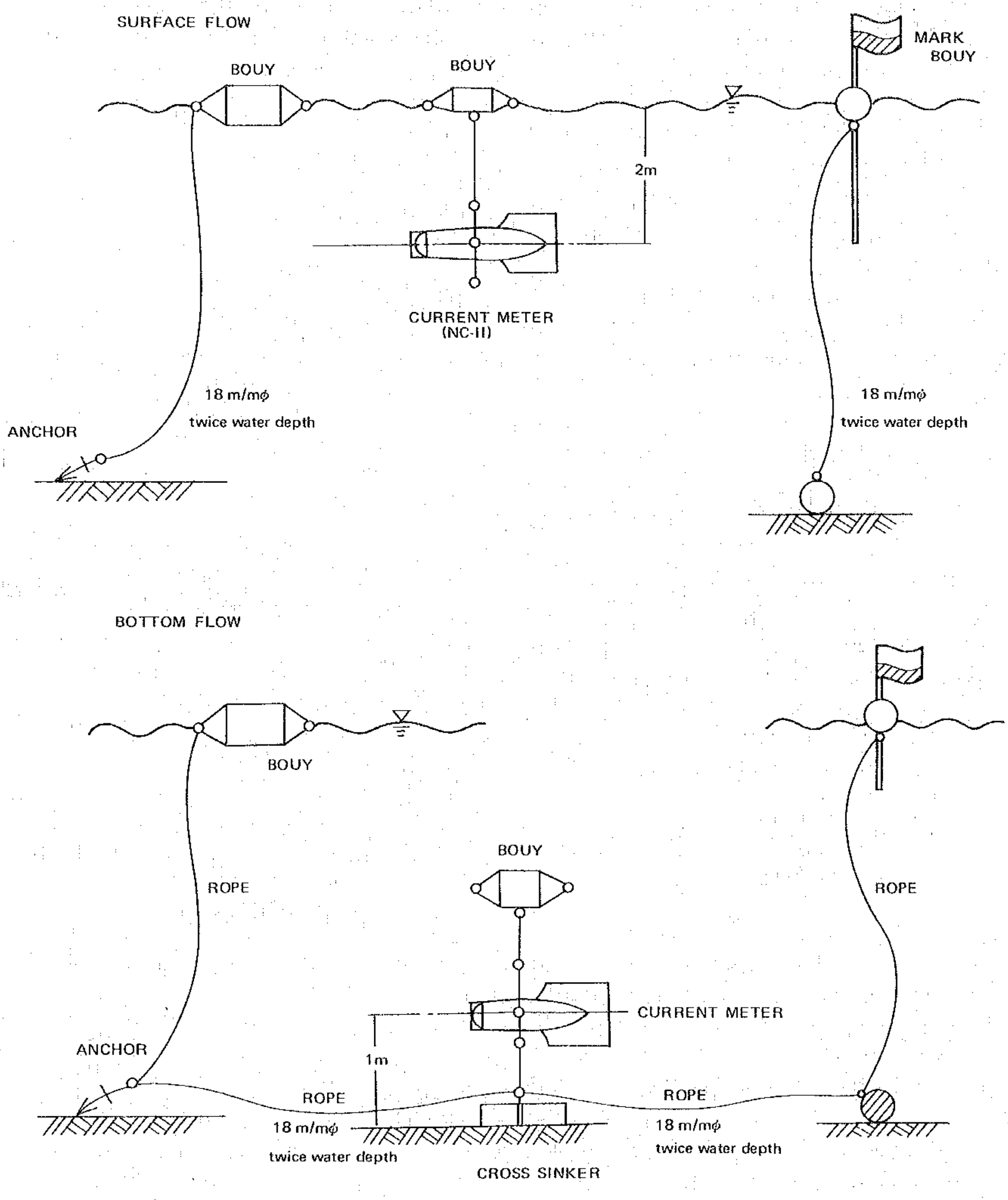
The old tide station was exposed due to ebbing, a survey boat was moored at St. 6. The sensory unit was installed at the bottom, a recorder installed in the ship and both were connected with a vinyl pressure pipe to obtain data for 15 consecutive days.

Specifications of Water Pressure-Type Current Meter LPT-3

Range measurable:	5m
Reduction rate:	1/40
Feeding speed recording paper:	12 mm/hr
Sensory unit:	146 mm ϕ (200 mm high)
Pressure pipe:	9 mm (outer diameter) x 5mm (inner diameter) x 60m (length)

A water level staff was connected to the old tide station during the observation period, and a survey was conducted between this staff and the temporary BM installed in the 1st survey to

Fig. 10 Settlement of Current Meter



correct tide observation data (See Fig. 11).

(4) Wave Observation

At St. 4, a self-recording wave recorder of the water pressure type was installed to observe the wave height for 10 minutes every two hours for a period of about one month.

Specifications of Directly-Recording Wave Recorder of Water Pressure Type

Range measurable:	Up to 200 mm with water depth of 5 m and a wave period of 10 sec.
Recording paper:	70 mm (width) x 85 m (length)
Operation interval:	10 minutes every 2 hours
Feeding speed of recording paper:	0.4 mm/sec
Recording period:	28 days

(See Fig. 12)

(5) Visual Observation

During the observation period, a survey boat moved among the nine stations 13 times to observe the wave direction, wave height, period, surface current, etc., visually at each station.

(6) Survey on Bed Materials

Bed materials at St. 1 to 9 were sampled with a soil sampler (SK type) and classified.

(7) Specific Gravity and Water Temperature

The vertical distribution of water temperatures at each station was checked and the specific gravity after water sampling was measured to compute salinity.

(8) Other Surveys

* Sand accumulators were made at Karachi and installed at St. 1, 3, 5, 7 and 9 to collect drift sand (See Fig. 13).

* Suspended Sand: A suspended sand sampler was installed 30 cm above the seabed near the beach to sample the sand 25, 48 and 72 hours later.

* Float Tracing: Floats with cross-shaped boards placed at optional depths in the surface and bottom layers were set free on the sea surface to follow up on their movement (See Fig. 14).

4-4 Survey Results

(1) Results of Tide Analysis

For 15 days from July 14 to 29, 1979, a tide-gauge of the water pressure type was used to observe the tide.

During the survey period, incidentally, comparison was made several times with tide poles to correct the reduction rate.

(Mean Sea Level)

The tide level at every hour for 15 days was averaged to compute the mean tide level during the observatory period Ao = 2.15 m (above datum level). From this value, the mean sea level (MSL) was computed as follows:

Year-round deviations in the monthly mean tide level of Karachi Port are indicated in the

Fig. 11 Settlement of Tide Gauge

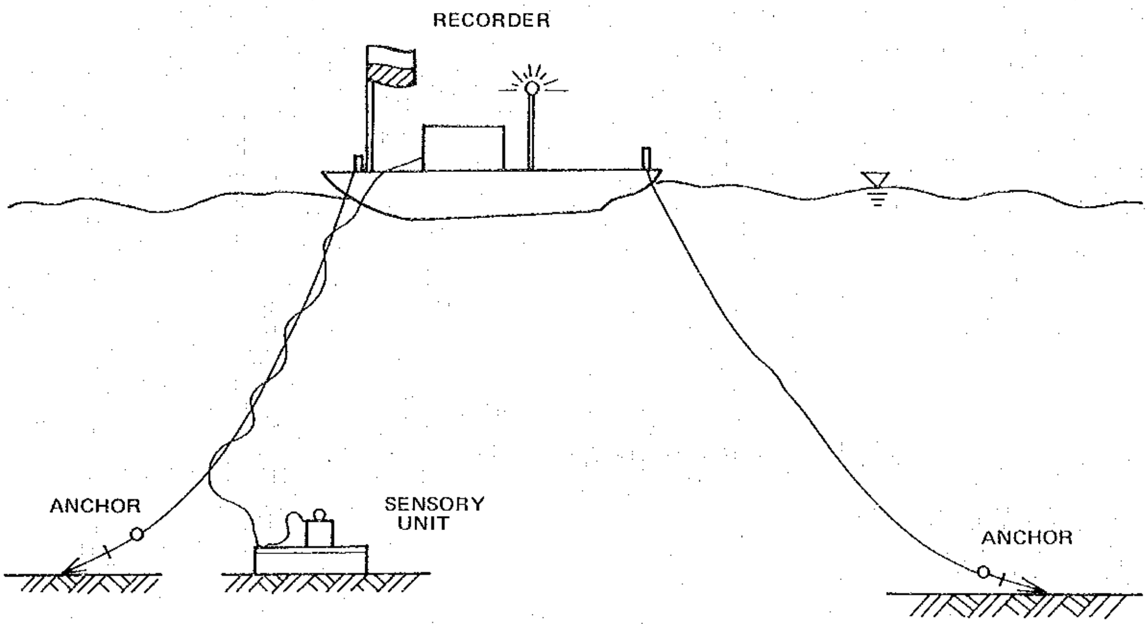


Fig. 12 Settlement of Wave Gauge

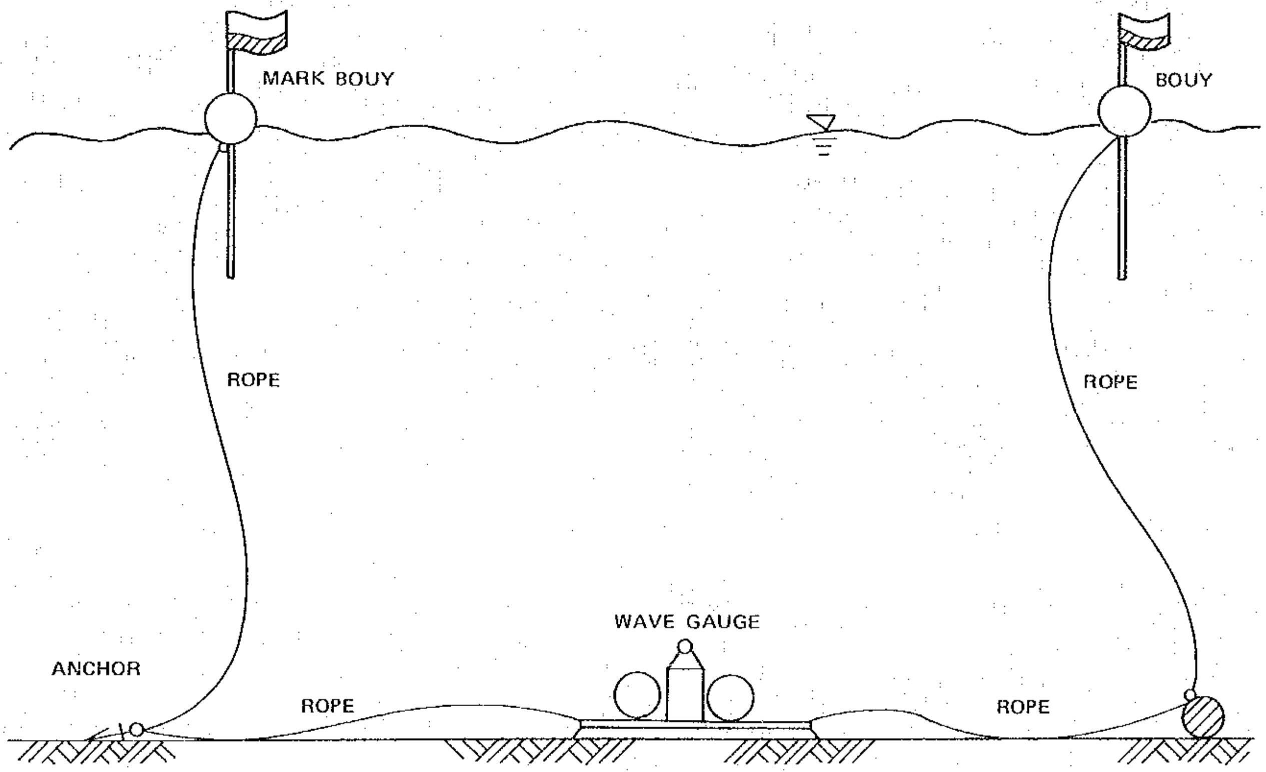


Fig. 13 Settlement of Sand Accumulator

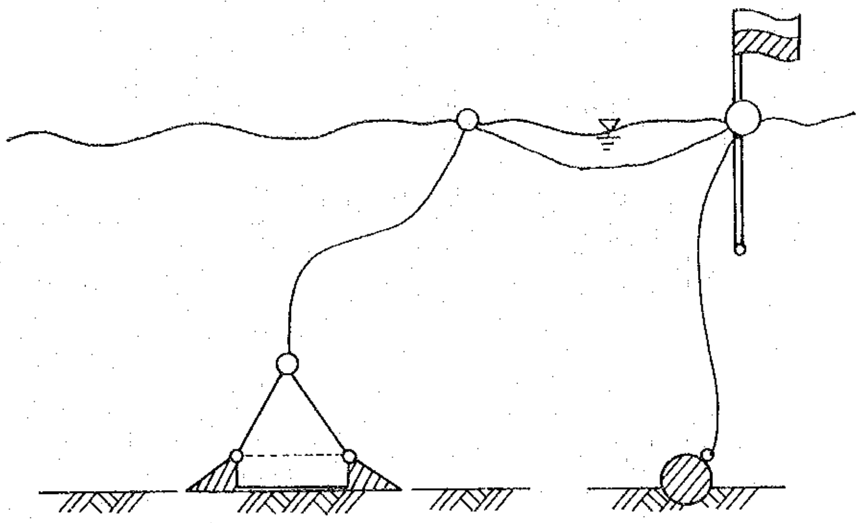
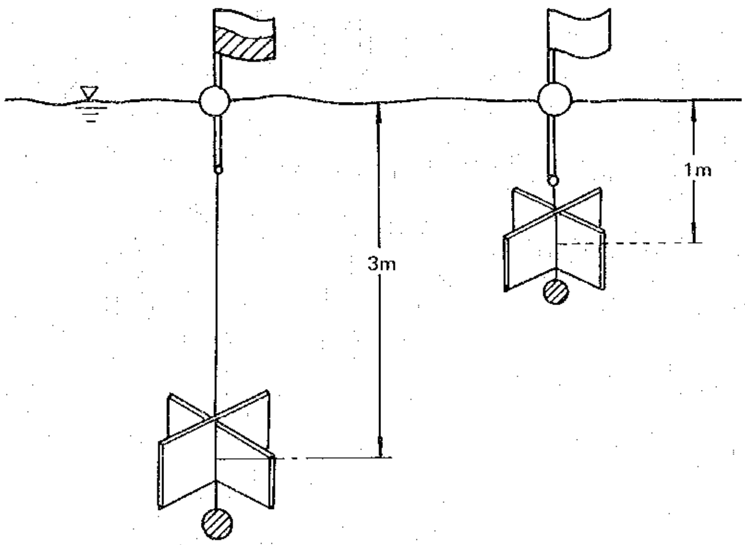


Fig. 14 Float Tracing



Pakistan Tide Tables (Table A 12). The year-round deviations are based primarily on seasonal meteorological deviations and encompass a wide area, and they are considered practically the same. From Tables A 10, deviations for the last 10 days of July are gained and the mean values related to the observatory period are corrected. Here, the mean sea level is:

$A_0 - \Delta h = MSL$; 2.15 m − 0.04 m = 2.11 m

(Harmonic Analysis)

From the tide observation data, the value at every hour h(t) is read, the period was analyzed and harmonic constants are computed. In this analysis, which is known as 15 days' method, there are 15 tidal constituents.

Table 3 Harmonic Analysis

SYMBOL	H	K	g	σ	T	Time Zone: -5.00^h Name of Component Tide
	m	°	°	°/hr	h m	
M2	0.728	282.6	302.8	28.984602	12 25	Principal Lunar
S2	0.277	303.9	329.2	30.000000	12 00	Principal Solar
K2	0.075	303.9	329.6	30.0821273	11 58	Lunisolar Semidiurnal
N2	0.180	280.0	297.5	28.4397295	12 40	Larger Lunar Elliptic Semidiurnal
K1	0.409	43.2	56.0	15.0410686	23 56	Lunisolar diurnal
O1	0.250	54.8	62.1	13.9430356	25 49	Principal Lunar diurnal
P1	0.136	43.2	55.6	14.9589314	24 04	Principal Solar diurnal
Q1	0.053	110.4	115.1	13.3986609	26 52	Larger Lunar Elliptic Diurnal
M4	0.019	27.8	100.9	57.9682084	6 13	Lunar Quarter diurnal
MS4	0.016	60.4	105.9	58.9841042	6 06	Compound Tide (M2+S2)
A_0	2.149	—	—	—	—	Mean Water Level

K : Lag measured by local meridian

g : Lag measured by Greenwich meridian

Table 4 Comparison of Harmonic Constants

Component	(1) TIDE TABLES		(2) JST		RATIO	PHASE DIFFERENCE	
	H	g	H	g	(1)/(2)	(2)-(1)/σ	h
M2	2.0 ft	282°	2.4 ft	303°	2.0/2.4=0.83	$\frac{(303-282)}{29.0}$ =	0.76
S2	0.7	314	0.9	330	0.7/0.9=0.78	$\frac{(330-314)}{30.0}$ =	0.63
K1	1.4	47	1.4	56	1.4/1.5=0.93	$\frac{(56-47)}{15.0}$ =	0.60
01	0.6	36	0.8	62	0.6/0.8=0.75	$\frac{(62-36)}{13.9}$ =	2.16

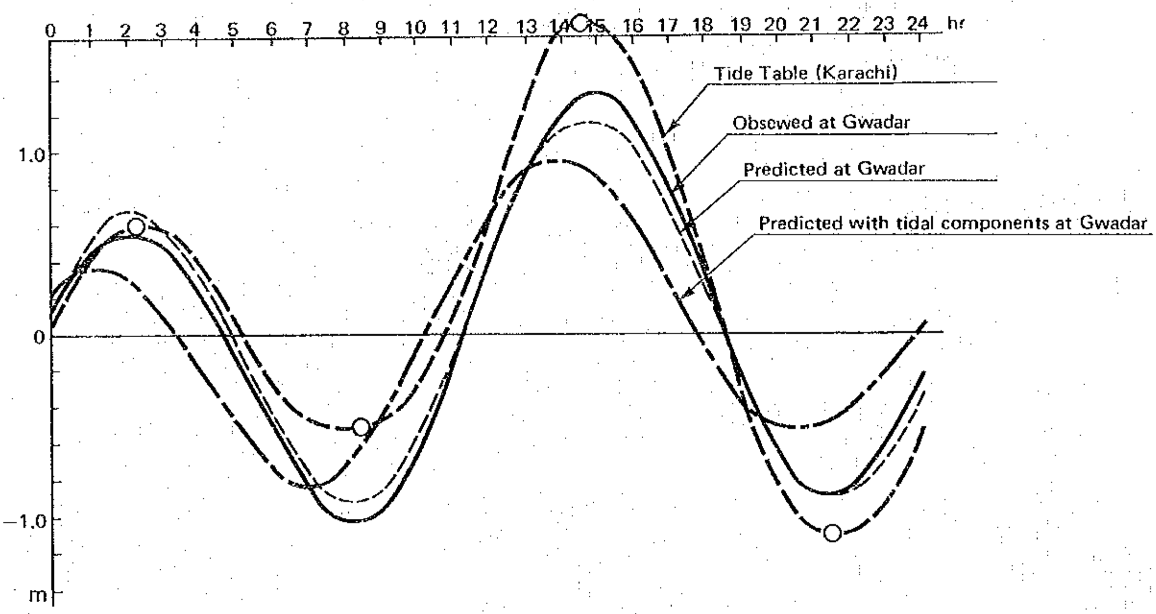
The results of this analysis are compared with the harmonic constants of Gwadar given in the 1979 Edition of the Pakistan Tide Tables.

The above table indicates that the values listed in the Tide Tables show a difference of 0.8 to 0.9 times in amplitude and 0.6 to 0.8 hour in phase from our results.

(Comparison of Tide between Karachi and Gwadar)

The observed values were compared to the values predicted for Karachi averaged on a daily basis to draw a diagram for July 15, 1979 (See Fig. 15).

Fig. 15 Comparison of Tide



The predicted tide drawn on the basis of the analyzed values practically coincides with the observed value. However some differences are observed, because the observation period was only 15 days.

The difference from the values predicted for Karachi stems from the different tide type of Gwadar.

(Tide Levels)

The analyzed values were used in preparing Fig. 16. However, the value of 4.2 ft listed in the Tide Tables was used for Zo.

The results are shown below while they are compared with the Pakistan Tide Tables. As the LAT and HAT values have to be determined from the values observed for a long period, no comparison could be made this time (See Table 5).

(2) Analysis of Current

(Analysis of Data on Current)

From the data obtained from a self-recording tide gauge, the current direction (θ) and the current speed (V) are computed and divided into the north constituent (V_N) and the east constituent (V_E).

Table 5 Tide Levels

Tide	Tide Tables			JST	
	DL		MSL	DL	MSL
	(ft)	(m)	(m)	(m)	(m)
MLWL Sp	1.5	0.46	-0.82	0.27	-1.01
MLWL Np	2.9	0.88	-0.40	0.83	-0.45
MSL	4.2	1.28	0.00	1.28	0.00
MHWL Np	5.5	1.68	0.40	1.73	0.45
MHWL Sp	6.9	2.10	0.82	2.29	1.01
HHWL	8.9	2.71	1.43	2.94	1.66

(Harmonic Analysis of Tide for 15 Days)

By combining Hi (speed amplitude) and Ki (lag of the tide) calculated in respect to the north and east speed constituents, current ellipse factors were computed. Moreover, the weighted means of the current speed amplitude in the major axis in the six main constituents are sought to realize the main current direction of the tide. Each ellipse value is computed along the main direction to compute the value of each tide component in the main direction. The results of this computation are indicated in Table 6 and Fig. 17.

(Harmonic Analysis of Tide in 14 Hours)

With the time of the moon passing the meridian as the datum time, a value is consecutively picked up every lunar hour and V(t) and t = 0 to 23 are assigned to north and east constituents, respectively. In an equation of

$$V(t) = A_0 + R_1 \cos(15t + T_1) + R_2 \cos(30t + T_2) + R_4 \cos(60t + T_4),$$

the residual current (A_0), current speed amplitude (Ri) and lag of the tide (Ti) were computed. From the results of a 25-hour-long observation at St. 1, 3, 5, 7, 9 and 10, the elliptic factors of the tide at each station were computed. The values thus obtained are known as a group of tidal constituents, and the current amplitude and phase are different, depending on the observation day, so that the harmonic constant of the tide at St. 5 was used for comparison and computation to gain a harmonic constant at each station in 24 hours (See Tables 7 and 8).

On the basis of the above analyses, a distribution of tide constituents and residual currents was drawn. However, the residual current sometimes tends to flow northward. In the survey period, the south-bound currents were predominant and this period was selected for the drawing of the diagrams (See Figs. 18 and 19).

(Statistical Analysis)

The aforementioned tide analysis was conducted to check the constituents of tide producing power contained in the current. In general, long-range values, periodical component values and random values are mixed in the values observed on a natural phenomenon. In a statistical analysis, an attempt is made to compute these values without restricting the computation period.

(Autocorrelation)

Fig. 20 indicates autocorrelation functions at St. 5. This diagram suggests that a peak is observed in the 25-hour constituent for the results of Vm and in the 12-hour constituent for

Table 6 Harmonic Analysis of Tidal Current

Place	:	Gwadar		
Station	:	5		
Location	:	Longitude	62° 21′ 10″	E
		Latitude	25° 7′ 30″	N
Depth	:	Below surface 1.0 m		
Date	:	July 5 to 20, 1979		
Recorder	:	NC-II Current Meter		

Component	North Component		East Component		Ellipse						Main Direction 23°	
					Major axis			Minor axis				
	Velocity	Lag	Velocity	Lag	Direction	Velocity	Lag	Direction	Velocity	Lag	Velocity	Lag
	cm/s	°	cm/s	°	°	cm/s	°	°	cm/s	°	cm/s	°
M_2	3.3	86	5.7	1	85	5.7	4	175	3.2	274	3.9	51
S_2	2.6	305	3.8	359	61	4.2	345	151	1.9	75	3.5	326
K_2	0.7	305	1.0	359	61	1.1	345	151	0.5	75	1.0	326
N_2	2.1	220	1.7	245	37	2.6	230	127	0.6	320	2.6	227
K_1	5.9	225	2.8	316	359	5.9	224	89	2.8	314	5.5	236
O_1	2.9	250	3.9	108	305	4.7	275	35	1.5	185	1.7	217
P_1	1.9	225	0.9	316	359	1.9	224	89	0.9	314	1.8	236
Q_1	4.1	121	3.5	212	356	4.1	118	86	3.5	208	4.0	141
M_4	0.7	331	1.2	74	280	1.3	259	10	0.6	349	0.7	15
MS_4	1.3	319	0.6	98	337	1.4	312	67	0.4	42	1.0	328
Vo	-2.1 cm/s		-0.2 cm/s		2.1 cm/s			186°			-2.0 cm/s	

Table 7 Harmonic Constants

Station	St. 1 Bottom			St. 3 Bottom			St. 5 Surface		
Current	θ	V	K	θ	V	K	θ	V	K
	°	m/s	°	°	m/s	°	°	m/s	°
M_2	57	0.032	110	81	0.032	78	272	0.027	236
S_2	57	0.028	25	81	0.029	353	272	0.024	151
K_2	57	0.008	25	81	0.008	353	272	0.007	151
K_1	36	0.039	261	345	0.025	62	311	0.029	23
O_1	36	0.012	242	345	0.008	43	311	0.009	4
P_1	36	0.013	261	345	0.008	62	311	0.009	23

Station	St. 5 Surface			St. 7 Bottom			St. 7 Bottom		
Current	θ	V	K	θ	V	K	θ	V	K
	°	m/s	°	°	m/s	°	°	m/s	°
M_2	280	0.033	218	271	0.046	165	286	0.033	187
S_2	280	0.030	133	271	0.041	80	286	0.030	102
K_2	280	0.008	133	271	0.012	80	286	0.009	102
K_1	43	0.014	152	29	0.061	159	328	0.043	267
O_1	43	0.004	133	29	0.069	140	328	0.013	248
P_1	43	0.005	152	29	0.020	159	328	0.014	267

Station	St. 7 Bottom			St. 9 Bottom			St. 10 Surface		
Current	θ	V	K	θ	V	K	θ	V	K
	°	m/s	°	°	m/s	°	°	m/s	°
M_2	298	0.033	130	348	0.017	124	279	0.061	261
S_2	298	0.029	45	348	0.015	39	279	0.055	176
K_2	298	0.008	45	348	0.004	39	279	0.016	176
K_1	69	0.029	184	34	0.032	257	273	0.095	263
O_1	69	0.009	165	34	0.010	238	273	0.029	244
P_1	69	0.009	184	34	0.010	257	273	0.031	263

θ : Direction
V : Velocity
K : Lag measured by meridian
Surface layer : 1 m below water surface
Bottom layer : 1 m above sea bottom

Fig. 16 Tide Levels

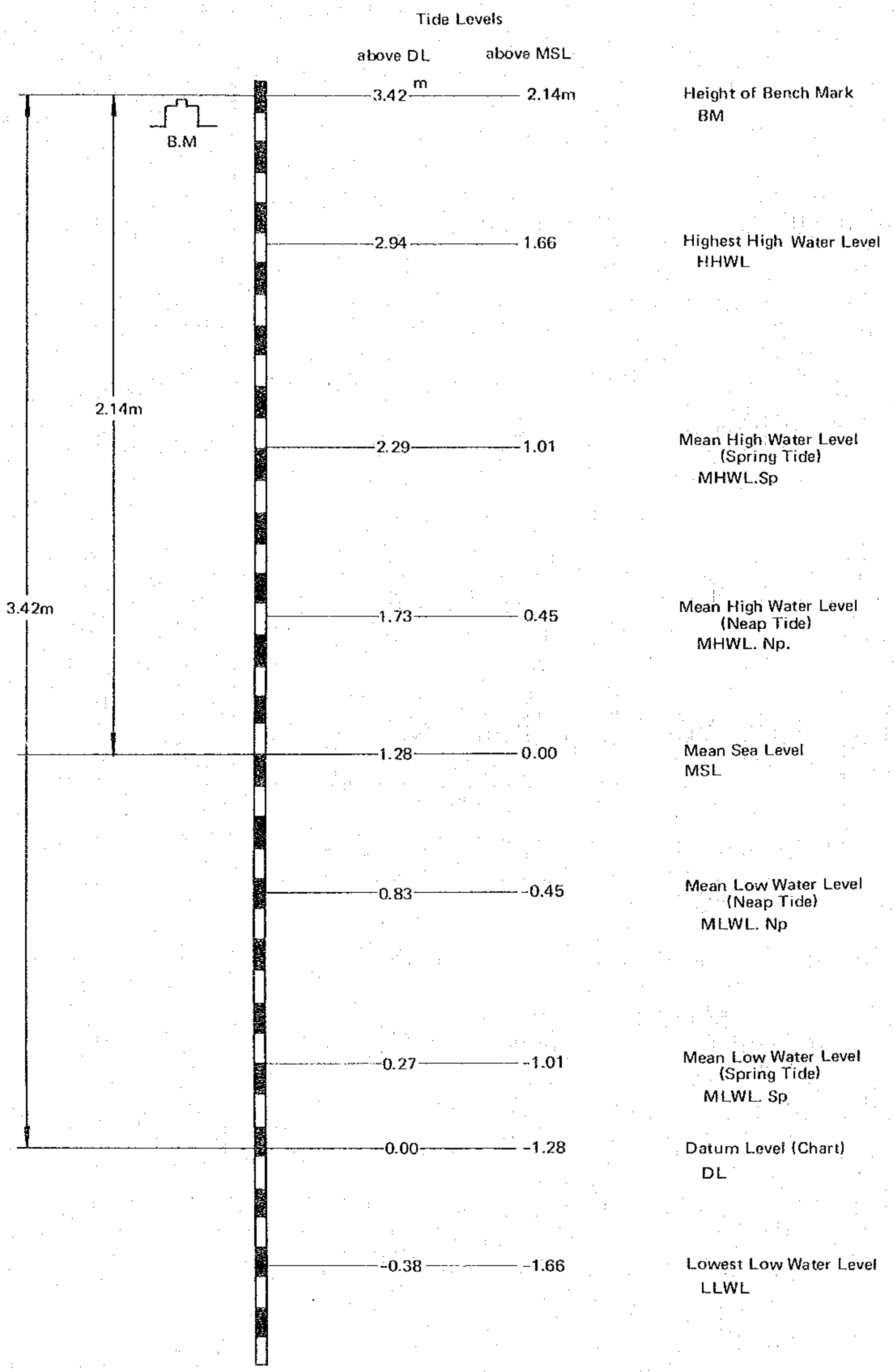
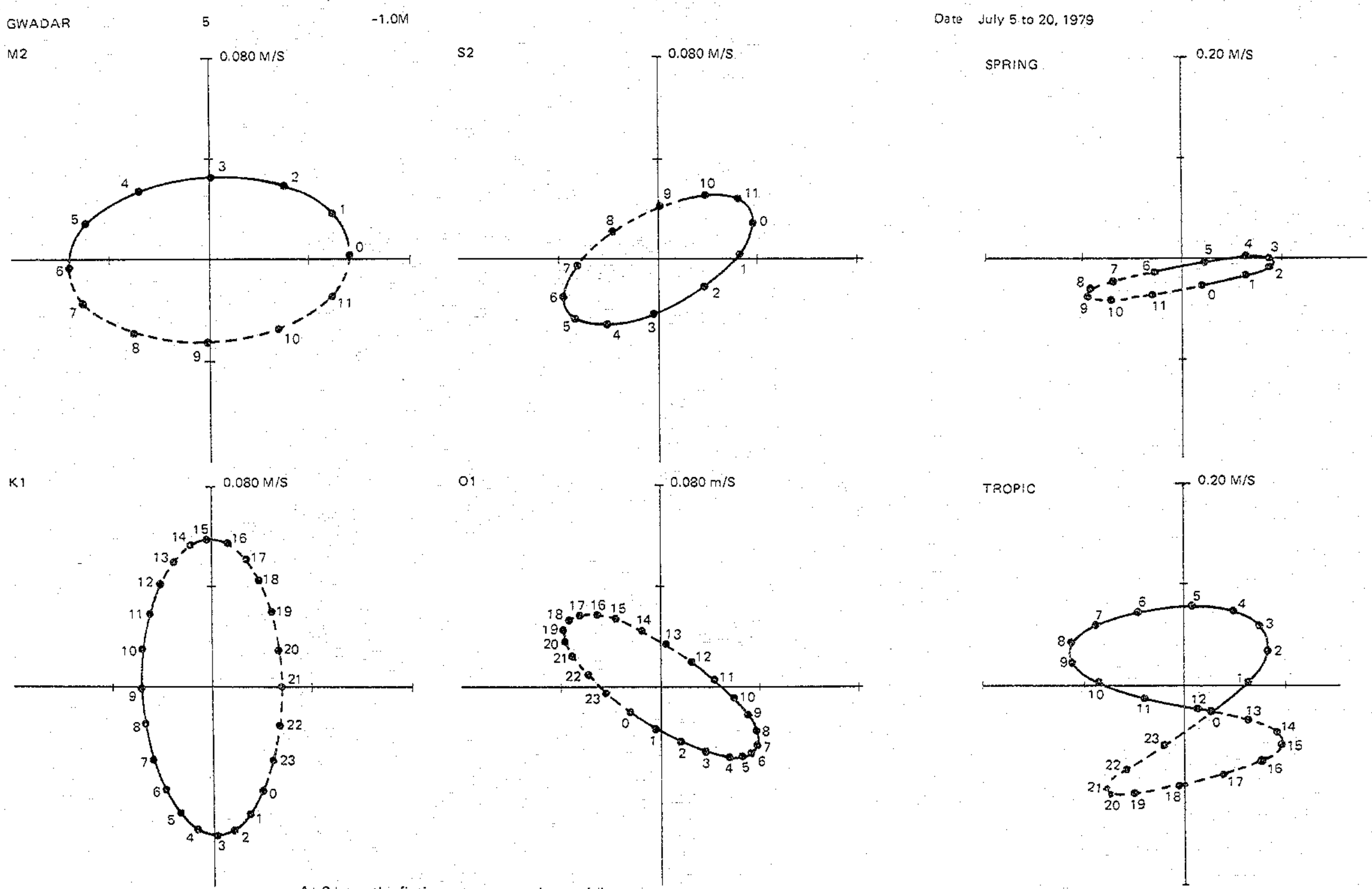


Fig. 17 Tidal Ellipse



At 0 hour the fictious star passes the meridian.

Table 8 Tidal ellipses

St	Depth	Axes	M1 θ	M1 V	M1 H	M2 θ	M2 V	M2 H	M4 θ	M4 V	M4 H	CONST
	m		°	m/s	h	°	m/s	h	°	m/s	h	
		L	36	0.065	17.7	57	0.061	2.8	286	0.029	0.9	142 °
1	-1	S	126	0.044	23.7	147	0.005	5.8	26	0.023	5.4	0.067 m/s
		S/L		0.67			0.09			0.79		
		L	345	0.047	4.6	81	0.069	1.6	30	0.025	2.1	191
3	-1	S	75	0.020	22.6	171	0.001	10.6	120	0.014	0.6	0.079
		S/L		0.42			0.01			0.57		
		L	311	0.037	2.2	272	0.057	6.5	83	0.010	2.2	324
5	+1	S	41	0.013	8.2	2	0.001	3.5	173	0.000	4.7	0.128
		S/L		0.35			0.02			0.01		
		L	43	0.012	10.2	280	0.060	6.0	30	0.015	0.1	313
5	+1	S	133	0.003	16.2	10	0.000	9.0	120	0.007	1.6	0.096
		S/L		0.28			0.01			0.47		
		L	29	0.031	8.4	271	0.066	4.5	89	0.022	4.6	220
7	-1	S	119	0.007	14.4	1	0.002	1.5	179	0.001	3.1	0.035
		S/L		0.21			0.02			0.06		
		L	328	0.030	12.5	286	0.036	6.0	347	0.016	0.2	238
7	-1	S	58	0.009	6.5	16	0.003	3.0	77	0.012	4.7	0.053
		S/L		0.29			0.10			0.77		
		L	69	0.024	5.9	298	0.028	4.9	353	0.008	3.7	226
7	-1	S	159	0.013	23.9	28	0.006	7.9	83	0.003	5.2	0.044
		S/L		0.52			0.23			0.45		
		L	34	0.058	17.8	348	0.038	2.9	298	0.011	2.1	43
9	-1	S	124	0.002	23.8	78	0.028	11.9	28	0.002	0.6	0.025
		S/L		0.04			0.73			0.22		
		L	273	0.155	18.2	279	0.139	7.4	272	0.044	4.3	112
10	+1	S	3	0.001	12.2	9	0.006	10.4	2	0.005	5.8	0.071
		S/L		0.00			0.04			0.12		

θ: Direction V: Velocity H: Time

+ : Below surface − : Above bottom

Fig. 18 Distribution of Tidal Current

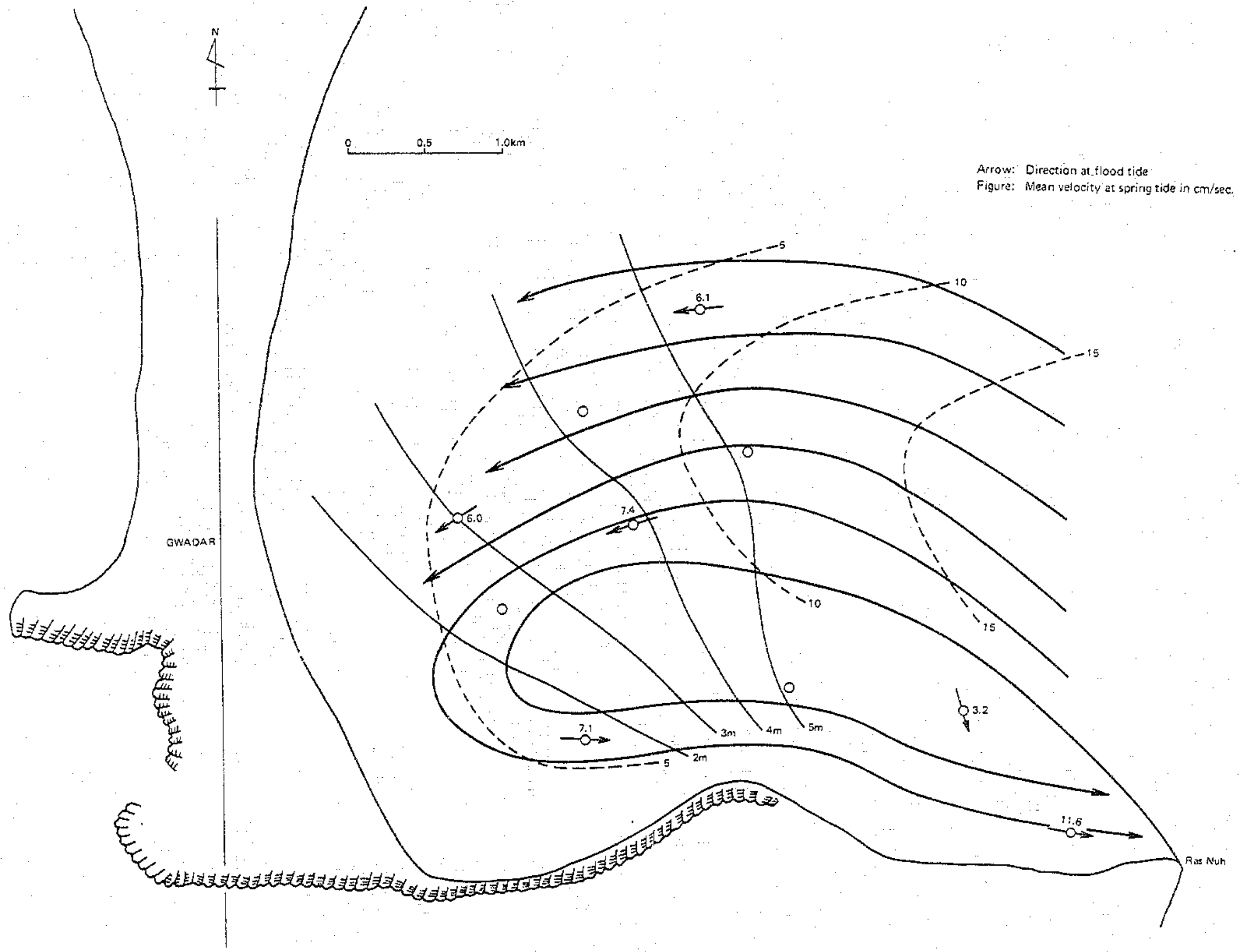


Fig. 19 Distribution of Residual Current

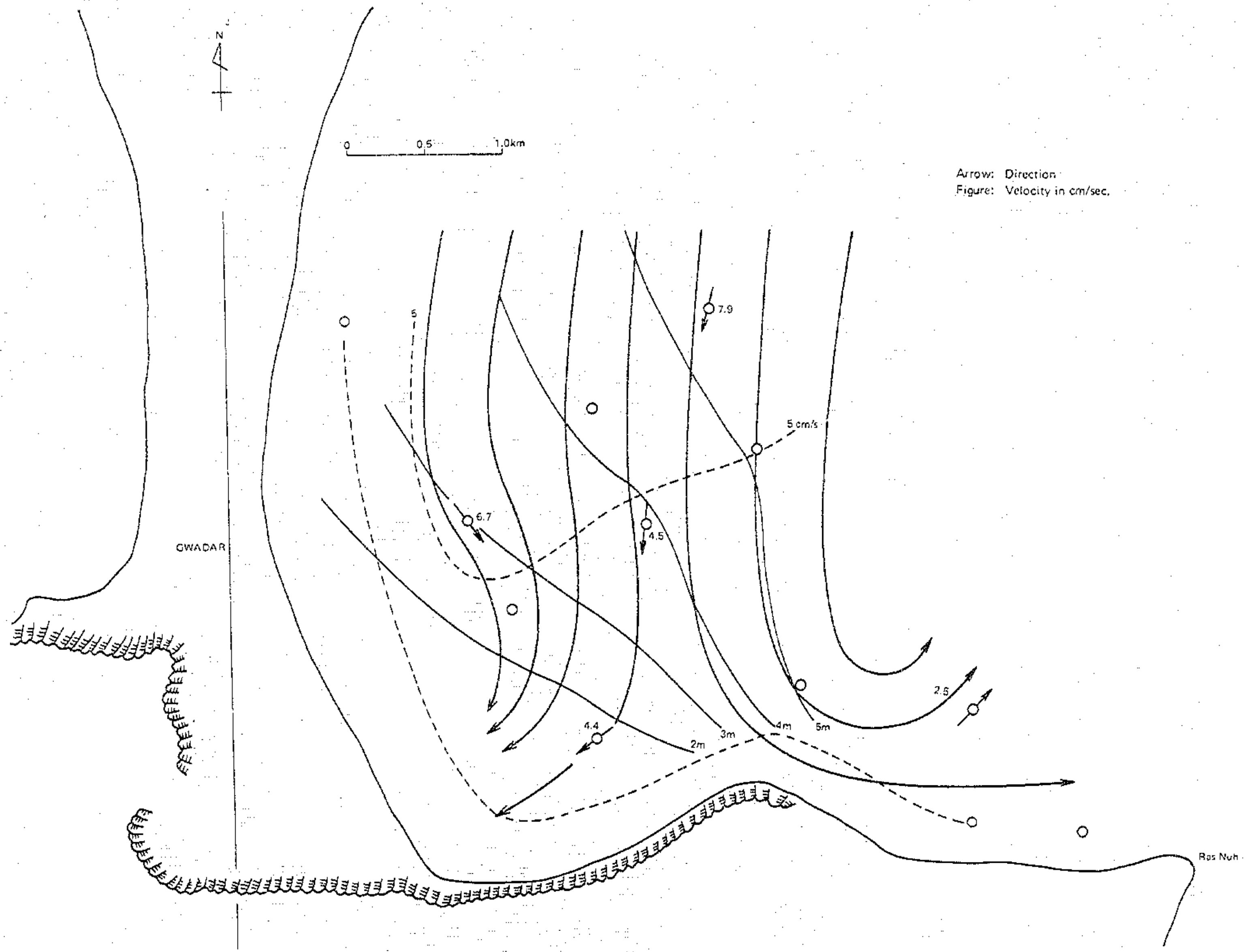


Fig. 20 (1) Spectrum of Current (Raw Data)

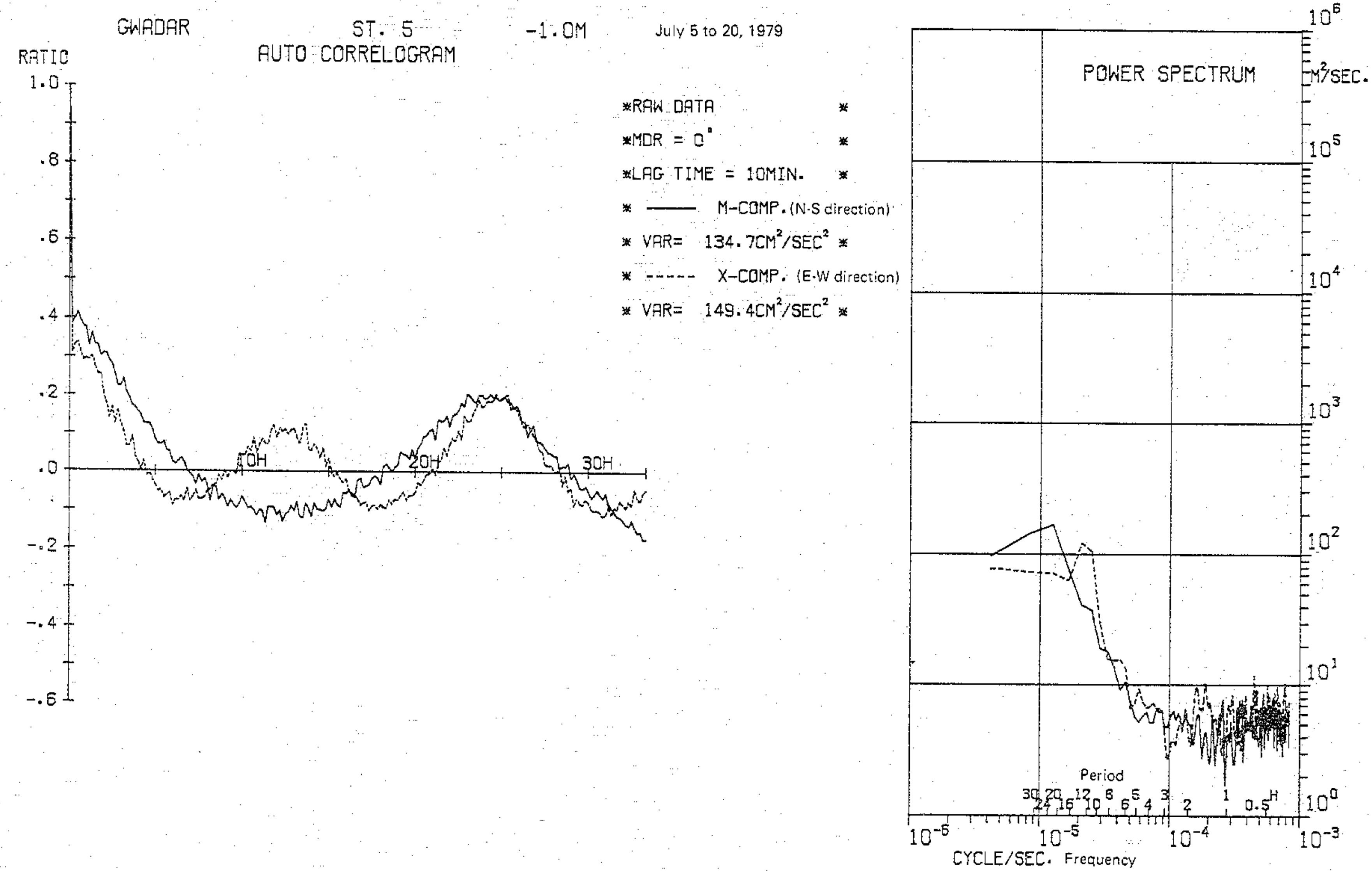
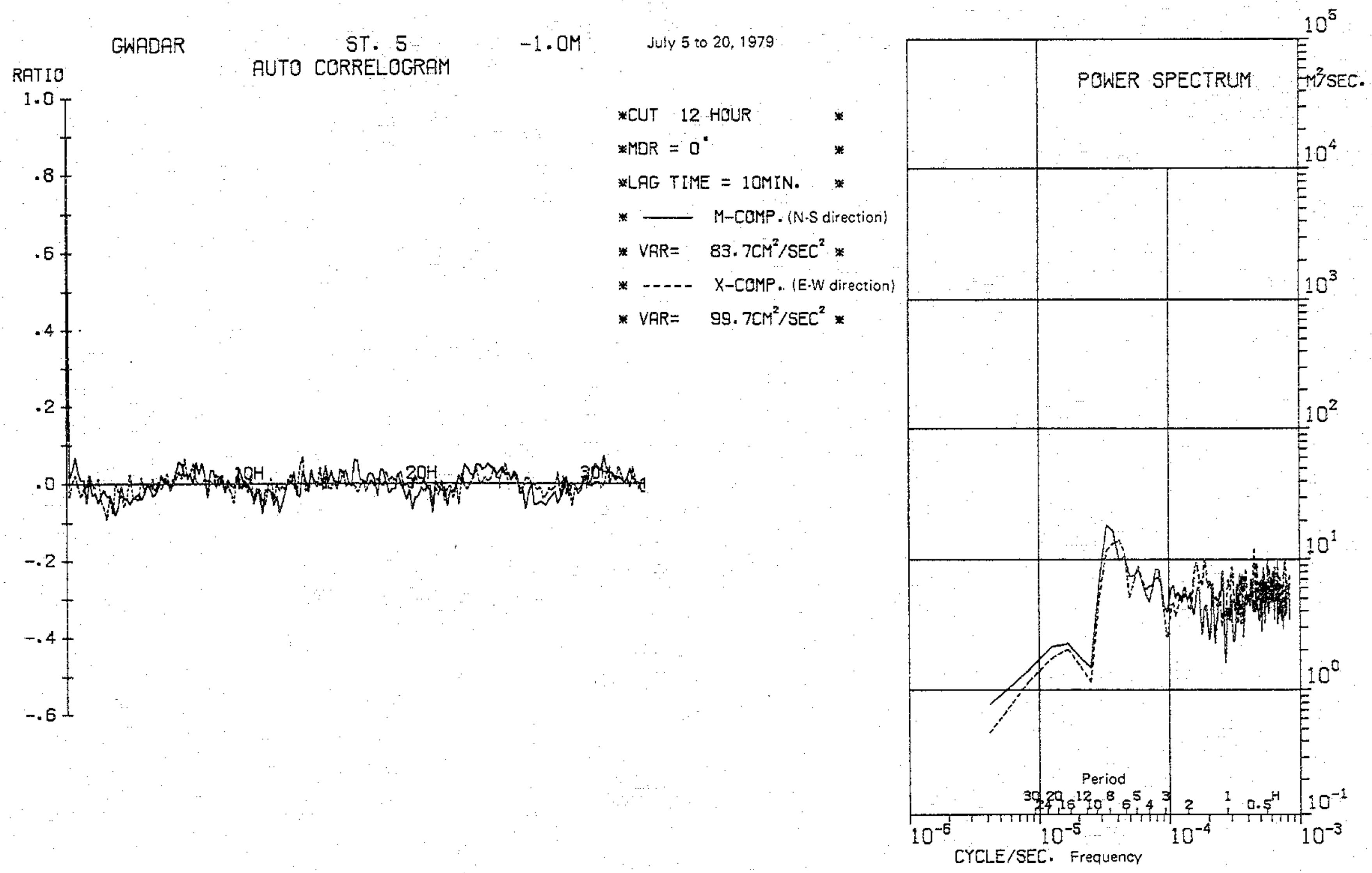


Fig. 20 (2) Spectrum of Current (Cut 12hr)



those of Vx. As semidiurnal constituents are predominant in the practically east-to-west direction and do not make their appearance in the main current direction but the constituents of the diurnal current appear north-northeast and south-southeast, the diurnal current is observed both in Vm and Vx.

The autocorrelation function sharply drops over a short span of time and goes below 0.4 with a peak of 0.1 to 0.2 appearing the period of tide constituents. Short-cycle fluctuations may be observed in the auto-correlation function, suggesting that there exist short-period variations or the data are prominently random.

(Power Spectrum Analysis)

A further analysis of the autocorrelation function C(T) and a spectrum analysis clarify the existing periodical components.

In general, this spectrum shows a slant of −5/3 power. The range of low-frequency value constituents for over three hours in respect to the analyzed values of RAW data practically satisfies this, but the same thing cannot be said to the range of high-frequency value components. This suggests that the current in this sea area makes its appearance at marked random in respect to short period constituents.

The current speed amplitude which corresponds to a prominent peak seen in the range of 1.7×10^{-4} cycles/sec of high-frequency value constituents in the components of spectrum X (in the east-to-west direction) is about 0.019 m/sec at 3×10^{-4} cycles/sec.

(Coefficient of Diffusivity)

According to G.I. Taylor's theory, coefficients of diffusivity were computed (Table 9).

Table 9 Coefficients of Diffusivity

DATA	Number	Time Difference	M-Comp ($x = 0°$)		X-Comp ($x = 90°$)	
		sec	Variance		Variance	
CUT 12"	2160	600	cm^2/sec^2 =83.7	cm^2/sec K=5.84 x 10^4	cm^2/sec^2 = 99.7	cm^2/sec K = 5.98 x 10^4

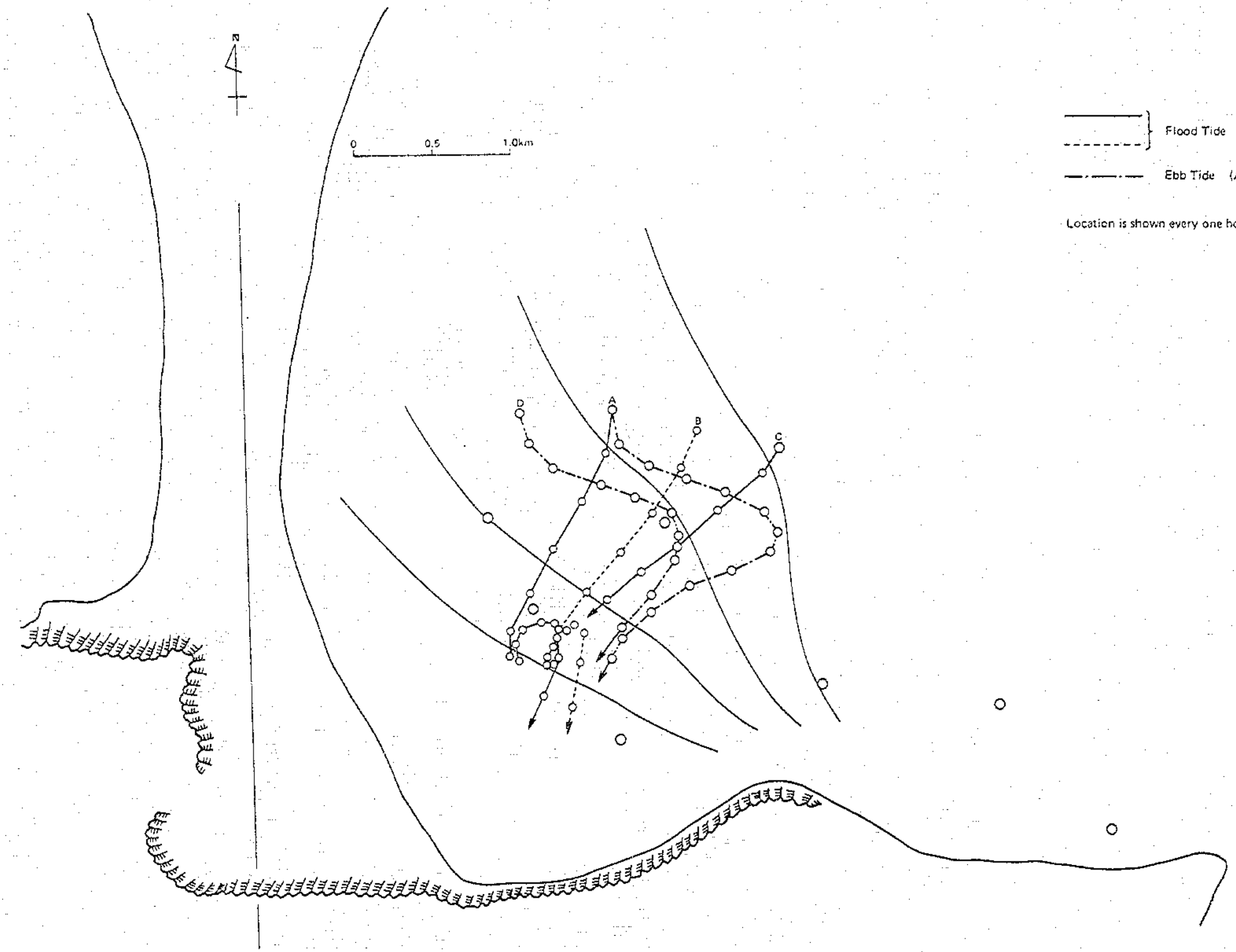
(Computation of Drift)

From the results of the analyses, a distribution of residual currents, which would indicate the distribution of current directions and speeds, and distribution of current factors, which would indicate the distribution of mean spring tide speed amplitudes. The residual current irregularly changes its direction from north to south and vice versa but its incidence is relatively high. An attempt was made to realize the average conditions in respect to the southward current.

Moreover, grids are placed on the distribution chart of residual currents and current factors, and an attempt was made to compute the drift every hour in case the current started flowing at an optional point within the survey area. The results are given in Fig. 21.

This drift is an outcome of the computation of a drift, which is started by mean spring tidal currents and south-bound currents when flood and ebb currents start, with the tidal current at their various moving places and the value of residual currents. Here, it is hypothesized that the tidal time was practically the same within the survey area.

Fig. 21 Float Tracing



(Residual Currents)

In the process in which the drift was computed, residual currents were schematized in a southward pattern, because they were southward whenever they were observed at every station for 24 hours. A check of the residual currents at St. 5, at which observation was conducted for 15 days indicates that the residual currents rapidly change day by day. sometimes showing a northward pattern. The variations in residual current were extremely irregular and sometimes show signs of a northward drift. The variations in residual current are presumably correlated to winds in the survey period and take on an extremely irregular pattern (See Table 10 and Fig. 22).

Table 10 Residual Current at St. 5

day	6	7	8	9	10	11	12	13	14	15	16	17	18	19
θ°	38	7	326	229	186	131	63	22	148	146	309	243	206	196
V cm/s	1.2	2.2	3.1	6.7	3.1	1.1	2.8	2.2	4.5	11.5	5.1	7.6	2.2	4.7

Fig. 22 Residual Current Vector

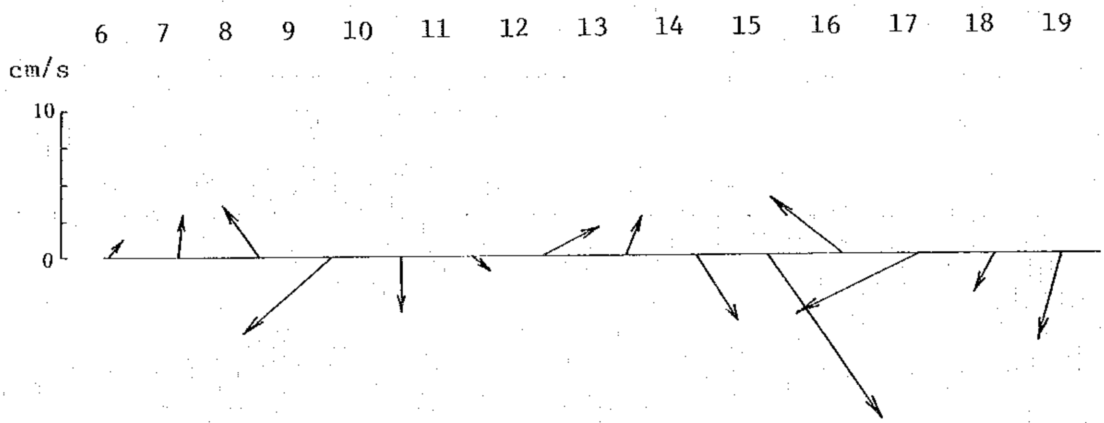


Fig. 22 indicates that the residual currents are faster in their southward drift than in the northward drift.

(Discussion)

The current direction in the survey markedly changes, as the residual and tidal currents are greatly influenced by winds. The results of the 2nd survey indicates that the current direction at Gwadar is north-northeast in the duration of rise and south-southwest in the duration of fall, but such response is not clear in the duration of neap tide. The speed of tidal current is roughly 0.1 m/sec but reaches 0.15 m/sec at the maximum. The 1st survey period coincided with a northeasterly season and the current direction was somewhat different from that of the 2nd survey season, in which signs of an east-to-west drift were noted with the speed standing at 0.12 m/sec and reaching a maximum of 0.2 m/sec. Presumably, this suggests the difference produced in the residual current by the influence of winds.

The residual currents were seen drifting at a speed of 5 cm/sec in the southwest direction during the 1st survey period and in the south direction during the 2nd survey period, presumably because they were also influenced by winds.

Table 11 Correlation between Wave Height and Period

Significant Wave

Height (m) \ Period (sec)	0 ~ 5.0	5.1 ~ 7.5	7.6 ~10.0	10.1 ~ 12.5	12.6 ~15.0	15.1 above	Total	Percentage
0 ~ 0.25							0	0%
0.26 ~ 0.50			1	52	39	3	95	33.1%
0.51 ~ 0.75			6	123	34	2	165	57.5%
0.76 ~ 1.00				22	5		27	9.4%
1.01 ~ 1.25							0	0%
1.26 ~ 1.50							0	0%
1.51 above							0	0
Total	0	0	7	197	78	5	287/100	
Percentage	0%	0%	2.5%	68.6%	27.2%	1.7%		

Maximum Wave

Height (m) \ Period (sec)	0 ~ 5.0	5.1 ~ 7.5	7.6 ~10.0	10.1 ~12.5	12.6 ~15.0	15.1 above	Total	Percentage
0 ~ 0.25							0	0%
0.26 ~ 0.50			2	3	3	2	10	3.5%
0.51 ~ 0.75			18	59	24	8	109	38.0%
0.76 ~ 1.00		2	40	66	18	7	133	46.3%
1.01 ~ 1.25		2	13	12	4		31	10.8%
1.26 ~ 1.50			4				4	1.4%
1.51 above							0	0%
Total	0	4	77	140	49	17	287/100	
Percentage	0%	1.4%	26.8%	48.8%	17.1%	5.9%		

Fig. 23 Occurrence of Wave Period

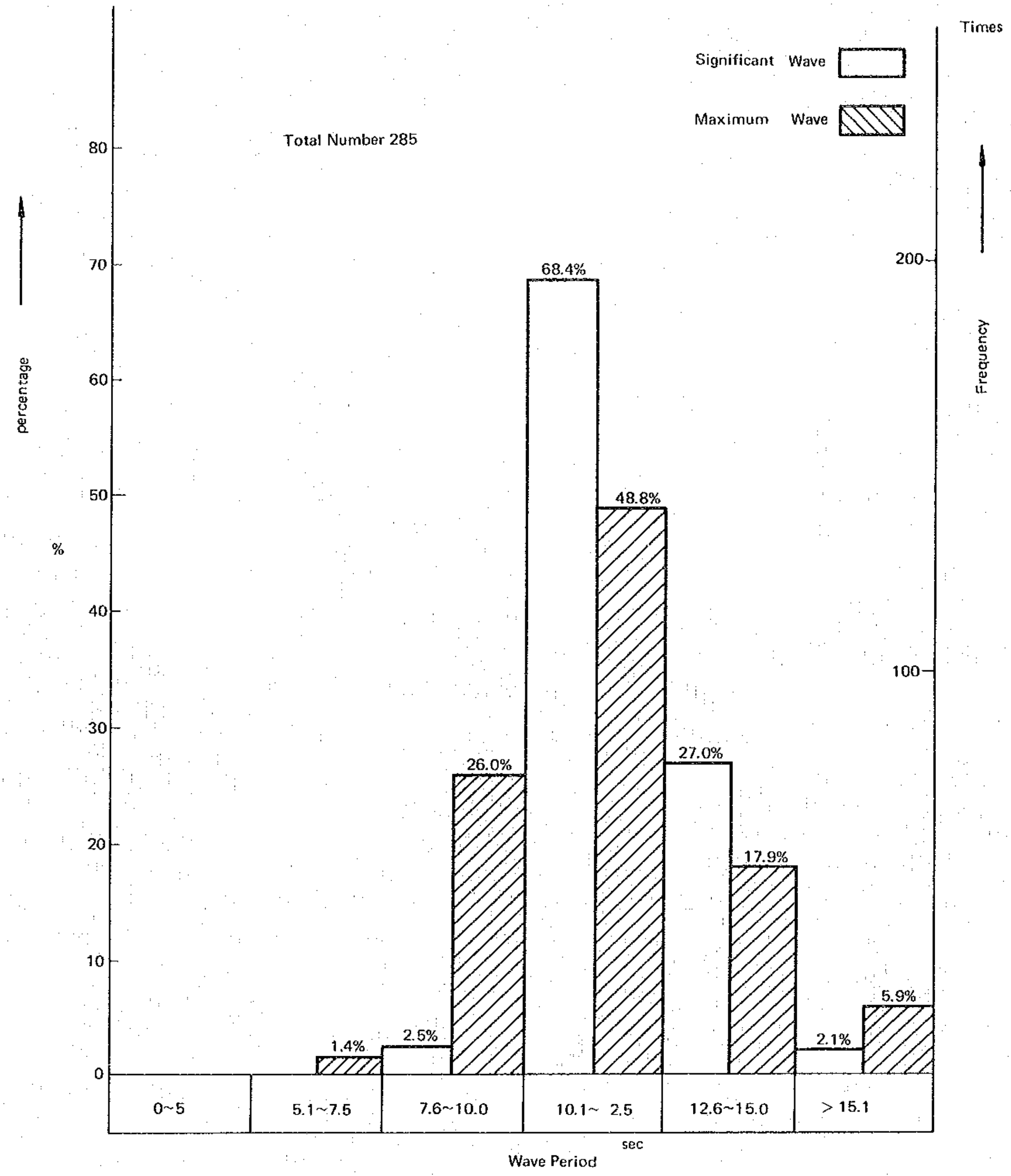


Fig. 24 Occurrence of Wave Height

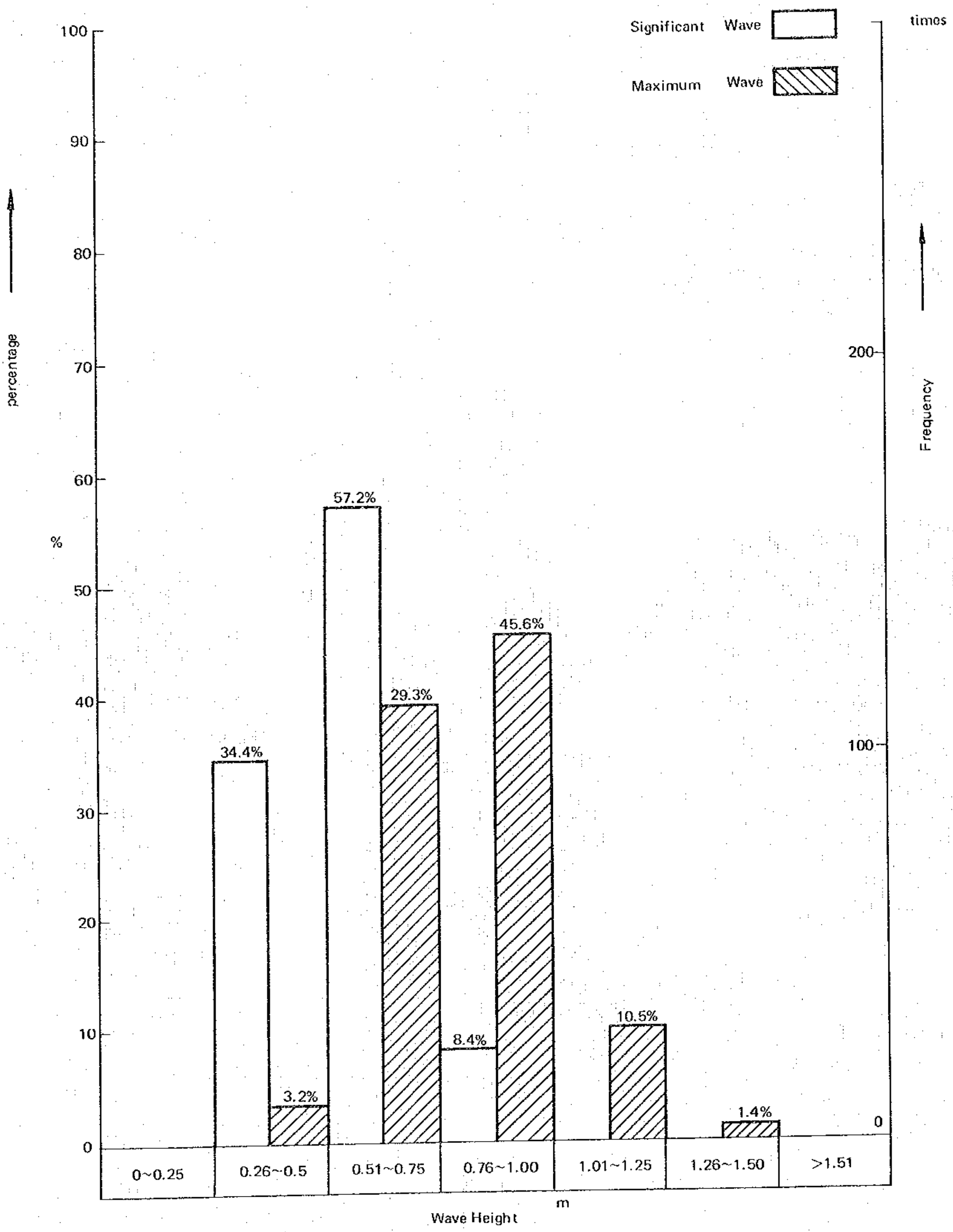


Fig. 25 Expected Wave Height

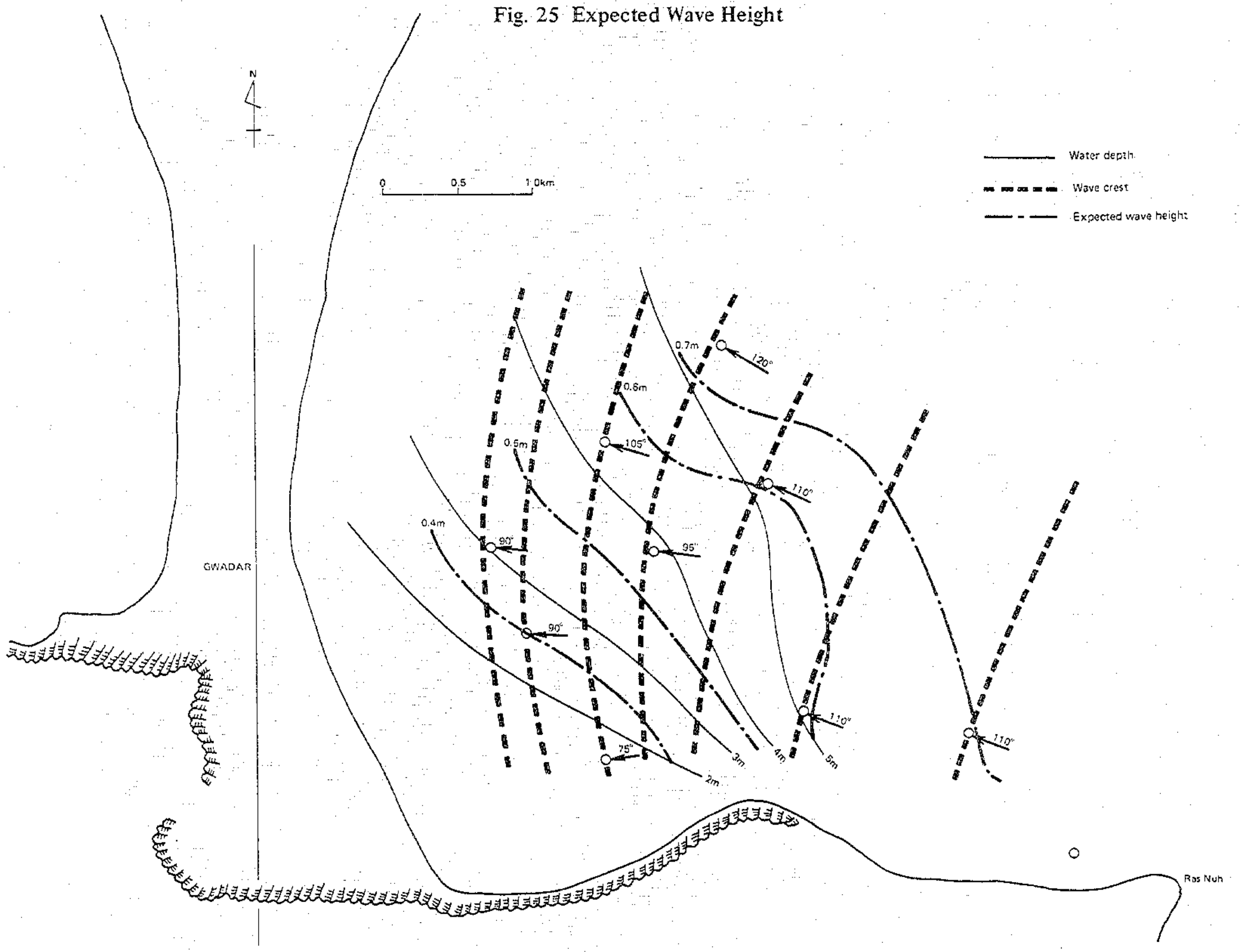


Fig. 26 Distribution of Wave around Headland

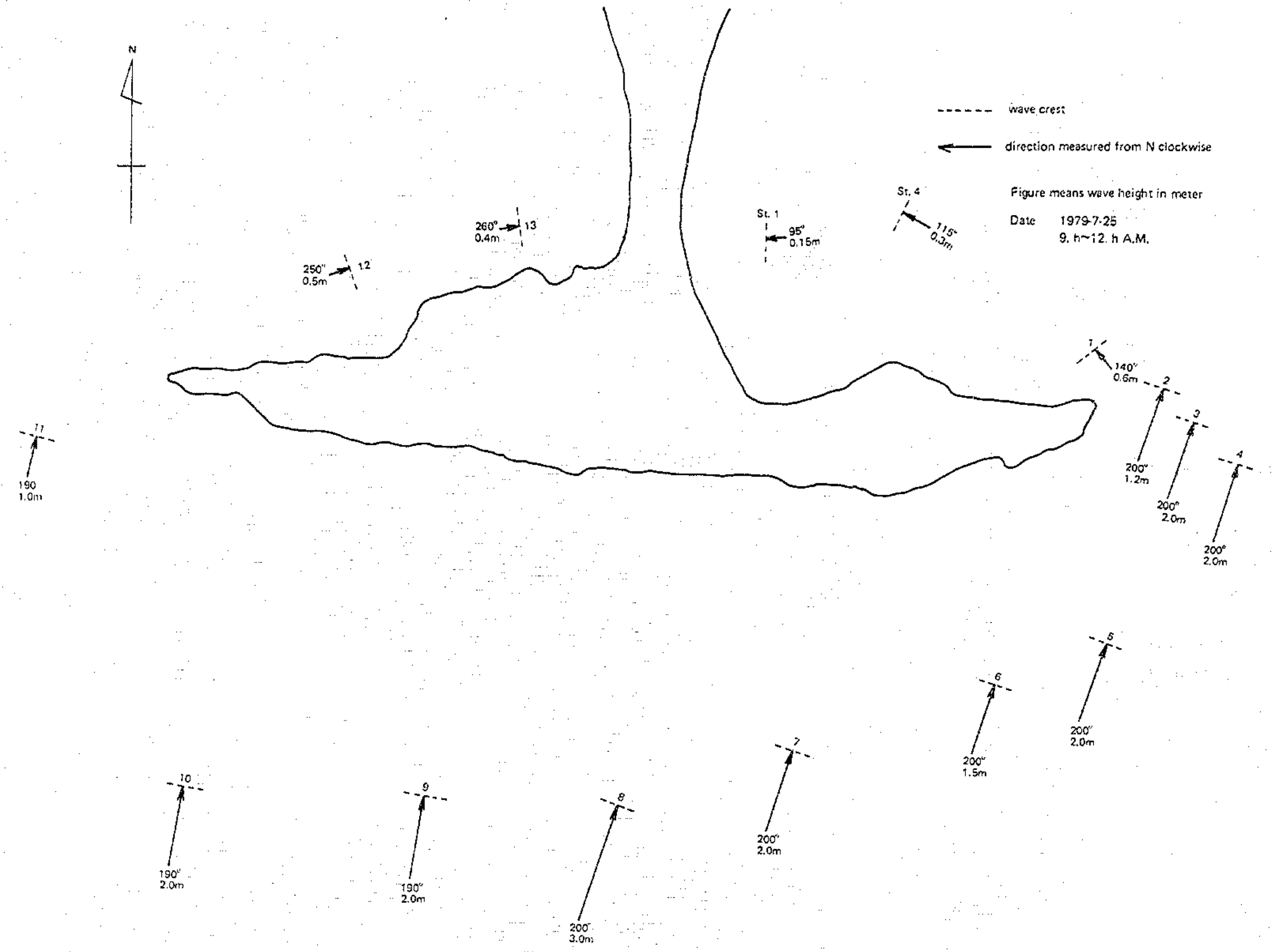
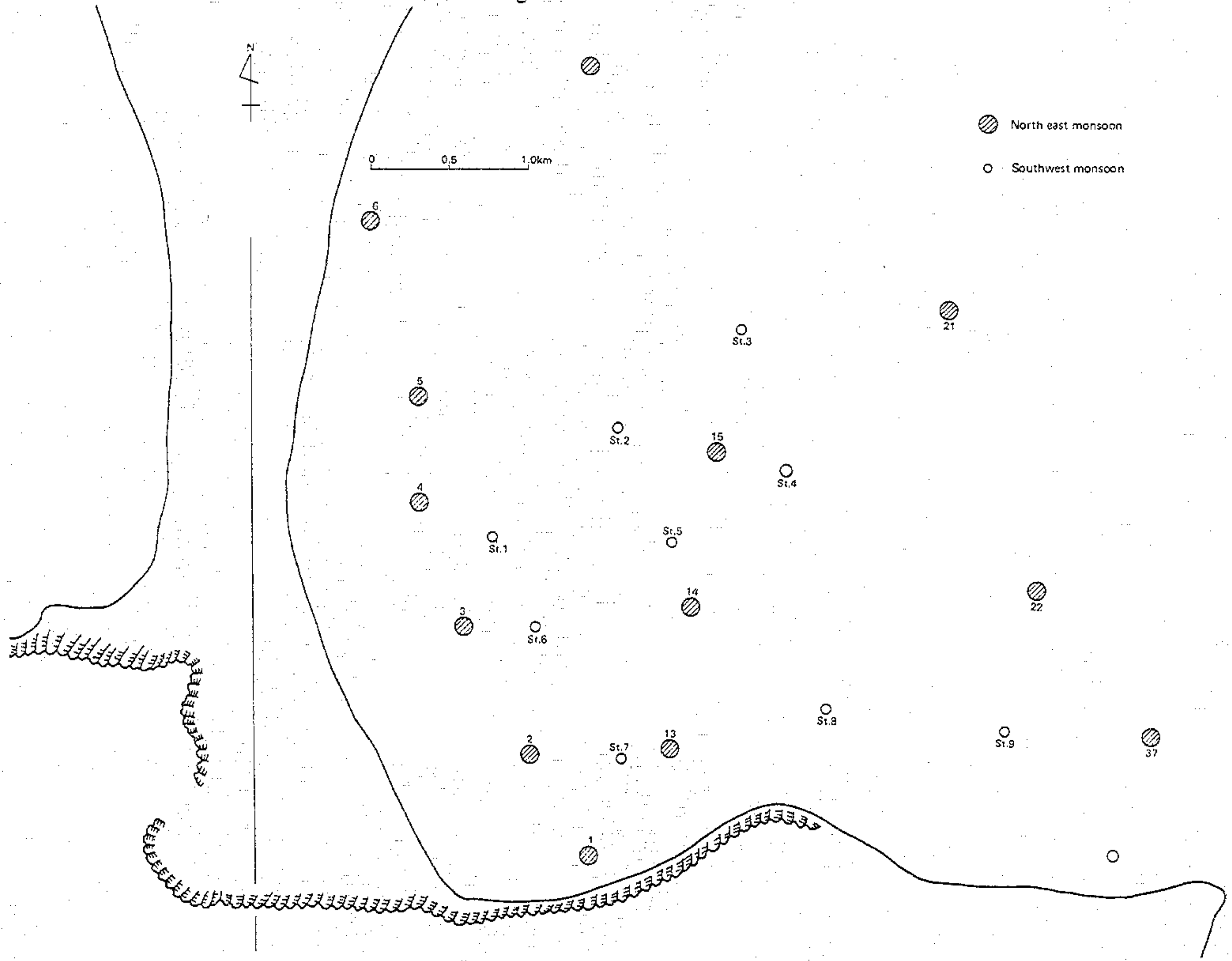


Fig. 27 Sea Bed Material



(3) Waves

The data obtained with a wave recorder at St. 4 for about one month during the 2nd survey period were analyzed to compute the wave height, period and frequency. (See Table 11)

One characteristic during the southwesterly season is that waves with a relatively long period are prominent. In other words, waves with a period of 10.0 to 12.5 sec. account for 68.6% of the total frequency of observation in terms of significant waves and 49% of the maximum wave (See Fig. 23).

The appearance of wave heights of 0.51 to 0.75 m account for 57.5% and those of 0.26 to 0.50 m stand at 33%, suggesting that both types of waves share the greater part. (See Fig. 24)

Most of the waves during this season are described as being waves with a long period in the Arabian Sea which have travelled into the east bay and have been diffracted at Ras Nuh, the eastern tip of Headland.

(4) Distribution of Wave Directions and Wave Heights by Visual Observation.

The wave heights visually observed and the significant waves observed with a wave recorder at St. 4 were compared, a distribution of wave heights in the sea area was computed with due consideration given to the appearance ratio of period of significant waves, and a distribution chart of expected waves along with the maximum appearance wave direction was prepared (See Fig. 25).

The results of the visual observation of wave directions conducted off Headland on July 25 indicates that the direction of the deepwater wave is 200°, the wave height about 2 m and the period 12 to 14 sec. (See Fig. 26)

It is conceivable that the deepwater wave was in this condition almost in the entire 2nd survey period.

The wave height observed visually at St. 4 was 0.3 m, but the data gathered with a wave recorder indicated that the height of the significant wave was 0.43 m and the period 11.5 sec.

The refraction coefficient for a wave height of 2 m may be calculated at 0.22. Incidentally, a refraction coefficient of 0.25 is adopted for the design deepwater wave (with a wave height of 6 m and a period of 12 sec.)

(5) Distribution of Bed Materials

The bed materials are sampled in 1st and 2nd Phase as shown in Fig. 27.

On the basis of the results of an analysis of bed materials, sorting coefficients and skewnesses were computed (Table 12). The values indicative of the characteristics of bed materials were computed in the following equation.

$Md\phi$ (median value) = $\Phi 5o$

$M\Phi$ (mean value) = $(\Phi 16 + \Phi 84)/2$

$\sigma\phi$ (sorting coefficient) = $(\Phi 84 - \Phi 16)/2$

$\alpha\phi$ (skewness) = $(M\phi - \Phi 5o)/\sigma\phi$

With the total quantity set at 100, the Φ values for 16%, 50% and 84% were defined as $\Phi 16$, $\Phi 50$ and $\phi 84$, respectively, and substituted in the above equation.

(Note: The correlation of grain size (d in mm) and ϕ is expressed in the following equation.

$d = 2^{-\phi}$

$(\log d = -\phi \log 2)$

From Table 12, a distribution of skewness in both monsoon seasons was computed (See Figs. 28 and 29).

Moreover, the correlations between the skewness and the median grain size were schematized for each time (See Fig. 30).

In the southwesterly season with high waves, the correlations between Mdϕ and $\alpha\phi$ are plus (i.e., the fine grains are rich in relatively finer soil.)

A comparison of the distribution of skewness between the two monsoon seasons indicates that areas with a minus skewness (much coarse grains) were observed near the beach line in this sea area during the northeasterly season, whereas these areas disappear and replaced by those with plus skewness (much fine grains).

In both monsoon seasons, areas with relatively few changes in skewness are distributed toward the deepwater from the center of the survey area.

Fig. 31 indicates correlations between the median grain size and the skewness. With the exception of Stations 16 and 22, which are somewhat separated in the north, the larger the grain size (with small Mdϕ), the greater the degree of sorting coefficient (deficient sorting – i.e., unevenness in grain size) in the northeasterly season. In the southwesterly season, little difference is observed in grain size between sorting – i.e., unevenness in grain size) in the northeasterly season. In the southwesterly season, little difference is observed in grain size between places.

Fig. 32 shows correlations between the sorting coefficient and skewness. With the exception of Stations 22, 37 and 16 in the deepwater, the correlations between the two are plus in the northeasterly season. In other words, the smaller the degree of sorting coefficient (well sorted), the smaller the skewness (much coarse grains). A similar tendency is also observed clearly in the southwesterly season.

Table 13 and Fig. 33 indicate correlations between the maximum current speed caused by the orbital motion of water particles due to waves prominent in the southwesterly season and the median grain size of bed materials. With the exception of Stations 37, 21 and 22 close to the baymouth, it might be said that the faster the speed of water particles, the coarser the grain size.

The cummulative curve of grain size distribution at No. 15 in the center of the survey area (during the northeasterly season) and St. 5 (during the southwesterly season) are schematized in Fig. A 14.

On the basis of the foregoing, the correlations between the waves and the characteristics of bed materials may be summed up as follows:

Waves	High	Low
Grain Size	Large	Small
(Mϕ	Small	Large
Sorting	Good	Bad
($\sigma\phi$	Small	Large)
Skewness	Many coarse grains	Many fine grains
($\alpha\phi$	Minus	Plus)

Table 12 Grain Size of Sea Bed Material

in NE monsoon

St.	Median		Average		Sorting coefficient $\sigma\phi$	Skewness $\alpha\phi$
	mm	ϕ	mm	ϕ		
1	0.053	4.24	0.047	4.40	0.57	0.30
2	0.066	3.92	0.063	3.98	0.46	0.28
3	0.075	3.74	0.080	3.56	0.36	−0.25
4	0.077	3.70	0.084	3.58	0.30	−0.40
5	0.130	2.94	0.121	3.05	0.42	0.26
6	0.067	3.90	0.063	3.98	0.49	0.16
13	0.032	4.97	0.027	5.20	1.48	0.12
14	0.057	4.13	0.049	4.34	1.04	0.20
15	0.051	4.29	0.056	4.17	0.71	−0.17
16	0.130	2.94	0.118	3.08	1.65	0.08
21	0.160	2.64	0.165	2.60	0.10	−0.40
22	0.095	3.40	0.118	3.08	1.53	−0.21
37	0.033	4.92	0.035	4.84	1.67	−0.05

in SW monsoon

St.	Median		Average		Sorting coefficient $\sigma\phi$	Skewness $\alpha\phi$
	mm	ϕ	mm	ϕ		
St-1	0.059	4.09	0.047	4.40	0.67	0.46
St-2	0.060	4.07	0.047	4.40	0.70	0.42
St-3	0.076	3.72	0.112	3.16	1.11	−0.50
St-4	0.061	4.04	0.062	4.01	0.39	−0.08
St-5	0.061	4.04	0.058	4.11	0.74	0.09
St-6	0.055	4.18	0.045	4.47	0.71	0.41
St-7	0.056	4.17	0.042	4.58	0.80	0.51
St-8	0.067	3.90	0.077	3.70	0.48	−0.42
St-9	0.655	0.61	0.688	0.54	0.54	−0.13

Fig. 28 Skewness of Sea Bed Material in Northeast Monsoon Season

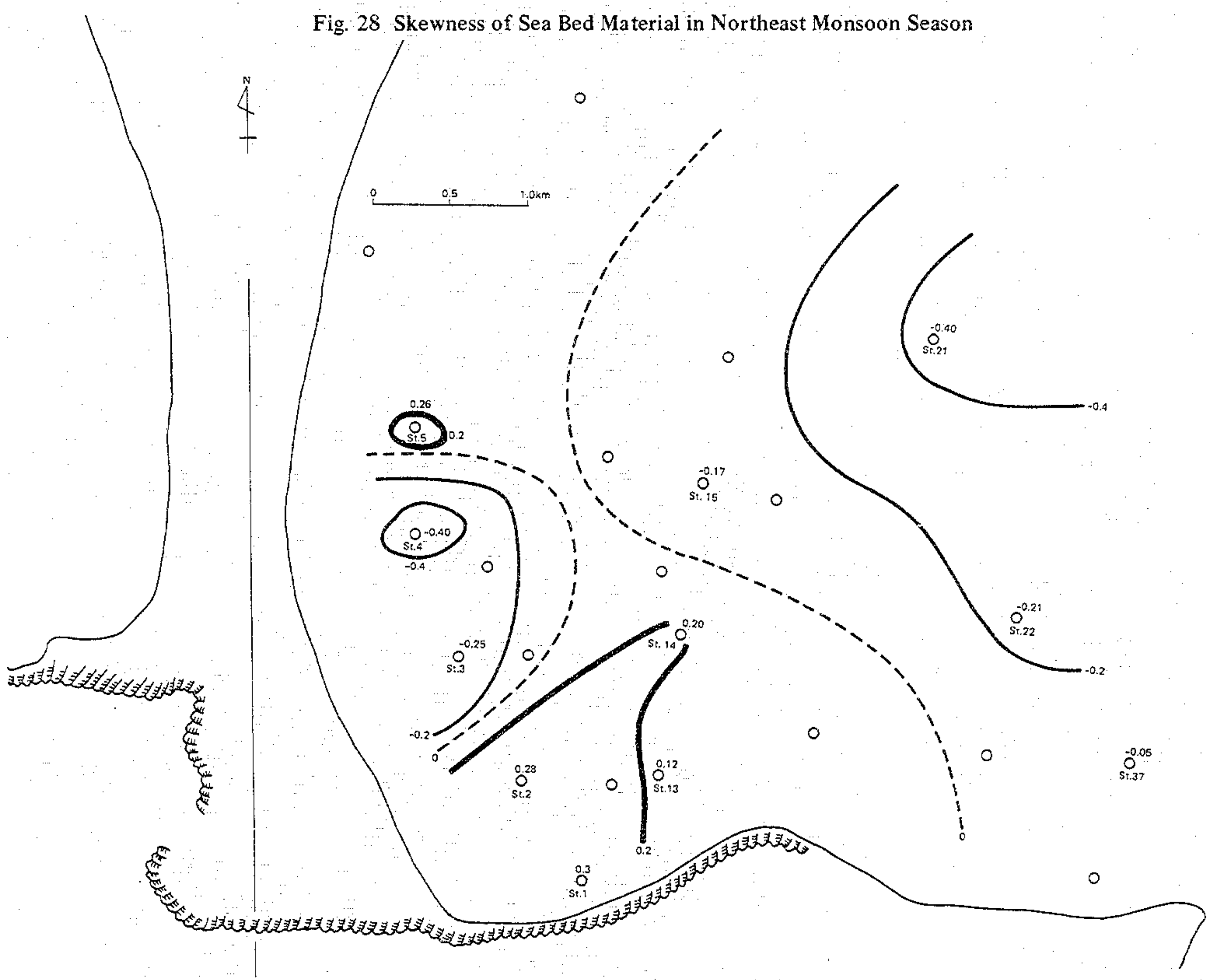


Fig. 29 Skewness of Sea Bed Material in Southwest Monsoon Season

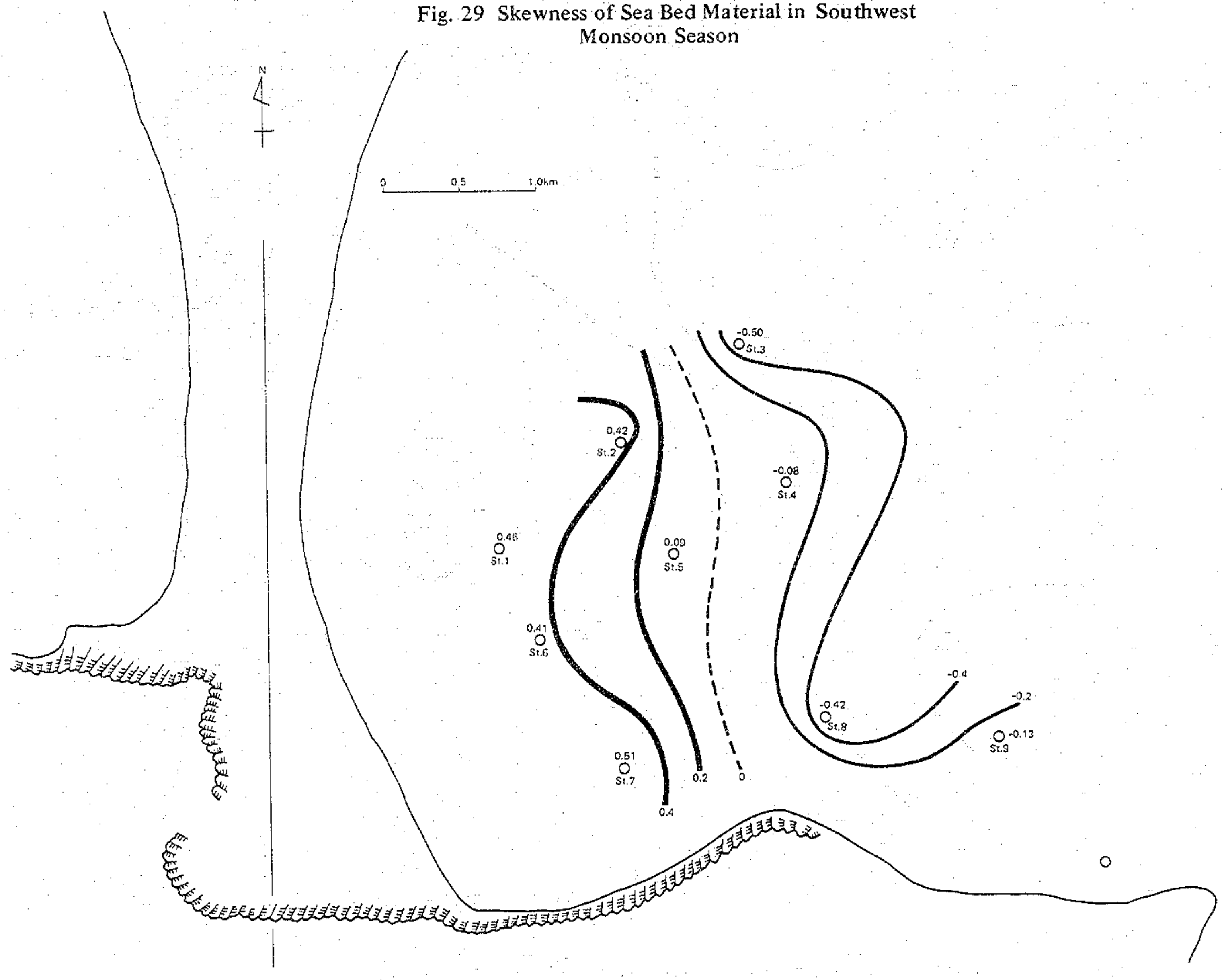
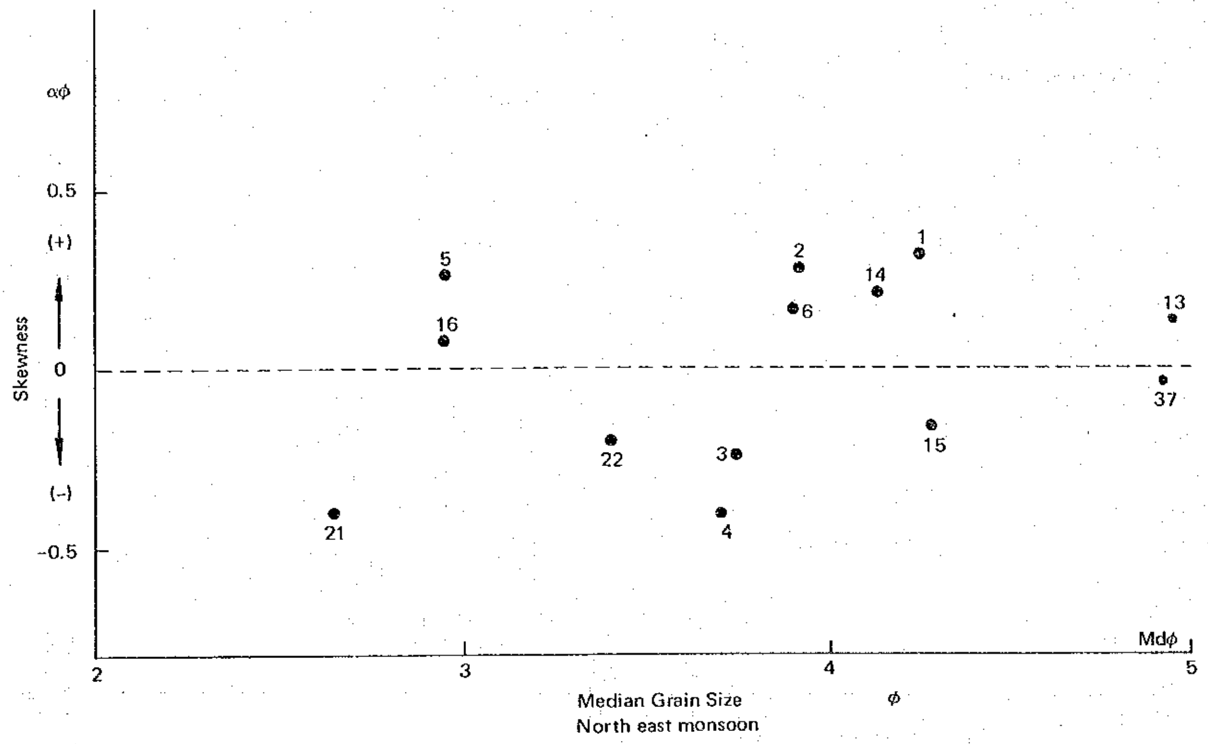


Fig. 30 Median Grain Size and Skewness



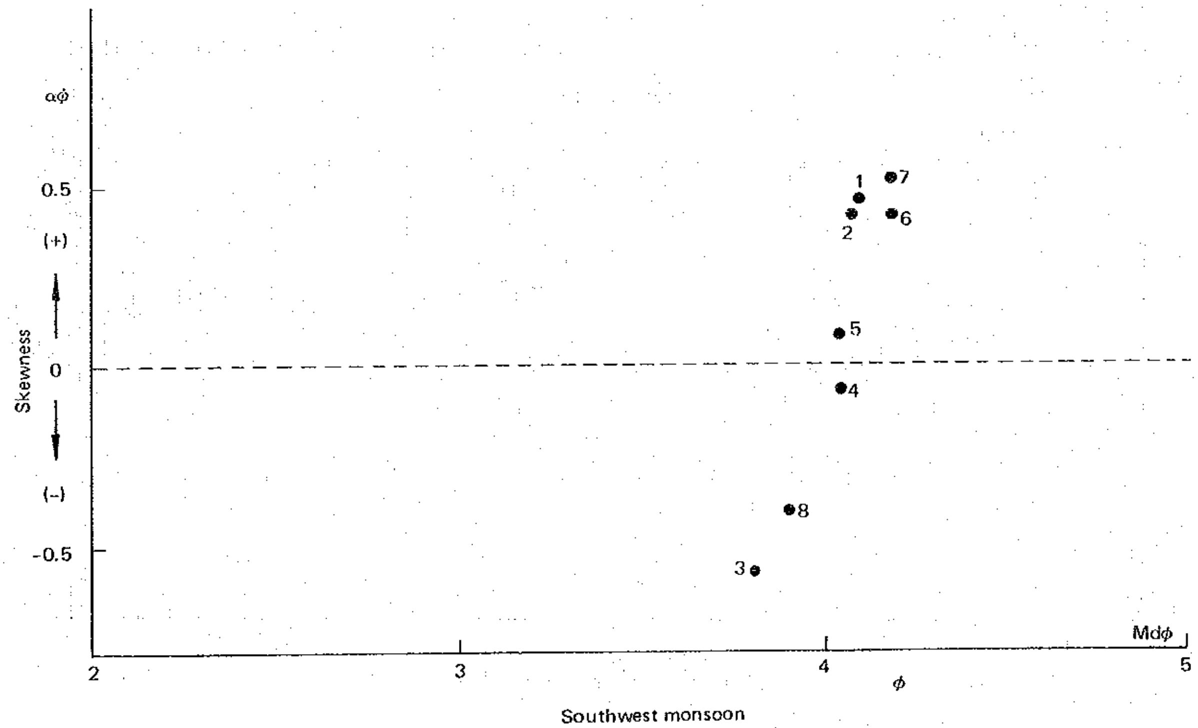
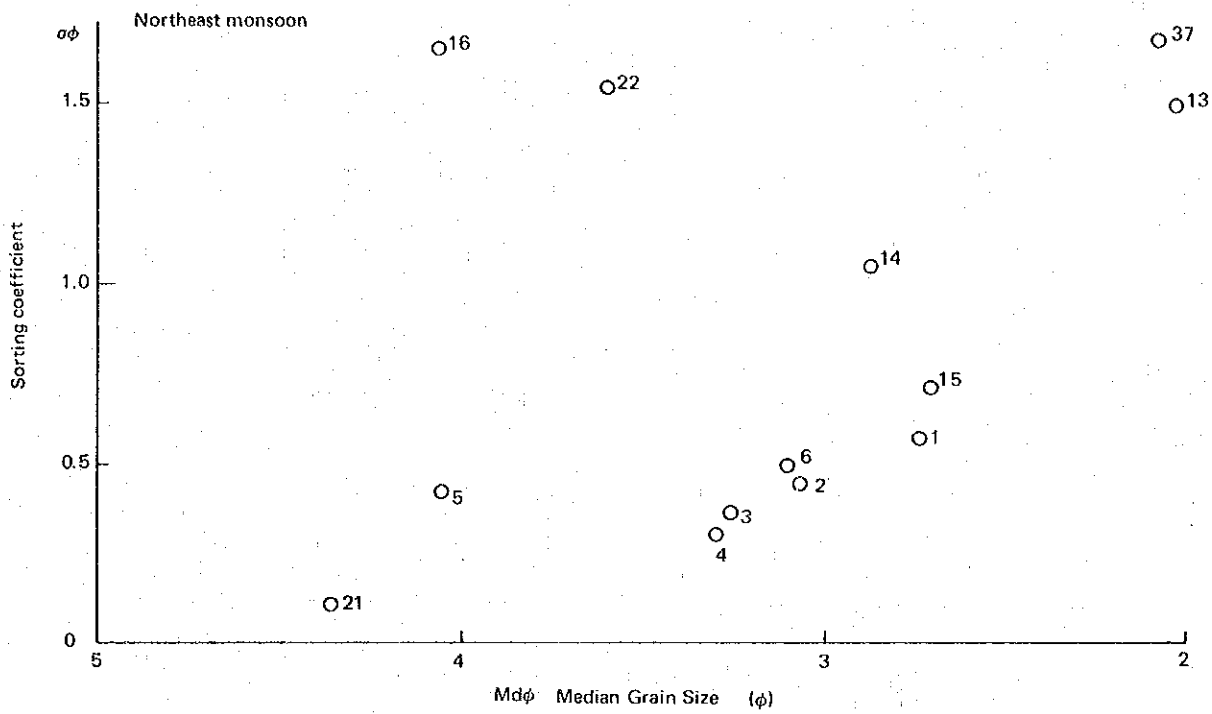


Fig. 31 Median Grain Size and Sorting Coefficient



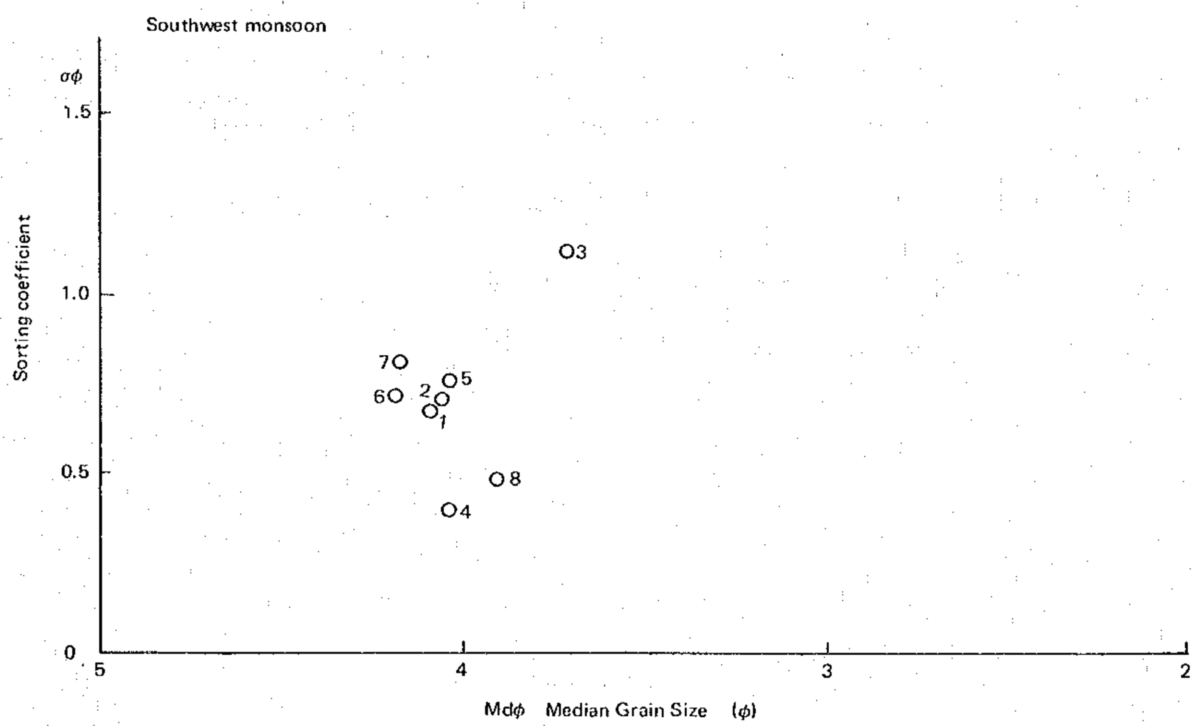


Fig. 32 (1) Sorting Coefficient and Skewness in Northeast Monsoon

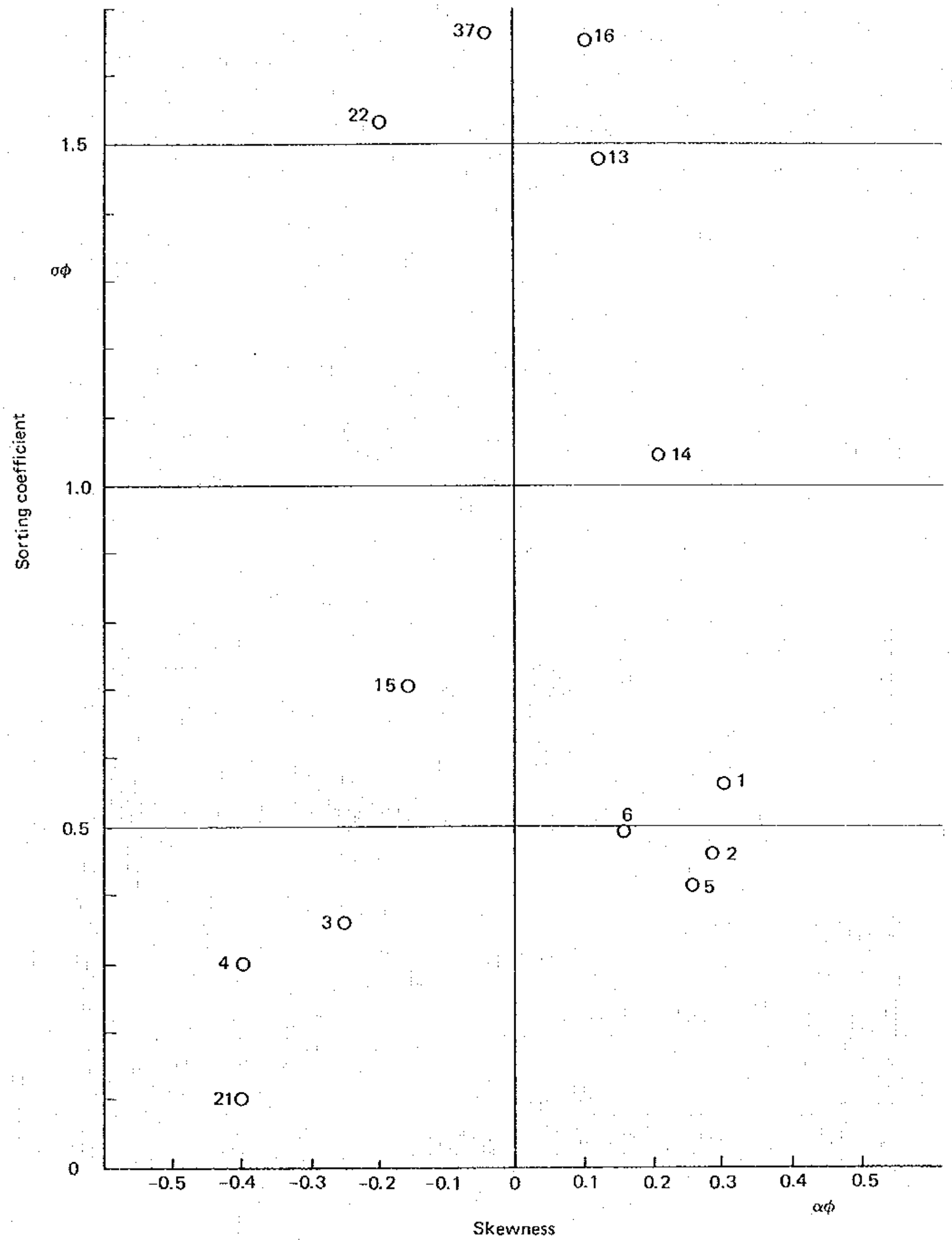


Fig. 32 (2) Sorting Coefficient and Skewness in Sohthwest Monsoon

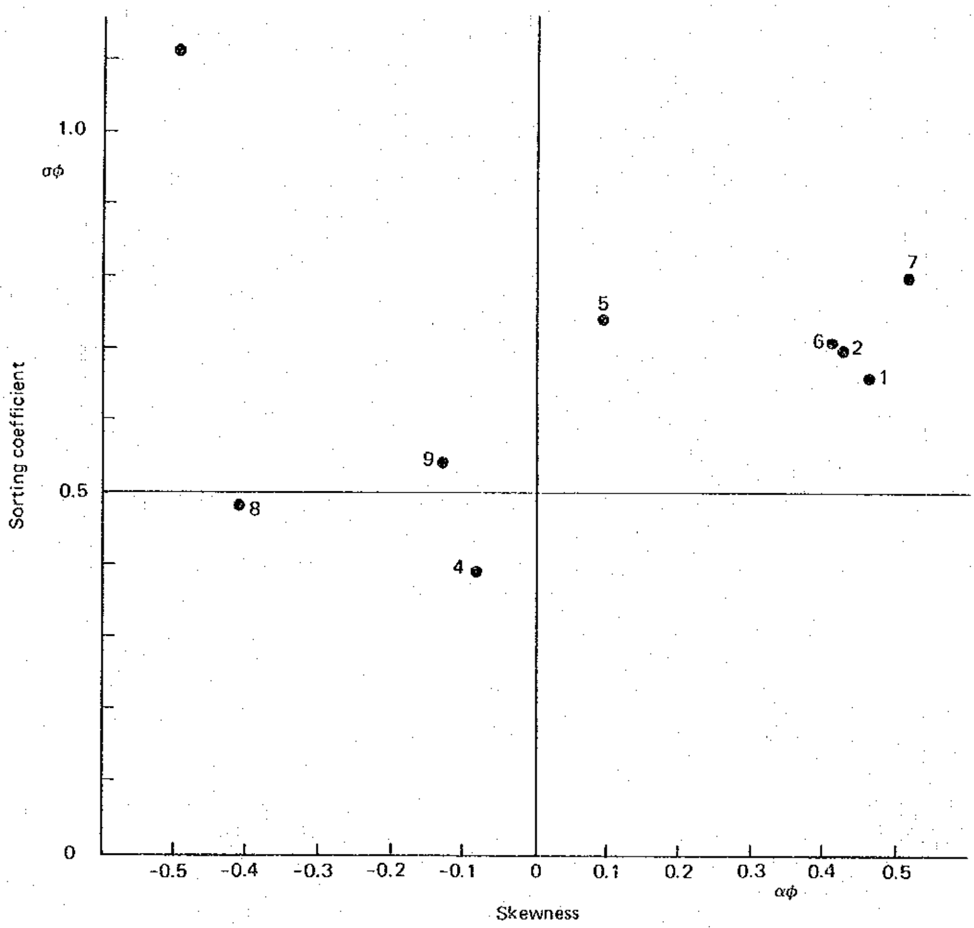


Table 13 Velocity of Water Particle and Grain Size

in NE monsoon

St.	Height (m)	Period (sec)	Length (m)	MSL Depth (m)	Median Grain Size		Velocity of water particle (m/sec)
					ϕ	mm	
1	0.1	8	35.4	2.1	4.24	0.053	0.103
2	0.1	8	37.0	2.3	3.92	0.066	0.098
3	0.2	8	39.3	2.6	3.74	0.075	0.184
4	0.2	8	40.6	2.8	3.70	0.077	0.176
5	0.25	8	42.6	3.1	2.94	0.130	0.207
6	0.25	8	43.9	3.3	3.90	0.067	0.200
13	0.2	8	48.5	4.1	4.97	0.032	0.141
14	0.25	8	55.6	5.6	4.13	0.057	0.145
15	0.3	8	60.2	6.6	4.29	0.051	0.158
16	0.35	8	58.5	6.3	2.94	0.130	0.188
21	0.4	8	66.8	8.6	2.64	0.160	0.174
22	0.45	8	64.2	7.8	3.40	0.095	0.210
37	0.6	8	65.8	8.3	4.92	0.033	0.268

in SW monsoon

St.	Height (m)	Period (sec)	Length (m)	MSL Depth (m)	Median Grain Size		Velocity of water particle (m/sec)
					ϕ	mm	
St. 1	0.40	10	64.4	4.5	4.09	0.059	0.277
St. 2	0.55	10	70.7	5.6	4.07	0.060	0.333
St. 3	0.70	10	79.0	7.0	3.72	0.076	0.375
St. 4	0.65	10	76.8	6.6	4.04	0.061	0.360
St. 5	0.60	10	70.1	5.4	4.04	0.061	0.375
St. 6	0.40	10	60.9	4.0	4.18	0.055	0.296
St. 7	0.30	10	55.6	3.3	4.17	0.056	0.247
St. 8	0.55	10	76.3	6.6	3.90	0.067	0.303
St. 9	0.55	10	79.0	7.0	0.61	0.655	0.295

(6) Temperature and Specific Gravity of Seawater

On July 8 and 27, the vertical distribution of water temperature and specific gravity in the duration of rise near the spring tide time was observed. In respect to the data obtained on July 8, the vertical cross sectional distribution of water temperature and salinity was schematized. The cross-section was schematized in the east-to-west direction (St. 6 – St. 5 – St. 4) and in the north-to-south direction (St. 2 – St. 5 – St. 8) with St. 5 (the center of the sea area) placed at the center (See Fig. 34).

Fig. 33 Velocity of Water Particle

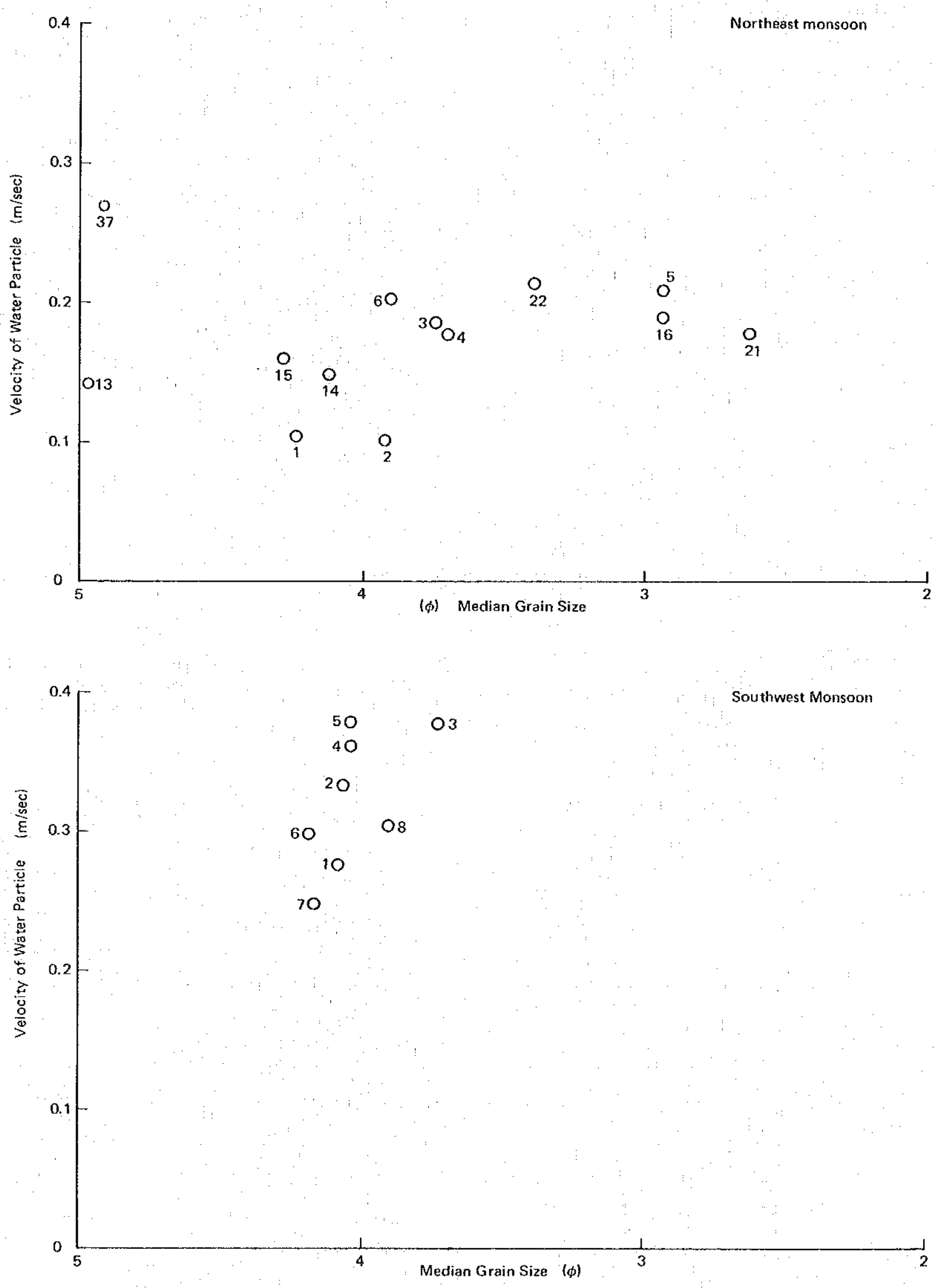


Fig. 34 Water Temperature and Salinity

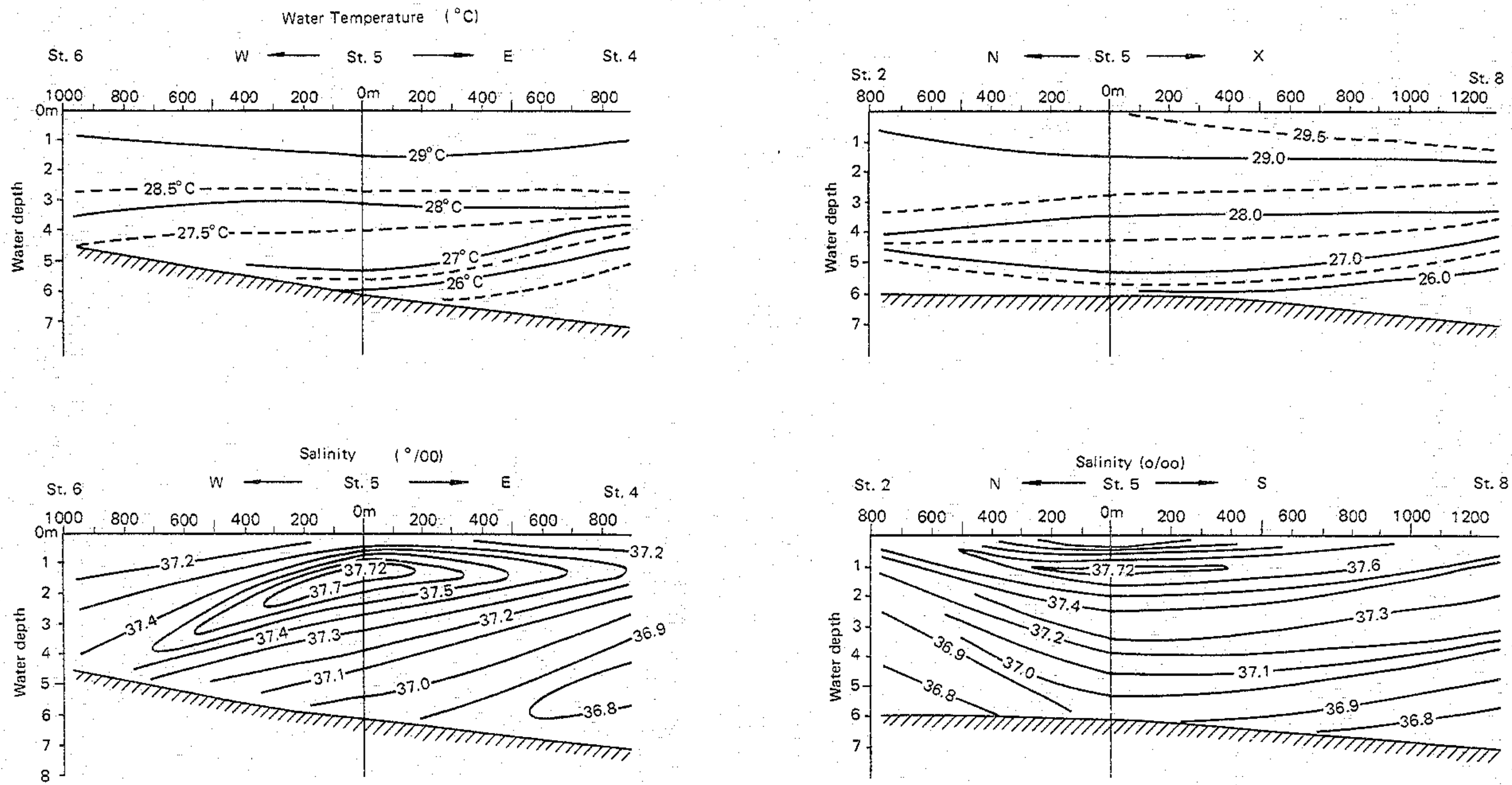


Fig. A-1 Tide Curve (the Port of Karachi)

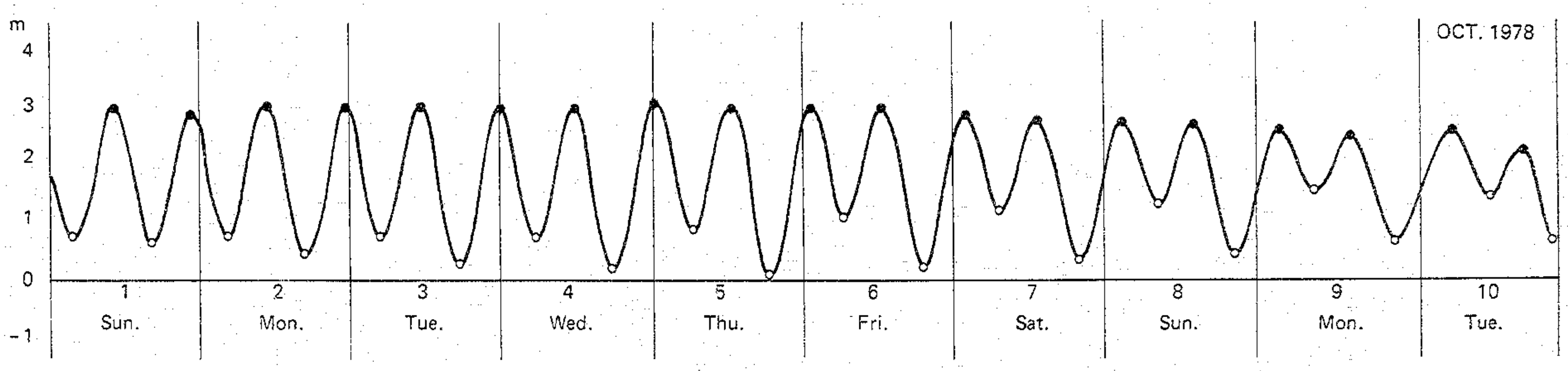


Fig. A-2 (1) Vertical Distribution of Water Temperature and Specific Gravity East Bay (1)

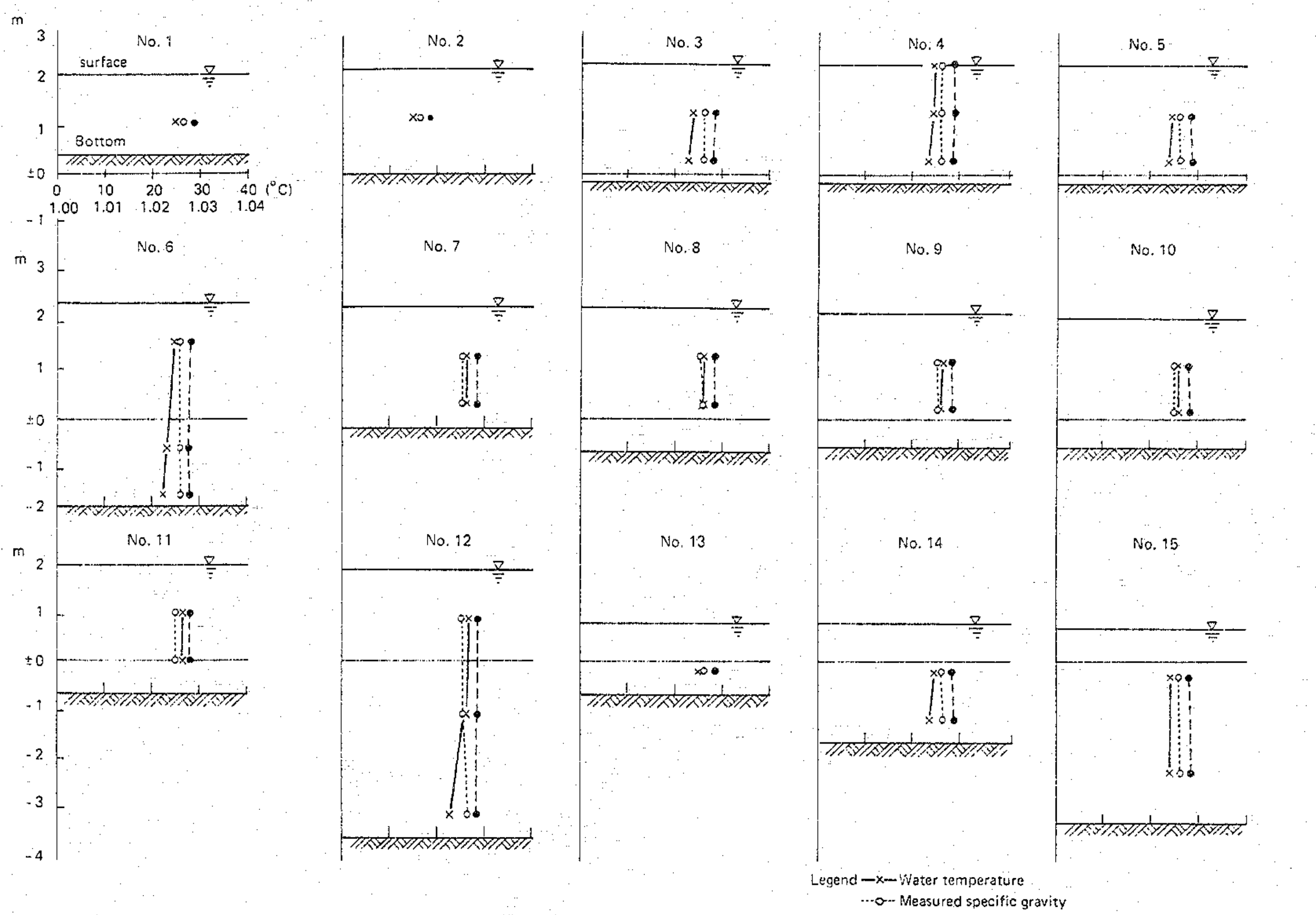


Fig. A-2 (2) East Bay

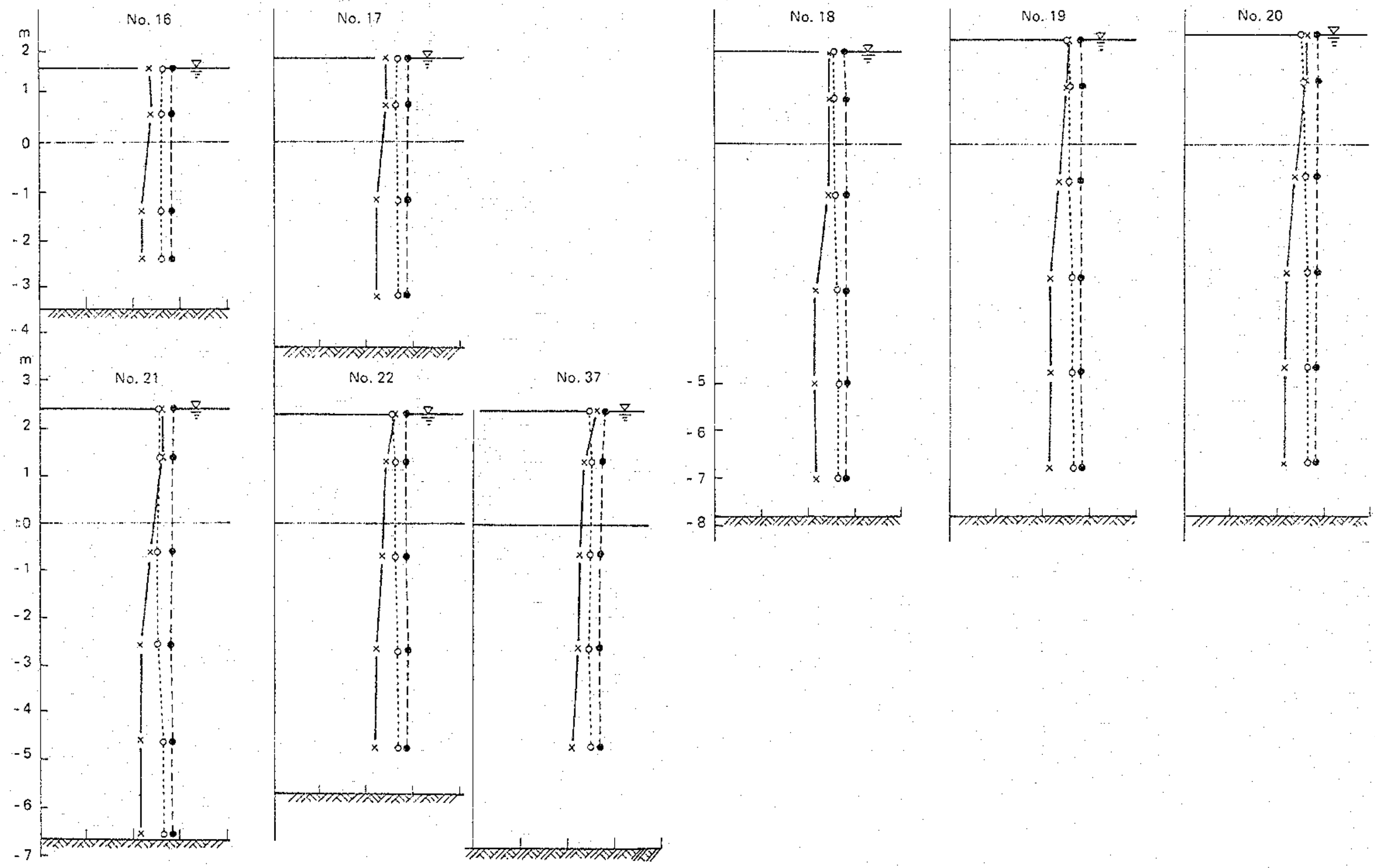


Fig. A-2 (3) West Bay

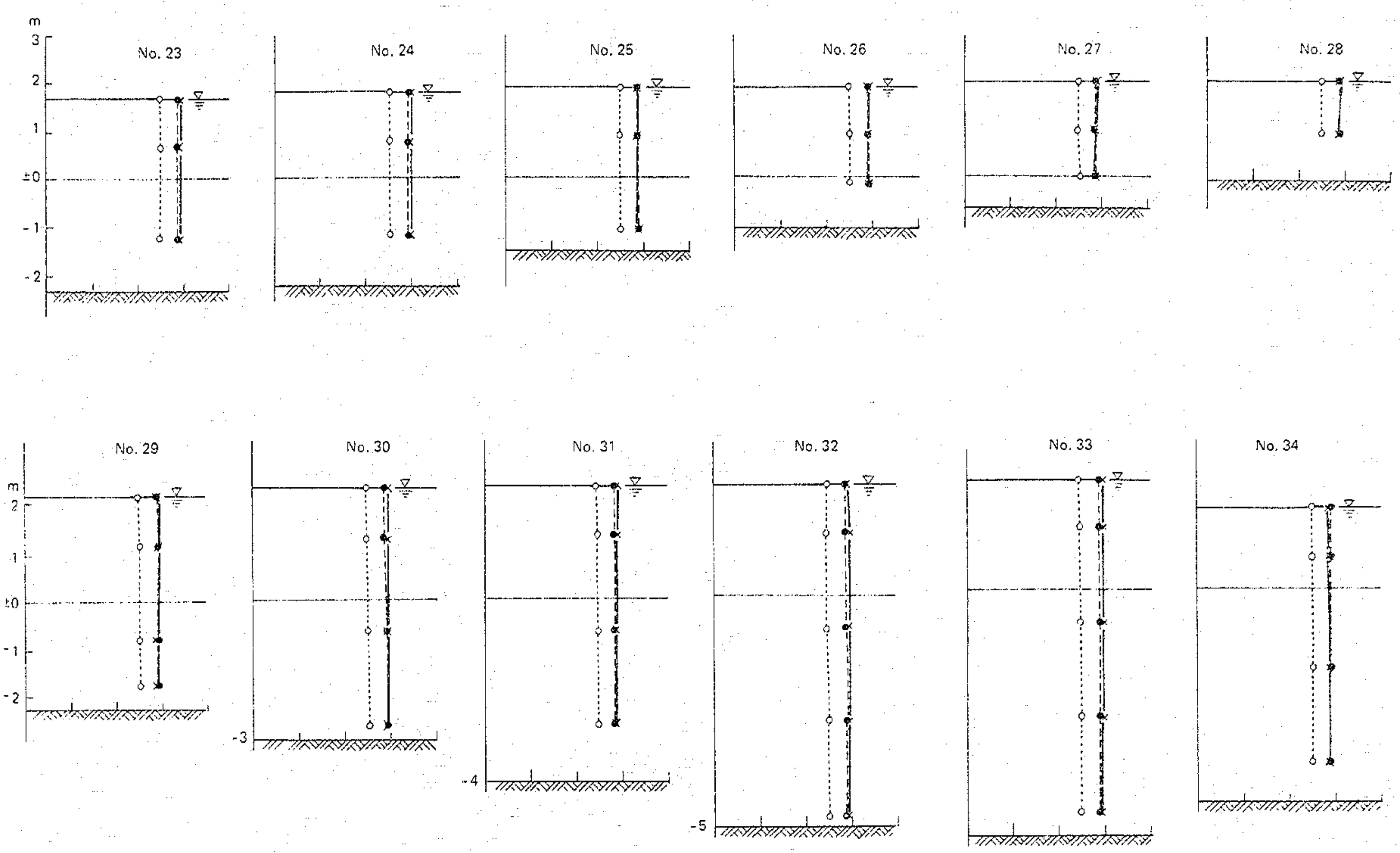
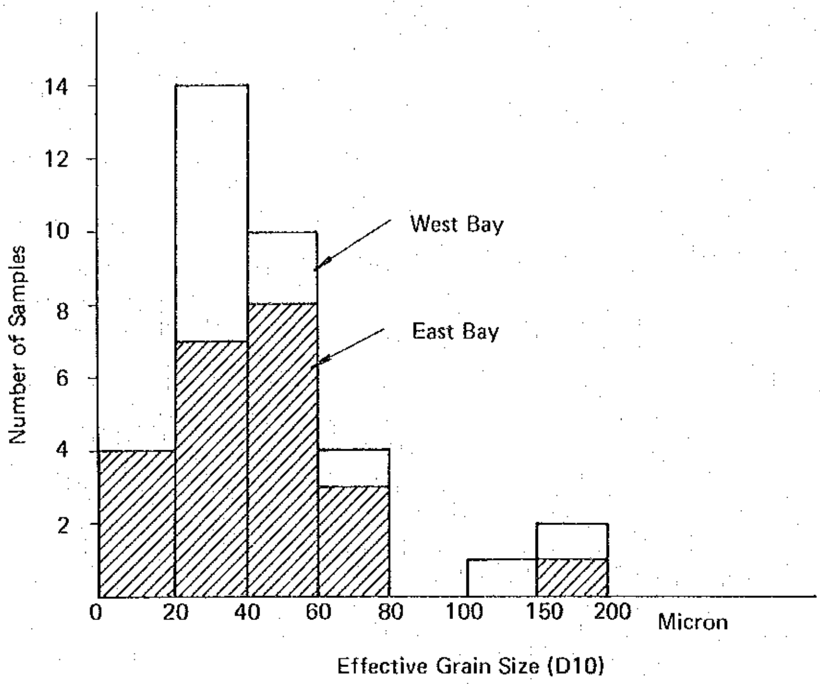


Fig. A-3 Distribution of Grain Size



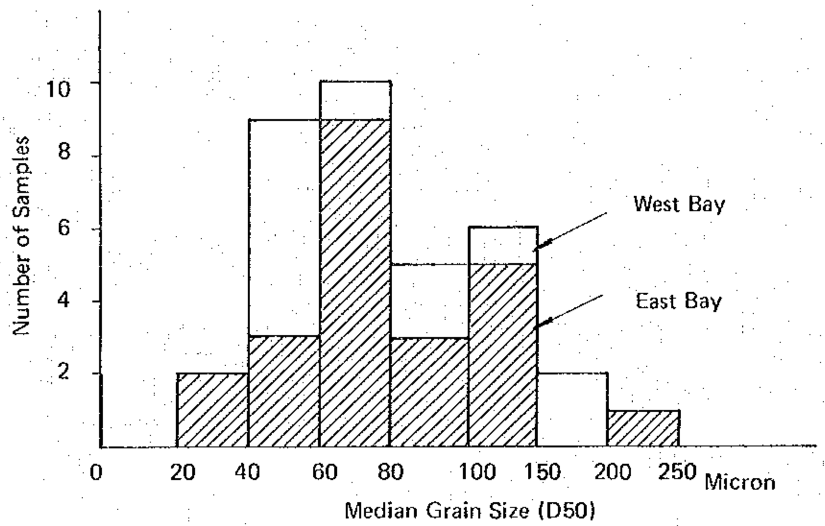


Fig. A-4 Distribution of Coefficient of Uniformity

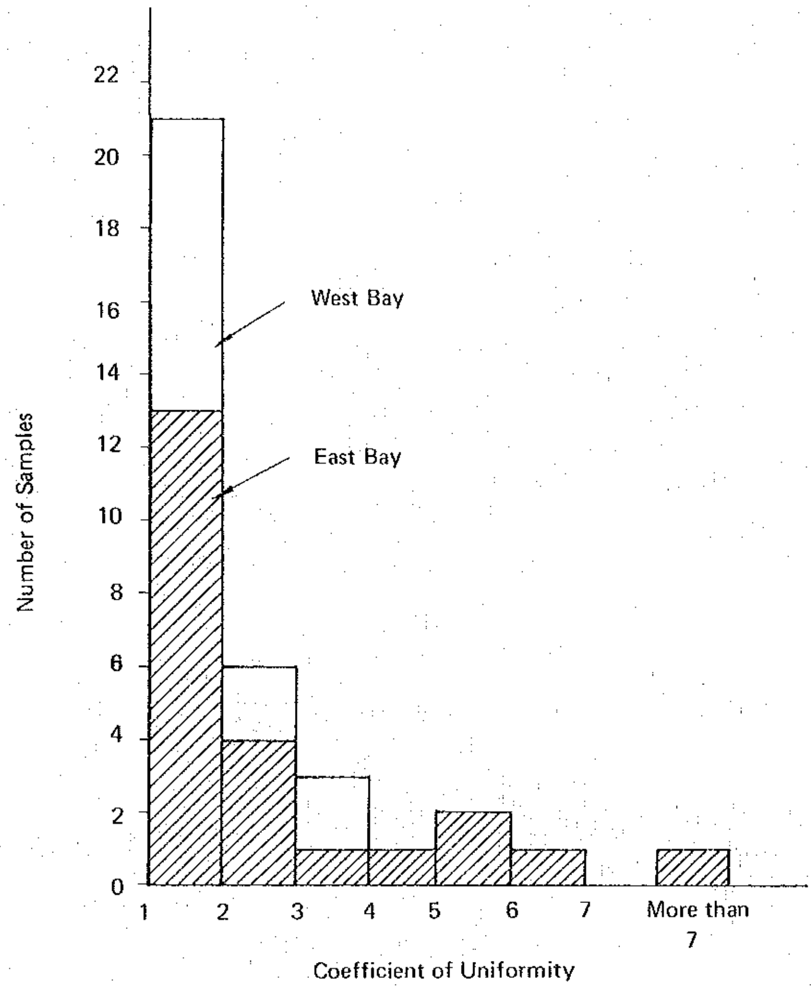
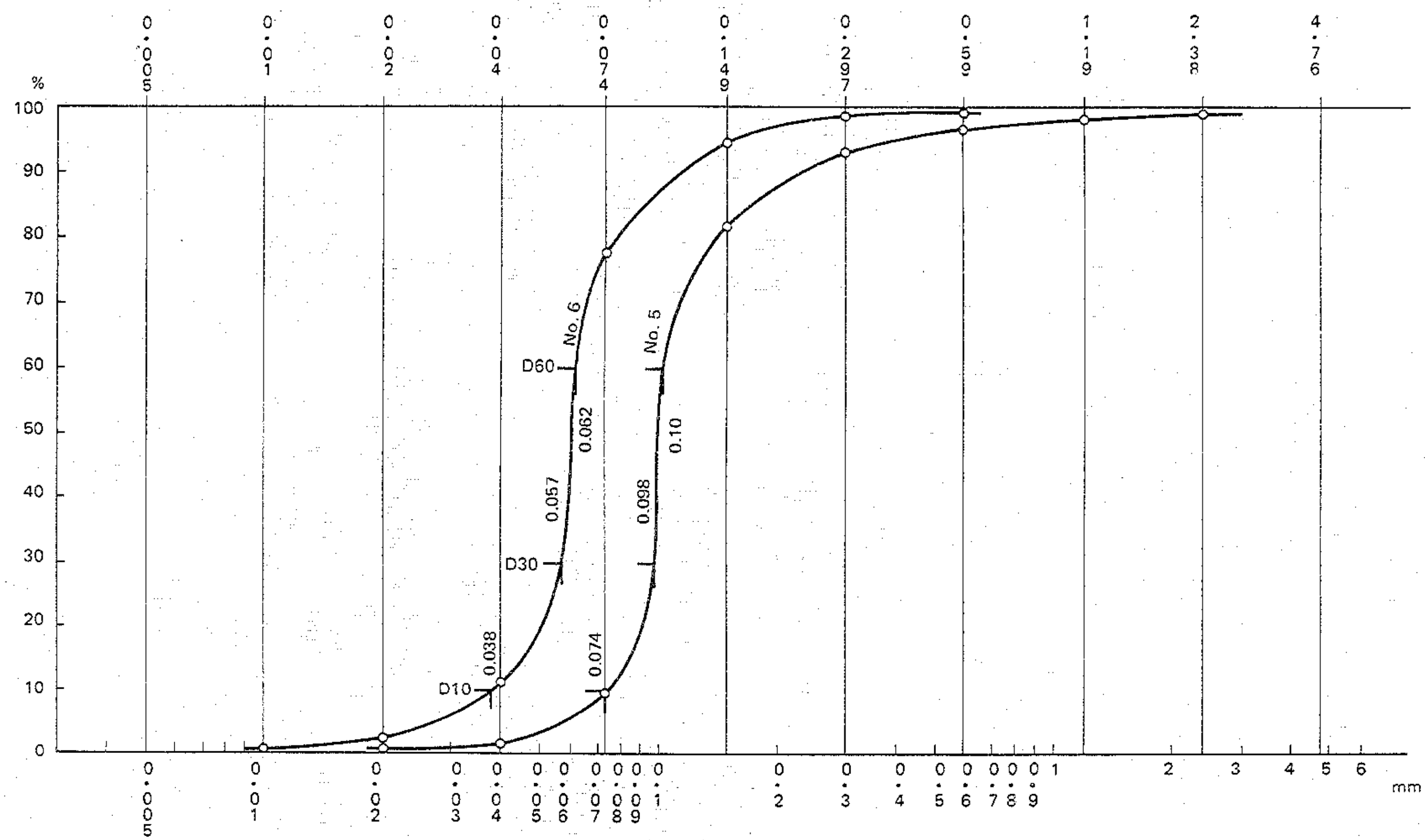


Fig. A-5   Typical Grain Size Percentage Curve



CLAY (PLASTIC) TO SILT (NON-PLASTIC)	SAND		
	FINE	MEDIUM	COARSE

No. 5

$$U_C = \frac{D60}{D10} = \frac{0.062}{0.038} = 1.63$$

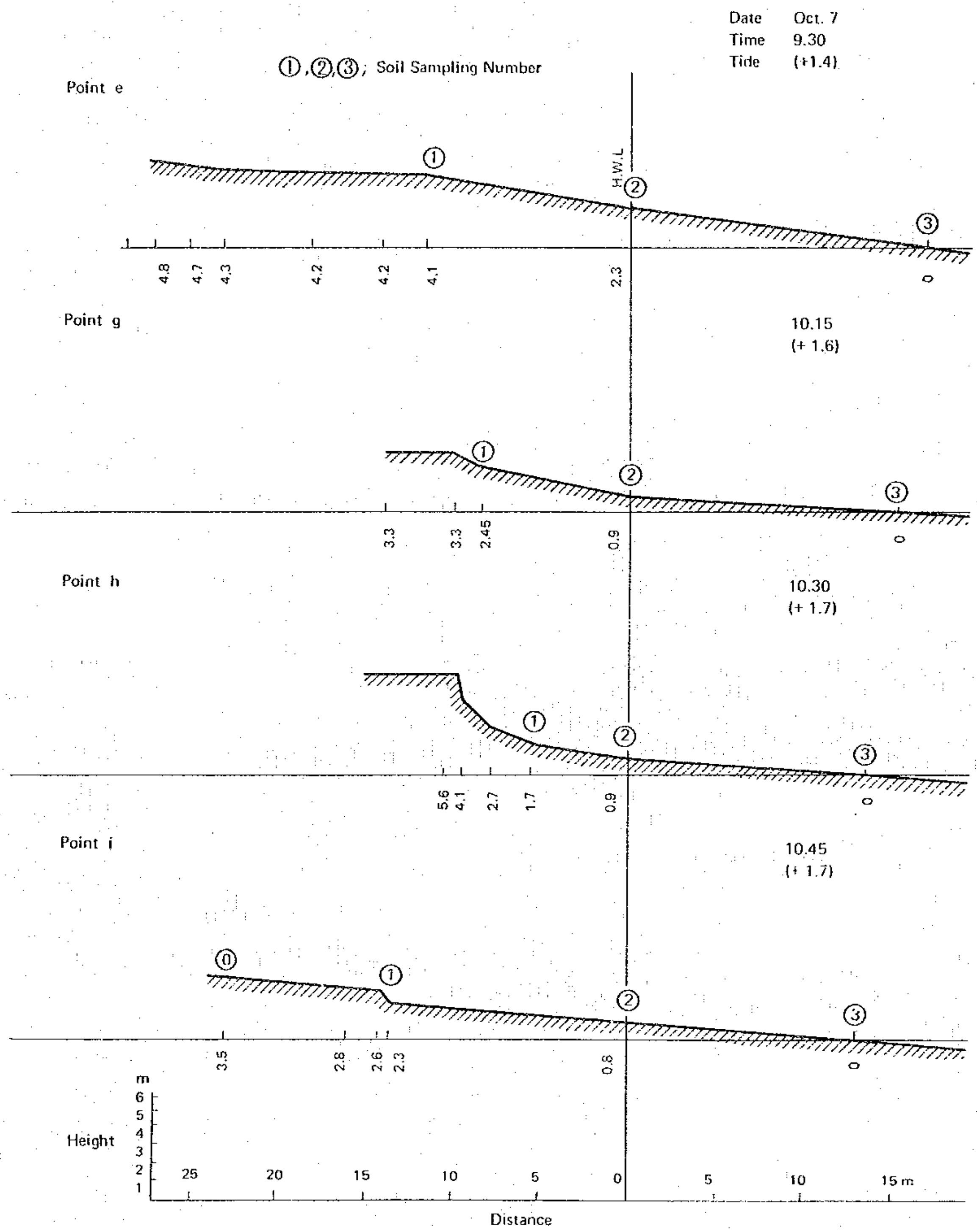
$$U'_C = \frac{(D30)^2}{D10.D60} = \frac{0.057^2}{0.038 \times 0.062} = 1.38$$

No. 6

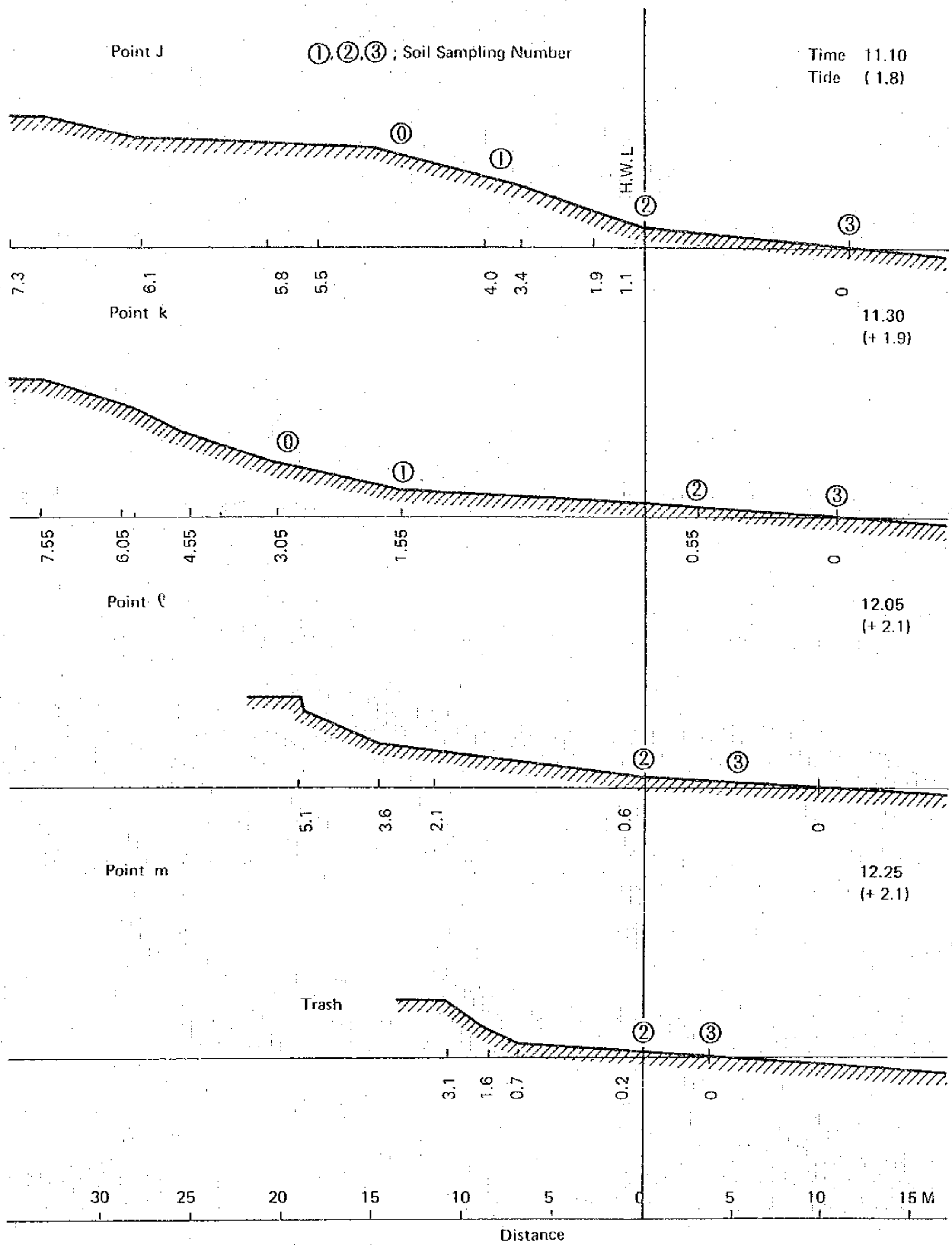
$$U_C = \frac{0.10}{0.074} = 1.35$$

$$U'_C = \frac{0.098^2}{0.074 \times 0.10} = 1.30$$

Fig. A-6 Beach Profil
East Bay (1)

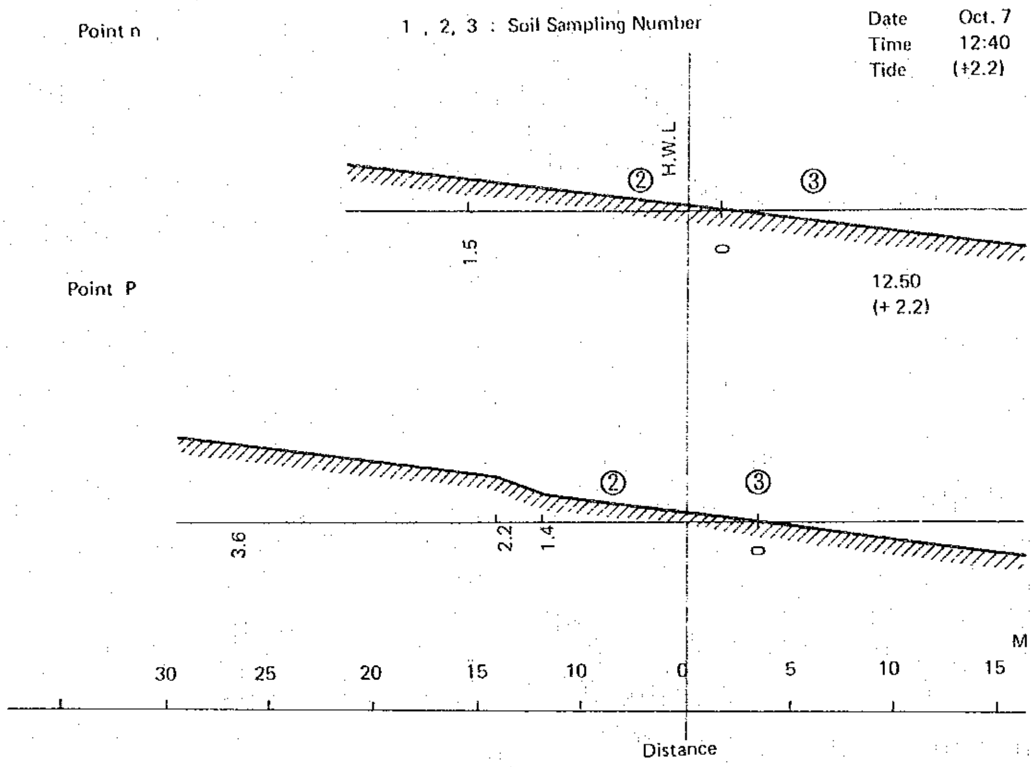


East Bay (2)

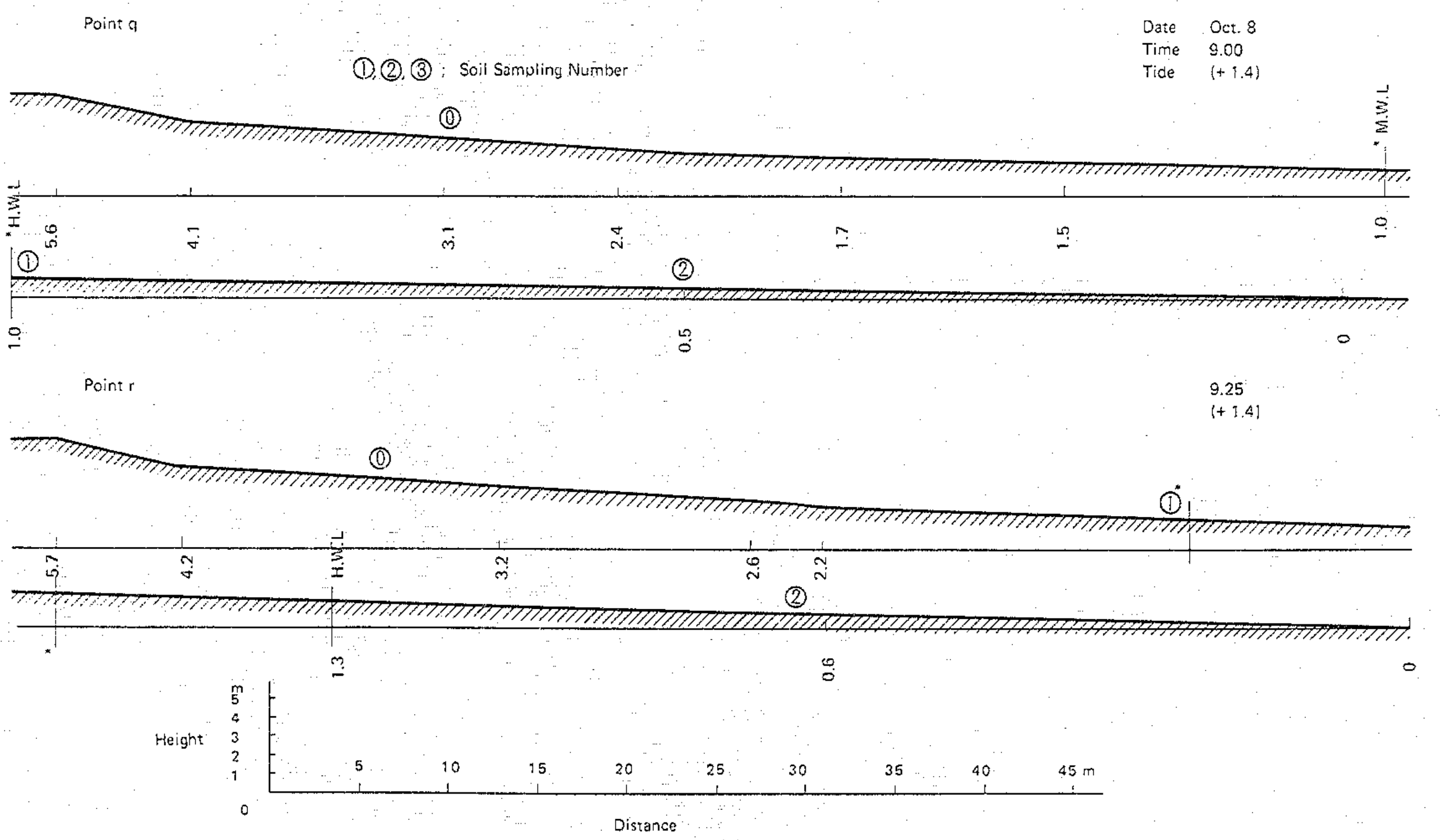


Point J
①,②,③ ; Soil Sampling Number
Time 11.10
Tide (1.8)
H.W.L
7.3
6.1
5.8
5.5
4.0
3.4
1.9
1.1
0
Point k
11.30
(+ 1.9)
7.55
6.05
4.55
3.05
1.55
0.55
0
Point ℓ
12.05
(+ 2.1)
5.1
3.6
2.1
0.6
0
Point m
12.25
(+ 2.1)
Trash
3.1
1.6
0.7
0.2
0
30
25
20
15
10
5
0
5
10
15 M
Distance

East Bay (3)

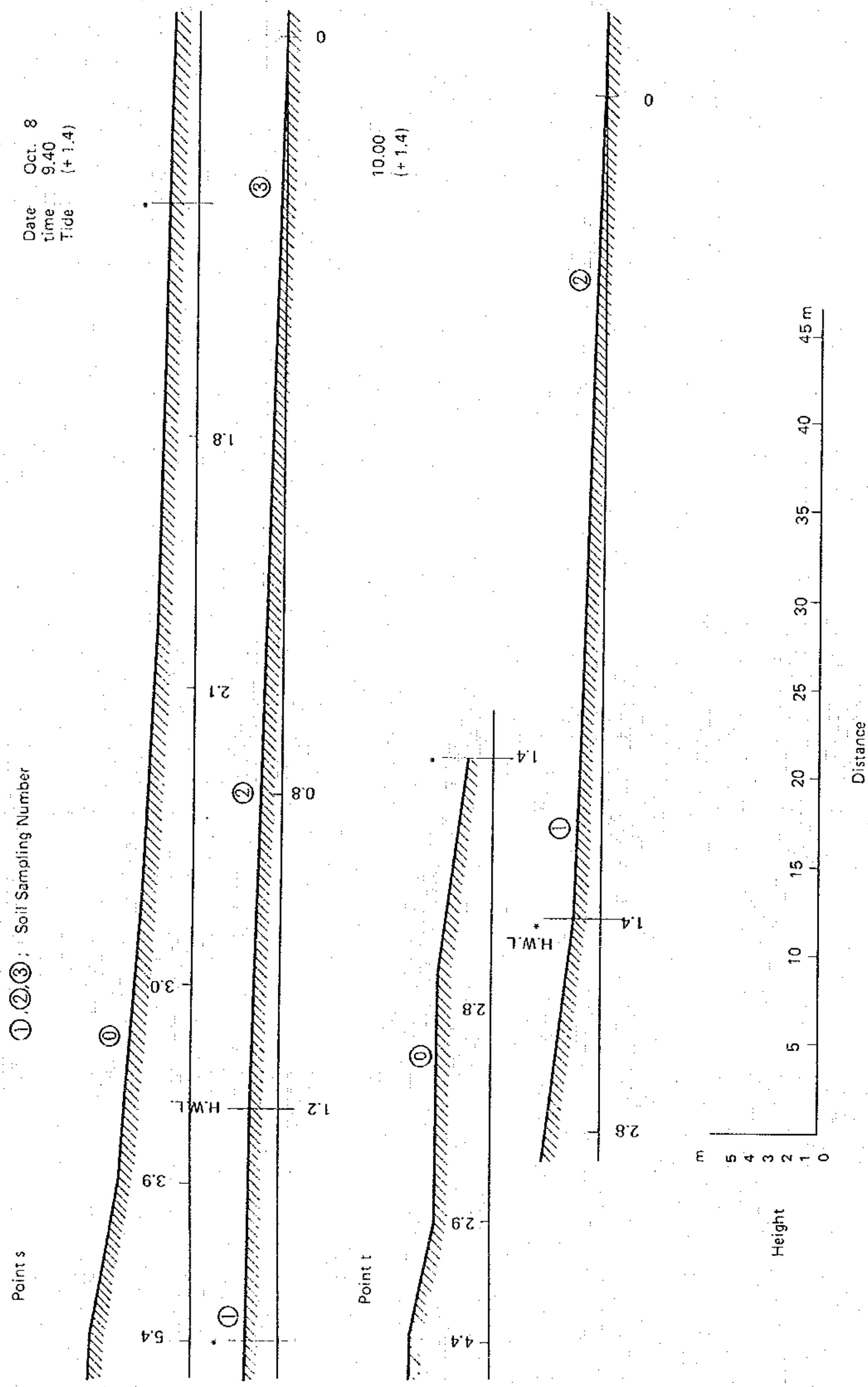

Point n
1 , 2, 3 : Soil Sampling Number
Date Oct. 7
Time 12:40
Tide (+2.2)
H.W.L
②
③
1.5
0
12.50
(+ 2.2)
Point P
②
③
3.6
2.2
1.4
0
M
30
25
20
15
10
0
5
10
15
Distance

West Bay (1)



Point q
①,②,③ ; Soil Sampling Number
Date Oct. 8
Time 9.00
Tide (+ 1.4)
* M.W.L
* H.W.L
5.6
4.1
3.1
2.4
1.7
1.5
1.0
1.0
0.5
0
Point r
9.25
(+ 1.4)
5.7
4.2
H.W.L
3.2
2.6
2.2
1.3
0.6
0
Height
5 m
4
3
2
1
0
5
10
15
20
25
30
35
40
45 m
Distance

West Bay (2)


①②③ : Soil Sampling Number
Point s
Date Oct. 8
time 9.40
Tide (+1.4)
Point t
10.00
(+1.4)
H.W.L.
5.4
3.9
3.0
2.1
1.8
1.2
0.8
4.4
2.9
2.8
1.4
0
Height
m
Distance
45 m

West Bay (3)

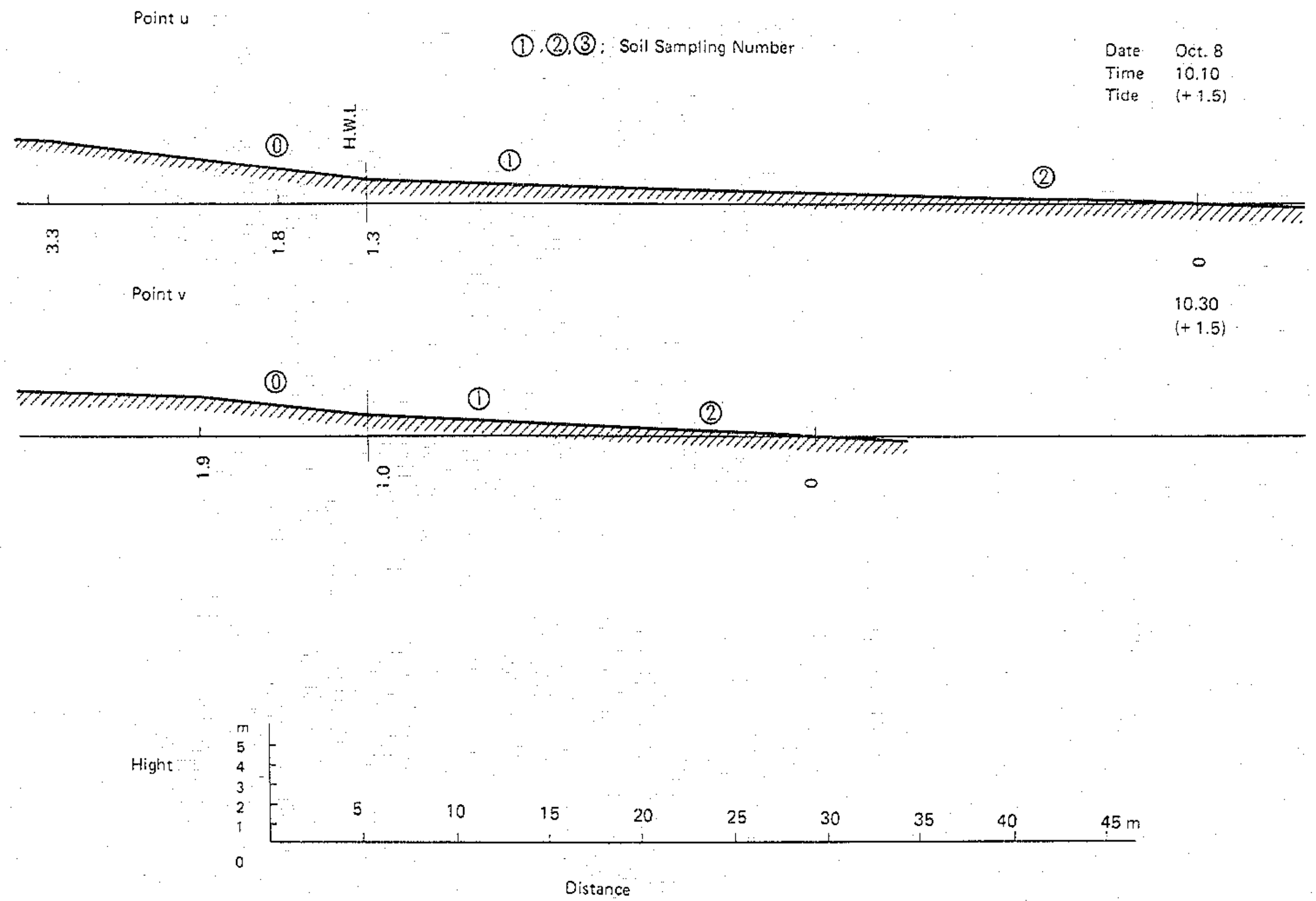

Point u
①,②,③; Soil Sampling Number
Date Oct. 8
Time 10.10
Tide (+1.5)
⓪
H.W.L
①
②
3.3
1.8
1.3
0
Point v
10.30
(+1.5)
⓪
①
②
1.9
1.0
0
Hight
m
5
4
3
2
1
0
5
10
15
20
25
30
35
40
45 m
Distance

Fig. A-7 Retreat of Cliff

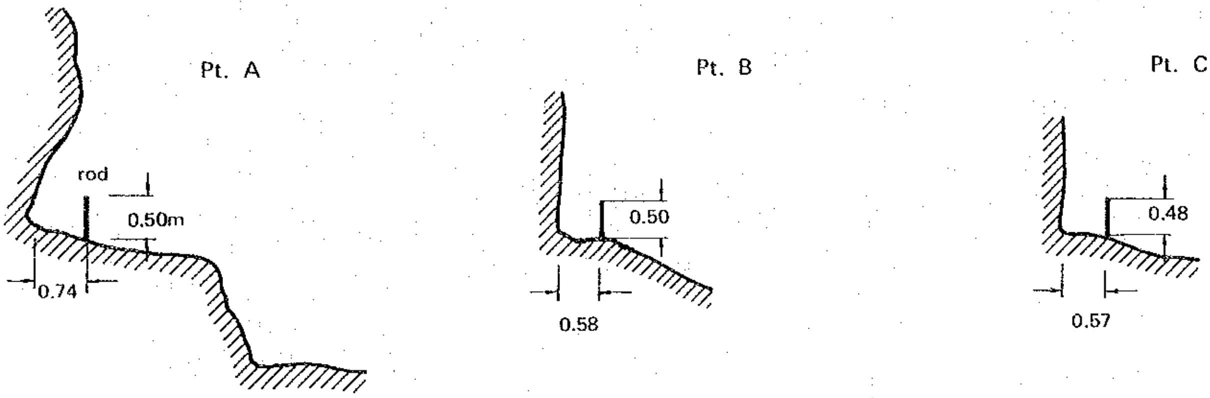


Fig. A-8 Current in Wave Breaking Zone

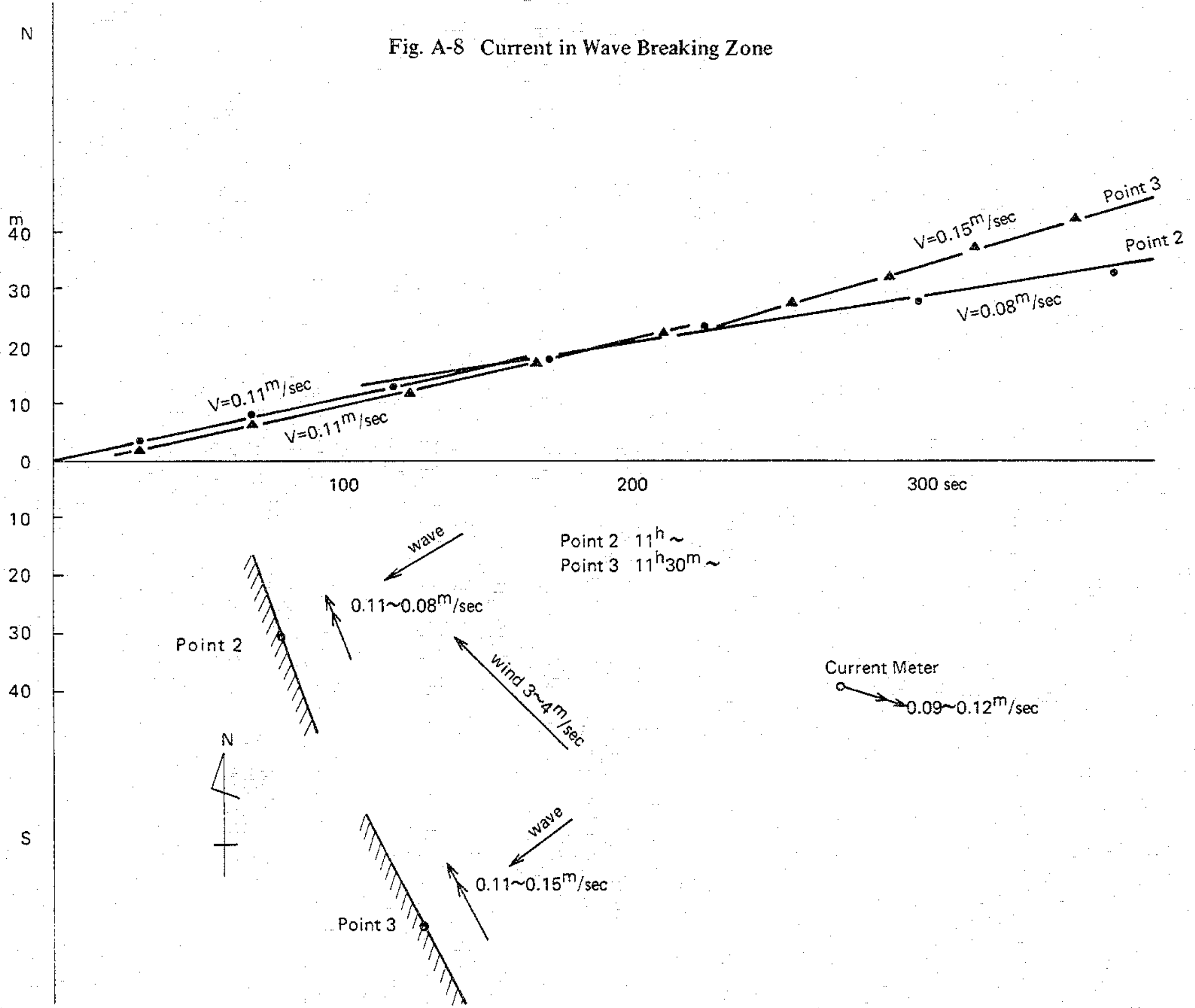
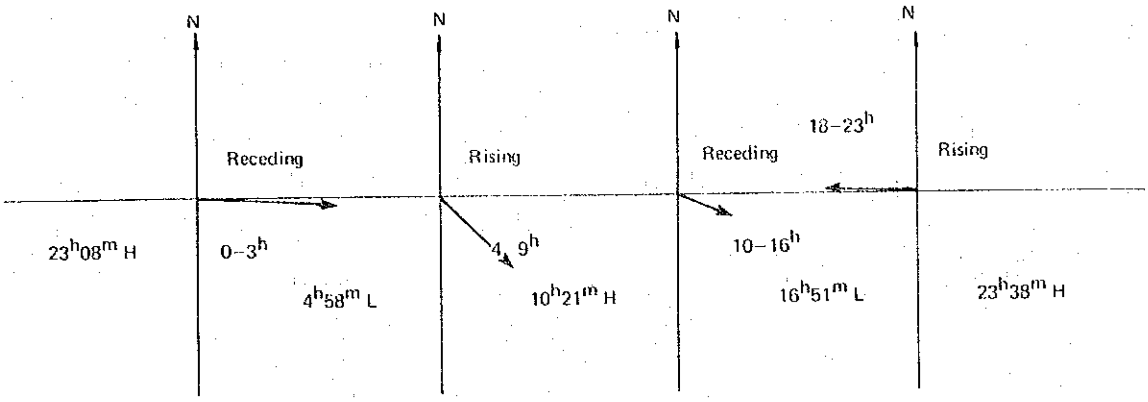


Fig. A-9 (1) Current Condition at Flood Tide (1)

13 Jan. 1979



Tide Level					
23h08m	H	2.8m	0h–3h	E	20~30cm/sec
4.58	L	1.2	4h–9h	SE	10~20cm/sec
10.21	H	2.4	10h–16h	ESE	5~15cm/sec
16.51	L	0.2	18h–23h	W	10~20cm/sec
23.38	H	2.9			

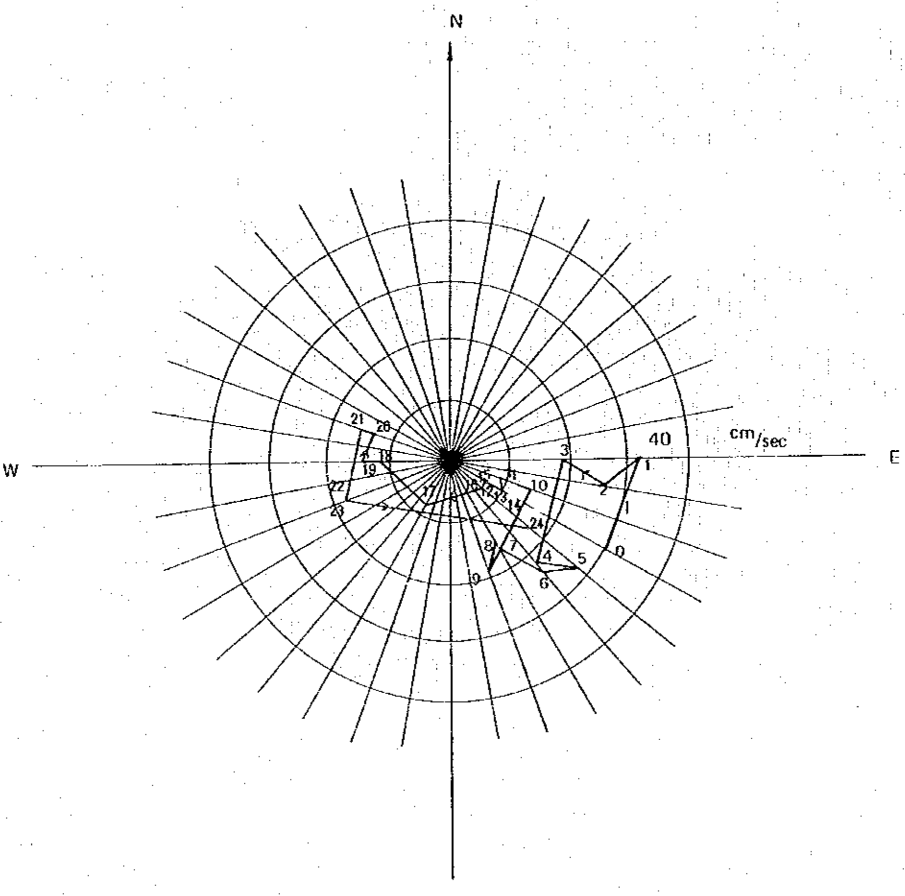
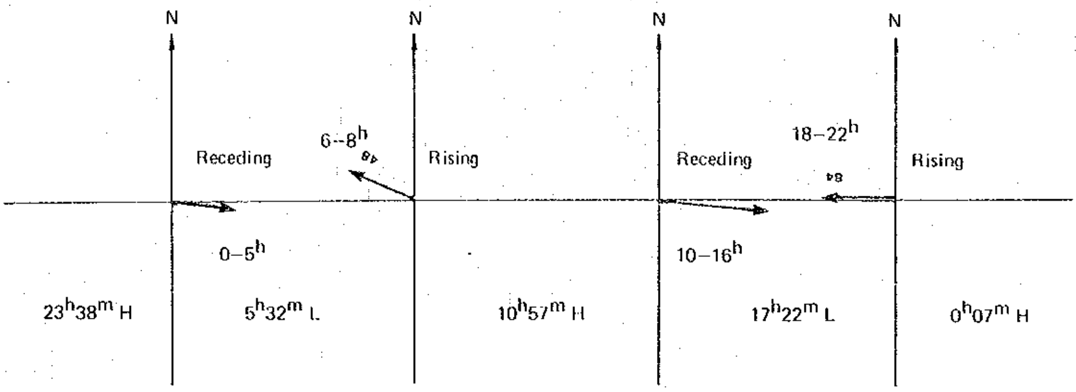


Fig. A-9 (2) Current Condition at Flood Tide (2)

14 Jan. 1979



Tide Level

23^h38^m	H	2.9^m	$0^h–5^h$	E	= $10^{cm}/sec$
5. 32	L	1.1	$6^h–8^h$	WNW	= $10^{cm}/sec$
10. 57	H	2.4	$10^h–16^h$	E	$15\sim25^{cm}/sec$
17. 22	L	0.2	$18^h–22^h$	W	$5\sim15^{cm}/sec$
0. 07	H	2.9			

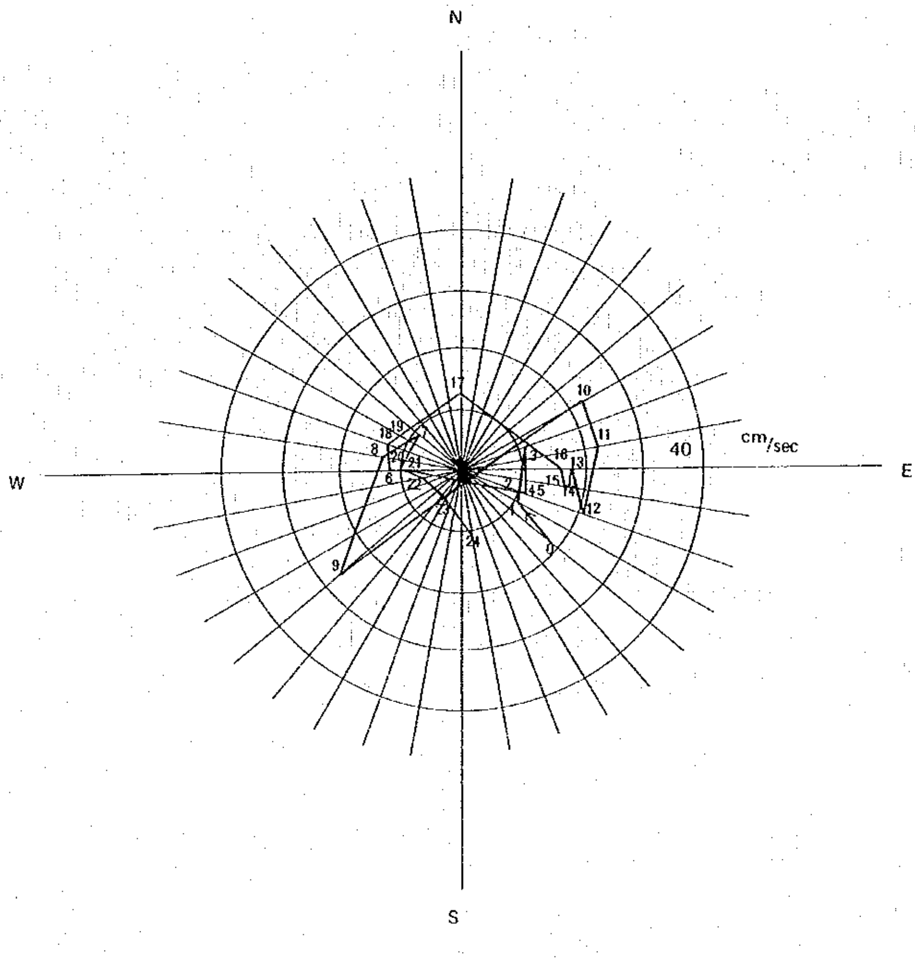
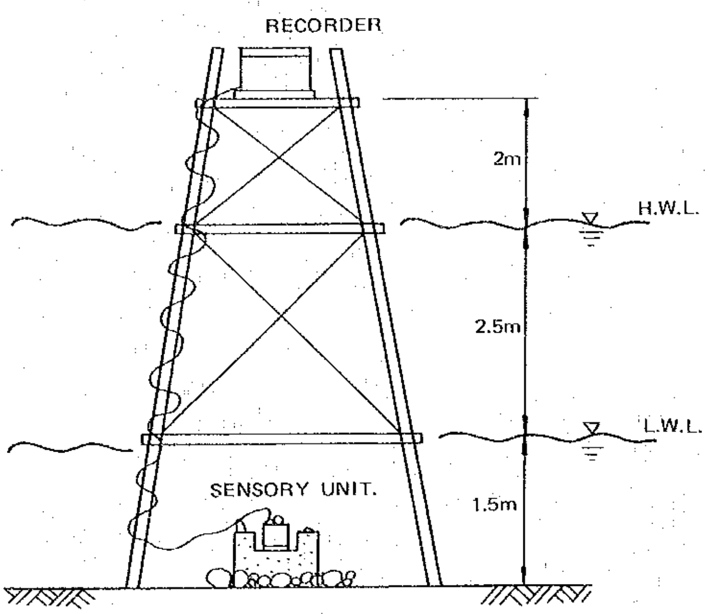


Fig. A-10 Tide Gauge



CONCRETE BLOCK

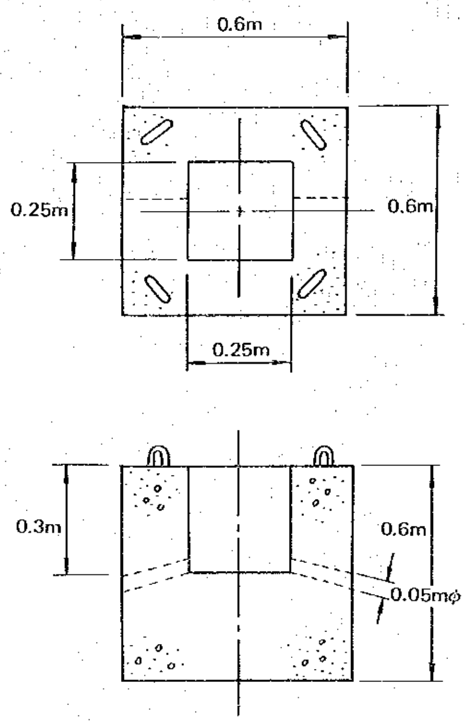


Fig. A-11 Vertical Distribution of Water Temperature and Density

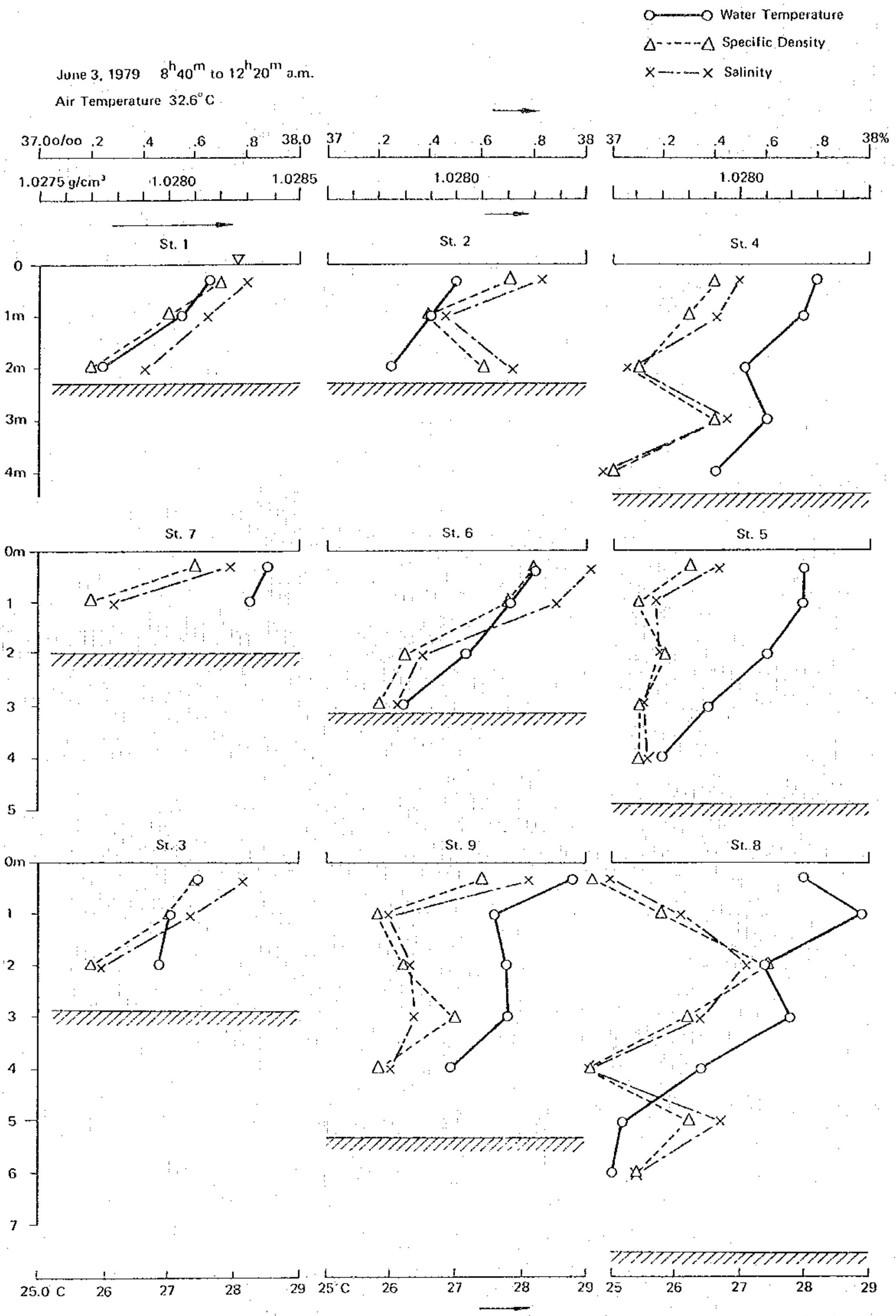


Fig. A-12 (1) Cross-sections of Cliffs

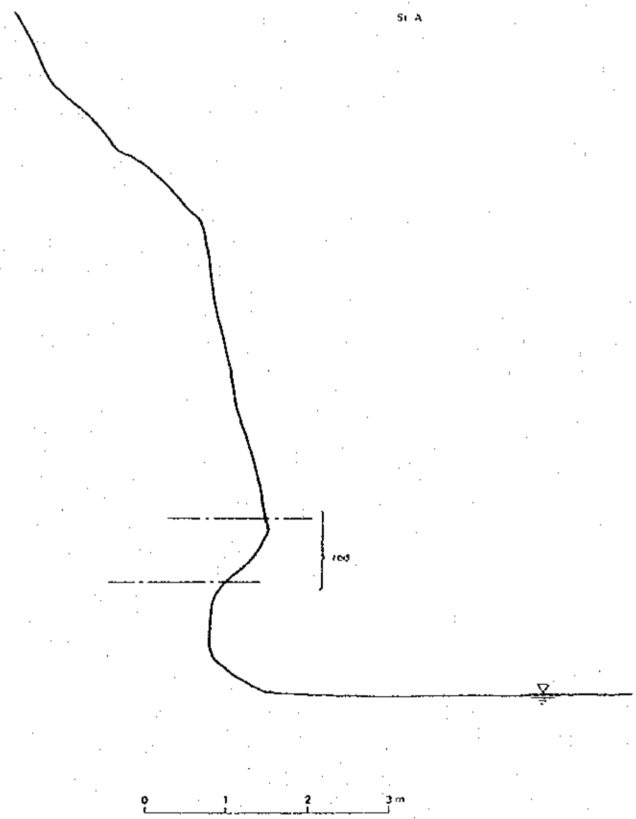


Fig. A-12 (2)

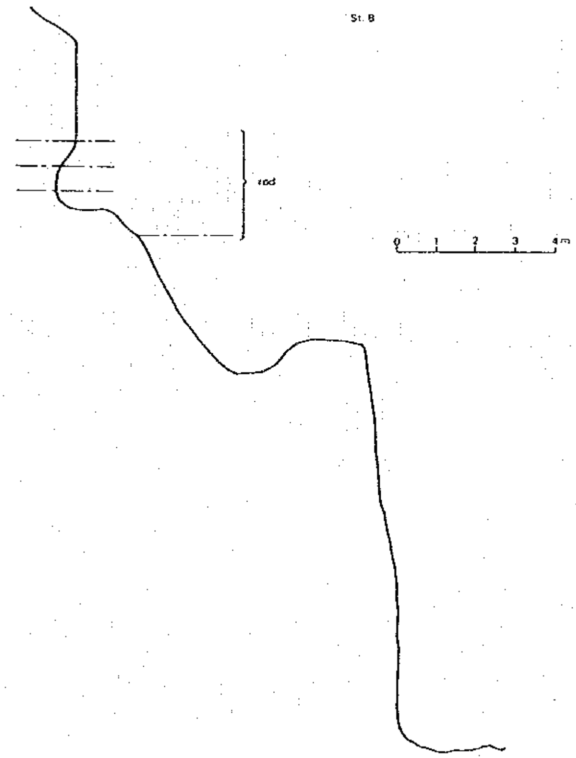


Fig. A-12 (3)

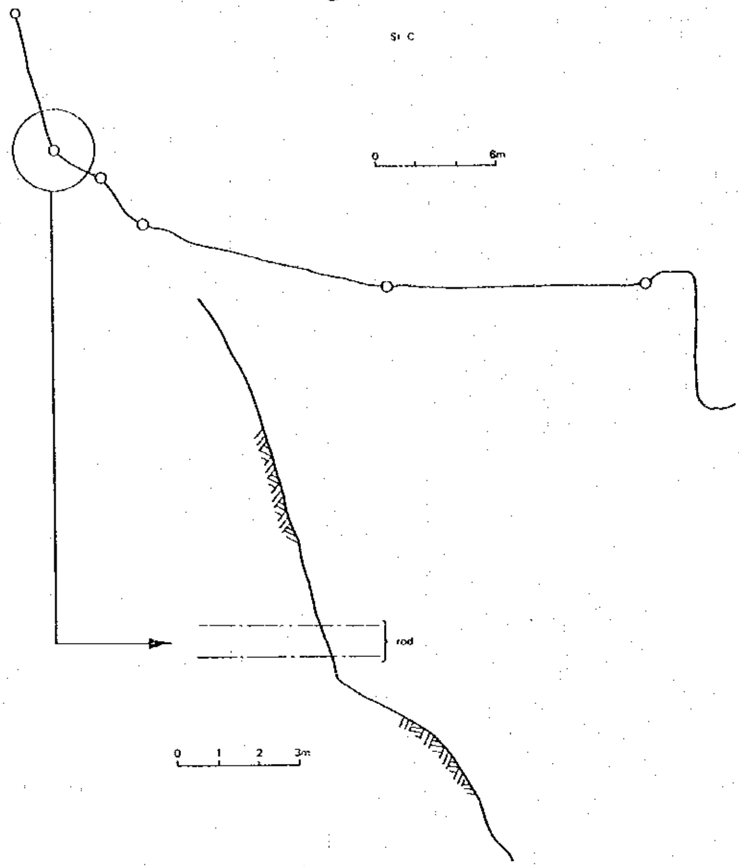


Fig. A-12 (4)

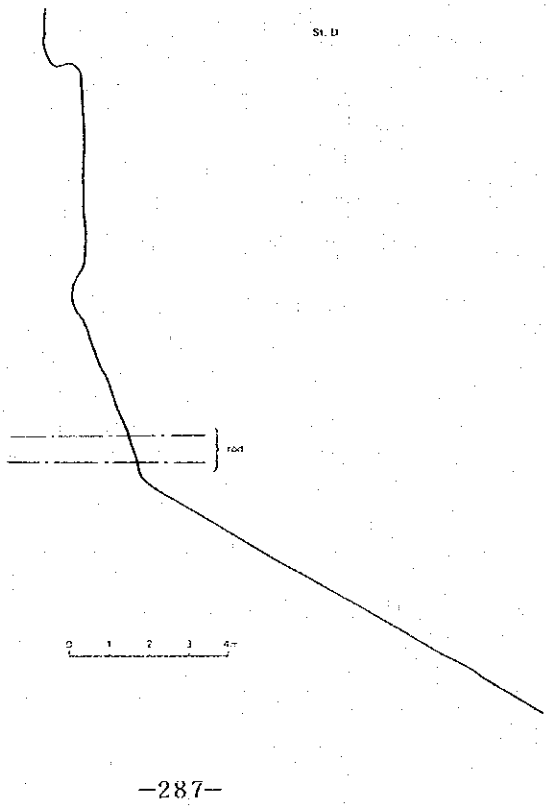


Fig A 13 2nd Survey at Phase II

June 29 to August 2, 1979

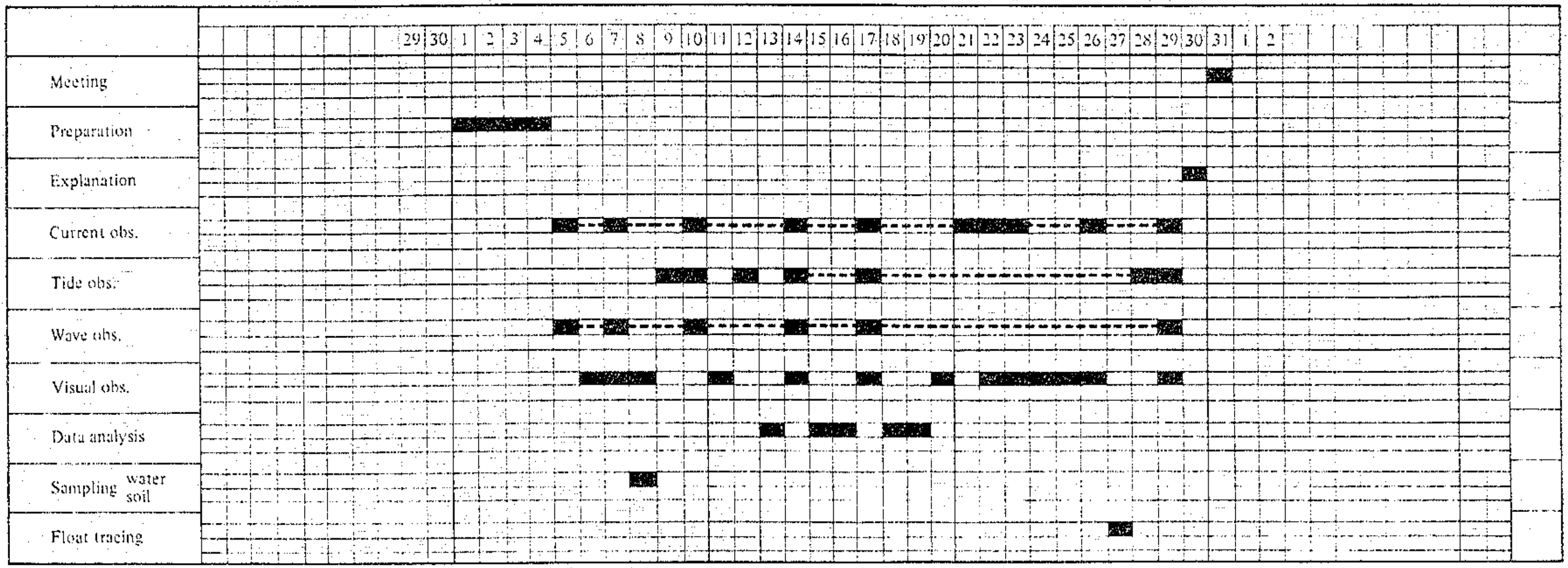


Fig. A-14 Cummulative Curle of Bed Material

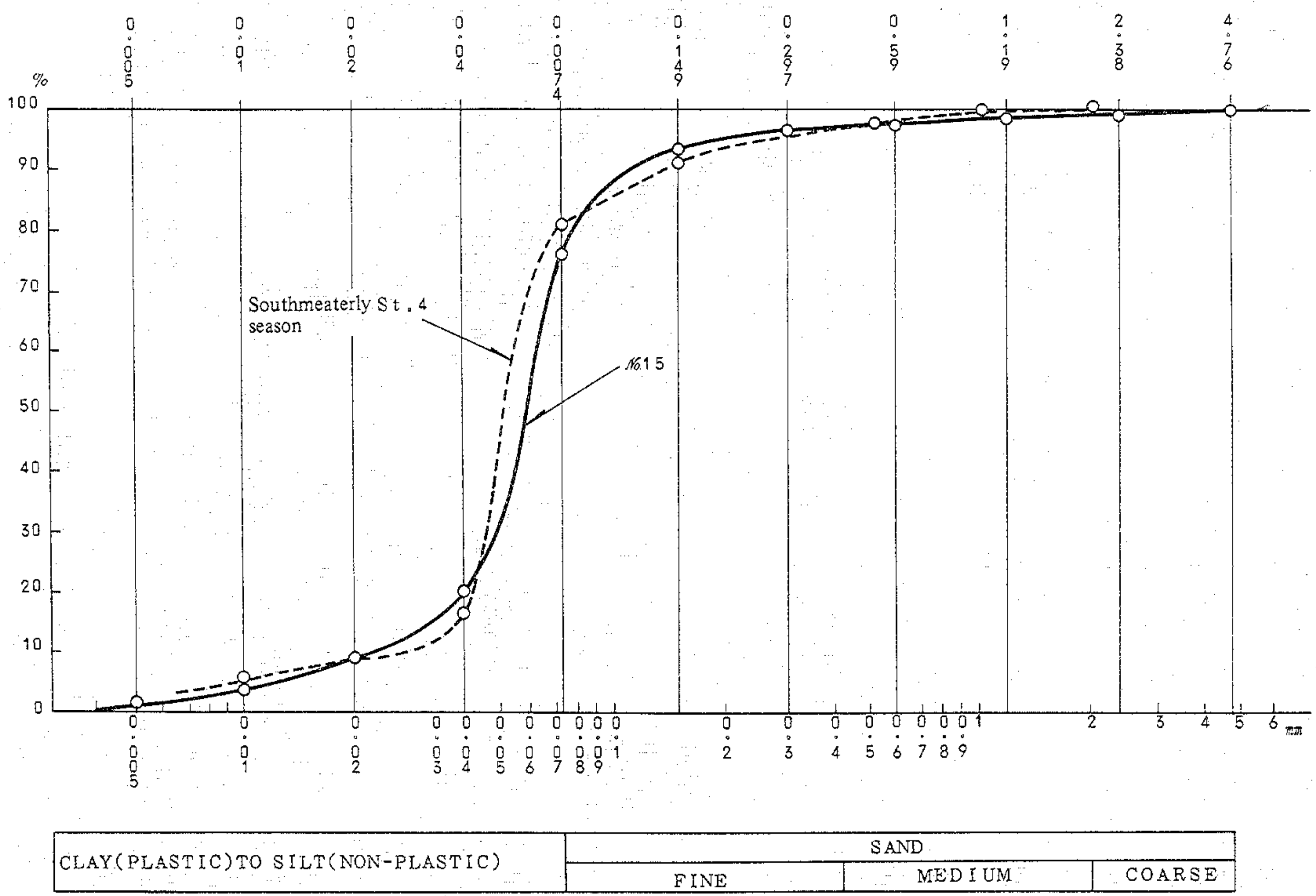


Table A-1 Tide Table (The Port of Karachi)

DATE TIME HEIGHT

	h m	m																											
1	0349	0.7	2	0423	0.7	3	0458	0.7	4	0534	0.7	5	0019	2.8	6	0100	2.7	7	0144	2.6	8	0236	2.5	9	0341	2.3	10	0503	2.3
SU	1009	2.7	M	1039	2.7	TU	1109	2.7	W	1140	2.7	TH	0611	0.8	F	0650	1.0	SA	0734	1.1	SU	0827	1.2	M	0937	1.4	TU	1106	1.3
	1612	0.6		1644	0.4		1717	0.3		1751	0.2		1210	2.7		1243	2.7		1318	2.5		1401	2.4		1459	2.2		1635	2.0
	2225	2.6		2302	2.7		2340	2.7					1828	0.1		1908	0.2		1953	0.3		2049	0.4		2200	0.6		2325	0.6

Note: Location Lat 24°48'N
Long 66°58'E

OCT. 1978

Table A-2 Water Temperature and Specific Gravity

(1) East Bay (1)

Point	Date & Time	Tide (m)	Water Depth (m)	Depth from Chart Datum (m)	Sampling Depth (m)	Water Temp. (°C)	Specific Gravity	S.G. at 15°C
	Oct. 2							
1	9.15	2.1	1.7	+0.4	1.0	24.5	1.0260	1.0285
2	9.55	2.2	2.2	±0	1.0	24.5	1.0258	1.0283
3	10.25	2.3	2.5	-0.2	1.0	23.3	1.0258	1.0280
					2.0	22.4	1.0258	1.0277
4	10.43	2.3	2.5	-0.2	0	24.3	1.0256	1.0281
					1.0	24.0	1.0257	1.0281
					2.0	23.0	1.0258	1.0279
5	11.00	2.3	2.5	-0.2	1.0	23.9	1.0257	1.0280
					2.0	23.3	1.0257	1.0279
6	11.25	2.4	4.2	-1.8	1.0	24.5	1.0255	1.0280
					3.0	22.9	1.0256	1.0276
					4.0	22.2	1.0260	1.0278
7	11.45	2.3	2.5	-0.2	1.0	25.8	1.0252	1.0281
					2.0	25.8	1.0250	1.0279
8	12.06	2.3	3.0	-0.7	1.0	25.9	1.0252	1.0281
					2.0	25.5	1.0255	1.0283
9	12.30	2.2	2.8	-0.6	1.0	26.2	1.0250	1.0280
					2.0	25.9	1.0251	1.0280
10	12.48	2.1	2.7	-0.6	1.0	25.9	1.0250	1.0279
					2.0	25.8	1.0251	1.0280
11	13.05	2.0	2.7	-0.7	1.0	26.4	1.0250	1.0281
					2.0	26.0	1.0250	1.0280
12	13.30	1.9	5.5	-3.6	1.0	26.5	1.0250	1.0281
					3.0	25.3	1.0253	1.0281
					5.0	22.3	1.0262	1.0281

(2) East Bay (2)

Point	Date & Time	Tide (m)	Water Depth (m)	Depth from Chart Datum (m)	Sampling Depth (m)	Water Temp. (°C)	Specific Gravity	S.G. at 15°C
13	16.30	0.8	1.5	-0.7	1.0	24.8	1.0256	1.0282
14	17.00	0.8	2.5	-1.7	1.0	24.1	1.0254	1.0278
					2.0	23.1	1.0259	1.0280
15	17.20	0.7	4.0	-3.3	1.0	24.0	1.0256	1.0280
					3.0	23.6	1.0260	1.0282
	Oct. 3							
16	8.25	1.6	5.1	-3.5	0	23.2	1.0260	1.0281
					1	23.4	1.0259	1.0281
					3	21.8	1.0262	1.0279
					4	21.8	1.0262	1.0279
17	8.54	1.8	6.1	-4.3	0	23.7	1.0261	1.0284
					1	23.4	1.0259	1.0281
					3	21.9	1.0262	1.0280
					5	21.8	1.0263	1.0280
18	9.40	2.0	9.8	-7.8	0	24.9	1.0253	1.0279
					1	24.8	1.0256	1.0282
					3	24.5	1.0258	1.0283
					5	21.7	1.0263	1.0280
					7	21.3	1.0264	1.0280
					9	21.8	1.0263	1.0280
19	10.05	2.2	10.0	-7.8	0	25.7	1.0253	1.0282
					1	25.4	1.0256	1.0284
					3	23.9	1.0258	1.0281
					5	21.8	1.0263	1.0280
					7	21.8	1.0264	1.0281
					9	21.4	1.0264	1.0280
20	10.35	2.3	10.2	-7.9	0	26.3	1.0251	1.0282
					1	25.8	1.0254	1.0283
					3	23.7	1.0258	1.0281
					5	21.8	1.0265	1.0282
					7	21.4	1.0264	1.0280
					9	21.4	1.0265	1.0281

(3) East Bay (3)

Point	Date & Time	Tide (m)	Water Depth (m)	Depth from Chart Datum (m)	Sampling Depth (m)	Water Temp. (°C)	Specific Gravity	S.G. at 15°C
21	11.05	2.4	9.0	-6.6	0	26.0	1.0252	1.0282
					1	25.9	1.0253	1.0282
					3	23.7	1.0258	1.0281
					5	21.8	1.0261	1.0278
					7	21.6	1.0262	1.0279
					9	21.5	1.0264	1.0280
22	11.30	2.3	8.0	-5.7	0	25.7	1.0252	1.0281
					1	23.9	1.0256	1.0279
					3	23.0	1.0259	1.0280
					5	21.8	1.0263	1.0280
					7	21.4	1.0262	1.0278
	Oct. 5							
37	12.10	2.4	9.2	-6.8	0	26.5	1.0252	1.0283
					1	24.3	1.0254	1.0279
					3	23.4	1.0255	1.0277
					5	23.0	1.0255	1.0276
					7	22.1	1.0260	1.0278
36	11.55	open	sea		0	29.5	1.0242	1.0283
	Oct. 4							
23	9.05	1.7	4.1	-2.4	0	29.3	1.0248	1.0289
					1.0	29.3	1.0248	1.0289
					3.0	29.6	1.0248	1.0290
24	9.30	1.8	4.1	-2.3	0	29.4	1.0248	1.0290
					1.0	29.3	1.0248	1.0288
					3.0	29.3	1.0249	1.0290
25	9.40	1.9	3.5	-1.6	0	29.4	1.0251	1.0292
					1.0	29.1	1.0249	1.0289
					3.0	28.9	1.0251	1.0290
26	9.55	1.9	3.0	-1.1	0	29.4	1.0248	1.0289
					1.0	29.2	1.0250	1.0290
					2.0	28.9	1.0250	1.0289

(4) West Bay (1)

Point	Date & Time	Tide (m)	Water Depth (m)	Depth from Chart Datum (m)	Sampling Depth (m)	Water Temp. (°C)	Specific Gravity	S.G. at 15°C
27	10.05	2.0	2.7	-0.7	0	29.2	1.0249	1.0289
					1.0	28.9	1.0246	1.0285
					2.0	28.6	1.0250	1.0288
28	10.20	2.1	2.1	±0	0	29.2	1.0250	1.0290
					1.0	28.6	1.0250	1.0288
29	10.45	2.2	4.5	-2.3	0	29.6	1.0247	1.0288
					1.0	29.0	1.0250	1.0290
					3.0	28.7	1.0250	1.0288
					4.0	28.8	1.0249	1.0288
30	11.00	2.3	5.3	-3.0	0	29.8	1.0247	1.0289
					1.0	29.3	1.0246	1.0286
					3.0	29.1	1.0249	1.0289
					5.0	29.0	1.0250	1.0290
31	11.15	2.3	6.2	-3.9	0	29.7	1.0247	1.0289
					1.0	29.5	1.0247	1.0288
					3.0	29.1	1.0248	1.0288
					5.0	28.9	1.0248	1.0287
32	11.33	2.3	7.2	-4.9	0	29.2	1.0246	1.0286
					1.0	29.7	1.0245	1.0287
					3.0	29.4	1.0246	1.0287
					5.0	29.3	1.0248	1.0288
					7.0	29.4	1.0248	1.0289
33	11.50	2.3	7.5	-5.2	0	30.0	1.0246	1.0289
					1.0	30.2	1.0245	1.0289
					3.0	30.0	1.0247	1.0290
					5.0	29.9	1.0248	1.0291
					7.0	29.7	1.0247	1.0289
34	Oct. 5 9.40	1.7	6.2	-4.5	0	28.5	1.0250	1.0288
					1.0	28.8	1.0250	1.0289
					3.0	28.5	1.0251	1.0289
					5.0	28.3	1.0250	1.0287

(5) West Bay (2)

Point	Date & Time	Tide (m)	Water Depth (m)	Depth from Chart Datum (m)	Sampling Depth (m)	Water Temp. (°C)	Specific Gravity	S.G. at 15°C
35	10.10	open	sea		0	30.2	1.0240	1.0283

Table A-3 Conversion Table for Specific Gravity of Sea Water

B / A	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	m
0°	28.08	28.07	28.07	28.06	28.06	28.05	28.04	28.04	28.03	28.03	0.951
1°	28.02	28.01	28.01	28.00	28.00	27.99	27.99	27.98	27.97	27.97	0.985
2°	27.96	27.96	27.95	27.94	27.92	27.92	27.91	27.90	27.89	27.88	0.960
3°	27.87	27.87	27.86	27.85	27.84	27.83	27.82	27.81	27.80	27.79	0.963
4°	27.78	27.77	27.76	27.75	27.74	27.72	27.71	27.70	27.69	27.68	0.967
5°	27.67	27.66	27.65	27.64	27.63	27.61	27.60	27.59	27.58	27.57	0.970
6°	27.56	27.55	27.53	27.52	27.51	27.50	27.48	27.47	27.46	27.44	0.973
7°	27.43	27.41	27.40	27.38	27.37	27.35	27.34	27.32	27.31	27.30	0.976
8°	27.28	27.26	27.25	27.23	27.22	27.20	27.19	27.17	27.16	27.15	0.980
9°	27.13	27.11	27.10	27.08	27.07	27.05	27.03	27.02	27.00	26.98	0.983
10°	26.97	26.95	26.93	26.92	26.90	26.88	26.86	26.84	26.83	26.81	0.986
11°	26.79	26.77	26.75	26.74	26.72	26.70	26.68	26.66	26.65	26.62	0.980
12°	26.61	26.59	26.57	26.55	26.53	26.51	26.49	26.47	26.45	26.43	0.992
13°	26.41	26.39	26.37	26.35	26.33	26.31	26.29	26.27	26.25	26.23	0.995
14°	26.21	26.19	26.17	26.15	26.13	26.10	26.08	26.06	26.04	26.02	0.997
15°	26.00	25.98	25.95	25.93	25.91	25.88	25.86	25.84	25.82	25.79	1.000
16°	25.77	25.75	25.72	25.70	25.68	25.65	25.63	25.61	25.59	25.56	1.003
17°	25.54	25.52	25.49	25.47	25.45	25.42	25.40	25.38	25.35	25.33	1.005
18°	25.30	25.27	25.25	25.22	25.20	25.17	25.14	25.12	25.09	25.07	1.007
19°	25.04	25.01	24.99	24.96	24.94	24.91	24.88	24.86	24.83	24.80	1.009
20°	24.78	24.75	24.73	24.70	24.68	24.65	24.62	24.60	24.57	24.51	1.011
21°	24.52	24.49	24.47	24.44	24.41	24.39	24.36	24.33	24.30	24.28	1.013
22°	24.25	24.22	24.19	24.16	24.13	24.10	24.08	24.05	24.02	23.99	1.015
23°	23.96	23.93	23.90	23.87	23.81	23.82	23.79	23.76	23.73	23.70	1.018
24°	23.67	23.64	23.61	23.58	23.55	23.53	23.50	23.47	23.43	23.40	1.020
25°	23.38	23.35	23.32	23.29	23.26	23.23	23.20	23.17	23.14	23.11	1.022
26°	23.09	23.06	23.03	23.00	22.95	22.93	22.90	22.87	22.84	22.81	1.024
27°	22.78	22.75	22.72	22.68	22.65	22.62	22.59	22.56	22.53	22.50	1.026
28°	22.46	22.43	22.39	22.36	22.33	22.29	22.26	22.23	22.20	22.16	1.027
29°	22.13	22.10	22.06	22.03	22.00	21.96	21.93	21.90	21.87	21.84	1.029
30°	21.80	21.77	21.72	21.70	21.67	21.63	21.60	21.57	21.54	21.50	1.031

Notes: The conversion table may be used as follows:

P_{15} may be obtained by the equation below.

$P_{15} = (g - g')m + 1.026$

Here, g – specific gravity obtained at the site.

g' – specific gravity of standard sea water t°C obtainable from the table.

m – figure on the right end.

1.026 – a constant.

Thus, if the gravimeter reading is 1.0250 (g) at 25.7°,

1) we find at the intersection of 25° on A and 0.7° on B 23.17, i.e., 1.02317 (g').
   $g - g' = 1.0250 - 1.02317 = 0.00183$
2) after obtaining 1.022 on m corresponding to 25°, computation by the above equation may be made, thus, $\sigma\ 15 = 0.00183 \times 1.022 + 1.026 = 1.02787$

Source: The Oceanographical Observation.

Table A-4 Air and Water Temperature

Date	Time	Air Temperature	Water Temperature (°C) (1m below Water Surface)
Oct.2	12°15′	29.0°C	26.0
	13°30′	30.8°C	26.5
	16°30′	29.0°C	24.8
3	8°05′	26.0°C	23.4
	10°05′	27.3°C	25.4
	10°30′	27.8°C	25.8
	11°10′	31.3°C	25.5
4	9°00′	29.8°C	29.3
	10°45′	31.8°C	27.0
	11°50′	31.1°C	30.2

1978

Table A-5 Test Results of Rock Samples at Gwadar

26 OCT. '78

Sample No.	Size	Sectional Area in Sq. inches	Dial Reading (Division)	Compressive Strength In P.S.I.	Compressive Strength (kg/cm^2) In tons/sq. ft.	Location
R-1	L = 1.5″ B = 1.5″ H = 3.5″	2.25	97	325.48	(25.2) 23.4	Headland
R-2	L = 1.6″ B = 1.6″ H = 3.6″	2.56	352	1038.12	(84.4) 74.72	Headland
R-3	L = 0.75″ B = 0.75″ H = 2.5″	0.56	4	53.92	(4.2) 3.88	Cliff-A
R-4	L = 1.7″ B = 1.7″ H = 2.25″	2.89	140	365.74	(28.3) 26.3	Cliff-B
R-5	D = 2.5″ L = 2.5″	4.9	160	246.53	(19.1) 17.75	Cliff-C

L: Length, B: Breadth, H: Height, D: Diameter

Table A-6 Tide Table

Karachi, Pakistan, 1979

Times and Heights of High and Low Water

January

Day	Time	Height	
	h.m.	ft.	m.
8	0022	4.9	1.5
M	0607	7.9	2.4
	1329	1.3	0.4
	2035	7.5	2.3
9	0147	4.9	1.5
Tu	0712	7.5	2.3
	1422	1.0	0.3
	2124	8.2	2.5
10	0252	4.9	1.5
W	0810	7.5	2.3
	1505	0.7	0.2
	2203	8.5	2.6
11	0342	4.6	1.4
Th	0900	7.5	2.3
	1543	0.3	0.1
	2237	9.2	2.5
12	0422	4.3	1.3
F	0943	7.9	2.4
	1618	0.3	0.1
	2308	9.2	2.8
13	0453	3.9	1.2
Sa	1021	7.9	2.4
	1651	0.7	0.2
	2338	9.5	2.9
14	0532	3.6	1.1
Su	1057	7.9	2.4
	1722	0.7	0.2
15	0007	9.5	2.9
M	0604	3.6	1.1
	1130	7.9	2.4
	1752	1.0	0.3

Table A-7 Water Temperature and Specific Gravity

9, Jan. 1979

Point	Time	Water Depth (m)	Sampling Depth (m)	Temp. °C	Specific Gravity	S.G. at 15°C	Note
1	9:40~	1.2	0	23.0	1.0262	1.0283	
			1	23.0	262	283	
2	9:55~	1.7	0	22.7	266	286	
			1	22.5	262	281	
3	10:05~	1.7	0	22.7	266	286	
			1	22.5	262	281	
4	10:20~	2.1	0	22.7	264	284	
			1	22.7	260	280	
			2	22.4	260	279	
5	10:35~	4.0	0	23.0	264	285	
			1	22.9	256	276	
			3	22.8	258	278	
6	10:50~	3.3	0	23.2	262	283	
			1	23.1	260	281	
			3	22.9	258	278	
7	11:00~	1.9	0	23.2	262	283	
			1	23.1	259	280	
8	11:10~	2.8	0	23.2	260	281	
			1	23.2	260	281	
			2	23.0	258	279	
9	11:25~	4.5	0	23.5	260	282	
			1	23.5	258	280	
			2	23.0	258	279	
			4	22.9	259	279	
10	11:40~	5.4	0	23.5	260	282	
			1	23.2	256	277	
			3	23.0	258	279	
			5	23.1	258	279	

Table A-8 Schedule of 1st Survey at 2nd Phase (May 25 to June 7)

Date	
May 25 (Fr)	Transfer from Tokyo to Karachi
26 (Sa)	Interim report to the Consulate General of Japan and the Ports and Shipping Wing
27 (Su)	Meeting at the Ports and Shipping Wing
28 (Mo)	Transfer from Karachi to Islamabad Interim report to the Embassy of Japan (KOH) Data collection at Karachi. Construction material (KATAOKA)
29 (Tu)	Transfer from Islamabad to Karachi (KOH) Data collection at Karachi Tide table, marine chart (KATAOKA)
30 (We)	Transfer from Karachi to Gwadar Check of instruments Discussion on Survey schedule
31 (Th)	Site survey at Gwadar Bench mark S.O.P. and control points Adjustment of current meter Settlement of anemometer
June 1 (Fr)	Site survey at Gwadar Settlement of current meter Observation of water temperature
2 (Sa)	Site survey at Gwadar Check of current meter Preparation for the settlement of tide gauge
3 (Su)	Site survey at Gwadar Soil sampling Water sampling Removal of current meter Settlement of measuring pole for the retreat of cliff.
4 (Mo)	Site survey at Gwadar Removal of anemometer Preparation of wave observation Transfer from Gwadar to Karachi
5 (Tu)	Meeting at the Ports and Shipping Wing
6 (We)	Report to the Consultate General of Japan
7 (Th)	Transfer from Karachi to Tokyo

Table A-9 Comparison of Tide Levels

Tidal Levels at Standard and Secondary Ports

Standard Port	L.A.T.	M.L.L.W.	M.H.L.W.	M.S.L.	M.L.H.W.	M.H.H.W.	H.A.T.	Year of tidal Observation
Karachi	-1.4	+1.4	+3.6	+5.4	+7.2	+ 8.8	+10.5	1950, 1953.
Md. Bin Qasim Port Ent.	-1.9	+1.8	+4.0	+5.7	+7.4	+ 9.6	+11.3	1972, 1973.
Md. Bin Qasim Port Pipri	-2.0	+3.2	+4.7	+6.7	+8.7	+11.1	+13.0	1972, 1973.
Gwadar	-1.4	+1.5	+2.9	+4.2	+5.5	+ 6.9	+ 8.0	1972.

The above levels, in feet, are referred to CHART DATUM, which is the same as the Zero of the tidal predictions in all cases.

Table A 10 Harmonic Constants

Time and Height Differences and Harmonic Constants for Predicting the Tide at Secondary Ports

No.	Place	Position		Time Differences		Mean Heights (In Feet)				Reference
	Standard Port	Lat.	Long.	MHW	MLW	HHW	LHW	LLW	HLW	
4322	KARACHI			8.0	2.8	8.8	7.2	1.4	3.6	
	Standard Port	N	E	h. m.	h.m.		Height Difference			
	PAKISTAN			(Zone–0500)						
	Makran coast									
4314	Chahbar bay	25 16	60 37	+0040	*	–0.2	–0.5	*	*	a
4315	Gwatar bay	25 09	61 30	+0035	*	–0.6	–0.8	*	*	a
4317	Pasni	25 12	63 30	+0013	+0013	–0.2	+0.2	+1.3	+1.0	
4319	Ormara	25 11	64 41	–0008	–0010	–1.8	–1.3	–0.5	–0.2	
4321	Sonmiani harbour	25 23	66 33	–0050	*	–0.6	0.0	*	*	a
	Indus river delta									
4322	KARACHI (ENTRANCE)	24 48	66 58	Standard Port						
4323	Hajambro mouth	24 06	67 19	0000	*	+0.5	+0.9	*	*	
4324	Sir mouth	23 40	68 07	+0005	*	+1.1	+1.6	*	*	
	MUHAMMAD BIN			MHW	MLW	HHW	LHW	LLW	HLW	a
4325	QASIM PORT ENTRANCE			8.5	2.9	9.6	7.4	1.8	4.0	a
	MUHAMMAD BIN			MHW	MLW	HHW	LHW	LLW	HLW	
4326	QUASIM PORT PIPRI			9.9	3.5	11.1	8.7	2.3	4.7	
4327	GWADAR	25 11	62 22	–0049	–0101	–1.9	–1.7	+0.1	–0.7	

a Data approximate.
† Time differences approximate.
** Seasonal changes not known, but they are probably greater than those given for coastal ports.
x M.L. inferred.
* No data.

Harmonic Constants

No.	M.L. Z_0 ft.	Harmonic Constants								Reference
		M_2		S_2		K_1		O_1		
		g°	H.ft.	g°	H.ft.	g°	H.ft.	g°	H.ft.	
				(Zone–0500)						
4314	5.3	*	*	*	*	*	*	*	*	x
4315	5.1	*	*	*	*	*	*	*	*	x
4317	6.0	311	2.4	342	0.8	051	0.9	056	0.7	
4319	4.5	301	2.3	336	0.8	055	1.4	052	0.6	
4321	5.3	*	*	*	*	*	*	*	*	x
4322	5.4	308	2.6	344	1.0	056	1.3	052	0.7	
4323	6.0	*	*	*	*	*	*	*	*	x
4324	6.5	*	*	*	*	*	*	*	*	x
4325	5.7	308	2.8	346	1.1	055	1.3	049	0.7	
4326	6.7	319	3.2	003	1.2	062	1.4	049	0.7	
4327	4.2	282	2.0	314	0.7	047	1.4	036	0.6	

Table A-11 Schedule of 2nd Survey at 2nd Phase
(June 29 to August 2)

Date			
June	29 (Fr)		Transfer from Tokyo to Karachi (14:30 JI 473)
	30 (Sa)		Meeting at the Consultate General of Japan and the Ports and Shipping Wing
July	1 (Su)		Meeting at the Ports and Shipping Wing
	2 (Mo)		Transfter from Karachi to Gwadar. Unpacking, check of instruments (13:00 PK515)
	3 (Tu)		Site survey at Gwadar
	4 (We)	1.	Preparation for observation
	5 (Th)	2.	Settlement/resettlement of wave gauge, current meter and tide gauge
	6 (Fr)	3.	Observation of current, littoral and eolian sand and breaker
	7 (Sa)	4.	Sampling of soil and water
	8 (Su)	5.	Measurement of cliff
	9 (Mo)	6.	Removal of wave gauge, current meter and tide gauge
	10 (Tu)	7.	Data analysis
	11 (We)	8.	Check and cleaning of instruments
	12 (Th)		
	13 (Fr)		
	14 (Sa)		
	15 (Su)		
	16 (Mo)		
	17 (Tu)		Transfer from Gwadar to Karachi (Koh & Kataoka) (15:30 PK502)
	18 (We)		Transfer from Karachi to Gwadar (Koh & Kataoka) (14:00 PK527)
	19 (Th)		
	20 (Fr)		
	21 (Sa)		
	22 (Su)		
	23 (Mo)		
	24 (Tu)		
	25 (We)		
	26 (Th)		
	27 (Fr)		
	28 (Sa)		
	29 (Su)		
	30 (Mo)		
	31 (Tu)		Transfer from Gwadar to Karachi (15:30 PK502)
August	1 (We)		Report to the Consulate General of Japan and the Ports and Shipping Wing
	2 (Th)		Transfer from Karachi to Tokyo (6:30 SR306)

Table A-12 Seasonal Changes in Mean Level

No.	Jan. 1	Feb. 1	Mar. 1	Apr. 1	May 1	June 1	July 1	Aug. 1	Sep. 1	Oct. 1	Nov. 1	Dec. 1
4315–4327	0.0	–0.1	–0.2	0.0	+0.2	+0.3	+0.2	0.0	–0.1	–0.2	–0.1	0.0

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