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Committee II

REPORT ON BALLASTING INVESTIGATIONS

Submitted by Norway

Attached hereto for information is a document by Norway on Investigation of weather and ballast conditions at beginning and end of ballast voyages for large crude oil tankers.

Distribution of the attachment (in English) is limited to this Committee only.

CONTENTS.

INVESTIGATION OF WEATHER AND BALLAST CONDITIONS AT BEGINNING AND END OF BALLAST VOYAGES FOR LARGE CRUDE OIL TANKERS

1. Introduction.

A study of weather and ballast conditions has been conducted by NSFI in cooperation with Norwegian Shipowners Association and 5 shipping companies.

The aim of the study is to retrieve information about the amount of ballast carried and the ballasting practices of several ships of different sizes during the first three days and the last three days of the ballast voyages. These periods at the beginning and at the end of the ballast voyages are considered to be of special importance with regard to tank cleaning and ballast discharge.

Data from log books of several ships have been collected concerning sea state, wind strength, and amount of ballast carried. These data cover several years of ship operation, although concentrated in time to recent years.

The data on ballast practices will not disclose the minimum amount of ballast which could have been used under the prevailing conditions, but they will at least indicate what has been considered sufficient.

The sea and wind data should make it possible to evaluate the probabilities of meeting conditions where a large ballast capacity will be required, although the data can not be considered sufficient to yield a true statistical basis.

The study does not generate fundamental information about how much ballast should be carried under different environmental conditions.

2. Data Collection.

Records of sea state, wind strength and amount of ballast carried, covering the three first and the three last days of ballast voyages, have been collected from 18 tankers of different sizes as specified in table I.

TABLE I
CRUDE OIL TANKERS INVESTIGATED

Tanker Size approx. t.dw.	Number of ships	Record Ship-years
100.000	3	12.2
160.000	2	5.5
200.000	2	6.2
220.000	8	10.6
280.000	3	4.9

Thus the collected data represent 39.4 ship-years of operation in the period from January 1968 until May 1973.

No attemp has been made to select special trades as records were sought for typical world wide operation. As the data have been submitted from only 5 different shipping companies they may not reflect a normal distribution of tanker trade.

The trade distribution for these ships is indicated in Table II where ports of call are listed.

The total number of port calls is 554 and the data thus cover 1662 days of operation or 9972 sea watches.

The data have been collected from the log books of the ships and the records of sea and wind states are based on the personal judgement of the officer of the watch without use of any special instruments.

A sample of the data collection sheet is shown on page 8.

TABLE II
PORTS OF CALL

Ports of Discharge	Number of Calls
AIOI	1
ANGLE BAY	9
ANTWERP	1
BANTRY BAY	4
BRUNSBUTTELKOOGI	1
CANAPORT	1
CHIBA	6
DURBAN	1
EUROPORT	4
FINNART	8
FOS SUR MER	6
FAWLEY	1
FREEPORT	2
GENOA	4
GOTHENBURG	3
HONOLULU	1
IMMINGHAM	1
ISLE OF GRAIN	3
IWAKUN	3
KAWASAKI	2
KIIRE	42
KIMITSU	1
KISHIMA	1
KITITSU	2
LAVERA	3
LE HAVRE	6
LE VERDON	1
LISBOA	2
MARSEILLES	2
MILAZZO	2
MILFORD HAVEN	3
MITZUSHIMA	3
NEGISHI	12
OITA	1
PEMBROKE	1
POINT TUPPA	1
POINTE A PIERE	1
PORTO TORRES	2
QUINTERO BAY	1
RICHMOND	4
RIO DE JANEIRO	1
ROTTERDAM	47
SAKAI	1
SAN FRANCISCO	1
SAO SEBASTIAO	3
SASEBO	1
SAVONA	2
SINGAPORE	1
SLAGENTANGEN	1
SOUTHAMPTON	1
STAVANGER	1
TARANTO	1
TRAMANDAL	1
TRIESTE	4
TRINIDAD	1
TUTUNCIFTLIK	3
UBE	8
WULSAN	4
WILHELMSHAFEN	8
YOKAICHI	23
YOKOHAMA	8
YOSU	1
SEEBRUGGE	2

Ports of Loading	Number of Calls
BAHRAIN	1
DAS ISLAND	9
DUMAI	2
ES SIDER	1
SAMARALDAS	1
FORCADOS	1
HALUL ISLAND	3
JEBEL DHANNA	8
KHARG ISLAND	90
KHOR AL AMAYA	3
LAVAN ISLAND	2
MENA AL AHMADI	50
MINA AL FAHAL	6
RAS TANURAH	75
RAS AL KHAFJI	9
RAS LANUF	11
TUBARAO	2
UMM SAID	2
VITORIA	1

3. Sea State and Wind Strength.

The records of sea state and wind strength, as observed onboard the 18 ships over 9972 sea watches, have been analysed and the results are presented in figures 1 - 6, one figure for each of the first and the last three days of ballast voyages.

The diagrams show the occurrence of sea state and wind strength equal to or less than any chosen combination of these as a percentage of the watches recorded.

Thus, referring to fig. 1, a sea state equal to or less than 3 with wind strength equal to or less than 5 may be read from the diagram as having occurred on 62% of the watches. Correspondingly, a sea state equal to or less than 7 with wind strength equal to or less than 8, has occurred on 99% of the watches or, in this case, in 1647 out of 1662 watches.

As may be seen from figs. 1, 2 and 3 the sea and wind conditions do not change significantly from the first to the third day after port of discharge. The occurrence of sea state 7 or less for each of these days has been very close to 99% of the watches. Wind strengths up to 12 have been reported on the first day, up to 11 on the second and up to 9 on the third day.

Generally, over-all conditions are better during the last three days on the ballast voyage, as may be seen when comparing figs. 1 - 3 with figs. 4 - 6. The difference between fig. 3 and 4 is not so great, but the last two days are considerably better. The occurrence of sea state 8 has been reported only once during the three last days before port of loading, otherwise sea state 7 or less are reported.

4. Ballasting Practices.

The ballasting practices for the 18 tankers in the size-range from 100.000 - 280.000 t.dw. have been reported, covering the first and the last three days of 277 ballast voyages.

From these reports, it is evident that the variations from ship to ship or from company to company are greater than any significant variation due to different ship sizes.

The results of the reports are shown diagramatically in figs. 7 - 11. Each of the entries in the diagrams represents the maximum sea state and wind strength encountered under the prevailing ballast condition for each particular voyage during the first three days after port of discharge and the last three days before port of loading.

Before port of loading, some of the ships seem to reduce ballasted displacement to about 35% of the full load displacement and will keep this up to sea state 7 with wind strength 8. Other ships seem to remain ballasted according to previous conditions on the voyage and take little notice of prevailing weather conditions.

After port of discharge, the practices seem more mixed and are probably reflecting expectations regarding conditions to be encountered on the voyage, rather than prevailing conditions. Both for the smaller and the larger ships, ballasting in the order of 40 - 50% of the deadweight is not uncommon, giving ballasted displacements of 50 - 60% of full load displacement.

The observations indicate that the weather conditions may change substantially during the three-day intervals considered, but it is very seldom that these changes have given cause for ajustment of ballast conditions. In the very few cases where the ballast has been increased, the weather conditions have developed beyond sea state 7 and wind strength 8.

5. Conclusions.

According to the sea state and wind strength data the weather conditions on the three first and the three last days of the ballast voyage have been quite favourable with sea state less than 6 more than 90% of the time and wind strength less than 7 also more than 90% of the time.

On the two last days of the ballast voyage the conditions are particularly favourable with sea state less than 6 more then 98% of the time and wind strength less than 7 more than 97% of the time.

The data on ballast conditions show that the ballasting practices vary widely from ship to ship or from company to company and that no consistent variation with ship size is apparent.

It seams likely that the ballasting depends more on weather to be expected or weather which have been experienced earlier on the voyage, than on the prevailing conditions. Even though the weather may change considerably during the three-day periods studied, this has only in a very few instances given cause for changes in ballast condition. In these cases the conditions have developed beyond sea state 7 and wind strength 8. Such conditions have occurred on approximately 1% of the watches.

Even though the data on ballasting indicate that the practices may vary by a factor of 2, the lower limit for ballasted displacement under "normal conditions" lies between 34 and 38% of the full load displacement, irrespective of ship size.

Unless a ship has special problems with regard to vibrations, seakeeping or manoeuverability it should be possible to operate with a ballasted displacement of 35% approximately 99% of the time during the first three and the last three days of the ballast voyage.

JWjr/RH.
4/9-1973.

Ship's Name _____ Deadweight _____

1. *0-24 hr after loading/before discharge port:* _____

Date: _____

	Sea State	Wind Strength	Wind Direction	Ballast (ts)
1. watch				
2. watch				
3. watch				
4. watch				
5. watch				
6. watch				

2. *24-48 hr after loading/before discharge port:* _____

Date: _____

	Sea State	Wind Strength	Wind Direction	Ballast (ts)
1. watch				
2. watch				
3. watch				
4. watch				
5. watch				
6. watch				

3. *48-72 hr after loading/before discharge port:* _____

Date: _____

	Sea State	Wind Strength	Wind Direction	Ballast (ts)
1. watch				
2. watch				
3. watch				
4. watch				
5. watch				
6. watch				

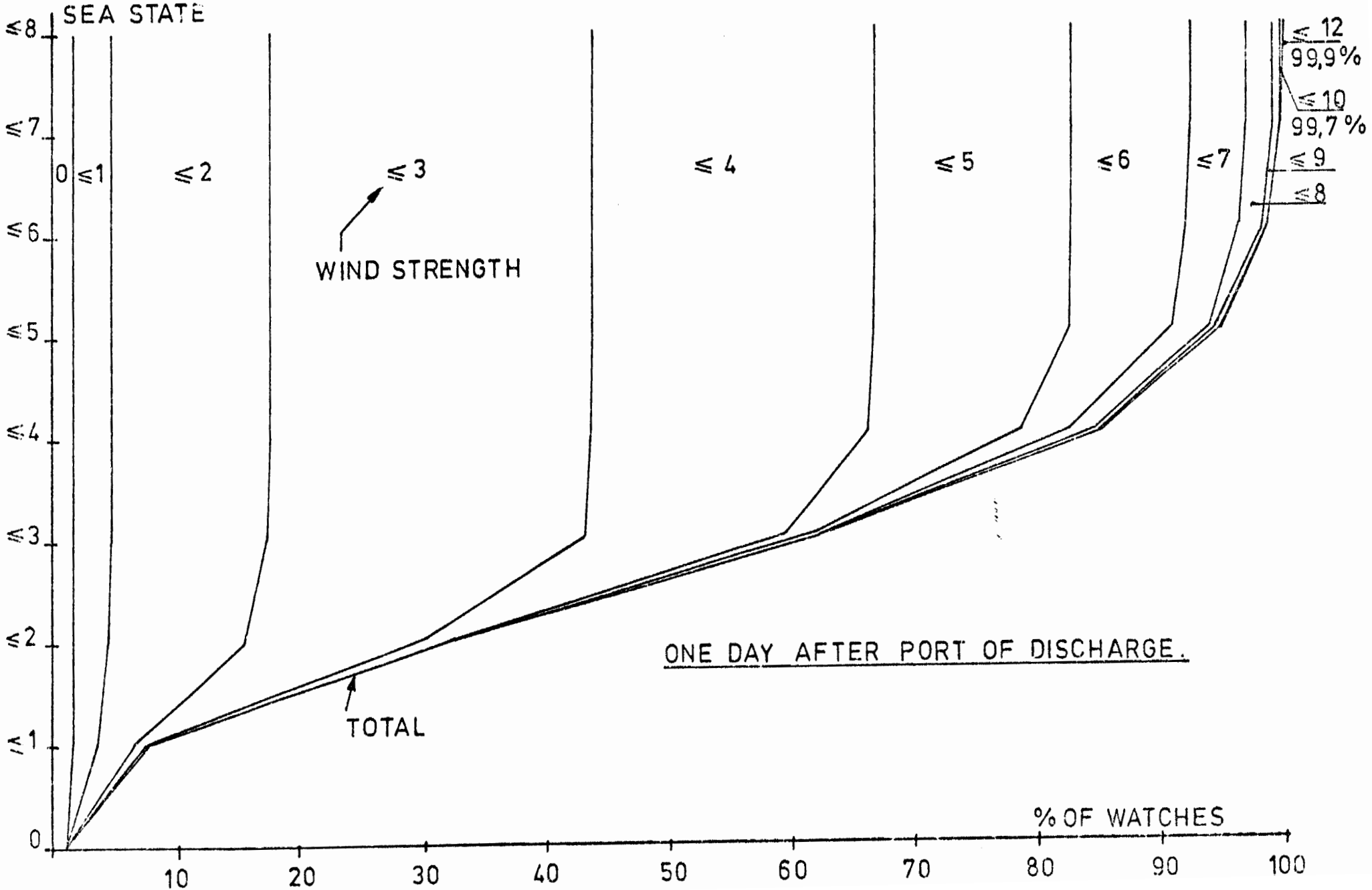

SEA STATE
≤8
≤7
≤6
≤5
≤4
≤3
≤2
≤1
0
≤1
≤2
≤3
≤4
≤5
≤6
≤7
≤12
99,9%
≤10
99,7%
≤9
≤8
WIND STRENGTH
TOTAL
ONE DAY AFTER PORT OF DISCHARGE.
% OF WATCHES
10
20
30
40
50
60
70
80
90
100

FIG. 1

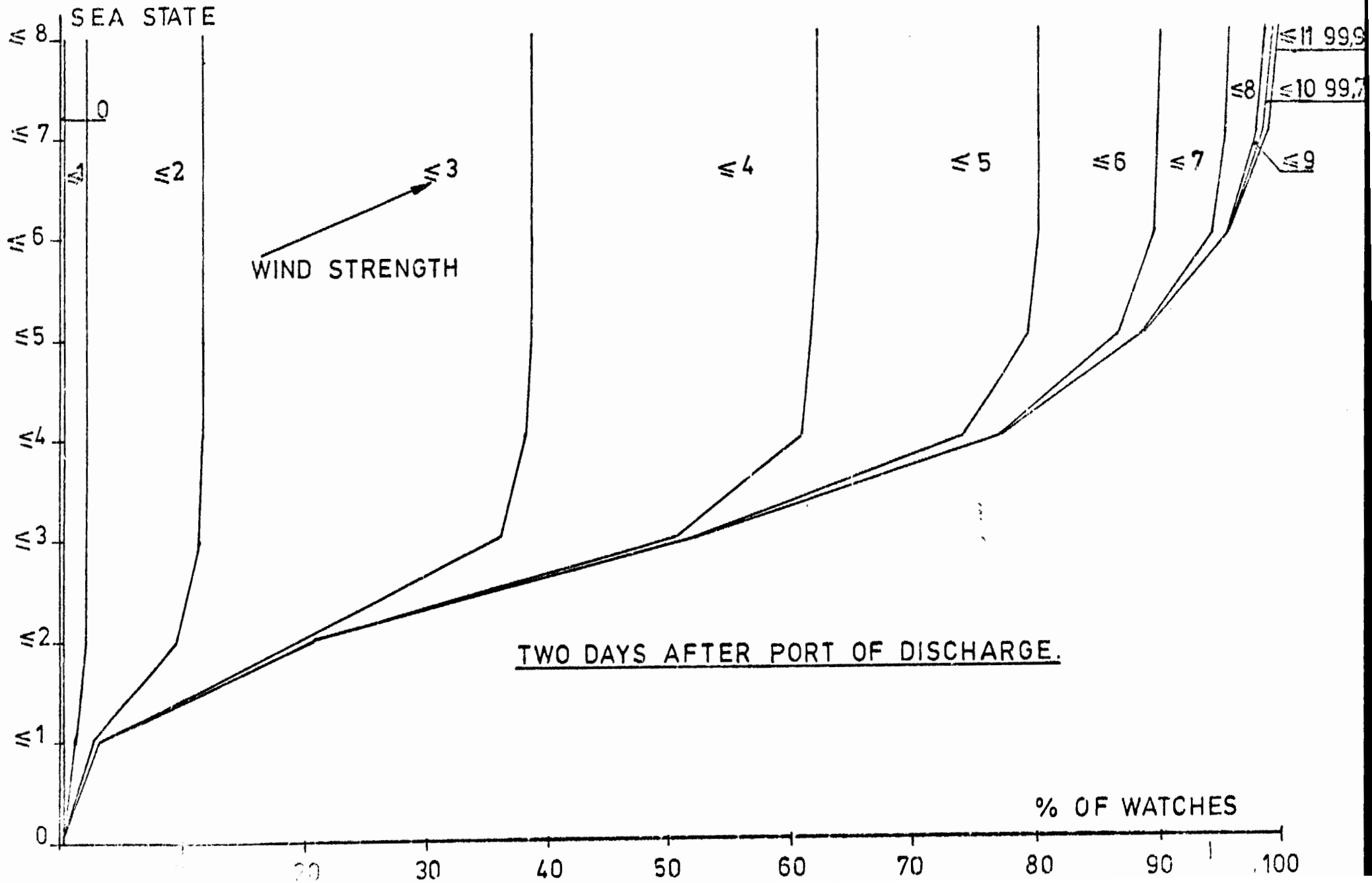

SEA STATE
≤ 8
≤ 7
≤ 6
≤ 5
≤ 4
≤ 3
≤ 2
≤ 1
0
≤1
≤2
≤3
≤4
≤5
≤6
≤7
≤8
≤9
≤10 99,7
≤11 99,9
WIND STRENGTH
TWO DAYS AFTER PORT OF DISCHARGE.
% OF WATCHES
20
30
40
50
60
70
80
90
100

FIG. 2

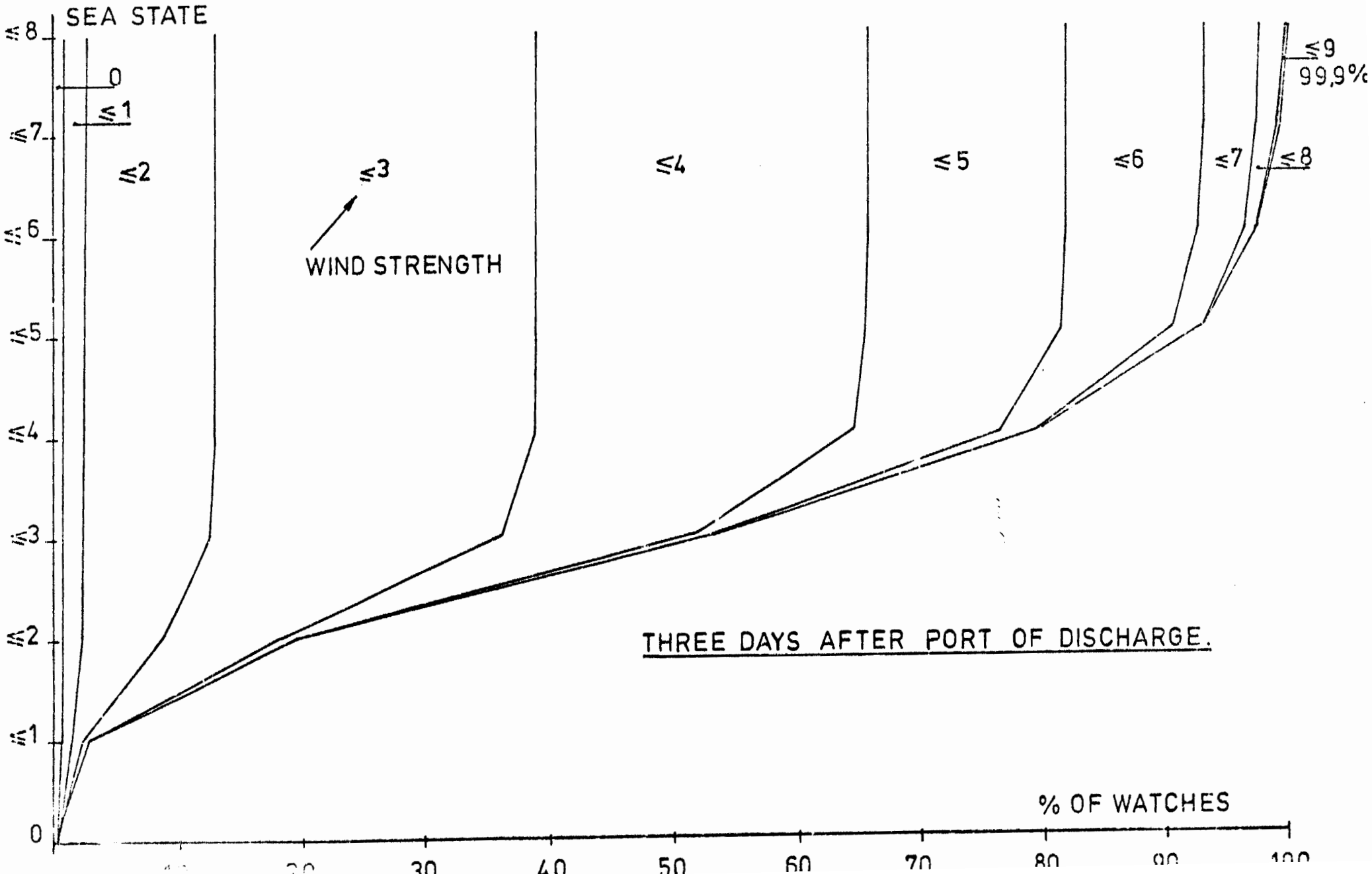

SEA STATE
≤8
≤7
≤6
≤5
≤4
≤3
≤2
≤1
0
≤9
99,9%
≤8
≤7
≤6
≤5
≤4
≤3
≤2
≤1
0
WIND STRENGTH
THREE DAYS AFTER PORT OF DISCHARGE.
% OF WATCHES
30
40
50
60
70
80
90

FIG. 3

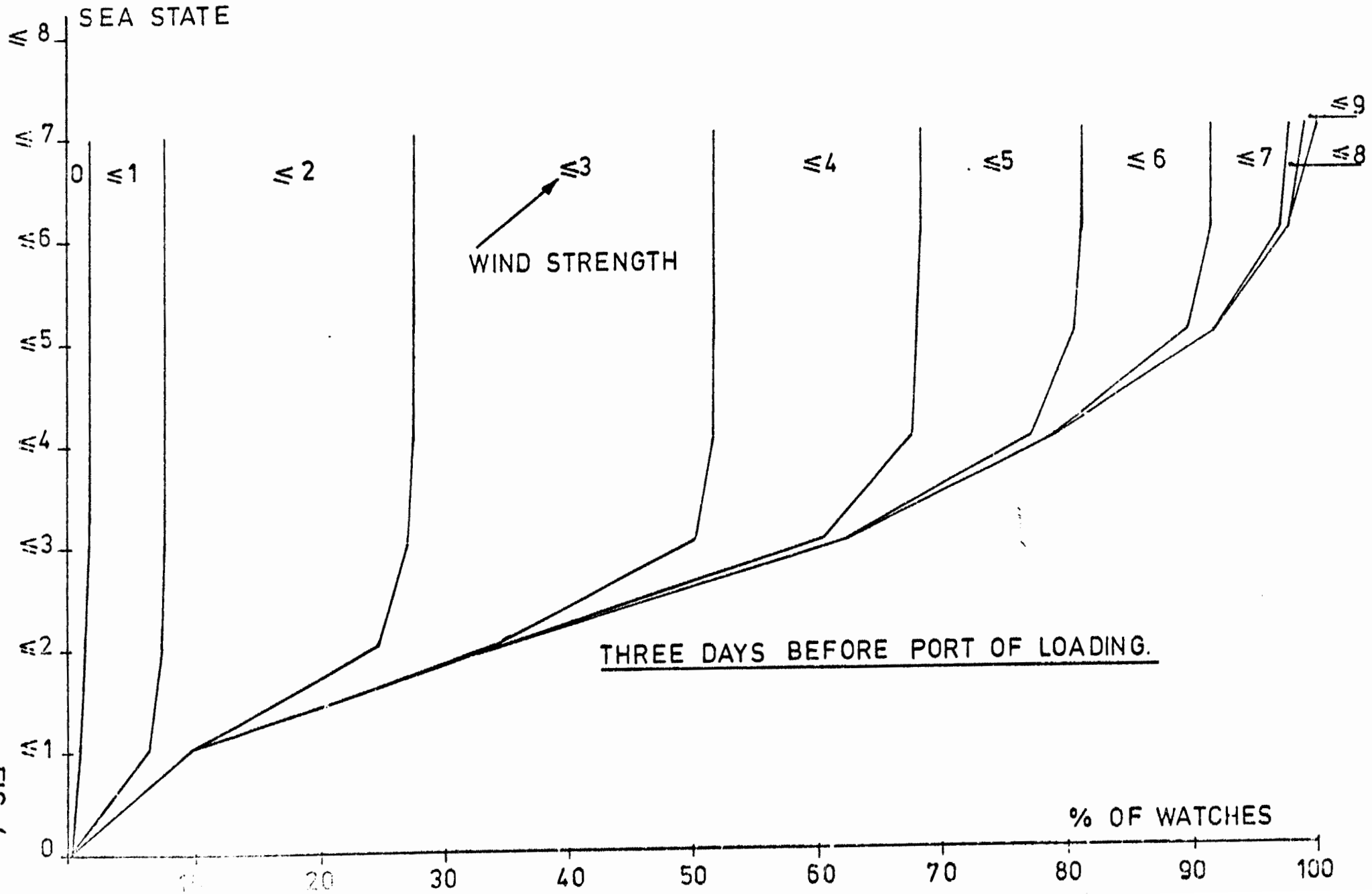

SEA STATE
≤ 8
≤ 7
≤ 6
≤ 5
≤ 4
≤ 3
≤ 2
≤ 1
0
≤ 1
≤ 2
≤ 3
≤ 4
≤ 5
≤ 6
≤ 7
≤ 8
≤ 9
WIND STRENGTH
THREE DAYS BEFORE PORT OF LOADING.
% OF WATCHES
0
20
30
40
50
60
70
80
90
100

FIG. 4

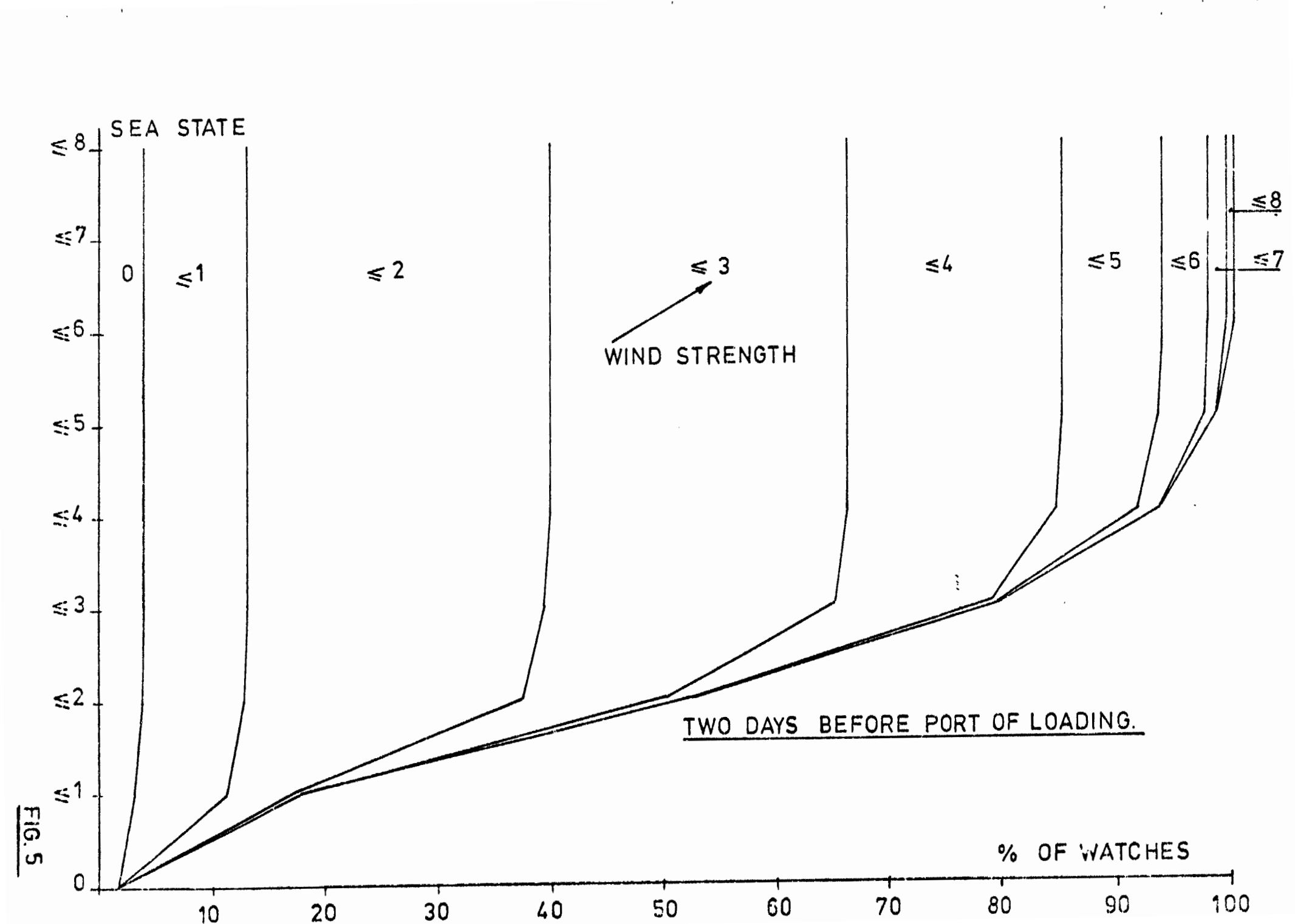

SEA STATE
≤8
≤7
≤6
≤5
≤4
≤3
≤2
≤1
0
WIND STRENGTH
≤8
≤7
TWO DAYS BEFORE PORT OF LOADING.
% OF WATCHES
0
10
20
30
40
50
60
70
80
90
100

FIG. 5

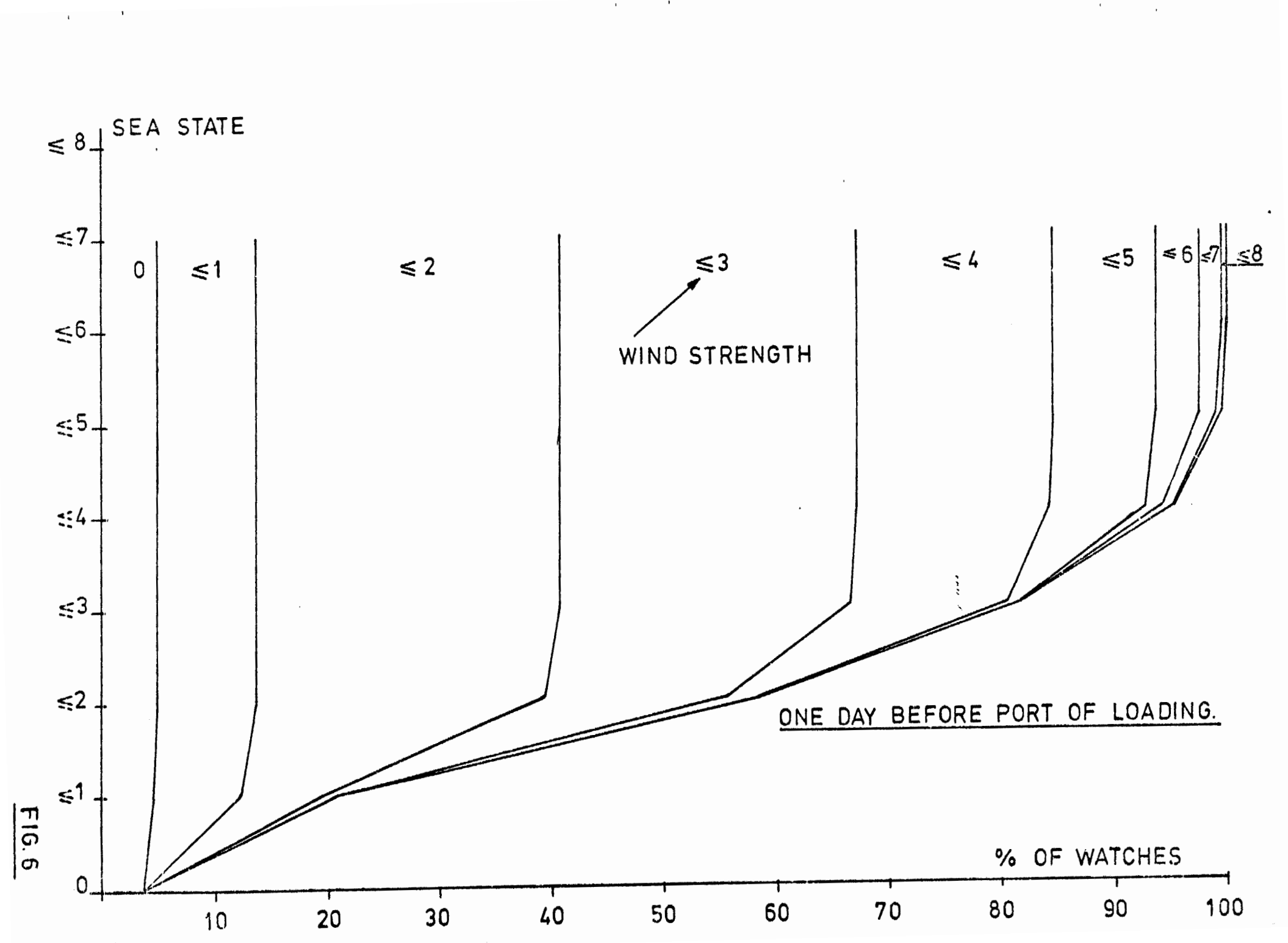
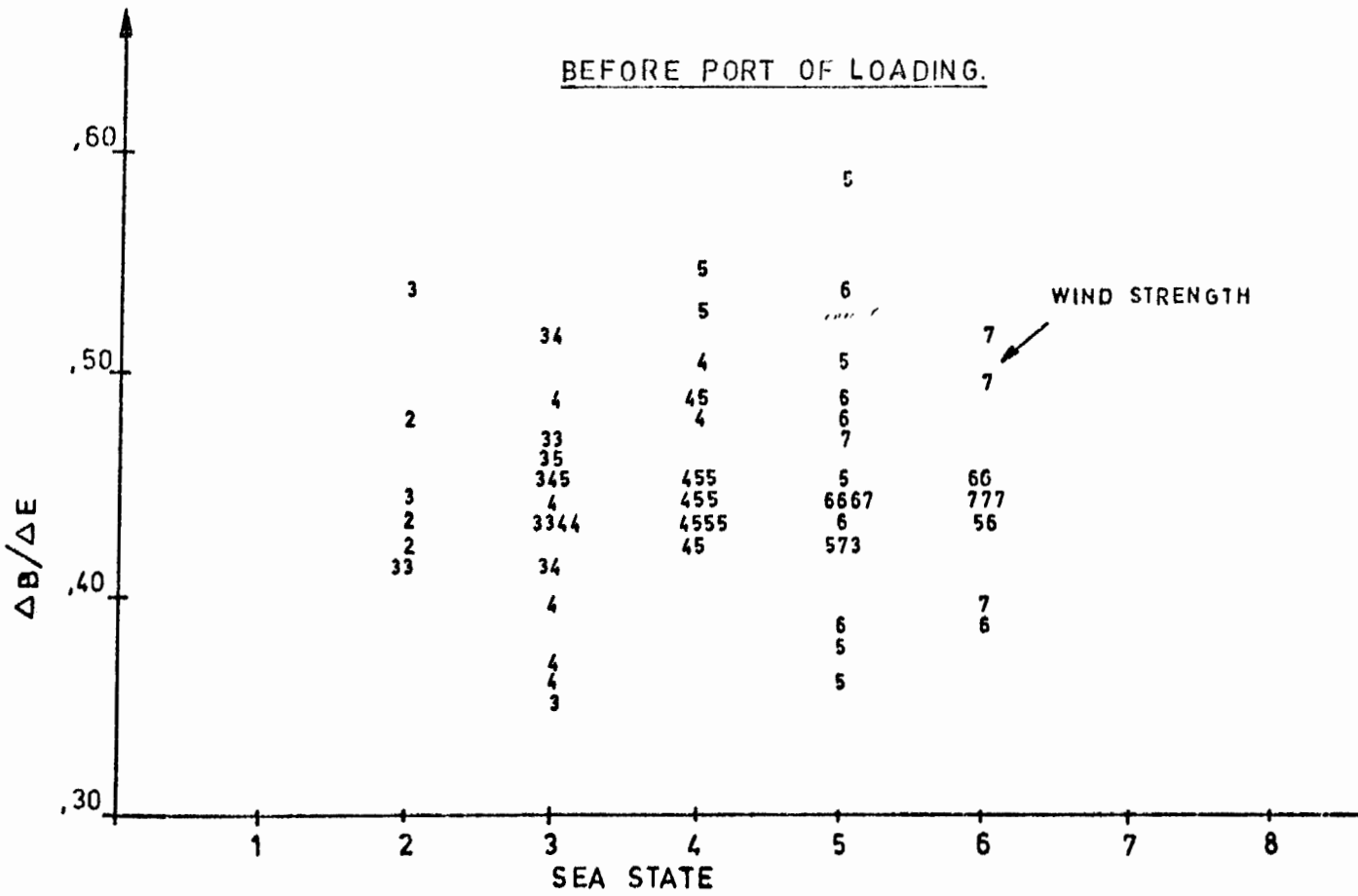

SEA STATE
≤ 8
≤ 7
≤ 6
≤ 5
≤ 4
≤ 3
≤ 2
≤ 1
0
WIND STRENGTH
ONE DAY BEFORE PORT OF LOADING.
% OF WATCHES
10
20
30
40
50
60
70
80
90
100

FIG. 6

APPROX. 100.000 t. dw. TANKER.

1. SHIP JAN. 70 - JAN. 73
2. SHIP APR. 69 - APR. 73
3. SHIP JAN. 68 - MAR. 73



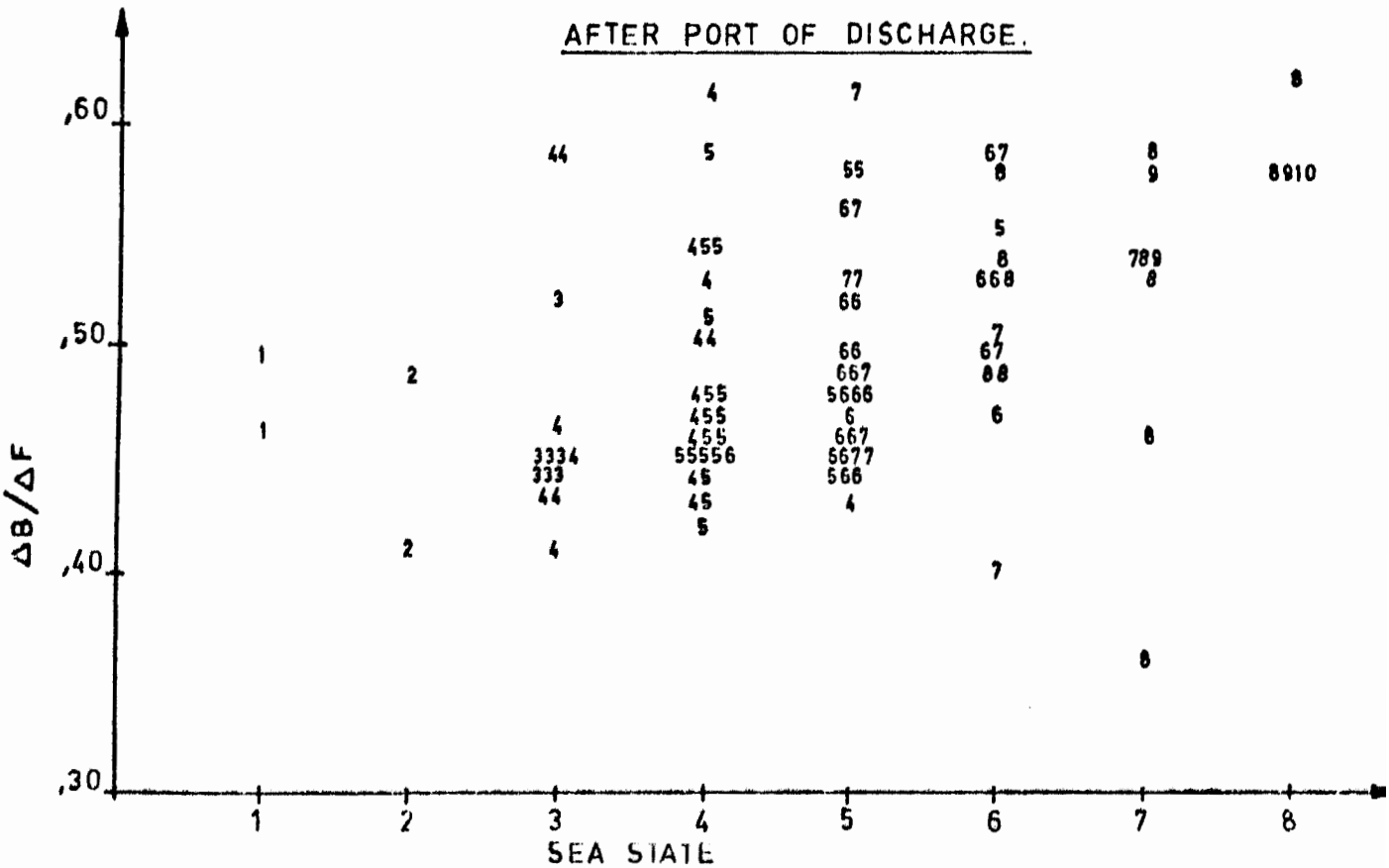
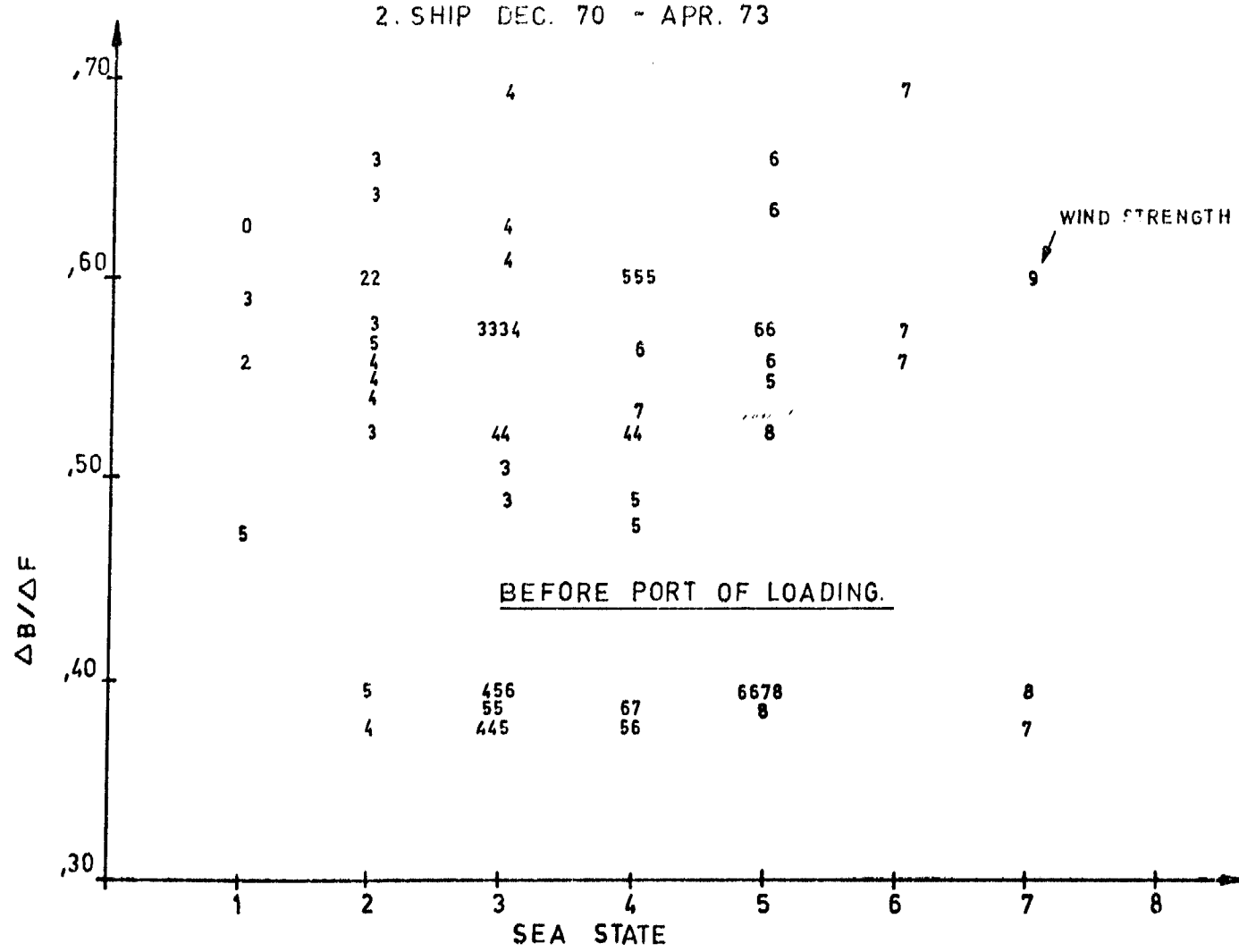


FIG. 7

APPROX. 160.000 t. dw. TANKER.

1. SHIP FEB. 70 - MAR. 73

2. SHIP DEC. 70 - APR. 73



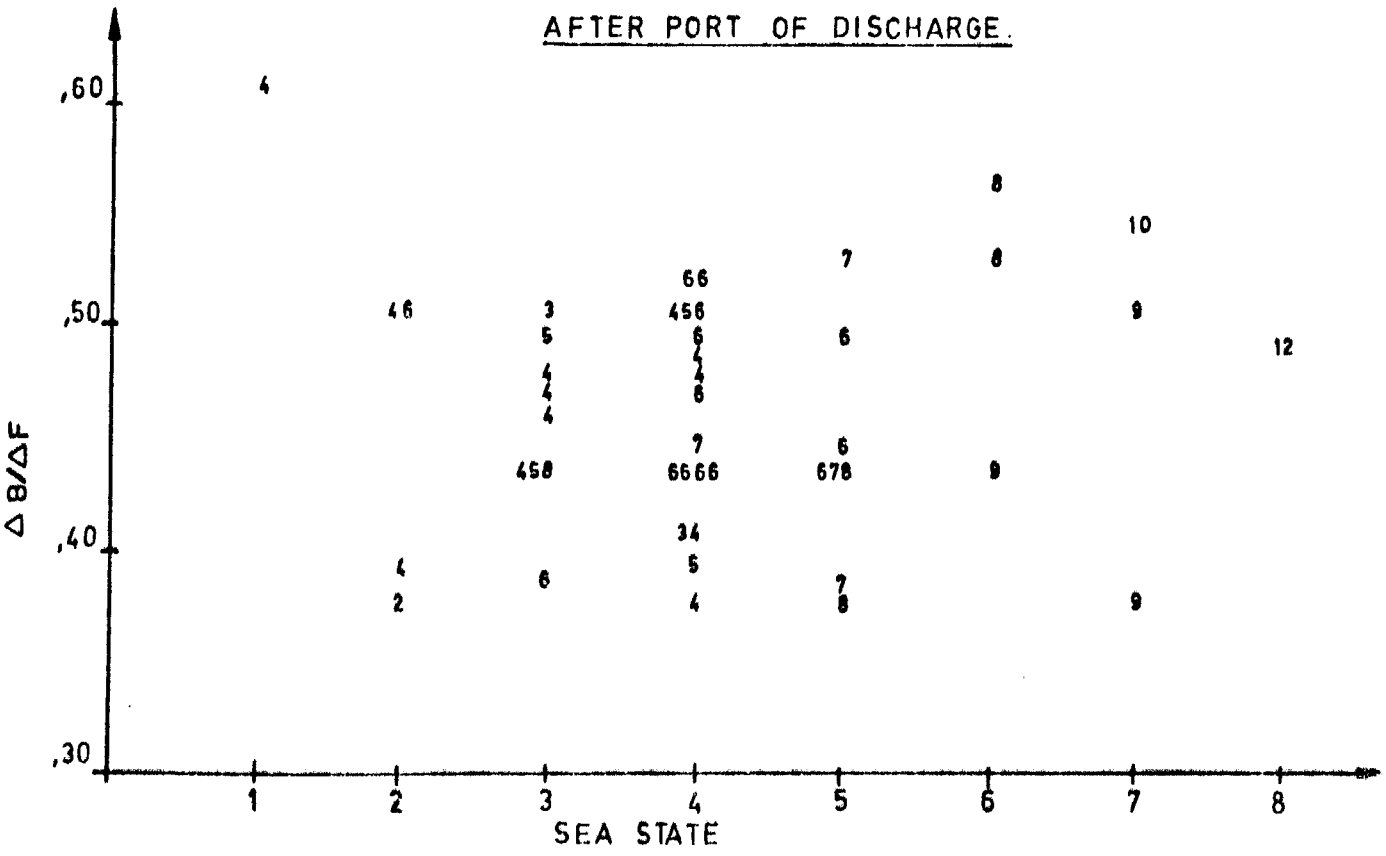
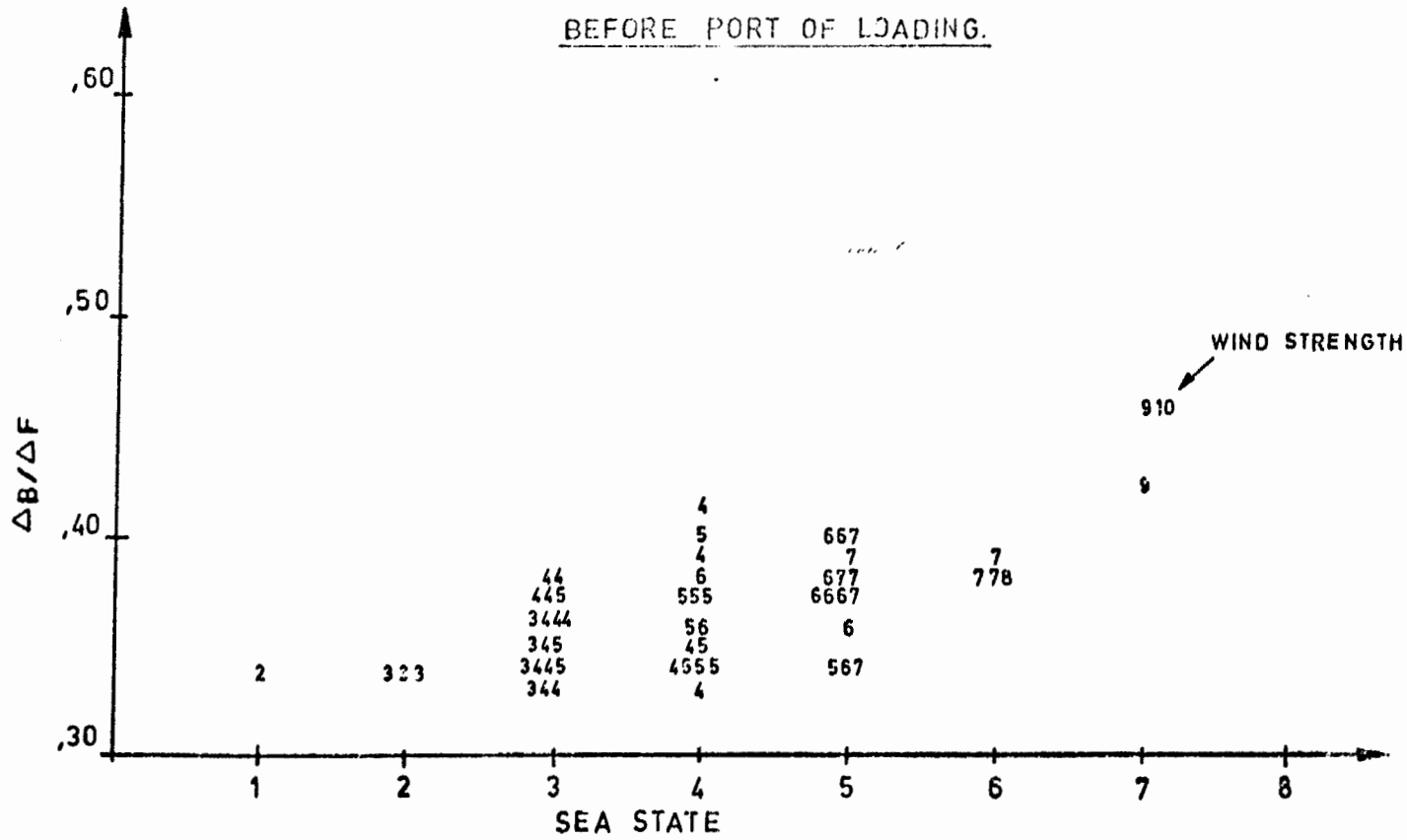


FIG. 8

APPROX. 200.000 t. dw. TANKERS.

1. SHIP OCT. 70 - MAR. 73
2. SHIP JUNE 69 - MAR. 73



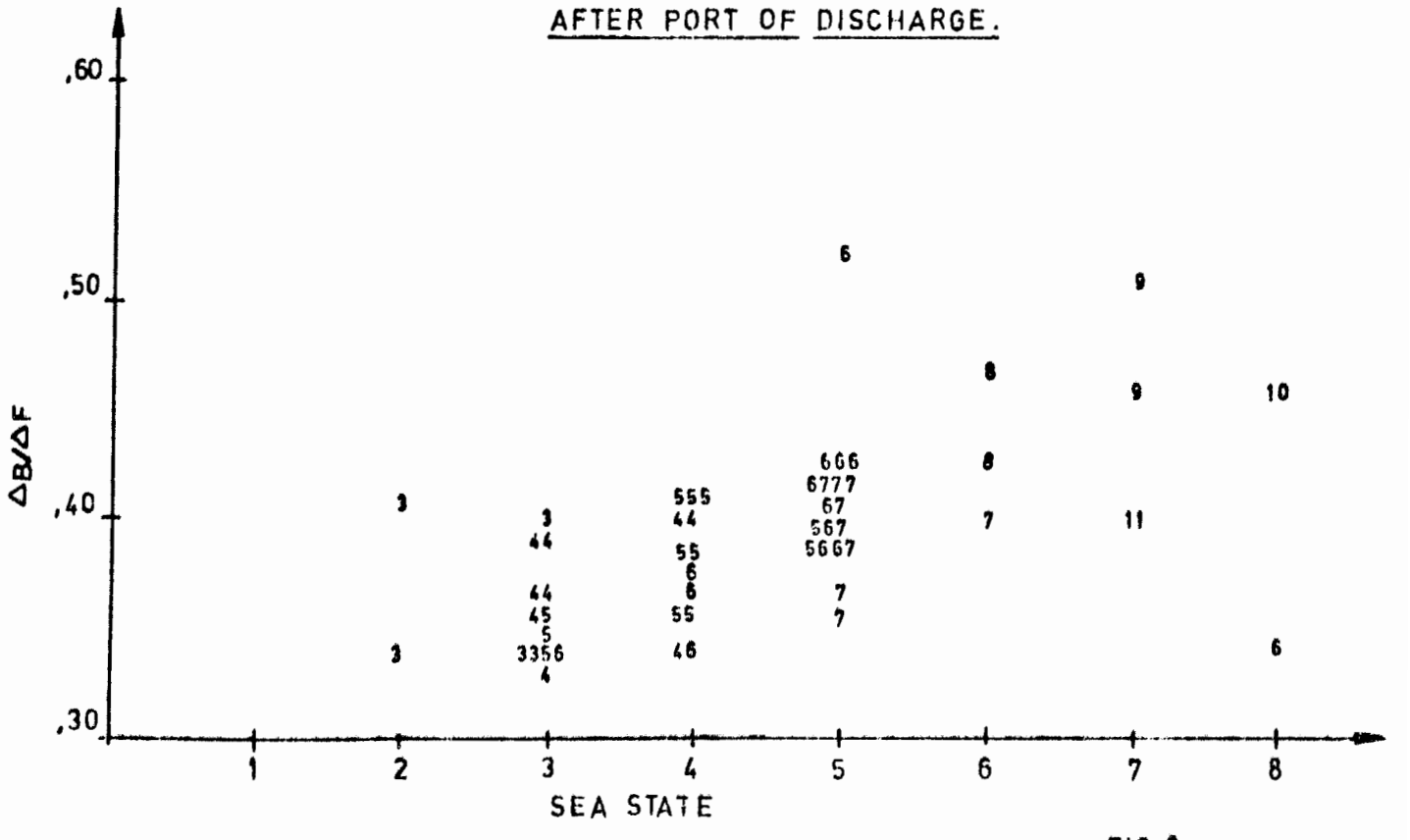
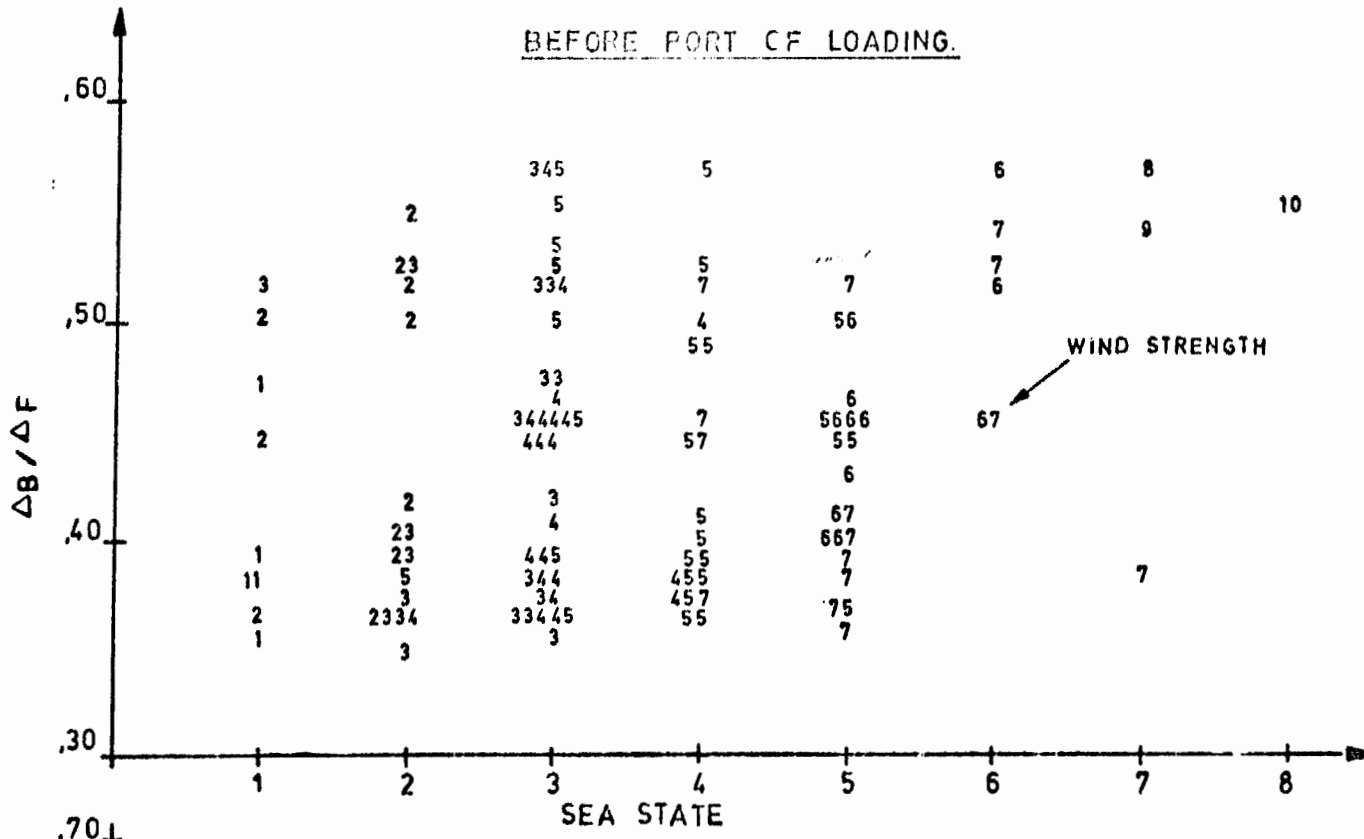


FIG. 9

APPROX. 220 000 t. dw. TANKERS.

1. SHIP	OCT. 71 - APR. 73		5. SHIP	JAN. 71	- APR. 73
2. SHIP	DEC. 72 - MAR. 73		6. SHIP	JAN. 72	- MAR. 73
3. SHIP	MAY 72 - MAR. 73		7. SHIP	JAN. 70	- APR. 73
4. SHIP	JUNE 72 - MAR. 73		8. SHIP	SEP. 72	- APR. 73

BEFORE PORT OF LOADING.



AFTER PORT OF DISCHARGE.

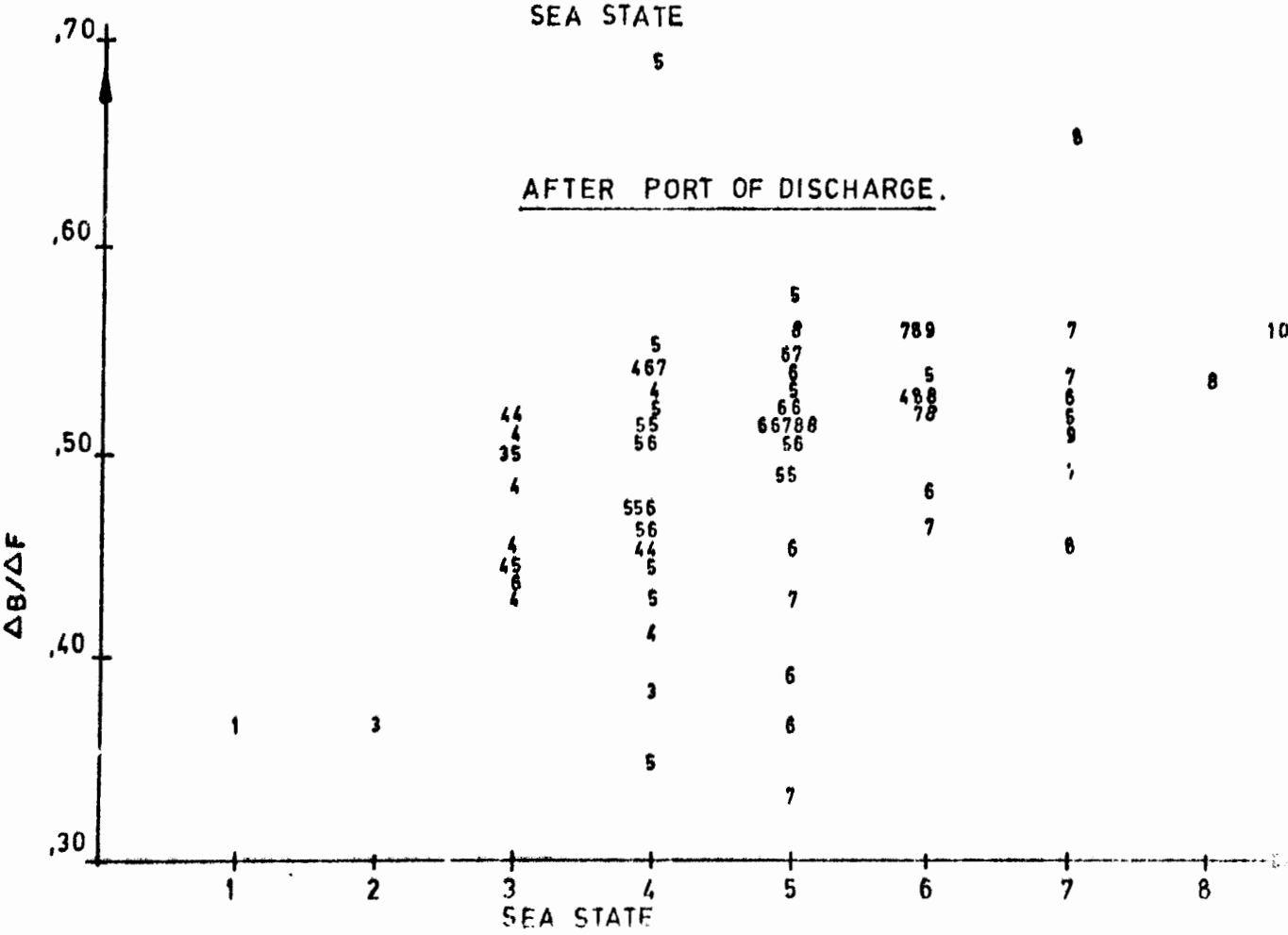
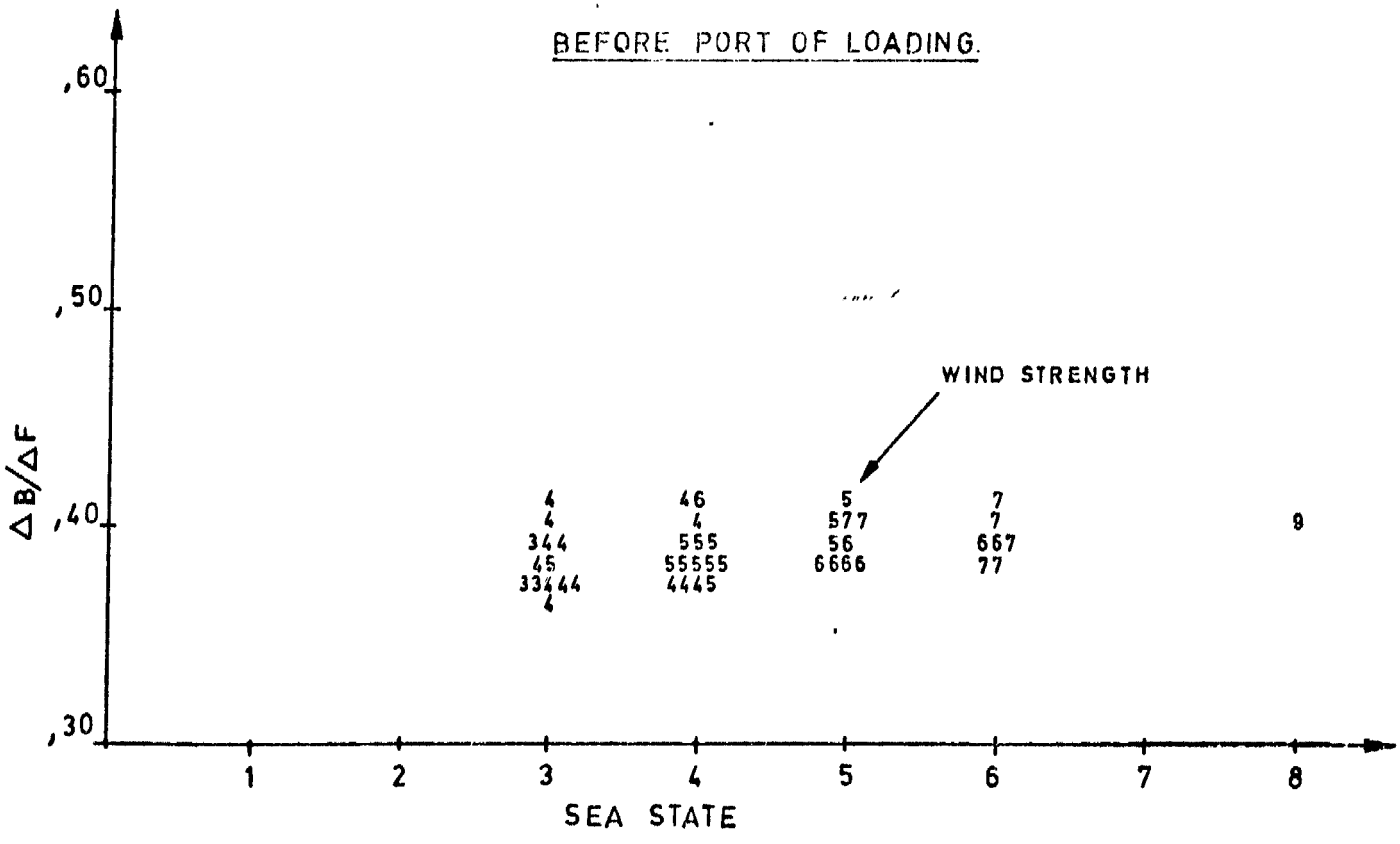


FIG. 10

APPROX. 280.000 t. dw. TANKER.

1. SHIP Nov. 70 - MARCH 73.
2. SHIP Apr. 71 - APR. 73.
3. SHIP Nov. 72 - MAY 73.



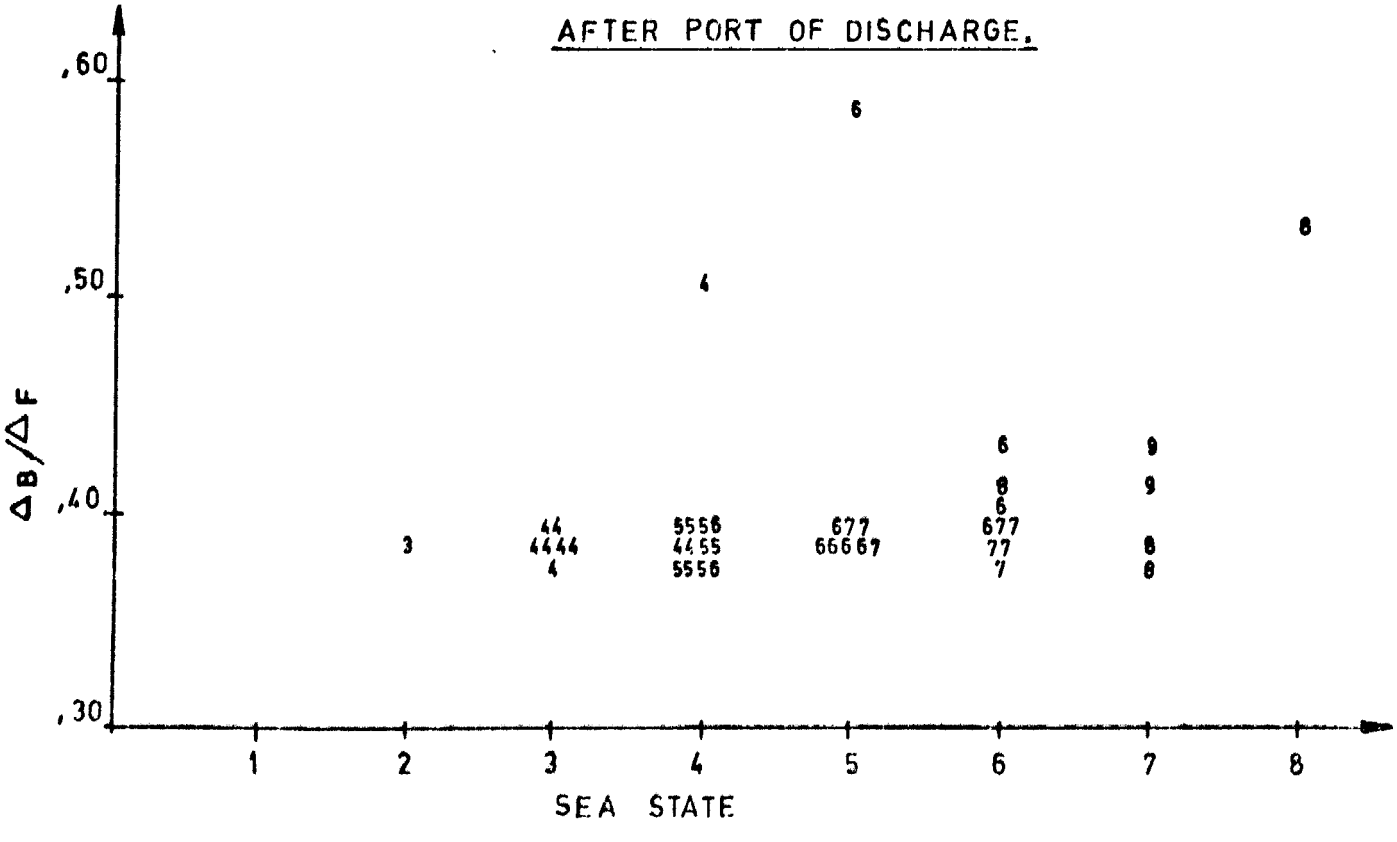


FIG. 11