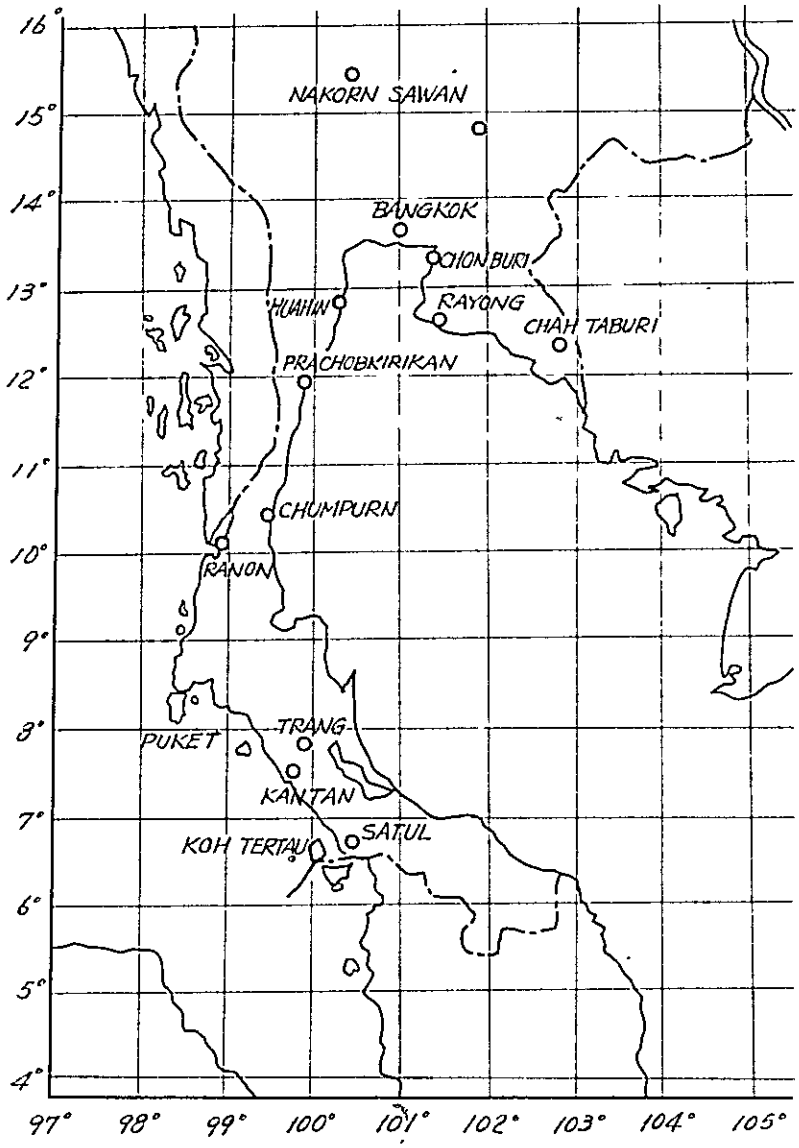
REPORT OF PINCTADA MAXIMA RESOURCE IN INDIAN OCEAN AREAR OF THAILAND

SURVEY TEAM OF JAPAN
DISPATCHED BY
OVERSEAS TECHNICAL COOPERATION AGENCY OF JAPAN

MAY, 1963



I. Introduction

1. Object of Survey

It is generally known that the coastal area of Thai along the Indian Ocean is a habitat of mother of pearl, along with the coastal areas of Australia, Burma, Indonesia and others. However, whether or not the coastal area of Thai really abounds in mother of pearl has not yet been confirmed, with no basic survey thus far made by means of actually fishing pearl-oyster and, accordingly, with no reliable data available. The object of the present survey is to assist, in accordance with the request from the Thai Government, a survey of mother of pearl resources to be carried out by the Fisheries Bureau, Thai Government.

2. Circumstances that led to assistance.

The Committee for Economy and Technology, Thai Government (attached to the National Economic Development Agency, this committee is a supreme organ in charge of matters concerning requests to oversea countries for assistance in technology) had sometime ago begged the Japanese Government to assist a survey of marine resources to be carried out on the coastal area along the Indian Ocean, by despatching technicians from Japan, and the Japanese Government had since then given consideration to this request and examined it. At an interview with Mr. Kai, Director of the Economic Cooperation Bureau, Ministry of Foreign Affairs, Japanese Government, Mr. Prida, Director of the Fisheries Bureau, Thai Government, when he visited Japan in August, 1962, hoped that a Japanese assistance be given to the survey of marine resources, mother of pearl in particular for the fiscal year 1962 and told to Mr. Kai that the Thai Government was prepared to cooperate as much as possible for the assistance if it had come to be given by the Japanese, by taking a budgetary measure and furnishing craft necessary for the survey. With the Japanese pearl culture industry already launching pearl culture in Australia and Burma, the Fisheries Agency, Japanese Government has generally given permission to Japanese companies to start pearl culture abroad, making it a basic policy to prevent them from releasing technology in public for making pearl culture, to make them reserve their right to sell and adjust the quantity of the product. On December 4th, 1962 the Thai Government prohibited fishing of mother of pearl through a Ministry of Agriculture notification with the intention of adopting a license system for fishing mother of pearl. In order to start pearl culture industry, the Thai Government considered it necessary to survey mother of pearl resources and decided the quantity of mother of pearl permitted to be fished for a year on the basis of the quantity of the resources discovered. Since the aim and direction of this policy is considered favourable for Japan in view of the prevailing disorder in starting operations on the part of the enterprises concerned, it is the intention of the Japanese Government to assist the survey to be carried out by the Thai Government and thus contribute to the promotion of friendly relations between Japan and Thai.

(3) Policy for survey

Despatching from Japan experts and divers, to fish mother of pearl at various places in the Indian Ocean which fall under the waters of Thai with the use of a survey ship furnished by the Thai Government at two tides (during each tide, diving will be made for ten days, resting five days), collect data concerning its distribution, its composition classified by age, quality,

quantity.

4. Matters to be surveyed

Survey will be made on the following matters:

(1) Collection of data available already and examination thereof;

(2) Survey of weather and condition of sea;

(3) Observation of the condition and composition of the sea-bed with the use of fish detectors;

(4) Observation by diving of the condition and composition of the sea-bed;

(5) Fishing of pearl-oyster by diving, measuring of the quantity of pearl-oyster fished, estimation of the quantity of resources on the basis of biological observation;

5. Survey teams

The following teams were formed, with the following members:

Japanese team

Capacity	Responsibility	Name	Position
Captain		Hiroshi Yokoyama	Technical official, Fishery Adjustment Section, Fisheries Administration, Division, Fisheries Agency
Survey of Mother of Pearl resources cc		Hiromu Oike	Pearl-Oyster Fishing Co., Ltd.
Installation and operation of compressor and equipment required		Denichi Yamamoto	"
		..	"
"	Diver	Tomio Izumi	Formerly of Pearl-Oyster Fishing Co., Ltd,
"	"	Hiroshi Mizuhata	"
"	Tender	Yoshitaka Michiwaki	"
"	"	Chiharu Mizuhata	"

Thai team

Capacity	Responsibility	Name	Position
Captain		Tuanthai Bamrajarinbai	Chief, Sea Section, Fisheries Bureau
Member	Survey of mother of pearl resources	Pisal Katanyuwong	Technical official, Sea Section, Fisheries Bureau
"	Survey of mother of pearl resources and biological observation of mother of pearl	Pairoj Brohmalonda	"

(6) Calendar of Survey

Year	Month	Day	Description	Remark
1963	Feb.	9 Sat.	'Yokoyama, captain and Yamamoto, member of the team started from Haneda Airport at 18-45 by PAA Machinery and materials needed for the survey (equipment to supply power for wireless telegraph, medicines, chemicals, charts) were sent by U.A.A.	
	"	10 Sun.	At 1-00, arrived at Bangkok Airport At 2-00, arrived at Fuji Hotel	Stayed in Bangkok
	"	11 Mon.	At 9-00, courtesy call on the Japanese Embassy and met Shimazu, Ambassador, Arita, Councillor and Nagata, Secretary; conferred with Nagata. Exchange of memorandums on the present survey was desired on the part of the Thai team. Accepted the exchange after examining contents of memorandums since we have no precedent regarding the exchange. Desided that the survey team should repay the expense paid by the Embassy for transportation and storage of machinery such as compressor and materials needed for the survey, sent previously by ship. At 13-00, conference at the National Economic Development Agency. Persons present at the conference: Nagata, Secretary, Yokoyama, Captain	

Dr. Taran (National Economic Development Agency), Sansanny (Committee for Economy and Technology) Prida and Tuanthai (Fisheries Bureau)

Matters conferred about:

Memorandums should be exchanged regarding the survey. Memorandums should be signed respectively by Ambassador and Director-general of the National Economic Development Agency. An offer was advanced to postpone the equipping of a ship for survey, taking into consideration the fact that the budget is to be decided on the part of Thai in accordance with the memorandums mentioned above. Asked for the modification and to start equipping at once.

12 Tues. At 9-00, conference at the Fisheries Bureau

Persons present: Yokoyama, Captain, Prida, Director, Tuanthai, Chief of Section, Sanan, Chief of Section

Matters conferred about:

Selection of anchorages, registration, procedures for navigation of the ship for Survey; matters to be communicated to Ranong, Pucket and Satool prefectures; to have the second detail bring chronometer and sextant; installation of a generator on the ship for survey.

At 15-00, visited to the fish-market and awaited in vain the arrival of the ship for survey until night.

13 Wed. From 9-00, conference at the Fisheries Bureau

Persons present:

Yokoyama, Captain, Prida, Director, Tuanthai, Chief of Section, Sanan, Chief of Section, Pairoj

Matters conferred about:

Examination of places to be surveyed. Distribution between Japanese and Thai teams of foodstuff, fuel, kitchen

utensils, bedding mosquito nets; setting up of a kitchen.

At 13-00, arrival of a ship for survey at Bangkok dock. Decided to start equipping of the ship tomorrow

At 19-00, present at a reception held at the Japanese Embassy

14 Thurs. At 9-00, carried compressor by a truck sent to the Embassy and loaded it on the ship

At 13-00, transportation to Haring dock of the ship for survey. Received on board the ship Prida, Director of Bureau, Sanan and Tuanthai, Chiefs of Section

15 Fri. At 9-00, conference at the Fisheries Bureau

Persons present:

Yokoyama, Captain, Prida, Director of Bureau, Tuanthai, Chief of Section, Sanan, Chief of Section

Matter conferred about:

Participation in the survey as an observer of Sugawara of the Oversea Pearl Culture Society

At 13-00, went to the airport with Tuanthai, Chief of Section to receive machinery and materials sent by air but refused delivery because they were addressed to Yokoyama, c/o the Japanese Embassy .

Decided to go to the airport on Feb. 18 (Monday) since tomorrow and the day after tomorrow are holidays.

Yamamoto went to Haringdock and started the installation of the compressor.

16 Sat. At 9-00, went to Haringdock to supervise the equipping of the ship and install the compressor. Received Sanan, Chief of Section, aboard the ship

At 13-00, went to Haringdock again to supervise the equipping of the ship and install the compressor.

17 Sun. At 9-00, went to Haringdock supervise the equipping of the ship and install the compressor. Received Sanan, Chief of Section, aboard the ship. Equipping of the ship showed much progress.

18 Mon. At 9-00, went to the Embassy and conferred about matters regarding Sugawara, an observer

At 9-30, went to the Fisheries Bureau, then to the airport with Tuanthai, Chief of Section. Received machinery and materials sent by air and carried them to the ship for survey.

At 13-00, carried a fish detector to the ship for survey by a truck sent to the Embassy. Because of a faulty screw, put the ship on a trestle.

19 Tues. At 8-00,went to Haringdock to supervise the equipping of the ship for survey. Received Sanan, Chief of Section, aboard the ship. Conferred about the day of embarkation. Planned to set sail on Feb. 21.

At 13-00, went to an air-line office to confirm the schedule of local lines, found out that, because of the repairing of airfield, air service would be stopped for the time being. Negotiated in vain the repayment of the fare.

At 17-00, received a telephone message from Nagata, Secretary, attached to the Embassy in which he said: A request had come from the Thai team that the charts asked for the other day should include those necessary for voyage to Singapore (Charts brought by the Japanese team cover only the waters where the survey is scheduled to be carried out.)

20 Wed. At 9-00, conference at the Fisheries Bureau.

Persons present:

Yokoyama, Captain, Prida, Director of Bureau
Thuanthai

Matters conferred about:

To have the second detail bring the charts requested by the Thai team.

Procedures for the extention of stay such as a renewal of a visa on the passport.

Mosquito nets and bedding for members of the Japanese team were decided to be bought by the Japanese team.

The second Japanese detail should leave Japan on Feb. 26 to arrive at Pucket on Mar. 2 from Bangkok by land. Chaiyos of the Fisheries Bureau would play the role of guide.

At 13-00, went to Haring dock. Repairing of a faulty part of the compressor. Put the ship down from the trestle, with the completion of repairing of the faulty screw.

At 16-00, went to the Embassy. Sent to Fuji Hotel all the machinery and materials for survey left there.

21 Thurs. At 9-00, went to the fish-market; supervised the equipping of the ship

At 14-00, carried by truck bedding, mosquito net, rice, soy and barrel to the fish-market and loaded them aboard the ship. Dispatched telegram to Oike, a member of the Japanese team, to inform him of the day of take-off (Feb. 26) and of the goods he should bring with them.

22 Fri. At 9-00, went to the fish-market to supervise the equipping of the ship.

At 13-45, the ship for survey left the port. Farewell gifts were given to Tuanthai, captain of the Thai team. Ordered marine bags to put in personal effects. Brought mosquito nets to the hotel from the ship - decided that the mosquito net be brought by each of the members.

23 Sat. At 9-32, received a telegram from Oike a member of the Japanese team informing that the second detail would start on Feb. 26. Received a telephone from Nagata, Secretary attached to the Embassy, informing us of the extention of the visa.

25 Mon. At 9-00, went to the Fisheries Bureau. Met with Prida, Director of Bureau, and Sanan, Chief of Section.

They said that the survey ship would start for Pucket on March 1.

At 15-00, went to the Immigration Bureau for the extention of visa.

	26 Tues.	At 9-00, went to the Fisheries Bureau, To a bus stop with Chaiyos an official of this bureau, to book for seats. Forced to change to railway due to a suspension of bus station, went to station, Bangkok Noi. Informed that all the tickets are booked at central station, went to that station and booked for seats of a train for Chumpon scheduled to start on March 1.	
		At 19-00, went to the airport to meet members of the second detail who were to arrive there.	
		At 23-10, arrival of the second team. Put up at Fuji Hotel.	
	27 Wed.	At 9-00, courtsy call on the embassy.	
		At 11-00, courtsy call on the Fisheries Bureau.	
		At 13-00, went to the Immigration Bureau, to negotiate for the extention of visa.	"
	28 Thurs.	At 8-00, left Bangkok to the Lake, in Nakornpactom, visited a fresh water pearl culture farm of the Japan Pearl Co., and returned to Bangkok at 17-00.	"
Mar.	1 Fri.	At 6-30, left Bangkok to Chumpon by train.	Stayed at Chumpon
		At 17-00, arrived in Chumpon. Put up there.	
	2 Sat.	At 7-30, left Chumpon and went to Ranong by bus.	
		At 11-00, arrived in Ranong and put up at Hotel. In the afternoon, visited a fish-market and an ice making plant.	Stayed at Ranong
	3 Sun.	A survey on the land. Paid a visit to Mr. Chevalit who has experience in fishing shells and pearl culture on a trial basis around Ranong Chang. Informed of the condition around Chang Island and Piam Island.	"
	4 Mon.	At 8-00, hired a ship at the port of Ranong. Surveyed on Chang Island and Piam Island.	
		On Piam Island, visited an experimental pearl culture farm managed by Sirisampan.	
	5 Tues.	At 9-00, left Ranong and went to Pucket by car.	

		At 18-30, arrived in Pucket. Put up at Imperial Hotel.	Stayed in Pucket
6	Wed.	At 8-00, went to the Fisheries Research Institute to make consultation. Informed of the arrival of the survey ship in Singapore.	
		At night, present at a reception given by the Fisheries Research Institute	"
7	Thurs.	Collection of data	
8	Fri.	"	"
9	Sat.	"	
10	Sun.	Arrival of the survey ship in Pucket	"
11	Mon.	At 9-00, courtsy call on the Governor of Pucket Prefecture.	"
12	Tues.	Consultation with the Captain of the Thai survey team.	"
13	Wed.	Purchase of food-stuffs, ice, etc. to be loaded on board the ship.	"
14	Thurs.	Trial operations	"
15	Fri.	Studied on the shells fished near Pucket.	"
16 ~ 19	Sat. ~ Tues.	Surveyed North of Pucket	Reference: tables
20	Wed.	At 11-20, to the airport to meet Nagata, secretary. Consultation with him.	Stayed in Pucket
21	Thurs.	At 7-00, went aboard the ship with Nagata. Surveyed at 9 places near Pucket. Fished 4 pairs of mother-of-pearl.	
		At 20-30, arrivel in Pucket. Nagata left the ship.	
		At 22-30, left port for Tertau Island. $_{T}T$	
22 ~ 25	Fri. ~ Mon.	$_{T}T$ Surveyed around Tertau Island, South of Pucket.	Reference: tables
26	Tues.	Received a telephone message from Bangkok regarding extention of survey. Conculta-tion with ~~Tuanetai~~, Captain of the Thai team. Decided that Tuanctai and Yokoyama should go to Bangkok to consult with the Director of Bureau and to re-ceive money needed for travel.	Stayed in Pucket

	27	Wed.	At 8-00, communication with Bangkok by telephone (consultation regarding a visit to Bangkok)	
			At 18-00, a reception for members of the Thai team.	
	28	Thurs.	At 14-45, started from Pucket Airport.	Yokoyama, Captain of the Japanese team, stayed in Bangkok
			At 18-00 arrived in Bangkok and put up at Fuji Hotel	
	29	Fri.	At 9-00, went to the embassy for consultation.	
			Borrowed money from the Bank of Tokyo to pay the expense of travel.	"
	30	Sat.	Adjustment of data and consultation with Nagata, secretary.	"
	31	Sun.	At 8-30, left Bangkok.	
			At 11-30, arrived at Pucket.	
			At 15-30, the survey ship left Pucket.	
Apr.	1 ~ 2	Mon. ~ Tues.	Surveyed North of Pucket.	Reference: tables
	3	Wed.	At 7-00, a visit to the survey ship by Sant, Deputy Director of Fisheries Bureau, Chief of Ranong Fisheries Section, 2 officials of Fisheries Bureau and Kodama, an observer.	
			Chavalit, an operater of shell fishing came on board the ship.	
			Surveyed at 5 places.	Stayed in Ranong
	4 ~ 7	Thurs. ~ Sun.	Surveyed around Ranong and North of Pucket.	Reference: tables
	8	Mon.	At 9-00, went to Thai Airlines Co. for consultation.	Stayed in Pucket
	9	Tues.	At 14-25, left Pucket.	
			At 18-00, arrived in Bangkok. Put up at Fuji Hotel.	Stayed in Bangkok
	10	Wed.	At 9-00, went to the embassy, paid respect to Saito, minister and Arita, councillor.	

		At 11-00, received money to pay the expense of travel.	
		At 18-00, present at a reception held by the Fisheries Bureau.	Stayed in Bangkok
11	Turs.	At 12-00, present at a reception held by the embassy.	
12	Fri.	At 12-25, left Bangkok.	
		At 17-00, arrived in Hongkong. Put up at Clover Hotel.	Stayed in Hongkong
13	Sat.	Investigation of sales of pearls cultured by mother-of-pearl.	
14	Sun.	At 19-00, left Hongkong.	
		At 22-30, arrived in Tokyo.	

II. Method of Survey and Results

1. On the method to estimate the mother-of-pearl resources.

We have considered the following methods to estimate the mother-of-pearl resources:

(1) Method to make an estimation directly from data obtained by fishing shells.

(a) Obtain the number of mother-of-pearl living per unit area from the distance covered by diving made by the diver, the distance of visibility while diving and from the number of shells fished.

(b) Carry out a survey by diving at various places in the same fish ground and obtain the number of shells living per unit are at each place and, then, calculate the average number of shells living per unit area.

(c) Obtain the dimensions of fishing grounds by estimating their extent on the basis of data obtained by making a survey by diving, a survey with the fish-detector of the sea-bed and a survey of mud.

(d) From the above, the number of shells living in the fishing grounds (quantity of resources in the simple meaning of the word) can be estimated.

(e) The precision of the estimation of the resources can be calculated from deviations in the number of shells living per unit area and from the number of times of diving made at the fishing grounds concerned.

(2) Estimate the quantity of shells considered possible to fish in a year by comparing results obtained by fishing shells and data of existing fishing grounds for the past years.

As for the data of the existing fishing grounds, data of shell fishing at the existing fishing grounds in the Arafura Sea are available.

Estimate the quantity of shells considered possible to fish by comparing the quantity of the catch at each fishing area of the said fishing grounds and the quantity of the catch there by a diver-boat a day with the results of shell fishing conducted by the present survey.

From the data of the Arafura Sea (Tables 1 - 4), it is considered possible for a diver-boat to fish about 250 kg. of shells a day of 200 kg. by 5 sq. miles at fishing grounds where fishing of some 15 tons - 20 tons of shells for a year is continuously possible. Or, inversely, at fishing grounds where 250 kg. or 200 kg. of shells can be fished a day by a diver-boat, it is possible to presume that fishing of 15 tons - 20 tons of shells would be possible each year. Fishing of some 15 tons to 20 tons of shells -- minimum quantity of mother shells required to carry out pearl culture on a paying basis -- is necessary in view of the maintenance of the prices of pearls by culture of mother-of-pearl.

Table 1. Quantity of Shells Fished in the Arafura Sea - I

(unit: ton)

Area \ Year	1957	1958	1959	1960	1961
Northern area	426	411	290	336	334
Queensland area	167	65	51	48	29
Western area	18				
Total	701	476	341	384	363
Quantity of shells fished by Australia	1,839	1,284	1,067	1,430	
Grand total	2,540	1,759	1,408	1,814	

Table 2. Quantity of Shells Fished in the Arafura Sea - II

(unit: ton)

Area \ Fishing area \ Year		1957	1958	1959	1960	1961
Northern area	18		62		3	
	19	192	141	199	21	129
	21	127	209	81	296	190
	22			11	15	15
Queensland area	8	167	65	51	48	29

Note: Figures on Table 2 were obtained by classifying figures on Table 1 by fishing area.

Table 3. Quantity of Shells Fished by One Boat a Day

(average for five years) (unit: kg.)

Fishing area		Daily quantity of shells fished per boat
Queensland area	No. 5	250 (86 - 477)
Northern area	No. 18	565 (151 - 834)
	No. 19 (N.)	501 (140 - 743)
	No. 19 (S.)	489 (347 - 534)
	No. 21 (N.)	424 (307 - 659)
	No. 21 (S.)	445 (323 - 641)
	No. 22	280 (194 - 387)

Table 4. Quantity of Shells Fished by 5 Sq. Miles per Boat a Day in the Arafura Sea (Unit: kg.)

Fishing area		Quantity of shells fished by 5 sq. miles per boat a day
Queensland area	No. 5	148 (20 - 200)
Northern area	No. 19	439 (200 - 522)
	No. 21	339
	No. 22	194

(3) Estimation of quantity of resources by De Lury's method

This is a method to estimate annual quantity of shell fished on the basis of data of past years. Appropriateness of the quantity of shells considered possible to fish estimated in accordance with the methods mentioned in (1) and (2) above may be confirmed by the changes registered from year to year in the annual quantity of shells fished.

2. Age Composition of mother-of-pearl

Age structure of shells living in fishing grounds is an important factor in deciding the value of fishing grounds. The fact that there live old shells alone an fishing grounds,-- no young ones -- means that no reproduction is carried out in these fishing grounds. Chicken shells of mother-of-pearl with happend to stay temporarily under some circumstances, they cannot be considered as permanent fishing grounds.

Some reports shows that a tendency is affirmed that shells living in fishing grounds where concentration of shells is high cannot become large.

To estimate the age of shells, data of Celebes are useful. Weight of shells can be a good indicator for age.

Table 5. Growth of Mother-of-Pearl

Age	Weight of shell	Length of shell	Length of hinge line	Breadth of shell	Hinge depth
0.5	6.9	7.3	6.8	1.40	-
1	10.8	11.4	9.5	2.05	0.33
2	16.0	16.7	12.4	2.92	0.66
3	18.8	19.4	13.7	3.45	0.90
4	20.6	20.9	15.2	3.92	1.14
5	21.8	22.0	16.0	4.35	1.47

3. The nature of the bed of fishing grounds for mother-of-pearl

According to the study made by Takemura (See "Tokai Area Fisheries Research Institute Report, A-No. 87, 1958 and A-No. 137, 1960"), the nature of the bed of fishing grounds for mother-of-pearl in the Arafura Sea is:

Mud content (the ratio of the quantity of mud of 0.05 m.m. in diameter to the total quantity) 0 - 20%

Quantity of Gravel	50% or under
Mud value	0.4 - 3.00 m.m.

In accordance with study and the data mentioned above, it can be possible to presume prospective fishing grounds, by picking soil from the bed.

4. Tables of the present survey and outline of implementation thereof

Tables 6 and 7 are prepared in accordance with the ideas mentioned in 1 - 3 above.

Table 6. Daily Survey Report

Date	Area No.	Location		Depth of Water	Nature of bed	No. of Shell Fished	Classification of Shell				Diving			
		Latitude	Longitude				Dead	Old	Mature	Chicken	Distance	Frequency	Time	No. of Men

Visibility	Weather	Wind		Barometer	Temperature			Tide		Remark
		Direction	Velocity	(m/o)	Atmosphere	Surface	Water Bottom	Speed	Direction	

Findings

Table 7. Biological Measurement

Date	Location	Area No.	Dead or Life	Height of Shell (1)	Length of Shell (2)	Breadth of Shell (3)	Hinge Depth (4)	Nacreous diameter (5)	Weight of Shell (6)	Attached chicken shell	Gold of Silver lip	Remark

Outline of execution of survey

1. The dimentions of fishing areas are 5 miles x 5 miles and 2 miles x 2 miles.

2. Carry out a survey by diving for each of fishing areas as much as possible, and fish shells at places, in preference to others, where mother-of-pearl is considered living.

3. The formula of the survey are to correspond with table 6

(1) Record accurately the location of points where shells were fished.

(2) Measure the depth of the sea with fish-detectors.

(3) Nature of bed

Nature of the bed of fishing grounds where mother-of-pearl is living is already known through the studies made formerly. By making a survey on the distribution of various kinds of the bed, it is possible to presume whether or not fishing grounds in question are those for mother-of-pearl.

Soil is to be picked up, in the course of diving with an empty food can and put in a vinyl bag to bring it back to Japan to measure the ratio of mud.

(4) Classification of shell

Making a biological measurement of shells fished, classify them into old, mature and chicken shells.

(5) Visibility, Weather, Tide } measure with the eye

(6) Record accurately frequency, distance and time of diving, and number of men engaged in diving for the estimation of resources of mother of pearl.

(7) Biological measurement

1° Make measurement in accordance with the form of table 7

2° Bring measuring machinery and apparatus and torsion balance;

3° Height(1) and weight(6) of shell and depth of hinge are to be measured, with respect to all the shells fished;

4° Measuring of height(1), length(2), breadth of shell(3), hinge depth(4), and weight of shell(6) is to be made with some 100 200 shells — not necessary to exceed this number — for each of fishing grounds (places where shells can be fished in considerable quantity);

5° Regarding dead shells, it is sufficient to measure nacreous diameter(5) and weight of shell(6) alone with 10 shells for each fishing ground. Put D in the column of "dead or life"

in the case of dead shells no entry is necessary in the case of living shells;

6° In the column of "attached chicken shell", put the number of attached shells;

7° Precision of measurement are to be in 5^{mm}

8° Put S in the column of "gold or silver lip" in the case of silver lip, no entry is necessary in the case of gold lip.

Remark 1. 7. 3° and 4° above are prepared in anticipation of abundunt in quantity of shells and taking into consideration the quantity of work to be performed by the survey ship. However these cautions proved unnecessary in practice.

Remark 2. Regarding 7. 8°, it is known that many of mother-of-pearl living around the coast of Malay Peninsular and the Indian Ocean have a gold-lip.

5. Results of survey

Results of the survey carried out in accordance with 4 are as follows:

I - Izumi M - Mizuhata

Apr. 30, '63

Date	No.	Frequency	Diver Name	Diving Time	Go up Time	Area No.	Location: Latitude	Location: Longitude	Depth	Nature of Bed	No. shell fished	Classification: Dead	Classification: old	Classification: nature	Classification: chicken	Recore of diving: Distance covered	Recore of diving: Frequency	Recore of diving: Time	Recore of diving: No. of men worked	Visibility	Weather	Weather: Direction	Weather: Velocity	Temperature: Water surface	Temperature: Bottom	Tide: Speed	Tide: Direction	Remarks
				h	h				m							m				m								
3/17	1	1	I	7-50	8-10	⑭-15	9°20′	98°15′	13	S.Sh	0	0	0	0	0	600	1	20	1	4	B	N	1	27°	26°	1	ENE	Name of ship for survey: Plamhong III(wooden ship 40 ston, D 240 HP) With neither thermometer nor barometer, figures concerning atomospheric pressure, atmospheric and water temperatures are estimates. Fished 5-6 pieces of double shell. No seaweed and other growth.
"	2	2	M	9-00	9-25	⑫-17	9-26	98-16	16	"	0	0	0	0	0	1000	1	25	1	3	"	NE	1	27	27	1.5	ENE	Slopes at the sea bottom are rather gentle. Seaweed and other growth are not seen. Almost same as No. 1 diving point.
"	3	3	I	13-30	14-10	⑤-4	9-28	97-50	35	M.S.	0	0	0	0	0	1000	1	40	1	2	"	N	1	27	25	1	WNW	North-side of Goh Sinderar Nua. At this point, the sea is steep because of high mountains. An observation by fish-detector found the depth more than 50m. Found no place fit for diving with the exception of vicinity of the beach of island. Tide is much more weaker than expect-

																															ed. Considered poor in fish. A lot of sea-cucumber is seen. There is a difference in temperature between water at the surface of the sea and that of bottom, so much as to affect adversely the body of divers on their way up to the surface.
3/17	4	4	M	14-20	15-07	③-4	9-28	97-52	36	M.S.	0	0	0	0	0	1100	1	45	1	2	B	N	2	27	25	1	WNW	Water temperature of the sea bottom is cold. No change in tide such as seen in the Arafara Sea. No life is seen here. Almost same as No. 3 diving point.
"	5	5	I	15-30	16-35	③-3	9-25	" -50	30-33	M.S. R.Co.	0	0	0	0	0	1200	1	60	1	2	"	NW	2	27	25	1	SW	300m. Offshore West of Goh. Sinderar Tai. With coral reefs and rock-bed visible at some places and rich in variety at the sea bottom, this place is considered a habitat of mother-of-pearl. Survey made by diving for a long time could not find mother-of-pearl.
18	6	1	M	7-28	7-58	⑭-14	"12	98-12	19	Sh.S.	0	0	0	0	0	700	1	30	1	3	"	SE	1	27	26	1	NE	West of Koh Rah. Nature of the sea bed is almost same as one at Nos. 1 and 2 diving points of Mar. 17. This place is not considered of value as a habitat of shells.

3/18	7	2	I	8-33	9-28	⊕-12	9-11	98-8	22	Sh.S.Co	0	0	0	0	0	1200	1	55	1	4-5	B	E	1	27	26	1	NNE	Easy to dive, with eastern wind blowing softly. 7 miles west of Koh Pah. With reefs found here and there among sandy soil and with life visible, this place is best fitted as a habitat of mother-of-pearl among the places where a survey by diving has already been made, but no mother-of-pearl is visible here. Fished single shell.
"	8	3	M	11-00	11-15	⊕-14	"-2	"-12	10	Cy.M.	0	0	0	0	0	200	1	15	1	30 cm	"	NW	0	27	27	0.5	NNE	4 miles offshore west of Goh khor channel. Shallow and easy to dive. Muddy, ankle deep, and visibility is not good. Existence of shells is not perceived. Situated at the gate of channel, water of this place is turbid.
"	9	4	I	12-58	13-53	⊕-2	8-54	"-07	22	M.S. Co.St.	0	0	0	0	0	1200	1	55	1	4m	"	NW	2	27	26	1	NE	Among muddy soil and sandy soil, seeweed, other growth and reefs are visible. This place is considered fit as a habitat of mother-of-pearl, but it is not seen here.
"	10	5	M	14-00	14-45	⊕-2	"-49	"-07	23	M.S.	1	0	0	1	0	1000	1	45	1	3-4	"	NW	1	27	26	1	NNE	Fit as a habitat of mother-of-pearl. Immediately after starting diving fished a pair of mother-of-pearl for the first time. Neither young nor chicken shell is living here. The shells fished are 3-4 years old and good in

																											quality and growth.
3/18	11	6	I	15-05	15-50	く-2	8-48	98-07	24	M.S.	2	0	2	0	0	1200	1	45	1	2-3	B	NW	1	27	26	0.5	NNW	Dived in the vicinity of the place a diving was made the last time. Fished 2 pairs of mother-of-pearl between growth and reefs. They are old one; not young nor chicken shell was visible. The shells fished are heavy; Nearly 3 kg. a pair.
"	12	7	M	16-35	17-25	け-2	"-44	" -07	26	S.Sh	0	0	0	0	0	1200	1	50	1	2-3	"	"	1	26	25	1	"	7 miles West of Lam Hua Klong-Yai. Sandy soil here and there.
19	13	1	I	7-55	8-10	さ-2	"-35	" -09	30	M	0	0	0	0	0	100	1	15	1	3	"	NE	1	27	26	0.5	NE	With neither growth nor coral reef, this place is not considered as a habitat of mother-of-pearl.
"	14	2	1	8-40	9-05	さ-2	"-33	" -08	35	M	0	0	0	0	0	700	1	25	1	3	"	"	1	27	26	1	"	The seabed is muddy and no growth is seen here.
"	15	3	M	9-40	10-15	し-3	"-30	" -10	33	M.S.	0	0	0	0	0	800	1	35	1	2	"	"	1	28	26	1	NW	With no change in tidal flow in general, seaweeds and fish are scarce.
"	16	4	I	11-50	11-55	せ-3	"-20	" -13	30	M	0	0	0	0	0	50	1	5	1	1	"	"	1	27	26	1	NE	Muddy, ankle deep. No prospect of finding mother-of-pearl. After diving 5 minutes, went up to the surface. Visibility is bad.
"	17	5	M	13-10	13-15	そ-3	"-12	" -15	19	S	0	0	0	0	0	300	1	5	1	1	"	ESE	1	27	26	1	"	Seabed is red sand. No growth at the sea-bottom. No shell.

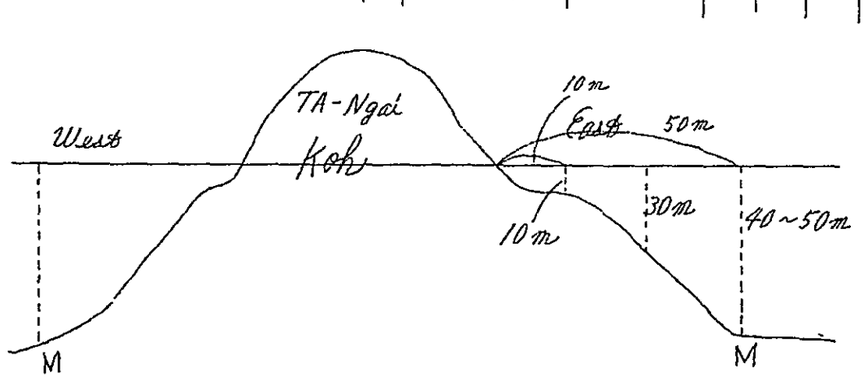
5/19	18	6	I	14-40	14-50	そ-4	"-13	" -16	18	M	0	0	0	0	0	200	1	10	1	1.5	B	SW	1	27	26	1.5	NW	Western coast of Puket Island (1 mile north-west of Ao Bang-Thao) Muddy and not of value as fishing grounds.
"	19	7	M	17-00	17-10	と-4	7-45	" -18	21	"	0	0	0	0	0	300	1	10	1	1.5	"	"	1	27	26	0.5	W	1/2 mile West of Lam Pra-Chao.
"	20	8	M	17-28	18-00	な-4	7-44	" -18	10-28	R	0	0	0	0	0	500	1	30	1	3	"	"	1	27	26	12.5	NW	1 mile south-east of Ko Kaeo Hyai, between Koh Kaeo Noi and Koh Kaeo Yai. Sandy soil here and there among the rolling rockbed. Back to Puket to replenish fuel, water and foodstuffs.
	21	21	1	M	9-30	9-40	と-7	7-52	" -31	19	S	0	0	0	0	0	300	1	10	1	2	"	E	1	27	27	1	W	At 8-00, left port, with Nagata, Secretary attached to the Japanese Embassy aboard the ship. Saw a dredger to mine time from the bottom of the sea. With a lot of sand all over the bed, unfit for shells to inhabit.
	"	22	2	I	9-50	10-10	と-7	7-53	" -30	25	M.S.	0	0	0	0	0	600	1	20	1	1	"	E	1	27	27	1	W	Saw some growth. Found a narrow place which can presumably become fishing grounds for mother-of-pearl. Unable to fish shells.
	"	23	3	I	10-20	11-05	と-7	7-54	" -31	"	M.Sh.	0	0	0	0	0	800	1	45	1	1	"	ENE	1	27	26	1	NW	Because of a slow tidal flow, change of place of diving is difficult. Due to fluctuations in the direction of tidal flow, it is difficult to steer ships. Fished one piece of

3/21	24	4	M	12-32	12-42	ε-8	7-54	98-18	26	M	0	0	0	0	0	200	1	10	1	1.5	B	SE	1	26	26	1	SW	Muddy, ankle deep, none of fish, seaweed, other growth and shell is seen here. Can not be considered as fishing grounds for mother-of-pearl fishery.
"	25	5	"	14-10	14-30	ε-10	"-49	" -46	26	M	0	0	0	0	0	500	1	20	1	3	"	SW	1	27	26	1	"	Covered with soft mud as the place diving was made the last time, this area is not promising.
"	26	6	M	14-45	14-55	"	"-48	" -46	20	"	0	0	0	0	0	400	1	10	1	2	"	"	1	27	26	1	"	Muddy and soft, existence of living things, etc. is not perceived at this place.
"	27	7	I	15-23	15-28	"	"-46	" -47	17	"	0	0	0	0	0	100	1	5	1	0	"	"	1	27	26	1	NE	Because of turbidity, visibility was 0 at the sea-bottom.
"	28	8	I	16-05	16-55	ε-10	7-42	" -46	30	M.S.St.	3	1	2	0	0	1000	1	50	1	3	"	SE	1	27	25	1	SW	3/5 mile south of Koh Phi-phi Dom. With seaweed and other growth among muddy sand and with stones scattered here and there, and having appropriate ups and downs, this place is considered fit to fish mother-of-pearl. Fished near living thing 3 pairs of shells, one of which is dead one. They are large, nearly 3 kg. apiece. Estimated 7-8 years old. Considered very good as a fishery but found neither young nor chicken shell. Nothing was found stuck to the shells fished.

3/21	29	9	M	17-10	17-45	〃-10	7-43	" -47	25	M.S.	1	0	1	0	0	.700	1	35	1	3-4	B	S.W.	1	27	25	1	NE	Nature of the bed is good, same as that of the place previously surveyed. No concentration of shells is visible. Young or checken shells are not seen. With old shells alone, this place is not promising as fishing grounds. Shell is 2.7 kg. - 3.0 kg. heavy a piece (average). Stopped survey at 17-50 and sailed to Puket to send Secretary Nagata to the island.
22	30	1	I	12-50	13-15	〃-18	6-41	99-27	25	M.S.	0	0	0	0	0	600	1	25	1	2	"	"	1	27	25	0.5	S	At some points the nature of the bed of this place resembles that of fishing grounds of an eastern part of the Arafara Sea. No seaweed and other growth and reef. Found no shell. Tide is weak here also.
"	31	2	I	14-00	14-25	〃-19	6-43	" -32	20	h M.S	0	0	0	0	0	600	1	25	1	1	"	SW	1	27	26	0.5	N	6-1/2 mile West of Koh terutan. Visibility is bad because of hard sandy mud. Irregularity of tide makes it difficult to steer ships here Shells fished are: Mauritia sp. Conus sp. Chlamys sp. Oliva sp. Placuna sp.

3/22	32	3	M	15-05	15-35	ち-20	6-43	99-35	14	M.S	0	0	0	0	0	700	1	30	1	1	B	SW	1	27	26	0.5	N	The place of to-day's third diving was fairly looked for as prospective fishing grounds before. With no growth, shell, sea-weed nor fish seen this place can not be considered as fishing grounds for mother-of-pearl. Although change in tidal flow was expected, with the period of floodtide nearing, no such change is perceived. It is lucky for us that operations are easy to carry out because of a spell of good weather and favorable condition of the sea.
"	33	4	I	16-40	16-45	め-20	"-35	" -35	13	M	0	0	0	0	0	50	1	5	1	0	"	S	0.5	27	27	0.5	SW	Almost no speed in tidal flow. Color of water of upper layer is bad. Visibility is 0 because of soft mud.
"	34	5	I	17-55	18-05	も-18	6-34	99-28	30	M	0	0	0	0	0	200	1	10	1	0	"	S	0.5	27	26	0.5	SW	2/5 mile West of Koh Tarutau Ngah. The Sea-surface of this place, south-west of Tarutau, is discolored due to soft mud. Visibility is not good. Dwelling of mother-of-pearl is considered impossible. In the vicinity, a ship is trawling.
23	35	1	I	07-00	07-30	"	"-33	" -26	30	So M.S.	0	0	0	0	0	600	1	30	1	1	"	NE	1	27	26	1	NW	1/5 mile east of Koh Ta Nagah. Because of the two storied tide (tide in the upper layer and one in the lower layer flow in contrary directions),

																															diving is difficult to perform. With no growth, not fit for shells to dwell in. Depth of sea 100m. offshore is 40m - 50m. deep though shallow just around the island. In the vicinity a ship was trawling.
3/23	36	2	I	7-50	8-20	8-18	6-33	" -27	27-31 -35	So M.S.	0	0	0	0	0	400	1	30	1	1- 1.5	B	NE	1	26	25	1	NE	South of Koh Ta Ngai. Nature of bed is same as that of the west side of the bed previously surveyed. With deep mud, unfit for shells to dwell in. Due to wind (direction of wind and that of tide are contrary) it is difficult to change the place of survey during the course of diving. Difficult to steer ships and dive. At three points around this island, diving was carried out. Up to 10m. from the shore, the sea is 10 - 30m. deep. Tide is irregular. The area along north-end to west side of Tarutau Island (No.30 and No.31 diving points) is a little better because of the nature of its bed. The further down south, the muddier becomes the bed. With the bed deep in mud, no shell is expected to live here at all, along with the sea around Koh Tagah.



5/23	37	3	M	9-28	9-33	6-19	6-31	99-34	15	So.M	0	0	0	0	0	30	1	5	1	0	B	NE	0.5	27	26	0.5	NE	4-2/5 miles West of Southern part of Koh Terutau. With knee-deep mud, visibility is 0. Diving is impossible to make.
"	38	4	M	10-38	10-43	6-21	"-30	" -42	26	Cy.M	0	0	0	0	0	20	1	5	1	0	"	E	"	27.	26	1	NW	According to an observation made by the use of fish-detector, the depth of the sea along the west-side of Koh Terutau corresponds with the one given in the chart. At 10-00, arrived at the border between Malay and Thai. Seawater around this place is discolored. Visibility is 0. Because of the extreme turbidity, diving is impossible to make. With tide not changing, marine resources seem scarce here. The sea-bed, covering a wide area, is clayish. In the visinity of this place, there was a lot of nets fixed for fishing. At 11-30, steering toward the east side from the southern-end of Terutau, sailed about an hour passing through

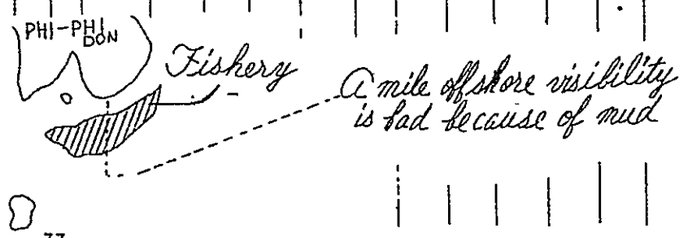
																													the offing in the Bay of Wanderer. Almost no tidal flow on the surface of the sea from the northern-end to southern-end. With the discolored water and with sea-bed clayish mud, visibility is 0. Impossible to make diving. Shore is mainly composed of rock, with almost no sandy beach. We can not see from offshore any promising grounds for fishing.
3/23	39	5	I	13-00	13-25	?-20	"-45	" -37	17	M.S. S.Sh.	0	0	0	0	0	500	1	25	1	1	B	WNW	1	26	25	1	WNW	2 miles north-west of northern port of Koh Terutau. The color of sea-water is bad. The sea bed is muddy sand and shellish sand. There is a possibility of habitation of mother-of-pearl here but unable to find it. Abound in Placuna sp., Pinna sp.
"	40	6	I	13-57	14-17	?-19	"-46	" -33	16	M	0	0	0	0	0	500	1	20	1	30cm -1m	"	W	1	27	26	0.5	W	5-3/5 miles north-west of the northern part of Koh Terutao. No seaweed and other growth. Not considered as fishing grounds for mother-of pearl.
"	41	7	M	14-37	15-07	?-19	"-47	" -32	13	M.S.	0	0	0	0	0	700	1	30	1	0	"	"	1	27	26	1.5	NW	1/6 miles south of Koh Rang-Nok. The bed of muddy sand continues next to a rock bed. Found no seaweeds. Can not be considered as fishing grounds for mother-of-pearl.

5/23	42	8	I	15-57	16-50	≠-18	6-53	99-27	13	M	0	0	0	0	0	10	1	3	1	0	B	W	1	27	26	1	W	Visibility at the sea bottom is completely bad. Diving is impossible to make.
"	43	9	I	16-25	16-30	≠17	"-50	" -24	26	"	0	0	0	0	0	10	1	5	1	0	"	NW	1	27	26	1	"	Because of deep mud, visibility is 0.
"	44	10	M	17-43	17-43	~18	7-02	" -28	12	M	0	0	0	0	0	15	1	50	1	0	"	W	1	27	27	1	NE	1/5 mile west of Koh Phe-Tra. Visibility is 0 because of muddiness In the area surveyed today, tidal flow is gentle But very muddy because the bed is clayish mud of part of west side of Terutau and along the border line with Malay and east side in general. Would become muddier at the time of the high tide. Although, according to the data already in existence, the sea around Terutau was considered a promising area, this can not be considered so because of the nature of bed and tide.
24	45	1	I	7-53	8-33	~17	7-03	" -24	13	MS	0	0	0	0	0	1000	1	40	1	2	"	NE	1	27	26	1.5	NE	1-1/5 miles south of Koh Liang. Difficult to dive because of wind and tide that move in contrary directions. Found seaweed and other growth here and there. In view of the nature of the sea bed, dwelling of mother-of-pearl is considered possible. However, failed to find it. Fished murex sp. Drill

																												pinctada sp., coral and Colum barium sp.
3/24	46	2	I	9-30	9-18	~17	7-03	99-23	15	M	0	0	0	0	0	200	1	15	1	30 cm	B	NE	1	27	26	1.5	SW	4/5 mile south-west of Koh Liang. Muddy and not considered as a habitat of mother-of-pearl. Gave Paisal, a member of the Thai survey team, a guidance to diving. Because of an ear trouble, stopped diving, after diving some 3 minutes (at the depth of 10m).
"	47	3	M	9-50	9-55	~17	7-06	" -20	24	"	0	0	0	0	0	10	1	5	1	0	"	"	0.5	27	26	1	SW	3-2/5 miles north-west of Koh Liang. Because of muddiness at many spots, visibility is 0. Impossible to dive.
"	48	4	I	12-05	12-25	~14	7-11	" -06	32	"	0	0	0	0	0	400	1	20	1	1	"	"	1	27	26	1.5	W	1-4/5 miles south-east of Koh Rok-Nai. With the sea-bed entirely of mud, found neither seaweed nor other growth here.
"	49	5	I	12-48	13-43	~13	7-12	" -03	20	S.St.	0	0	0	0	0	800	1	50	1	1.0	"	"	1	26	25	1	SW	1/8 mile west of Koh Rok-Nai. Dived at a place 5m - 10m off the beach of the island. With rock, stone and sand, bed is rich in variety. Visibility is good. Considered possible for mother-of-pearl to dwell in but found neither growth and mother-of-pearl. Abounds in fish. Thai fishing boats were seen fishing.

3/24	50	6	M	14-00	14-40	ひ-13	7-13	99-04	17	S.St.	0	0	0	0	0	600	1	40	1	1.0	B	W	1	27	26	1	SW	1/7 mile west of Koh Roh Rok-Nai. With sand, stone and rocks, visibility is good. Native "water men" are fishing Turbo sp. at the beach.
"	51	7	I	16-23	16-25	ㅎ-13	"-26	" -05	15	So.M.	0	0	.0	0	0	5	1	2	1	0	"	"	1	27	26	1.5	SW	2 miles south of Koh Lanta Hyai. Muddy and visibility is bad because of muddiness. Not fit for mother-of-pearl to dwell in.
25	52	1	M	9-46	10-26	ㅎ-10	"-43	98-47	23	S.	2	0	1	1	0	900	1	40	1	3	"	NE	1	27	26	1	NE	1/2 mile south-east of Koh Phi-Phi-Don. This area is the location of diving made on Mar. 21 (No.28 and No.29). A habitat of shells but they are distributed rather scatteringly. Found no concentration of shells. The shells living here are generally old; Neither young nor chicken shells are seen. To the shell fished here are stuck larval of crab and starfish.
"	53	2	M	10-40	11-25	"	"-43	" -47	35	M.S	0	0	0	0	0	700	1	45	"	2	"	"	1	27	26	1.5	"	2 miles south-west of Phi-Phi-Don. Off the shore of the island, mud becomes deeper and unfit as fishing grounds for mother-of-pearl. It is considered, therefore, fishing grounds for mother-of-pearl in the neighborhood of Phi-Phi-Don have to be very narrow.

3/25	54	3	I	11-40	12-50	〃-10	7-43	99-47	30	S.	2	0	2	0	0	1200	1	70	1	4	B	NE	1	26	25	2	W	Near the land, the sea bed becomes sandy and seaweed and other growth can be seen. Among them dwell mother-of-pearl. All the shells fished here are old ones (7-8 years old), nearly 3 kg. heavy a piece. In view of this fact this place is considered of little value as fishing grounds.
〃	55	4	I	13-3	13-58	〃	〃	〃 -48	26	MS	3	0	2	1	0	1000	〃	55	1	4	〃	W	1	27	26	1	SW	1/2 mile east of Koh-Phi-Phi-Don. A lot of seaweed, shell and growth is seen here. This area is considered as a habitat of mother-of-pearl. Could not find a place where shells live in swarms. Two out of three shells are large 7-8 years old ones, worm-eaten and with a lot of cuts. Remaining one is a mature shell of good quality, excellent in growth. This area is of low value as fishing grounds. "Umimatsu" (a kind of coral), hermit crab, Star fish and Sea fan are seen here.
〃	56	5	M	14-30	14-40	〃	〃	〃 -48	25	M	0	0	0	0	0	250	〃	10	1	1	〃	〃	1	27	26	2	〃	1-1/5 miles south-east of Koh Phi-Phi-Don. Offshore, the sea becomes muddy and visibility bad. Therefore a habitat of mother-of-pearl here is very small.



3/25	57	6	M	14-13	15-28	ก-10	7-44	99-48	25	S.Sh	0	0	0	0	0	500	1	30	1	2	B	W	1	27	26	2	SW	1 mile of Koh Phi-Phi-Don. Stretching from South to West, fishing grounds of this area are very narrow. No shell can be seen a little off the fishing grounds.
"	58	7	M	16-03	16-18	"	"-40	" -46	35	M.	0	0	0	0	0	300	"	15	1	2	"	SSW	1	27	26	1	SSW	1/2 mile east of Koh, Phi-Phi-Le. Changing the location of diving, dived near an islet that stands in the offing. Different from places where diving was made previously. This place is muddy and growth and living things are not seen.
"	59	8	I	17-08	17-18	ก-9	"-40	" -40	30	M.S.	0	0	0	0	0	200	"	10	1	3	"	W	1	27	26	2	"	6 miles South-West of Koh Phi-Phi Don. Fished one piece of oyster.
"	60	9	I	17-55	18-10	ก-8	"-44	" -37	25	S	0	0	0	0	0	300	"	15	1	3	"	W	1	27	26	2	SE	1/4 mile South-West of Koh Kai. Sandy and with neither seaweed nor other growth, this piace is not fit for mother-of-pearl to dwell in.
4/1	61	1	I	7-20	8-05	८-2	8-38	98-08	29	MSR	0	0	0	0	0	700	"	45	1	1	"	SE	1	26	25	0.5	SW	6 miles North-west of Lam-Kor-Khang. Tide at the bottom of the sea is cold comparatively. Rocks are seen here and there on the muddy, sandy soil. Considered possible for mother-of-pearl to dwell in. No seaweed and other growth. Saw a sea serpent.

4/3	62	2	M	8-25	8-40	ゖ-12	8-40	98-07	35	M	0	0	0	0	0	200	1	15	1	0	B	SE	1	26	25	0.5	SW	7-1/2 miles North-west of Lem Ao Kham. Muddy and with sediments, visibility is very bad. Diving is impossible to make.
"	63	3	M	9-15	10-15	く-1	"-45	" -04	41	"	0	0	0	0	0	1200	"	60	1	3	"	NE	0.5	26	25	"	W	Even in the offing, sea-bed is muddy and not fit for mother-of-pearl to dwell in. Upper layer is clear.
"	64	4	I	10-38	10-58	く-2	8-47	" -05	"	M	0	0	0	0	0	400	"	20	1	2	"	NE	"	27	25	1	N	9 miles West of Lam Hua Kwang Yai. With mud and sand mixed here, the sea bed is of soft mud. Found no habitat of mother-of-pearl.
"	65	5	I	11-22	11-32	ゖ-2	8-43	" -05		M	0	0	0	0	0	200	"	10	1	1.5	"	NE	1	27	25	0.5	N	6-5 miles West of Lam Hua-Kwang Yai. Difference in temperature is large between upper layer and lower one (a difference of some 2°) and an attention should be given for the prevention of disease caused by diving. Because of muddiness, almost neither growth nor fish is seen here.
"	66	6	M	12-10	12-55	ゖ-2	"	" -09		SSh	0	0	0	0	0	600	"	45	1	3	"	W	1	27	26	1	N	4 miles West of Lam-Hua Kawang Yai. Found some growth, but no mother-of-pearl.
"	67	7	M	13-33	13-43	く-2	8-48	" -09	25	MS	0	0	0	0	0	200	1	10	1	1	"	NW	1	26	25	0.5	SE	6 miles West of Lam Hua-Kawang Nai. Found no place fit for mother-of-pearl to dwell in. No growth

4/1	68	8	M	14-10	14-45	<-2	8-49	98-08	33	M	0	0	0	0	0	600	1	35	1	1	B	NW	1	26	25	1	SE	8 miles West of Lam Hua-Kawang Nai. This place is in the neighborhood of the place where a survey was carried out previously (No.10, Mar. 18) but, from the depth of the sea as well as the nature of the bed, this place looks different from the place previously surveyed.
"	69	9	I	16-20	17-20	≧-2	8-54	98-07	28	MS	0	0	0	0	0	1200	1	60	1	2-4	"	"	1	26	25	0.5	NW	8 miles south-west of Koh Pra-Tang. At 15-34 diving was started but at 15-39, came up to the surface due to a failure of compressor and pump. After completion of repair, which took some 40 minutes, dived again at 16-20. Nature of the bed is mostly muddy sand, sand and sandy mud. This composition may change somewhat. Could not find growth and mother-of-pearl.
"	70	10	1	17-45	17-55	≧-3	8-52	98-10	18	N.S.	0	0	0	0	0	300	1	10	1	4	"	"	2	26	25	1	NE	6 miles north-west of Lam Hua Kwang Nai. Because of sandy bed, visibility is good. Not considered as fishing grounds for mother-of-pearl.
4/2	71	1	I	7-48	8-08	≧-3	9-05	98-11	12	MS	0	0	0	0	0	300	1	20	1	3	"	NE	1	26	25	1	NW	4-1/4 miles West of Koh Pra-Tang. There are places, here and there, covered mainly with shellish sand. Can not be considered as fish-

																										ing grounds for mother-of-pearl.
4/2	72	2	I	8-40	9-10	ﾈ-2	9-08	98-08	22	M.S.R.	0	0	0	0	0	700	1	30	1	2	B	NE	1	26	25	1	NW	7-1/2 miles West of Koh Pra-Tang. Hard sandy mud with seaweed and other growth and rocks here and there. Could not find mother-of-pearl.
"	73	3	I	9-45	10-25	ﾖ-2	9-12	98-05	34	M.S.	1	0	1	0	0	800	1	40	1	4	"	"	1	27	25	1	NE	At this muddy place, found only one solitary shell, just before going dead -- considered a 10 years old shell. Could not find a habitat of mother-of-pearl in the neighborhood though searched for it in detail.
"	74	4	M	10-45	11-15	ﾖ-2	9-12	" -05	32	MS	0	0	0	0	0	500	1	30	1	1.5	"	"	1	26	24	1	"	9-1/2 miles West of Koh Rati. With neither growth nor coral reefs, this place is not considered as fishing grounds for mother-of-pearl.
"	75	5	"	11-35	12-10	ﾍ-1	"-15	" -05	35	"	0	0	0	0	0	700	1	35	1	3	"	N	1	26	25	1	NNE	10-1/2 miles North-west of Lam Fox-Nose (Koh Rah).
"	76	6	I	13-05	13-30	ｵ-2	"-22	" -05	34	"	0	0	0	0	0	400	1	25	1	"	"	NNW	1	26	25	1	"	4 miles east of Richelien Rock. The speed of tide is gentle and condition of the sea calm, could not find a place where shells are living.
4/3	77	1	M	12-00	12-20	ﾛ-24	"-55	" -32	11	b.S.	0	0	0	0	0	300	1	20	1	20cm -30 cm	"	N	0.5	26	26	0.5	W	In accordance with the direction of Mr. Chavalit, a diving operation was made at the month of a river. Considerably muddy because of the river. Judging

4/3	78	2	M	12-35	12-40	⊕-24	9-54	98-32	11	Cy	0	0	0	0	0	50	1	5	1	0	B	N	0.5	26	26	0.5	W	from the nature of the bed, existence of mother-of-pearl was considered possible but unable to find it. Mr. Sant, Deputy Director of Fisheries Bureau; Mr. Ranong, Chief of Fisheries Section, Chief of Telegraph Section, Chief of Fish Market Division, Mr. Chavalit and Mr. Kodama, an observer came on board the ship.
																												1-3/5 miles South of Koh Ru. Although this place was one designated by Mr. Chavalit, the nature of the bed is bad. Visibility is extremely bad because of muddiness. Not considered as fishing grounds for mother-of-pearl.
"	79	3	I	14-30	14-35	⊕-31	"-47	" -27	17	M	0	0	0	0	0	20	1	5	1	0	"	NW	1	27	26	1	"	1/5 mile South of Koh-Chang. Although this place is one designated by Mr. Chavalit, could not find mother-of-pearl here. Got two native "water men" aboard the ship and have them point out the place. Dived but visibility was 0 because of the muddy bed. Judging from the nature of the bed, this place is not considered as a habitat of mother-of-pearl. Understood that the place where we made a diving operation was a little off from

																													from the nature of the bed, existence of mother-of-pearl was considered possible but unable to find it. Mr. Sant, Deputy Director of Fisheries Bureau; Mr. Ranong, Chief of Fisheries Section, Chief of Telegraph Section, Chief of Fish Market Division, Mr. Chavalit and Mr. Kodama, an observer came on board the ship.
4/3	78	2	M	12-35	12-40	⊛-24	9-54	98-32	11	Cy	0	0	0	0	0	50	1	5	1	0	B	N	0.5	26	26	0.5	W	1-3/5 miles South of Koh Ru. Although this place was one designated by Mr. Chavalit, the nature of the bed is bad. Visibility is extremely bad because of muddiness. Not considered as fishing grounds for mother-of-pearl.
"	79	3	I	14-30	14-35	⊛-31	"-47	" -27	17	M	0	0	0	0	0	20	1	5	1	0	"	NW	1	27	26	1	"	1/5 mile South of Koh-Chang. Although this place is one designated by Mr. Chavalit, could not find mother-of-pearl here. Got two native "water men" aboard the ship and have them point out the place. Dived but visibility was 0 because of the muddy bed. Judging from the nature of the bed, this place is not considered as a habitat of mother-of-pearl. Understood that the place where we made a diving operation was a little off from

																													the designated place. If so, fishing grounds here are considered extremely narrow.
4/3	80	4	I	14-45	15-00	⊕-31	9-47	98-27	10	M		0	0	0	0	0	200	1	15	1	0	B	N	0.5	27	26	1	W	1/4 mile South of Koh Chang. Dived at a place designated by native "water men". Could not see the sea bottom because of turbidity. Not considered as a habitat of mother-of-pearl. A native "water man" who dived at the same time could not fish shells also. Since, according to the data supplied by Mr. Chavalit, some 70 tons of shells were fished here, we have expected much from Ranong area but thus far could not find here mother-of-pearl. According to the experience of Mr. Chavalit and native "water men", young mother-of-pearl live in a shallow near the beach and those that live in places of which more than 20m. under the sea-surface are old ones only. Within the Burma area, there are fishing grounds for mother-of-pearl at places of which depth is more than 30m. below the sea-surface.

3/3	81	5	I	15-57	16-37	⊕-19	9-45	98-24	10	S.Sh	0	0	0	0	0	700	1	40	1	1	B	N	1	27	26	2	NE	3/4 mile North-west of Koh Piam. Dived around the island, off 10m - 20m from the beach. Bed of the shallow is of shellish sand. Turbid offshore because of mud. Not fit for mother-of-pearl to dwell in.
4/4	82	1	I	9-10	9-30	⊕-19	9-51	98-25	15	hMS.	0	0	0	0	0	500	1	20	1	1.5	"	NE	0.5	27	26	0.5	W	1-1/5 miles South-west of Koh-kan. There are places here considered fit as a habitat of mother-of-pearl but neither growth nor shell are seen here.
"	83	2	I	9-45	10-00	"	9-51	" -25	"	S.Sh	0	0	0	0	0	400	1	15	1	1.5	"	"	"	26	26	1.5	"	1/2 mile West of the Northern part of Koh-Chang. Dived along a line 10m -20m off the beach. Considered fit as a habitat of mother-of-pearl because of the nature of the sea bed (rock and shellish sand). Extent of this kind of sea bed is narrow. The rest of the sea bed of this area is generally muddy.
"	84	3	I	10-28	10-53	⊘-18	"-48	" -23	12	So.M.	0	0	0	0	0	500	1	30	1	1	"	"	0	26	26	0.5	SW	2-1/2 miles West of Koh-chang. The further one goes offshore, the muddier becomes sea-bed and the worse visibility. Sailing along the west 3' -4' border line between Burma and Thai, found stakes for fixing fishing nets. Sea bed around this place are presumed to be muddy.

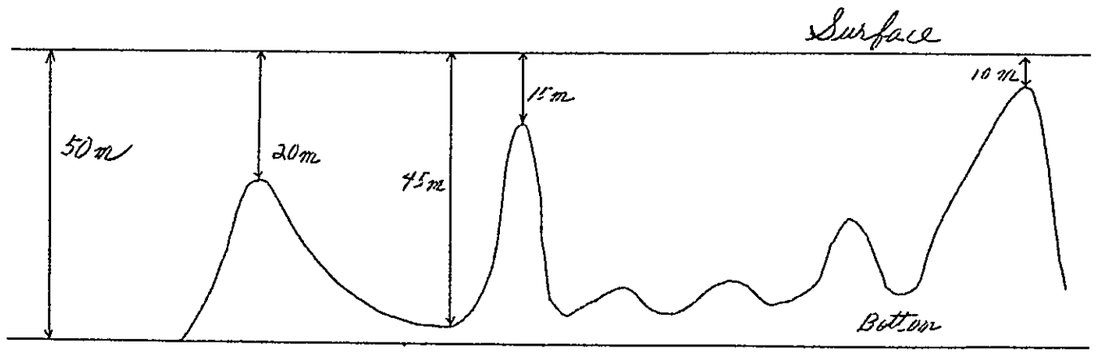
-/4	85	4	M	11-25	11-35	⑳-18	9-47	98-22	25	Cy.M	0	0	0	0	0	200	1	10	1	1	B	NW	1	27	26	0.5	SSW	2-1/2 miles West of Northern-part of Koh-Piam. Neither growth nor fish is seen here.
"	86	5	M	12-43	12-53	⑰	"-43	"-23	11	M	0	0	0	0	0	200	1	10	"	30cm	"	"	0.5	26	26	1	NW	2/5 mile West of Koh Piam. We found here a raft for pearl culture when I made a survey on Mar. 4, by hiring a ship at Ranong. No raft was found this time.
"	87	6	M	13-10	13-15	"	"-42	" -23	10	M	0	0	0	0	0	20	1	5	"	0	"	"	"	"	"	1	"	1/2 mile West of Koh Piam. Because of shin-deep mud, tide is dis-colored and visibility is entirely bad. In general, change in tide is supposed scarce, a factor, presumable, of the scarcity of life here.
"	88	7	M	13-52	13-57	⑰	"-38	" -22	19	M	0	0	0	0	0	20	1	5	"	30cm	"	"	"	27	26	0.5	SW	4 miles North of Koh Chang Piam. Muddy and cannot be considered as a habitat of mother-of-pearl. According to the data supplied by Chavalit, a ship (20 tons, 240 HP) had fished as much as 70 tons of shells. The sea-bed of the area surveyed so far is soft and muddy and can not be consider-ed as a habitat of mother-of-pearl.
"	89	8	I	14-38	14-48	⑱	"-34	" -23	12	"	0	0	0	0	0	100	1	10	"	20cm	"	"	0.5	26	26	0.5	NE	3/5 mile North of Koh-chang Piam. Visibility at the bottom of the sea is same as the spot pre-viously surveyed.

1/4	90	9	I	15-05	15-30	⑰-18	9-33	98-23	15	M	0	0	0	0	0	500	1	25	1	1	B	NW	0.5	26	26	1	NE	1/4 mile South of Koh-Chang Piam. Same as the previous place.
"	91	10	I	15-50	16-05	⑰-18	"-32	" -23	17	M	0	0	0	0	0	300	1	15	"	1	"	"	"	26	26	1	E	South of Koh Chang Pianam. Generally speaking, visibility and condition of the bed is bad here. Not considered as a habitat of mother-of-pearl.
"	92	11	I	16-33	16-53	⑰-17	"-30	" -21	8	S	0	0	0	0	0	600	1	20	"	1	"	W	"	"	"	1.5	NNE	1/2 mile North of Koh Kam-Hyai.
"	93	12	I	17-30	17-55	⑰-17	"-28	" -20	8	M	0	0	0	0	0	500	1	25	"	30cm -1m	"	"	"	26	26	1.5	NE	1/4 mile South of Koh Kam Hyai. During the course of diving, nature of sea-bed changed from sandy soil to mud and to sandy soil again. Despite a low tide, visibility is bad. Not able to find a habitat of mother-of-pearl.
4/5	94	1	M	7-28	7-48	⑭-14	"-30	" -16	18	S	0	0	0	0	0	400	1	20	"	3	"	NNE	1	27	26	1	NE	4 miles West of Koh Kam Yai. Here and there sand is covered with mud. Seawater near the island is discolored and turbid in some parts. Offshore, visibility becomes better.
"	95	2	M	8-08	8-33	"	"	" -15	19	"	0	0	0	0	0	500	1	25	"	3	"	NE	1	26	25	1	"	5-1/2 North-west of Koh Kam Hyai. Same as the point previously surveyed.
"	96	3	M	8-48	9-03	⑬-13	"-29	" -12	20	"	0	0	0	0	0	300	1	15	1	4	"	"	1	27	26	1	"	8 miles West of Koh Kam Hyai.
"	97	4	M	9-30	9-40	⑭-14	"-27	" -11	19	"	0	0	0	0	0	300	1	10	1	4	"	"	0.5	27	26	1	"	9 miles West of Koh Kam Hyai. Because of sandy soil, visibility is good.

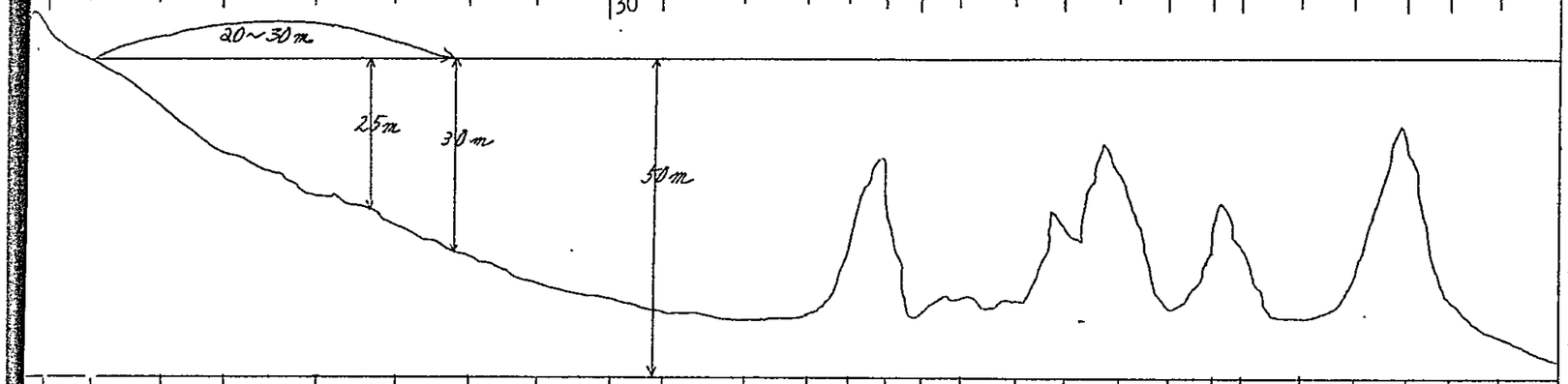
4/5	98	5	I	10-32	10-57	⑫-12	9-24	98-12	19	S	0	0	0	0	0	300	1	25	1	6	B	NE	0.5	27	26	0.5	SW	Considered unfit as a habitat of mother-of-pearl.
"	99	6	I	11-38	12-03	⑬-12	"-22	" -12	17	"	0	0	0	0	0	400	1	25	1	4	"	"	1	27	26	1	"	8 miles South-west of Koh Kam Hyai. Same as the point surveyed previously.
"	100	7	I	13-17	13-27	⑭-15	9-16	98-18	9	rS	0	0	0	0	0	200	1	10	1	2	"	NW	1	26	26	1	SW	8 miles North-west of the northern part of Koh Pan. With sandy soil alone, no growth is seen here. Neither coral reef nor rock bed.
"	101	8	I	13-37	13-47	"	"	"	9	"	0	0	0	0	0	300	"	10	1	3	"	"	1	26	26	2	"	Because of sandy soil, visibility is good. No life is seen.
"	102	9	I	13-58	14-13	⑯-16	"	" -19	9	"	0	0	0	0	0	200	"	15	1	3	"	"	1	26	26	1.5	NW	2/5 mile north Koh Ran. Generally, the bed is red sand and found no life here.
"	103	10	M	14-28	14-48	⑰-17	"	" -19	12	R.S.	0	0	0	0	0	100	"	20	1	3	"	"	1	27	27	1	"	1/4 mile North of Koh Ram. Around this area, there is a place designated by Mr. Chavalit where, according to his opinion, mother-of-pearl can be fished without fail. Entirely of red sand, not considered as a habitat of shells.
																												Because of the fact that the bed is of rock and sand, visibility is good. Sea bottom can be seen from the ship. Since the sea was not so deep, coached Mongkol, a Thai member, how to dive.

1/5	104	11	M	15-04	15-24	⊖-17	9-15	98-20	11	St.	0	0	0	0	0	300	1	20	1	1	B	NW	1	26	26	1	NW	1 mile east of Koh Ram. Covered mostly with small stones, looking like molten lava, with sandy soil scattered here and there. Coached Mongkol how to dive for the second time (5 minutes)
"	105	12	"	15-43	15-48	"	"-14	"	10	M	0	0	0	0	0	10	1	5	1	0	"	"	1	26	26	1	W	Dived at a number of points designated by Mr. Chavalit. Unable to find mother-of-pearl. Far in the bay, visibility is 0 because of muddiness. No place fit for shell to dwell in.
"	106	13	"	15-58	16-03	⊖-17	"-12	" -18	10	"	0	0	0	0	0	30	1	"	1	30cm	"	"	1	26	26	0.5	W	Dived, going further into bay. Visibility is bad because of the discolored sea water. Not considered as a habitat of mother-of-pearl. At 16-10 stopped a survey and gave members of Thai Keam guidance to diving.
"	107	1	I	7-02	7-22	⊖-5	"-27	97-55	37	MS	0	0	0	0	0	200	1	20	1	7m	"	"	1	26	25	1	NW	1 mile North-west of Koh Sindara. Due to wind and tide moving in contrary directions, diving is difficult to make. Visibility is excellent.
"	108	2	I	7-35	8-25	"	"	" -54	27	S	0	0	0	0	0	1000	1	50	"	4	"	N	1	26	25	1.5	S	1/5 mile East of Koh Sindara Nua. Judged from the nature of the bed, this area is considered fit for a habitat of mother-of-pearl. Neither growth

4/6	109	3	I	9-09	9-24	⊛-4	9-23	97-53	10-30	S.R.	0	0	0	0	0	300	1	15	1	5	B	NW	1	26	26	0.5	SE	nor coral reef. No habitat of shell is seen here. With a lot of ups and downs in the sea bed and with rocks scattered here and there, a special attention should be taken, when diving is to be made. Fished pomacentidae, scaridae, etc.
"	110	4	M	10-08	10-48	⊛-3	"-23	" -52	20	rS.	0	0	0	0	0	800	1	40	"	4	"	NE	1	27	26	1	SW	1/5 mile West of Koh Sindara. In the offing some 100m. off the shore, the depth of the sea becomes 50m. or above. Diving is not possible except in places near the beach. Fished 2 pieces of helmet shells cassidae and pecten.
"	111	5	"	11-25	11-50	⊛-2	"-23	" -50	29-35	R	0	0	0	0	0	400	1	25	"	4	"	"	1	36	26	1	"	1 mile South-west of Koh Sindara. According to a survey made with the fish-detector, the bottom of the sea of this area has steep slopes and dangerous for divers because of many a rock jutting upward. A survey made by diving found out that there are few footholds (flat points) for divers at the bottom of the sea.



1/6	112	6	I	14-37	15-02	㊙-3	9-05	97-49	15-30	S.R.	0	0	0	0	0	400	1	45	1	10	B	NW	1	27	26	1	S	1/6 mile East of Koh Tasai. A survey made around the island revealed that because of steep slopes at the bottom of the sea and the depth of the sea off-shore--50m. or above deep--there is no place in this area fit for diving. Dived at points some 20m - 50m off the beach and found out that the sea bed is of white sand, and rocks. No life is seen.
"	113	7	I	7-23	7-53		8-40	97-39	27	S.Sh	0	0	0	0	0	500	1	30	1	10	B	NE	1	27	25	0.5	SW	1/5 mile East of Koh Similan. Here and there a lot of , rock and sand is seen. Attention should be given not to get pipes caught in them during the course of diving. Big fishes are seen here and there.
"	114	2	I	8-55	9-30		8-34	" -38	20-25	S.R.	0	0	0	0	0	200	1	35	1	"	"	"	1	"	26	1	"	1/4 mile North-east of Koh Miang. Found rocks, stone and sand. There are steep slopes at the sea bed and attention should be given to the life-line. Fished 2 pieces of black lip oysters (one of them is dead one) and one helmet shell
"	115	3	I	10-05	10-18		8-30	11-39	30	S	0	0	0	0	0	200	1	13	1	"	"	"	0.5	26	25	"	NW	1/4 mile South-east of Koh Payan. Visibility is excellent but the area is very narrow where diving is possible to make.



BIOLOGICAL RECORD

Date	Location	Area No.	Dead or life	Height of shell (1)	Length of shell (2)	Breadth or shell (3)	Hinge depth (4)	Nacreous diameter (5)	Weight of shell (6)	Immature shell attached	Gold or silver lip	Remarks
3/18	8−49 98−0.7	く− 2	L	23	22	5.0	2.0	16.5	2.2㎏	0	Silver	♀ 7 Years
〃	8−48 98−0.7	く− 2	L	25	23	5.5	2.0	20.0	2.8	0		6～7 〃
〃	〃	〃	L	24	24	5.8	2.0	18.5	3.0	0	Silver	〃
3/21	7−42 98−46	な−10		29	29	7.0	2.0	26.0	2.5	0	Silver	♀ 8 〃
〃	〃	〃		32	30	8.5	2.2	28.0	2.8	0	Silver	♂ 10 〃
〃	〃	〃	D	18	16	6.5	1.0		2.0	0		
〃	7−43 98−47	〃		28	22	7.0	2.5	21.0	2.2	0	Silver	♂ 8 〃
3/25	7−42 98−47	な−10	L	27	25	7.0	2.5	21.0	1.8	0	gold	♀ 7 〃
〃	〃	〃	L	28	26	7.5	2.5	22	2.2	0	〃	♀ 7～8 〃
〃	〃	〃	L	27.5	25	7.0	2.0	21	2.2	0	〃	♀ 7～8 〃
〃	〃	〃	L	24	24	6.0	1.5	18	1.1	0	〃	♂ 2～3 〃
〃	7−43 98−48	〃	L	22	23	5.5	1.4	17	0.8	0	〃	♂ 2～3 〃
〃	〃	〃	L	25	25	6.5	2.2	20	2.1	0	〃	♀ 7～8 〃
〃	〃	〃	L	25	25	6.5	2.0	20	1.9	0	〃	♀ 7～8 〃
4/ 2	9−12 98−05	う− 2	L	25	25	7.0	2.0	18	1.5	0	Silver	♀ 7～8 〃

BAY OF BENGAL
WEST COAST OF THAILAND

S^T MATTHEW'S ISLAND TO SIMILAN ISLANDS

FROM SURVEYS BY CAPT. A. L. JACKSON, R.N., & COMM^R ALUN JONES, R.N.,
assisted by the Officers of H.M. SURVEYING SHIP "STORK," 1938-39.
The area North of Lat. 9° 30' N. mainly from Surveys by the Marine Survey of India, 1935-38.
With additions from Thai charts and maps to 1939.
Details in Hairline mainly from older Surveys.
With additions and corrections to 1946.
All Bearings are True (thus:—126° etc.) and are given from Seaward.
Underlined figures on the drying banks and rocks express the Heights in Feet above the datum to which the soundings are reduced.
All other Heights are expressed in Feet above Mean High Water Springs.
For Abbreviations see Admiralty Chart 5011

SOUNDINGS IN FATHOMS
(Under Eleven in Fathoms and Feet)

Natural Scale $\frac{1}{200,000}$ *(at Lat. 10° 40' N.)*

Projection — Mercator

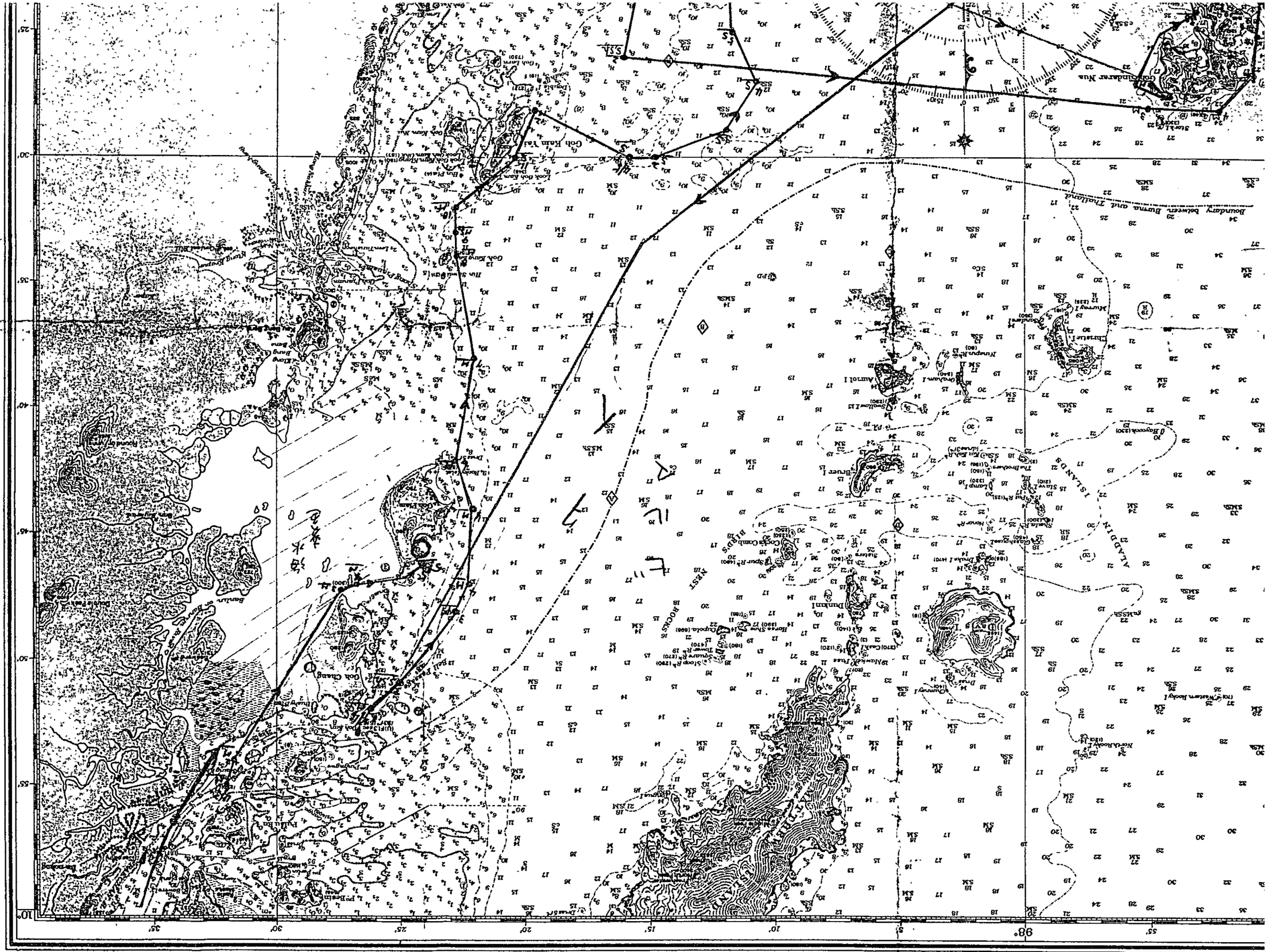
NOTE — *The Boundary shown on this chart is approximate only.*

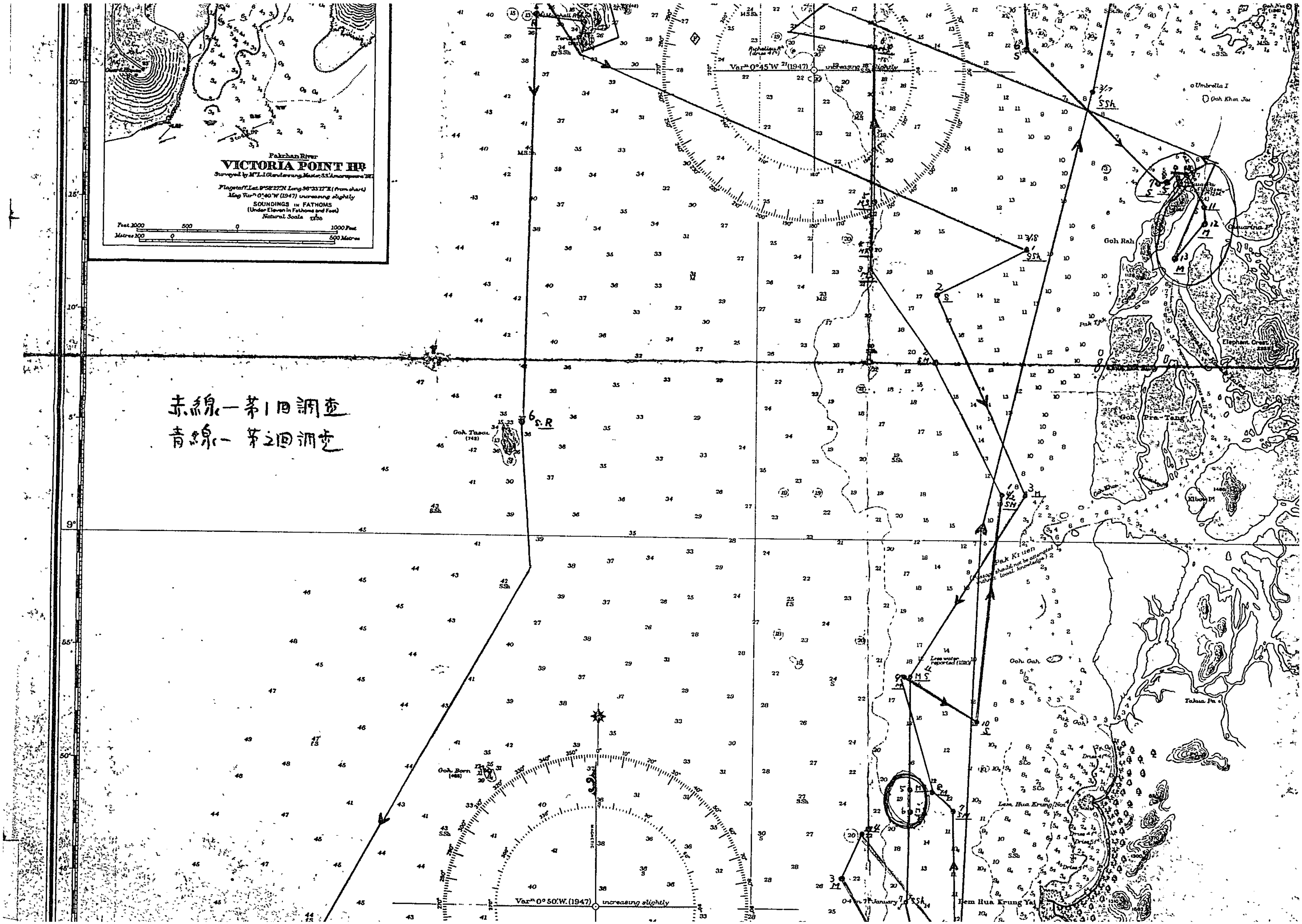
Tidal Information and Chart Datum

Place	Height above datum of soundings				Datum to which soundings are reduced and Remarks
	High Water		Low Water		
	Mean Springs	Mean Neaps	Mean Springs	Mean Neaps	
Pulau Besin	12·9 feet	9·1 feet	1·5 feet	5·3 feet	(a) 22·00 f^t below a B M embedded in the ground about 10 f^t above H W. on the S. coast of the island; or (b) 25·80 f^t below a B M cut in a cement block on top of a rock about 400 yards W. of (a)
St. Matthew's I.:— South Bay	10·5 "	7·3 "	1·1 "	4·3 "	15·62 f^t below a B M cut on a rock on the E side of the creek
Goh Kam Yai	9·9 "	6·7 "	0·5 "	3·7 "	13·36 f^t below a B M cut on the upper surface of the Northern granite rock on the H.W. line at the S end of the sandy beach on the E. side of Look Goh Kam Klang.
Goh Sindarar	9·1 "	6·3 "	0·9 "	3·7 "	9·16 f^t below a B.M. cut on the E side of a large isolated granite rock situated in a small bay on the N. side of Goh Sindarar Tai at the narrowest part of the channel.
Pak Kruen	8·9 "	6·1 "	0·4 "	3·3 "	
Klong Tub-Moh	8·2 "	5·8 "	1·0 "	3·4 "	12·41 f^t below a B M cut on the top of a detached granite boulder about 8 f^t high situated near the N end of the sandspit at the entrance to the [illegible], the centre of Ao Kaulok and about 7 cables E.S.E from Hin Khi-nok
Similan I^s	8·3 "	5·9 "	1·1 "	3·5 "	

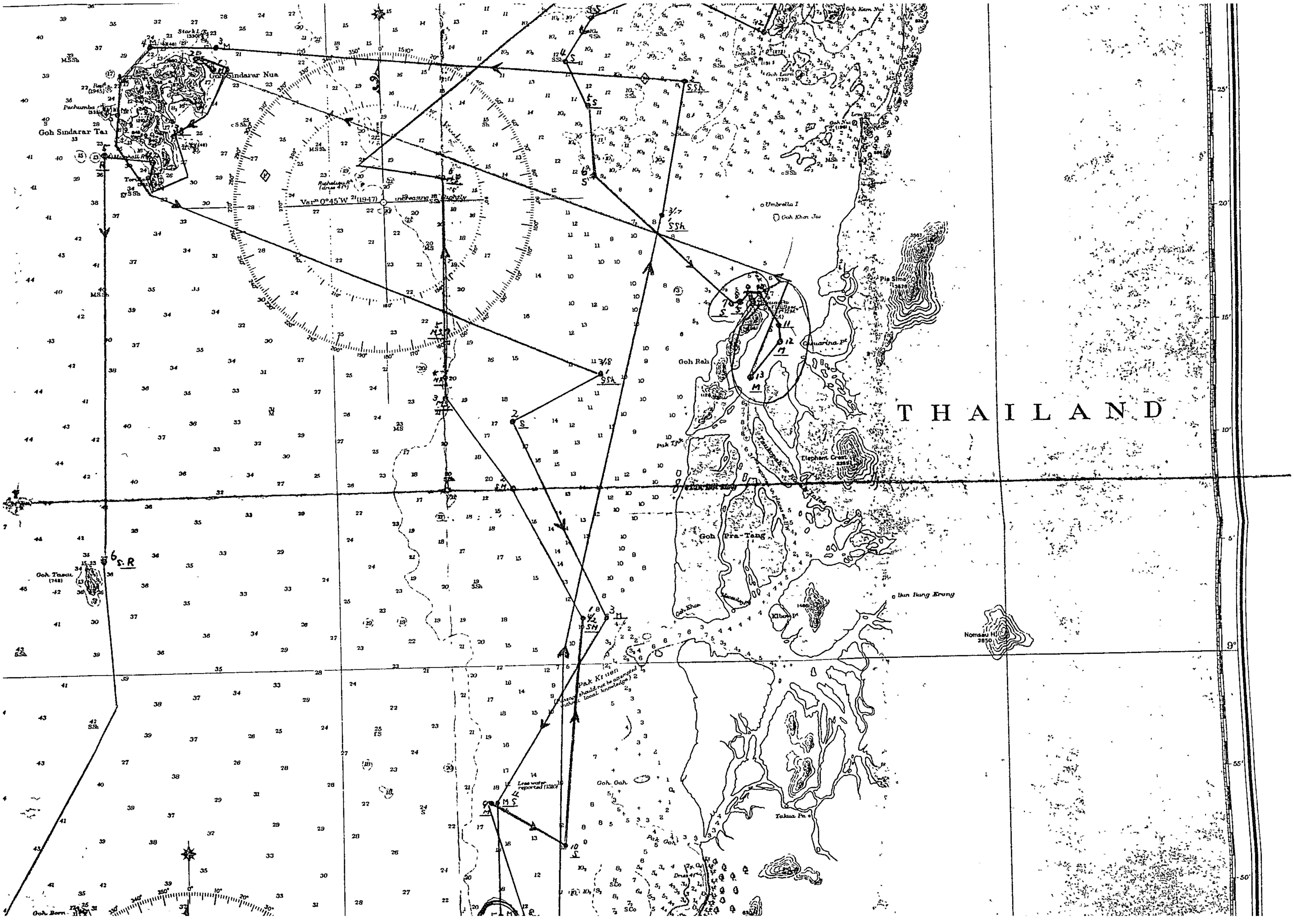
Tidal Streams

Hours	Ⓐ Lat. 9° 43·7' N. Long. 98° 16·6' E.			Ⓑ Lat. 9° 36·8' N. Long. 98° 13·0' E.			Ⓒ Lat. 9° 33·7' N. Long. 98° 05·4' E.			Ⓓ Lat. 9° 44·7' N. Long. 98° 05·1' E.			Ⓔ Lat. 9° 36·1' N. Long. 98° 14·4' E.			Ⓕ Lat. 9° 22·2' N. Long. 97° 57·1' E.			Hours
	Direct'n	Rate Sp.	Rate Np.	Direct'n	Rate Sp.	Rate Np.	Direct'n	Rate Sp.	Rate Np.	Direct'n	Rate Sp.	Rate Np.	Direct'n	Rate Sp.	Rate Np.	Direct'n	Rate Sp.	Rate Np.	
Before H.W. Mergui 6	78°	0·4 kn.	0·1 kn.	68°	0·2 kn.	0·1 kn.	28°	0·5 kn.	0·1 kn.	000°	0·2 kn.	0·1 kn.	48°	0·2 kn.	0·1 kn.	90°	0·2 kn.	0·1 kn.	6 Before H.W. Mergui
5	55°	0·6 "	0·2 "	56°	0·8 "	0·1 "	35°	0·6 "	0·2 "	37°	0·5 "	0·1 "	46°	0·4 "	0·1 "	76°	0·5 "	0·1 "	5
4	53°	0·7 "	0·2 "	44°	0·6 "	0·1 "	40°	0·8 "	0·2 "	58°	0·7 "	0·2 "	44°	0·6 "	0·2 "	70°	0·6 "	0·2 "	4
3	58°	0·7 "	0·2 "	40°	0·6 "	0·2 "	40°	0·7 "	0·2 "	61°	0·8 "	0·2 "	45°	0·7 "	0·2 "	60°	0·5 "	0·2 "	3
2	53°	0·6 "	0·2 "	41°	0·5 "	0·1 "	63°	0·6 "	0·2 "	106°	0·6 "	0·1 "	44°	0·5 "	0·1 "	20°	0·3 "	0·1 "	2
1	61°	0·4 "	0·1 "	58°	0·2 "	0·1 "	90°	0·3 "	0·1 "	151°	0·2 "	0·1 "	31°	0·2 "	0·1 "	304°	0·3 "	0·1 "	1
HW	274°	0·2 "	0·0 "	221°	0·1 "	0·0 "	131°	0·2 "	0·1 "	201°	0·2 "	0·1 "	235°	0·2 "	0·0 "	283°	0·4 "	0·1 "	HW
After H.W. Mergui 1	243°	0·4 "	0·1 "	225°	0·3 "	0·1 "	226°	0·6 "	0·2 "	186°	0·2 "	0·1 "	224°	0·4 "	0·1 "	258°	0·4 "	0·1 "	1 After H.W. Mergui
2	252°	0·7 "	0·2 "	242°	0·4 "	0·1 "	219°	0·3 "	0·2 "	210°	0·4 "	0·1 "	222°	0·7 "	0·2 "	225°	0·4 "	0·1 "	2
3	242°	0·8 "	0·2 "	237°	0·6 "	0·2 "	222°	0·8 "	0·2 "	231°	0·8 "	0·2 "	221°	0·7 "	0·2 "	217°	0·4 "	0·1 "	3
4	235°	0·7 "	0·2 "	238°	0·6 "	0·2 "	230°	0·7 "	0·2 "	248°	0·9 "	0·2 "	223°	0·5 "	0·1 "	217°	0·3 "	0·1 "	4
5	219°	0·6 "	0·1 "	214°	0·3 "	0·1 "	270°	0·5 "	0·1 "	279°	0·6 "	0·2 "	225°	0·2 "	0·1 "	200°	0·1 "	0·0 "	5
6	176°	0·3 "	0·1 "	117°	0·2 "	0·1 "	304°	0·2 "	0·0 "	312°	0·2 "	0·1 "	Slack water			102°	0·1 "	0·0 "	6


135.61
98°
55'
5'
10'
15'
20'
25'
30'
35'
10°
55'
50'
45'
40'
35'
30'
25'
Western Rocky I
North Rocky I
Chimney I
Davis I
Mawkes Pass
Dunkan I
Drake I
Glasshouse I
Sheila Rk
Honor Rk
Pat Rk
Slave I
Lamp I
The Brothers
Kai Kah Rk
Haycock
ALADDIN ISLANDS
Cock's Comb
Spur Rk
Sisters
BIRD'S NEST ROCKS
Stoop Rk
Square Rk
Tower Rk
Horse Shoe
Cupola
Bruer I
Swallow I
Auriol I
Graham I
Ninepin Rk
Christie I
Sanders I
Murray I
Boundary between Burma and Thailand
Goh Chang
Goh Phayam
Rocky Islet
Bell Pass
Double Peak
Klong Bang Bens
Hin Sawa Dam
Goh Kang Kao
Goh Kam Yai
Look Goh Kam Tok
Goh Kam Nui
Goh Larn
Goh Sindarar Nua
Stork I
ビ
ル
マ
タ
イ



Pakchan River
VICTORIA POINT HR
SOUNDINGS IN FATHOMS
(Under Eleven in Fathoms and Feet)
赤線—第1回調査
青線—第2回調査
Goh Tasai
Goh Born
Goh Rah
Elephant Crest
Goh Pra-Tang
Pak Kiuen
Umbrella I
Goh Gah
Lem Hua Krung Yai
Var^n 0°45'W (1947) increasing slightly
Var^n 0°50'W.(1947) increasing slightly



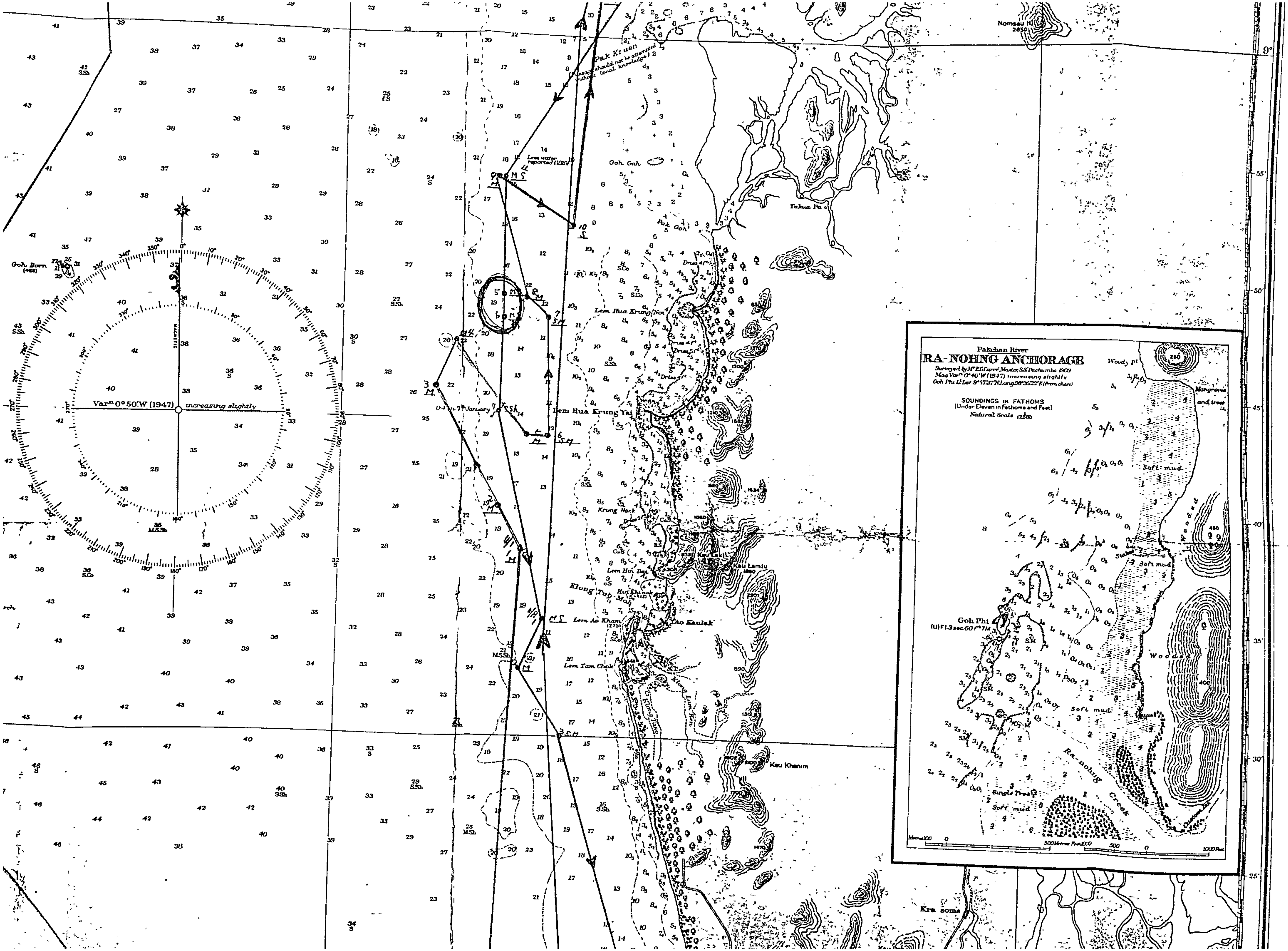
Goh Sindarar Nua
Goh Sindarar Tai
Pachumba
Stork I.
Var^n 0°45'W (1947) increasing slightly
Umbrella I
Pia Sima
Casuarina Pt
Goh Rah
THAILAND
Elephant Crest
Goh Pra-Tang
Bun Bang Krong
Nomsau Hl
2850
Goh Tasai
(742)
Pak Kruen
Passage should not be attempted without local knowledge
Less water reported (1920)
Goh Gah
Takua Pa
Pak Goh
Goh Born
25'
20'
15'
10'
5'
9°
55'
50'

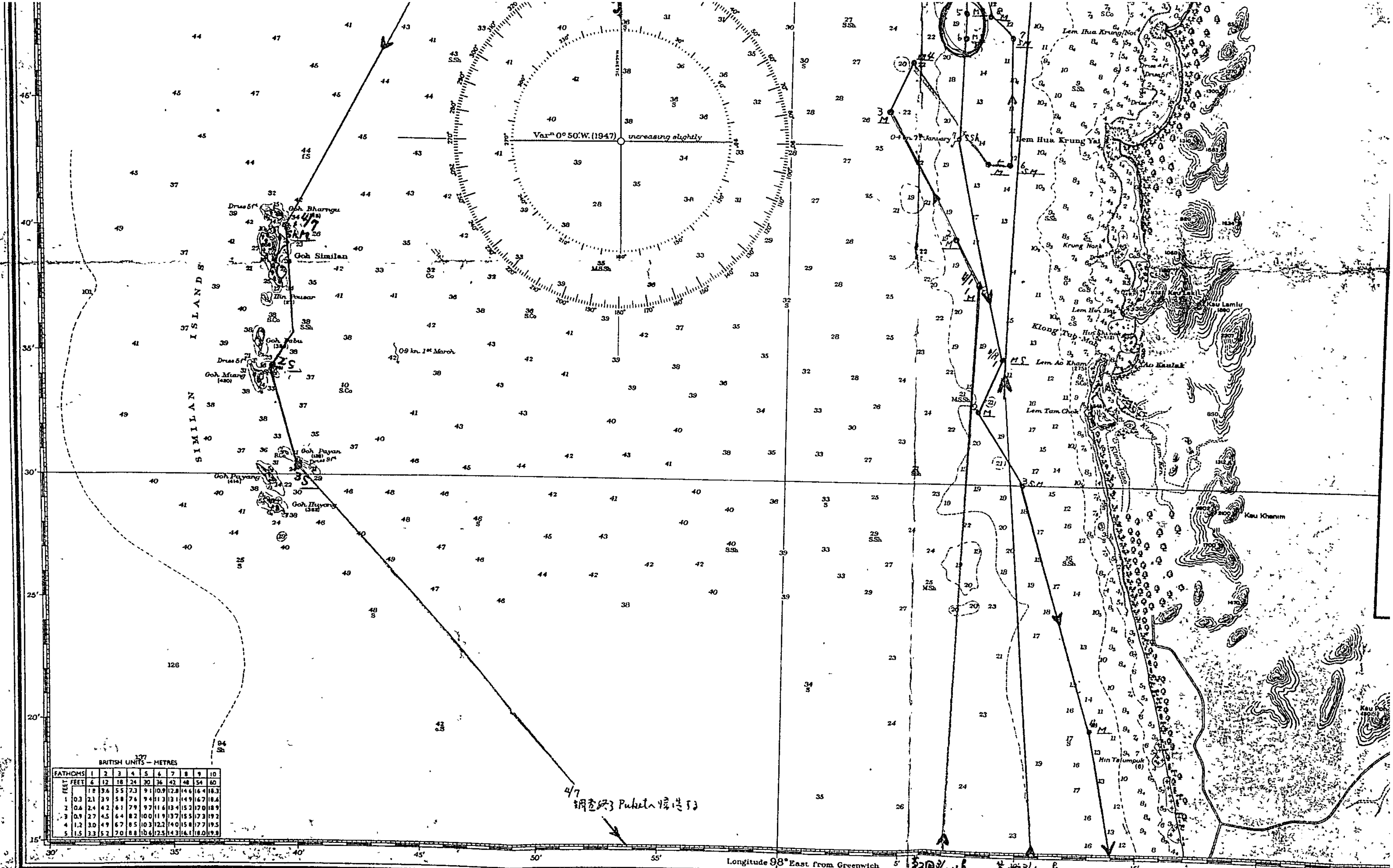
SIMILAN ISLANDS

Var^n 0°50'W (1947)

decreasing slightly

MAGNETIC


Nomsau Hill
2850
Pak Kruen
Passage should not be attempted without local knowledge
Takua Pa
Less water reported (1920)
Goh Gah
Pak Goh
Goh Born
Var^n 0° 50' W (1947) increasing slightly
Lem Hua Krung Nok
Lem Hua Krung Yai
Krung Nork
Lem Hin Bak
Klong Tub Mai
Lem Ao Kham
Ao Kaulak
Kau Lamly
Lem Tam Chok
Kau Khanim
Kra some
Pakchan River
RA-NOHNG ANCHORAGE
SOUNDINGS IN FATHOMS
(Under Eleven in Fathoms and Feet)
Woody Pt
Mangroves and trees
Soft mud
Wooded
Goh Phi
Single Tree
Ra-nohng Creek

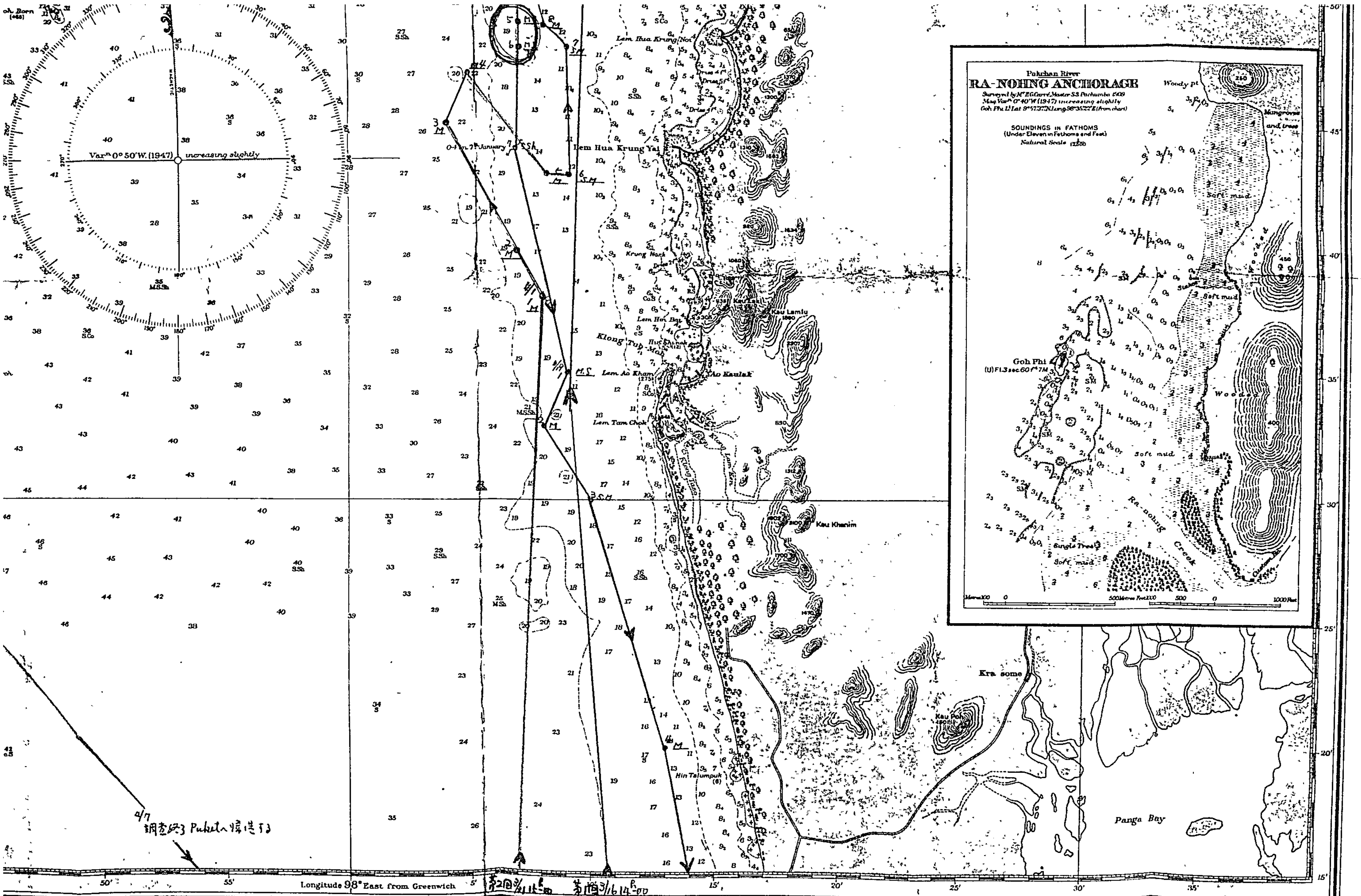


BRITISH UNITS — METRES

FATHOMS		1	2	3	4	5	6	7	8	9	10
FEET	FEET	6	12	18	24	30	36	42	48	54	60
		1.8	3.6	5.5	7.3	9.1	10.9	12.8	14.6	16.4	18.3
1	0.3	2.1	3.9	5.8	7.6	9.4	11.3	13.1	14.9	16.7	18.6
2	0.6	2.4	4.2	6.1	7.9	9.7	11.6	13.4	15.2	17.0	18.9
3	0.9	2.7	4.5	6.4	8.2	10.0	11.9	13.7	15.5	17.3	19.2
4	1.2	3.0	4.9	6.7	8.5	10.3	12.2	14.0	15.8	17.7	19.5
5	1.5	3.3	5.2	7.0	8.8	10.6	12.5	14.3	16.1	18.0	19.8

Small corrections 1949 · 1950 · 1953 · 1955 · 1956

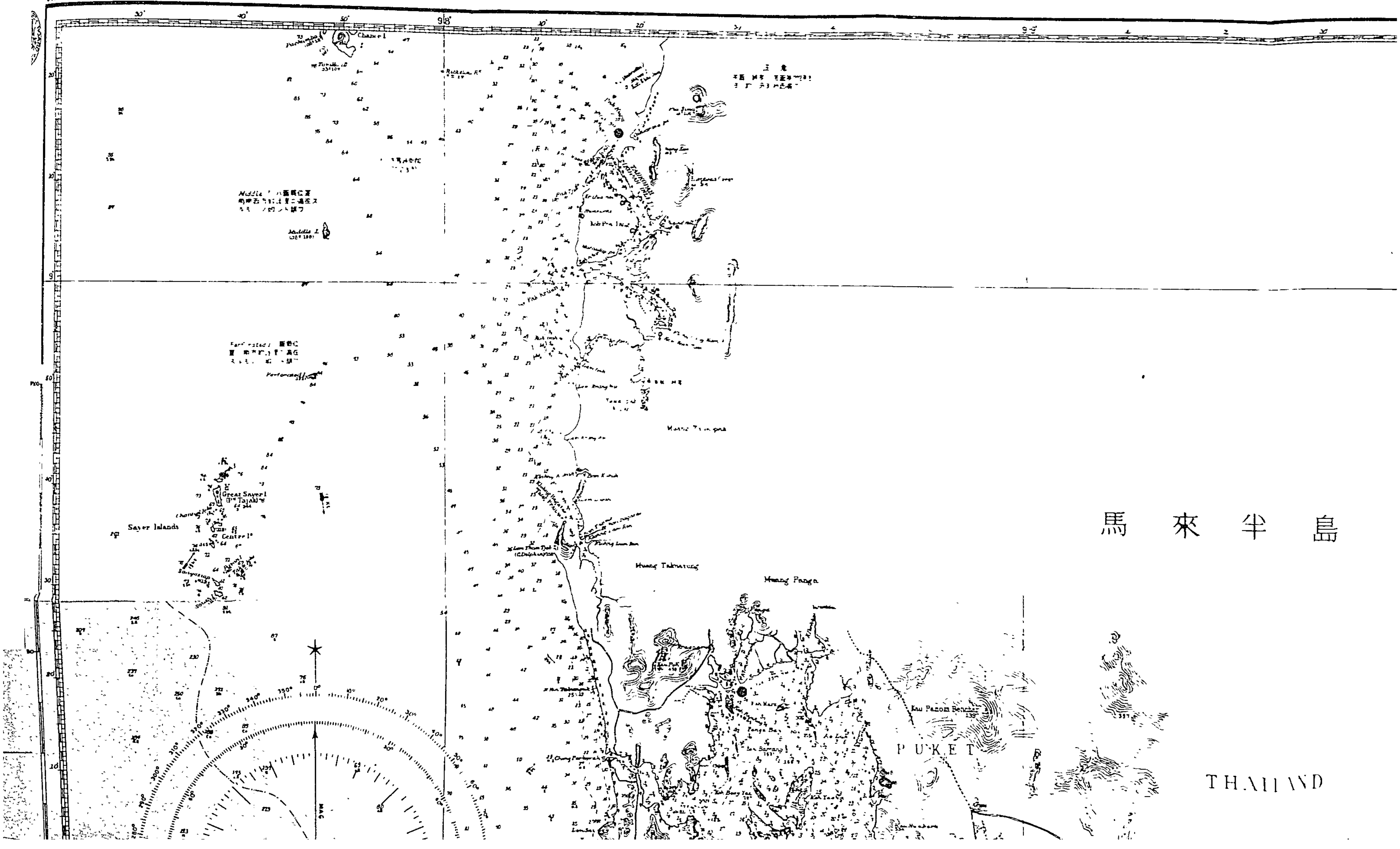
London. Published at the Admiralty, 9th July 1948, under the Superintendence of Rear-Admiral A G N Wyatt, C.B. Hydrographer


Varn 0° 50'W. (1947) increasing slightly
Lem Hua Krung Noi
Lem Hua Krung Yai
Krung Nork
Lem Hin Bai
Klong Tub Mao
Lem Ao Kham
Ao Kaulak
Lem Tam Chok
Kau Khanim
Kau Lamlu
Kau Pon
Hin Talumpuk
Kra some
Panga Bay
Pakchan River
RA-NOHNG ANCHORAGE
SOUNDINGS IN FATHOMS
(Under Eleven in Fathoms and Feet)
Goh Phi
Woody Pt.
Mangroves and trees
Soft mud
Wood
Ra-nohng Creek
Jungle Trees
4/7
調査終了 Puketへ帰港する
Longitude 98° East from Greenwich

London, Published at the Admiralty, 9th July 1948, under the Superintendence of Rear-Admiral A G N Wyatt, C.B. Hydrographer

3052

第776號



Sayer Islands
Great Sayer I
Centre I
Middle I
Chance I
馬 來 半 島
PUKET
THAILAND

注意　本図は戦後ほとんど小改正を行っていない
NOTICE SCARCELY CORRECTED SINCE THE 2ND WORLD WAR H.D

馬來半島

サエル諸島至ペナン島

1 : 500,000 (lat 6°)

1939年迄ノ英國 海軍水路部及ヲランダ海圖 陸地測量部
圖ヲ1938年迄ノ英國海圖及ヲランダ圖ノ圖ヲ用ヒタリ

水深 米
高程 米

港名	平均大潮昇 M H W I	大潮升 Sp rise	小潮升 Np rise	平均小潮 M S L
Kruseng Dyamba Aye Dumatrai	0h 40m	2.7m		
Pak Kruen Inlet	12h 50m	3.1	2.4m	
Puket Harbour	12h 50m	2.7	2.1	
Pulau Rajwai	1h 40m	2.1	1.0	
Wanderers Bay	0h 10m	2.4		
Butang Group	1h 10m	2.7		
Dyon Strait	11h 0m	2.4		
Ruggat I.	11h 0m	1.2		
S^t Kedah	12h 0m	2.1		
Penang Harbour	0h 8m	2.1	1.4m	1.1m
Pulau Rimau	0h 30m	2.0	1.1	1.2

MALAY PENINSULA WEST COAST

SAYER I^s to PULAU PENANG

Compiled from the British and Netherlands and Thailand Charts 1:1939

SOUNDINGS IN METRES

Heights in Metres

Fathoms	Feet	Metres
0	1	1.8
1	3	1.8
2	6	3.7
3	9	5.5
4	12	7.3
5	15	9.1
6	18	11.0
7	21	12.8
8	24	14.6
9	27	16.5
10	30	18.3
100	300	182.9

Muang Trokspah
Muang Takmatung
Muang Panga
Elephant Cape
Kau Panom Bencher 1337
PUKET
THAILAND

THAILAND

PUKET

KOH PUKET

MAG

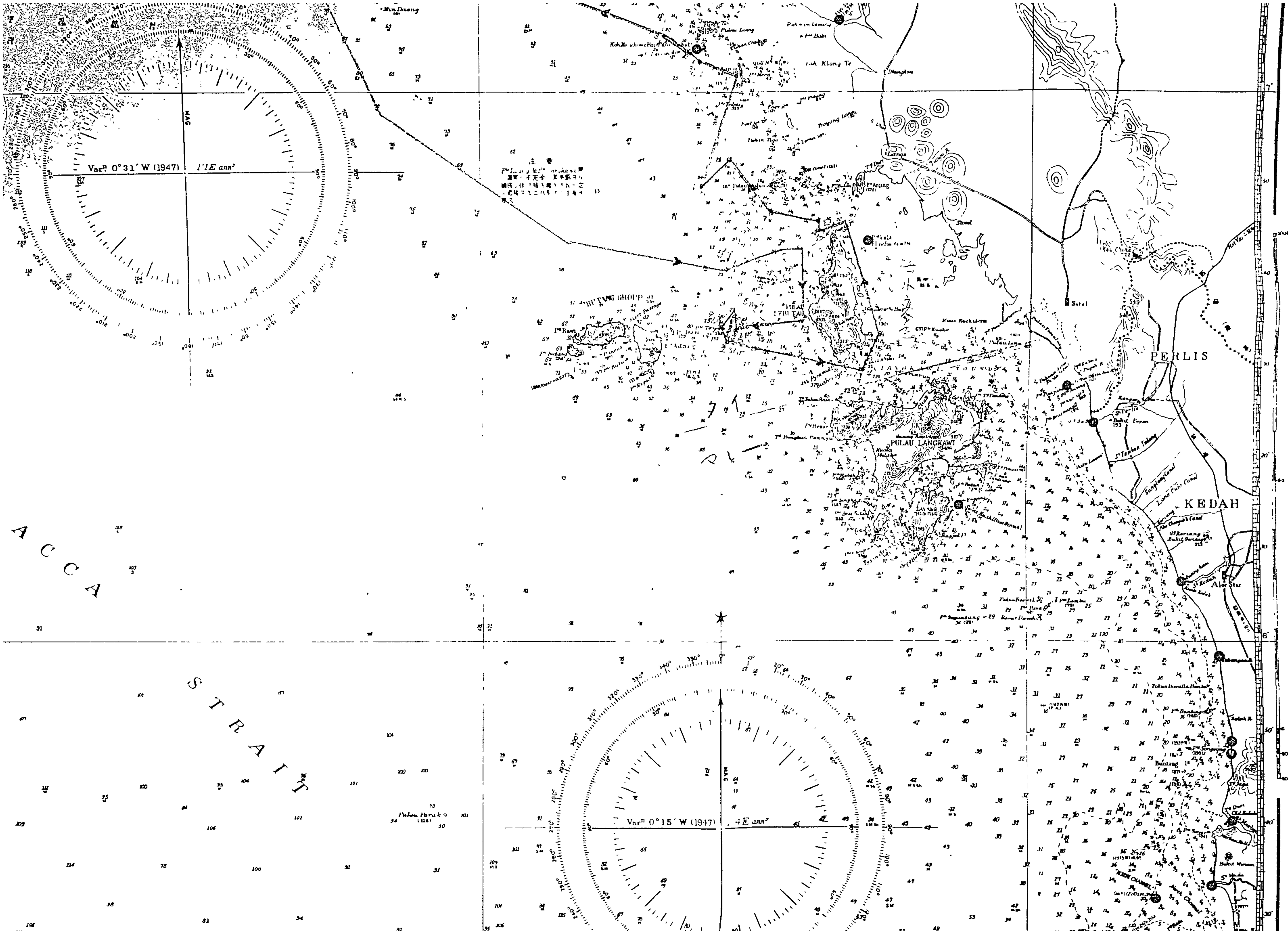
Var^{n} 0° 31′ W (1947)

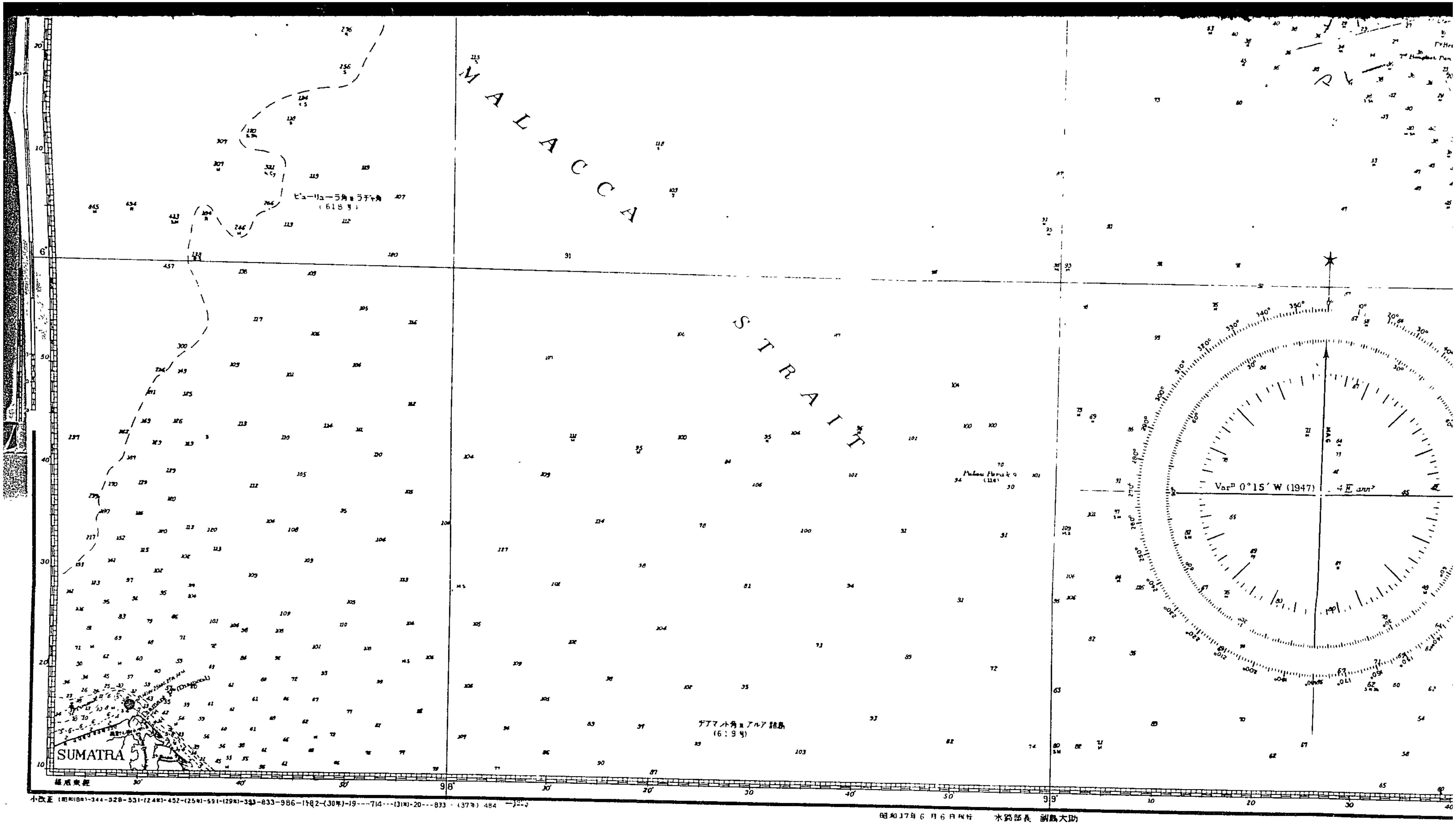
MAG

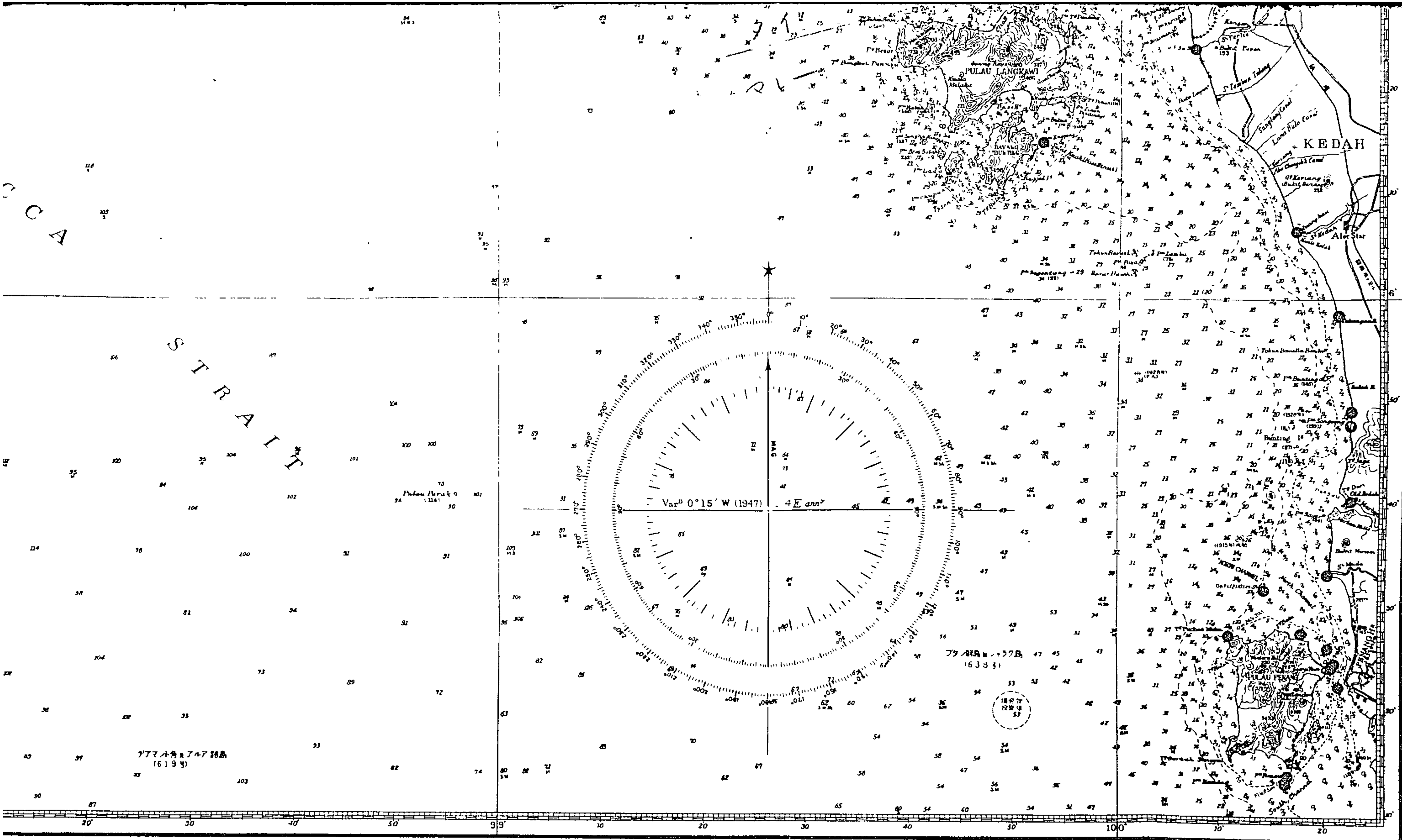
Var^{n} 0° 41′ W (1947)

THAILAND
カンタン河口
ENTRANCE to KANTANG
1/160 000 (Lat 7°20')
1937年タイ国海図ヨリ採ル
From the Thailand Chart, 1937
Koh Nok
北緯 (Lat N) 7°16 07"
東經 (Long E) 99°28 40"
Mag Var 0°15' W (1947) 7' E ann
Kan Tang
Kau Kan Tang
Kau Namrab
Koh Libong
Koh Lien
Koh Talibong
KOH PUKET
Puket Harbour
Koh Yao Yai
Koh Yao Noi
Koh Lantar Yai
Koh Lantar Noi
Koh Kradan
Koh Muk
Koh Ngai
Koh Kok Yai
Koh Kok Kork
Koh Raja Yai
Koh Raja Noi
Koh Phi Phi Lay
Trang
Kan Tang
Satul
Kau China
Pulau Lang
Tanjung Lenga
BUTANG GROUP
PULAU TERUTAU
PERLIS
Var 0°31' W (1947) 1'E ann
MAG
注意

MALACCA STRAIT
Varn 0°31′ W (1947) 1′E annʸ
MAG
Varn 0°15′ W (1947) 1′E annʸ
BUTANG GROUP
Pᵘ Rawi
Pᵘ Adang
PULAU TERUTAU
Pulau Perak (123)
ビューリューラ角ョラヂヤ角
(618米)
7°
6°
50
40
30
20
10


Varn 0°31′ W (1947)
1′1E annl
MAG
PERLIS
KEDAH
PULAU LANGKAWI
Alor Star
Setul
A C C A
S T R A I T
Varn 0°15′ W (1947)
MAG


MALACCA
STRAIT
SUMATRA
ピューリューラ角ヨリウヂャ角
(618号)
デアマント角ヨリアルア諸島
(619号)
Pulau Perak
Varⁿ 0°15′ W (1947)
98°
99°
6°
経度東経
小改正
昭和17年6月6日刊行 水路部長 副島大助



昭和17年6月6日発行　水路部長　副島大助
昭和17年7月13日印刷発行 印刷者 発行者 水路部

No776

○印ヤ1回調査地点

△印オ2回調査地点

BURMA

THALLAND

Banong

97°-46′

98°

98°-30′

98°-50′

10°

15

16

17

18

19

20

21

22

23

24

ビルマ、タイ境界線

1:28

ビルマ、タイ境界線

2哩区画図

30°

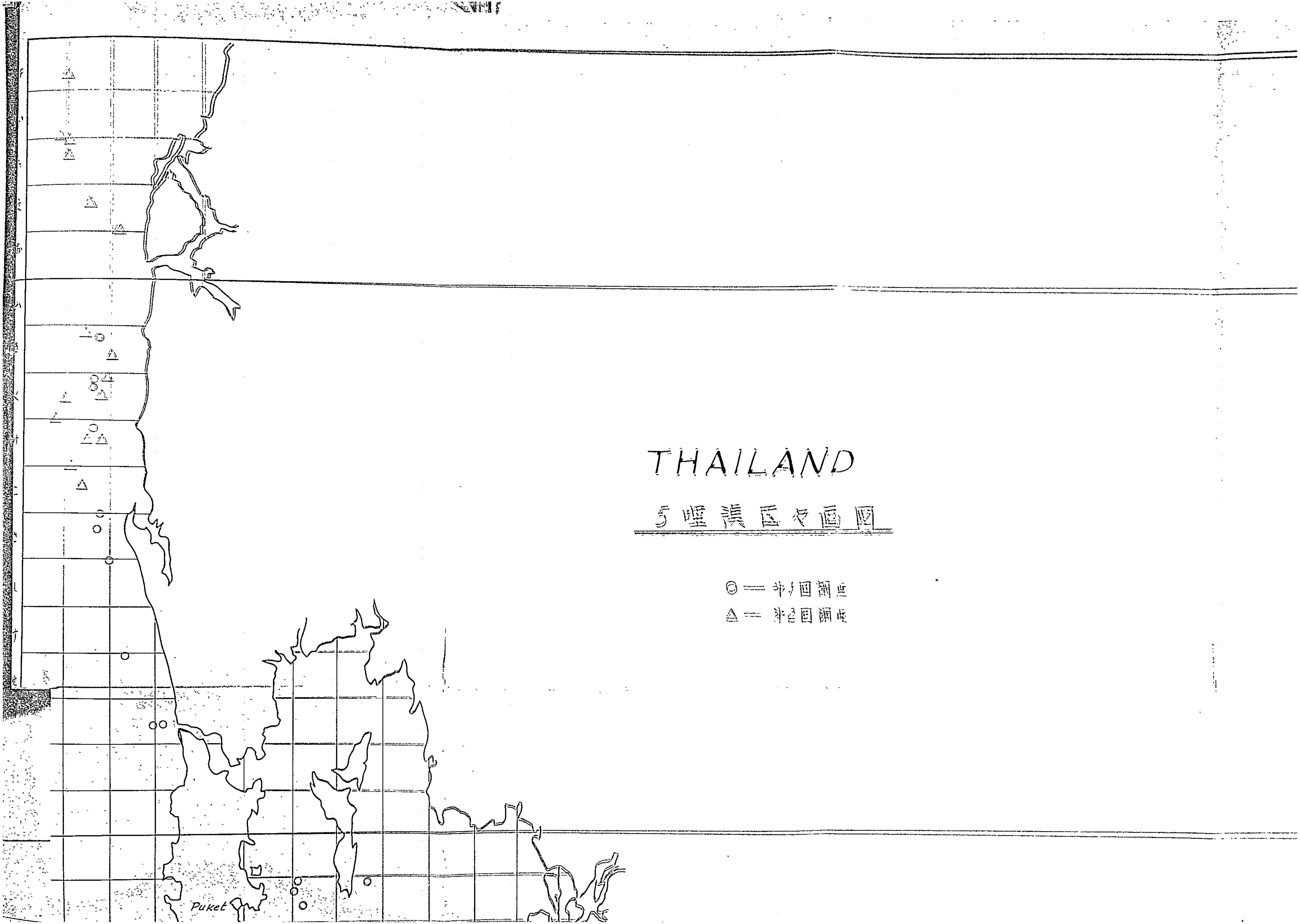
9°

97°-48′

98°

98°-30′

98°-50′

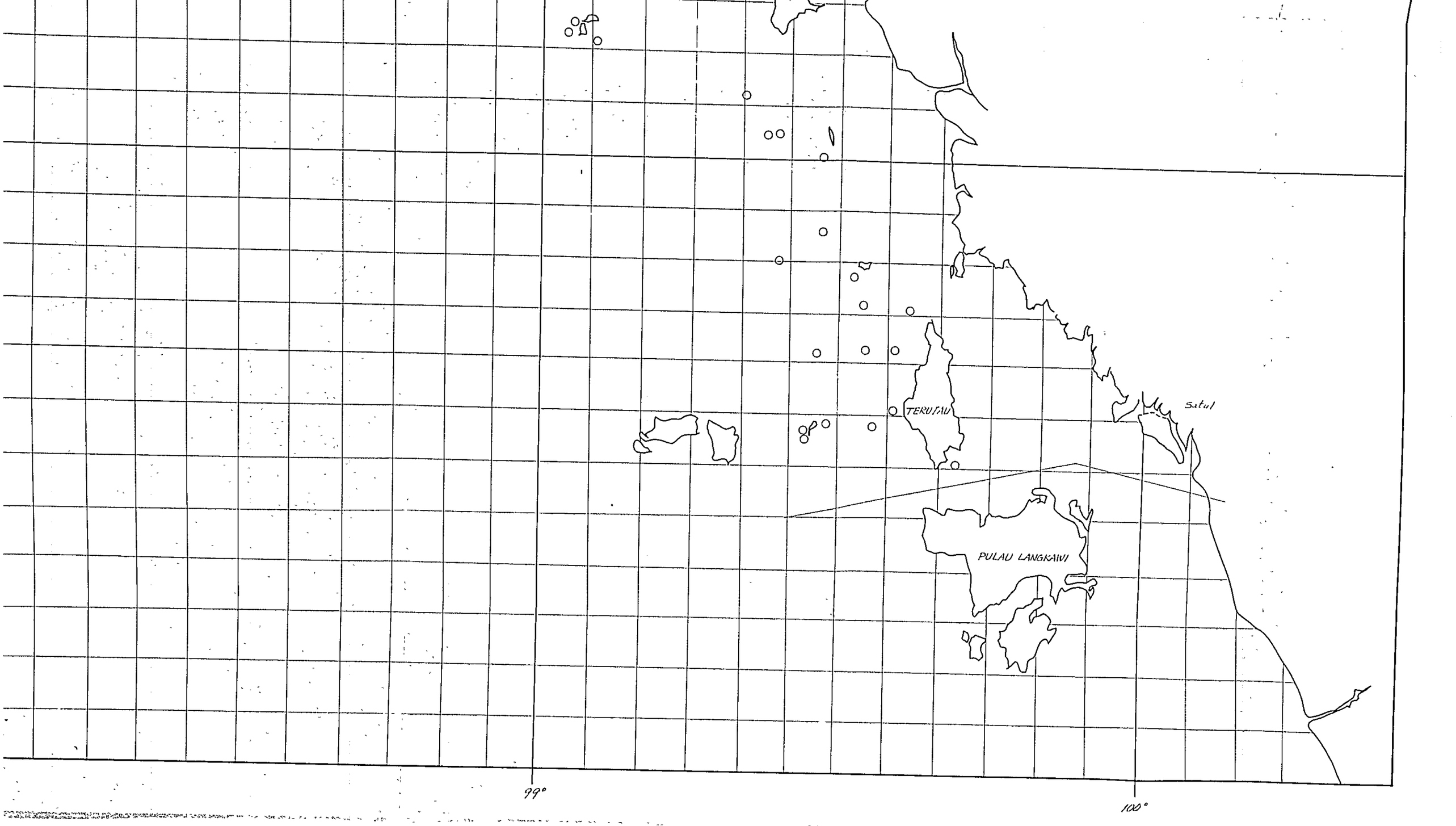

THAILAND
○ — 第1回調査
△ — 第2回調査
Puket

Puket

Kan Tang

TERUTAU

Satul


TERUTAU
Satul
PULAU LANGKAWI
99°
100°

6. Conclusion obtained from the present survey.

1. General conclusion

(1) It was confirmed that mother-of-pearl is living around the coast of the Indian Ocean.

(2) From 115 diving places (117, if experimental operations are included), 15 pieces of shells were fished; all of them old ones.

(3) In general, movement of tide is not considerable and the sea bed is mostly of mud.

(4) The sea bed around this area is generally flat and has few banks. However, troughs are very steep in the case of jagged bed.

(5) With the sea deepening suddenly there are around islands only a few places where diving is possible to make. The further down south from Pucket, the more conspicuous becomes this tendency.

(6) It was considered that, generally speaking, there are in this area only a few seaweeds, other growth and shells other than mother-of-pearl and sea serpents. Within the extent of the area covered by the present survey, promising fishing grounds for mother-of-pearl were not discovered. However, from the above conclusion can not be obtained that there are no fishing grounds around the coast of the Indian Ocean with resources enough to enable pearl culture on a paying basis as an enterprise. For this we have to look for results of surveys that would be made in years to come.

If put in a chart a general idea obtained from the present survey of fishing grounds for mother-of-pearl around the coast of the Indian Ocean, that would be something like the chart on the next page.

Regarding the estimation of the quantity of mother-of-pearl resources, it is impossible from the results of the present survey to estimate it because of scarcity of sampling picked.

2. Areas around the coast of Indian Ocean fit for culture of mother-of-pearl.

The areas mentioned below can be exploited as culture farms.

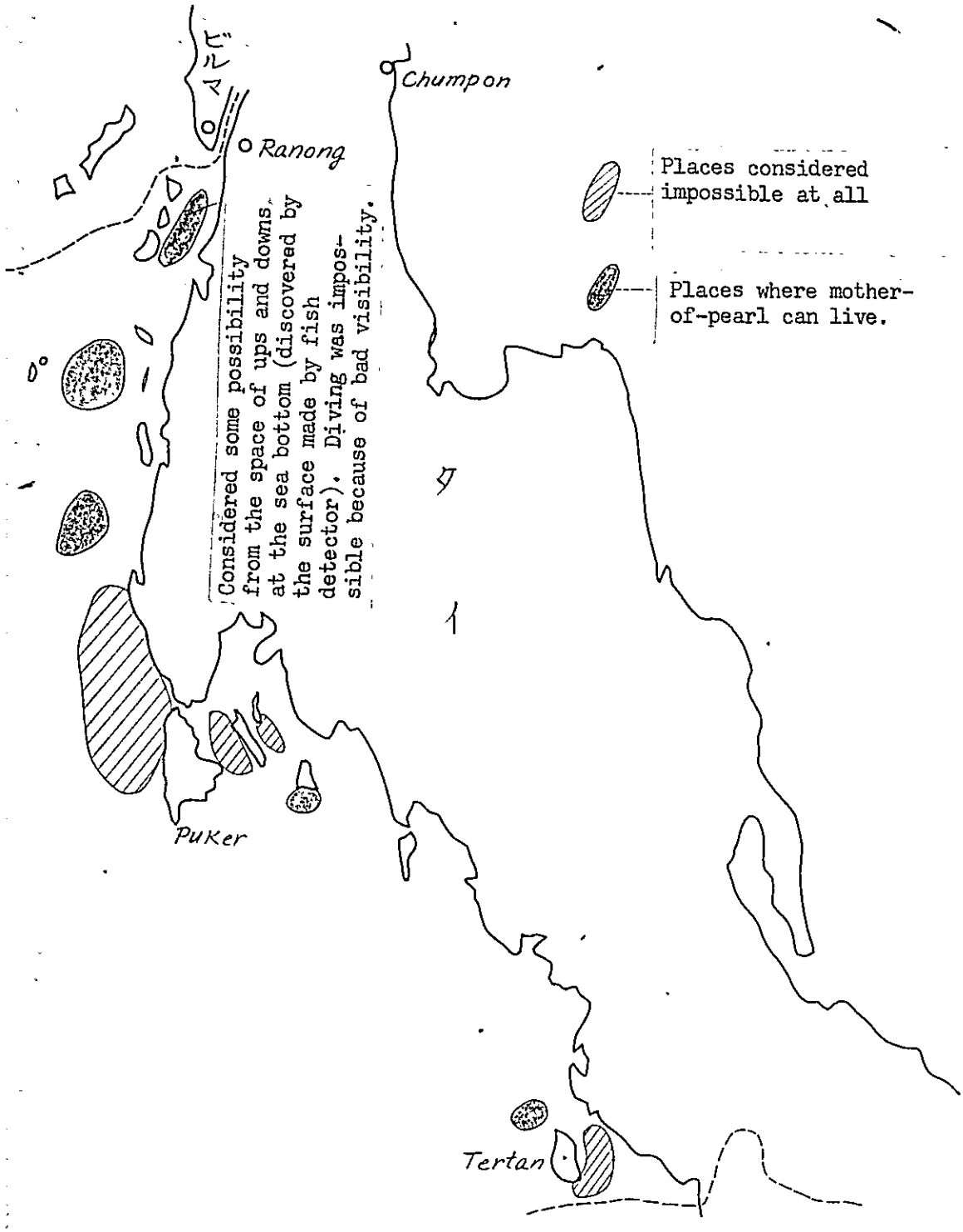
(1) Waters between Phi-phi Don Island and Pipilai Island;

(2) Waters around Au Island which lies near the Northern-end of Pucket Island;

(3) Sindarar Tai Island and Sindarar Nua Island

(4) Piam Island

It is necessary to change the location of farms, to east side in the rainy season and to west side in the dry season.


Chumpon
Ranong
Puker
Tertan
Considered some possibility from the space of ups and downs at the sea bottom (discovered by the surface made by fish detector). Diving was impossible because of bad visibility.
Places considered impossible at all
Places where mother-of-pearl can live.

(see: table 8. Weather condition in Ranong; table 11. rain fall in Ranong, Pucket, Trang). Because of this, it costs much in labor in the case of large scale pearl culture farm.

3. Condition of weather around the coast of the Indian Ocean

Weather condition in Ranong, Pucket and Trang are as ones listed respectedly in tables 8, 9 and 10 below.

Table 8. Weather Condition In Ranong (1956-1958)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Temperature (°C)												
Average	25.7	26.9	28.0	28.6	27.6	26.7	26.5	26.2	26.2	26.1	25.9	25.3
Maximum	33.8	35.9	36.1	36.0	34.3	32.5	32.1	31.9	31.6	32.4	32.5	32.5
Minimum	16.1	17.9	19.4	21.9	21.8	21.9	21.7	21.3	21.5	21.2	17.7	16.5
Humidity (%)												
Average	79.5	75.1	75.6	80.1	87.2	89.3	89.4	86.9	90.9	90.4	83.4	79.7
Maximum	98.7	97.7	98.0	99.0	99.3	99.7	99.7	100.0	100.0	99.7	99.3	99.3
Minimum	47.0	43.0	40.0	47.3	60.7	66.0	65.0	66.7	69.7	65.7	55.7	52.7
Direction of wind (%: 1950-1954)												
N	0.5	2.2	2.6	2.1	0.9	1.1	1.2	0.5	0.7	1.7	0.8	1.3
NE	16.4	13.5	12.3	9.5	5.9	1.5	1.9	1.2	0.8	5.4	16.5	23.1
E	47.7	41.8	44.5	31.9	10.7	4.8	3.0	1.0	2.4	11.9	33.6	57.4
SE	1.3	2.6	1.7	0.5	0.7	1.2	-	-	0.1	0.3	0.5	-
S	2.1	3.0	3.2	1.6	7.2	13.7	2.7	4.3	4.0	4.4	4.5	0.5
SW	1.3	3.3	4.8	5.3	9.6	14.8	24.9	25.3	20.3	13.9	3.5	0.4
W	0.9	2.3	9.2	19.9	27.0	36.8	35.7	40.8	36.1	16.1	4.8	0.3
NW	0.5	3.2	3.2	8.1	8.8	3.3	4.7	3.0	3.5	1.7	0.8	-
No wind	29.3	28.8	18.6	22.0	29.3	22.8	25.9	24.0	32.1	44.7	34.9	17.0
Average velocity (km/Hr)	8.0	7.4	8.5	7.4	7.4	11.4	10.0	13.6	8.0	4.6	5.8	11.4
Maximum velocity (km/Hr)	37.7	29.8	28.0	33.5	35.3	30.8	46.3	53.2	39.7	31.5	29.8	33.5

Table 9. Weather Condition In Pucket (1956 - 1958)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Atmospheric temperature (°C)												
Average	27.3	28.1	28.8	28.9	28.2	27.8	27.6	37.4	27.2	27.1	27.2	27.2
Maximum	32.7	33.9	34.7	34.6	34.1	33.5	32.8	32.7	32.5	32.2	32.7	32.2
Minimum	19.5	21.1	22.1	22.2	22.7	22.5	22.7	22.4	22.6	22.7	21.3	21.5
Humidity (%)												
Average	72.1	69.2	71.4	77.3	83.1	80.6	81.7	81.2	84.5	85.4	80.2	77.9
Maximum	97.7	96.3	97.3	98.0	98.0	98.0	98.0	98.0	98.7	98.0	98.7	98.0
Minimum	46.3	40.3	45.0	47.3	51.7	53.7	58.0	49.3	60.0	59.7	50.3	48.7
Direction of wind (%: 1950-1954)												
N	0.5	0.9	0.8	1.5	-	-	-	-	-	0.1	1.1	2.1
NE	24.5	16.5	12.3	5.6	0.4	0.4	-	-	0.1	1.8	12.8	14.7
E	49.9	49.8	47.5	24.5	4.4	1.3	1.7	0.4	0.1	12.8	27.9	60.9
SE	2.8	3.3	1.5	0.3	0.5	0.3	0.9	0.1	0.1	0.9	0.7	-
S	0.5	0.6	1.0	2.3	1.0	2.1	0.5	0.3	0.3	0.4	0.5	-
SW	0.3	0.3	0.4	1.1	4.1	5.5	2.3	5.0	14.4	4.3	0.3	-
W	0.5	3.8	5.4	20.7	42.8	58.8	62.3	71.2	55.3	36.9	11.5	0.4
NW	3.5	3.5	5.7	7.6	2.1	0.8	0.9	-	0.5	1.5	2.7	0.5
No wind	17.4	21.4	25.4	36.5	44.7	30.8	31.4	23.0	29.1	41.3	42.7	21.4
Average velocity (km/Hr.)	6.8	5.2	4.6	3.5	3.0	5.2	4.6	7.4	5.2	3.5	2.7	6.4
Average maximum velocity (km/Hr.)	29.8	24.0	29.8	37.7	28.0	37.7	50.8	50.8	50.8	28.0	24.0	28.0

Table 10. Weather Condition in Trung (1956-1958)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Atmospheric temperature (°C)												
Average	26.9	28.2	29.3	29.2	27.8	27.5	27.6	26.8	26.7	26.7	26.3	26.3
Maximum	36.4	38.0	38.2	38.1	35.2	34.3	34.2	33.4	33.6	33.3	32.9	33.6
Minimum	17.8	19.0	19.9	21.2	22.6	21.7	21.8	21.2	21.3	21.3	19.1	18.2
Humidity (%)												
Average	81.1	77.5	77.7	82.2	87.3	87.8	88.0	88.9	90.2	90.9	87.8	84.5
Maximum	99.7	99.7	99.7	100.0	100.0	99.7	100.0	100.0	100.0	100.0	100.0	99.7
Minimum	43.3	40.7	34.0	42.0	52.7	58.7	56.3	60.3	61.0	64.0	55.7	50.3
Direction of wind (%: 1950-1954)												
N	8.4	3.4	1.2	0.5	0.8	0.3	-	0.3	0.4	0.7	2.0	4.3
NE	34.2	24.1	13.2	6.0	1.2	0.3	0.5	-	0.1	3.4	17.3	49.7
E	9.3	12.9	14.3	4.8	1.4	0.1	0.7	0.3	0.9	7.0	12.1	8.1
SE	1.4	0.7	2.8	1.5	0.6	-	-	-	-	-	0.3	2.5
S	0.8	5.4	8.6	7.2	2.6	3.7	3.5	3.7	2.7	3.9	2.0	0.5
SW	0.5	2.0	4.0	15.6	21.0	22.3	19.4	14.1	20.4	14.2	5.5	0.4
W	-	1.7	1.6	4.9	11.7	16.7	17.0	32.0	23.2	14.7	2.4	0.1
NE	0.1	-	-	0.1	1.0	0.4	0.5	0.1	-	0.8	0.5	0.1
No wind	45.3	49.8	54.3	59.3	59.6	56.3	56.5	49.6	52.3	55.5	57.9	34.3
Average velocity (km/Hr)	7.4	5.2	4.6	3.5	3.5	5.2	5.2	6.4	5.2	4.0	3.0	6.8
Average maximum velocity (km/Hr)	41.8	37.7	44.0	44.0	46.3	50.8	58.0	55.5	53.2	41.8	33.5	41.8

Table 11. Rain Fall in Ranong, Pucket and Trung

	Ranong	Pucket	Trung
Jan.	240	136	226
Feb.	738	224	204
Mar.	837	289	211
Apr.	1,242	302	267
May	749	277	268
Jun.	1,284	307	256
Jul.	386	387	317
Aug.	270	314	288
Sep.	100	63	78
Oct.	15	56	93
Nov.	15	11	21
Dec.	15	52	47
Total	5,891	2,418	2,276

Note: ..verage of 1932-33, 1933-37-1933-37)