

## Topography and Substratum of the Jaffna Lagoon

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### Introduction

Little is known of the topography and substratum of the lagoon and estuarine waters of Ceylon. This knowledge is important in understanding the fisheries and its effective management. Bottom topography of the sea is usually given in the British Admiralty charts and other navigational charts. Some indications of the different types of bottom of the continental shelf are also given. The information given in these charts is inadequate to understand the fisheries of lagoons and estuarine waters. Jaffna lagoon is such a body of water situated in Northern Province of Ceylon. Knowledge of the bottom topography of this lagoon was found to be necessary in revising the fishing regulations in force in the Northern Province of Ceylon, with special reference to the use of the fishing gear, Sirahu Valai. As such a preliminary survey of the topography and type of the bottom of Jaffna lagoon was undertaken.

### Area

Jaffna lagoon is located in the Northern Province of Ceylon. It has an area of 160 sq. miles (412.8 sq. km.) and extends from Fort Hammenhill in the east to the Elephant pass in the west as a narrow body of water separating the Jaffna Peninsula from the mainland and a few neighbouring islands. The lagoon is connected to the open sea the Palk Bay—through four openings. Of these, two are very shallow, i.e., one at Punnalai and the other between Mandaitivu and Kayts Island. The other two are relatively deep, i.e., one between Karaitivu and Kayts and the other between Kalmunai and Mandaitivu. Mixing of water is effected by the tidal currents entering and flowing out through these channels. Five distinct bays can be marked out in the Jaffna Lagoon. They are, Punnalai Bay, Kallundai Bay, Velichchaveedu Bay, Ariyalai Bay and Kachchai Bay. (Fig. 1) Small marshy islands such as Kuruchchadditivu in the Kallundai Bay, Chirutivu in the Velichchaveedu Bay, Poo-varasantivu, Kannativu and Mantivu in Ariyalai Bay are found in the lagoon. Two causeways, Pannai Causeway and Punnalai Causeway, connect the Jaffna peninsula with the neighbouring islands. The Mahadeva Causeway between Keraitivu and Pooneryn is still incomplete. Three salterns, the Elephant Pass saltern at the eastern end of Kachchai Bay, Ariyalai saltern in the northern sector of the Ariyalai Bay, and Kallundai saltern along the North-eastern shoreline of Kallundai Bay are using the lagoon water to produce salt. Fishing villages are found all along the coastline. The most widely used fishing gear in the lagoon is Sirahu valai (Sachithanathan and Thevathasan, 1970). The investigations covered an area of 71 sq. miles (183.2 sq. km) extending from Punnalai causeway and Kayts channel in North-west to Kerativu—Sangupiddy ferry in the south east. Kachchai bay has been left out as the fishery in that region is poor and has little relevance to the regulations under revision.

### Bottom Topography

A hand lead line was used in making the soundings. Horizontal angles between three or four land marks measured with a hand bearing compass of one degree accuracy gave the position of the soundings. More accurate angular measurements could have been made with a sextant but the reduction in final error would have been negligible as the maximum distance to the land marks was only four miles and the map that was available for use represented one mile by one inch. Admiralty Tide Tables were used in calculating the height of tide.

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Soundings are represented as 1 ft. (0.3048 m.) 3 ft. (0.9143 m.) and 6 ft. (1.8287 m.) isobaths in fig. 2. Areas deeper than  $2\frac{1}{2}$  ft. (0.7619 m.) are represented in fig. 3. Sections of the four bays are shown in fig. 5. The area deeper than  $2\frac{1}{2}$  ft. (0.7619 m.) as represented in fig. 3 indicate a continuity of these depths which form a channel. Deepest areas in the lagoon are along these channels. 13 ft. (3.9622 m.) is the maximum depth encountered during the investigations. Kayts channel never

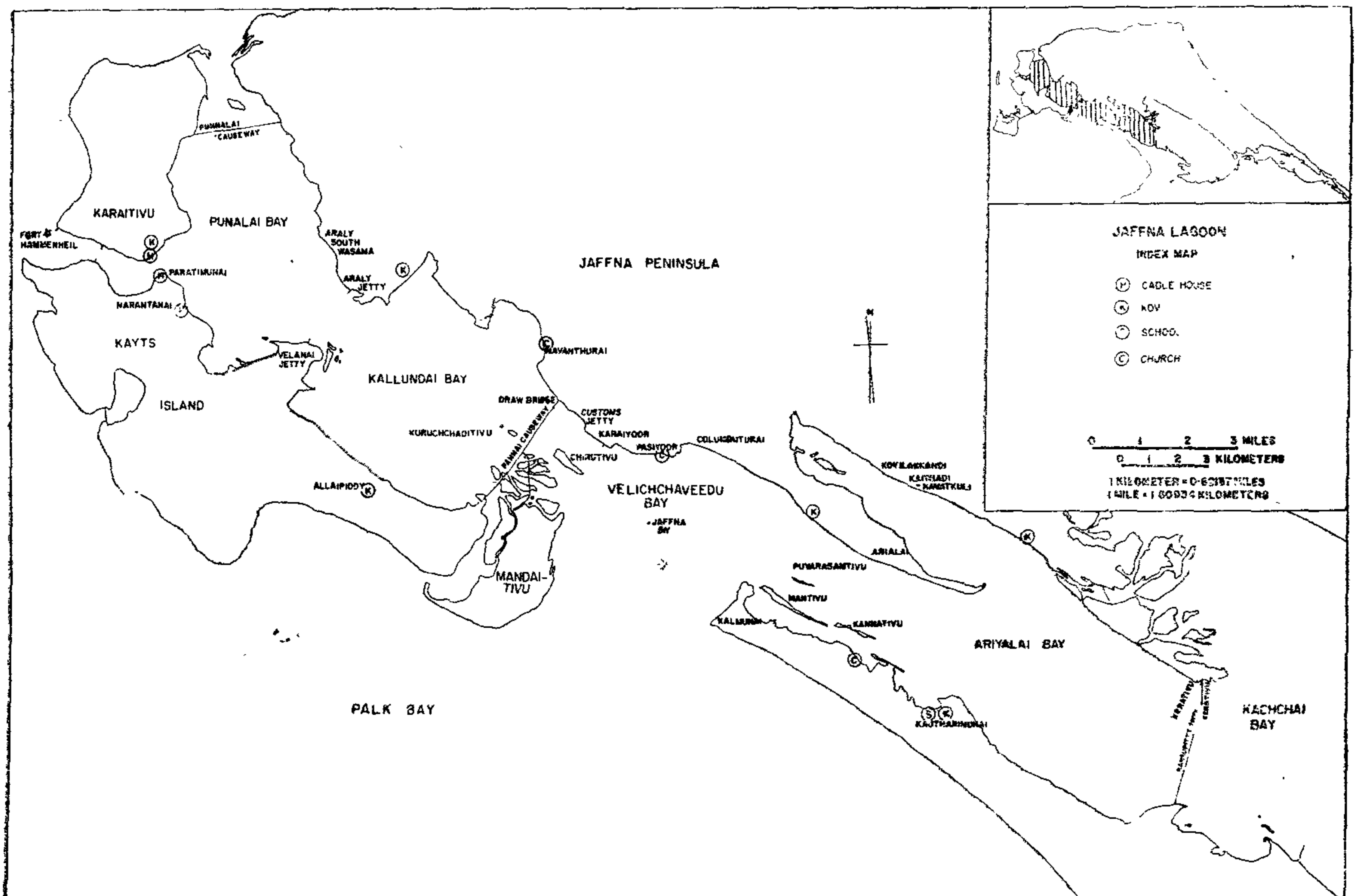


Fig. 1—Index Map of Jaffna Lagoon indicating landmarks etc. used during the survey. The shaded area in the inset map indicates the portion of the lagoon surveyed.

exceeds a depth of 12 ft. (3.6574 m) and has a general depth range of 9 to 10 ft. The depth of the Punalalai bay channel is 3–4 ft. The depth of channel along the Kallundai bay varies from 3 ft. to 6 ft. The depth of channel in the Velichchavedu bay rarely exceeds 12 ft. In Ariyalai bay depth of channel never exceeds 13 ft. but the depth range is between 5 ft. and 7 ft. Most of the northern part of Punalalai bay remains exposed during low tide. Numerous tidal pools are visible. Kallundai bay has no tidal flats. Urbanisation has crept into such tidal flats at Velichchavedu bay. They are being filled for constructing housing complexes. The shallow region near Sangupiddy at Ariyalai bay remains exposed during low tide.

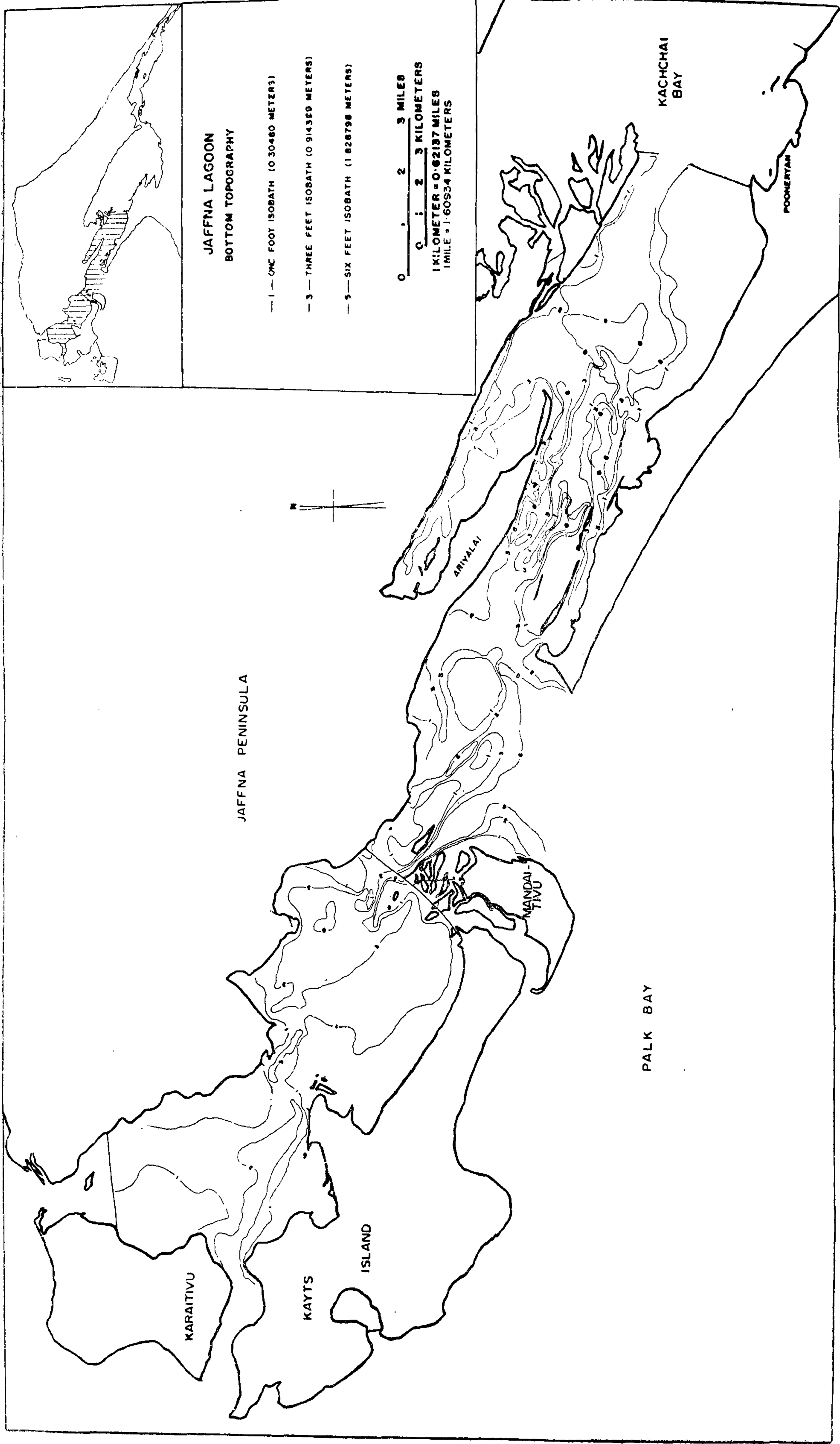


Fig. 2—Bottom Topography of Jaffna Lagoon.

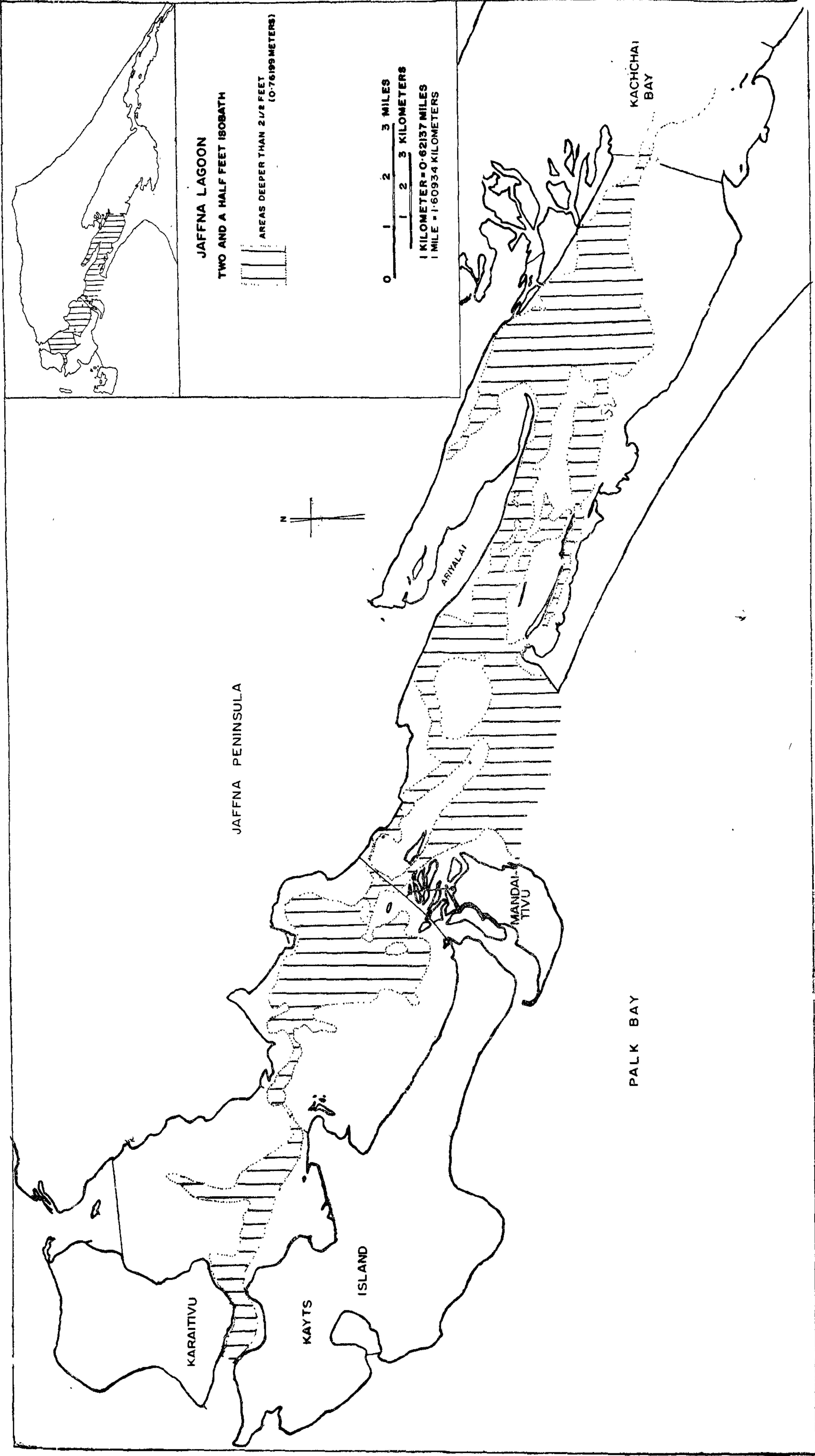


Fig. 3—Two and a half feet isobath

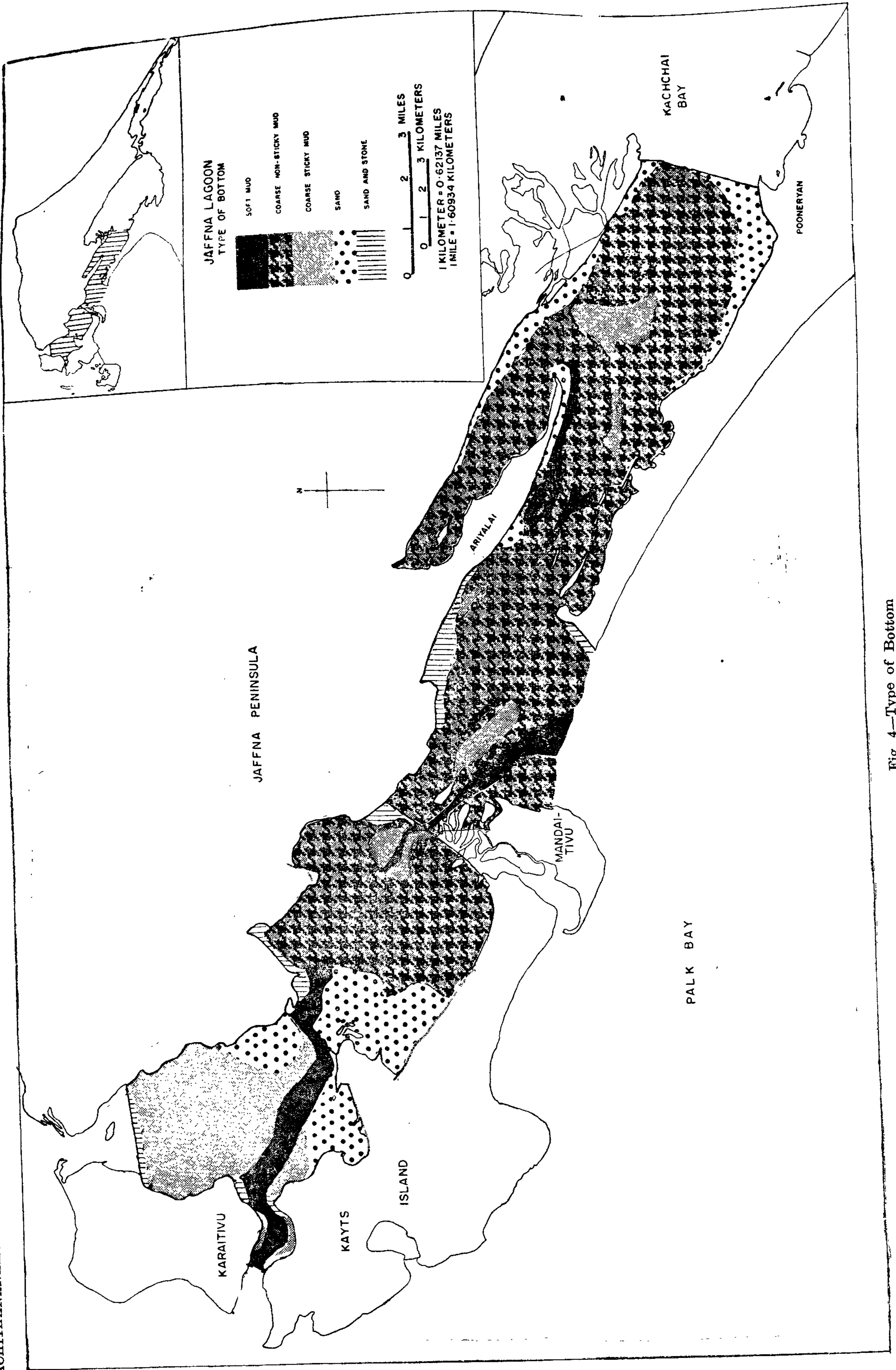


Fig. 4—Type of Bottom

Jaffna lagoon is very shallow and is navigable only through the few channels which are generally 3 ft.-5 ft. in depth. As a result of mechanisation of the fishing crafts these channels are being used extensively. Crafts sail from Kayts to Kerativu without interruption except at the draw bridge at Pannai causeway. At this region the channels cannot be navigated at low tide by the popular 26 ft. mechanised boat with a draft of  $2\frac{1}{2}$  ft. It has been found that a relatively deeper channel situated towards the southern side in the same region could have been used by the boats if not for the obstruction caused by the construction of the causeway. The operation of Sirahu valai in the lagoon sometimes thus interfere with the navigation of fishing boats along the channels in the lagoon.

### Type of Bottom

The shoreline of the lagoon is sandy, the channels are muddy and the bottom is not firm. The bottom sediments can be differentiated into five types. Percentage composition of the organic content and textural classes are given in Table I and are marked in Fig. 4.

### Soft Mud

All along the channels in the lagoon the bottom has a slate-coloured fine soft sticky friable mud. This mud becomes hard when dried. The bottom in these areas is loose. The channels in the Punnalai bay, Velichchaveedu bay and Ariyalai bay are characterised by this type of bottom.

### Coarse non-sticky mud

Areas other than the channels in Velichchaveedu bay, Ariyalai bay and Kalmunai bay are characterised by a coarse non-sticky mud bottom which is relatively more firm. *Enhalus* sp. *Holothuria* sp. and *Peneaus semisulcatus* are the taxonomic groups associated with this bottom. The prawn is greenish in colour and finds shelter under the eel grass. *Holothuria* sp. are found burrowing in the mud.

### Coarse sticky mud

Punnalai bay has a distinct loose bottom characterised by coarse sticky friable slate-coloured mud. The bay is partially exposed during low tide. Patches of this type of bottom are found in other bays also.

### Sand

The shoreline of the lagoon is characterised by a sandy bottom. This bottom extends into the gradient at certain regions of Kallundai bay and Ariyalai bay. This compact, medium size sand is non-sticky and extremely firm in consistancy.

### Sand and Stone

Coarse cherty fragments are mingled with sand in some shore lines. At Punnalai bay, this is a continuation of the similar terrain of the adjoining land at Kerativu. Construction of causeways, jettys and beacons have resulted in the accumulation of these fragments in other areas--referred in Fig. 6.

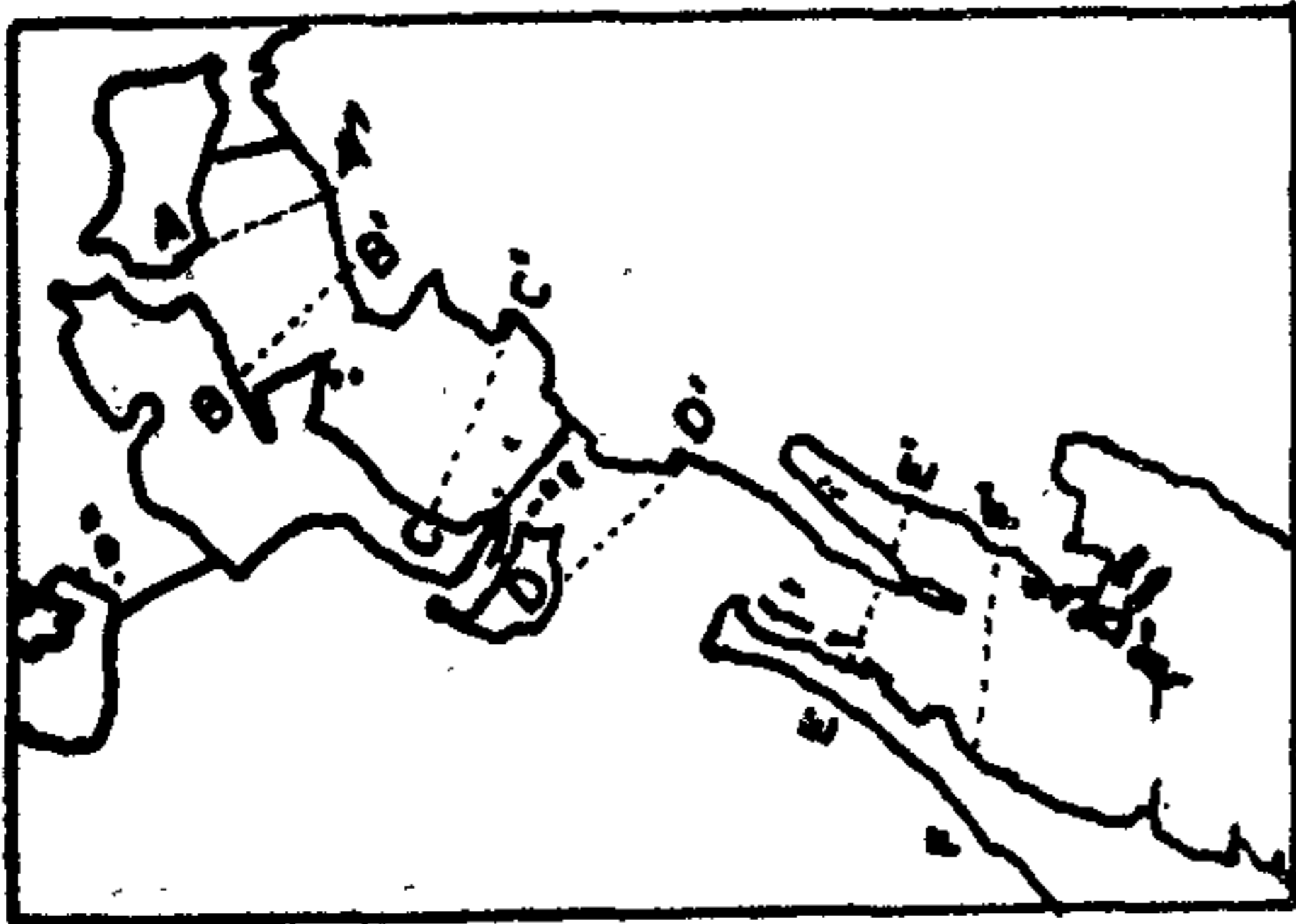


FIG. 5

JAFFNA LAGOON

PROFILE OF THE BOTTOM

----- IN INSET MAP INDICATE POSITION OF THE PROFILE

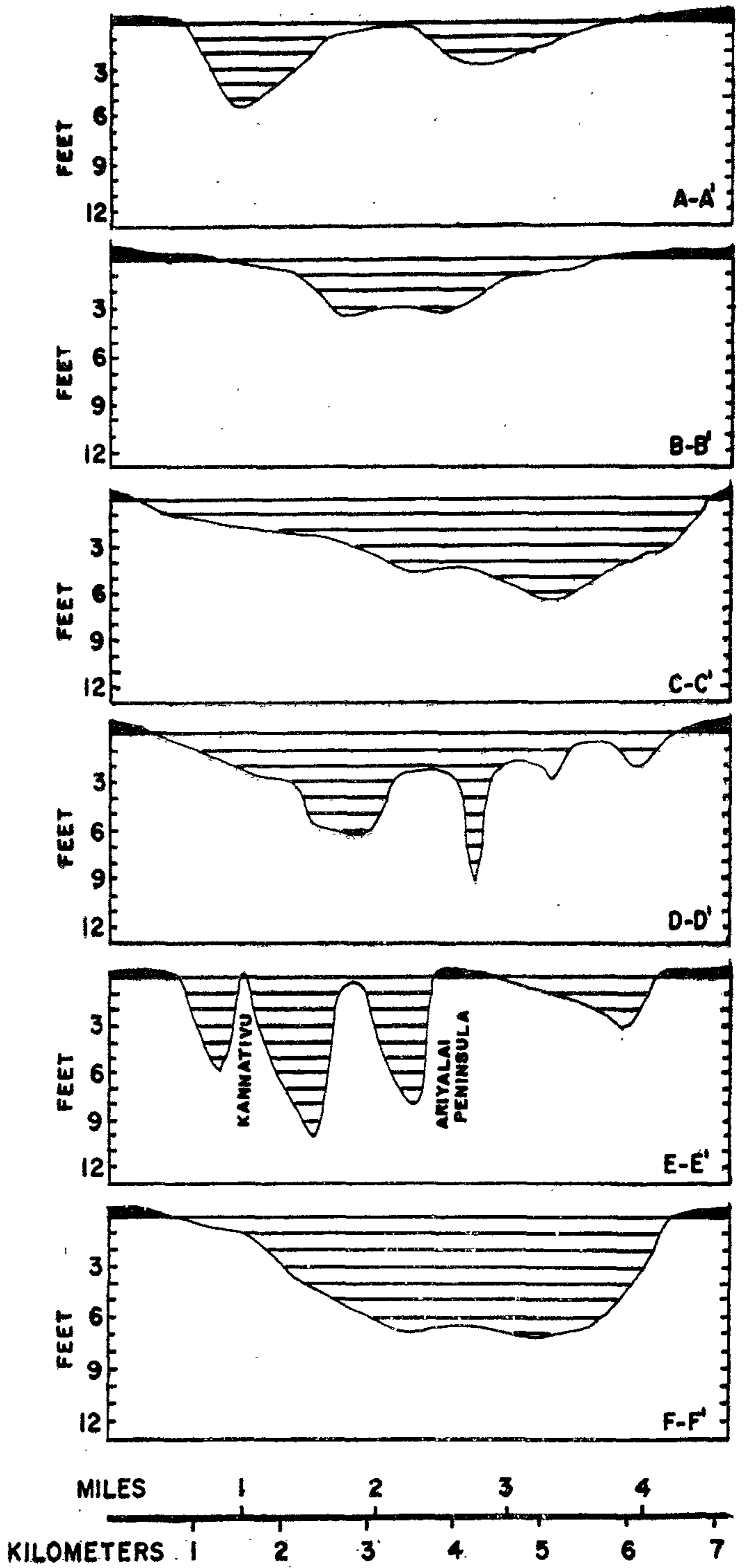


TABLE I

Percentage of Organic matter and Textural classes of the five types of bottom sample in the Jaffna Lagoon—December, 1970

Type	Organic Matter %	Very coarse particle (More than 1 mm.) %	Coarse sand (1 mm.— 0.5 mm.) %	Medium sand (0.5 mm.— 0.25 mm.) %	Fine Clay particle (less than 0.25 mm.) %
Soft mud ..	12.0	7.3	11.4	6.0	63.5
Coarse non-sticky mud ..	2.9	11.6	30.9	30.3	23.4
Coarse sticky mud ..	16.1	13.7	15.0	6.4	46.8
Sand ..	1.7	1.6	1.4	87.7	5.6
Sand and Stone ..	5.3	4.6	44.6	14.1	30.2

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### References

- CEYLON, SURVEY DEPT., One inch to one mile, Jaffna, AA 27, 22, A, 1, 2 (1937); Pooneryn, A 7, 8, 12, 13 (1958).
- JACKSON, M. L. (1958), Soil chemical analysis, Prentice Hall Inc. N. J., U. S. A.
- SACHITHANANTHAN, K. and A. THEVATHSAN, (1970), *Sirahu Valai* a passive fishing gear in Ceylon, Bull. Fish. Res. Stn., Ceylon. Vol. 21 (2), pp 87-95.
- STEARNS, FRANKLING (1969), Bathymetric maps and geomorphology of the Middle Atlantic continental shelf, Fish. Bull. Vol. 68 (1), pp. 37-66.
- SVEDRUP, H. U. et al. (1942), The Oceans, their physics chemistry and general biology, Prentice Hall Inc., N. J., U. S. A.
- UNITED KINGDOM, LONDON ADMIRALTY (1958), Palk strait and Gulf of Mannar (Northern sheet), 68a.
- UNITED KINGDOM, SOMERSET, HYDROGRAPHER OF THE NAVY (1969), Admiralty Tide tables, Vol. II (1970) Atlantic and Indian Oceans.
- UNITED STATES DEPT OF AGRICULTURE, Agriculture research Administration (1951), Soil Survey Manual.