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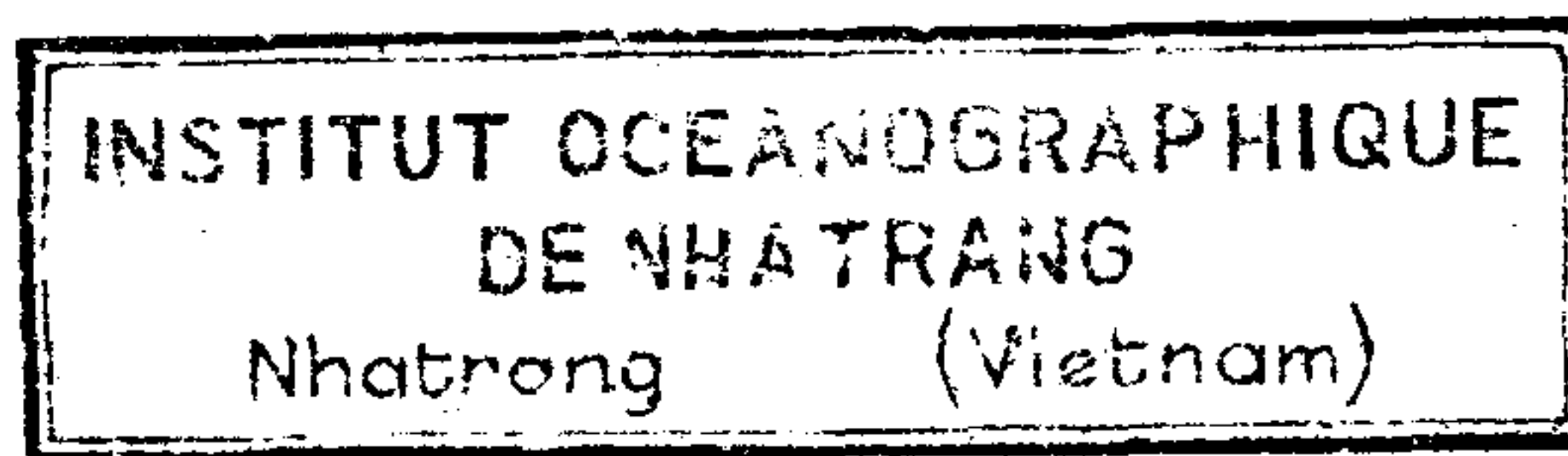
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# PRELIMINARY PLANKTON RESEARCH IN THE BAY OF NHATRANG, VIETNAM

by

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## Contribution No. 51

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# Preliminary plankton research in the Bay of Nhatrang, Vietnam

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**ABSTRACT.** — An account is given of the work done on plankton of the Bay of Nhatrang, beginning with a study made by Rose in 1926. At the present time, identification studies are being conducted at the Faculty of Sciences Saigon, bearing on Diatoms and Protozoa.

**RÉSUMÉ.** — Le plancton de la baie de Nhatrang a été étudié par plusieurs auteurs, à commencer par Rose (1926). L'étude systématique des Diatomées et des Protozoaires est amorcée à la Faculté des Sciences de Saigon.

The bay of Nhatrang, where the Oceanographic Institute of Nhatrang is located, is in central Vietnam, on latitude 12° N, and longitude 109° E (Map No. 1).

The bay is divided into two parts by Hon Lon island : the northern part is called the bay of Nhatrang proper, the southern part is the bay of Câu Da. In this article, the term bay of Nhatrang is used to include both southern and northern parts.

The northern part of the bay is wide open on the east side to the South China Sea. The southern part or bay of Câu Da, limited by Hon Lon island and a number of smaller islands is much more sheltered.

The northern part gets the outflow from the Sông-Cai river whereas the southern part receives a tributary, the Sông Cua Bé.

The entire bay is rather shallow : 25 meters in its center ; 40 to 50 meters at its opening into the South China Sea.

The continental shelf is rather narrow around Nhatrang : from Varella cape to Cau Da it consists of a narrow strip only 100 miles wide. Beyond this limit, the sea bottom drops precipitously to 2000 meters or even 4000 meters.

This is the zone of upwellings with their consequences on marine life.

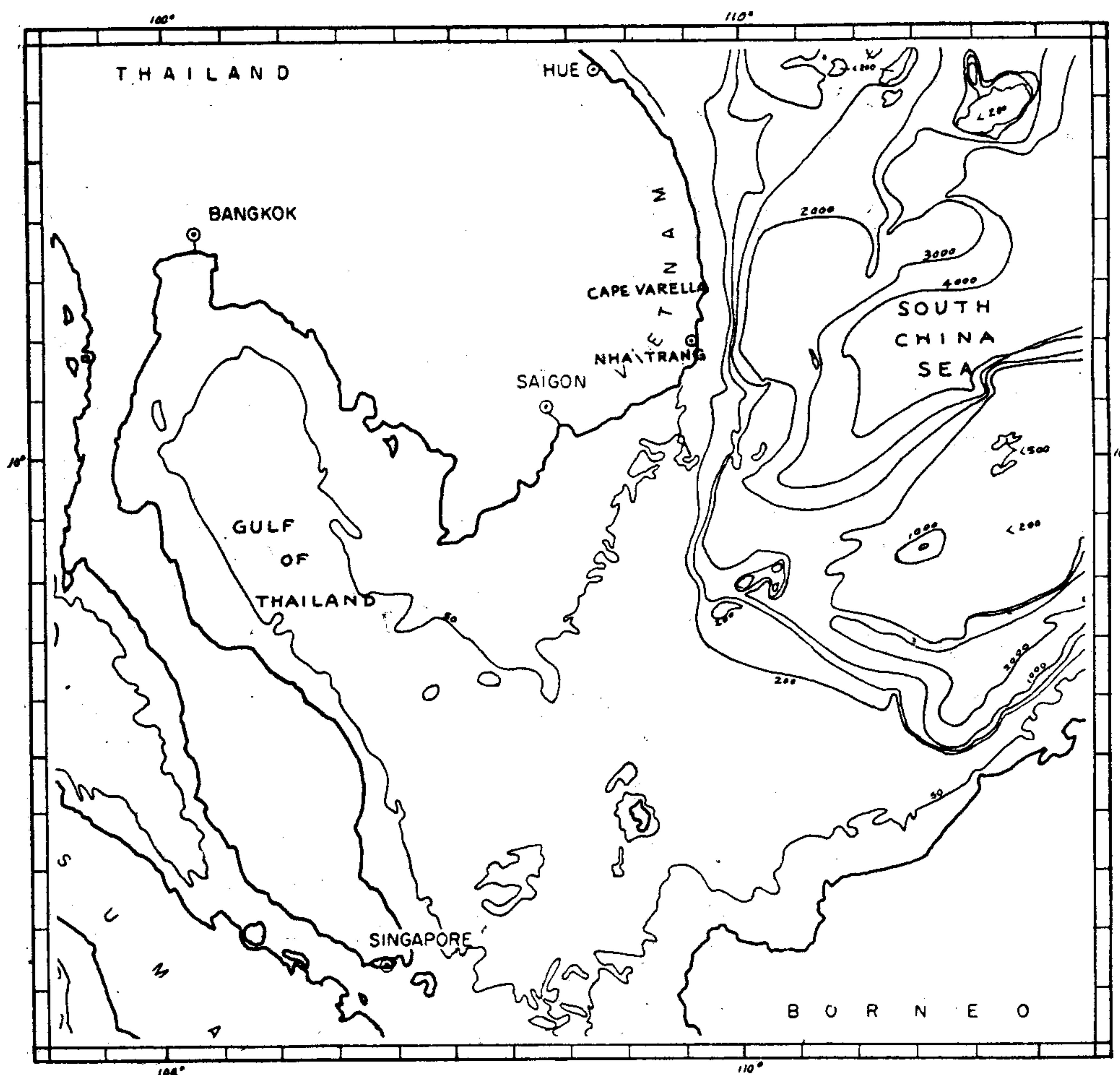
Variations of temperature and salinity in the bay are the subject of a recent study by Nguyễn Hai, Trinh thiên Tu and Nguyễn dinh Ba (1960).

From daily readings of surface temperature made from January 1957 to June 1960, a maximum is observed in autumn (August-September-October)

and a minimum in January-February, with the highest average at 31°3 C in May 1957 and the lowest at 23°4 C observed in January 1957.

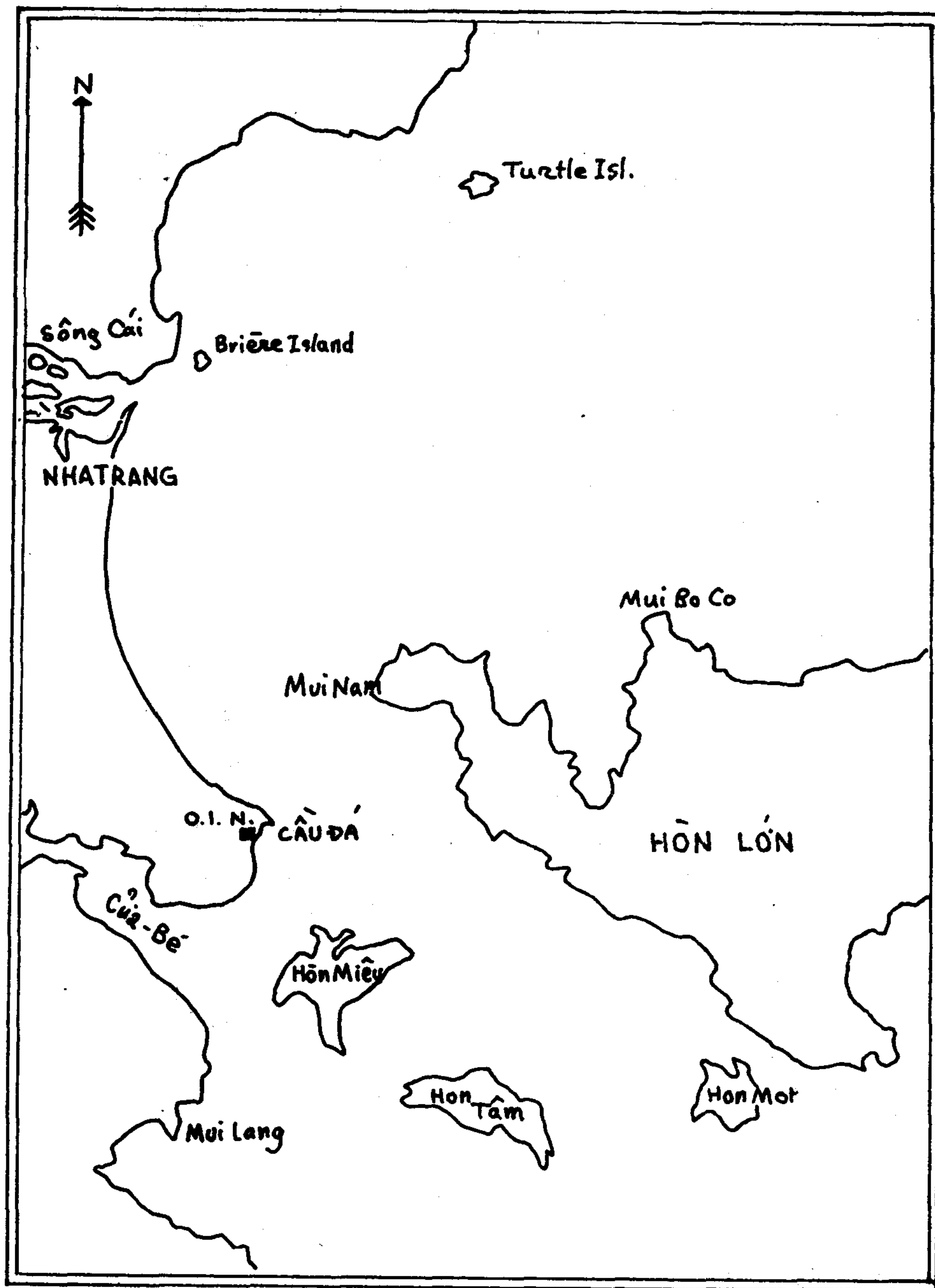
Salinity measurements made during the same periods at 48 different stations in the bay, showed that wherever the sea water was not mixed to fresh water coming from the two above mentioned rivers, normal salinity was found to be between 33 ‰ and 35 ‰ ; with an occasional peak at 36.66 ‰. The height of the wet monsoon season which happens around September-October when great amounts of fresh water pour out of the rivers into the bay, is also marked by a precipitous drop in the salinity, down to 25 ‰.

Dawydoff (1936) mentioned that whenever torrential rains are combined with increased outflow from enlarged rivers, the water in the bay showed characteristic brackish conditions. It becomes a dirty yellow, lost its transparency and even has a peculiar smell.



Map No. 1.

*Bathymetric map of the South China sea area in  
the vicinity of Nha Trang, Viet Nam*



OIN: OCEANOGRAPHIC INSTITUTE NHATRANG

Map No. 2. — The Bay of Nhatrang



Nguyen Hai and al. (1960) gave some precisions concerning the influence of the fresh water output from the Song Cai and the Song Cua Be.

In the northern part of the bay, the fresh water flows in the bay in the form of a fan reaching as far as Mui Bo Co.

The water around Brière island was often found to be the least saline of the bay. Normal saline water seems to be pushed back toward the coastline.

In the southern part of the bay, between the coastline and Hon Lon, there seems to be a more thorough mixing of fresh and salt water. The islands Hon Mieu and Hon Tam are surrounded at all times by low salinity water. The influence of fresh water can be felt sometimes as far as Mui Nam and Mui Lang.

### Plankton studies in the Bay of Nhatrang.

Rose (1926) was the first to make a study of the plankton of the bay of Nhatrang.

It was a short list of planktonic organisms observed in passing by the author in 54 different samples of plankton gathered in the bay of Nhatrang.

The diatoms and protozoa of the list are as follows :

| Diatomaceae                     | Dinoflagellata               |
|---------------------------------|------------------------------|
| Asterionella japonica Ci.       | Ceratium furca Duj.          |
| Asterolampra marylandica Ehbgs. | — fusus Duj.                 |
| Bacteriastrum (several species) | — gravidum Gourret           |
| Biddulphia mobiliensis Bailey   | — reticulum Pouchet          |
| -- sinensis                     | — candelabrum Ehrh.          |
| Chaetoceras densum Cl.          | Dinophysis sp.               |
| — curvisetum Cl.                | Gonyaulax polygramma Stein   |
| -- tetrastichon Cl.             | Diplopsalis lenticula Bergh. |
| Corethron sp.                   | Peridinium divergens Ehrh.   |
| Coscinodiscus gigas Ehbgs.      | — globulus Stein             |
| Eucampia sp.                    | — oceanicum Vanhoffen        |
| Guinardia flaccida              | Phalacroma sp.               |
| Hemiaulus sp.                   | Podolampas bipes Stein       |
| Nitzschia sp.                   | — palmipes Stein             |
| Rhizosolenia alata              | Pyrophacus horologium Stein  |
| -- calcar avis Schultze         |                              |
| --- imbricata Btw.              | <b>Silicoflagellata</b>      |
| -- Setigera Btw.                | Dictyocha fibula Ehrh.       |
| --- stolterifothii Perag.       | Distephanus speculum Ehrh.   |
| Thalassiothrix <sup>1</sup> sp. | <b>Cystoflagellata</b>       |
|                                 | Nectiluca miliaris Surir.    |

**Rhizopoda***Globigerina bulloides* d'Orb.**Radiolaria***Acanthometron* sp.*Amphilonche* sp.*Collozoum inerme* Mull.**Ciliata***Amphorella* sp.*Codonella* sp.*Cyttarocyclis* sp.*Dictyocysta* sp.*Tintinnus* sp.*Undella* sp.

Gravier and Dantan (1934) made a study of polychete annelids gathered during night tows with a light trap on different locations of the coast of central Vietnam. A total of 50 species were identified.

Dawydoff (1936) established a list of plankton organisms found in the same area and more particularly in the Nhatrang Bay itself. His list may be taken as representative of the planktonic fauna of the superficial zone, down to a depth of 20 meters. It will be reproduced in part as follows:

**Diatomaceae***Rhizosolenia alata* Bt.— *calcar avis* Sch.— *acuminata* Btw.— *imbricata* Btw.— *styliformis* Stolterfothü  
Per.

— sp.

*Chaetoceras densum* Cl.— *curvisetum* Cl.— *coarctatum* Cl.— *tetrastichon* Cl.— *lorenzianum* Cl.— *peruvianum* Cl.

— sp.

*Biddulphia sinensis* Bail.*Biddulphia mobilianus* Bail.*Bacteriastrum hyalinum* Cl.*Asterionella japonica* C.*Asterolampra marylandica* Ehbgs.*Guinardia flaccida* Cast.*Thalassiothrix frauenfeldii* Bt.*Hemiaulus sinensis* Et.*Coscinodiscus gigas* Ehbgs.— *jonesianus***Dinoflagellida***Ceratium deus* Ost.— *Schmidtii* Ins.— *furca* Duj.— *gravidum* Gar.— *candelabrum* Ehbgs.— *contortum* v. *saltans* Schr.— *inflatum* Kof.— *fuscus* Duj.— *tripos* O. Mull.— *armatum* v. *robustum* Schr.— *pentagonum* Gour.— *limulus* G.— *pulchelleum* Duj.— *ranipes* Schr.— *breve* Schr.— *concilians* Iörg.— *massiliensis* G and K.— *platycorne* Dad.— *incisum* Karst*Peridinium**Amphisolenia**Dinophysis**Ceratocorys**Pyrocystis*

**Dinoflagellida**

Ornithocercus  
 Histioneis  
 Triposolenia  
 Acanthodinium  
 Gonyaulax polygramma  
 Podolampas bipes  
 — palmipes  
 Goniiodoma  
 Pyrophacus  
 Phalacroma  
 Diplopsaulis  
 Gymnodinium  
 Cochlodinium  
 Pouchetia  
 Polykrikos  
 Noctiluca miliaris Sur.

**Silicoflagellida**

Distephanus speculum Ehrh.  
 Dictyocha fibula Ehrh.

**Chrysomonadida**

Phaeocystis  
 Trichodesmium

**Foraminiferida**

Globigerina bulloides d'Orb.  
 Discorbina  
 Tretomphalus  
 Bolivina

**Coelenterata**

|               |                                    |
|---------------|------------------------------------|
| Hydromedusa   | 34 genera                          |
| Siphonophora  | 23 genera                          |
| Scyphomedusa  | 20 genera                          |
| Hexacorallina | Larvae of 6 genera of Cerianthidae |
| Ctenophora    | 21 genera                          |

**Vermes**

|                 |                  |
|-----------------|------------------|
| Platyhelminthes | 3 genera         |
| Polychaeta      | 8 pelagic genera |

**Ciliatea**

Tintinnus  
 Tintinnopsis  
 Codonellopsis  
 Codonella  
 Salpingella  
 Amphorella  
 Cyttarocyclis  
 Dictyocysta  
 Undella  
 Epiprocyllis  
 Rhabdonella  
 Petarotricha

**Radiolaria**

Acanthometron  
 Thalassicola  
 Aulosphaera  
 Drymosphaera  
 Diplosphaera  
 Haliomma  
 Protocystis  
 Litharachnium  
 Diplocolpus  
 Amphilonche  
 Coelodendron  
 Collozoum inerme I. Mull.  
 Sphaerouzoum  
 Gazenella

|                              |   |
|------------------------------|---|
| <b>Vermes</b>                | 13 benthonic genera                                   |
|                              | 12 species of <i>Nereis</i> (epithecal form)          |
| <b>Chaetognatha</b>          | 12 species of <i>Sagitta</i>                          |
|                              | 6 species of other genera                             |
| <b>Crustacea</b>             |   |
| Copepoda                     | 28 genera   |
| Cladocera                    | 7 genera  |
| Isopoda                      | 7 genera and larval forms                             |
| Amphipoda                    | 4 pelagic genera                                      |
| Decapoda                     | 4 genera  |
| Mysids and euphausiids       | 6 genera  |
| Cumacea                      | 45 species  |
| <b>Mollusca</b>              |   |
| Heteropoda                   | 6 genera, notably 4 species of <i>Atlanta</i>         |
| Pteropoda                    | 18 genera   |
| Cephalopoda                  | 6 genera, notably <i>Argonauta</i> and <i>Spirula</i> |
| <b>Tunicata</b>              |   |
| 13 species of <i>Salpa</i>   |   |
| 2 species of <i>Pyrosoma</i> |   |
| 4 species of <i>Doliolum</i> |   |
| <b>Appendicularia</b>        |   |
| 3 genera with 13 species     |   |
| <b>Céphalochoordata</b>      |   |
| Larvae of Branchiostoma      |   |

On the whole it was estimated by Serène (1959) that the plankton pelagic fauna consists of more than 250 genera, represented by a total of at least 1000 species.

Dawydoff also describes a cycle in the relative abundance of zooplankton and phytoplankton according to the seasons. During the dry season, zooplankton is relatively abundant and rich. Beginning september, with the monsoon rains lowering the salinity of the water in the bay, zooplankters decrease in numbers and disappear completely in October, November and December. Phytoplankton then is then very rich, with enormous amounts of diatoms :

|                |               |
|----------------|---------------|
| Chaetoceras    | Ditylum       |
| Bacteriastrum  | Asterionella  |
| Biddulphia     | Stephanopyxis |
| Rhizosolenia   | Hemidiscus    |
| Eucampia       | Hemiaulus     |
| Thalassiothrix | Coscinodiscus |



The last genus sometimes appears in prodigious quantities along with *Trichodesmium*, a *Chrysomonad*, and various dinoflagellates. Zooplankton begins to reappear in January in the bay, to become completely normal only in March.

This disparition of zooplankton during part of the year has been observed in the Gulf of Thailand by Weill in 1927.

Serène (1937) published a list of marine invertebrates observed in coastal waters of Vietnam, particularly in the Bay of Nhatrang. As far as Plankton is concerned, his list is identical to the list established by Dawydoff (1936).

In a special note, Serène (1948) gave the results of plankton studies in the bay of Nhatrang during the years 1938 to 1942.

Both night tows and day tows were made every week.

For day tows, plankton was collected by towing a net on a predetermined route.

For night tows, an insulated electric light was fitted over the net, which was raised after 30 minutes immersion.

The catch was fixed in formalin and afterwards sorted out.

The sorting was followed by the counting of each group.

This allows a quantitative evaluation of the catch as well as seasonal variations in the availability of each species according to the months of the year; in any one month, the presence or absence as well as fluctuations of a group can be noticed.

The results of the sorting and counting are tabulated according to the following groups :

(the diatoms and protozoa have not been taken into account by Serène)

#### **Coelenterata**

Medusae  
Siphonophora  
Ctenophora

#### **Crustacea**

Ostracoda  
Amphipoda  
Copepoda  
Cumacea  
Isopoda  
Schizopoda  
Decapoda larvae  
Stomatopoda

#### **Vermes**

Chaetognatha  
Annelida  
Trematoda

#### **Mollusca**

Pteropoda  
Heteropoda

#### **Prochordata**

Appendicularia  
Salpa

#### **Chordata**

Fish eggs and embryos

Monthly yields were plotted on tables, showing that 1500 samples were taken into consideration. The results showed great fluctuations from year to year. No attempt was made to correlate the fluctuations with changes in the outer environment.

Hamon (1956) made a detailed study of the Chaetognatha found in the plankton of Nhatrang Bay.

Yamashita (1958) made a survey of the Nhatrang Bay plankton during the years 1957-1958, while working on a project sponsored by the Directorate of Fisheries of Vietnam.

Monthly catches were made at 13 stations in the Bay of Nhatrang.

Two of the stations No. 3 and 13, were located at the estuaries of the Song Cai and the Cua Be Rivers.

The highest average monthly catch was made in May 1958, with 36,6 cc per cubic meter. The lowest catch was made in February 1958, with only an average of 0.28 cc per cubic meter.

Yamashita also found that the increase was due not to zooplankton, but to phytoplankton, mainly diatoms and green algae.

The peak in May seems to be in contradiction with the remark made by Dawydoff concerning a peak in phytoplankton occurring in October, November and December.

In order to get better data for the solution of this problem, a program has been set up to gather plankton in the bay of nhatrang at monthly intervals at the same stations indicated by Yamashita. Transparency, salinity, specific weight measurements are also carried out at each station.

Meanwhile, work has also begun in the systematic study of the planktonic organisms found in the bay, particularly of the Diatoms and the Protozoa.

With similar work being preformed in neighboring countries, it was hoped that a thorough knowledge of the plankton of the entire region can be obtained, based on both quantitative and qualitative studies, for the greatest benefit of all countries concerned.

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