Ann. Fac. Sci. Saigon, 1961, *91-100.*

Preliminary plankton research in the Bay of Nhatrang, Vietnam

by

HOANG QUOC TRUONG

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.

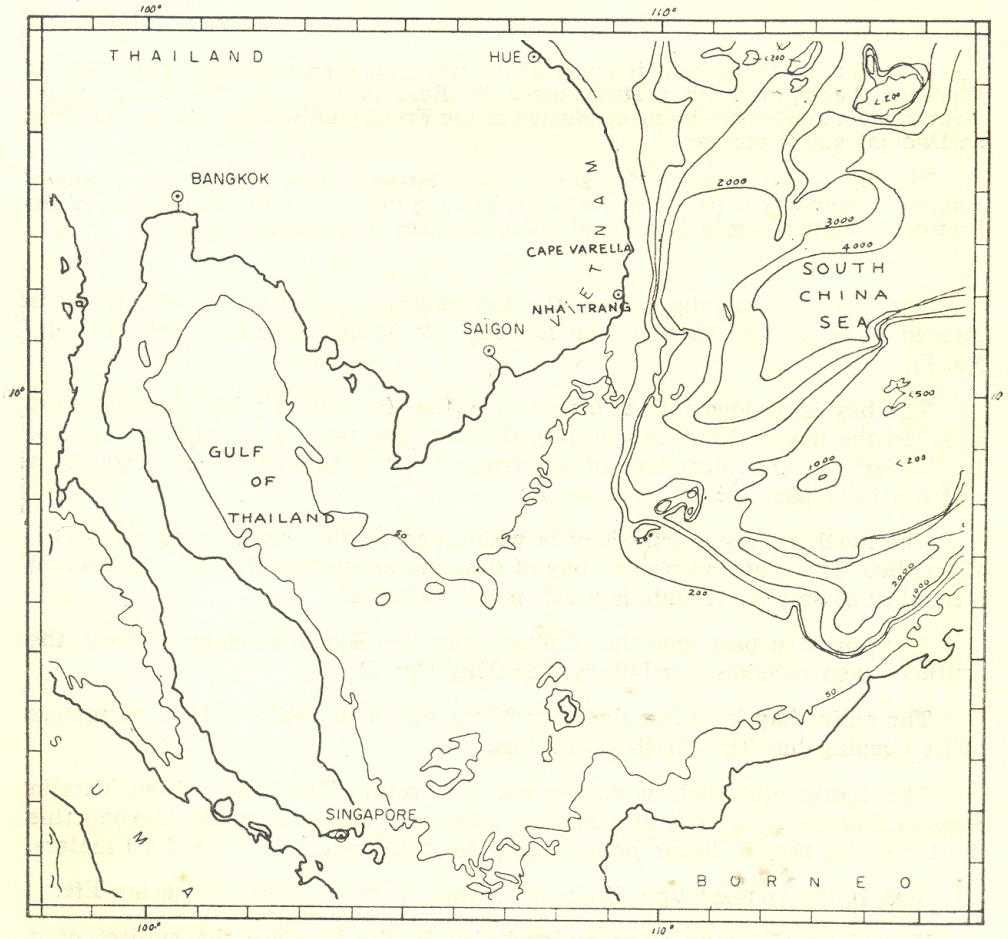
Variations of temperature and salinity in the bay are the subject of a recent study by Nguyên Hai, Trinh thiên Tu and Nguyen dinh Ba (1960).

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

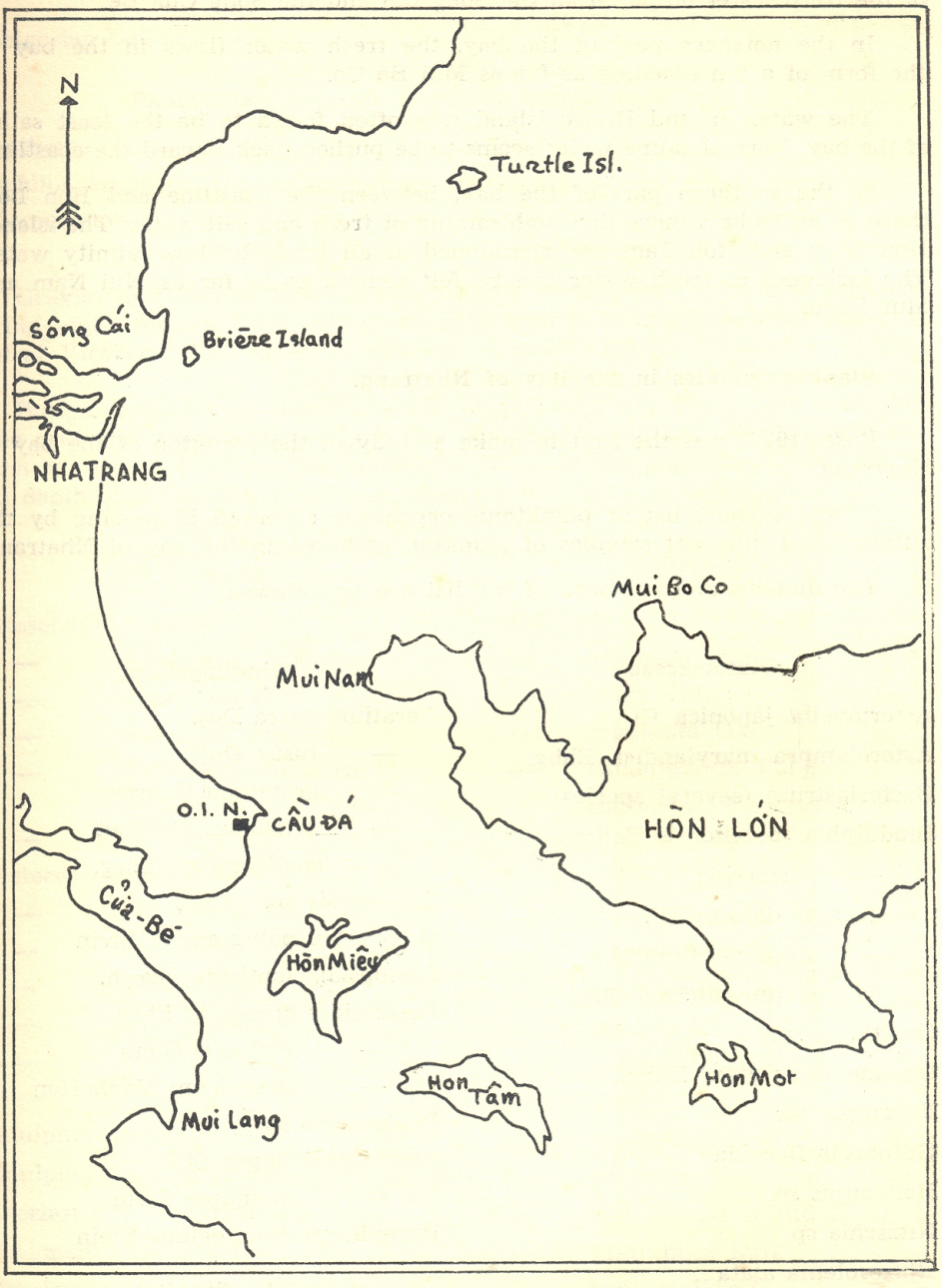
and a minimum in January-February, with the highest avearage at 31°3 C in May 1957 and the lowest at 23°4 C observed in January 1957.

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 transparence 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



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

Asterionella japonica Ci.
Asterolampra marylandica Ehbg.
Bacteriastrum (several species)
Biddulphia mobiliensis Bailey
— sinensis
Chaetoceras densum Cl.
— curvisetum Cl.
— tetrastichon Cl.
Corethron sp.
Coscinodiscus gigas Ehbg.
Eucampia sp.
Guinardia flaccida
Hemiaulus sp.
Nitzschia sp.
Rhizosolenia alata
— calcar avis Schultze
— imbricata Btw.
— Setigera Btw.
— stolterifothii Perag.
Thalassiothrix sp.

Dinoflagellata

Ceratium furca Duj.
— fusus Duj.
— gravidum Gourret
— reticulum Pouchet
— candelabrum Ehrg.
Dinophysis sp.
Gonyaulax polygramma Stein
Diplopsalis lenticula Bergh.
Peridinium divergens Ehrg.
— globulus Stein
— oceanicum Vanhoffen
Phalacroma sp.
Podolampas bipes Stein
— palmipes Stein
Pyrophacus horologium Stein

Silicoflagellata

Dictyocha fibula Ehrg.
Distephanus speculum Ehrg.

Cystoflagellata

Noctiluca 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 Ehbg.
Guinardia flaccida Cast.
Thalassiothrix frauenfeldii Bt.
Hemiaulus sinensis Et.
Coscinodiscus gigas Ehbg.
— jonesianus

Dinoflagellida

Ceratium deus Ost.
— Schmidtii Ins.
— furca Duj.
— gravidum Gar.
— candelabrum Ehbg.
— contortum v. saltans Schr.
— inflatum Kof.
— fusus 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

Dinoflagéllida

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

Silicoflagellida

Distephanus speculum Ehrg.
Dictyocha fibula Ehrg.

Chrysomonadida

Phaeocystis
Trichodesmium

Foraminiferida

Globigerina bulloides d'Orb.
Discorbina
Tretomphalus
Bolivina

Ciliatea

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

Radiolaria

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

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

Vermes	13 benthonic genera
	12 species of Nereis (epithecal form)
Chaetognatha	12 species of Sagitta
	6 species of other genera

Crustacea

Copepoda	23 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

Mollusca

Heteropoda	6 genera, notably 4 species of Atlanta
Pteropoda	18 genera
Cephalopoda	6 genera, notably Argonauta and Spirula

Tunicata

13 species of Salpa
2 species of Pyrosoma
4 species of Doliolum

Appendicularia

3 genera with 13 species

Cephalochordata

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. Transparence, 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 throurough 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.

BIBLIOGRAPHY

DAWYDOFF C. — Observations sur la faune pélagique des eaux indochinoises. *Bull. Soc. Zool. France,* 1936, LXI, 461-484.

» — Contribution à l'étude des Invertébrés de la faune benthique marine de l'Indochine. *Contribution de l'Inst. Océanog. Nhatrang,* N° 9, 1952.

GRAVIER C. et J.L. DANTAN. — Annélides polychètes recueillis au cours des pêches nocturnes à la lumière sur les côtes d'Annam. *Ann. Inst. Océanog. Paris,* 1934, XIV, Fasc. IIII.

HAMON M. — Chétognathes recueillis dans la baie de Nha Trang, Cau Da, Viêt-Nam. *Bull. Mus. Hist. Nat. Paris,* 1956, XXVIII, N° 5, 466-473.

NGUYEN HAI, TRINH THIEN TU and NGUYEN DINH BA. — Sur les récentes variations de température et de salinité de surface de Nhatrang. *Ann. Fac. Sci. Saigon*, 1960, 71-89.

ROSE M. — Quelques remarques sur le plancton des côtes d'Annam et du golfe de Siam. *Note de l'Inst. Océanog. Nhatrang*, N° 3, 1926.

SERÈNE R. — Inventaire des Invertébrés marins de l'Indochine. *Inst. Océanog. Nhatrang*, Note N° 30, 1937.

» — Résultats des pêches planctoniques effectuées par l'institut océanographique de l'Indochine à Nhatrang, période 1938-1942. *Note de l'Inst. Océanog. Nhatrang*, N° 44, 1948.

» — Report on marine biology in the central Indo Pacific Region at the Regional conference on marine sciences, Saigon Jan., 14-21, 1959.

YAMASHITA M. — Report to the Directorate of Fisheries of Vietnam, N° 545 of Sept. 16, 1958.