THE FIRST PMBC/DANIDA TRAINING COURSE AND WORKSHOP ON TAXONOMY OF MARINE BIVALVES WITH EMPHASIS ON ECONOMIC SPECIES

by

BOONLERT PHASUK AND JORGEN HYLLEBERG

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Fig. 1 Oyster shell, left valve, showing characters that can be observed and terminology used to describe these characters.
ABSTRACT

A training course and workshop was organized by Phuket Marine Biological Center in co-operation with DANIDA during 23-28 January 1984. The course was attended by 54 participants from the Department of Fisheries and Universities of Thailand. The programme encompassed lectures on bivalve taxonomy and biology, laboratory work on description and identification of adult and larval bivalves, field collections, and discussions on existing problems within the scope of the course.

The course demonstrated the need for much more taxonomic and biological research in Thailand. This applies to both commercially exploited groups and to groups which are presently not commercially exploited, but are of importance in general ecological studies, and for a better understanding of the marine and brackish water ecosystems. Expertise in this field found in other countries will only rather slowly help to solve the problems which are found in Thailand and therefore it seems urgent to develop and train such expertise in this country. This conclusion was arrived at by the participants at the end of the course.

I. INTRODUCTION

Very limited information concerning marine bivalves of Thailand is available. Tantanasiriwong (1979) provided a checklist of the bivalves from Phuket Island and neighbouring areas. In total 241 species were collected and deposited in the reference collection of PMBC. Recently Nielsen (1986) has studied bivalves associated with corals and a new species of gastrochaenid was described. This material, in addition to type material and general collections of mytilids collected and identified by K. Ockelmann, has been added to the collection. However, it is obvious that there is a long way to go before the mollusc fauna of this area is reasonably well known.

For a long time molluscs have been of economic significance in Thailand and this significance has recently increased. Today we face a situation with complicated patterns of fluctuating shellfish production and trade. For example Thailand imports "cockle seed" (Anadara granosa) from Malaysia amounting to millions of baht per year. Such import can be avoided by producing the seed cockles in Thailand. Therefore steps have been taken by the Department of Fisheries to increase production

II. RESULTS

The value of standardized treatments of molluscs both as to morphology and biology of biologically important families, genera and species was stressed, and it
was agreed upon to prepare such treatments and make them available to all relevant people and institutions. If possible this information should be published in Thai as well as English. A description scheme for anyone species of molluscs was presented and the structure and contents of this scheme was discussed. The scheme is shown in Annex 1. The approach to taxonomy of adult oysters presented during the course is shown in Annex 2. The fauna of oysters in Thai waters is very rich in species and oysters, in general, are very important economically. The taxonomy of this group of molluscs is particularly difficult and far from clarified at present. Pilot investigations on oyster larvae initiated during the course, and continued later, have shown, however, that it is comparatively easy to distinguish between the larvae of the various species, rather different from what is the case with adult oysters. Therefore detailed studies on oyster larvae, settling experiments on these larvae, improvement of the spat collectors, and studies of the juveniles may be one approach to clarify the taxonomy of all the Indo-Malayan species. Such studies will at the same time provide biological information of direct importance to practical work.

It is important to realize that differences between populations of one species (with respect to tolerance limits, growth rates, resistance to parasitism and disease) do occur to be of great importance. The usefulness of such information depends on what is known about the biology of a particular species in general. This is a further argument for improving detailed taxonomic work.

The discussions during the course led to an agreed resolution shown below. The participants also concluded that a number of problems should be solved because they hamper progress in regard of work with mollusc taxonomy and biology. The participants identified the following major problems:

- limited studies on taxonomy and biology of commercial bivalves hampers utilization to a full extent of this resource.
- there is a very limited access to relevant literature at field stations and other units of the Department of Fisheries.
- there is a general limitation in flow of information between universities and the Department of Fisheries.
- the personnel assigned to work with identification of commercial species is not adequate, partly because of many other duties of this staff so bivalves cannot be studied in sufficient detail.
- the practical work on rearing of larvae, food and feeding, and damage caused by boring organisms cannot be studied efficiently because of limited knowledge in these fields.

It was noted that one condition for successful experimental work with aquaculture is that the studies are carried out with only one species at a time, and not with mixtures of species. Otherwise the experiments cannot be repeated and the conclusions drawn from the experiments may be misleading. The implication can be economic losses and frustration. The solution would be that Thailand educates experts in mollusc taxonomy.

III. DIARY 23-28 JANUARY 1984

23 January
The training course and workshop was declared open by Director Mr Boonlert Phasuk. He said that the Phuket Marine Biological Center was very pleased to note the widespread interest in bivalve taxonomy which manifested itself in the high number of participants repre-
senting a broad spectrum of institutions and laboratories working with descriptions and utilization of molluscs.

Mr Jorgen Hylleberg continued with an introduction to the training course. He explained how the cooperation between the Department of Fisheries and DANIDA, under the Ministry of Foreign Affairs, Denmark, was established as a result of the 5th Thai-Danish Expedition to the Andaman Sea in 1966. He introduced the programme and the teacher Dr Kurt Ockelmann, Associate Professor at the Marine Biological Laboratory in Helsingor. This laboratory belongs to the University of Copenhagen, Denmark. He stressed the significance of the Reference Collection of PMBC in terms of providing basic knowledge of the marine resources in the Andaman Sea. The collection has an important service function to the Department of Fisheries which can obtain information on distribution and occurrence of marine organisms whenever such information is needed. Mr Kurt Ockelmann started lecturing about general problems in bivalve systematics. Although the concept of a biological species is recognized as the base of taxonomic work it is usually difficult to employ the concept because species tend to vary with environmental factors and geographical distribution. In addition, the same species has often been described by several independent authors working in different countries at different times. The result has been the establishment of a number of species and subspecies which careful taxonomic studies later have revealed as only representing a single species. The commercially important green mussel *Perna viridis* was used to illustrate this point. This mussel has had at least 8 different names during the 200 years which have elapsed since the first description by Linne in 1758, and at that time it was placed in a different genus (*Mytilus*). It should be noted that the binominal system (genus and species) was invented by man (Linne) and could be changed accordingly. He concluded that the name in itself was not the most important aspect of taxonomy. The fundamental aspect of taxonomic work was a careful description and good illustrations of the specimen. Furthermore, if the material was deposited in a museum collection, such as the PMBC Reference Collection, it would always be possible for other researchers to review the material should some doubt arise as to the name chosen in the first description. The description scheme shown in Annex I was scrutinized and the programme of the day ended with a general discussion and subdivision of the participants into 3 groups for the practical work in the laboratory and field work. This was necessitated by the high number of participants. In the evening a get together party was arranged on the roof of the Reference Collection Building. The party was sponsored by DANIDA.

24 January

Field work started by one group collecting on the beach and coral reef in front of PMBC. Another group collected benthic bivalves on board the research vessel no.8. A quantitative bottom sampler (the Smith-McIntyre grab) was used for this purpose.

Mr Ockelmann lectured on shell characteristics. The formation of shell material, bivalve shell sculpture and growth of the shell was explained. The ligament connecting the right and left valves was shown to consist of 3 layers: an outer protection layer continuous with the periostracum of the shell; a median layer continuous with the outer shell layer, and an inner compression layer continuous with the inner shell layer. Variation in the various impressions (scars) in the shell left by adductor muscles, foot muscles, siphons and mantle were demonstrated for selected families of bivalves. Mr Phasuk lectured about shellfish culture in Japan and
reviewed laboratory set up and procedures used in culture of among others hard-neck clams and scallops.

In the afternoon one group studied shell characteristics in the laboratory using material from the PMBC reference collection and own collections. In the evening participants met with Mr Ockelmann and discussed problems related to identification of bivalves.

25 January
One group went collecting on board the research vessel. Mr Ockelmann continued with lectures on soft parts of bivalves. The siphons and arrangement of gills were exemplified and the ciliation of the gills was explained in relation to food and feeding of bivalves. Emphasis was put on adductor muscles in relation to classification of bivalves. In the afternoon one group went collecting on the beach and another group sampled on board the research vessel. During the evening, discussions were continued in the class room.

26 January
The lectures of soft parts were followed up by dissections and other practical work in the laboratory. Green mussels and a variety of venerids were examined. In the afternoon Mr Ockelmann reviewed reproduction in bivalves and explained the ontogeny of larvae. The development of eggs and types of sperms were exemplified in families of bivalves. The basic pattern of development of larvae is that a trochosphere larva develops into a prodissoconch stage 1, followed by prodissoconch stage 2. The next stage is called nepioconch = juvenile stage or spat. The last stage is termed dissoconch or the adult stage. Larvae are called pediveligers when they have developed a foot. Larvae and juveniles have well developed hinge teeth which are important characters in identification. The first hinge is termed provinculum and the provincular teeth are important in identification of larvae. Presence or absence of eyespots is a basic character in planktotrophic larvae which develop from small eggs. Such larvae generally have a long pelagic stage and they depend upon external food sources in the water. In contrast, lecithotrophic larvae develop from medium sized eggs. They have a short swimming stage but they do not feed while they are in the plankton. Such larvae are less common in the tropics compared to the planktotrophic larvae. The last type of development is called direct development. The eggs are large and the larvae do not feed or swim in the plankton.

The programme of the afternoon was closed with continued laboratory work on soft parts of bivalves. In the evening participants met with Mr Ockelmann and discussed problems concerning identification of bivalves.

27 January
In the morning 2 groups worked in the laboratory. Bivalve larvae were studied in plankton samples obtained in front of the PMBC. In the afternoon Mr Ockelmann lectured on oysters. The approach to identification of oysters shown in Annex 2 was scrutinized and exemplified by material from the reference collection in addition to specimens brought by some of the participants. The taxonomy of oysters is very difficult and the oysters of Thailand are not well known. Work on adults is particularly difficult but the larvae are more easy in terms of identification. All oysters attach the left valve to hard substrates so spat collectors (which are placed at different depths and in different positions) can be sure to collect newly settled oysters. Work on oysters should include work on larvae and spat.

In the afternoon laboratory work on bivalve larvae was continued and in the evening discussions continued with Mr Ockelmann.
28 January
Mr Poonsin Parnichsuke opened the morning session with a lecture on transplantation of green mussel to Pattani - and Nakornsrithammarat Bay. The experimental period was 1981-83. The transplantation was successful. Next Mr Apichart Thammaruxs lectured on coastal resources and technical development for marine molluscan culture in southern Thailand. He reviewed the environmental conditions and pointed out places of interest for culture of bivalves. After a general discussion of the two papers presented, Mr Ockelmann finished his lectures with a review of the family Mytilidae. It is a very species rich family, approximately 350 species have been described on a world basis. At least 30 species are of economic interest. The species *Perna viridis* is well known but also some species of *Modiolus*, *Septifer* and *lithophagines* are important in this region.

The difference between *Mytilus* and *Perna* in the number of adductor and retractor muscles was pointed out. *Perna* has only the posterior adductor muscle while *Mytilus* has 2 adductor muscles.

The afternoon was closed with a general discussion and recommendations from the participants shown below. After the official closing the participants enjoyed a dinner on the roof of the Reference Collection Building.

One participant Mr Thaithaworn Lirdvitayaprasit, Marine Fisheries Division stayed at PMBC after the closing in order to work a fort-night with Mr Ockelmann on identification and description of bivalves, in particular venerids.

IV. RESOLUTION; RECOMMENDATIONS FROM PARTICIPANTS

The fifty four participants, as well as staff and teachers at PMBC participating in the DANIDA/PMBC workshop on "Taxonomy of Marine Bivalves, with emphasis on Commercial Species" held at Phuket Biological Center during 23-28 January 1984, recommend that the following steps are taken in order to promote the field of taxonomy of commercial species:

- that a committee is formed to deal with the identification of commercial species
- that the committee meets at least once a year to evaluate progress of work and distribute the results to all institutions concerned with utilization of marine bivalves.
- that the committee consists of approx. 5 persons representing institutions involved in taxonomic work such as the Brackish Water Division, NICA, PMBC and the universities.
- that the committee is headed by a chairman selected by the committee.

- that the Reference Collection of PMBC should be used for deposition of specimens in order to secure the material for future taxonomic work.
- that a scientist specialized in mollusc taxonomy and biology is assigned to work in a permanent position at the Reference Collection of PMBC. The priority of work of this person will be to yield complete descriptions of commercial species to the benefit of profitable aquaculture and improvement of culture techniques. The participants strongly support taxonomic work because of obvious economic benefits associated with knowledge of the species and various races. Such knowledge is useful for propagation of the right species to be cultured in various environments.

Hence, the aim of taxonomists in this field should be to give a complete description, including
local Thai names, of all commercial bivalves. Descriptions should be given of all species exported or sold in local markets, such as species of Ostrea, Crassostrea, Anadara, Arca, Paphia, Meretrix, Pinctada, Donax, Pinna, Solen, Placuna, Pholas, and Perna. This work should receive financial support from Thai budgets and international agencies.

V.

ANNEX 1.

DESCRIPTION SCHEME

1) NAME: e.g. Perna viridis (Linne).

2) SYNONYMS and REFERENCES to other works.

3) MATERIAL: Locality data, collecting date and gear, collector, station number, preservation, number of specimens.

4) DIAGNOSTS: Those features by which the species is readily identified with certainty.

5) DESCRIPTION: A) SHELL a) exterior: shape, size, dimensions and ratios (re measurements), sculpture, shell texture, periostracum, colours of shell itself and of periostracum.

b) interior: hinge, ligament, muscle scars, pallial line, colours and appearance of inside (e.g. pearly).

c) shell ontogeny or shell stages.

B) SOFT PARTS

a) musculature, such as adductors, foot muscles etc.

b) pallium, secondary fusions of mantle, siphons, mantle lobes.

c) foot and byssal organs, byssus.

d) gills, labial palps, gill structure.

e) visceral mass, digestive - excretory - vascular nervous - and reproductive systems.

f) colours of soft parts.

g) eggs and sperm, sexual condition.

C) MEASUREMENTS: dimensions, ratios, regression equations.

D) VARIATION

E) COMPARISON with related species.

F) BIOLOGY: life observations, feeding, reproduction, behavior, life cycle, etc.

G) ECOLOGY: habitat, eco-physiological data, associated fauna and flora.

H) DISTRIBUTION

I) DEPOSITORY of material

GOOD FIGURES AND GRAPHS ARE VERY IMPORTANT
ANNEX 2.

APPROACH TO DESCRIPTION OF ADULT OYSTERS

(Fig. 1)

1. FAM. GRYphaEIDAE. Non-incubatory. Provinculum with continuous series of teeth. Promyal passage present. Intestine passes through pericardium and ventricle of the heart. Attachment area of left valve most often small. Prismatic shell layer thin or absent. Euhaline and euryhaline = truly marine.

SUBFAM. Pycnodontinae.

Chomata short to long, branching and vermiculate. Vesicular shell structure present.

Hyotissa

(H. hyotis (L. 1758)). Shell commissure plicate. Chomata long, vermiculate or branching, breaking up into tubercles. Marine, often reef forming. Few species. THAILAND.

Neopycnodonte

(N. cochlear (Poli, 1795)). Shell commissure not plicate, irregular. Shell thin, often translucent, often auriculate. Chomata on LV only close to hinge. Off shore and in deep water. THAILAND.

2. FAM. OSTREIDAE. Non-incubatory or incubatory. Provinculum with teeth in two groups separated by smooth central region. Intestine bypasses pericardium and heart dorsally. Prismatic layer present, often conspicuous and strong. Marine and brackish water.

1. SUBFAM. OSTREINAE.

Chomata present or absent. No pustules on inside along margins, which are generally without plications.

A) Non-incubatory genera: with promyal passage. Usually with umbonal cavity in LV.

Crassostrea

(C. virginica (Gmelin, 1791)): No chomata, well developed umbonal cavity, usually oblong or spatulate in outline. Adductor scar rather distal, with 1-2 sharp corners. If there are radial ribs, these are usually more pronounced on LV projecting beyond margin of RV. Marine and brackish water. Several spp. THAILAND.

Saccostrea

(S. cucullata (Born, 1780)): Strong chomata in both valves, commonly all along free margin. Umbonal cavity deep in LV, RV rather flat. Outline oblong, often irregular. LV with 10-30 rough, dichotomous radial folds, RV without radial folds. Distinct pallial line. LV with large attachment area. On bare rocks and mangrove. Several spp. THAILAND.

Striostrea

(S. magaritacea (Lamarck, 1819)): Chomata absent or present. Umbonal cavity very deep in LV with many thin cross-walls to form chambers. Promyal passage large. Adductor scar reniform (=kindney-shaped). Interior shell nacreous and iridescent. Young shells with numerous fine radial riblets.
Marine and brackish water. Few spp. Unknown from THAILAND.

B) Incubatory genera: No promyal passage, usually no umbonal cavity; both LV and RV rather flat.

*Ostrea* (O. edulis L., 1758)): Chomata always present but few and small, no plications along shell margins. Roundish to oval in outline. Adductor scar reniform with rounded outline. Different sculpture of LV and RV, with LV with more or less distinct radial ribs. Marine. Several spp. THAILAND.

2. SUBFAM. LOPHINAE.

Incubatory. No promyal passage. Rib pattern similar in RV and LV, commisure distinctly plicate. With many very small tubercles on shell inside, especially near margins. Some with shelly claspers.

*Lopha* (L. folium (L., 1758)): Both valves convex, about equivalve. Outline often oblong. Often with claspers. Two ecomorphs according to substrate:

1) on mangrove or each other
2) on sea-fans and gorgonians

Few spp. THAILAND.

*Alectryonella* (A. plicatula (Gmelin, 1791)): Highly inequivalve, LV deep, RV flat. Outline semicircular. Attachment area large. Both valves with 14-22 continuous, often well rounded and about equal radial ribs. Shell interior often with fingerprint structure. RV with band of small tubercles on inside near margin. One recent species. THAILAND.

LV = left valve

RV = right valve
ANNEX 3.
LIST OF PARTICIPANTS in the workshop on
"TAXONOMY OF MARINE BIVALEVS, WITH EMPHASIS ON COMMERCIAL SPECIES"
At Reference Collection Building, Phuket Marine Biological Center.

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<td>1.</td>
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<td>3.</td>
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<td>Mr Teerayut</td>
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<td>Mr Prawin</td>
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<td>Mrs Wantana</td>
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<td>11.</td>
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<td>Miss Pimonpan</td>
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<td>Miss Mantana</td>
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<td>Miss Neena</td>
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ANNEX 4.
REFERENCES


ANNEX 5.
ACKNOWLEDGEMENTS

The Phuket Marine Biological Center wishes to express sincere gratitude to DANIDA for the financial support which made the training course and workshop on taxonomy of commercial bivalves possible during 1984. The Center also wishes to thank Professor Kurt Ockelmann for sharing his great knowledge with the participants.

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