



REGIONAL SEAS

UNITED NATIONS ENVIRONMENT PROGRAMME

OCTOBER 1988

*Sampling and
identification of common
Mediterranean Scyphomedusae
and evaluation of their occurrence*

*Reference Methods For Marine Pollution Studies
No. 51 (draft)*

Prepared in co-operation with



UNEP 1988

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PREFACE

The Regional Seas Programme was initiated by UNEP in 1974. Since then the Governing Council of UNEP has repeatedly endorsed a regional approach to the control of marine pollution and the management of marine and coastal resources and has requested the development of regional action plans. The Regional Seas Programme at present includes ten regions and has over 120 coastal States participating in it. (1), (2)

One of the basic components of the action plans sponsored by UNEP in the framework of the Regional Seas Programme is the assessment of the state of the marine environment and of its resources, and of the sources and trends of the pollution, and the impact of pollution on human health, marine ecosystems and amenities. In order to assist those participating in this activity and to ensure that the data obtained through this assessment can be compared on a world-wide basis and thus contribute to the Global Environment Monitoring System (GEMS) of UNEP, a set of Reference Methods and Guidelines for marine pollution studies are being developed and are recommended to be adopted by Governments participating in the Regional Seas Programme.

The methods and guidelines are prepared in co-operation with the relevant specialized bodies of the United Nations system as well as other organizations and are tested by a number of experts competent in the field relevant to the methods described.

In the description of the methods and guidelines the style used by the International Organization for Standardization (ISO) is followed as closely as possible.

The methods and guidelines, as published in UNEP's series of Reference Methods for Marine Pollution Studies, are not considered as final. They are planned to be periodically revised taking into account the development of our understanding of the problems, of analytical instrumentation and the actual need of the users. In order to facilitate these revisions the users are invited to convey their comments and suggestions to:

Marine Environmental Studies Laboratory
International Laboratory of Marine Radioactivity
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MC98000 MONACO

which is responsible for the technical co-ordination of the development, testing and intercalibration of Reference Methods.

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- (1) UNEP: Achievements and planned development of the UNEP's Regional Seas Programme and comparable programmes sponsored by other bodies. UNEP Regional Seas Reports and Studies No. 1 UNEP, 1982.
- (2) P. HULM: A Strategy for the Seas. The Regional Seas Programme: Past and Future UNEP, 1983.

This issue of the Reference Method for Marine Pollution Studies No. 51 was prepared in co-operation with the coordinating unit of the Mediterranean Action Plan (MEDU). It was a direct consequence of a large-scale project on Mediterranean Scyphomedusae developed under the auspices of the MEDPOL component of the Mediterranean Action Plan. It includes the comments received from a number of scientists from within and outside the Mediterranean region. The assistance of all those who contributed to the preparation of this reference method is gratefully acknowledged.

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1. SCOPE AND FIELD OF APPLICATION

The present reference method describes approaches which may be followed to obtain quantitative information on the aggregation of the Medusae in the Mediterranean Sea, including the keys for identifying various species of Scypho-medusae occurring in this region. The procedures for standard surveys, such as those by using plankton nets, by counting shore stranding individuals and by sight counts, are described. In addition, are given a guideline for collecting information on past jelly-fish blooms as well as procedures for collecting data from voluntary observers. Seeking the correlations between quantitative data obtained through these surveys of geographical and seasonal distributions of the aggregation of the Medusae as well as its species identity and physical, chemical and biological environmental parameters measured at the same time, the objective of these surveys is to better understand the factors controlling the population dynamics of scyphomedusae in the Mediterranean marine ecosystems with an eventual goal to predict the occurrence of the aggregation along a specific given coastal zone.

Although the procedures for the surveys described may be applied to regions other than the Mediterranean Sea, the identification keys proposed are only applicable to the Mediterranean Region.

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3. DEFINITIONS

3.1 Scyphomedusa (jelly-fish proper) is the dominant, sexual free-swimming life stage of the scyphozoans. As compared with the hydrozoan medusa, it is larger and more conspicuous, with a well developed umbrella margin which is divided into lappets, carrying tentacles and sensory organs but possessing no velum. The scyphomedusae are the most conspicuous planktonic forms, often occurring in large aggregations extending over large areas, constituting sometimes a major component of the epipelagic ecosystem.

3.2 In order to help non-biologists, simple scientific terminology used to describe the external features of a scyphomedusa is given in Fig. 1.

3.3 Ephyrae is the larvae stage in the reproductive cycle of medusae.

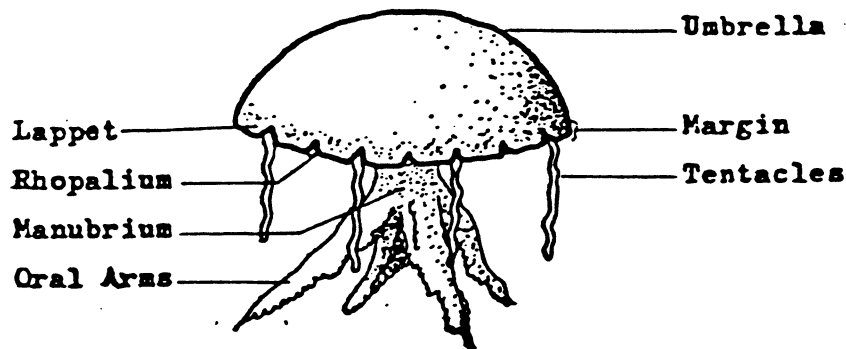


FIGURE 1: External features of a scyphomedusa.

4. PRINCIPLES

In order to obtain quantitative data on the scyphomedusa biomass in an area, several approaches should be considered, as an estimation of the biomass is extremely difficult.

The quantitative assessment of zooplankton swarms is extremely difficult. Conventional plankton hauls with nets usually yield underestimated average densities for such species unless sufficiently large volumes of medium are sampled or alternatively unless sampling is carried out when the species is relatively dispersed and not found in swarms. On the other hand, the large densities reported to occur during aggregation do not represent the general abundance over a wider area, and are not particularly useful for biomass determination and energy flow and trophic consideration.

The procedures for three survey methods, that is, (a) plankton survey, (b) shore stranding counts and (c) sight counts are described in the following sections. The principles of these surveys are given in this section.

4.1 Plankton survey

Tow appropriate plankton nets horizontally, obliquely or vertically by a boat through a large volume of sea water, collect medusae caught by the nets on board. Count the number of individuals caught, measure volume or wet weight of medusae on board or organic carbon content in laboratories. The biomass existing in a unit volume of sea water is estimated in various manners.

4.2 Shore stranding counts

Walk along a determined length of shoreline (50-100m), collect medusae from several randomly chosen $1m^2$ quadrants within the "splash" zone. Count the number of individuals collected and estimate the volume of jelly-fish material collected by the displacement volume of water.

4.3 Sight counts

Walk along a long stretch of shoreline (100-200m) with polarizing glasses on, count every jelly-fish visible within approximately 3m out. Number of individuals m^{-3} is calculated from the counting.

5. BOAT AND GEAR

5.1 Surface and subsurface horizontal hauls

5.1.1 A small boat with 30-45 HP outboard motor.

Note: This is the easiest type of sampling which may be carried out with minimal requirements.

5.1.2 Two plankton nets of nylon 5-2mm mesh size with a 1m mouth opening and 230cm long, with a 3 line bridle at the mouth end and a 0.5 litres polyethylene jar at the cod end, which preferably threads on to a collar for rapid dismantling after each haul. These plankton nets, whose constructional details appear in figure 2, are used for sampling of medusae. For surface sampling, one net is buoyed up at one end of the mouth ring and for subsurface sampling at 5 meters, the other net is weighed down by a 35kg depressor weight at the lower edge of its mouth ring by a short length of nylon rope (see figure 2).

5.1.3 Two plankton nets of 0.3mm mesh size, with a 50cm mouth opening and 150cm long. The rest of the construction details are similar to those of the above medusae nets. Similarly one is adjusted for surface sampling while the other for sub-surface sampling at 5 meters with a depressor weight of 25kg.

5.2 Oblique hauls

5.2.1 A medium size vessel equipped with a boom and winch handling 6mm hydrographic cable (approx. 350m) with meter markers or a meter wheel.

5.2.2 One plankton net of 1m mouth opening and 5mm mesh size similar in construction to that of figure 2, with a depressor weight of 50kg at the cod end. This net is used for medusae sampling.

5.2.3 One ephyrae plankton net of 0.5m mouth opening and 0.33mm mesh size. Alternatively, a Bongo net of approximately 60cm mouth diameter and the same mesh size may be used, also with a depressor weight.

Note: This sampling method may be used to estimate the abundance of medusae and ephyrae within the whole water column, or down to 300m in offshore areas. However, unlike the sampling described in 5.1, this requires more elaborate sampling gear.

5.3 Vertical hauls

5.3.1 A medium size vessel as in 5.2.1 above.

5.3.2 Two WP-2 plankton nets of 60cm mouth opening with 5mm mesh size for medusae, and 0.33mm mesh size for ephyrae. Each is equipped with a Nansen system which allows the net to be closed at a particular depth (Stirn, 1981), and with a depressor weight of 25kg or 40kg at the cod end.

6. PLANKTON SURVEYS

These surveys provide more accurate and reliable quantitative data on the occurrence of jelly-fish and ephyrae, and their fluctuations with season, location, as well as vertical distribution in water column and size frequency distribution of medusae. However the statistical limitations of such surveys should be appreciated. These arise mostly from the extremely patchy distribution of such planktonic forms, as well as the tendency of adult medusae (when greater than 100mm in diameter) to be diverted by the current of water flowing to the sides of the collecting net opening, and thus avoid the net.

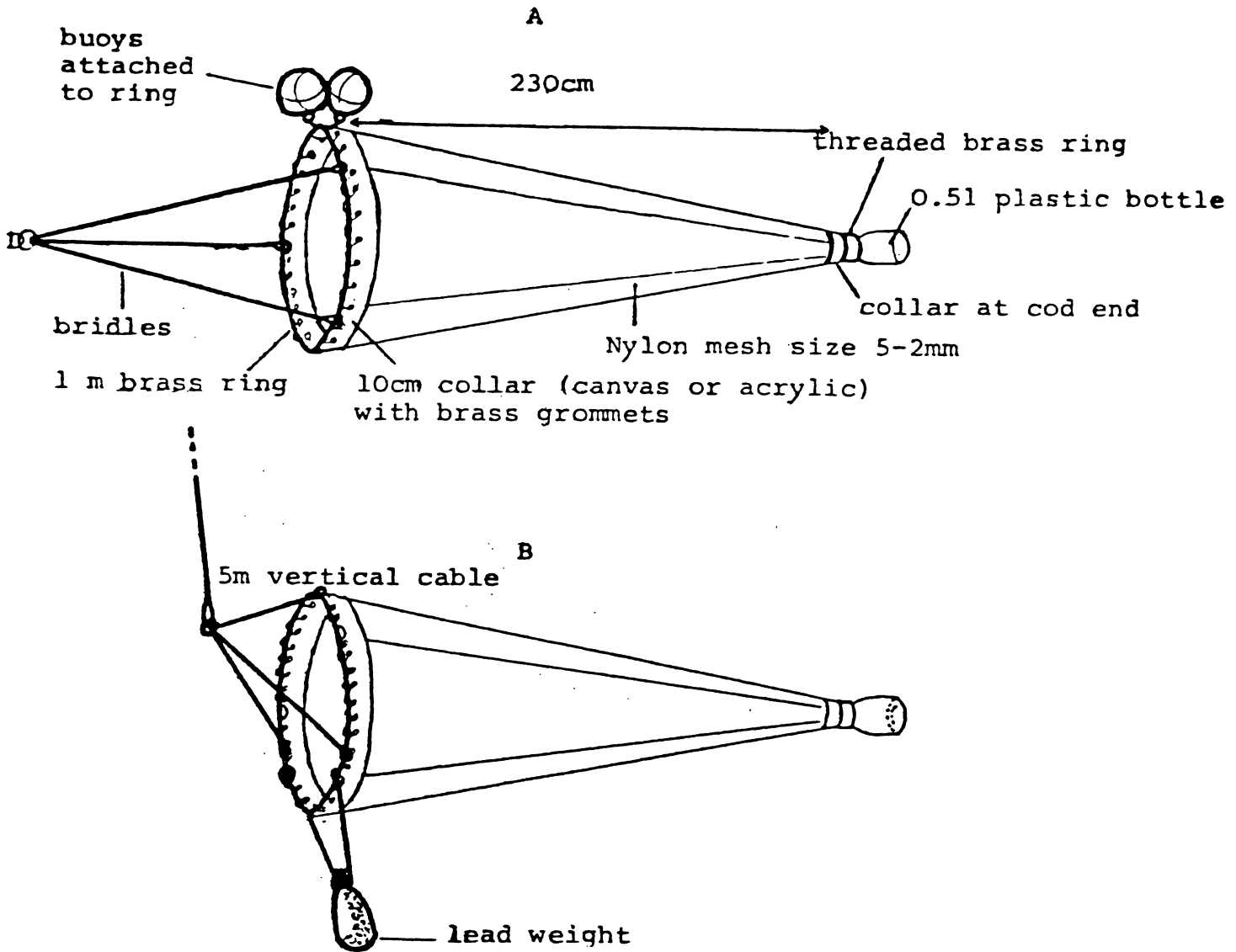


Figure 2: Plankton nets for surface (A) and subsurface (B) sampling for medusae.

6.1. Areas to be monitored

A grid of sampling stations is set up in such a way as to include:

- a. distinct water masses, such as longshore, shelf, estuarine influenced, and offshore waters;
- b. Polluted (particularly eutrophication areas) and unpolluted zones with comparable environmental parameters;
- c. regions with semi-permanent cyclonic eddy currents or sluggish water movements where medusae may accumulate.

6.2 The number of stations monitored depends upon the available facilities and obviously the more the stations, the better. However, when facilities are limited, it is better to restrict the number of stations and increase the number of frequency of sampling at each station.

6.3 Preliminary background information

The following information for the areas to be monitored should preferably be available:

- a. the distribution of distinct water masses in time and space including surface and sub-surface current patterns, stability and vertical thermohaline stratifications;
- b. extent and nature of pollution.

6.4 Sampling frequency

This greatly depends on the facilities available but should be at least every month and during the swarming season, every other week, at every fixed station.

6.5 Types of sampling, requirements and procedures

The type of sampling surveys undertaken again depends on the facilities available - i.e. type of sea craft, amount of ship's time available, type of sampling gear etc.. In the following account, three types of sampling are described, each of which can provide a certain amount of quantitative data on the occurrence of medusae and their ephyrae at different water depths, and each presenting different degrees of difficulty in execution and facilities required.

6.6 Surface and subsurface horizontal hauls

The surface plankton net is towed on a line approximately 6m long while the subsurface net is sunk almost vertical by hanging it with the appropriate length of rope, to 5m depth with its depressor weight. Both hauls are carried out simultaneously for 10 minutes at a speed of 2 knots. The procedure is repeated for ephyrae sampling using the appropriate nets. Medusae larger than 100mm in diameter and which appear in line with the net's mouth, may be dipped up individually since often these will not be collected by the surface net as explained above. Obviously the same applies to the subsurface net, but here these medusae cannot be dipped up. Wide mesh size for the medusae nets will minimize net clogging. However, especially during the last minutes of the haul and even more in the case of ephyrae nets, progressive clogging of the nets may occur inducing an increase in the currents diverted from the mouth and loss of some medusae and ephyrae.

6.7 Oblique hauls

Oblique hauls from 300m depth or from 5m above sea bottom may be carried out, first by lowering on a cable to the required depth. This may be calculated trigonometrically from the towering angle and the cable length used. The net is then allowed to stabilize at the required depth for 30 seconds and then retrieved at 20m/min. The net is towed at a cable angle of approximately 45° at a speed of 2 knots. The procedure is similar for both ephyrae and medusae. However it is much more time consuming and may be carried out at a limited number of stations every month at fixed times: about sunrise, noon and midnight. Preferably at one station, sampling is carried out 1 hour before sunset, at sunset, and 1 hour after sunset as well as 1 hour before, at and after sunrise, so that the effect of changes in the light intensity on vertical migration may be investigated.

6.8 Vertical hauls

A series of vertical hauls with the WP-2 net may be carried out at different layers - i.e. 400-300m, 300-200m, 200-100m, 100-50m, 50-20m, and 20m to surface, at each particular time of day. The net is lowered vertically at 60m/min. to the desired depth. If due to drift, the net is not hanging vertically in the water, the length of cable needed to reach the required lower depth is estimated trigonometrically as explained above in 4.3.4.2. In case of a strong drift, the depressor weight may be increased to 40kg. The net is then raised at 45m/min. until it reaches the upper limit of the sampled layer where it can be closed by sending a messenger down the cable. The closed net is then hauled on board.

6.9 Treatment of samples

After each haul for medusae, the net is emptied of its contents into a large bucket. Bigger medusae which have been individually dipped, are added to the sample at this stage. The catch is then counted and species noted. Then while still fresh, each medusa is picked up (using disposable plastic gloves) and the extended umbrella diameter measured to the nearest mm. Measurement of displacement volume of the jelly-fish material (including any fragments of damaged medusae) is carried out as described in 7.4 to the nearest ml. The volume of filtered sea water area of the net's mouth by the distance of haul and reducing by 20% for known losses (some nets accept only 75% of the calculated volume of water). Alternatively a calibrated current meter is suspended in the mouth of the net.

6.10 Biomass determination

The wet weight of the medusae material is determined by a spring balance and any excess water (e.g. beneath the umbrella) should be carefully drained off before weighing. Biomass data may be more properly expressed in mg organic carbon which in turn is approximately 0.3% of the wet weight of scyphomedusae (Moller, 1980).

6.11 Sampling of ephyrae

When sampling for ephyrae, after each haul, any medusae caught are removed from the net and gently rinsed in a bucket so as to dislodge any ephyrae adhering to them. These ephyrae are later added to the sample jar. Then, while the net is held up, its sides are well washed with sea-water so that any ephyrae adhering to the net are washed into the sampling jar. The jar is then removed from the net and emptied into another second larger jar (1 litre), and its inner walls carefully washed with sea water from a squeeze bottle. These washings are again transferred to the second jar, and contents immediately fixed in 3% formalin (neutral) by adding the appropriate volume of buffered formaldehyde, followed by gentle mixing of contents. A label containing such information as date, station and type of haul, is placed inside and the jar is then securely closed. The net is then examined closely for any ephyrae still adhering to its inner sides. These are counted and removed by crushing between fingers and washed away with sea water. The number of crushed ephyrae may be entered on the same label of the preserved sample.

6.12 Treatment of ephyrae samples

Later, in the laboratory, the sample may be further concentrated by filtration through a 0.33mm sieve, to 200ml. The contents are then examined microscopically and any ephyrae identified, counted, and their umbrella diameter between opposite rhopalia measured with a microscope eyepiece micrometer.

6.13 Treatment of nets after use

After use, nets should not be allowed to dry before removing any adhering mucus or material of medusae. This is done by flushing its sides with sea water. Moreover, nets should be periodically cleaned by scrubbing both surfaces with a soft brush on a flat surface using a mild detergent. This is done to prevent accumulation of material and gradual clogging of mesh.

6.14 Other environmental parameters

At each sampling station, the vertical distribution of salinity, temperature, oxygen, illumination, nitrates and phosphates should be measured at least at surface and above and below the thermocline. Wind direction and speed, conditions of sea surface (i.e. wave period and wave height) and the general climatic conditions at time of sampling are also recorded. A measure of phytoplankton biomass may be taken by measuring the chlorophyll content of water samples taken by a van Dorn sampler at least at the above mentioned depths. The ephyrae samples obtained by the plankton hauls may also be utilized to study the mesozooplankton composition at that site. For detailed instructions on field and laboratory methods for the above mentioned measurements, UNEP Reference Methods and standard marine science handbooks should be consulted (e.g. Grasshoff, 1976; Strickland and Parsons, 1969; Laevastu, 1965; Schlieper, 1972).

6.15 Other observations

If an aggregation of medusae is encountered during sampling; it should be fully described, noting its length, width, approximate depth, and area covered as well as its general shape.

The behaviour of the aggregation should also be studied. Observations on the following aspects should be included: the possible occurrence of size segregation of the individual medusae; the reactions of individuals when disturbed (e.g., by the presence of the boat); the orientation of swimming individuals relative to the direction of the prevalent water current; the rate of umbrella pulsations of randomly selected individuals; whether the aggregation is being actively maintained by the swimming activities of its individuals and any other relevant observations. Such investigations may be more easily carried out from a small boat or inflatable dinghy. Some aspects of these behavioural activities may be recorded by underwater photography or cine cameras. In fact underwater observations by scuba divers may provide extremely useful information on the factors leading to the formation of aggregations as well as their biological significance.

7. SHORE STRANDING COUNTS

Often, especially during the summer coastal aggregations, medusae are cast ashore in great numbers. Naturally, the degree of shore stranding is dependent on the prevalent wind direction and speed and it only provides useful information if this can be correlated with other data obtained from other surveys. Moreover, it is highly variable and, while on a particular day, a shoreline may be littered with jelly-fish, it may be clean the next day.

7.1 Selection of stations

A fixed number of coastal stations should be selected taking into account the following points:

- a. Shores known to be relatively frequently littered with jelly-fish during the summer blooms, should be selected. These are usually stretches of sandy shores with gentle slopes.
- b. Stations should be fairly accessible and their numbers obviously depend on the availability of personnel and transport facilities.
- c. Stations should be chosen in such a way that they face different compass orientations.

7.2 Preliminary data

Information should be available regarding the usual seasonal circulatory patterns of surface waters associated with the particular shore to be selected as a station. Such information would be useful in interpreting data of shore stranding counts.

7.3 Frequency of counts

Daily shore stranding counts should be taken.

7.4 Procedure

A convenient length of shoreline (approx. 50-100 m) is permanently marked off and a number (greater than 20) of 1 m² quadrats are randomly chosen within the "splash" zone. Any jelly-fish within each quadrat are counted, collected and species noted. Every fragment of jelly-fish material is to be collected. The volume of jelly-fish material is then calculated by the displacement volume of water method i.e. place material in a known volume of water and note apparent increase in volume of water.

7.5 Data recorded

At each station the following data is to be recorded: Locality, date, time, wind direction and speed at time of survey, weather condition, state of surface waters, species of jelly-fish stranded.

8. SIGHT COUNTS

Sight counts of Chrysaora quinquecirrah have been made at Chesapeake Bay, U.S.A. by Cargo and co-workers since 1960 (1966). Provided that one is aware of their limitations, such counts may present a reasonably accurate picture of seasonal fluctuations of jelly-fish in coastal waters. Moreover, such survey requires minimal effort and finances. On the other hand many factors may effect visibility and accuracy of observation, including: time of day, cloud cover, condition of sea surface and direction of viewing in relation to overhead sun.

8.1 Selection of stations

A fixed number of stations are selected on criteria similar to those in 7.1. Ideal locations include quays, piers and rocky shores with relatively straight shorelines.

8.2 Preliminary data

As in 7.2. Moreover in this case, the approximate average depth of water up to 3 meters away from shore should be known.

8.3 Frequency of counts

Daily sight counts should be taken.

8.4 Procedure

A long stretch of shoreline (100-200m) is marked off and its length recorded. The observer, while wearing polarizing glasses, walks slowly from one marked end to the next, counting every jelly fish visible within approximately 3 meters out, preferably with the help of a hand counter. He then walks back the marked length in the opposite direction, repeating the procedure. Then the mean number of jelly fish from the two counts is calculated.

8.5 Recording data

At each station the following data is recorded: locality, date, time of observations, wind direction and speed, weather condition, condition of the sea surface, surface water temperature, average counts of visible medusae. This may be further expressed in individuals/m³, if the approximate depths up to 3m off-shore are known and the approximate volume of sea water observed is then calculated (i.e. 3m x length of walked shore x approximate measured depth).

9. SPECIES IDENTIFICATION

9.1 Identification of adult scyphomedusae

Correct species identification is obviously of paramount importance in any monitoring programme of coastal and offshore jelly-fish swarming. Moreover, if this monitoring is to be extensive enough, sight and shore stranding counts have to be carried out at a large number of stations, utilizing a correspondingly large number of personnel. It is assumed that many of these will not necessarily be biologists or have proper scientific background. Therefore, correct species identification of the most common Mediterranean scyphomedusae has to be greatly facilitated.

It is preferable that all species identification would be carried out on freshly collected specimens. Preserved medusae rarely appear in their normal form. Moreover, moribund medusae which have been left lying in small volumes of seawater for hours, often exhibit changes in the relative proportions of body parts. If, for some reason, specimens have to be preserved for later species identification, alcohol should never be used as a preservative since it causes dehydration and shrinkage of body tissues especially in scyphomedusae, leading to major changes in the relative proportions in size of umbrella, tentacles and manubrium. 5% buffered formalin in sea water should be used instead.

9.2 Identification of ephyrae

Much information may be obtained on the reproductive cycles of these species if the abundance and size frequency distribution of their ephyrae may be properly monitored. Correct species identification of ephyrae is however much more difficult to perform, especially on newly liberated ephyrae or planulae. In this case, more so than in the adult medusae, freshly collected specimens should be investigated. The illustrated key found in the appendix may be useful in the identification of ephyrae which will most commonly be encountered with in Mediterranean coastal waters. For more complete identification, several good references are available (e.g. Russel, 1970). When in doubt, specimens should be preferably preserved in 3% neutral formalin in seawater, carefully labelled and sent to taxonomic specialists for proper identification.

9.3 Identification keys

In order to assist correct species identification of Mediterranean Scyphomedusae as well as their ephyrae, identification keys for them are given in the Appendix of this document.

10. EXPRESSION OF RESULTS

10.1 Plankton surveys

The data obtained in plankton surveys are expressed in the following ways:

- a. number of individuals/ m^3 , for medusae and ephyrae of each species;
- b. umbrella size frequency distribution of medusae;
- c. inter-rhopalial diameter frequency distribution of ephyrae;
- d. volume of medusae in ml/m^3 ;
- e. biomass in wet weight or mg organic Carbon/ m^3 for medusae.

10.2 Shore stranding counts

The data obtained from the shore stranding surveys are expressed in the following ways.

- a. mean number of individuals m^{-2}
- b. mean volume of jelly-fish material in $ml m^{-2}$.

Note: At the same time species of jelly-fish and condition of material (i.e. whether it appears fresh or withered) should be recorded.

10.3 Sight counts

The average counts of visible medusae is expressed in individuals m^{-3} , if the appropriate depths up to 3m off-shore are known and the approximate volume of sea water observed is then calculated (i.e. 3m x length of walked shore x approximate measured depth).

11. COLLECTION OF SUPPLEMENTARY INFORMATION

11.1 Collection of data by voluntary observers

Useful qualitative and semi-qualitative data on jelly-fish occurrences from relatively large areas may be obtained with the cooperation of interested voluntary observers. These may include personnel of coastal patrolling boats of national security forces, and also fishermen. Such people are often found to possess good powers of observations in the field. Moreover, they are familiar with local coastal and offshore waters and cover large regions during their normal duties. The method of reporting of their observations must be simplified and planned in such a way as to minimize interference with their normal activities. Data sheets similar to that shown in figure 3 are distributed to such people to be filled-in and returned. Such a data sheet should include information regarding:

- a. date, time and location of observation made;
- b. wind direction and speed at time of report;
- c. surface water temperature (if possible) and condition of sea surface;
- d. degree of occurrence of jelly-fish (i.e. large, medium, occasional);
- e. if possible, type and species of jelly-fish encountered which may be done with the help of the identification sheets mentioned above;
- f. approximate dimensions of bloom patch. If an area is covered by irregular smaller patches, the dimensions of the total area should be given. Units to use are meters or nautical miles;
- g. other comments, including colour of jelly-fish (in Pelagia noctiluca quite variable), shape of patches etc.;
- h. name and address of observer.

Personnel of coastal hotels, beach cleaners and interested local people may volunteer to provide data on the occurrence of shore stranding of jelly-fish. These are asked to observe daily the shore-line and report their observation on the data sheets provided (see figure 4). Information regarding wind speed and direction may be obtained later from local meteorological stations.

Personal experience indicated that much useful information may be obtained from these "informal" type of surveys, provided that personal contact is established with such volunteers, that they fully realize the significance of their contributions, and that they receive clear, concise instructions on the filling up of data sheets. Periodic meetings with such observers will provide the opportunity of further oral descriptions of their observations and ensures their continued interest in the participation in this monitoring programme.

Fig. 3.

DATA SHEET FOR THE JELLY-FISH PROJECT

We are asking for your kind cooperation to help us study the blooms of jelly-fish in our waters. You are requested to fill in the following form every time you encounter jelly-fish during your patrolling/fishing duties.

DATE:	TIME:	LOCATION:
-------	-------	-----------

WIND DIRECTION:	WIND SPEED:	SURFACE WATER TEMPERATURE:
-----------------	-------------	----------------------------

CONDITION OF SURFACE WATERS:	CALM <input type="checkbox"/> RUFFLED <input type="checkbox"/>	WAVE HEIGHT: WAVE PERIOD:
------------------------------	---	------------------------------

OCCURENCE OF JELLY-FISH:	LARGE Nos. <input type="checkbox"/>	MEDIUM Nos. <input type="checkbox"/>	OCCASIONAL Nos. <input type="checkbox"/>
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APPROXIMATE DIMENSIONS OF BLOOM AREA:

TYPE OF JELLY-FISH:

OTHER COMMENTS:

.....

.....

.....

NAME OF OBSERVER:

ADDRESS:

.....

.....

Thank you very much for participating in this important project.

Fig. 4.

DATA SHEET FOR THE JELLY-FISH PROJECT

Observation and reporting of jelly-fish stranding on shores

We are asking for your kind cooperation to help us study the blooms of jelly-fish in our waters. You are requested to fill in this form every day for each month.

MONTH:

LOCALITY:

DAY	TIME	NUMBERS OF JELLY-FISH +				TYPE *	ANY REMARKS
		None	Few	Medium	Large		
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

- + Mark with a + were appropriate.
- * See identification sheets supplied.

NAME OF OBSERVER
 ADDRESS

Thank you for participating in this important project.

11.2 Information about past occurrences of jelly-fish blooms

Very often, coastal jelly-fish aggregations are accompanied by increasing number of reports in the local newspapers of stinging of bathers. The research for and compilation of such reports is time consuming but can often be delegated to other people not directly involved in the monitoring programme. Moreover, this source of information may extend back over relatively long periods of time. It may be supplemented by interviews with local people such as fishermen, etc.. This type of information may not be accurate and reliable enough, especially with reference to the particular species of jelly-fish involved, however it is useful especially in indicating areas which commonly experience such blooms and which are useful stations to be monitored by more standard techniques.

12. FURTHER INVESTIGATIONS

The following supplementary investigations on some of the samples of medusae obtained may be carried out to provide useful information on the reproductive cycle of the particular species of scyphomedusae in the region, as well as on their feeding and natural preys.

12.1 Maturity of Gonads

This can be reliably studied histologically. The gonads of some medusae of varying sizes (large medusae are not necessarily more sexually mature) are dissected out and immediately fixed in Karnowski or Zamboni de Martino, embedded in Epon 812, or paraffin wax, and stained with PAS and Malachite green or 1% toluidine blue. Histological examinations of such stained tissues readily reveal the state of maturity of the gonads. The histology of gonads of Pelagia noctiluca at different states of maturity, as well as methods to use, have been extensively studied by Rottini-Sandrini and coworkers of the University of Trieste (Brattina, et al 1981; Avian, 1982).

12.2 Examination of Coelenteron Contents

Freshly collected medusae have their gastric portions dissected out and immediately preserved in 5% neutral formalin in sea water. Gut contents are later examined microscopically in the laboratory. It is however not easy to correlate the normal diet of medusae with their gut contents as very often, these are found empty of food. This may be due to rapid digestion as well as infrequent food capture. However such a technique has been used rather successfully by Larson (1978) to study the diets of scyphomedusae including that of Pelagia noctiluca.

APPENDIX: IDENTIFICATION KEY TO COMMON MEDITERRANEAN SCYPHOMEDUSAE

In order to assist correct species identification of common jelly-fish in the Mediterranean, an identification key for individual species is given in a table presented in the next page. More detailed descriptions of the following species as well as those of ephyrae are given in the following pages with illustrated figures:







Medusae:

Pelagia noctiluca (Forskal)
Chrysaora hysoscella (Linnaeus)
Aurelia aurita (Linnaeus)
Rhizostoma pulmo (Macri)
Cotylorhiza tuberculata (Agassiz)
Nausithoe punctata (Kolliker)

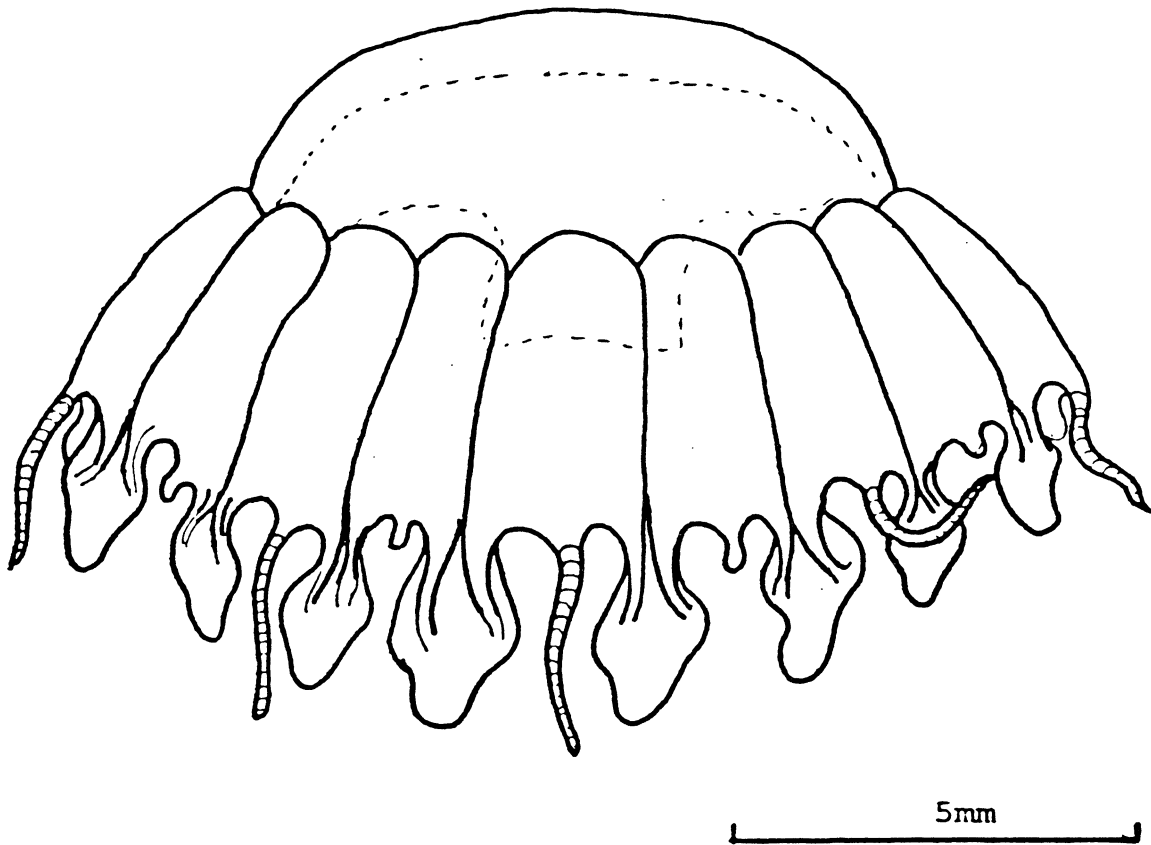
Ephyrae:

Pelagia noctiluca
Chrysaora hysoscella
Aurelia aurita
Rhizostoma pulmo

IDENTIFICATION KEY OF COMMON JELLY-FISH (Scyphomedusae) in the Mediterranean

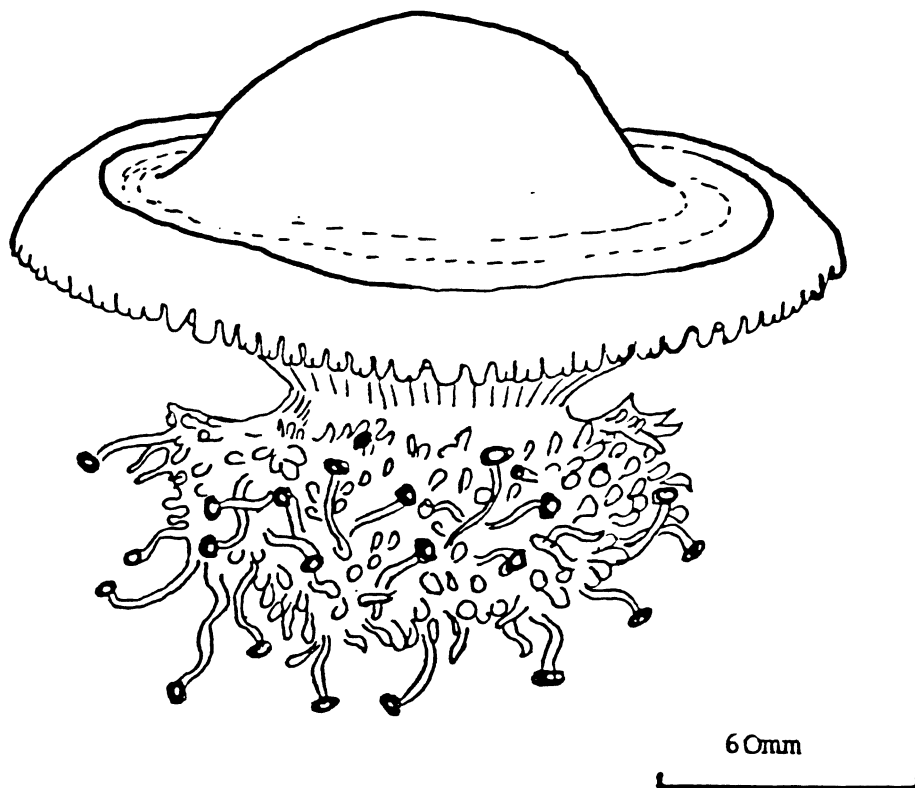
SPECIES:	<u>Pelagia noctiluca</u>	<u>Chrysaora hysoscella</u>	<u>Aurelia aurita</u>	<u>Rhizostoma pulmo</u>	<u>Cotylorhiza tuberculata</u>	<u>Nausithoe punctata</u>
INITIALS (for use in data sheets)	P.n.	C.h.	A.a.	R.p.	C.t.	N.p.
GENERAL SHAPE (not to scale)						
Maximum DIAMETER of umbrella	12 cm	35 cm	30 cm	60 cm	30 cm	2 cm
COLOUR	transparent with brown/violet/pink warts	yellowish with brown marks on umbrella	transparent with bluish tinges & pink oral arms	milky blue, purple margin	yellowish/brown with purple tipped projections	transparent
UMBRELLA	covered with warts	smooth, flattened	smooth flattened with 4 gonads visible	high dome	sombrero shape	central dome with peripheral bulges
MARGIN	16 lobes 8 tentacles	32 lobes 24 tentacles	no lobes, numerous tentacles	numerous small lobes no tentacles	16 lobes no tentacles	16 lobes 8 tentacles
ORAL (central) ARMS	4 covered with warts	4 with frilled upper parts	4 with frilled inner edges	8 fused	8 highly branched	not visible

NAUSITHOE PUNCTATA (Kolliker)



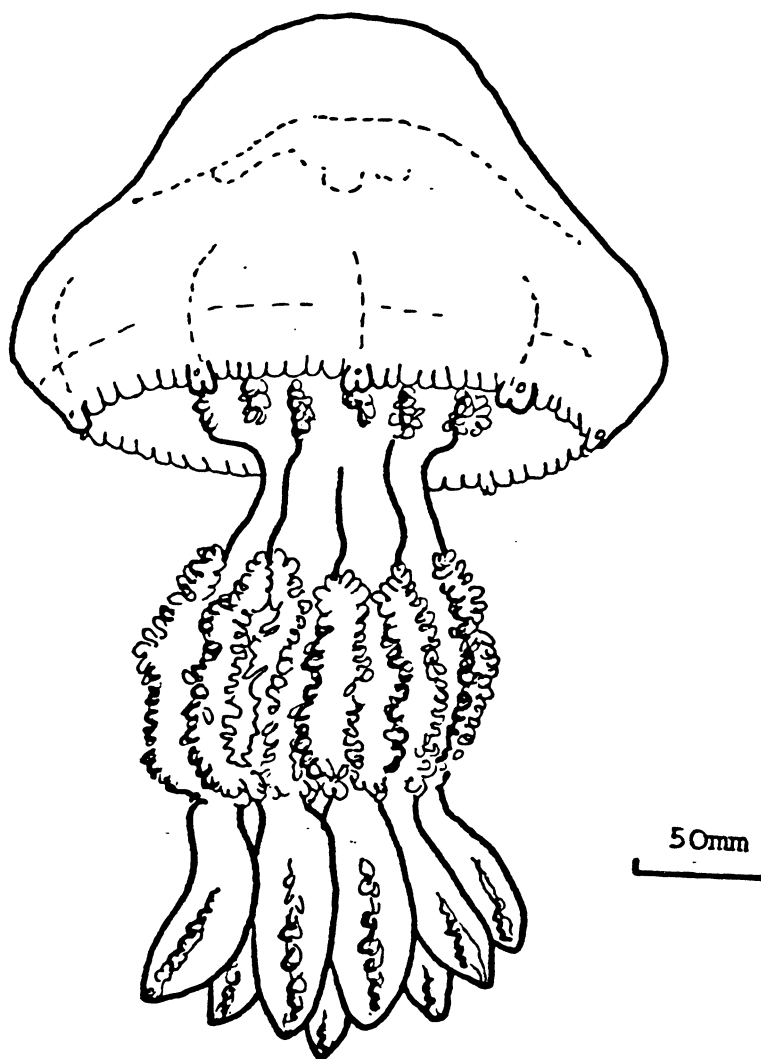
A small medusa, 8-20mm in diameter, with umbrella divided into central area and periphery by a distinct groove. Peripheral area consisting of 16 thickened zones or pedalia. Margin deeply scalloped containing 16 lappets with 8 tentacles.

COTYLORHIZA TUBERCULATA (Agassiz)



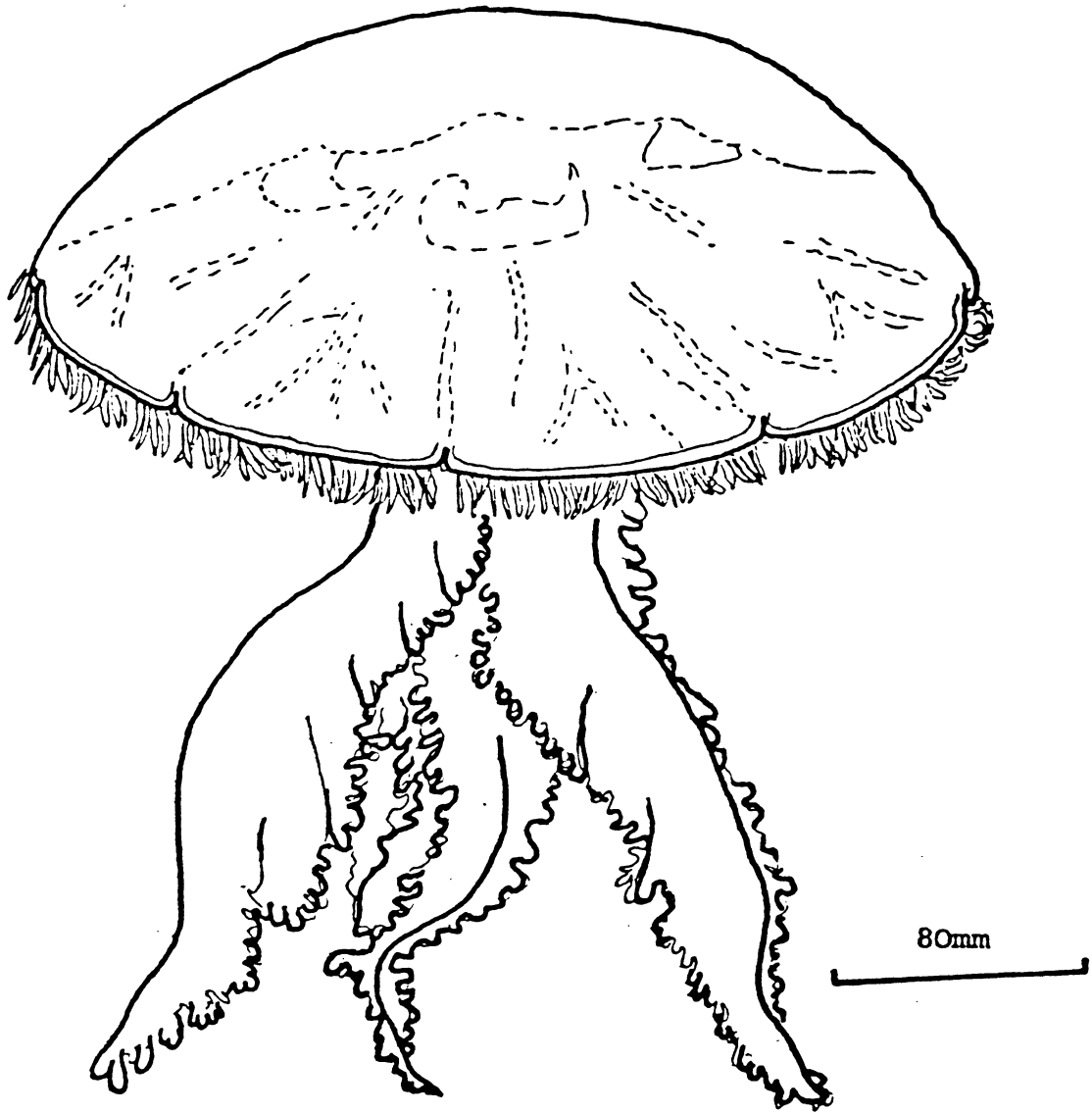
'Sombrero'- shaped umbrella with a central dome separated from thinner peripheral margin by a shallow groove. Margin divided into 16 lobes which are in turn subdivided in numerous smaller lobes. 8 oral arms with numerous projections having purple coloured tips. Umbrella coloured yellowish-brown.

RHIZOSTOMA PULMO (Macri)



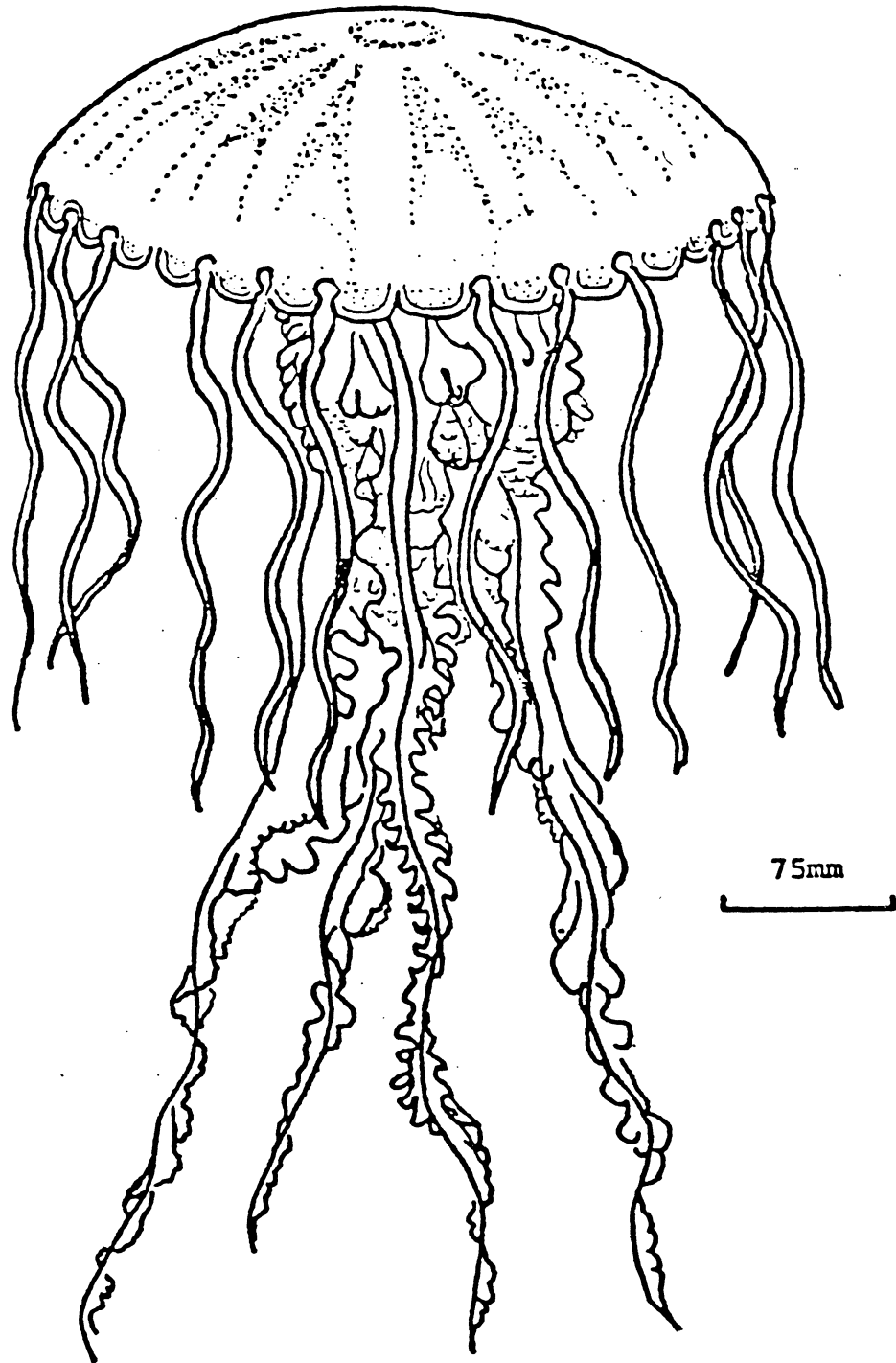
Large high dome-shaped umbrella relatively hard and up to 650mm in diameter, covered with minute warts. Manubrium with numerous lappets (approx. 80) but no tentacles. Large central manubrium with 8 oral arms, having frilled upper portions and smooth club-shaped terminals. Oral arms with numerous small mouth openings. Milky bluish yellow with violet/brownish marginal lappets and tinges of violet/blue on oral arms.

AURELIA AURITA (Linnaeus)



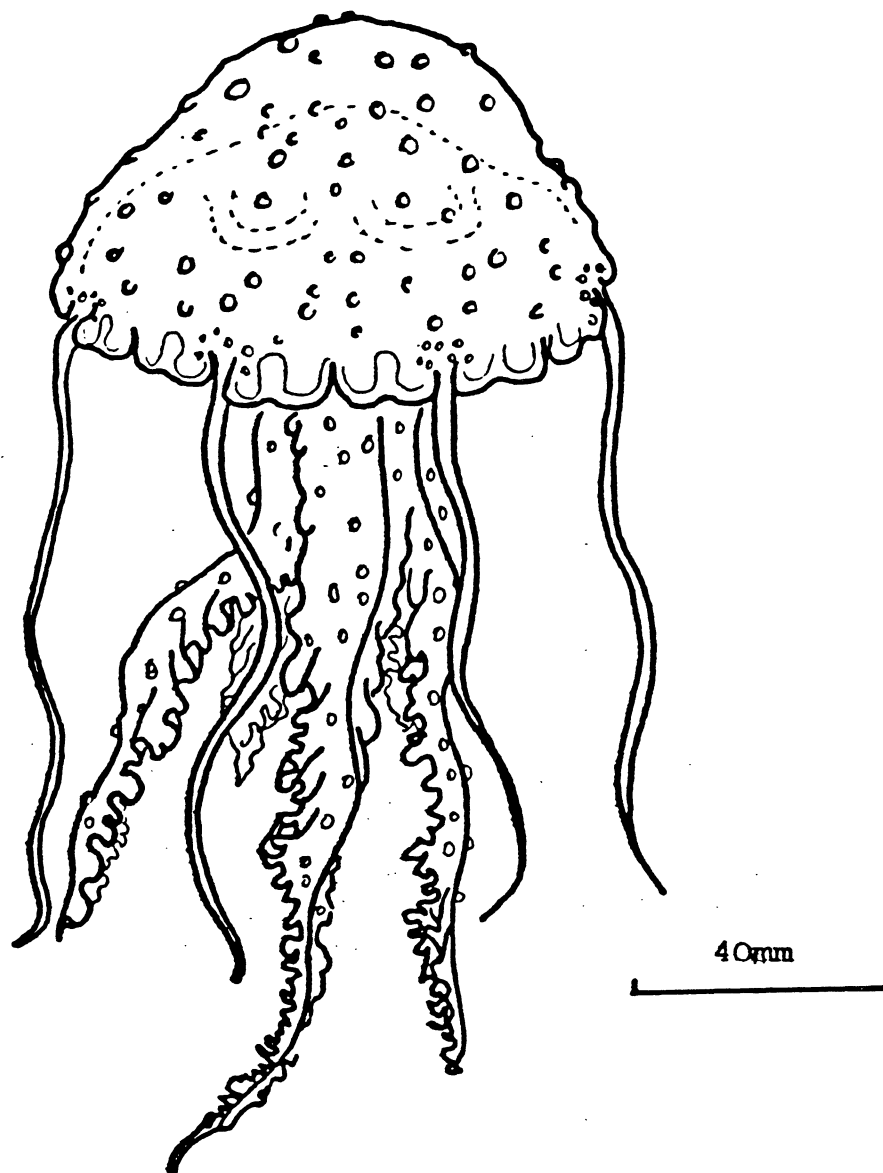
Flattened, smooth, transparent umbrella up to 300mm in diameter. Smooth margin with 8 small indentations and numerous short tentacles. Four long and thick oral arms with minute finger-like projections on inner edges. Oral arms and gonads (the latter visible through umbrella) often violet or pink.

CHRYSAORA HYSOSCELLA (Linnaeus)



Known as the compass jellyfish due to the radial dark brown markings on yellowish umbrella which may reach up to 350mm in diameter. Has 24 marginal tentacles with 32 semicircular lappets. Central manubrium with four long oral arms with frilled inner edges.

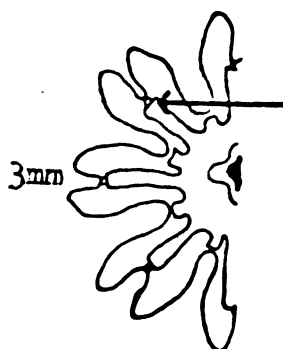
PELAGIA NOCTILUCA (Forsk.)



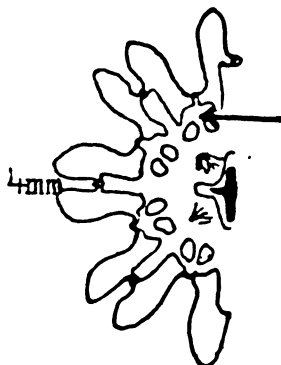
Umbrella covered with warts of stinging cells and may reach a diameter of 100 mm. Has a margin with 16 rectangular lappets and 8 long tentacles. Four long oral arms arising from central manubrium, also covered with coloured warts. Colour is variable being usually from transparent to brownish yellow with purple, pink or brown warts. Luminescent. Gonads usually brightly coloured and easily visible through umbrella.

IDENTIFICATION OF EPHYRAE

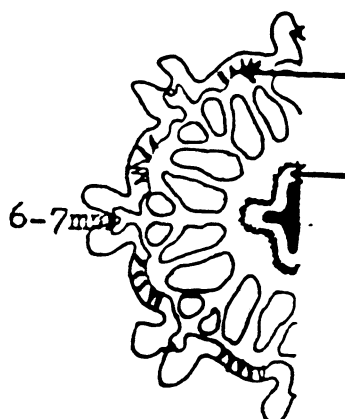
Aurelia aurita



* No horns at tips of radial canals.



*Formation of gastrovascular canals.



*Four oral arms with numerous small small projections.

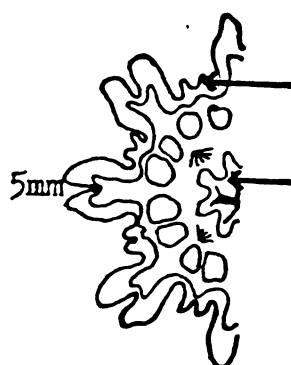
*Numerous marginal tentacles.

Physostoma pulmo



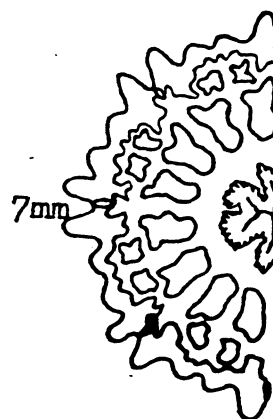
*Small warts on exumbrella

*Horns at tips of radial canals.



*Paired velar lappets at margin.

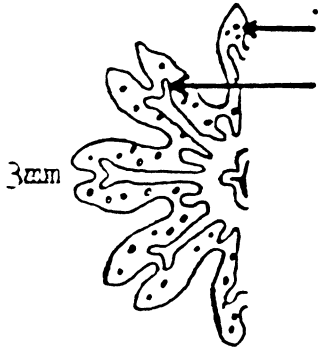
*Large manubrium with eight oral arms.



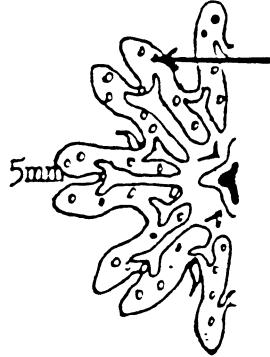
*No marginal tentacles

IDENTIFICATION OF EPHYRAE

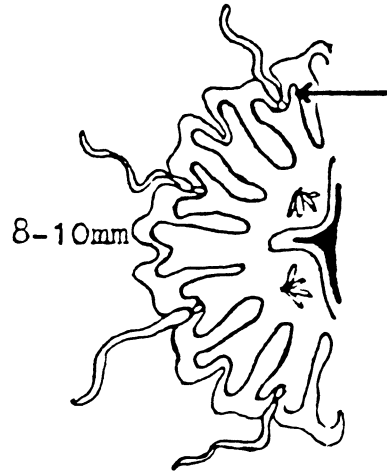
Pelagia noctiluca



* Nematocysts all over exumbrella.

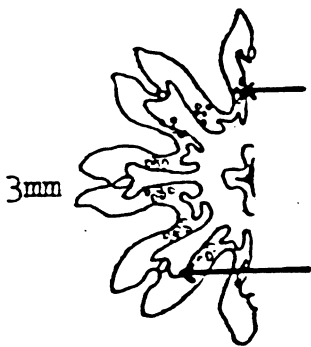


* Nematocysts all over exumbrella.



* No lateral out-growths in tentacular pouches.

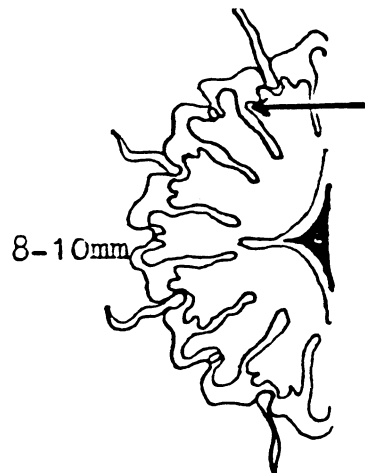
Chrysaora hysoscella



* Nematocysts at base of marginal lobes.



* Radical canals with horns at tips.



* Tentacular pouches with lateral out-growths.

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