

GFCM Workshop on Algal and Jellyfish blooms
Sub-Committee on Marine Environment and Ecosystems (SCMEE)
6-9 October, Istanbul, Turkey

**Jellyfish bloom in the Lebanese seawaters:
is it a sequence of the “Tropicalization” of the
Levantine Basin ?**

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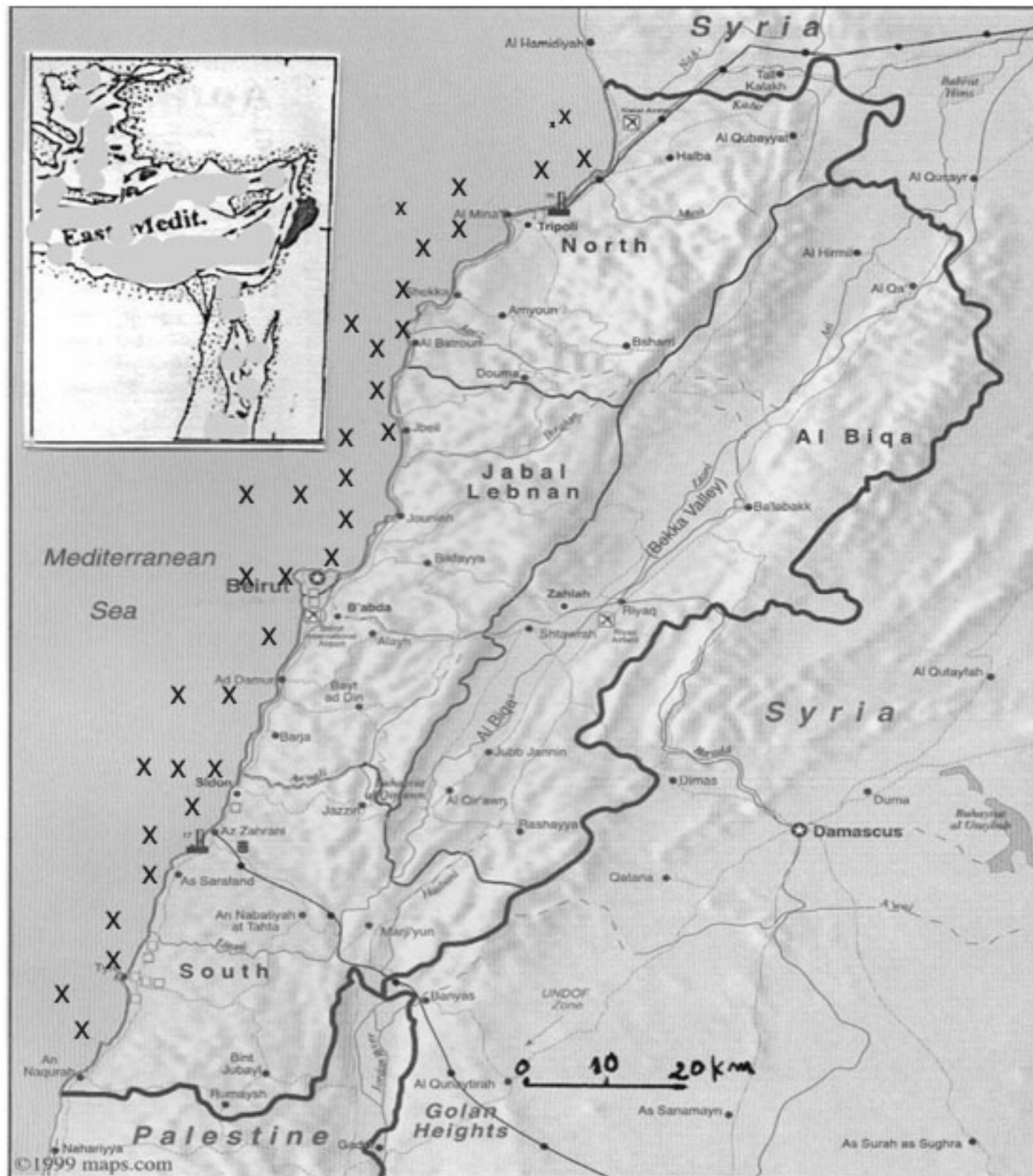
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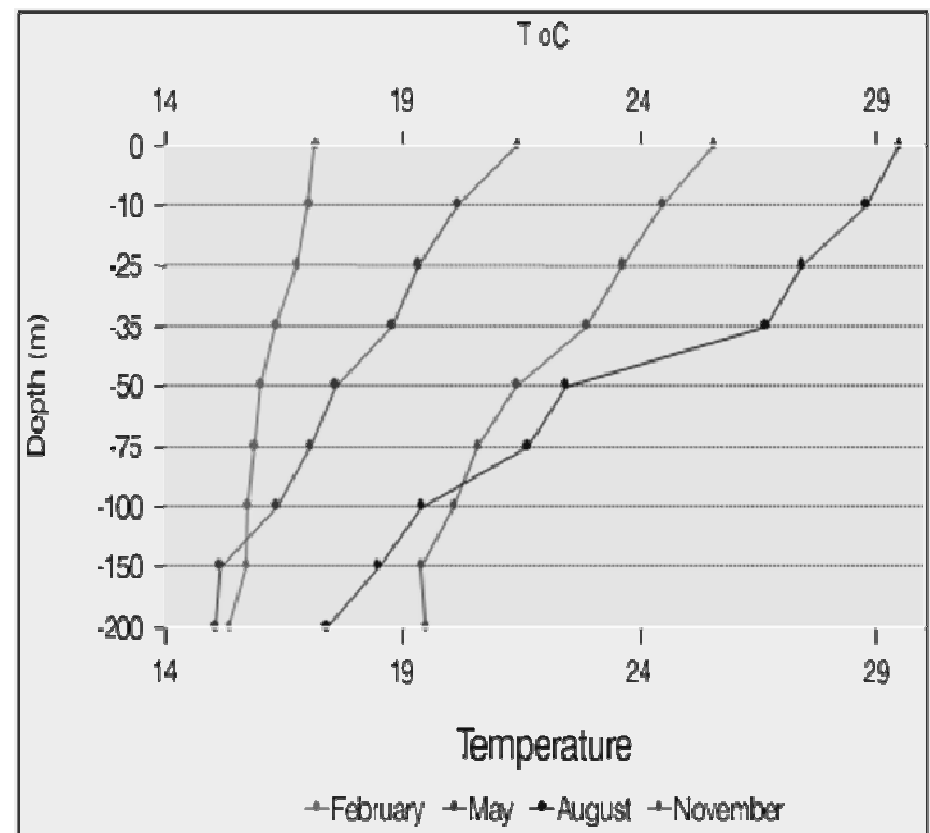
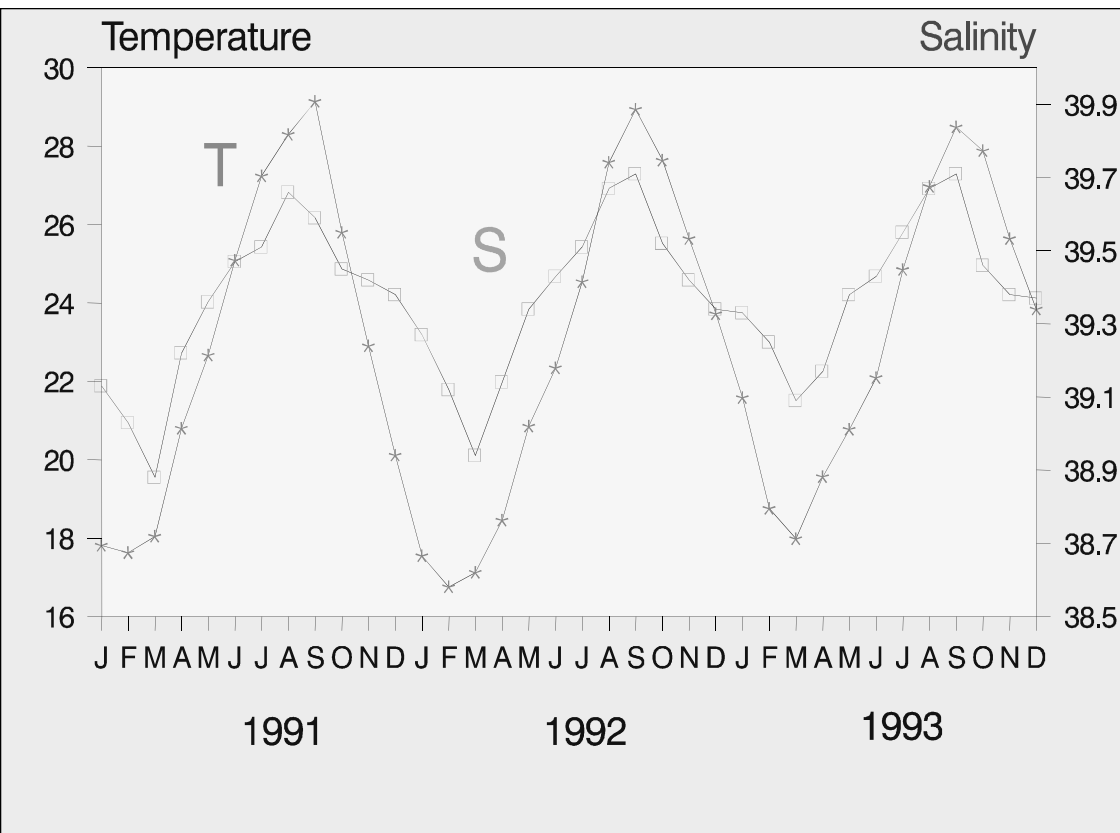
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Hydrobiological stations

along the coast of Lebanon during the long period of survey: 1965-2005.

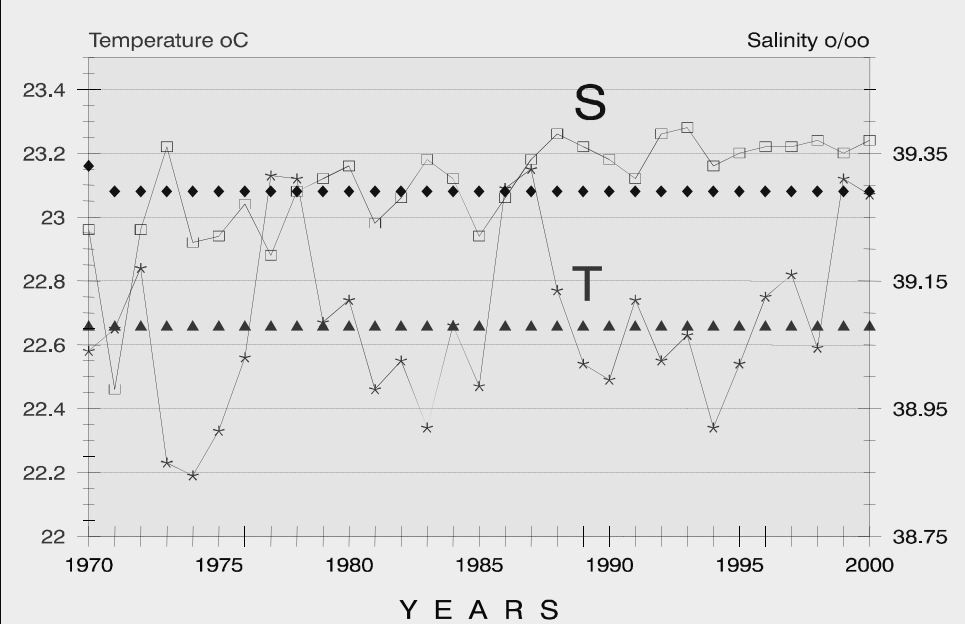
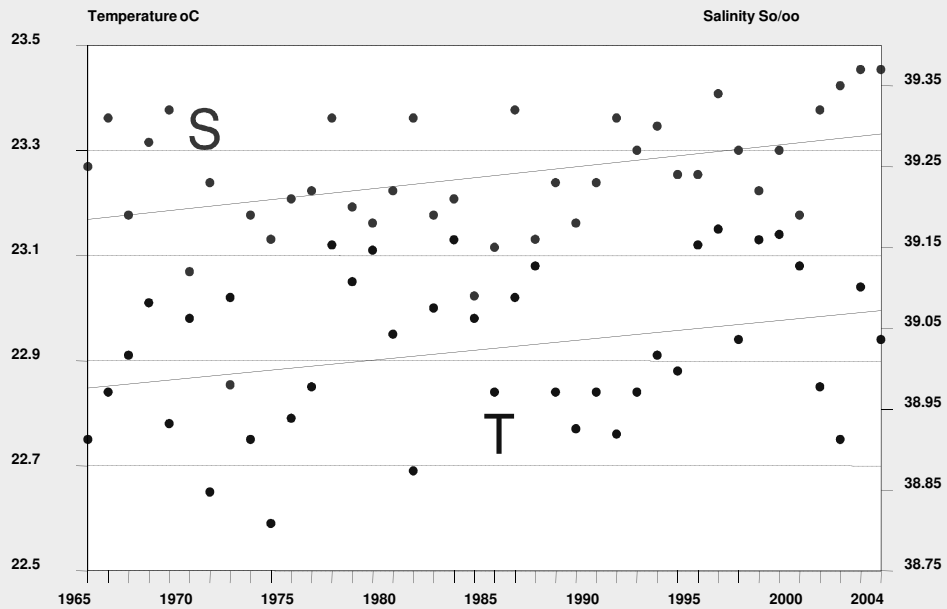
Some stations are situated in coastal and neritic zones, while many others are in open sea beyond the narrow continental shelf: 2-5 miles offshore.





SEASONAL VARIATIONS OF T/S AT THE SURFACE SEAWATER DURING THREE CONSECUTIVE YEARS 1991,92,93

VARIATIONS OF TEMPERATURE WITH DEPTH DURING MONTHS: Feb.,May, Aug.,Nov., 2003



**MULTIANNUAL INCREASING TREND
OF T/S DURING LAST FOURTY YEARS**

**MULTIANNUAL FLUCTUATIONS
OF T/S DURING LAST FOURTY YEARS**

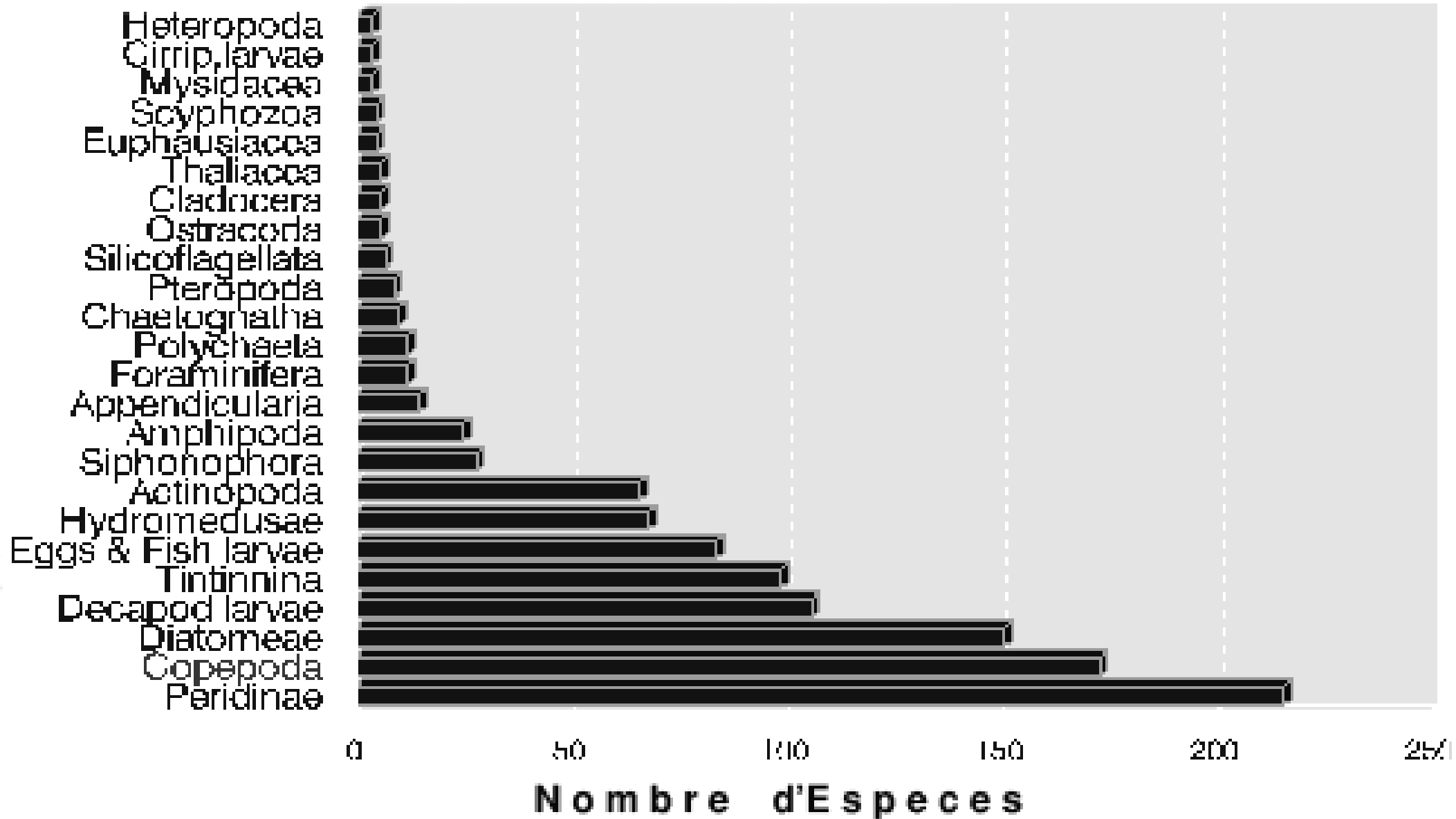
**MONTHLY VARIATIONS OF HYDROBIOLOGICAL PARAMETER AT SURFACE
SEAWATER AT 5 MILES OFFSHORE STATION DURING 2003.**

Month	Temp. oC	S ‰	Diss.O2	NO₃ μM l⁻¹	PO₄ μM l⁻¹	CHL.a mg.m⁻³	PH	Secchi m.	Phyto cel .l⁻¹
J	17.84	39.39	7.10	0.33	0.25	0.09	8.18	19	25000
F	17.18	39.38	7.21	0.28	0.15	0.09	8.17	15	38000
M	18.35	39.29	7.25	0.25	0.19	0.21	8.16	12	55000
A	21.13	39.39	7.09	0.24	0.09	0.42	8.27	10	120000
M	22.85	39.38	7.00	0.19	0.11	0.39	8.25	9	250000
J	23.75	39.51	6.89	0.28	0.11	0.37	8.31	14	300000
J	26.25	39.49	6.18	0.12	0.07	0.12	8.35	22	200000
A	28.91	39.58	5.22	0.41	0.09	0.11	8.32	25	95000
S	29.58	39.54	6.15	0.28	0.08	0.10	8.30	28	35000
O	28.12	39.51	6.46	0.35	0.12	0.11	8.29	29	41000
N	25.61	39.47	7.00	0.23	0.13	0.18	8.29	30	45000
D	22.74	39.39	7.00	0.31	0.16	0.12	8.29	26	35000

Hydrologic parameters in the profile 0-200 m at an offshore station (By3) in 13 February 2003

DEPTH (m)	Temp. oC	Salinity ‰	Diss.O ₂ mg.l ⁻¹	NO ₃ μM.l ⁻¹	PO ₄ μM.l ⁻¹	CHL.a mg.m ⁻³	Phyto cel .l ⁻¹	PH
0	16,98	39,34	7,05	0,29	0,18	0,14	40000	8,19
10	16,87	39,32	7,00	0,26	0,15	0,12	25000	8,16
25	16,68	39,28	6,88	0,24	0,14	0,10	20000	8,14
35	16,18	39,21	6,72	0,23	0,09	0,07	15000	8,14
50	16,12	39,19	6,65	0,27	0,11	0,06	5000	8,15
75	15,65	39,26	6,37	0,29	0,13	0,04	4000	8,19
100	15,32	39,29	6,10	0,31	0,18	0,08	1000	8,20
150	15,29	39,30	5,94	0,38	0,19	0,02	0	8,20
200	15,12	39,31	5,75	0,35	0,22	0,00	0	8,20

Major Zooplankton groups in Lebanese seawater (Levantine Basin)

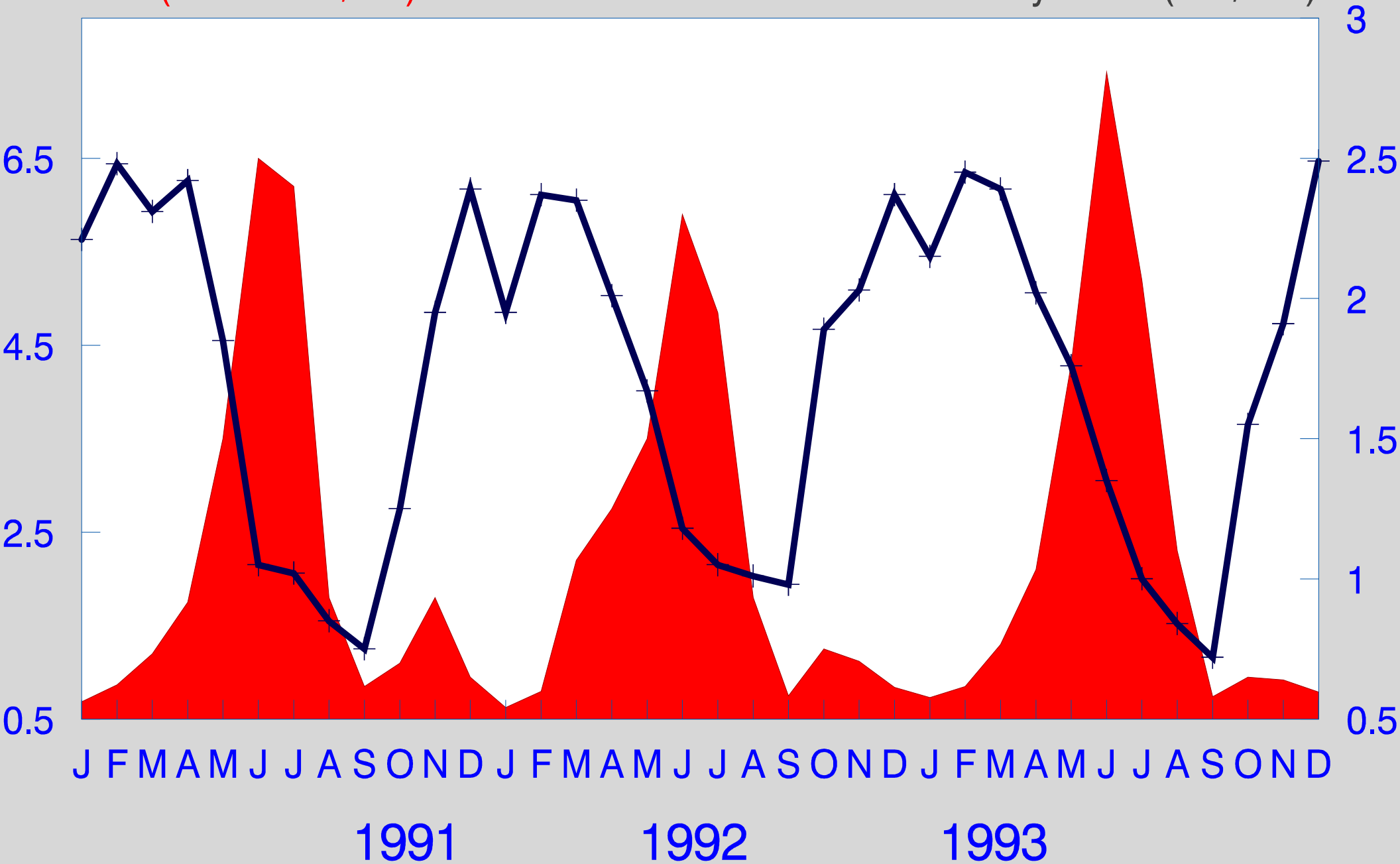


MONTHLY VARIATIONS OF TOTAL ZOOPLANKTON ABUNDANCE (ind.m3)

IN RELATION WITH SPECIES DIVERSITY INDEX (Shannon)

Zoo (x 100 ind./m3)

Diversity Index (bits/ind.)



HYDROMEDUSAE OF LEBANESE WATERS

ANTHOMEDUSAE

<i>Dipurena halterata</i> (Forbes)	x		
<i>Dipurena ophiogaster</i> Haeckel	x		
<i>Sarsia eximia</i> (Allman)	R		
<i>Sarsia gemmifera</i> Forbes	x		
<i>Sarsia tubulosa</i> (M.Sars)	x		
<i>Sphaerocoryne bedoti</i> Pictet	x		
<i>Ectopleura dumortieri</i> (Van Beneden)	x		
<i>Ectopleura minerva</i> Mayer	x		
<i>Euphysa aurata</i> Forbes	R		
<i>Euphysa flammea</i> (Linko)	x		
<i>Plotocnide borealis</i> Wagner	x		
<i>Zanclaea costata</i> Gegenbaur	R		
<i>Zanclaea sessilis</i> (Gosse)	R		
<i>Cytaeis tetrastyla</i> Eschscholtz	R		
<i>Cytaeis vulgaris</i> Agassiz et Mayer	R		
<i>Paracytaeis octona</i> Bouillon	R		
<i>Oceania armata</i> Kolliker	R		
<i>Turritopsis nutricula</i> Mc Crady	x		
<i>Podocoryne carnea</i> M.Sars	R		
<i>Podocoryne minima</i> (Trinci)	R		
<i>Podocoryne minuta</i> (Mayer)	x		
<i>Bougainvillia aurantiaca</i> Bouillon	x		
<i>Bougainvillia platygaster</i> (Haeckel)	x		
<i>Bougainvillia ramosa</i> Bouillon	x		
<i>Pandea conica</i> (Quoy & Gaimard)	x		
<i>Nubiella mitra</i> Bouillon	x		
<i>Thamnostoma</i> sp	x		
<i>Amphinema dinema</i> Peron et Lesueur	R		
<i>Amphinema rugosum</i> Mayer	x		
<i>Halitiara formosa</i> Fewkes	R		
<i>Halitiara inflexa</i> Bouillon	R		
<i>Merga tergestina</i> (Neppi et Stiasny)	x	<i>Merga violacea</i> (Agassiz et Mayer)	x
<i>Laodicea undulata</i> (Forbes et Good.)	C	<i>Niobia dendrotentaculata</i> Mayer	R

LEPTOMEDUSAE

<i>Obelia</i> spp	A
<i>Obelia fimbriata</i> (Dalyell)	x
<i>Clytia hemisphaerica</i> (Linné)	R
<i>Clytia macrogonia</i> Bouillon	x
<i>Clytia mccradyi</i> (Brooks)	x
<i>Phialidium haemisphericum</i> Leuckart	R
<i>Pseudoclytia pentata</i> Mayer	x
<i>Cirrholovenia tetranema</i> Kramp	R
<i>Eucheilota paradoxica</i> Mayer	C
<i>Eucheilota ventricularis</i> McCrady	R
<i>Phialella quadrata</i> (Forbes)	x
<i>Eirene viridula</i> (Péron et Lesueur)	R
<i>Helgicirrho schulzei</i> Hartlaub	x
<i>Eutima gracilis</i> (Forbes et Goodsir)	x
<i>Eutima mira</i> McCrady	x
<i>Lovonella cirrata</i> (Haeckel.....)	x
<i>Aequorea aequorea</i> (Forsskal)	R
<i>Aequorea conica</i> Browne	x
<i>Kantiella enigmatica</i>	x
LIMNOMEDUSAE	
<i>Moerisia carine</i> Bouillon	x
<i>Pochella oligonema</i> Kramp	x
<i>Pochella polynema</i> Hartlaub	x
<i>Proboscidactyla ornata</i> (McCrady)	x
TRACHYMEDUSAE	
<i>Geryonia proboscidalis</i> (Forsskal)	x
<i>Halitrephes maasi</i> Bigelow	x
<i>Liriope tetraphylla</i> (Cham.&Eysenh.)	A
<i>Aglaura haemistoma</i> Péron et Lesueur	C
<i>Pantachogon haeckeli</i> Maas	x
<i>Persa incolorata</i> McCrady	x
<i>Rhopalonema velatum</i> Gegenbaur	C
<i>Sminthea eurygaster</i> Gegenbaur	x
<i>Tetrorchis erythrogaster</i> Bigelow	C
NARCOMEDUSAE	
<i>Solmundella bitentaculata</i> (Q.&Gaim.)	R
<i>Cunina octonaria</i> McCrady	R
<i>Solmissus albescens</i> (Gegenbaur)	R

SCYPHOMEDUSAE

Nausithoe punctata Kolliker R

Cotylorhiza tuberculata Agassiz R

Rhizostoma pulmo Agassiz A

Cassiopea andromeda Eschscholtz C

Rhopilema nomadica Galil & Spanier D

Figs.1: *Dipurena ophiogaster*;

2: *Sarsia eximia* ;

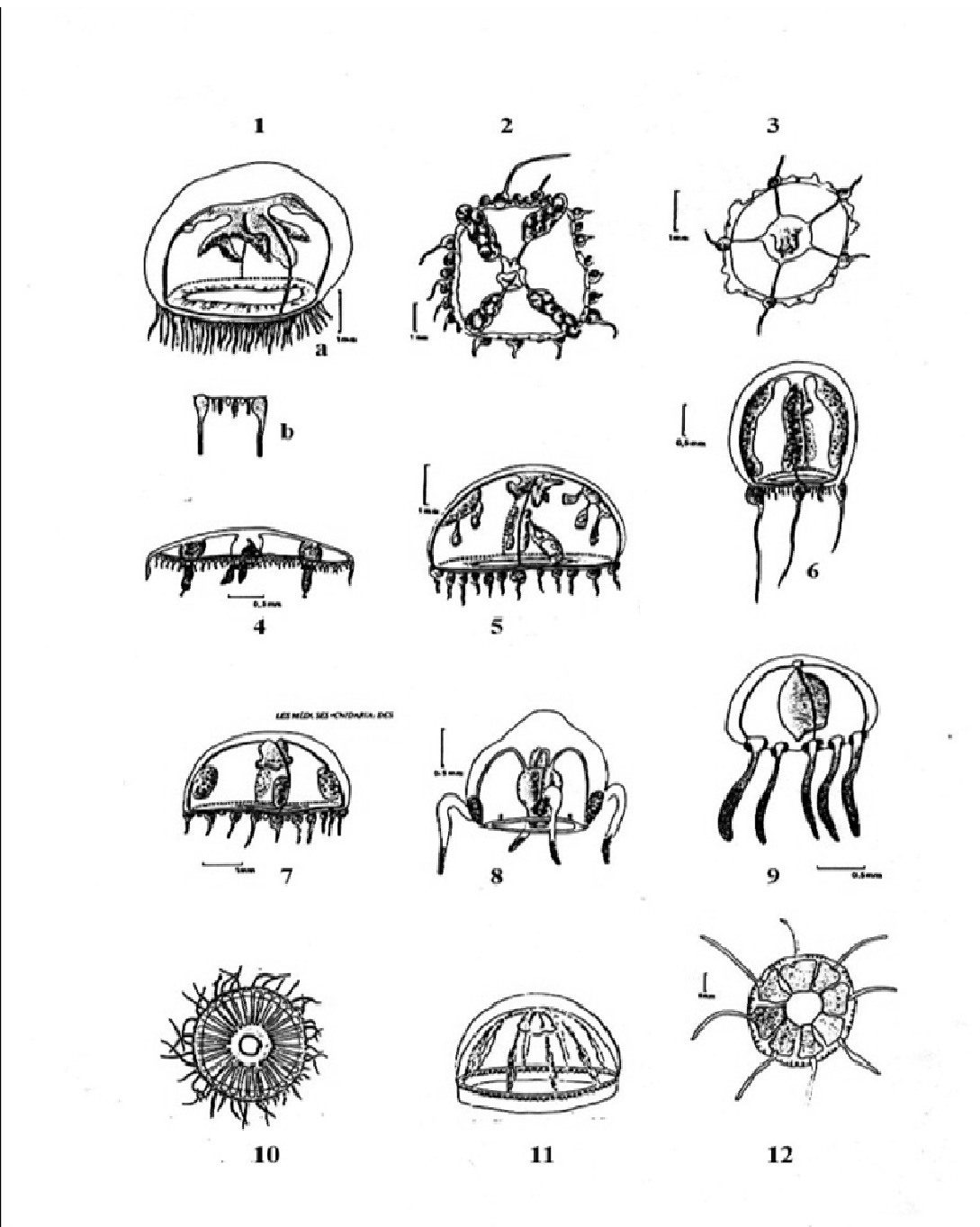
3: *Sarsia gemmifera* ;

4: *Ectopleura dumortieri*;

5 : *Euphysa aurata*;

6 : *Plotocnide borealis*,

7-11, etc.....



Figs.1: *Podocoryne carnea*;

2 :*Podocoryne minuta*;

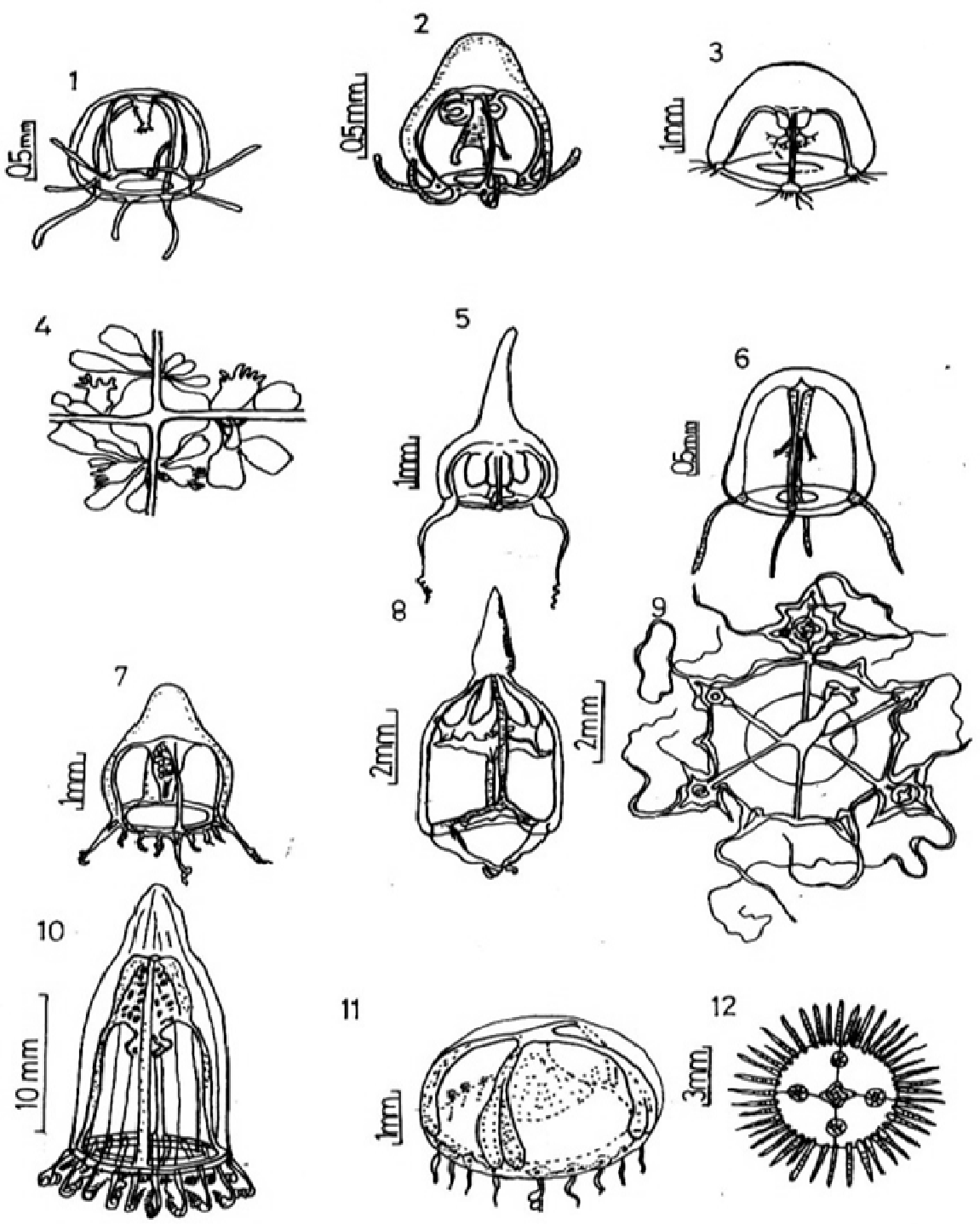
3: *Bougainvillia ramosa* ;

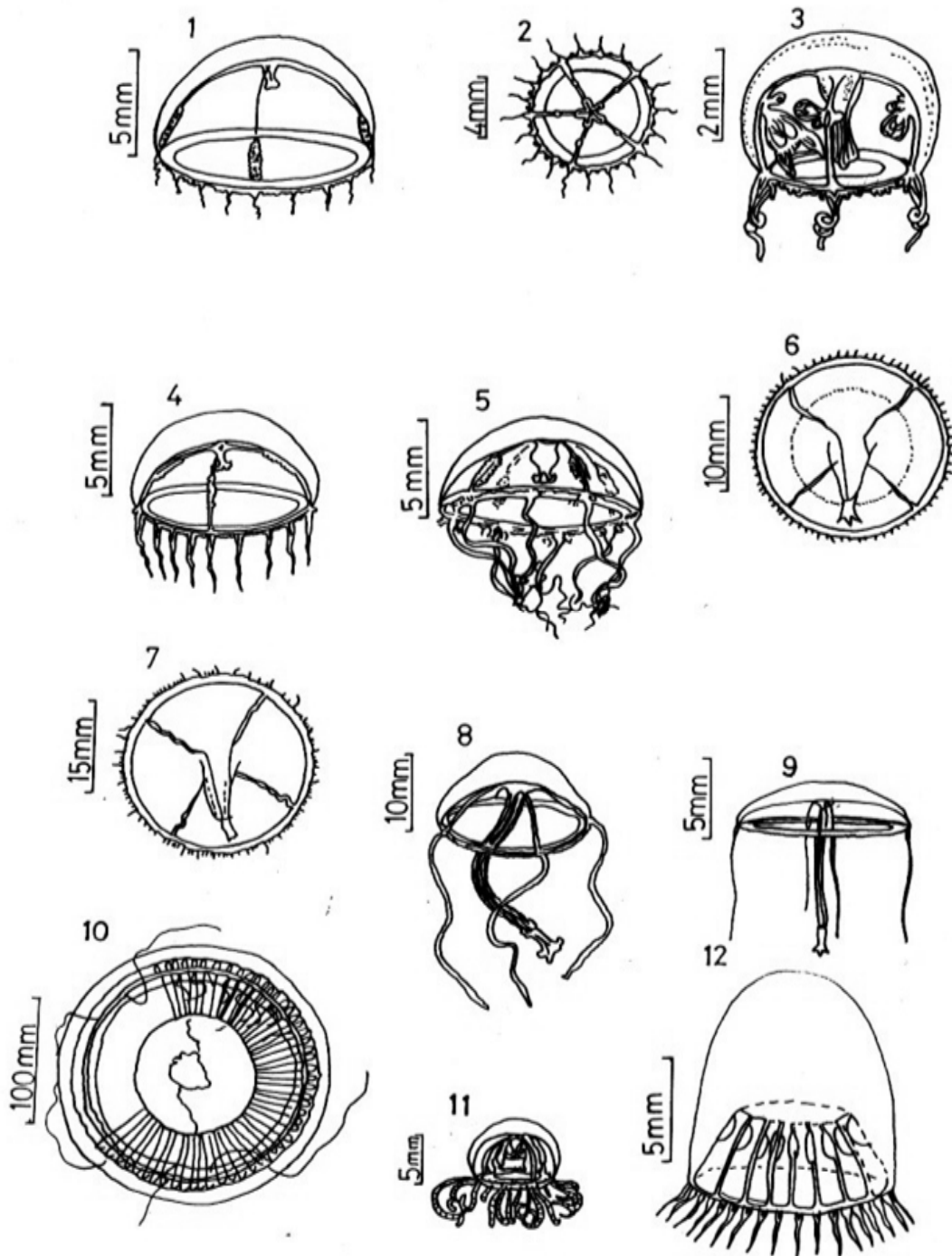
4: *Bougainvillia platygaster* ;

5 :*Amphinema dinema*;

6: *Thamnostoma* sp.;

7-12,etc.....





Figs.1: *Phialidiumhaemisphricum*,

2:*Pseudoclytia pentata*;

3: *Eucheilota paradoxa*;

4: *E. ventricularis*;

5: *Lovenella cirrata*;

6: *Eirene viridula* ;

7:*Helgicirrha*

8:*Eutima mira* ; 9:*E. gracilis*;

10: *Aequorea aequorea*;

11: *Gossea corynetes*;

12 : *A. conica*

Figs.1: *Rhizostoma pulmo*;

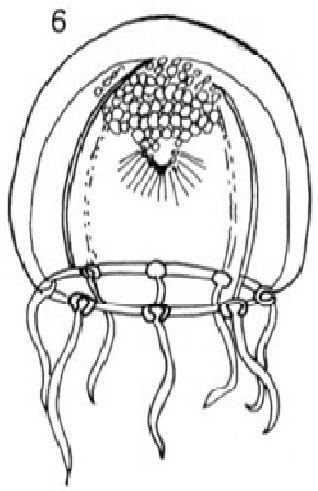
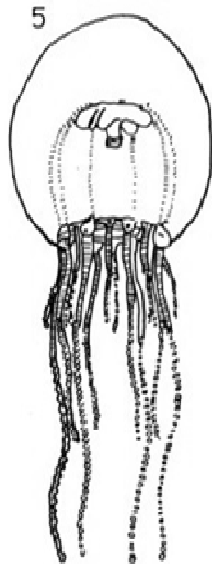
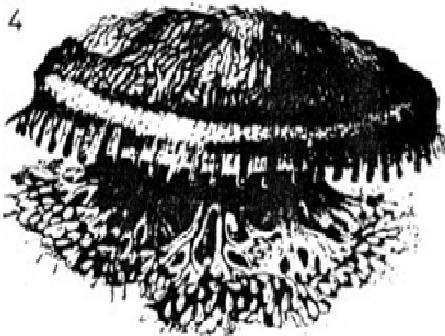
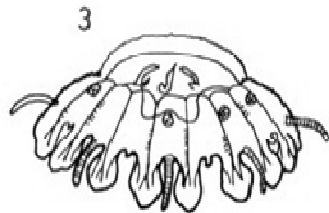
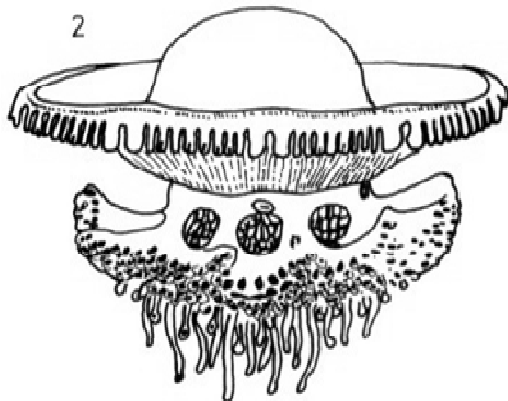
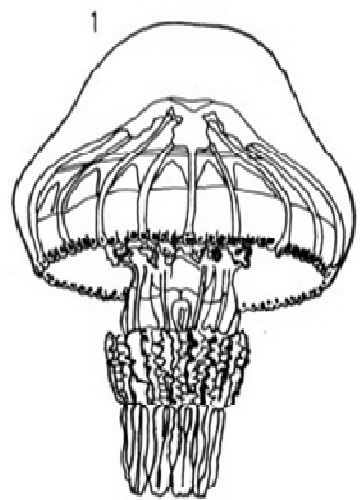
2 :*Cotylorhiza tuberculata*;

3: *Nausithoe punctata*;

4 :*Cassiopea andromeda* ;

5:*Moerisia carine* ;

6: *Paracystaeis octona*



**SCYPHOMEDUSAE OF
LEBANESE COASTAL WATERS**

Fig.1 : *Pelagia noctiluca*;

2: *Aurelia aurita*;

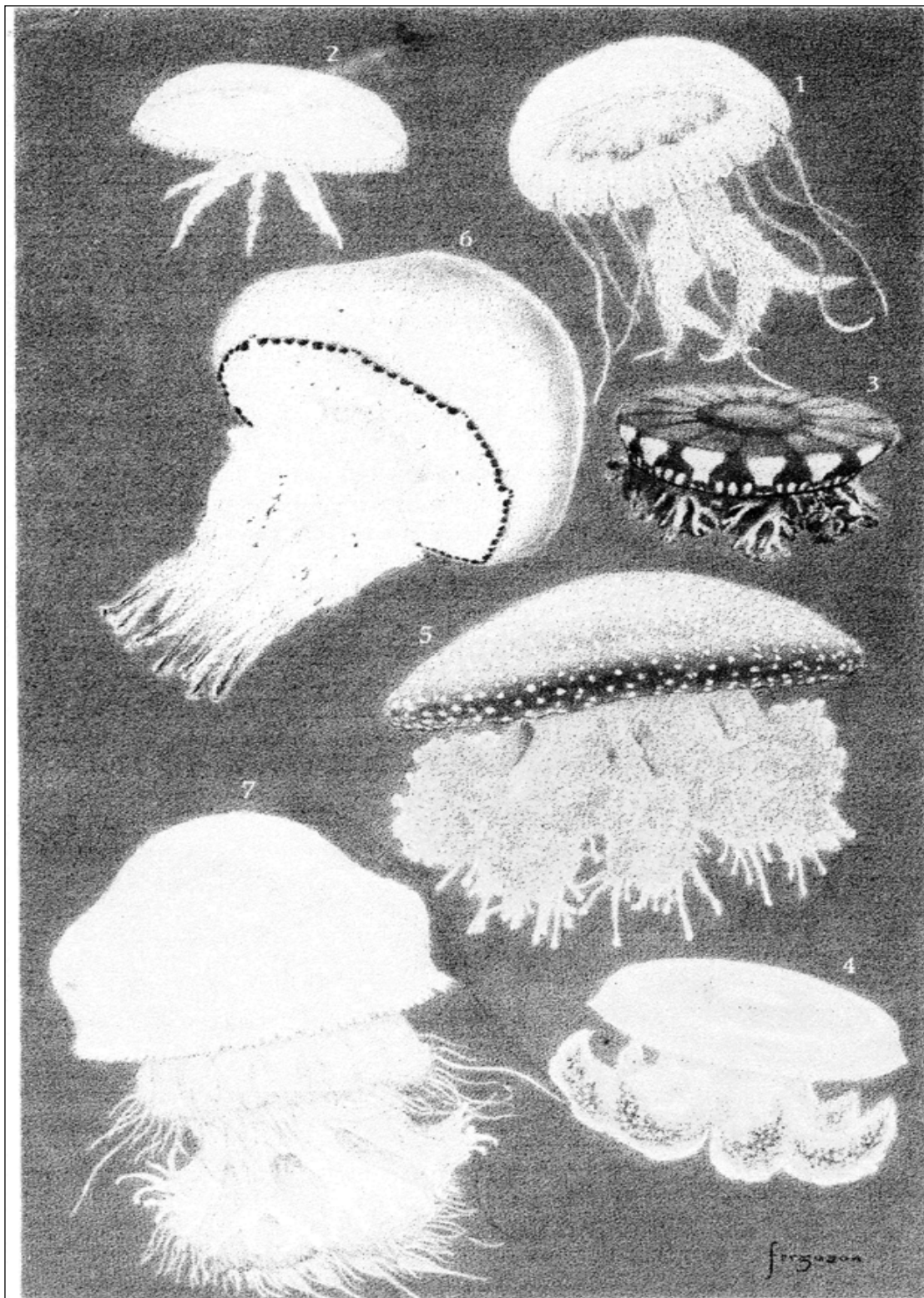
3: *Cotylorhiza tuberculata*;

4: *Nausithoe punctata*;

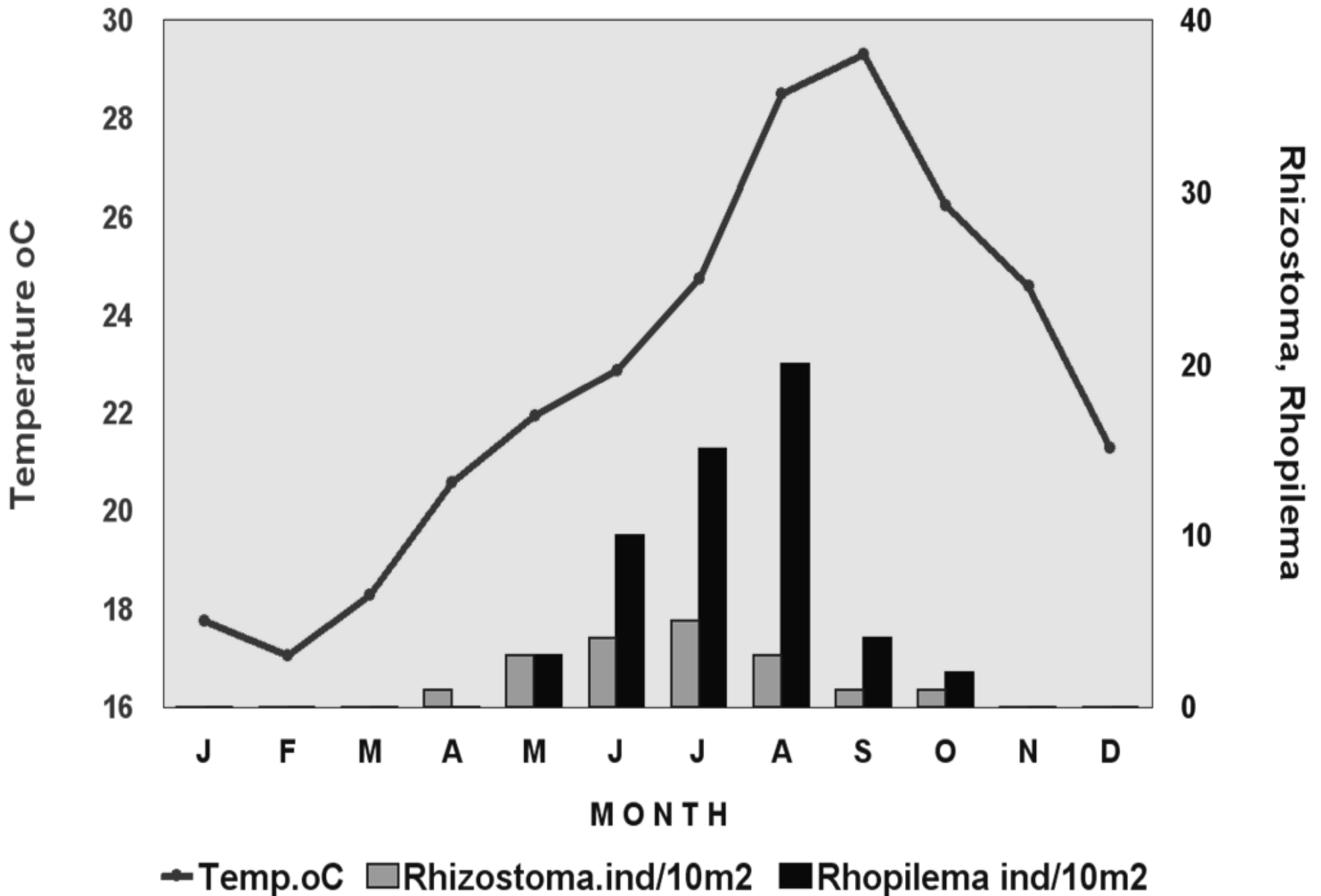
5: *Cassiopea andromeda*;

6: *Rhizostoma pulmo*;

7: *Rhopilema nomadica*



Seasonal variations of Rhopilema and Rhizostoma in relation to surface Temperature



Aggregation of *Rhopilema nomadica* Galil, Spanier & Ferguson

- Stinging venomous Scyphomedusae species. Diameter : 50-85 cm
- Indo-Pacific species, 1st record 1977 on Palestine coast
- Invasive species after 1987 overcame *Rhizostoma*. Dominant scyphomedusae
- Abundance : summer-fall. Aggregation : July-August (20-40 indiv.10 m⁻²) coinciding with phytoplankton-Zooplankton bloom
- Formation of polyps, polydisc strobilisation
- Pelagic larvae (Planula= Ephyrae larvae) give adults within 2 months
- Ephyrae larvae transformed into polyps with capacity of reproduction giving 25-100 medusae during 1 week
- When environmental conditions are favorable, the reproduction restart again
- This biological life remains several years
- The life of *R.nomadica* may continue for 100 years
- Damage to fishermen nets and fearing to swimmers
- Spreading extension northward up to Turkish Mediterranean water

CONCLUSION

Climate change inducing Global Warming

- Global Warming leading to the “Tropicalization” of the Levantine basin
- During the last decades Increase Temperature ($\Delta T=0.40$ °C) and Salinity ($\Delta S=0.35\text{‰}$)
- Increasing Indo-Pacific invasion into the East Mediterranean
- Increasing jellyfish blooms

***TANK YOU FOR
YOUR ATTENTION***