INSTITUT ZA OCEANOGRAFIJU I RIBARSTVO — SPLIT
F N R JUGOSLAVIJA

Ribarstveno-biološka ekspedicija
m/b „Hvar"

1948-1949

The M. V. „Hvar"
cruises researches into fisheries biology

IZVJEŠĆA - REPORTS

VOL. VI, No. 2

OCTOCORALS AND STONY CORALS OF THE HIGH ADRIATIC TRAWLING GROUNDS

WIT 3 MAPS AND 2 FIGURES IN THE TEXT

by
Hj. BROCH

S P L I T

1953

OCTOCORALS AND STONY CORALS OF THE HIGH ADRIATIC TRAWLING GROUNDS

by

HJALMAR BROCH (Oslo)

Institute of Oceanography and Fisheries, Split

With 3 maps and 2 figures in the text

OCTOCORALS

ALCYONARIANS

ALCYONIUM PALMATUM Pallas 1766.

A. Table of specimens examined by the author

Date	St.	Depth m	Colour	Relative frequency
15. III. 48	35	110	Whitish rosy.	rr
29. III. 48	44	220	Rosy.	rr
30. III. 48	42	131	Light rosy.	rr
3. IV. 48	70	110	Whitish with a hint at blue.	+
14. IV. 48	62	154	Dirty rosy.	rr
14. IV. 48	54-63	168	Faintly rosy white. Dirty white whith a hint at blue	c
2. V. 48	101	96-113	Colourless, but with a hint at yellow. — Dark carmine	2
3. V. 48	107	138-139	Light rosy.	+
8. V. 48	121	150-152	Blueish grey with blood-red polyps.	1
9. V. 48	98	106-120	Rosy. — Rosy with blood-red polyps.	rr
10. V. 48	92	61	Light rosy.	r
10. V. 48	104	128	Dirty blueish red.	1
10. V. 48	105	130-154	Blood-red.	rr
15. V. 48	116-118	146-245	Blueish rosy. — Light rosy.	cc
16. V. 48	119 a	148	Rosy.	r
16. V. 48	120	443	Light reddish with blood-red polyps.	rr
20. V. 48	127	190-135	Orange.	1
24. V. 48	132-131	204-125	Dirty yellovish.	1
26. V. 48	135	110	Blood-red. — Rosy. — Blueish grey. — Light reddish yellow. — Colourless.	+
27. V. 48	137	106-101	Rosy. — Brick-red. — Orange. — Blueish grey with blood-red polyps.	+
28. V. 48	143	42-25	Dark carmine. — Blood-red with yellowish polyps.	rr
11. VI. 48	150	123-124	Dirty orange with dark orange polyps.	2
13. VI. 48	156	86-82	Brick red.	4
18. VI. 48	142	42-16	Blood-red.	rr

continued

Date	St.	Depth m	Colour	Relative frequency
19. VI. 48	139	44-51	Brick red.	+
19. VI. 48	138	56-58	Blood-red with colourless polyps.	r
23. VI. 48	96-91	144-137	Light rosy.	cc
25. VII. 48	40	181-123	Light yellowish red	r
1. VIII. 48	74	157-150	Light dirty rosy.	cc
15. VIII. 48	29	93-92	Dirty orange.	r
16. VIII. 48	30	100-99	Dirty grey with blood-red polyps.	rr
16. VIII. 48	22	75-71	Dirty yellowish grey with blood-red polyps.	2
17. VIII. 48	16	67-68	Yellow (F. Pax det.)	rr
18. VIII. 48	10	71-73	Dirty yellowish white	rr
21. VIII. 48	1	32-31	Dirty reddish grey.	1
25. VIII. 48	11	64-68	Dirty dark orange.	1
26. VIII. 48	14	77-79	Orange with colourless or brownish polyps. — Dirty orange with dark orange polyps.	2
26. VIII. 48	21	79-82	Orange.	1
26. VIII. 48	28	92-97	Red. (F. Pax det.)	rr
27. VIII. 48	35	95-108	Light orange.	1
28. VIII. 48	68	166-157	Light rosy.	r
29. VIII. 48	69	176-188	Rosy.	1
2. IX. 48	54-63	168-146	Rosy. — Yellowish rosy.	(c) rr
3. IX. 48	53	176-166	Light rosy.	3
3. IX. 48	62	153-170	Dirty rosy.	2
7. IX. 48	44	208-190	Light rosy.	rr
7. IX. 48	37	115-155	Dirty rosy. — Light yellowish red. — Lilac.	3
8. IX. 48	36	121-128	Dirty rosy.	1
10. IX. 48	71	117-123	Yellowish white.	1
11. IX. 48	70	110-137	Light rosy. — Dirty yellowish.	2
11. IX. 48	61	146-159	Light dirty yellowish.	rr
12. IX. 48	79	117-137	Yellowish light red.	1
16. IX. 48	82	53-51	Brown.	2
21. IX. 48	77	152-144	Yellowish white (translucent), light reddish.	+
21. IX. 48	87	144-138	Rosy.	c
23. IX. 48	92	126-121	Dirty whitish (translucent).	rr
24. IX. 48	97	126-122	Light rosy.	1
24. IX. 48	104	126-128	Dirty white (traslucent).	1
29. IX. 48	82	53-51	Dirty dark rosy.	rr
6. XI. 48	101	96-115	Dark orange.	1
7. XI. 48	108	99-110	Blood-red.	rr
22. XI. 48	123	128-144	Light orange.	2
24. XI. 48	132	125-174	Bright orange.	1
12. XII. 48	138	58-57	Orange.	3
8. I. 49	85	161-155	Orange. — Dirty yellowish	2
14. III. 49	26	82	Rosy. — Rosy and orange	1
26. III. 49	8	67-71	Brick red.	rr
28. III. 49	24	80-87	Orange.	1
28. III. 49	31	91-95	Orange.	2

B. Additional data according to the journals from the expedition

Date	St.	Depth m	Colour	Relative frequency
5. III. 48	1	30	Red.	
8. III. 48	10	72	Red.	rr
15. III. 48	28	100	Red.	2
26. III. 48	27	90-95	Red.	+
3. IV. 48	61	150	Light.	1
9, IV. 48	82	50	Red.	1
18. IV. 48	77	150	Light.	
3. V. 48	93	168-172	Light.	c
7. V. 48	114	176-183	Light.	+
			Red.	1
8. V. 48	119	155-183	Light.	2
			Red.	1
9. V. 48	106	186-181	Light.	7
17. V. 48	123	132-144	Light rosy with red polyps.	+
17. V. 48	124	170-208	Yellow with red polyps.	2-3
23. V. 48	130	154-114	—	
28. V. 48	147	48-44	Red.	3
31. V. 48	154	46-27	Red.	2
1. VI. 48	162	36-13		1
16. VI. 48	146	119-91	Red.	2-3
17. VI. 48	141	88-97	Red.	3-4
18. VI. 48	148	34-38	Red.	+
18. VI. 48	144	40-38	Red.	11
23. VI. 48	96-91	144-137	Red.	rr
20. VII. 48	73	146-135	Light.	+
22. VII. 48	38	113-97	Red.	2
26. VII. 48	32	100-95	Light.	3
26. VII. 48	39	115-119	Red.	2
29. VII. 48	57	157-150	Light.	3
30. VII. 48	58	157-137		cc
30. VII. 48	67	126-126	Light.	6
1. VIII. 48	85	161-153	Light.	3
2. VIII. 48	65	170-186	Light.	3
3. VIII, 48	83	31-9	Red.	4
16. VIII. 48	22	75-71	Yellow and light with red polyps.	
26. VIII. 48	20	80-82	Red.	
28. VIII. 48	59	199-196	Red.	3
3. IX. 48	53	176-166	Light-rosy.	
14. IX. 48	93	167-168	Light.	3
6. XI. 48	100	124-115	Light.	1
12. XI. 48	118	150-144	Light.	2
15. XI. 48	99	170-174	Light.	3
15. XI. 48	106	186-175	Light.	1
16. XI. 48	117	212-173	Light.	1
18. XI. 48	118 a	117-135	Light.	1
20. XI. 48	126	116	Light.	1
22. XI. 48	124	164-201	Light.	2
27. XI. 48	135	110-107		1
28. XI. 48	130	276-170		3
11. XII. 48	136	374-258	Rosy.	1
12. XII. 48	139	50-44	Red.	5-6
12. XII. 48	137	105-101	Rosy.	rr
17. XII. 48	135 a	95-100	Light.	2
22. XII. 48	96-91	144-137	Light.	rr
22. XII. 48	86	95-89	Rosy.	rr
23. XII. 48	75	115-113	Rosy.	rr
23. XII. 48	82	50-51	Red.	rr
24. XII. 48	83	38-38		rr

continued

Date	St.	Depth m	Colour	Relative frequency
8. I. 49	74	152-133	Light.	7
28. I. 49	67	126-137	Light.	c
9. II. 49	58	152-163	Light.	20
10. II. 49	48	188-173	Light.	1
11. II. 49	57	170-160	Light.	1
20. II. 49	90-95	133-132	Light.	20
22. II. 49	65	177-161	Light.	1
9. III. 49	54 a	174-163	Light.	2
10. III. 49	47	199-192	Light.	1
23. III. 49	23 b (Zadar Channel)	44-49	Red.	3
26. III. 49	12	75-77	Red.	3
28. III. 49	17	79-84	Red.	2
29. III. 49	39	126-117		1
31. III. 49	64	158-177	Light.	1

Only one species of Alcyonarian corals is present in the collections from the »Hvar«-Expedition, viz. *Alcyonium palmatum* (map 1). On the other hand, this species must be characterized as one of the most prominent bottom species of the fishing grounds, especially in the median parts of the Adriatic (see also Broch 1935[1]).

Alcyonium palmatum settles on every solid, dead object of the bottom, in the present collections preferably on shells of dead lamellibranchiates. The base of the colony may spread over more fragments of dead shells, or sit on only one. The bases of the colonies thus vary greatly in width, and it is moreover obvious that the colonies on the whole possess an almost incredible faculty of extension and contraction. This has also been stated by observations in aquaria. — The weight of the colony all but equals that of the surrounding water, and the equilibrium is accordingly easily established and kept, also with a narrow holdfast. A small and rather thin shell will thus suffice for anchorage, where the currents are so slight as in most fishing grounds in the Adriatic.

The colours of the species depend partly on a colouring of the soft tissues, mostly on colours of the spicula. When the spicula are colourless, the colony generally is light rosy like the majority of the specimens brought home by the »Hvar«-Etpedition. However, the light rosy colonies in many cases also have some of the spicula coloured, and the variation in colours of the specimens in most cases depends on the colours of the spicula.

It is in this place of importance to note that the fusiform spicula of the polyp crown (the anthocodia) and the spicula of the deeper layers of the coenenchym in most cases agree, and that their colour varies independently of that of the small spicula of the superficial layers (the bark) of the coenenchym and the rudimentary calices.

When the fusiform spicula are blood-red and the spicula of the bark colourless, the colony is light reddish (or rosy) with blood-red anthocodia. It is, however, in this case only the spicula crown, which is dark-coloured, the tentacles (and their spicula) as well as the thinwalled, contractile »neck« between the crown and the calix are colourless. This colour pattern is by no means seldom. In extreme cases the polyps appear as blood-red spots in contracted, greyish or dirty white colonies.

On the other hand we find colonies, the small bark-spicula of which are more or less deeply red-coloured, whereas the large spindles are colourless. This results in more or less darkly red-coloured specimens with colourless, or whitish, polyps. Also this colour pattern is rather common. As a variant of this colouring we also find examples, that the spicula of the eight teeth representing the rudimentary calix, are colourless or, in a few colonies, bright orange, lending a fascinating appearance to the colony, especially when the polyps are withdrawn. The colonies in this case decidedly recall the description of *Alcyonium brioniense* of Kükenthal[2]).

In rare cases the spicula are throughout dark red-coloured, or brick-red, so that the colony exhibits a uniformly dark colour all over. In extreme cases the colour may even change into brown.

---

[1]) Beobachtung an einigen adriatischen Seichtwasser-Anthozoen von Split. — Biol. gen. Wien, Bd. 11.

[2]) *Alcyonium brioniense* n. sp. Ein neues Alcyonium des Mittelmeeres. — Jen. Zeitschr. Naturwiss., Bd. 42, 1907.

— The spicula in some cases show a brillianty orange pigmentation instead of blood-red, and in these cases we may observe orange colonies with whitish (colourless) polyps, or such with rather intensively orange-coloured anthocodia.

Almost without exception, the coloured bark spicula are mixed with colourless spicula in varying numbers, and the intensity of the colouring of the colonies varies in accordance with this.

The colonies have, almost without exception, a polyp-less stalk of greatly varying length. This stalk is always a little lighter coloured than the polyparium, the coloured spicula being here always strongly outnumbered by the colourless ones.

It is evident from this that *Alcyonium palmatum* varies to a great extent, and this is also the case in other characters than colours.

Although the spicula are rather stable in their main features, their individual variation is extensive, and it is on the basis of the spicula impossible to distinguish a special form, *adriatica,* from the typical *palmatum* group as proposed by Kükenthal[3]). The differences defined between the spicula (see G. Frenzel[4]) fall well within the range of variation of most Alcyonarian species, and all intermediate stages are easily found in a somewhat larger collection. — It might also seem questionable, whether *Alcyonium brioniense* Kükenthal 1907 is based on anything but extreme variants of *Alcyonium palmatum.* However, the relative dimensions of the spicula of the coenenchym and the polyps are so aberrant, that it at present seems most correct to look on them as different species. The present collections contain no certain specimens of *Alcyonium brioniense,* and there is accordingly no reason to enter farther into the question in this place.

It was mentioned above that the colours vary to a great extent. Also the shape of the colony is changing from unbranched to more or less copiously branching, almost always with a polyp-less stalk which in some cases continues as a main stem sending side branches in one main plane, so that the colony is irregularly pinnate.

These great variations in the general shape of the colonies, shape and colours of the spicula, and colours of the specimens, make it easy for us to understand that investigators, who have generally only had a few colonies at their disposal, in many cases have been inclined to look on more extreme variants as representatives of separate species, When, however, such large collections as the present are at hand, it is impossible to draw defensible specific limits.

That question on the other hand arises, whether it is possible to group the specimens in fairly well defined sub-species like those of *Pennatula phosphorea* (see below). I have in vain tried to do this. It is impossible to tell where to draw the limits, all transitory stages being at least equally numerously represented as the eventual sub-specific type variants.

There is nevertheless in the present comprehensive collections (more than 70 colonies) a hint at colour groups, viz. dark red colonies (brick-red, carmine, blood-red, or dark brown, comp. the table above), orange colonies, and rosy or all but white (translucent) colonies. It is a question whether these three colour groups are ecologically determined. A first glance at the table (p. 3, 4) gives a somewhat chaotic impression. If, on the other hand, we arrange the specimens according to depths, a correlation can be traced in so far that the bulk of the dark red colonies is met with in the upper part of the specific habitat (mostly shallower than 100 m) the majority of the orange specimens from 60 to 150 m, and the rosy or whitish (colourless) colonies generally between 100 and 200 m depth.

Roughly speaking we can thus say that the rosy colour is predominant in the deeper part, yellow colours in the median, and darker red colours in the shallower parts of the habitat of *Alcyonium palmatum.* To a certain degree this coincides with the distribution of the colour groups in *Pennatula phosphorea* (see below), only the colour groups are here more distinctly limited and accordingly more defensible as basis for »sub-species«.

An examination of the detailed conditions of the finding places from the »Hvar«-Expedition gives as result, that *Alcyonium palmatum* prefers salinities between 37.18 ‰ and 38.81 ‰; the specimens are evenly distributed between these limits. Only in two »aberrant« cases is the salinity much lower, viz. 36.60‰ (st. 14, 25. VIII. 48) and even 34.51‰ (st. 1, 21. VIII. 48). Both the last-named localities are at the same time rather shallow (resp. 79—77 m, and 34—32 m), and the specimens are typical *palmatum* colonies according to Kükenthal (1907, l. c.) and Frenzel (1937, l. c.).

The colonies have in most cases been found in temperatures between 11.5° and 16° C. In two cases the temperatures were lower, viz. 10.2° (in st. 12, 26. III. 49, 75—77 m depth, and st. 17, 28. III. 49, 79—84 m depth) and 10.8° (in st. 44, 29. III. 48, depth 220 m, and in st. 8, 26. III. 49,

---

[3]) 1. c. 1907. — Beobachtungen an einigen Korallentieren des Adriatischen Meeres. — Aus der Natur, Bd. 5, 1909.

[4]) Die systematische Stellung des adriatischen *Alcyonium.* — Not. Ist. Biolog. Rovigno, Vol. II, 1937.

71—67 m depth). On the other hand, two localities also show »aberrantly« high temperatures, viz. 18.1° (st. 138, 19. VI. 48, 58—56 m depth), and 20.95° (st. 139, 19. VI. 48, 51—44 m).[5]) In all four extreme cases the colonies were irregularly branched, but the colours correspond with the depths: in the localities with the lowest temperatures the colonies were rosy (220 m) and brick-red (71—67 m), in the localities with extreme high temperatures brick-red or blood-red (44—58 m).

Alcyonium palmatum is distributed throughout the Adriatic in moderate depths and seldom descend into greater depths than some 200 m, whereas on the other hand in places it can thrive as shallow as about 50 m or even a little less.

A combination of the optimal ecological conditions (salinity and temperature) from the above data at once shows us that the level trawling grounds of the median part of the Adriatic (between a line from Mljet to Hvar, and a transverse line from Lošinj) give the ideal habitat of the species. In this locality the colonies generally attain a luxuriant growth, often irregularly pinnate or, as often, quite irregularly bushy. The species occurs more scantily from Boka Kotorska and southwards along the Albanian coast, where the temperatures evidently are less suitable. Here the colonies are less luxuriant and more irregular, often scarcely branched.

Frenzel (1937, l. c.) gives reasons which in his opinion point in the direction that the Adriatic *Alcyonium palmatum* should be treated as a geographical race (or sub-species) as suggested by Kükenthal (1907, 1909, l. c.). An analysis of his data, and a comparison with the data given above as to continuous variations of the extensive collections from the »Hvar«-Expedition give as a result that the only feature which might serve as a base for distinction, is the more or less pronouncedly pinnate branching of the colonies. This, however, evidently in the main depends upon ecological conditions in so far that optimal conditions of salinity and temperature cause a rich development of the colonies and at the same time a greater percentage of rather pinnately branching colonies. It seems questionable whether we ought to base »geographical races« (or sub-species) on a tendency in a great percentage of the colonies to arrange their branches in one main plane under optimal conditions of life.

I shall not dwell here further on this question. Even though the present collections are extraordinarily extensive and might seem to be unusually representative, we must remember that the object of the Expedition was fishery investigations, and that it was impossible to preserve all animals captured. From most of the stations only examples were picked out. In several cases only fragments of »common« specimens have been preserved, whereas in many cases more or less »aberrant« specimens have caught the interest and been preserved by preference. The picture given by the collections therefore no doubt is a little out of alignment, and especially in common species with extensive range of variation like the present one, we must be extra guarded in our conclusions in spite of the very large numbers of specimens.

After the above was written I got the list of specimens according to the journals of the Expedition (inserted on p. 5, 6 as B). The data of this table B on the whole well agree with the statements given and support them furthermore. The numerous localities of this table tell us, that *Alcyonium palmatum* indeed is one of the character species of the important trawling grounds of the Adriatic.

GORGONARIANS
(Fig. 1)

The Adriatic Gorgonarians throughout belong to hard bottom, and the »Hvar«-Expedition therefore only brought home very few specimens.

ISIDELLA ELONGATA (Esper 1788)

4. VI. 48 . . . St. 167 . . . 236—256 m depth . . . Several fragments of a large colony (together with an Antipatharian).

The species had as yet not been found in the Adriatic. The next locality of *Isidella elongata* seems to be in the environs of Messina and Naples, where according to Kükenthal[6]) it lives in the lower littoral and the upper part of the abyssal zone. This agrees well with the present find in 291 m depth on the eastern slope towards the great deep west of Albania.

---

[5]) The data of temperature for the last two neighbouring localities near the coast are put in the parenthesis in the journal of the Expedition, because there are some uncertainty of their exactness.

[6]) Gorgonaria. — Das Tierreich, Lief. 47. Berlin 1924.

Fig. 1

EUNICELLA VERRUCOSA (Pallas 1766)

24. IX. 48 . . . St. 105 . . . 154—135 m depth . . . One colony.

Eunicella verrucosa is a shallow-water species and according to Kükenthal (1924, l. c.) has only been found in 1 to 50 m depth. The locality of the »Hvar«-Expedition is accordingly of great interest, showing that the species can thrive in much greater depths, in the Adriatic at all events as deep as 135 m.

PARAMURICEA PLACOMUS (Linné 1758)

11. VI. 48 . . . St. 150 . . . 123—124 m depth . . . One colony and several slender, but richly branching fragments.

V. Koch[7]) writes that the species is common in the Gulf of Naples in some 80 m depth. Other data from the Mediterranean very scarce, and Kükenthal (1924, l. c.) only gives a general remark

[7]) Die Gorgoniden des Golfes von Neapel. — Fauna und Flora des Golfes von Neapel, Monogr. XV, 1887.

that its habitat is »Nördliche atlantische Küsten von Europa und Amerika. Im tiefen Littoral und Küsten-Abyssal«. — The depth of the Adriatic locality is a little greater than finding places at Naples according to v. Koch. Dr. F. Pax kindly directs my attention to the statement of Heller (1868) that he has taken *P. placomus* in 30—40 fathoms depth on hard bottom near Hvar, and in specially fine specimens at the southwestern coast of Lastovo. Kükenthal (1924) does not mention them, and their identity is uncertain; the possibility of a confusion with *P. chameleon* is at hand, which species is of a newer date. Kolosvari (1943) has mentioned the species from the Hungarian expeditions with the »Najade«.

PARAMURICEA CHAMAELEON (v. Koch 1887)

23. VI. 48 . . . St. 96 . . . 144—137 m depth . . . One colony on a dead *Ostrea cochlear*.

According to Kükenthal (1924, l. c.) *Paramuricea chamaeleon* is a Mediterranean species which has its habitat between 50 and 100 m depth. The species does not seem to be recorded earlier from the Adriatic, and the present find is the more interesting, because the depth of the locality shows us that the species can live considerably deeper than we knew up till now.

PENNATULARIANS

VERETILLUM CYNOMORIUM (Pallas 1766)

18. VI. 48 . . . St. 142 . . . 42—16 m depth . . . One specimen.
18. VI. 48 . . . » 148 . . . 38—34 m » . . . One specimen.

The occurence of this shallow-water sea-feather in the Mediterranean is well-known (see Kükenthal[8]). Dr. F. Pax has kindly directed my attention to some earlier finds not noted by Kükenthal (1915): Heller (1868) mentions the species from Trieste, Stossich (1876) from southern Istria, and Matisz (1899) from Rijeka. To this must be added that one specimen collected near Kotor in November, 1931, is kept in the Zoological Museum in Zagreb and has been examined by Dr. Pax. The two finding places of the »Hvar«-Expedition are situated near the Albanian coast (see map 3).

FUNICULINA QUADRANGULARIS (Pallas 1766)

A. Finding places of *F. quadrangularis* and *Pennatula phosphorea:*

Date	St.	Depth m	Species	Relative frequency
6. III. 48	4	36	*P. ph. rubella.*	rr
10. III. 48	15	75	*F. quadrangularis*	rr
15. III. 48	35	110	*P. ph. candida.*	rr
29. III. 48	44	220	*F. quadrangularis*	1
29. III. 48	37	130-140	*P. ph. candida.*	rr
30. III. 48	59	220	*P. ph. candida.*	rr
3. IV. 48	70	110	*P. ph. candida.*	rr
13. IV. 48	71	122	*F. quadrangularis*	rr
14. IV. 48	62	154	*P. ph. candida_rubella.*	rr
14. IV. 48	54-63	168	*P. ph. candida.*	c
15. IV. 48	52	188	*P. ph. candida_rubella.*	rr
15. IV. 48	50	256	*P. ph. candida_rubella.*	rr
18. IV. 48	77	150	*P. ph. candida*-rosy.	4
19. IV. 48	88	129	*P. ph. candida.*	rr
19. IV. 48	89	154	*F. quadrangularis*	c
2. V. 48	101	96-113	*P. ph. rubella.*	r
3. V. 48	93	168-172	*P. ph. candida.*	+
			F. quadrangularis	2 (1 big, 1 small
3. V. 48	99	170-177	*P. ph. candida_rubella.*	1
6. V. 48	108	110	*P. ph. rubella.*	rr

[8]) Pennatularia. — Das Tierreich, Lief. 43. Berlin 1915.

continued

Date	St.	Depth m	Species	Relative frequency
9. V. 48	103	173-141	*P. ph. candida.*	r
10. V. 48	92	61	*P. ph. candida-rubella*-rosy.	+
10 V. 48	97	128-132	*P. ph. candida.*	
			F. quadrangularis	
15. V. 48	118-116	146-245	*P. ph. candida-rubella.*	1
			F. quadrangularis (big and small specimens)	+
3. VI. 48	163	356-207	*F. quadrangularis*	6
11. VI. 48	150	123-124	*F. quadrangularis*	r
20. VII. 48	84-73	146-135	*P. ph. candida.*	rr
26. VII. 48	47	199-186	*F. quadrangularis*	cc
1. VIII. 48	85	161-153	*F. quadrangularis*	cc
18. VIII. 48	8	67-68	*P. ph. rubella.*	
			F. quadrangularis	
18. VIII. 48	10	71-73	*P. ph. rubella.*	4-5
25. VIII. 48	7	68-71	*P. ph. rubella.*	1
			F. quadrangularis	c
25. VIII. 48	9	71-78	*F. quadrangularis*	4
26. VIII. 48	14	77-79	*P. ph. rubella.*	1
28. VIII. 48	59	199-196	*P. ph. candida.*	2
			F. quadrangularis	1
28. VIII. 48	68	166-157	*P. ph. candida.*	+
29. VIII. 48	69	176-188	*P. ph. candida.*	rr
29. VIII. 48	60	210-238	*P. ph. candida.*	1
			F. quadrangularis	4
2. IX. 48	54-53	168-146	*P. ph. candida.*	rr
3. IX. 48	44-37	208-115	*P. ph. candida.*	rr
7. IX. 48	44	208-199	*F. quadrangularis*	c
7. IX. 48	37	115-155	*P. ph. candida.*	1
8. IX 48	43	220-210	*F. quadrangularis*	1
10. IX. 48	71	117-123	*F. quadrangularis*	+
11. IX. 48	70	110-137	*P. ph. candida.*	1
			F. quadrangularis	
11. IX. 48	52	188-183	*P. ph. candida.*	1
			F. quadrangularis	r
11. IX. 48	61	146-159	*P. ph. candida.*	r
12. IX. 48	79	117-137	*F. quadrangularis*	+
14. IX. 48	89	156-82	*P. ph. candida.*	3
			F. quadrangularis (big and small).	5
14. IX. 48	93	167-168	*P. ph. candida*-rosy.	1
14. IX. 48	94	117-119	*F. quadrangularis*	+
16. IX. 48	82	53-51	*P. ph. rubella.*	rr
21. IX. 48	77	152-144	*P. ph. candida.*	rr
21. IX. 48	87	144-138	*P. ph. candida.*	+
			F. quadrangularis	2
23. IX. 48	92	126-121	*P. ph. candida.*	2
			F. quadrangularis (small and of middle size).	c
24. IX. 48	97	126-122	*P. ph. candida.*	rr
24. IX. 48	104	126-128	*F. quadrangularis*	1
24. IX. 48	105	154-135	*F. quadrangularis*	r
15. XI. 48	99	170-174	*F. quadrangularis*	2
22. XI. 48	124	164-201	*P. ph. rubella.*	rr
28. I. 49	67	126-137	*P. ph. candida.*	r
11. II. 49	57	160-170	*P. ph. candida.*	2
22. II. 49	56	170-196	*P. ph. candida.*	1
22. II. 49	65	177-161	*P. ph. candida.*	2
10. III. 49	47	199-192	*P. ph. candida.*	6
14. III. 49	26	82	*P. ph. rubella.*	rr

Funiculina quadrangularis

B. Other localities recorded in the journals of the expedition

Date	St.	Depth m	Relative frequency	Remarks
28. II. 48	26	75	rr	
8. III. 48	9	72	25	
14. IV. 48	53	178	c	
18. IV. 48	79	126	c	
3. V. 48	107	138-139	r	
6. V. 48	111	130-144	c	
7. V. 48	114	176-183	+	
8. V. 48	121	150-152	c	with *Pennatula*
9. V. 48	106	186-181	c	with *Pennatula*
10. V. 48	104	128	5	
16. V. 48	119a	148	1	with *Pennatula*
17. V. 48	123	132-144	+	
17. V. 48	125	260-210	1	
3. VI. 48	163	356-207	5-6	
10. VI. 48	161	172-148	1	
17. VI. 48	145	196-155	6	
23. VI. 48	90-91	144-137	2	
15. VII. 48	107	138-150	+	
17. VII. 48	110	174-177	1	
21. VII. 48	64	172-186	+	with *Pennatula*
21. VII. 48	56	188-168	1	with *Pennatula*
29. VII. 48	57	157-150	1	with *Pennatula*
30. VII. 48	48	188-164	1	with *Pennatula*
30. VII. 48	58	157-137	1	with *Pennatula*
2. VIII. 48	65	170-186	4	
2. VIII. 48	75	115-113	2	
17. VIII. 48	13	71-71		
18. VIII. 48	10	71-73	+	
3. IX. 48	53	176-166	2	
11. IX. 48	61	146-159	r	with *Pennatula*
14. IX. 48	93	167-168	2 big + small	
9. XI. 48	111	130-149	4	
15. XI. 48	106	186-175	2	with *Pennatula*
18. XI. 48	118a	117-135	2	
20. XI. 48	126	116		
22. XI. 48	123	128-144	4	
24. XI. 48	132	125-174	1	
12. XII. 48	139	50-44	1	
8. I. 49	85	161-155	7	
8. I. 49	74	152-133	2	with *Pennatula*
9. II. 49	58	152-163	1	
10. II. 49	48	188-173	2	
9. III. 49	54a	174-163	3	
26. III. 49	13	69-71	1	
26. III. 49	12	75-77	2	
28. III. 49	17	79-84	2	with *Pennatula*
28. III. 49	24	80-87	1	
31. III 49	64	158-177	1	

Funiculina quadrangularis is a very common species on muddy bottom in the Adriatic. According to Kükenthal (1915, l. c.) it belongs to the lower parts of the littoral zone and to the deep sea.

The »Hvar«-Expedition caught the species in 57 places (map 2). Bathymetrically the localities range from 44 to 356 m depth: however, finds in shallower waters than 100 m are rather scanty.

— In 25 places the species was caught together with *Pennatula phosphorea,* and it is evident that these two species in most places live side by side on the Adriatic fishing grounds. On the other hand *Funiculina quadrangularis* descends to great depths and was west of Albania met with as deep as in 356 m, whereas the deepest find of *Pennatula phosphorea* is from 264 m. Although this may be fortuitous, it seems probable that investigations in the deeper parts of the Adriatic will push the border of *Funiculina's* habitat deeper down, whereas *Pennatula phosphorea* evidently has its lower limit with about 264 m in accordance with the available data from the Atlantic Ocean.

Funiculina quadrangularis was found by the »Hvar«-Expedition only in localites with temperatures between 10.7° and 14.6° C. These temperatures are somewhat higher than common in the Atlantic habitat, and the species in the Adriatic also seems to prefer somewhat higher salinities, viz. from 38.24‰ to 38.78‰. Only in one case was the salinity exceptionally as low as 37.66‰ (st. 43, 218 m depth).

The collections mostly consist of quite small specimens or fragments of somewhat larger colonies, and it is at present impossible to give an answer to the question whether a racial difference exists as compared with the Atlantic stock.

VIRGULARIA MIRABILIS (O. F. Müller 1776)

19. V. 48 . . . St. 139 . . . 51—44 m depth . . . Some specimens of the forma *multiflora* Kner.

The species had up till now only been recorded from the northernmost parts of the Adriatic (Kükenthal and Broch[9]). The new finding place near the Albanian coast is also the more interesting because with a depth between 51 and 44 m it ranges among the deepest finds recorded for this species (see map 2).

PENNATULA PHOSPHOREA (Linné 1758)

(Map 3)

Localities: see under *Funiculina quadrangularis.*

Pennatula phosphorea

B. Localities according to the journals during the expedition not found in the previous table

Date	St.	Depth m	Relative frequency	Remarks
8. III. 48	10	72	rr	
3. IV. 48	61	150	1	Light coloured.
14. IV. 48	53	178	2	Light coloured.
8. V. 48	119	155-183	1	Darker red-coloured.
9. V. 48	106	186-181	6	Light coloured.
4. VI. 48	166	179-108	1	Darker red-coloured.
8. VI. 48	165	44-47	1	Darker red-coloured.
17. VI. 48	141	88-97	1	Darker red-coloured.
20. VII. 48	73	146-135	2	
21. VII. 48	64	172-186	2	
21. VII. 48	55	186-225	1	
21. VII. 48	56	188-168	1	
26. VII. 48	47	199-186	1	
29. VII. 48	57	157-150	3	
30. VII. 48	48	188-164	1	
30. VII. 48	58	157-137	some 20	Darker red-coloured.
30. VII. 48	67	126-126	2	Darker red-coloured.
1. VIII 48	74	157-150	4	Darker red-coloured.
2. VIII. 48	65	170-186	rr	Darker red-coloured.
3. IX. 48	53	176-166	3-4	Light coloured.
11. XI. 48	121	146-148		Darker red-coloured.
15. XI. 48	99	170-174	5	Darker red-coloured.
15. XI. 48	106	186-174	3	
9. II. 49	58	152-163	1	Darker red-coloured.
11. II. 49	57	170-160	2	
28. III. 49	17	79-84	2	Darker red-coloured.

[9]) Pennatulacea. — Wiss. Ergebnisse d. deutschen Tiefsee-Exped., Bd. XIII, Berlin 1911.

Pennatula phosphorea is a strongly varying and almost cosmopolitan species, and Kükenthal (1915, l. c.) distinguished 6 sub-species, mainly basing on slight differences in the arrangement and comparative size of the spicula, especially of the under side of the leaves, partly also on the colours. — Jaworski[10]) is of the opinion that Kükenthal's sub-species *variegata, rubella, and candida* (the northern specimens) should be reduced to one, and that one other of the sub-species, viz. the japanese *longispinosa,* represents a separate species. For lack of material he did not take any definite attitude as to the sub-species *antarctica.* He thus acknowledges only three sub-species, viz. *candida* (Marmara Sea), *rubella* (= *variegata,* Mediterranean, northern Atlantic), and *californica* (California).

A study of the Adriatic collections gives as a result, that it is at present most correct to keep the Adriatic *rubella*-specimens apart from the northern *variegata*-form, which rather markedly deviates from them, especially in colours. Racial investigations demand large numbers of specimens, and as long as the variations have not been thoroughly disentangled, it is better not to throw together suspect groups. Jaworski is no doubt correct in his view concerning the independence of the »Marmaran« *candida* group as against the northern Atlantic *variegata* group (according to nomenclatorial rules, this sub-species probably correctly ought to be named *Pennatula ph. phosphorea).* His categorical declaration concerning the sub-species *rubella* is, like his paper on the whole, based on too scanty a material. Although also the present collections are too scanty to draw definitive conclusions, they seem to indicate that *rubella* in the sense of Kükenthal and Jaworski comprises two different variant groups: the very dark and mostly shallow living *rubella* group, and a lighter, mostly deep living *candida-rubella* group. The latter to a certain degree adjoins the northern *variegata* group in its composite colouring, whereas the shallower living, typical *rubella* is uniformly much darker coloured than northern specimens of *Pennatula phosphorea.*

Incidentally, the remark should be inserted here that especially in sea-feathers (and alcyonarians) it is most necessary to study living specimens. The colonies are capable of almost incredible contractions and movements, and measurements must be used with the utmost care in deductions as to taxonomic characterisations. Thus e. g., a character like »narrow« or »broad« leaves, is, in the present species, of very questionable value, like »long« or »short« tentacles in the polyps.

The accompanying map 3 gives the finding places of the »Hvar«-Expedition and at the same time indicates that the collections contain typical specimens of the Marmara sub-species *candida,* of the dark-coloured, typical sub-species *rubella,* and some specimens designated as *candida-rubella,* because their colours hold an intermediate position between the two first-named subspecies.

The sub-species *candida* (Marshall and Fowler 1888) was found in 30 localities, the subspecies *rubella* Köllicker 1869 in 8 places, and »intermediate« *candida-rubella* specimens in 5 localities. One of the latter localities with a depth of 256 m (St. 50) lies beyond the earlier known lower limit of the specific habitat in European waters, which according to Kükenthal (1915, l. c.) is in 220 m depth.

The sub-species *candida* occurs numerously in hauls from 110 to 220 m depth, the overwhelming majority between 130 and 200 m. The temperatures of the finding places range from 10.2° to 13.7° C. An exception, however, must be noted, viz., st. 105 with a temperature of 14.3° — The salinities are remarkably stable, varying only from 38.34‰ to 38.69‰, however, with one exception (st. 97) of 38.10‰. — It is questionable how these data stand as compared with those of the only previously registered locality of the sub-species, viz., the type locality of Marshall & Fowler in the Marmara Sea, where the depth, 50 m, at all events, seems rather aberrant.

The sub-species *rubella* which is typically, uniformly dark blueish red coloured, is more scantily represented in the collections. The proportion in numbers between *candida* and *rubella* is on the whole as 30:8. At the same time, the finding places of *rubella* are very scattered. Six of the localities show depths from 50 to 96 m, indicating that *rubella* decidedly prefers shallower waters than *candida.* However, more data are needed to draw definitive conclusions, because a seventh locality (st. 108) with a depth of 110 m touches upon the habitat of *candida,* and the last finding place (st. 124) even shows a depth between 201 and 164 m and is thus in the central part of the *candida* habitat.

Evidently *rubella* prefers somewhat higher temperatures than *candida,* the finding places showing temperatures from 11.8° to 14.5° C. The salinities vary from 38.44‰ to 38.71‰, with one remarkable exception (St. 14), where a salinity of only 36.60‰ has been recorded.

It was most surprising to find that some specimens from five localities, at first sight seemingly intermediate between *candida* and *rubella,* belong to the deepest part of the entire European habitat of the species on the whole. The depths of the finding places range from 154 to 256 m.

---

[10]) Geographische Rassen und Standorts-Modifikationen bei Seefedern. — Thalassia, Vol. III, Bolzano 1939.

Four of the localities show temperatures from 10·2° to 11.8° C; the last locality, however, (st. 116) showed in 233 m depth a temperature of 13.6°. (However, in one case (St. 61) some intermediate specimens of dubious character have been found as shallow as 61 m, the temperature here being 13.7° C.). — The salinities cover the space from 38.31‰ to 38.71‰.

The sub-species *candida* and *rubella* must at present be treated as »geographical races« (»Rassenkreise«), although their geographical ranges are as yet only very scantily known. In reality, the data from the »Hvar«-Expedition in the Adriatic and the single locality of Marshall & Fowler in the Marmara Sea cover our knowledge of *candida,* and as to *rubella* only the data from the »Hvar«-Expedition are quite reliable. This is caused by the enigmatic *candida-rubella* group of the deeper Adriatic parts of the *phosphorea* habitat, which has no doubt in other places in many cases been confused with true *rubella* specimens. Future investigations must be awaited before the riddle concerning this group of variants, which to a certain degree recalls the northern *variegata (phosphorea)* group, can be solved.

It may be objected to the interpretation of the two sub-species *candida* and *rubella* as »geographical races« that in the Adriatic they occur side by side. It is, however, obvious from the data of the »Hvar«-Expedition that the two groups probably prefer somewhat different ecological (hydrographical) conditions, and, accordingly, that their habitats in broad features are probably different. It must moreover be kept in mind that the term »geographical race« as yet must be looked upon as a working-theory. It still remains to verify it by tracing the occurrence outside the Adriatic.

A glance at the map 3 reveals an interesting feature in the horizontal distribution of the sub-species *candida* (and the species on the whole), viz., that it is lacking in all stations southwards of the Isl. Mljet. Considering the great number of stations in the fishing grounds from Mljet and southwards to the slope at Himara, this feature cannot be fortuitous. The distribution of the sub-species *candida* is therefore discontinuous: it is numerously met with on the fishing grounds in the median Adriatic, disappears in the southern Adriatic waters, and again turns up in the Marmara Sea. Whether it is common in the latter locality, has on the other hand yet to be stated. — The sub-species is also very scarce, if at all to be fond. in the shallower, northern part of the Adriatic. According to the present data it is probable that the sub-species is rather narrowly restricted in its ecological valence.

PTEROEIDES GRISEUM (Bohadsch 1761)

6. III. 48	St.	4		36 m depth	One specimen.
23. VIII. 48	»	4	37— 40 m	»	One specimen.
18. XI. 48	»	118a	117—135 m	» (F. Pax det.)	One specimen.

The species is rather common in the northern, shallow waters of the Adriatic. However, because the »Hvar«-Expedition almost only worked in somewhat deeper parts of the Adriatic, they only caught a couple of specimens in shallow water near Pula (see map 3).

The locality subsequently added by my friend Dr. F. Pax is of special interest. *Pteroëides griseum* has in the Adriatic up till now been found only in the northernmost, shallower part. The new locality on the slope SW of Lastovo indicates that the species may probably also live in more places off the Adriatic coasts, and that its habitat in Mediterranean waters thus in all probabilty is continuos. — The literature to my knowledge up till now gives only one exact date concerning depth of occurrence, viz. 60 m in the Bay of Tanger (see Kükenthal and Broch 1911, l. c.); otherwise seemingly implicitly it has been accepted that at all events in Mediterranean waters the species lives in rather shallow localities only. The locality SW of Lastovo in the Adriatic at all events pushes the lower limit of the habitat downwards to 117 m or more.

MADREPORARIANS

(Fig. 2)

The madreporarians generally prefer hard bottom and are accordingly scantily represented in catches from the trawling grounds.

CARYOPHYLLIA CLAVUS (Scacchi 1835).

	St.:	Depth, m:	
13. IV. 48	72	112	One dead specimen.
17. IV. 48	80	108	One dead specimen.

continued

7.	V. 48	114	176—183	One dead specimen.
10.	V. 48	97	128—132	One dead specimen.
10.	V. 48	104	128	One dead specimen.
17.	V. 48	123	132—144	One *living* specimen.
22.	VI. 48	122	225—183	Five dead specimens.
1.	VIII. 48	85	161—153	One dead specimen.
28.	VIII. 48	68	166—157	One dead specimen.
22.	IX. 48	124	164—201	One dead specimen.
12.	XI. 48	78	142—119	One dead specimen.

The specimens are attached to different supports: calcified worm tubes, shells of dead lamellibranchiates and gastropods, and, in one case on a piece of cinder. In some cases the supports had been broken away.

The external structure of the calices is to a certain degree varying. The wall of the calix is granulated, and even though the granulation in most cases must be characterized as fine and uniform, in other cases it is rather coarse and uneven. However, the upper part of the calix just below the aperture is always only delicately granulated. In all cases the septa are observed externally as longitudinal, fine ribs as emphasized by Döderlein[11]).

It may be a question whether the conditions of life on the trawling grounds are especially profitable for *Caryophyllia clavus*. It appears from the above table of finding places that the species was only once taken alive, in all the other ten localities only dead specimens were found.

COENOCYATHUS SP. ?

4. VI. 48 . . . St. 166 . . . 179—108 m depth . . . One defective, dead specimen.

The basal part of a single individual seems to belong to some species of *Coenocyathus*. The specimen is all but cylindrical, although with an approach at ovate in transverse section. The wall is externally very finely granulated, or almost level, and without longitudinal striation. The greatest diameter is 4.5 mm, the height of the fragment 5 mm. The specimen is by a broad base fixed to a pebble. The uppermost part of the calix has been cut off by a clean, transverse cut, and it is therefore impossible to give exact data as to the columella and pali. The septa have comparatively large spines on both sides and coalesce in the centre of the calix indicating the formation of a columella.

The specimen evidently belongs to the genus *Coenocyathus*, probably in the next neighbourhood of *C. dohrni* and *C. apertus* of Döderlein (1913, l. c.).

LOPHELIA PERTUSA (Linné 1758)

(Syn. *Lophelia prolifera* (L.), see Dons[12])

22. VII. 48 . . . St. 46 . . . 216—261 m depth . . . One large and robust, dead colony fragment.

The large fragment is from the basal part of one, or two, copiously branching, coalescing colonies. As is usual in *Lophelia* the branches coalesce when they touch,also when they come from different colonies. The network has been intervowen by tubes of large worms, probably the tubes have been inhabited by large specimens of *Eunice norvegica* (Gunnerus) like those of northern colonies, and these tubes have been imbedded in rather thick deposits of calcareous substance by the coral tissues, which grow out over the tubes. The original worm tubes, which in northern colonies show a parchment-like consistency, disappeared of course long ago. The worm tubes have an inner diameter of about 1 cm, and their calcareous walls are 1 to 1.5 mm thick, or even more. In this way the entire branchwork has grown almost into one heavy mass from which diverging branches in many places have originated. These branches, however, have mostly been broken away and are only indicated by basal fragments.

---

[11]) Die Steinkorallen aus dem Golf von Neapel. — Mitteil. a. d. Zool. Station zu Neapel, Bd. 21. Berlin 1913/14.

[12]) Coralla madreporaria norvegica in Linnei Systema naturae. Nomina corallorum saxa aedificantium. — D. Kgl. Norske Vid. Selsk. Forhandlinger, Bd. XVI. Trondheim 1943.

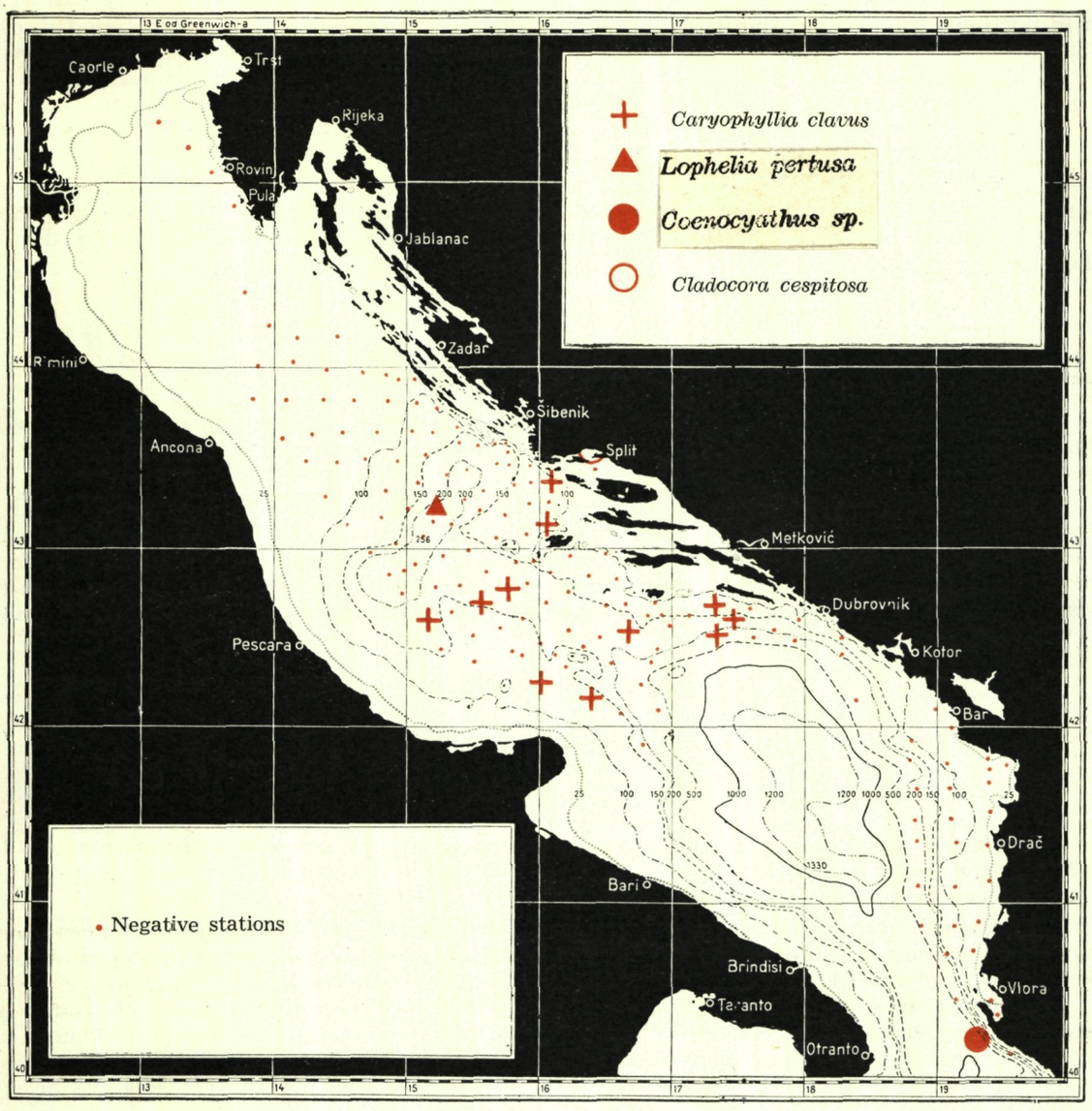


Fig. 2

The specimen is from a coral bank near Jabuka I. (43° 14' N., 15° 12.5' E., 216 m depth). The question is whether living specimens occur on the bank or not (comp. Heller[13]). Döderlein (1913, l. c.) does not say anything concerning this question, but sums up the occurrence as follows: »Mittelmeer: Zwischen Sizilien und Afrika, Golfe du Lion, 600—700 m., Adria«. Dr. F. Pax kindly directs my attention to Donati's (1750) description of a living »Madrepora« from Orsera, which Milne Edwards has interpreted as *Lophelia prolifera;* it is, however, impossible to identify the species on basis of Donati's paper. — Specimens of a madreporarian collected by Stossich near Šibenik have been compared with northern specimens of *Lophelia* by Heller (1868) and stated to be specific identical with these; nothing is said, whether the specimens were alive, when Stossich collected them, and it seems most probable that casually he has stumbled into the remains of an extinct *Lophelia*-bank in the neighbourhood of Šibenik.
deep.

Outside the Mediterranean *Lophelia pertusa* is reported to be almost cosmopolitan in its occurrence. However, living *Lophelia* prefer much greater depths in temperate and warmer seas

[13]) Die Zoophyten und Echinodermen des Adriatischhen Meeres. Wien 1868.

than in northern waters, and the literature shows that living specimens have been found in depths of 250 m or less only along the Scandinavian coast where colonies have been found living even in some 100 m depth in places with special ecological conditions (e. g., at the mouth of the Oslo Fjord, and in the innermost basin of the Trondheim Fjord, in Norway). In the Atlantic area south of the ridges from Scotland to Iceland living specimens evidently do not occur till about 4—500 m

The question is therefore also still open whether *Lophelia pertusa* today lives in some places in the Adriatic, and it is accordingly also as yet premature to draw conclusions based on the present find only. However, the dead *Lophelia* bank at Jabuka directs our thought to problems touching conditions of life in the Adriatic in the past — problems also connected with the study of the glacial periods.

CLADOCORA CESPITOSA (Linné 1758)

24. XII. 48 . . . St. 83 . . . 38 m depth . . . a few dead fragments.

The fragments are rather straggling branches of colonies which seem to have been of the *stellaria* growth type. On the other hand, the low numbers of septa in the calices decidedly point to the central *eu-cespitosa* group (see Broch 1935, l. c.).

I wish to express my best thanks to the leader of the Expedition, Dr. Tonko Šoljan, and to Prof. Otmar Karlovac, who kindly have placed their notes in the journals of the Expedition at my disposal and thus enabled me to extend my investigations beyond the limits set by the preserved material alone. My cordial thanks are also due to Dr. Ferdinand Pax, who has furnished me with the data concerning some specimens from the Expedition not included in the collections examined by me.

SUMMARY

Alcyonarian corals are represented by one species only, viz. *Alcyonium palmatum,* this being one of the most prominent bottom species of the trawl fishing grounds. It settles on any solid dead object of the bottom.

The colours of the colonies depend partly on the colouring of soft tissues, but mostly on the colours of the spicula. In most cases the colours of the fusiform spicula of the polyp crown agree with the colours of the spicula of the coenenchym, which lie deeper and show variations not dependent upon the colour of the small spicula of the bark of the coenenchym and the rudimentary calices of the polyps. — The colours of the colonies vary from light rosy red (or almost quite colourless) to blood-red ones, often with colourless polyps or also with orange-yellow tentacles and rudimentary calices of the polyps (like *Alcyonium brioniense);* some of the colonies are brick-red, orange or dark brown. — The main features of the spicula are rather stable, but there are extensive individual variations and it is impossible to distinguish a special form *adriatica* from the typical *palmatum* group.

Although neither the forms of the spicula nor the forms of the colonies make it possible to distinguish sub-species (or forms) of *Alcyonium palmatum,* the large collection (more than 70 examined colonies) hints to three colour groups: 1) dark-red (brick-red, carmine-red, blood-red, dark-brown); 2) orange, and 3) from light rosy-red to colourless (white) colonies (see Table on page 3, 4). According to depths of the finding places the bulk of the dark-red colonies is met with mostly in depths up to 100 m, whilst the majority of the orange and light coloured specimens usually occur at depths ranging between 100 and 200 m.

Alcyonium palmatum prefer salinities between 37.18‰ and 38.81‰; most of the colonies have been found in temperatures between 11.5° and 16° C. This species is distributed throughout the Adriatic in moderate depths and rarely descends into depths beyond 200 m, but, on the other hand, it can thrive at a depth of 50 m and even less than that. A combination of the optimal salinity and temperature make the trawling grounds of the median part of the Adriatic an ideal habitat of the species. In this area the colonies attain luxuriant forms rarely found elsewhere, and the question arises whether that fact may serve to distinguish a special sub-species.

Among the caught Gorgonarians the following are new species for the Adriatic: *Isidella elongata, Paramuricea placomus,* and *Paramuricea chamaeleon. Eunicella verrucosa,* not caught before at depths beyond 50 m, has been found as deep as 135 m during the cruises of the »Hvar«-Expedition. The depth border of both *Paramuricea* species has been pushed deeper down by these finds.

Among the Pennatularians *Veretillum cynomorium* were found on two stations not distant from each other, situated near the Albanian coast. *Funiculina quadrangularis* was found in 57 localities, with depths ranging from 44 to 356 m, but waters shallower than 100 m yielding scanty finds. This species often occurs side by side with *Pennatula phosphorea,* but can thrive at greater depths than the latter. The Adriatic finding places mostly show a temperature ranging between 10.7° and 14.6° C and a salinity between 38.24‰ and 38.78‰.

Virgularia mirabilis f. multiflora was found in the vicinity of the Albanian coast, at a depth of 51—44 m. This species has been previously known from the northern Adriatic only.

Pennatula phosphorea is represented in the Adriatic by the sub-species *candida* and *rubella;* but the latter clearly comprises two groups: 1) a typical one, of a uniformly dark colour (darker than the northern specimens) and 2) an intermediate group of a composite spotted colouring, recalling the sub-species *variegata* found in the northern regions. The latter group has been entered under the name *candida-rubella* in both the table (page 10, 11) and map 3.

The sub-species *candida occurs* in localities lying between 110 and 120 m, but it is most abundant at depths ranging between 130 and 200 m, particularly at temperatures between 10.2° and 12.7° C and salinities from 38.34‰ to 38.69‰. It is questionable how these data stand as compared with those of the original locality (Marmara sea, depth 50 m).

The sub-species *rubella* is uniformly very dark blueish-red coloured; the collection comprises a small number of localities. Six of the localities show depths from 50 to 96 m, and the seventh, with a depth of 110 m, reaches the upper border of the *candida.* But the station 124, with a depth between 201 and 164 m shows that further investigations as to the depth range are necessary. *Rubella* prefer a little higher temperature than *candida;* the temperatures of the finding places range between 11.8° and 14.5° C. It is surprising that the *candida-rubella* group prefers the deepest part of the entire European habitat of the species on the whole as its finding places occur at depths ranging between 154 and 254 m.

The *candida* and *rubella* groups must at present be treated as »geographical races«, although their geographical ranges are as yet very little known. Outside the Adriatic the *candida* group is certainly known in the Marmara only; its occurrence, however, being not yet traced south of Mljet Island in the Adriatic, the possibility of a discontinuous distribution cannot be declined in advance.

Pteroeides griseum, a species common in the northern, shallow waters of the Adriatic, were caught in the vicinity of Pula.

Madreporarians generally prefer hard bottom and occur rather scantily on trawling grounds. *Caryophyllia clavus* is relatively frequently met with, usually attached to different supports: calcified worm tubes, shells of dead lamellibranchiates and gastropods, etc. Caught specimens were mostly dead ones; only one specimen was taken alive.

One defective, dead specimen of *Coenocyanthus* was found, and in the vicinity of the Institute at Split fragments of *Cladocora cespitosa* were gathered.

Several typical, but dead specimens of the robust colonies of *Lophelia pertusa* were taken from the coral bank in the vicinity of Jabuka Islet. It is not certain whether also living specimens occur in the Adriatic any more (the available literature offers no positive data with regard to finds of living specimens of *Lophelia*). There are data confirming that this species was found in other parts of the Mediterranean at depths ranging between 600 and 700 m. This is in agreement with depths at which the species occurs at present in the moderate regions of the Atlantic; but it seems that the species can today thrive only north of Wyville- Thomson in as shallow water as on the bank near Jabuka Islet (216 m).

The dead *Lophelia* bank near Jabuka Islet directs our thought to earlier conditions of life in the Adriatic which are also connected with the study of the glacial periods.

Received for publication january 1952.

OKTOKORALJI I KAMENI KORALJI NA TRAWL-ERSKIM LOVIŠTIMA OTVORENOG JADRANA

HJALMAR BROCH (Oslo)

Institut za oceanografiju i ribarstvo, Split

KRATAK SADRŽAJ

Alcyonaria su zastupani samo jednom vrstom, *Alcyonium palmatum,* ali je ona jedna od najistaknutijih karakternih forma na lovištima otvorenog Jadrana podesnim za povlačenje mreže tipa trawl (vuča). Naseljuje se na svaki čvrst, mrtav predmet dna.

Boja kolonija potječuje djelomično od boja mekoga tkiva, a ponajviše od boja spikula. U većini slučajeva slažu se boje vretenastih spikula polipnih glavica s bojama spikula cenenhima, koje dublje leže i variraju nezavisno od boje malih spikula kore cenenhima i rudimentarnih čašaka polipa. Kolonije variraju od svijetlo ružičastocrvenih (ili gotovo sasvim bezbojnih) do krvavocrvenih, često s bezbojnim polipima ili također s narančastožutim tentakulima i rudimentima čašaka (dakle kao *Alcyonium brioniense);* neke su kolonije opekasto crvene, narančaste do tamnosmeđe. — Oblik spikula je istina u glavnim crtama stabilan, ipak individualno tako jako varira, da se ne može prema tomu odvojiti posebna forma *adriatica* od tipične *palmatum*-grupe.

Premda se ni prema formama spikula ni prema formama kolonije ne mogu u Jadranu razlikovati podvrste (ili forme) kod *Alcyonium palmatum,* opsežni materijal (nešto više od 70 ispitanih kolonija) pokazuje tri grupe boja: 1) tamnocrvene (opekastocrvenu, karminocrvene, krvavocrvene ili tamnosmeđe); 2) narančaste i 3) svijetlo ružičastocrvene do bezbojnih (bijelih) kolonija (tabela na str. 3, 4). Prema dubini nalazišta većina tamnocrvenih kolonija nalazi se pliće od 100 m, a većina narančastih i svijetlo obojenih obično između 100 do 200 m dubine.

Alcyonium palmatum voli salinitet između 37,18‰ i 38,81‰; najveći dio kolonija bio je nađen kod temperature između 11,5° i 16° C. Vrsta je u umjerenoj dubini rasprostranjena po cijelom Jadranu i ide rijetko dublje od 200 m, ali s druge strane može uspijevati i na 50 m ili čak nešto pliće. Kombinacija optimalnih saliniteta i temperatura potvrđuje, da lovišta srednjeg Jadrana moraju biti idealna za vrstu. U tom području kolonije dobivaju bujne oblike kao inače rijetko gdje, a veliko je pitanje, da li bi se prema tome mogla ustanoviti neka posebna podvrsta.

Između ulovljenih gorgonarija nove su vrste za Jadran: *Isidella elongata, Paramuricea placomus* i *Paramuricea chamaeleon. Eunicella verrucosa,* koja se do tada nije lovila dublje od 50 m, na krstarenjima ekspedicije »Hvar« bila je nađena u dubini od 135 m, i granice dubine obiju vrsta *Paramuricea* bile su ovim nalazima također pomaknute nešto na niže.

Od penatularia *Veretillum cynomorium* je nađen na dvije blize postaje nedaleko od albanske obale. *Funiculina quadrangularis* bila je nađena na 57 lokaliteta. Dubine variraju od 44 do 356 m, ali su ipak rijetka nalazišta plića od 100 m. Vrsta se javlja često združena s *Pennatula phosphorea,* ali zalazi u veće dubine nego ona. Jadranska nalazišta pokazuju ponajviše temperaturu između 10,7° i 14,6° C, a slanost između 38,24‰ i 38,78‰.

Virgularia mirabilis f. multiflora, koja je do sada bila poznata samo iz sjevernog Jadrana, bila je ulovljena nedaleko od albanske obale na samih 51—44 m dubine.

Pennatula phosphorea javlja se u Jadranu u podvrstama *candida i rubella;* ali se potonja jasno dijeli na dvije grupe: 1) tipičnu, jednolično tamno obojenu grupu (tamnije nego sjeverni primjerci vrste) i 2) poprskano išaranu prelaznu grupu, koja se približava podvrsti *variegata* sjevernih područja; potonja je na tabelu (str. 10, 11) kao i na kartu 3 unesena kao *candida-rubella.*

Podvrsta *candida* obiluje na mjestima između 110 i 220 m dubine, ali je pretežno vrlo česta između 130 i 200 m, ponajviše kod temperature od 10,2° do 13,7° C i kod slanosti koje se kreću samo od 38,34‰ do 38,69‰. Za sada nije sigurno, kako se ti podaci odnose prema podacima originalnog lokaliteta (Mramornoga mora, 50 m dubine).

Podvrsta *rubella* je jednolična, vrlo tamno plavocrveno obojena i u materijalu zastupana na malom broju lokaliteta. Šest nalazišta pokazuju dubinu od 50 do 96 m, a sedmo dopire do gornje granice *candida* sa 110 m. Ipak postaja 124 s dubinom od 201 do 164 m pokazuje, da su potrebna daljnja istraživanja što se tiče odnosa dubine. *Rubella* voli nešto višu temperaturu nego *candida;* temperatura nalazišta varira od 11,8° do 14,5° C. Iznenađuje nas, da *candida-rubella* grupa voli najdublji dio svega evropskoga životnog područja vrste, jer nalazišta pokazuju dubinu od 154 do 254 m.

Grupe *candida* i *rubella* moraju se za sada smatrati »rasnim krugovima«, premda su geografski vrlo malo poznate. Izvan Jadrana »*candida* je, sa sigurnošću poznata samo iz Mramornoga mora; budući da u Jadranu nije još dokazana južno od otoka Mljeta, ne može se unaprijed odbiti mogućnost diskontinuiranoga rasprostranjenja.

U plitkom, sjevernom Jadranu obična vrsta *Pteroeides griseum* bila je ulovljena blizu Pule.

Madreporaria su obično vezana za tvrdo dno i stoga rijetka na lovištima povlačnim mrežama. Relativno često nalazi se *Caryophyllia clavus,* koja se naselila na ovapnjele cijevi crva, na ljušture mrtvih školjkaša, puževa i sl. Po najviše su primjerci mrtvi; samo u jednom slučaju bio je nađen živ individuum. I mrtav odlomak *Coenocyathus* sp. bio je nađen. Nedaleko od Instituta u Splitu sakupljeni su odlomci kolonije *Cladocora cespitosa.*

S koraljnoga grebena u blizini otoka Jabuke ima nekoliko tipičnih, ali mrtvih odlomaka bujnih kolonija *Lophelia pertusa.* Ne zna se sigurno, da li vrsta danas u Jadranu živi (pristupačna literatura nema sigurnih podataka o nalazima živih primjeraka *Lophelia*). Iz drugih dijelova Sredozemnog mora ima podatak, da je vrsta bila ulovljena između 600 i 700 m. To se slaže s dubinama, gdje vrsta u umjerenim atlantskim područjima danas živi; tako plitko kao na grebenu kod Jabuke (216 m) čini se da vrsta može živjeti u naše vrijeme samo sjeverno od Wyville-Thomson.

Mrtvi greben kod Jabuke upućuje s toga naše misli na Jadranske životne uvjete prošlosti, koji su u vezi s proučavanjem Ledenoga doba.

Map 1

Alcyonium palmatum

● = — Finding places according to specimens examined by the author

✦ = — Additional finding places according to the journal kept during the Expedition

------- = — Combined stations

. = — Negative stations

Map 2

Funiculina quadrungularis

● = — Finding places according to specimens examined by the author

✦ = — Additional finding places according to the journal kept during the Expedition

○ = — *Virgularia mirabilis*

---- = — Combined stations

. = — Negative stations

Map 3

○ = — *Pennatula phosphorea candida*

◯ = — *Pennatula phosphorea rubella*

× = — *Pennatula phosphorea candida-rubella*

} Finding places according to specimens examined by the author

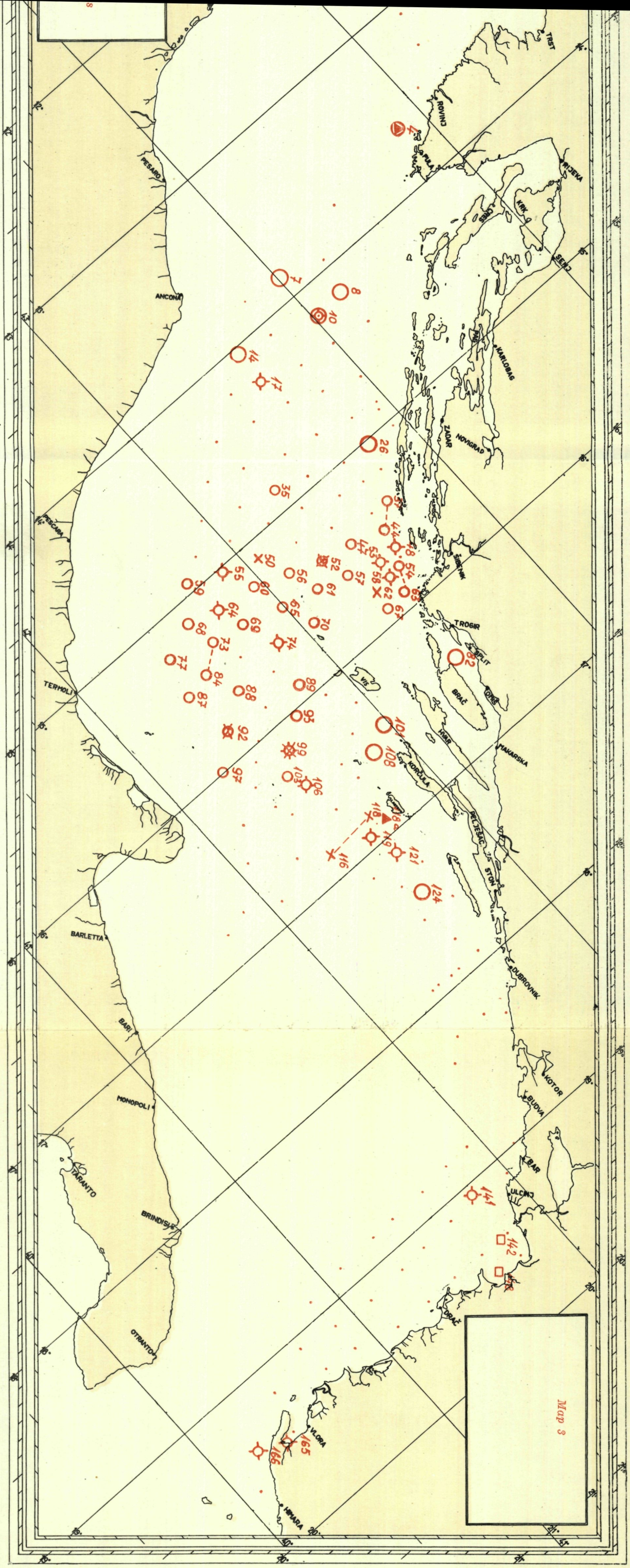
⊙ = — *Pennatula phosphorea.* Additional finding places according to the journal kept during the Expedition

▲ = — *Pteroëides griseum*

□ = — *Veretillum cynomorium*

– – – – = — Combined stations

. = — Negative stations


TRST
ROVINJ
PULA
RIJEKA
KRK
CRES
SENJ
PESARO
ANCONA
KARLOBAG
RAB
ZADAR
NOVIGRAD
ŠIBENIK
PESCARA
TROGIR
SPLIT
BRAČ
HVAR
KORČULA
VIS
PELJEŠAC
STON
DUBROVNIK
TERMOLI
BARLETTA
BARI
MONOPOLI
TARANTO
BRINDISI
OTRANTO
KOTOR
BUDVA
BAR
ULCINJ
DURAZ
VLORA
HIMARA
Map 3