THE BENTHIC COPEPODA OF THE SIRBONIAN LAGOON (SABKHAT EL BARDAWIL)

by

F.D. Por

Department of Zoology,
The Hebrew University of Jerusalem

Résumé

Les Copépodes benthiques du lagon sirbonien (Sabkhat el Bardawil).

Le Sirbonis ou lagon sirbonien (Sabkhat el Bardawil) est un important lagon s'étendant sur les côtes septentrionales de la Péninsule du Sinaï. En 1969, les ouvertures sur la mer furent partiellement fermées par des bancs de sable. De ce fait, la salinité, comprise normalement, entre 39 et 70 p. 1000 monta jusqu'à plus de 90 p. 1000.

L'auteur décrit quinze espèces de Copépodes benthiques trouvées dans ce lagon ; *Robertsonia salsa, Heterolaophonte quinquespinosa, Cletocamptus confluens* et *Neocyclops salinarum* supportent une salinité dépassant 80 p. 1000 ; seul, *Cletocamptus confluens résiste* à 100 p. 1000. *Paramphiascella sirbonica* n. sp. est décrit. *Robertsonia salsa* est rétabli comme espèce valable. *Neocyclops salinarum* et *Heterolaophonte quinquespinosa* sont redécrits et discutés. Le mâle de *Mesochra rostrata* est également décrit pour la première fois.

Au point de vue zoogéographique, la plupart de ces espèces sont des immigrants indo-pacifiques.

Introduction

The Sirbonian Lagoon, a system of hypersaline waterbodies along the Mediterranean coast of Sinai (Fig. 1), has been, since 1967, one of the main research areas of a joint project of the Hebrew University and the Smithsonian Institution. The Lagoon, measuring 700 square kilometers, is a big salt swamp which has been artificially turned into a 2-3 m deep lagoon. Three openings to the sea were built and/or artificially maintained during the last few decades and the Lagoon served as a feeding ground for a very productive fish population. By 1969, two of these openings became obstructed by sand bars. Consequently, the salinity of the Lagoon increased steeply.

It is evident that the fauna of the « open » lagoon, with salinities fluctuating between 45-70 p. 1000, has been built up from two sources: highly euryhaline species which lived and survived in the old hypersaline swamps and euryhaline marine species which penetrated through the artificial openings. Presently, the fauna is reverting to the situation which probably existed in the salt swamps over millenia and the overall salinities are around 80-90 p. 1000.

Under the conditions of the open lagoon, there existed a very clear gradient of increasing salinities from the openings to the more

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distant corners of the lagoon, especially to the high salinity point of Nakhal Yam (Mitzfaq), the locality most distant from the openings. This gradient has now almost disappeared in the big eastern basin of the Sirbonian Lagoon. There existed also, as shown by Ben Yami

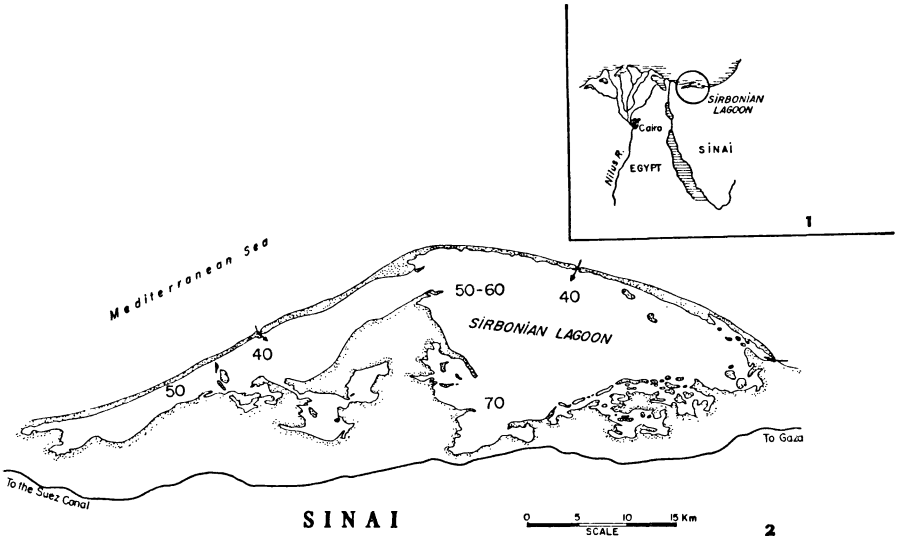


FIG. 1 and 2

1. Location map of the Sirbonian Lagoon; 2. salinities (p. 1000) in the Sirbonian Lagoon, while openings were functioning.

(in letteris) a very marked seasonal fluctuation in the salinities, with a high in october and a low in march-april. At places, the fluctuation was as much as 20 p. 1000. This seasonal fluctuation still exists after the closure of the openings, but the range is probably much narrower.

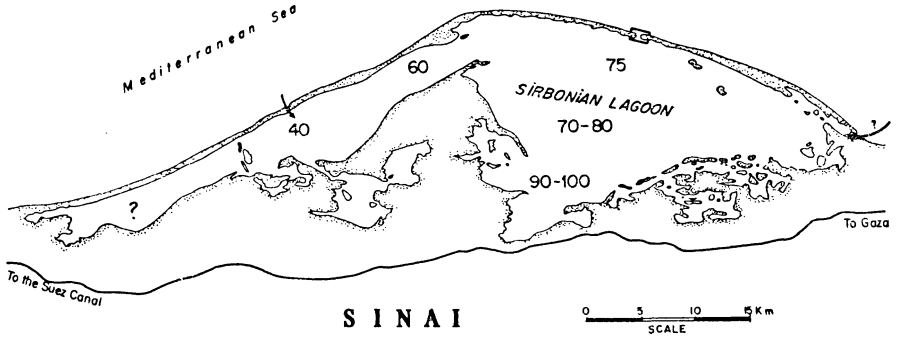


FIG. 3

Salinities (p. 1000) in the Sirbonian Lagoon after partial closure of the openings.

A schematic representation of the salinities, while the openings were functioning, and after the closure of two of them, is shown in Fig. 2 and Fig. 3. It should be added that, on the sand bars and islands, there is a variety of salt pools with salinities as high as 311.8 p. 1000.

There are only preliminary data concerning the other groups of the zoobenthos in the Sirbonian lagoon (see also Por, 1971). At any rate, when the lagoon openings were free, the macrobenthos of the level bottoms was represented by portunids and penaeids, *Cardium edule* and *Pirenella conica* (Mollusca) and the bottoms were covered by extensive growths of *Ruppia maritima*. On the vegetation, the sabellid polychaet *Augeneriella lagunari* (Gitay, 1970) and a *Cordylophora* like hydrozoid were very common. On the few wooden structures in the lagoon grew *Mytilus variabilis* and *Balanus improvisus*. Besides the copepods, the meiobenthos was represented by a few nematods and amphipods, many chironomids (among them *Cricotopus mediterraneus*, as identified by Y. Margalit) and big numbers of ostracods (*Cyprideis littoralis* and *Aglaiella* sp., as identified by Ruth Seggev). At some times and in some localities, big numbers of mysids and watermites could be found. As shown below, along with the copepods, the whole variety of the zoobenthos undergoes considerable impoverishment following the rapid increase in salinities of the last years.

THE COPEPODA AND THEIR RELATION TO SALINITY

There is a surprisingly rich fauna of benthic copepods in the lagoon. To date, 15 species of harpacticoids and one species of cyclopoids have been identified:

Harpacticoida

Longipedia minor T. et A Scott
Canuella perplexa T. et A Scott
Canuellina insignis Gurney.
Harpacticus flexus Brady et Robertson
Stenhelia minuta A. Scott
Robertsonia knoxi (Thompson et A. Scott)
Robertsonia salsa (Gurney)
Robertgurneya similis (A. Scott)
Paramphiascella sirbonica n.sp.
Nitocra lacustris (Schmankewitsch)
Nitocra affinis Gurney
Mesochra rostrata Gurney
Enhydrosoma vicinum Por
Cletocamptus confluens Schmankewitsch
Heterolaophonte quinquespinosa (Sewell)

Cyclopoida

Neocyclops salinarum (Gurney)

Samples of Copepoda have been collected in the lagoon from different sites and at different dates (21.7.67; 13.3.68; 10.9.69; 20.1.70; 23.6.70).

A number of species (*Canuella perplexa, Stenhelia minuta, Robertgurneya similis, Paramphiascella sirbonica* n. sp., *Nitocra affinis, Mesochra rostrata* and *Enhydrosoma vicinum*) are always found only in the vicinity of the openings and the limit of their salinity tolerance is situated probably around 45 p. 1000.

Another four species (*Longipedia minor, Canuellina insignis, Harpacticus flexus* and *Robertsonia knoxi*) are still of marine origin but being able to survive at salinities up to 65-70 p. 1000, they are widespread in the Sirbonian Lagoon, when the openings are active.

Presently, they are restricted to the narrow, western part of the lagoon, where the normal influence of the sea is still felt.

Robertsonia salsa and *H. quinquespinosa* were still found at salinities of around 85 p. 1000, in september 1969. However, they probably do not survive at such salinity for a long period since in june 1970 when, at neighbouring sites, salinity dropped to 76.7 p. 1000, these species were no longer found.

Only two species, *Cletocamptus confluens* and *Neocyclops salinarum* can survive salinities of over 90 p. 1000. In june 1970, they thrived in big numbers all over the eastern basin of the Sirbonian Lagoon and were found at S 91.05 p. 1000 near Nakhal Yam. Besides

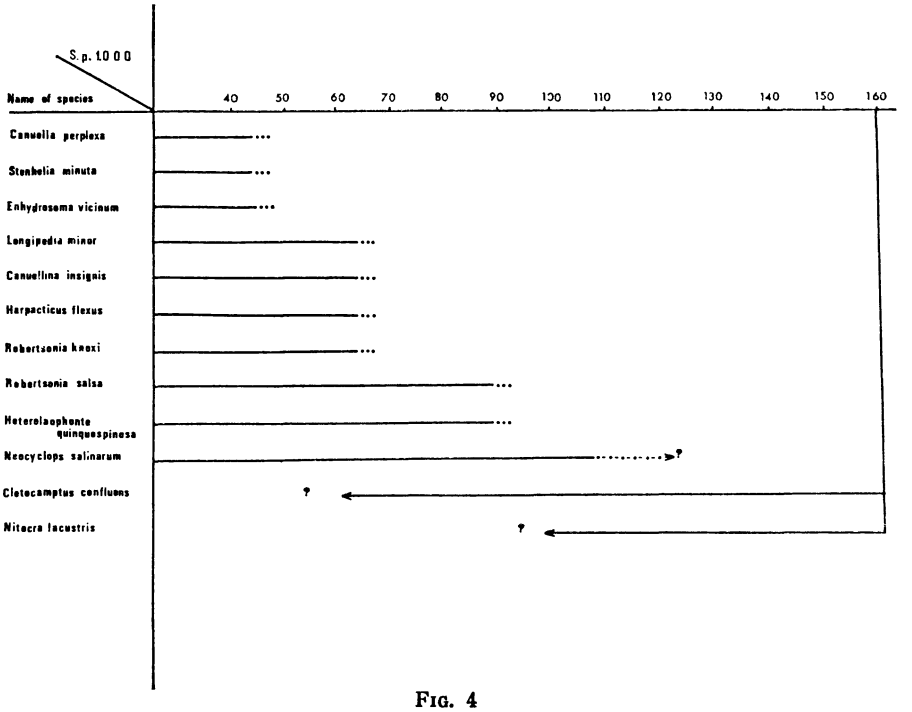


FIG. 4
Distribution of benthic copepods in the Sirbonian Lagoon according to the salinity.

them only four other benthic invertebrates survived from the original rich zoobenthos (Por, 1968): the ostracod *Cyprideis littoralis*, the sabellid polychaete *Augeneriella lagunari*, the chironomide *Cricotopus mediterraneus* and one species of nematods. *Cletocamptus confluens* appears first at salinities of around 60 p. 1000.

In the highly hypersaline pools on the sand bars, two copepods are living: *Nitocra lacustris* and *Cletocamptus confluens*. *N. lacustris* was never found in the lagoon proper. In the pools, salinity is probably always well over 100 p. 1000. In a pool of 169.5 p. 1000 for instance, both species were still found. At 311.8 p. 1000, the highest water-salinity measured, there was no fauna.

The relation of the copepod species to salinity is tabulated in Fig. 4.

General faunal connections

Besides *Paramphiascella sirbonica* n. sp., and *Enhydrosoma vicinum,* described and until now found only at Elat, all the other species are known from the area.

As many as 12 species are known from the waters of, or connected with, the Suez Canal. *Canuellina insignis, Canuella perplexa, Stenhelia minuta, Robertsonia knoxi, Nitocra affinis* and *Mesochra rostrata* have been reported from the open waters of the Suez Canal (Gurney, 1927 ; Por and Marcus, 1973). *Longipedia minor, Robertsonia salsa, Nitocra lacustris, Cletocamptus confluens* and *Neocyclops salinarum* are known from lagoons and salt pools related to the Canal. *N. lacustris* has recently been found (Por and Marcus, op. cit.) in a salt pool near the Great Bitter Lake, at S 93.15 p. 1000. This species accompanies the dominant *R. salsa* also in the Solar Lake near Elat, at salinities of over 80 p. 1000 (Por, 1969).

The Indopacific immigrants living in the lagoon are *Canuellina insignis, Stenhelia minuta, Mesochra rostrata* and *Enhydrosoma vicinum. Robertsonia salsa,* known only from waters of the Sinai peninsula, might eventually be considered a Red Sea immigrant (1). Both *Canuella perplexa* and *Harpacticus flexus* are Atlanto-mediterranean species which have penetrated the Suez Canal. Up until now, *Neocyclops salinarum* was known only from the Suez area and from the Rhone Delta. *Heterolaophonte quinquespinosa* and *Nitocra affinis* are probably circumtropical species. *Robertgurneya similis* and *Robertsonia knoxi* are wide spread and even cosmopolitan.

SPECIAL SECTION

Neocyclops salinarum (Gurney) 1927 (Tab. I, II and Plate I, 73, 74).

The Sirbonian populations of *N. salinarum* served to elucidate the taxonomic confusion around this species.

N. salinarum became the type species of a genus which now obviously includes species which do not belong together (see Herbst, 1964; Plesa, 1961). Herbst even describes a *Neocyclops salinarum?* which is completely different from the type species. This mistake arises from the conception that the number of eight joints of the antennula in *N. salinarum* is not constant and that species of the genera *Eurycyclops* and *Pareuryte* which have twelve antennular segments can be included in the genus *Neocyclops* too. The number of antennular segments is however a very stable and taxonomically useful criterium in the Cyclopoida. Having seen many specimens of

(1) There is a *Robertsonia* reported from Australian salines, by Bayly (1966) which eventually might be *R. salsa.*

N. salinarum from the Sirbonian lagoon, specimens which, in fact, might be considered topotypes of Gurney's specimens, I am convinced of the stability of this character, as given by Gurney (1927a, 1927b).

Full illustration for the *N. salinarum* specimens, both males and females, is given. Some further points could therefore be clarified.

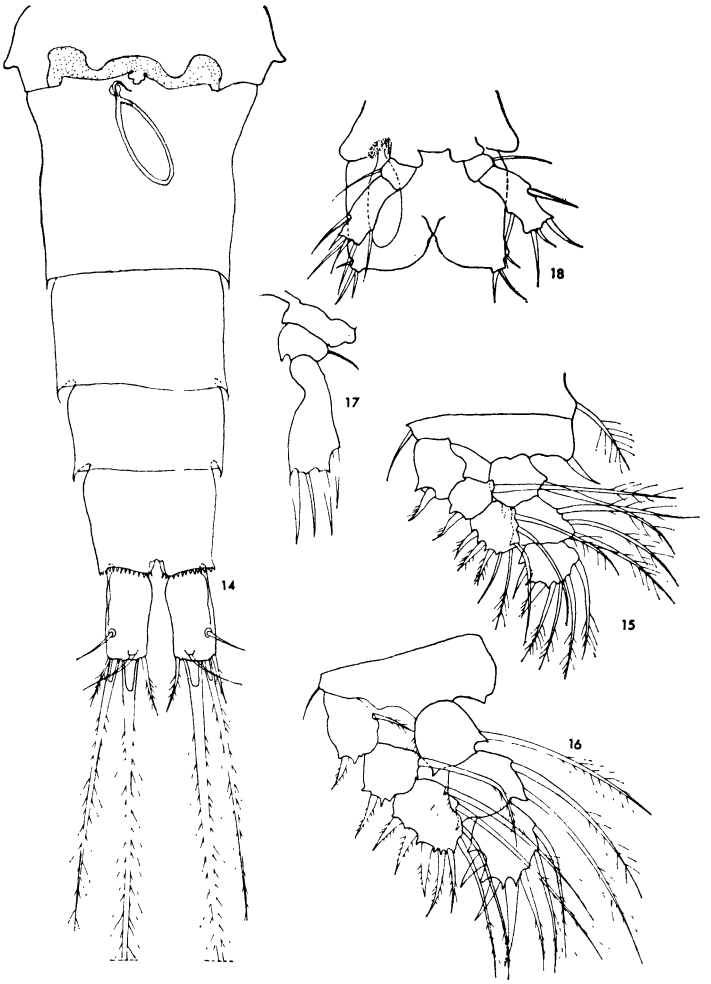
TAB. I. *Neocyclops salinarum* Gurney

5. Antennula female; 6. Antennula male; 7. Antenna; 8. Labrum; 9. Mandibula; 10. Maxillula; 11. Maxilla ; 12. Maxillipede; 13. P IV.

The antennula is 8-segmented in the female and 13-segmented in the male. Labrum is identical with the type.

The mandible is entirely devoided of a palp or any seta. The setation of the maxillula is different from the drawing given by

Gurney; the palp has three spical setae instead of two; the spines of the basis are also different. The maxilla figurated by Gurney is erroneous: the palp is totally different and the basal endite has been overseen. The maxillipede is similar but does not present an additional (fourth) seta on the basal joint, while the small last joint has one seta more.



TAB. II. *Neocyclops salinarum* Gurney

14. Abdomen, female, ventral view; 15. P I; 16. P III; 17 P V, female; 18. P. V and P VI, male.

The legs are figurated and have the following armature formula:

	Ex.	End.
P I	0.1.323	1.2.321
P II	1.1.333	1.2.321
P III	1.1.333	1.2.321
I IV	1.1.332	1.2.321

P V of the female corresponds to the type. The male P V has also three points and an additional internal seta. P VI as in Tab. II, 18.

The shape of the receptaculum seminis is typical. The same goes for the shape of the abdominal segments and the furca. The ventral row of small spines above the furcal insertions should be emphasized.

Discussion

Neocyclops as seen now is characterized by the 8-segmented antennula and the lack of any palpal seta on the mandibula. There is no reason to include into this genus the species described under the genera *Eurycyclops* (Sewell 1949, Plesa 1961) and *Pareuryte* (Herbst 1955, 1962). There do not seem to be sufficient reasons to create subgenera as proposed by Verwoort (1962) and accepted by Wells (1967).

The only other locality for *Neocyclops salinarum* Gurney, besides Lake Menzala, the Suez Canal and the Sirbonian Lagoon is the Camargue in S. France whence it has been reliably reported by Aguesse and Dussart (1956).

Robertsonia salsa (Gurney) (Tab. III-VI ; Plate I, 75-77.)

In his short note on the Copepods of a brine pool near Kabret (1927 a) Gurney described *Robertsonia salsa.* In the next study (1927 b), Gurney already feels justified to consider *salsa* to be merely « Form B » of *Robertsonia knoxi.* He also mentions the close similarity with *R. diadematata* Monard, a Mediterranean species. Lang (1938) accepts Gurney's view of equating *R. salsa* with *R. knoxi* while expressing some doubts with respect to the opinion of Gurney concerning *R. diadematata.*

Finding now—50 years after Gurney—*R. knoxi* together with *R. salsa* in the Sirbonian Lagoon, while both species are easy to recognize and even show marked ecological differences with regard to salinity—induced me to establish the validity of *R. salsa* (Gurney). Both species have been found together also in our Suez Canal material. *R. salsa* alone is a mass-inhabitant of the hypersaline Solar Lake near Elat (Por, 1969).

The features once given by Gurney as characteristic for « Form B » as compared with « Form A » of *R. knoxi* are all found in the two populations of *R. salsa* (Sirbonian Lagoon and Solar Lake) on which the present description is based.

Female. 0.69-0.85 mm. Abdominal segments covered with several lateral rows of hair and one marginal row. The last segment also bears two supplementary rows. The hair and spine cover of the abdominal segment, is thus much richer than that of *R. knoxi* (Tab. V). The furcal branches are about twice as broad as long. The first spine from the external edge is 2/3 times longer than the following spine. This is relatively longer and smooth and not pennated and short, as in *R. knoxi.*

The rostrum and antennula are shown in Tab. III 20. The last antennular joint bears a long pennated seta —unlike *R. knoxi*— and also two surface spines. Antenna is characterized by the two, parallel rows of surface spines on the last segment.

The mouthparts are illustrated in Tab. III 22-25. They all show minor differences as compared to *R. knoxi.*

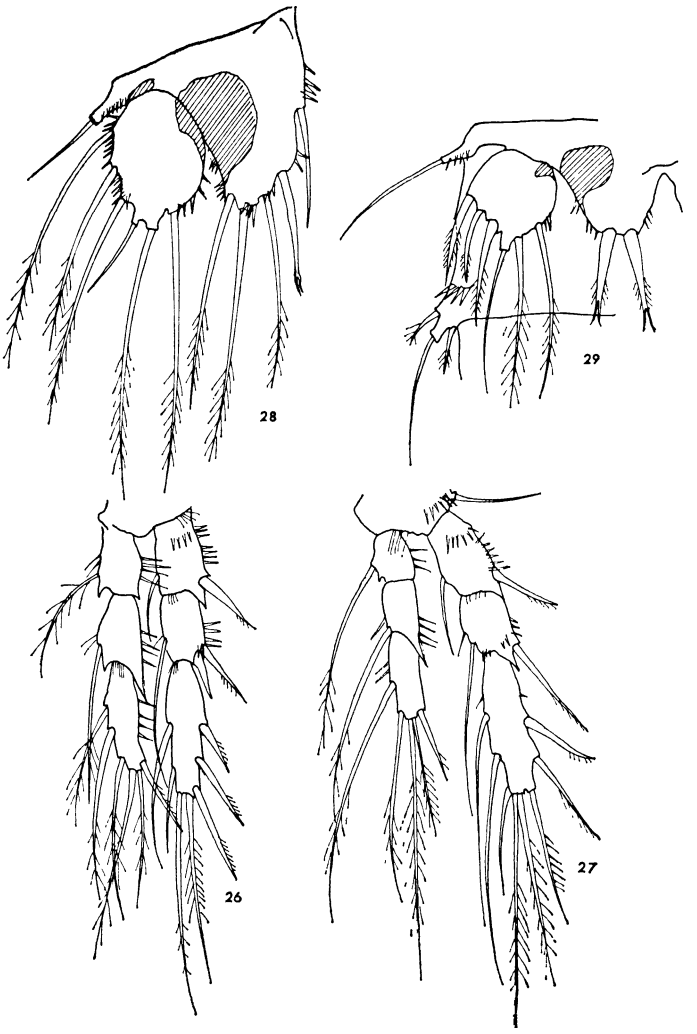
TAB. III. *Robertsonia salsa* (Gurney)

19. Second nauplius stage; 20. Antennula and rostrum, female; 21. Antenna; 22. Mandibula; 23. Maxillula; 24. Maxilla; 25. Maxillipede.

P I endopodite is much more robust and shorter than in *knoxi;* length relations between the joints are different too. All the setae of the endopodite in our species are much longer than in *R. knoxi,* especially that on first segment.

The swimming legs (Tab. IV, 26, 27) have the same armature as in *knoxi* but there are several minor differences which although relevant are of little practical use in discussing the two species.

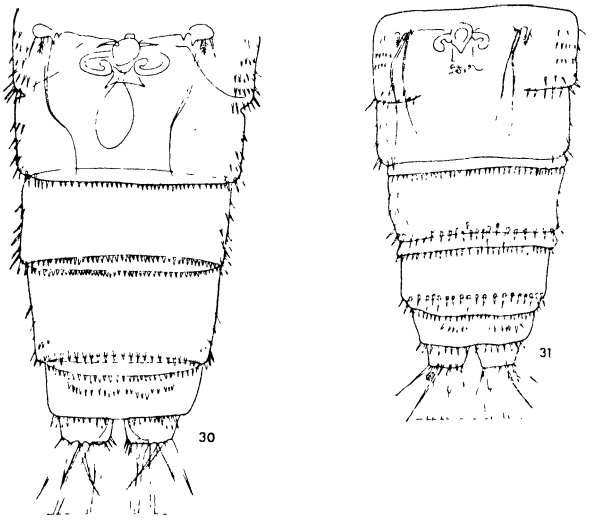
P V has also on the average much longer setae than in *R. knoxi;* thin apical seta of the exopodite however is relatively shorter and weaker than in the other species. The hyaline field on the exopodite in *R. salsa* is much smaller and almost reduced.



TAB. IV. *Robertsonia salsa* (Gurney)
26. P III, female; 27. P V, female; 28. P V, female; 29. PV and P VI, male.

The differences emphasized by Gurney in the structure of the genital field are found also in our specimens. The lateral branches are coiled in a spiral in *salsa* (Plate I, 76), whilst in *knoxi* they are only bent in a right angle (Plate I, 77). The genital segment itself shows no trace of ventral division in *R. salsa.* There are two long setae among the three of P VI in *knoxi* and only one in *salsa.*

Male. 0.56-0.7 mm. Antennula is 9-segmented. The presence of a very strong spine and of two trifide ones on the fourth segment should be emphasized. In the dimorphic teeth on P I basipodite, there are no significant differences between the two species, unless the fact that the angle between the teeth is smaller in *salsa* than in *knoxi* is taken into account.



TAB. V. *Robertsonia salsa* (Gurney)

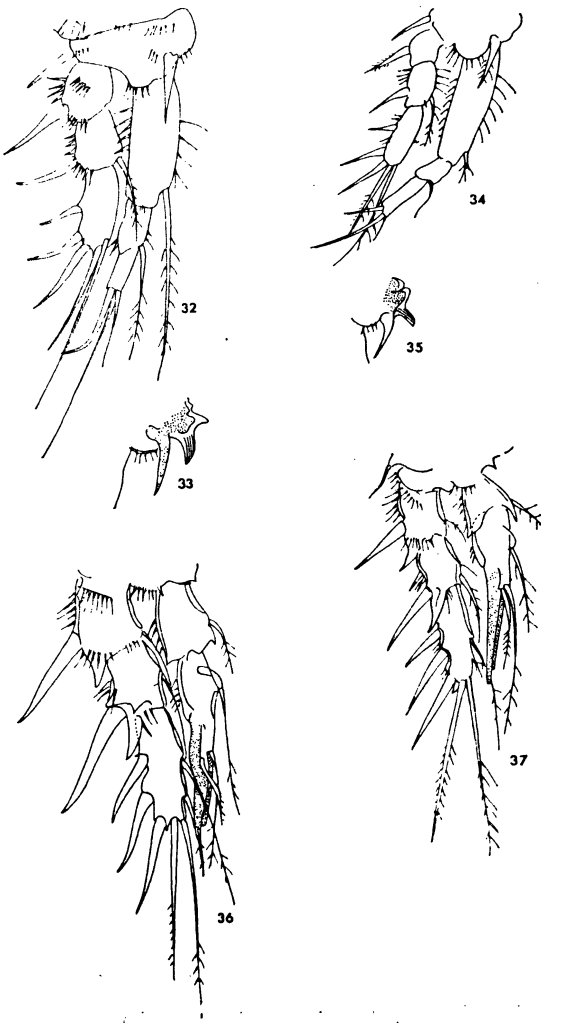
30. Abdomen, female, ventral view; *Robertsonia knoxi* (Thompson et A. Scott).
31. Abdomen, female, ventral view.

In the P II, besides other less obvious differences, two should be mentioned: the external spur of the endopodite is sinuous and not straight as in *knoxi* and the external apical seta is modified too into a falciform structure. P V and P VI are shown in Tab. IV, 29.

The second stage nauplius is also illustrated (Tab. III, 19).

Discussion

Summing up the differences between *R. salsa* and *R. knoxi,* size should be emphasized: the females of the former species have sizes between 0.69-0.85 mm, while those of the second have sizes around 0.50 mm. The differences in the structure of the genital fields are a most reliable criterium to assume the intersterility of the two species. The ecological difference —*R. salsa* being much more euryhaline— should also be considered. *R. salsa* appears alone in water-bodies where salinity rises above 45 p. 1000 : in the Sirbonian Lagoon, in pools like that of Kabret along the Suez Canal and in the Solar Lake near Elat. Both species appear together at lower salinities, but *R. salsa* has not yet been reported from the open sea.



TAB. VI. *Robertsonia salsa* (Gurney)

32. P I female; 33. Basipodite P I, male; *R. knoxi*, 34. P I, female; 35. Basipodite P , male; *R. salsa*, 36. P. II, male; *R. knoxi*; 37. P. II, male.

Paramphiascella sirbonica n. sp. (Tab. VII, VIII, 38-53).

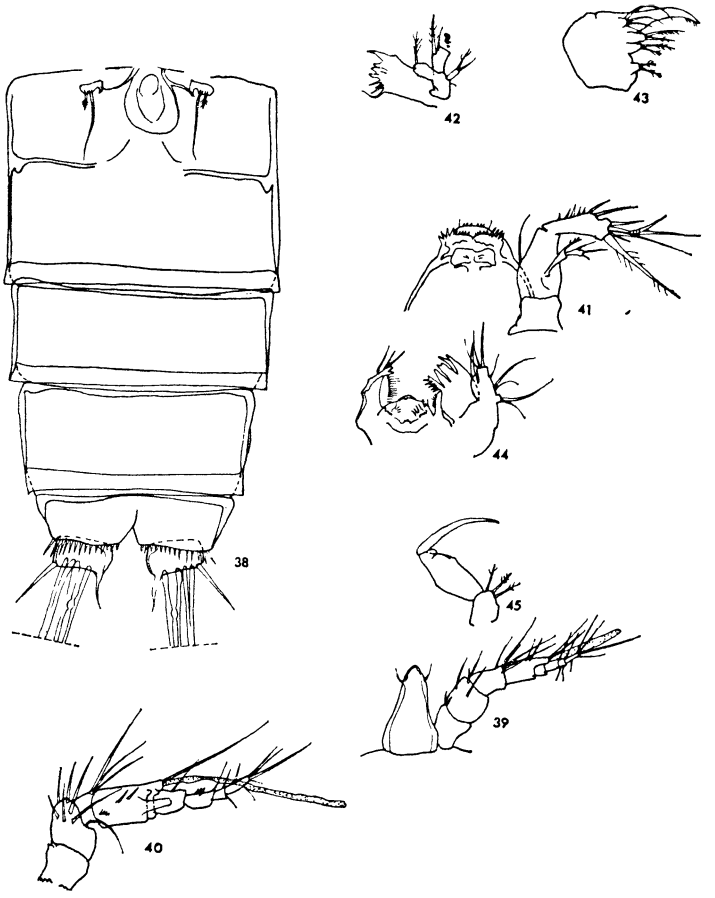
It is with some regret that a new species has to be added to this not so well understood genus. Verwoort (1962) pointed out that the unity of this genus is given only by the typical structure of the male P II. Lang (1965) avoids giving a key to the genus and mentions that some light might be shed on the classification within the genus, by analyzing the armature of the abdominal segments.

Female. 0.56-0.68 mm. Rostrum with undivided tip. Abdominal segments completely smooth with the exception of the distal edge of

the last segment which bears spinulae mainly on the ventral side. Furcal branches much broader than long, bearing normal setae. The innermost seta seems to have no articulation to the furca.

Antennula is 8-segmented with a relatively short sensory seta on the fourth segment. Antenna is three-segmented with a two-segmented exopodite.

Mandibular palp bears exo- and endopodite. Maxillula with endo-



TAB. VII. *Paramphiscella sirbonica* n. sp.

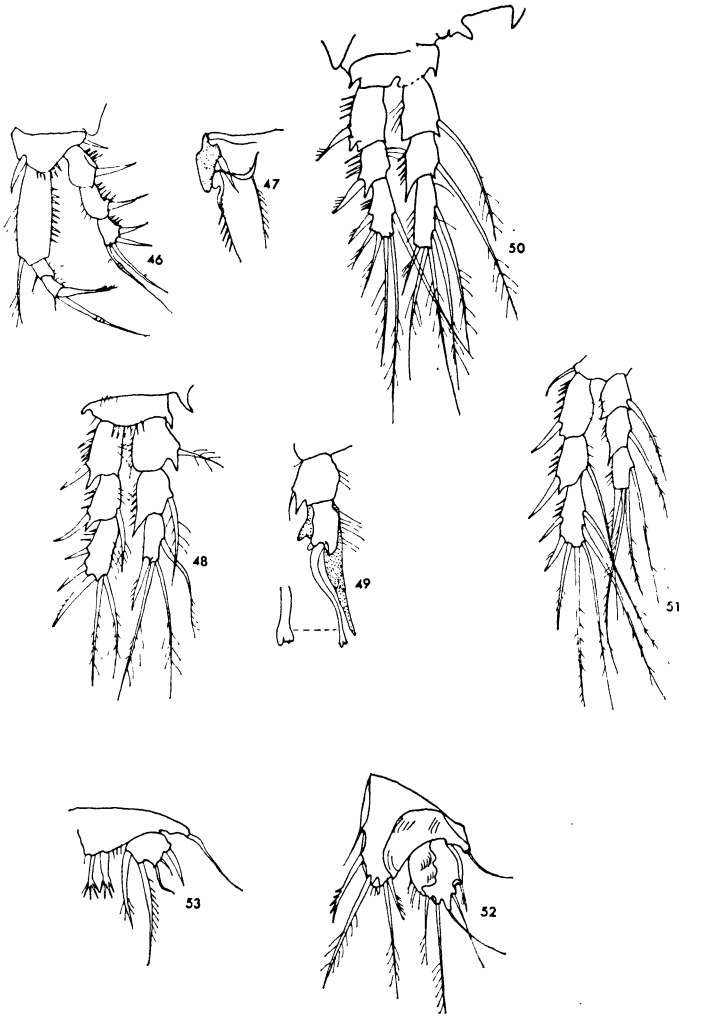
38. Abdomen, female, ventral view; 39. Rostrum and antennula, female; 40. Antenna, male; 41. Left antenna and labrum; 42. Mandibula; 43. Maxillula; 44. Left maxilla and right paragnath; 45. Maxillipede.

podite reduced to two setae and a very small knob-like exopodite. Maxilla massively built, with four endites and a massive terminal claw. Maxillipede shown in Tab. VII, 45.

A special mention is justified concerning the very complicated structures of both the labrum (Tab. VII, 41) and the paragnaths. These are bound together in a structure reminiscent of an insect labium (Tab. VII, 44).

In P I, first joint of endopodite is longer than exopodite. The structure of the swimming legs and their armature is similar to that of other species of the genus.

P V has a pointed, piriform exopodite with a very short outermost spinelike seta. The tip of the basiendopodite has no setae and is



TAB. VIII. *Paramphiscella sirbonica* n. sp.

46. P I, female; 47. Basipodite, P I male; 48. P II, female; 49. Endopodite P II, male and detail of spine; 50. P III; 51. P IV; 52. P V, female; 53. P V, male.

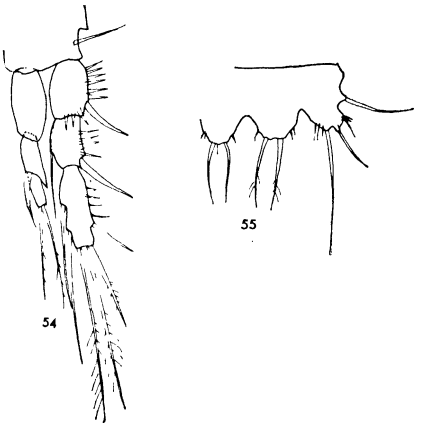
bordered by a brush of spinulae. Both joints have large hyaline fields. P VI has one long and one very short and pennated seta. The genital segment is divided only laterally.

Male. 0.44.-0.46 mm. Antennula of 9 joints, the fourth exhibiting an unarmed and strong finger-like projection. The dirmorphic spine

on P I is a blunt and strong tooth. Endopodite of P II bears only two thick rods and no setae. The external rod is sinuous and has a split tip. P V has a very broad exopodite with two short median setae. The basiendopoditic part bears two brushlike species. There are no hyaline fields on P V.

Mesochra rostrata Gurney (Tab. IX).

This species too has been described by Gurney from Suez Canal material. His material was one single female. Wells (1967) lists numerous females and males of *M. rostrata* among his material from Mozambique. He probably was not aware of the fact that the male of this species has still not been described. The females, in the present material, are identical to the thoroughly described specimen of Gurney.



TAB. IX.
Mesochra rostrata Gurney
54. P III, male; 55. P V, male.

Male. 0.42 mm and an unclearly 6-7 segmented antennula. The P III has only a slightly modified endopodite — with a spur-like spine arising from the inner edge of the second segment. P V has two setae of about equal length on the basiendopodite and three long and one extremely short setae on the exopoditic part.

Mesochra rostrata appears to be an indopacific species, presumably known only from East Africa (Mozambique) from the Suez Canal (El Ferdane) and from the Sirbonian Lagoon. In this lagoon, *M. rostrata* does not live at salinites exceeding 45 p. 1000.

Heterolaophonte quinquespinosa (Sewell)
(Tab. X-XI, 56-72; Plate I, 78-79).

This species, described originally from Chilka Lake by Sewell (1924), has been reported by Gurney (1927) from Lake Menzala. Its massive finding now in the Sirbonian Lagoon and at very high salinities, indicates that *H. quinquespinosa* might be an important lagoon species in the Indopacific. The species has been reported also from

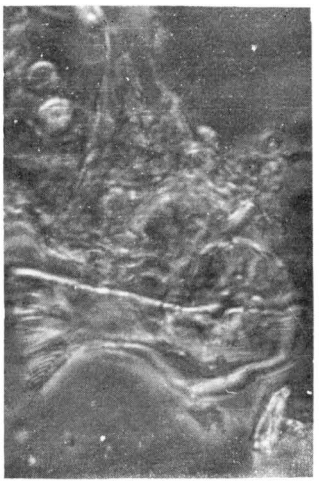
Mozambique (Wells, 1927). The report from Algeria (Monard, 1935) should be checked.

Willey's (1930) *L. sigmoides* is most probably synonymous, since the main difference between the two species seems to be restricted

TAB. X. *Heterolaophonte quinquespinosa* (Sewell)

56. Antennula, female; 57. Antenna; 58. Mandibula; 59. Maxillula; 60. Maxilla; 61. Maxillipede; 62. P I; 63. P II; 64. P III; 65. P IV; 66. Furca and furcal setae, dorsal view.

to the structure of the long furcal seta. This shows a « bulbous swelling » in the middle. The present material shows that the furcal setae of this species are attacked by a vegetal parasite (fungus ?) and the setae show different degrees of damage and deformation



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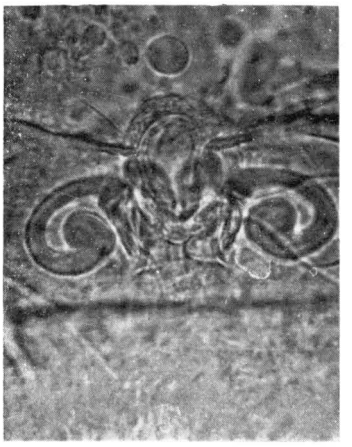

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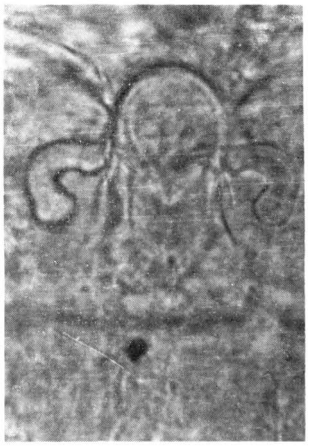

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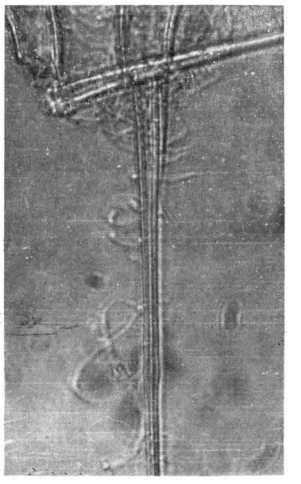

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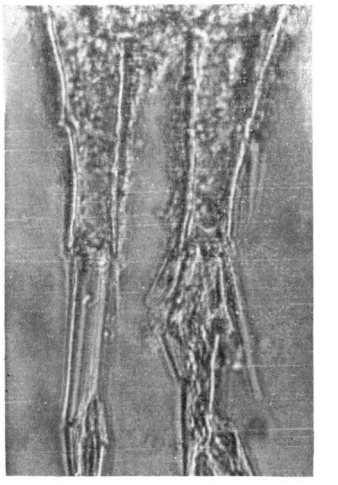

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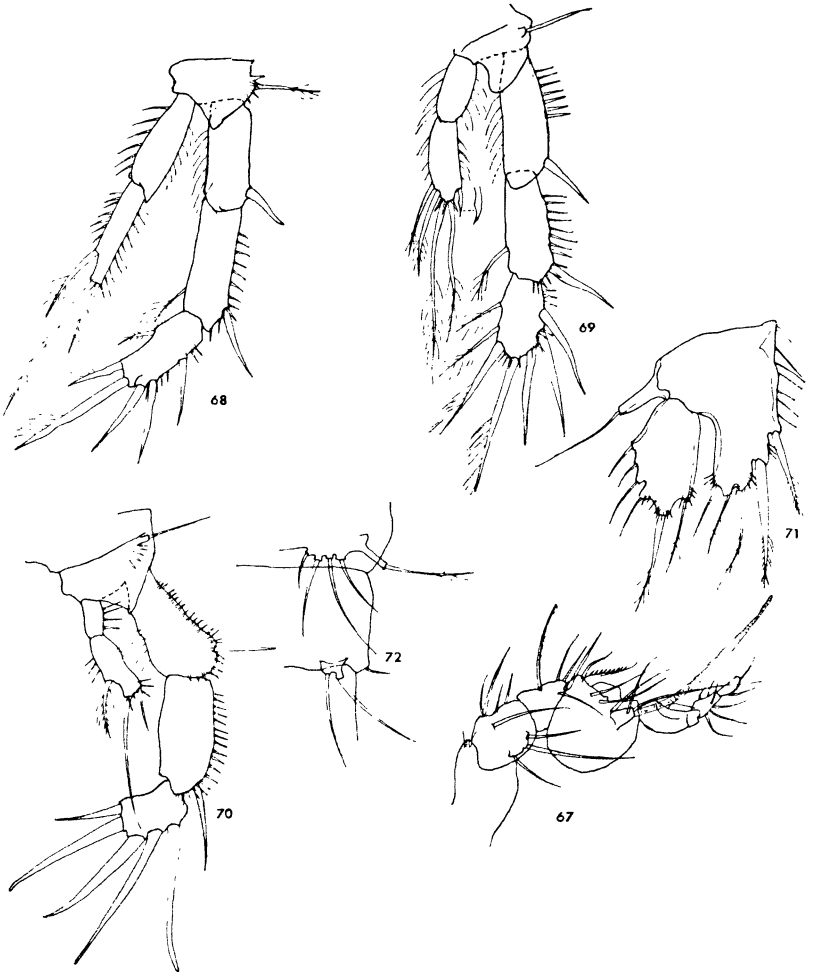
F.D. Por

PLATE I

73. *Neocyclops salinarum* Gurney, Mandibula (Phase contrast). 74. *Neocyclops salinarum* Gurney, Maxillipede (Phase contrast). 75. *Robertsonia salsa* (Gurney), Detail of male antennula, with trifide spines on fourth segment. (Phase contrast). 76. *Robertsonia salsa* (Gurney), Genital field. 77. *Robertsonia knoxi* (Thompson et A. Scott), Genital field. 78. *H. quinquespinosa* (Sewell), Slightly damaged furcal seta with parasitic fungus (Phase contrast). 79. *H. quinquespinosa* (Sewell), Heavily damaged furcal setae. (Phase contrast).

(Plate I, 78-79). A detailed description of the species was considered necessary.

Female. 0.78-0.82 mm. Rostrum rounded. Abdominal segments smooth, with spinulae only along the ventral edges. The genital segment and the first abdominal segment have lateral bulges. The



TAB. XI. *Heterolaophonte quinquespinosa* (Sewell)
67. Antennula, male; 68. P II, male; 69. P III, male; 70. P IV, male; 71. P V, female; 72. P V and P VI, male.

operculum is smooth. Furcal branches about three times longer than broad. The internal seta is very small. The long apical seta is smooth and shows the deformations as mentioned above.

Antennula is 6-segmented and, compared with the type, shows slight differences in the relative lengths of the segment and in some details of the secondary spinulation. The exopodite of the antenna is a well delimited small segment, with one stronger and two minute setae.

Mandibular palp with three setae, respectively one seta marking the place of the exopodite and the endopodite. Endopodite of the maxillular palp is slightly prominent though not articulated. There is an endite-like structure between the gnathobasis and the palp. Maxillipede bears two short and pennate setae on the basal joint instead of the one indicated by Sewell.

P I and all the following legs have rows of surface spines not indicated in the original description. Besides, first joint of P I endopodite bears the usual seta — which has not been drawn by Sewell. The illustrations given for the other legs show also some differences in the lengths of the segments and of the setae.

P V is remarkably similar to the drawing given by Gurney (1927 b) and shows many differences compared to Sewell's poor figures. A very interesting feature to emphasize, is the tridentate ending of the big spine of the basiendopodite. The secondary spinulation of the exopodite edge is an additional feature even if compared with Gurney's figure.

Male. 0.58-0.65 mm. Antennula has a peculiar spoon-like and smooth last joint. The spine on the big fourth segment is strongly pennated with spinulae. In the structure of the swimming legs there are again slight differences in the lengths of the segments — these being on an average longer than in Sewell's type specimen. Last joint of P II exopodite has only one slender internal seta. P III endopodite bears a dimorphic pointed spine at the distal-external corner of the last segment. P IV has also a strong and curved exopodite; the second segment of the endopodite has a dimorphic internal spine as shown in Tab. XI, 70. P V and VI are identical with those drawn by Sewell.

Zusammenfassung

Die Sirbonis (Sabkhat el Bardawil) ist eine grosse, hypersaline Lagune entlang der nördlichen Sinai Küste. Da die Öffnungen zum Meere in 1969 teilweise versandeten, stieg der Salzgehalt der Lagune stark an. Normal stand dieser zwischen 39 und 70 ‰ ; gegenwärtig werden stellenweise 90 ‰ überschritten.

Fünfzehn benthische Copepodenarten leben in der Lagune. *Robertsonia salsa, Heterolaophonte quinquespinosa, Cletocamptus confluens* und *Neocyclops salinarum* werden jenseits 80 ‰ angetroffen. Nur *C. confluens* toleriert Konzentration von über 100 ‰. *Paramphiascella sirbonica* n. sp. wird als neue Art beschrieben. *Robertsonia salsa* wird wieder als Art aufgestellt. *Neocyclops salinarum* und *Heterolaophonte quinquespinosa* werden neubeschrieben und diskutiert. Das Männchen von *Mesochra rostrata* ist zum ersten mal gemeldet.

Zoogeographisch gehören wahrscheinlich die Mehrzahl der Arten zur eingewanderten indopazifischen Fauna.

Summary

The Sirbonis or Sirbonian lagoon (Sabkhat el Bardawil) is a big lagoon along the northern shores of the Sinai Peninsula. In 1969, the openings to the sea were partially closed by sandbars. As a consequence, salinities usually ranging between 39-70 p. 1000 went up to over 90 p. 1000.

Fifteen species of benthic copepods are reported from the lagoon. *Robertsonia salsa, Heterolaophonte quinquespinosa, Cletocamptus confluens* and *Neocyclops salinarum* withstand salinities of over 80 p. 1000. Only *Cletocamptus confluens*

is left at above 100 p. 1000. *Paramphiascella sirbonica* n. sp. is described, *Robertsonia salsa* reestablished as valid species and *Neocyclops salinarum* and *Heterolaophonte quinquespinosa* are redescribed and discussed. The male of *Mesochra rostrata* is reported for the first time.

From the zoogeographical point of view it seems as if most of the species are from among the indopacific immigrants.

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