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1. REPORT ON THE PLANKTONIC STAGES OF DECAPOD CRUSTACEA (EXCLUDING PENAEIDAE) IN THE COLLECTIONS AT THE INDIAN OCEAN BIOLOGICAL CENTRE, by D.I. Williamson, Marine Biological Station, Port Erin, Isle of Man, United Kingdom.

I visited the Indian Ocean Biological Centre, Ernakulam, South India, from 2 February to 4 March 1968 as Senior Specialist for Decapod Larvae in the IOBC collections. An interim report on the decapod material was prepared about mid-way through my visit for the benefit of the Consultative Committee of IOBC, who were meeting at that time. The present report amends the figures on the state of preservation of material given in the earlier report, but it does not alter any of the general conclusions or recommendations in it. Further progress in the allocation of material on loan to specialists has been made since the preparation of the interim report.

I am grateful to Unesco for meeting the expenses of my visit to India, and to the Curator and staff of IOBC for the help and hospitality I received at Ernakulam.

The Samples

Numbers, state of sorting and general analysis

The collections consist predominantly of larval Decapoda, but in a few cases juveniles or even adults also occur. There are 18,844 specimens of Decapoda from 1,320 stations; only 365 of the 1,685 plankton samples from the International Indian Ocean Expedition analysed at IOBC have contained no decapod material. The bulk of the brachyuran zoeas and megalopas have not been further subdivided, but the remainder of the collections has been sub-sorted to families by P. Gopala Menon and V.T. Paulinus under the guidance of M. Krishna Menon. Comparisons of

catches of Decapoda with respect to area, season and time of day, and the numbers of specimens in the various sub-groups are available in an IOBC report prepared by Gopala Menon and Paulinus.

Work during visit to IOBC

The Penaeidea and Palinuridea (phyllosoma larvae) have already been entrusted to Senior Specialists in India and Pakistan and were not examined by me at Ernakulam. About 35% of the remaining samples were examined, including a number from each ship which took part in the International Indian Ocean Expedition, a number from each major region and a number collected at each season. All specimens were examined which the sorters had been unable to assign to a family (e.g. 'other Caridea', 'other Anomura'), or where they had found difficulty in distinguishing familes (e.g. Dromiidae, Diogenidae, Paguridae). In such cases, taxonomic criteria were profitably discussed with the sub-sorters. Where representatives of a family occurred at less than 50 stations, all the samples were examined; in other cases at least 40 samples from each family were examined.

Notes were made on the diversity of species and the state of preservation. Enquiries from interested specialists were answered.

State of preservation

All planktonic Decapoda have a resilient, chemically resistant, non-calcified, chitinous exoskeleton, and systematic characters are drawn almost entirely from features of this exoskeleton. The value of such material from a taxonomic point of view is, therefore, unaffected by acidity of the preservative, and may be only slightly reduced if the preservative is added so late or in such small quantities that the soft parts suffer considerable decay. Antennae or legs of zoeas of some families tend to get broken by abrasion in the net or by subsequent rough handling, and it is probable that the megalopas of some families of the Anomura and Brachyura tend to autotomise their large chelae when formalin is added to the sea-water containing them. This loss of appendages may seriously reduce the possibility of linking the larvae with described adults, but if other larval characters are unimpaired the material may remain very useful.

Well over half the Decapoda in the IOBC collections show some degree of decay of the soft protoplasm, and cases in which only the exoskeleton remains are by no means rare. There appear to be cases in which all samples taken by a particular ship are in a poor state of preservation, but there are no cases in which all samples from one ship are in a thoroughly satisfactory state of preservation. On the other hand, a significant minority of samples are in a thoroughly satisfactory condition. There is no evidence of continuing deterioration of samples stored at IOBC.

The following list gives the approximate percentage of specimens in each category, assessed from the standpoint of value for systematic work:

(1) Well preserved, undamaged . . . . . about 20%

(2) Systematic value not appreciably reduced but protoplasm poorly preserved . . . . . about 35%

(3) Systematic value reduced, usually by loss of appendages, but other specimens of same species intact . . . . . about 28%

(4) Systematic value reduced, usually by loss of appendages; no intact specimens of species . . . . about 15%

(5) Of little value; severely damaged . . . . . about 2%

All the specimens in category (2) and most of those in categories (3) to (5) show some deterioration of the soft parts.

Loss of chelae in megalopas is particularly marked in the Galatheidae (anomura) and the Portunidae (Brachyura). In both families the number of species in the collections is small and the number of specimens is large, and it is probable that there are some fully intact specimens of most species.

Potential value

There are good prospects of significant taxonomic advances in several groups. For example, Thalassocaris has been included by some in the Pandalidae while others have placed it in a separate family. Its larvae were not previously known, but they are common in the IOBC collections, and a full series of stages from egg to adult makes firm identification possible. Larval characters should also help to clarify the position of Heterocarpus, another doubtful member of the Pandalidae. The material also includes a full range of stages of members of both the Callianassidae and the Axiidae; it should now be possible to remove much of the existing confusion over the larval characters of these two families. New types of larvae in the Galatheidae and the Paguridae could lead to a reconsideration of the affinities of these families.

Many species in a wide range of families are sufficiently well represented to permit useful studies on their distributions and breeding periods.

Allocation of Material

Agreement has been reached with the following Specialists to work on the families shown:

Dr. M. Dechancé, Paris:	Paguridae, Diogenidae.
Dr. A.L. Rice, London:	Dromiidae, Homolidae, Raninidae.
Dr. R.R. Makarov, Moscow:	Crangonidae, Galatheidae.

Dr. K.N. Sankolli) Dr. S.S. Shenoy) Bombay:	Thalassinidea (Axiidae, Callianassidae, Upogebiidae) and Hippidea (Albuneidae).
Dr. C. Sankarankutty, Ernakulam:	Brachyura (except Dromiidae, Homolidae and Raninidae).
Prof. A.J. Provenzano, Miami:	Porcellanidae (work by graduate student under supervision).

I intend to work first on the Amphionididae, Stenopodidae and Pandalidae, and I shall later accept other families of the Caridea, either for my own work or for work under my supervision.

Recommendations

Adult and juvenile Decapoda, where these occur, should be left with the larvae, and in such cases publications on the material should not be limited to the larvae. Adults occur in only a few species (mostly Caridea) and in most cases they can be linked with larvae occurring in the same samples.

The sub-sorters, Gopala Menon and Paulinus, are very familiar with the collections of Decapoda at IOBC and have acquired a very useful practical knowledge of decapod larval taxonomy. The Director and the Curator of IOBC and myself are agreed that opportunity should be given to these workers to participate in the future, more detailed work on the decapod collections.

The present practice of preserving the samples in formalin is fully satisfactory from the point of view of the Decapoda, although it can cause considerable discomfort to the sorters. It is not recommended that any general transfer to another medium should be made, but specialists should be free to transfer the material to other media in their laboratories. My own experience over the last four years has convinced me that ethylene glycol is a thoroughly satisfactory preservative for most crustacean groups, and it is generally more pleasant and convenient than formalin from the point of view of the biologist.

There is a fairly good coverage of relevant literature on decapod larvae at IOBC but a few important recent papers are not available. In these cases requests for reprints have been sent to the authors. The Proceedings of the FAO World Scientific Conference on the Biology and Culture of Shrimps and Prawns and volume 2 of the Marine Biological Association of India's Symposium on Crustacea, both of which are due to be published later this year, should be of considerable use to workers on larval decapod Crustacea.

Concluding Remarks

My visit to Ernakulam was very fruitful, allowing me to make a first-hand assessment of the decapod material at IOBC and to meet those concerned with its sorting and storage. The fortunate co-incidence of my visit with that of the Consultative Committee of IOBC permitted me to meet biologists from many countries and from several parts of India, and gave an added relevance to most of the discussions in which I was involved.

Before leaving India, I visited Marine Biological Research Stations of Maharashtra State Fisheries Department at Bombay and Ratnagiri, giving a lecture on research on decapod larvae at each. I was greatly impressed by the recent and current work at these stations on the laboratory rearing of Decapoda, using extremely simple techniques with no elaborate apparatus. It is hoped that the success of this work will encourage the study of living marine larvae at other Indian laboratories.

2. STUDIES OF THE FISH EGGS AND LARVAE IN THE COLLECTIONS AT THE IOBC,

by T.S. Rass, Institute of Oceanology, Academy of Sciences of the USSR, Moscow, USSR.

Unesco had invited me to prepare a plan of activity for coordinating the studies of the fish eggs and larvae component of the collections of IOBC (Cochin, India). I proceeded to Delhi and spent eight weeks in India, working at Cochin from 9 December to 28 January 1968. Unesco and the Indian Government each paid expenses for four weeks.

I was working along four main lines: (1) making immediate acquaintance with the state of the ichthyoplankton (fish eggs and larvae) component of the International Collection; (2) examining the scheme of subsorting of the above material with the aim of finding some improvement to this scheme; (3) compiling draft instructions or guides for subsorting; (4) preparing a list of competent specialists to be invited to studying the fish eggs and larvae.

1. My acquaintance with the state of fish eggs and larvae materials was facilitated by the preceding study of 50 samples carried out by Dr. E. Ahlstrom in January-February 1967. The observations given in his report enabled me to limit my work to examining and comparing several random samples collected by different vessels (i.e. Argo, Pioneer, Meteor, Anton Bruun, Zulfiquar, Discovery, Varuna, Vityaz). My primary attention was given to studying the condition of the material. Examination of samples revealed different states of preservation. Some samples were in a very bad condition, containing only remnants of larvae, their melanin pigments faded to brown or pale yellow (e.g. samples of Meteor, 1965, Stations 184, 205); some samples were better preserved (e.g. Pioneer, 1964, Station 42); and some were in a satisfactory condition (e.g. Varuna, 1963, Station 1805). Most samples are in a more or less satisfactory state and can be studied by specialists, in spite of the larvae being partly macerated with consequent fading of the melanin pigment and in having white spots sedimented on the surface of their bodies. The main reason for the spoilage of samples is evidently not their long-term preservation in preservative (as is clear from comparing the state of samples of Meteor, 1965, and Varuna, 1963). Neither is the main reason for spoilage the preservation of samples in tropical conditions in Cochin, since samples of fish eggs and larvae from another scientific institute in Cochin (Biological Oceanography Division of the National Institute of Oceanography) which I was able to study for comparison purposes were in quite a good state. I suppose that the main reason for decay of the material in the samples is probably the using of hexamine for the

neutralization of formalin. This supposition can well be verified by comparing the condition of samples of plankton taken and preserved at the same time with or without addition of hexamine. Such experiments are currently being made by a member of the IOBC staff, Mr. Balachandran. The second possible reason for the decay of material could be the removal of the material from usual sea water into fresh water.

I deem it expedient to take the following action:

a) if experiments show the destructive action of hexamine, and if the samples are now being kept in fresh water, to place the material in a 2% solution of formaldehyde (1 part 40% formaldehyde to 19 parts of water) in sea water - despite large amount of material - to about 2,200 samples in all;

b) to prevent direct illumination of fish eggs and larvae samples (especially by sunlight), which causes decolourization and quickens destruction;

c) to hasten the subsorting and working out of the material.

2. Larvae and fry were subsorted according to the general scheme, which includes 64 groups. The number of groups may be reduced, since material on some groups will be directed to only one person, and there is no need to separate such groups; e.g. the Anguilliformes (6 families), Beloniformes (3 families), Pleuronectiformes (4 families), and Stomiatoidei (5 families). At the same time some groups and families which are of interest to some known specialists and can be easily separated were not mentioned within the scheme (e.g. Dactylopteridae, Xiphioidei, Ceratioidei). In taking these groups into consideration, I examined the scheme of subsorting of groups of fish larvae, with the result that the number of groups (families) was reduced to 50 (a revised scheme is enclosed, see Annex 1). Besides the fish larvae, it was necessary to subsort the fish eggs, and this is now being done under the supervision of Mr. K.G. Peter.

3. The absence of special keys or instructions to determine the taxonomic group of tropical ichthyoplankton (fish eggs and larvae) complicated the work of the sorters of this material at IOBC. The necessity to compile such instructions was evident, despite insufficiency of available data.

Because of this I was obliged to compile draft tables of the most important characters for the three main groups of Indian Ocean ichthyoplankton: viz. fish eggs, larvae with embryonal fin fold (without fin-rays), and "finned" larvae (those having fin-rays). These tables were compiled for subsorting the 50 groups of group-families (see Annex 2 of this report).

Two tables of characters for two categories of floating fish eggs were also compiled: viz. fish eggs not containing oil drops and fish eggs containing several (more than five) oil drops. (Annex 3.) Schematic drawings or sketches of the main types of tropical ichthyoplankton larvae were also prepared. It is believed that the use of these tables and drawings will facilitate and hasten the sub-sorting of the Indian Ocean ichthyoplankton.

4. When making a list of specialists to be invited to study the ichthyoplankton of IOBC collections, I took into consideration:

a) that the study of each group (or family) should be made, preferably, by the most competent scientist for this group;

b) that the international character of the material necessitated that it be studied by specialists from different countries;

c) that it is desirable to give some preference to Indian scientists since India is immediately providing the staff for the IOBC.

It was necessary to invite specialists to treat all the 50 groups of ichthyoplankton; it was also necessary to clear up whether they would agree to treat the corresponding group of ichthyoplankton; and, finally, if there were several candidates for one group, to decide which scientist should be given preference.

With these considerations I prepared the attached list (Annex 4) which includes 21 scientists from India, Japan, New Zealand, Denmark, USA and USSR. For those groups of larvae for which treatment was claimed by several scientists, preference was given to such specialists who: (a) work with the group in question on the World Ocean scale, having comparative material also from the Pacific and Atlantic Oceans; (b) work with the taxonomic group as a whole, studying larvae as well as adult specimens; (c) work with the group at the present time and have published material during recent years.

Scientists mentioned in the list were sent letters in which they were asked to say whether it was desirable and possible for them to participate. The letters were signed by the curator of Unesco, Mr. D.J. Tranter and myself. As for the scientists of India, everything was settled by means of immediate correspondence and subsequent discussions with Dr. N.K. Pannikar. Participation of scientists from New Zealand and the USSR is now settled as well. The scientists from Japan informed us that they would like to work in cooperation with each other and together with the scientists of the USSR; the possibility of organizing such cooperation is now being ascertained. Of the scientists of the USA we have received a positive answer from Dr. R. Rofen and a

negative one from Dr. V.V. Anderson. Dr. A.V. Ebeling (USA) and Dr. E. Bertelsen (Denmark) have not sent any answer yet. We express our regret that Dr. E. Ahlstrom who is a well-known specialist in the USA on ichthyoplankton and who has firsthand acquaintance with the material of IOBC has no possibility to participate in this work.*

Thus, it is now necessary to:

i) hasten the subsorting of IOBC material in Cochin into group-families of ichthyoplankton;

ii) distribute the material on the sorted groups among the corresponding specialists;

iii) provide Japanese scientists with the possibility to work according to their request (in this question the help of Unesco is necessary);

iv) obtain the consent of Dr. Bertelsen and Dr. Ebeling to participate in the work;

v) find a specialist who would substitute Dr. Anderson (who could not participate) in the treatment of Mugilid larvae. (Dr. C. Jones has expressed a wish to take this group.)

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* See IIOE Information Paper of May 1968 (UNESCO/NS/IOC/INF - 137), "Appraisal of the IIOE Larval Fish Collection at IOBC, Cochin, India", by Elbert H. Ahlstrom.

Annex 1

Corrected List of Groups of Fish Larvae

Clupeiformes

a Albulidae, Elopidae, Megalopidae
b Clupeidae
c Engraulidae
d Bathylagidae, Argentinidae
e Stomiatoidei (not to separate Stomiatidae, Idiacanthidae, Chauliodontidae, Astronesthidae, Melanostomiatidae)
f Gonostomidae, Sternoptychidae
g Other families

Scopeliformes (Myctophiformes)

a Synodontidae
b Paralepididae
c Myctophidae
d Scopelarchidae
e Other families

Anguilliformes (not to split)

Beloniformes (not to separate Exocoetidae, Hemirhamphidae, Other families)

Perciformes

a Serranidae
b Carangidae
c Coryphaenidae
d Pomacentridae
e Labridae, Scaridae
f Stromateidae
g Gempylidae, Trichiuridae
h Scombridae
i Scomberomoridae
j Thunnidae
k Gobiidae
l Scorpaenidae
m Triglidae
n Blenniidae
o Other families

Pleuronectiformes (not to split)

Other and additional orders and families

a Bregmacerotidae
b Syngnathidae, Fistularidae
c Melamphaidae
d Holocentridae
e Sphyraenidae
f Mugilidae, Polynemidae
g Dactylopteridae
h Xiphioidei: Xiphiidae, Histiophoridae
i Balistidae, Monacanthidae
j Diodontidae, Tetraodontidae
k Lophioidei: Lophiidae, Antennariidae, Ogeocephalidae
l Ceratioidei
m Other families

Fish - Eggs

		Not known	Demersal	Floating			Size (Diameter) in mm				Egg-capsule					Smooth	General appearance				Perivitelline space (PS)			Yolk (V)			Oil-drop (G) number and size					Properties	
				in floating mucous bands or rafts	attached to weeds and others objects	solitary	2,5-5,0	2,0-2,5	1,5-2,0	1,0-1,5	0,6-1,0	with lobe, mostly with appendages	" spinules	" filaments	"conical outgrows	of honeycomb like structure	of punctilious or netted structure	ordinary	double	double, with gelatinous external	pear-form	elongate ellipsoidal	spherical-ellipsoidal	spherical	large (V=60%D)	medium (V=70-80%)	small (V=85-95%)	globular	irregular	segmented	homogeneous	pigmented	50-100	5-50	2-5 (7)	big (ca 30%D)	medium (24-25%)	small=20%D	only one	coloured	pigmented	absent
a	Albulidae, Elopidae, Megalopidae	+																																					
b	Clupeidae, Dorosomatidae, Dussumieridae	+				+		+	+	+	+						+	+	+				+	+	+	+	+			–		+	+		+	+		–	+
c	Engraulidae					+			+	+							+			+	+	+	+			+	+			–		+				+		–	+
d	Argentinoidei (inc. Bathylagiidae)					+			+								+						+			+	+			–			+			+	+	–	
e	Stomiatoidei					+			?	?								+						+			+				–		?		?				+
f	Gonostomidae, Sternoptychidae					+			+	+	+			+			+	+						+			+	+			–				+	+			
g	Others: Chanidae, Chirocentridae					+			+						+			+									+						+						
a	Synodontidae					+				+	+				+			+						+			+			+	–								+
b	Paralepididae	+				?																																	
c	Myctophidae	?				?			?		?		?				?							+			+			+				?					
d	Scopelarchidae	+																																					
e	Others	+																																					
	Anguilliformes					+		+	+	+							+						+	+		+				–	+	+	+		+				+
	Beloniformes (Exocoetidae, Belonidae etc.)				+	+		+	+	+			+	+			+									+			+			+			+				+
a	Serranidae					+					+						+							+			+			+						+		+	
b	Carangidae					+				+	+						+							+			+	+								+		+	
c	Coryphaenidae					+			+	+							+							+			+	+		+						+		–	
d	Pomacentridae		+																			+																		
e	Labridae, Scaridae					+			+	+	+						+				+			+			+			+						+	+		+	
f	Stromateidae	+				+											+							+			+												
g	Trichiuridae, Gempylidae	+				+		+	+	+						+	+							+			+			+						+	+	+	+
h	Scombridae					+				+	+						+							+			+			+						+		+	
i	Scomberomoridae					+			+	+							+							+			+			+						+		+	
j	Thunnidae					+				+	+						+							+			+			+						+		+	
k	Gobiidae		+																																				
l	Scorpaenidae, Synanceiidae			+		+					+						+					+				+									+			+	+
m	Triglidae, Peristediidae					+			+	?																		+			+				+			+		
n	Blenniidae, Clinidae	+				+			+		+						+							+			+	+			+	+			+			+		
o	Others					+			+	+	+	+				+	?	+						+			+	+	+	+					+					
	Pleuronectiformes					+			+	+	+	+				+	?	+						+			+	+	+	+					+					
a	Bregmacerotidae	+				?			?	?							?							?			?						?	?		?				
b	Fistulariidae, Syngnathidae		+			+			+	+							+							+			+				–							–	+
c	Melamphaidae	+																																					
d	Holocentridae	+																																					
e	Sphyraenidae					+					+						+							+			+									+				
f	Mugilidae					+					+						+							+			+			+									
g	Dactylopteridae					+					+						+					+					+			+							+	+	
h	Xiphiidae, Histiophoridae					+			+	+							+							+			+			+						+			
i	Balistoidei					+					+						+							+			+			+									
j	Tetrodontoidei	+																																					
k	Lophiidae, Antennariidae		+		(+)	(+)			+		+						+					+				+									+				
l	Ceratioidei	+																																					
m	Others																																						
	Ophidioidei		+	+					+		+						+					+				+									+				
	Ostraciontidae			+					+								+							+			+			+			+						
	Echeneidae			+				++		+							+							+			+			+						+		–	
	Callionymidae			+							+				+		+							+			+		+										
	Trachipteridae, Regalecidae			+				+	+								+							+			+		+									+	+
	Leiognathidae			+							+						+							+			+			+						+	+		+	
	Lethrinidae			+							+						+							+			+			+									
	Sparidae			+							+						+							+			+			+						+	+		+	
	Macrouridae			+					+						+		+							+			+			+						+		+	+
	Sillaginidae			+							+						+							+			+			+	–					+	+		
	Mullidae			+							+						+							+			+			+									+	
	Atherinidae				+				+				+											+			+		+	+									
	Zeidae, Caproidae			+				+		+							+							+			+									+		(+)	
	Priacanthidae	?																																					
	Lactariidae	+																																					
	Nemipteridae			+							+						+							+			+									+				
	Uranoscopidae			+					+				+											+			+		+										

Larvae apinnatae (with embryonal finfold lacking fin-rays)

		Vert (Myot)										anteanal distance in %L				Spines on head			Body form intestine					Type of body							Swim bladder		Pawed fins	
		Not known	17-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100-200	0%L	ca.60-70%	ca.50-60	ca.40-50	ca.30-40	30	on occiput	on operculum strong	" " feeble	absent	elongate, low (15%)	medium high	high, short	swelled, inflated	Strait, long	accumulated thick anteriorly	hooped, hind	parrusnelly	bent downwards	string like I(Clupeid)	string with addition like II (Stomiat)	ribbon-like	Zola-like horny	Triaxial (Serranid)	Shortbodied longtailed	Balloon	Other	clear, present	not seen	Ventral precoc.	P.especially big
a	Albylidae					+	+						+									++				+												
b	Clupeidae				++								+									++				+					+							
c	Engraulidae			+	+								+									++				+					+					+		
d	Argeninidae					+	+						+									++				+					+	+						
e	Stomiatidae						+						+									++				+						+						
f	Gonostomidae, Sternoptychidae			+									++	+								++	+			+	+				+					+		
g	Chanidae, Chirocentridae			+				+					+									++				+					+							
a	Synodontidae					+							+									++				+					+						+	
b	Paralepididae														++	+						++				+	+								+			
c	Myctophidae			++	+									+	++							+	+			+												
d	Scopelardaidae													+								+	+			+												
e	Others													+	+							++				+	+										+	
	Anguilliformes										+		+									++				+				+								
	Beloniformes				+	++	+	+	+				+	+								++	+			+												
a	Serranidae		24												+				++				+				+							+			+	
b	Carangidae		24											+	+				+				+				+										?	
c	Coryphaenidae			+											+				++	+	++					+												
d	Pomacentridae		26																				+															
e	Labridae		27-37																			++	+			+												
f	Stromateidae		24-25											+						+		+					+											
g	Trichiuridae, Gempylidae										+											+	+				+											
h	Scombridae		27-31													+						+	+				+											
i	Scomberomoridae				42-55										+				+				+				+											
j	Thunnidae				+43											+			+				+				+											
k	Gobiidae		27+												++						+	++			+													
l	Scorpaenidae		25-26											+	+				++				+				+											
m	Triglidae			+															++				+					+									+	
n	Blennidae			+												++			++			++	±			+	+											
o	Others														++								+	++			+										+	
	Pleuronectiformes			++											++				+			+			+			+										
a	Bregmacerotidae				+	+																+	+				+										+	
b	Syngnathidae, Fistulariidae									+												+	++				+											
c	Melamphaidae		23-31																				+				+											
d	Holocentridae													+	+				++				+					+										
e	Sphyraenidae		24											+								++	+				+											
f	Mugilidae		24																			+	+					+										
g	Dactylopteridae		21																++				+					+										
h	Xiphiidae		24											+								+	+				+											
i	Balistoidei				I8-20										+							+		+	+			+											
j	Diodontidae	nl	LA?++																			+			+													
k	Lophiidae														++								+					+										
l	Ceratioidae																					+		+														
m	Others																					+	+				+											
	Ophidioidae																					++					++											
	Ostracioidae																							+			+											
	Echeneidae																					+	+				++											
	Callionymidae													+						+					+		+											
	Trachipteridae													+								+	+				+											
	Leognathidae		24												++					+			+				+											
	Lethrinidae																			+			+				+											
	Sparidae		24												++					+			+				+											
	Macrouridae																					+	+				+											
	Sillaginidae				35									+								+	+				++											
	Mullidae		24												+					+			+				+											
	Atherinidae				+										+							+	+				+											
	Zeidae, Caproidae																							+			+											

Finned larvae

	Not known	Vertebra I7-20	20-30	30-40	40-50	50-60	60-80	80-I00	I00-200	Adipose-fin present	Dorsal fin number one	two	Spines no spines	(I)III-YIII	IX-XIY	XY-XYII	rays I-9	I0-I5	I6-20	2I-30	3I-40	40	abs.	Anal fin Spines I	II	III	IY	Y	rays 6-I0	II-20	2I-30	3I-50	50	Caudal fin Rays 7-9	I0-I2	I3-I5	I6-I7	I?-22
a Albulidae							+			+	+		+						+	+			+						+	+	++							+
b Clupeidae					+	+					+		+					+	+				+							+	+	++				+		+
c Engraulidae				+	+						+		+					+	+				+							+	+++			+	++			+
d Argentinidae						++				+	+		+										+															
e Stomiatidae							+			+	+		+					+	+				+							+	+							
f Gonostomidae, Sternoptychidae				+						+	+		+										+															
g Others: Chanidae, Chirocentridae					+		+				+		+					+	+				+							+		+						
a Synodontidae						+				+	+		+					+					+							+								
b Paralepidide										+	+		+										+							+	+							
c Myctophidae			+	+	+					+	+		+					+	+				+															+
d Scopelarchidae										+	+		+										+															
e Others													+										+															
Anguilliformes									+		+		+										+															
Beloniformes					+	+	++				+		+					+	+	+			+						+	+	+				+		+	+
a Serranidae			+								+			+	+			+	+							+			+	+							+	+
b Carangidae			+									+		+					+	+					+					+	+						+	+
c Coryphaenidae				+							+		+								+		+								+							
d Pomacentridae			+								+				+			+	+						+					+							+	
e Labridae, Scaridae			+	+							+			+	+			+							+	+			+	+						+		
f Stromateidae			+								+		+	+							+	+	+	++	+						+							
g Trichiuridae, Gempylidae									+		+	+		+										+						+							+	+
h Scombridae			+									+			+			+					+							+								+
i Scomberomoridae					+	+						+		+	+			+							+	+	+			+					+			
j Thunnidae			+	+								+			++			+						+						+								
k Gobiidae			+	+								+		+			++			+		+		+					+	+++				+	+			
l Scorpaenidae			+								+				+		++								+	+			+					+	+			
m Triglidae				+								+		+	+			+	++				+							+								
n Blenniidae				+							+		+		+			+	++				+	+						++				+	++			
o Others														+	+										+	+												
Pleuronectiformes				+	+						+		+								+		+								+		+	+	+			+
a Bregmacerotidae					+	+					+	+	+						+	++			+										+					
b Fistulariidae, Syngnathidae							+				+		+								++		+														+	
c Melamphaidae			+	+							+			+				+	+					+					+									
d Holocentridae												+		+				+	+								+		+	+								
e Sphyraenidae			+									+		+										+	+	++			+								+	
f Mugilidae			+									+		+			++								+	+			+	+								
g Dactylopteridae			+									+		+			+						+				+							+				
h Xiphiidae, Histriophoridae			+								+	+	+	+							++		+			+				+								+
i Balistoidei		+									+	+		+					+		+		+							+	+			+	+			
j Diodontidae, Tetraodontidae		+	+								+		+				+	+					+					+		+				++				
k Lophiidae, Antennariidae											+						+						+				+	+						+				
l Ceratioidei											+		+				++						+											+				
m Others																																						
Ophidioidei											+		+																									
Ostracioidei											+																											
Echeneidae											+																											
Callionymidae												+			+				+		+		+					+						+				
Trachipteridae											+																											
Leiognathidae			+								+			+			+	+								+				+						+		
Lethrinidae											+				+			+								+	+											
Sparidae		+									+				+		+									+	+	+								+		
Macrouridae												+																										+
Sillagihidae				+							+	+			+						+		+				+	+		+								
Mullidae		+										+		+				+								+	+					+			+			
Atherinidae					+	+						+		+			+	+								+	+					+	+		+	+		
Zeidae Caproidae											?			+							+		+					+		+								
Priacanthidae											+				+		+			+						+					+				+			
Lactariidae												+		+							+						+					+			+			
Nemipteridae											+				+		+																					

Data on floating fish-eggs not containing oil-drops

	Egg united (agglutinated) into raft or ribbon or balloon by gelatinous mass	Eggs tied to floating subjects (algae, pieces of wood) or tied in clumps by filaments of egg-capsule (membrane)	Eggs floating solitary (isolated one from another)	Egg-capsule (membrane)					Form of egg-membrane				Size of egg (diameter)	Perivitelline space		Structure of yolk				Black pigment on yolk in III-IV stage of egg-development	
				provided with filaments	provided with spines or spimuler	with honeycomb hexagonal mesh-like structure	smooth double	smooth ordinary	ellipsoidal pyriform, with a knob on one pole	distinctly ellipsoidal	ellipsoide-spherical (not spherical)	spherical		big (i.e. vitellus not bigger 2/3 of the egg diameter	small (vitellus smaller than 2/3 of the egg diameter)	segmented (yolk subdivided) rough granular	fine (small) granular	superficially segmented	homogenous	present	absent
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Clupeidae: Sardinella sirm			+					+				+	2,12	+		+					+
Engraulidae: a) Thrissa spp. (kammalensis, hamiltonii, grayi, etc)			+					+			+		?(0,6)0,9 -I,25		+	+					+
b) Anchoviella (?) spp (heterolobus, Collingeri)			+					+		+			0,9-I,24 x0,43-0,55		+	+					+
c) Stolephorus spp. (indicus?, insularis?)			+					+	+				I,76-2,25 x0,6-0,8 0,8-0,9		+	+					+
Chirocentridae: Chirocentrus dorab(?)			+					+				+	I,6-I,65		+	+					+
Chanidae: Chanos chanos			+					+				+	I,2		+		+				+
Anguillidae: Anguilla spp			+					+				+	3,I-3,6	+							+
Muraenidae: Muraena sp.			+					+				+	(2,5)3,2-3,5(5,5)	+		+					+
Gonostomidae: Vinciguerria lucetia			+					+				+	0,56-0,74		+	+					+
Chauliodontidae: Chauliodus sp.			+				+					+	2,0-2,12		+	+					+
Synodontidae: Trachinocephalus myops			+			+						+	0,95-1,15		+				+		+
Synodus spp.			+			+						+	1,0-1,15		+				+		+
Saurida spp			+			+						+	1,1-1,27		+				+		+
Saurida elongata			+					+				+	1,26-1,55		+				+		+
Belonidae: Strongylura spp.		+			+							+	3,2-3,9		+				+	?	+
Hemiramphidae: Hemiramphus spp		+			+							+	2,5-2,8		+				+	?	
Oxyporhamphidae: Oxyporhamphus spp.			+		+							+	1,6-2,2		+				+	?	
Exocoetidae: Exocoetus sp.			+					+					2,7-3,I		+				+	?	
Parexocoetus spp.		+				+							I,3-I,4		+				+	+	
Cypselurus "		+				+							I,2-I,		+				+	+	
Fistularidae: Fistularia sp.			+				+	+					I,5-2,I		+				+		-
Trachipteridae: Trachipterus sp.			+					+					I,9-2,3 (3,6)		+			?	+	+	
Regalecidae: Regalecus			+					+					2,5		+			?	+	+	
Uranoscopidae: Uranoscopus sp.			+			+						+	I,6-2,0		+				+	+	
Ophidiidae: Ophidium spp.	?		+								+	+	0,7-I,0		+				+		+
Dactylopteridae: Dactylopterus sp.			+			+						+	0,6-I,0		+			+	+	?	
Scorpaenidae: (genera, spp.)	+							+			+	+	0,7-I,I 0,6-0,7		+				+	+	
Synanceiidae: Inimicus sp.			+					+				+	I,5-I,5		+						
Triacanthidae: Triacanthus			+					+				+	0,8		+				+		
Antennariidae: Antennarius	+							+			+		0,7-I,0 x0,6-0,7		+			?	+		

Special table to identification of floating fish-eggs, possessing from 5 to 100 oil-drops

	D (size)	Capsule					Perivitelline space		Yolk			Oil-drops	
	external capsule	internal or ordinary	ordinary	double	smooth	of honeycomb structure	Large or medium	small	globular	homo-genous	Size	no	Size
Clupeidae													
Kowal coval		0,7-0,84	+		+		+		+		0,65	6-12	0,03-0,07
Anodontostoma chacundo		0,8-1,14	+		+			+	+			6-20	0,04-0,08
Dussumieria acuta		1,3-1,6	+		+			+	+			5-15	0,16-0,18
Pellona(Ilisha?) ditchoa	1,47-1,71	1,18-1,34		+	+			+	+			5-6	
Ilisha sp.(indica?)	1,9-2,0	1,4-1,6		+	+			+	+			5-8	
Engraulidae													
Coilia spp.		1,0-1,1	+		+			+	+			8-12	
Setipinna spp.		0,9-1,55	+		+			+	+			5-20	-0,5
Chirocentridae													
Chirocentrus sp.a		1,6-1,7	+			+		+	+			7-19	
Chirocentrus sp.b		1,6	+			+		+	+			plenty	small
Muraenesocidae													
Muraenesox sp.		1,5-2,2	+		+		+		+			40-60	small
Ophichthidae													
Ophichthys spp.		2,5-3,1	+		+		+		+		1,6-1,9	1-14	
Coecula spp.		2,2-3,4	+		+		+		+			group	
Cynoglossidae													
Cynoglossus		0,6-0,9	+		+			+		pigm		5-50	0,05-0,08
Areliscus		1,19-1,23	+		+			+		pigm		30-50	
Symphurus		0,75	+		+			+		pigm		22-28	
Soleidae													
Solea		0,6-0,7(1,3)	+		+								
Zebrias		1,75-1,80	+		+			+		+		many	
Aesopia		1,45-1,60	+			+		+		+		many	0,015-0,07
								+		+		many	0,014-0,024
Uranoscopidae													
Uranoscopus japonicus		1,5-1,9	+			+		+		+ pigm		3-27	
Ostraciontidae													
gen. sp.		1,6-2,0	+		+			+		+		6-29	0,02-0,2

Proposal for distribution of material of fish-eggs and Larvae

Scientist	Group	No. of samples (approximate)
India:		
Dr. S. Jones	Scomberomoridae	20
	Thunnidae	20
	Holocentridae	20
	Dactylopteridae	20
Dr. S.V. Bapat	Carangidae	20
Dr. E.G. Silas	Synodontidae Bregmacerotidae	50
Mr. K.J. Pater	Clupeidae	
	Engraulidae	190
	Scombridae	20
Mrs. C.B. Lalithambika Devi	Pleuronectiformes	20
Japan:		
Dr. Tokiharu Abe Tokai Regional Fisheries Research Laboratory, Tsukishima, Chuo-ku, Tokyo, Japan. Professor Keitaro Uchida Faculty of Agriculture, Kyushu University, Fukuoka City, Japan. Dr. Satoshi Mito Inland Sea Regional Fisheries Laboratory, Ujina, Horoshima City, Japan.	Elopidae, Albulidae, Megalopidae; Serranidae; Pomacentridae; Labridae, Scaridae; Stromateidae; Trichfuridae; Scompaenidae; Triglidae; Blennioidei; Sciaenidae; Platycephalidae; various Acanthopterygii; Syngnathidae, Fistulariidae; Sphyraenidae; Polynemidae; Balistidae, Monacanthidae; Diodontidae, Tetrodontidae; Lophiidae, Antennariidae.	
Dr. Shoji Ueyanagi	Xiphiidae, Histiophoridae	20
New Zealand:		
Dr. Castle	Anguilliformes	20
Denmark:		
Dr. E. Bertelsen Danmarks Fiskeri-og, Havundersøgelser, Charlottenlund Slot, Charlottenlund, Denmark.	Ceratioidei	20

Scientist	Group	No. of samples (approximate)
U S A :		
Dr. W.W. Anderson Bureau of Commercial Fisheries, Biological Laboratory, P.O.B. 280, Brunswick, Georgia, USA.	Mugilidae	
Dr. A.W. Ebeling	Melamphaidae	
Dr. Robert R. Rofen Research Director, Aquatic Research Institute, Port of Stockton, California, USA.	Paralepididae; Scopelarchidae; other Scopeliformes (Omosudidae, Everinannellidae, Aulopidae, Chlorophthalinidae)	
USSR:		
Professor T.S. Rass; his team of ichthyoplanctologists:	Argentinoidei	20
Professor T.A. Ostroumova	Myctophidae	760
Dr. N.S. Novikova	Stomiatoide	20
Dr. N.N. Gorbunova) Dr. T.N. Belianina)	Gempylidae	20
Mrs. N.V. Kovalevskaia	Beloniformes	20
Miss V.A. Mukhacheva	Gonostomidae	300
Mr. Y. Shcherbachev	Coryphaenidae	20