DEPARTMENT OF AGRICULTURE AND TECHNICAL INSTRUCTION
FOR IRELAND.

REPORT

ON THE

SEA AND INLAND FISHERIES OF IRELAND

FOR

1905.

IN TWO PARTS.

PART I.—GENERAL REPORT.

PART II.—SCIENTIFIC INVESTIGATIONS.

PART II.—SCIENTIFIC INVESTIGATIONS.

Presented to both Houses of Parliament by Command of His Majesty.

AGRICULTURE AND TECHNICAL INSTRUCTION
(IRELAND) ACT, 1899.
(62 AND 63 VIC., CAP. 50.)

DUBLIN:
PRINTED FOR HIS MAJESTY'S STATIONERY OFFICE,
BY ALEXANDER THOM & CO. (LIMITED), ABBEY-STREET.

And to be purchased, either directly or through any Bookseller, from
E. PONSONBY, 116, GRAFTON-STREET, DUBLIN; or
WYMAN AND SONS, LTD., FETTER-LANE, E.C., and
32, ABINGDON-STREET, WESTMINSTER, S.W.; or
OLIVER & BOYD., EDINBURGH.

1907.

[Cd. 3540.] *Price 2s. 1d.*

To

His Excellency JOHN CAMPBELL, EARL OF ABERDEEN, Lord Lieutenant-General and General Governor of Ireland.

MAY IT PLEASE YOUR EXCELLENCY,

I am directed by the Vice-President to submit to Your Excellency the Report on the Sea and Inland Fisheries of Ireland for the year 1905, Part II., Scientific Investigations.

I have the honour to remain,

Your Excellency's faithful Servant,

T. P. GILL,

Secretary.

DEPARTMENT OF AGRICULTURE AND
TECHNICAL INSTRUCTION FOR IRELAND,
UPPER MERRION-STREET,
DUBLIN, 16*th May*, 1907.

CONTENTS.

To the

SECRETARY OF THE DEPARTMENT OF AGRICULTURE AND TECHNICAL INSTRUCTION FOR IRELAND.

Department of Agriculture and Technical Instruction for Ireland,
Fisheries Branch.

SIR,

I have the honour to submit the following Report, prepared by Mr. E. W. L. Holt, Scientific Adviser to the Fisheries Branch of the Department, and forming Part II. of the Report on Sea and Inland Fisheries of Ireland, 1905, *already submitted.*

I have the honour to be,

Sir,

Your obedient servant,

WM. SPOTSWOOD GREEN,
Chief Inspector of Fisheries.

13th May, 1907.

SEA AND INLAND FISHERIES, 1905.

REPORT OF THE SCIENTIFIC ADVISER.

To the Chief Inspector of Fisheries.

Sir,

I have the honour to submit my report of the scientific work of the Fisheries Branch of the Department for the year 1905.

SEA FISHERIES.

International Investigations.—The official adhesion of Ireland to the International Scheme of Sea Fisheries Research has somewhat added to the duties of the scientific staff of the Branch, but since the programme of this scheme is not essentially different from that which had already commended itself as conducive to our purely national requirements, the increase of work is chiefly of a clerical nature, involved by correspondence and the transcription of records for communication to the Central Bureau, and since the activities of the scientific officers have never been limited to official hours the public service of this country has not, by our participation in international work, been deprived of any time to which it possessed an official claim.

Per contra, in return for communication of hydrographic data collected primarily in our own interests, we have been able to devolve upon our Danish colleagues the laborious task of studying the life-history of the freshwater eel, a fish which is shown by your Report to be of very considerable value to this country. While we contribute such observations as the *Helga* is able to make, having regard to the limitation of area and time imposed by her constant administrative duties, the Danish cruiser extends the field of observation westward of our seaward limit and southward to the Bay of Biscay, and it has become apparent that the rivers of all North Europe are stocked by elvers hatched in the deep water to the south-west of this country. Apart from the fact that the relatively huge and most conspicuous larvae cannot be found elsewhere in the North-East Atlantic or its inlets, I understand that the dates of arrival of elvers, and their relative size, in the rivers of North Europe absolutely confirm the statement of their common origin, but while this is established there is as yet no evidence to show that parent eels from, for instance, the Gulf of Bothnia ever reach the district in which their sexual products might be of value, and it may be that our rivers, easily accessible to the favourable breeding grounds, contribute not alone to their own productivity but very largely to that of the fresh waters of North Europe generally. If this be so we are in effect trustees of a fishery which extends vastly beyond the limits of this country.

In this connection it may be permissible to advert briefly to the measures taken in other countries to utilise what may be termed the waste products of the generative activities of the eel. Elvers, as everyone knows, will ascend any kind of stream or drip of fresh water, or even wriggle across wet grass, and great numbers pass into the merest drains and bog-holes where it is certain that hardly any of them can find sufficient sustenance to permit of maturation. In such situations it is probable that they are for human purposes either absolutely wasted or even deleterious. In the smallest trickles they serve at most to nourish herons, while in small streams capable of holding trout they get much of their living, in season, from trout spawn or fry. No eels of reputable size are ever found in such streams, and probably none descend to contribute to the general upkeep of the species.

In the present state of our fishery laws it is impossible to make any use of such wasted elvers, since the capture, purchase or sale of the fry of eels is most clearly prohibited; and such prohibition, where observed, is no doubt most salutary in river systems which are capable of bringing eels to maturity. In Sweden the inutility of elvers in small streams appears to be recognised, and it is customary to trap them in such situations and sell them to persons interested in the eel fisheries of large rivers or lakes. The little creatures seem to travel well in wet moss.

It is matter of doubt whether any of our large river systems, situate immediate to the source of supply of elvers, are really in need of artificial stocking, and whether, since all of them are valuable in one part or another for production of salmonidae, it is advisable to take any measures to increase their stock of eels; though there is nothing to indicate that in such rivers as the Shannon and Bann the eels have ever succeeded in injuriously affecting the yield of salmon.

It is perhaps more material to consider whether our present code permits us to take legitimate advantage of the run of mature eels. Eel fisheries are in fact confined to a few places, though all or nearly all of our larger river systems are known to produce at least a fair supply. Since the owners of some of the most valuable salmon fisheries appear to experience no pecuniary disadvantage in the concomitant working of eel-weirs, it is probable that the latter are not in themselves inimical to the proper care of salmon, and it would seem that the limited exploitation of eel-fishing is largely due to doubt as to the legality of erecting an eel-weir. Situate, as they are, so near to the immediate source of supply of elvers, it does not seem likely that an enhancement of eel-fishing, by its prosecution in rivers not now exploited for this purpose, would injuriously affect any existing eel fishery.

International Fisheries Statistics.—A most important part of the work of the International Council is the co-ordination of the statistics collected by the several Fisheries Authorities of the North European States, and their presentation in uniform system. This is of especial importance to us because so much of the fishing area which is nearer to the coast of Ireland than to that of any other country, is at present worked by vessels which do not land their catches in our ports. In fact the necessarily limited surveying operations of the *Helga* and the courtesy of the owners of the few Irish deep-sea trawlers afford our only available means of knowing anything about the resources of the apparently rich grounds which fringe our south-western littoral. There are, moreover, a number of grounds off the east and north coasts of this country which cannot be defined as being fished exclusively by boats belonging to any one of the Three Kingdoms, and it is obvious that statistics which deal only with the fortunes of the fishermen of one or other country may present a false impression of the whole fish supply of the area in question.

It has been my duty, as the Irish representative at the meetings of the International Council, to arrange with the British delegates such delimitation of the area worked in common by British and Irish boats as may permit of a natural rather than a purely national definition.

In the statistics issued from this office the coast is divided roughly as follows :—North, from Ardara in County Donegal to Garron Head in Co. Antrim; east, from Garron Head to the south-east point of Ireland in Co. Wexford; south, from the point last mentioned to a line drawn down the centre of the Kenmare River; west, the remaining area.

The northern and eastern of these divisions are naturally associated with British areas of which the limits which concern us are respectively the Mull of Cantyre and the south-west point of Wales; but the boundary between the south and west coasts used in our own statistics is not applicable to statistics embracing the operations of both English and Irish vessels, since English steam-trawlers are much occupied in deep-sea grounds which extend round the south-west corner as far north as Loop Head. As it happens, this headland is also a natural boundary for the operations of our own drifters, and has accordingly been made the limit between the south and west coasts in statistics furnished to the International Council. Similarly, but with a view rather to the probability of future fishery development than to existing conditions, the limit between the north and west coasts has, for international statistics, been shifted from Ardara to Eagle Island in Co. Mayo, where the precipitous and rocky character of the sea floor forms an effective natural barrier to the extension of fishing enterprise from either direction.

Trawling.—The survey of the trawling grounds in the Irish Sea has been continued at regular quarterly intervals, and while it is probable that our experience of the varied duties of the *Helga* now enables us to allot to this survey the *maximum* of available time, our observations are still less complete than could be wished, and on this account open to serious criticism by the advocates of perfection. The records are, however, so consistent that, taken in conjunction with such commercial statistics as can be localised, they seem to me to afford an indication of the condition of the grounds during the period of examination. Our work commenced in 1901, and I regret to say that I cannot find any evidence that the Irish Sea trawl fishery has improved since that date, nor am I in a position to believe that it has not deteriorated.

The popular explanation of decrease in the return of any sort of sea-fishery is steam-trawling, and it is possible, but not on any evidence provable, that the balance of supply, once upset by any form of human interference, may be incapable of natural readjustment when such interference is withdrawn. No doubt, before the Fishery Authority acquired any means of enforcing the law, the areas off the eastern coast which were supposed to be exempted from the operations of steam trawlers were fished by those vessels practically whenever they appeared to be worth fishing. Our observations, however, commence at the same time as the efficient protection of the areas closed to steam-trawling, and within a few months after the commissioning of the *Helga* poaching by steam-trawlers was, in so far as concerns the east coast, reduced to a negligible quantity. Yet, if I rightly interpret the data before me, the fish supply has deteriorated, and, if one may accept the statements of the long-shore class of fishermen whose somewhat sporadic activities yield no return tangible in statistics, the depreciation is by no means confined to trawling, nor perhaps to those kinds of fish which the present state of our information leads us to suppose to be possibly assailable at some stage of their existence by any sort of trawl.

When no question arises of the prevention of interference by trawling with some seasonal method of fishing which cannot be profitably pursued in the presence of trawlers, it is, I believe, generally considered that the legitimate use of the power of prohibiting trawling is confined to grounds which are the nurseries of fishes valuable when adult to all kinds of fishery. It is obvious that in the case of fishes which pass through all the stages of their existence on the same ground, protection in the form of prohibiting one particular kind of fishing is hardly feasible, for, apart from considerations of undue interference with competition, it happens that these sorts of fish inhabit offshore grounds that can in no wise be sufficiently policed. In effect all of the Irish Sea that can be reasonably protected from the depredations of steam-trawlers has been effectively closed to them during the period covered by our observations, and, as far as I can ascertain, the strain on the offshore parts of the area has been continuously more and more relaxed by the diversion of steam-trawling activity to grounds remote from the Irish Sea. It is quite possible that the conditions of the fishing of our inshore grounds is but a reflection of the effect of over-fishing in the central parts of the Irish Sea, and that though this may be, as I think, diminishing rather than increasing, it is still too much for the natural recuperation of the supply. If so, a practicable remedy does not readily suggest itself, as the protection by by-law of such areas as can in this way be protected has already been carried to a very considerable extent on both sides of the sea.

Flatfish Marking.—I referred in my last Report to the marking of flatfish, chiefly plaice, which had been commenced on our side of the water by the *Helga* and on the English side by the authorities of the Lancashire and Western Sea Fisheries Joint Committee. Messrs. Farran and Kemp have marked some 1,400 plaice, of which a large number have been recaptured, and the operations of our English colleagues have been conducted on a considerable scale. Perhaps the most remarkable result is found in the absence of any indication of frequent migration across the sea or to the central parts thereof, or indeed of any constant extensive wandering of the fish. It may be suggested that we get few returns from the central parts because these are chiefly worked by steam-trawlers who may entertain a pardonable suspicion of the ultimate use to which the data of recaptured fish may be put; but we receive in fact so many returns from the coastal area that any considerable concealment of captures on offshore grounds seems improbable. The work has not yet been continued for a period sufficient to justify more than a passing mention of apparent result, or to permit of an attempt to extract from the tables any valid information as to the intensity of fishing.

Mackerel and Herring Fisheries.—Our scheme of research in connection with these fisheries consists chiefly in the tabulation of records of temperature, salinity and plankton taken at regular intervals at a series of stations along the coast. The results are communicated to the International Bureau and are published quarterly in the *Bulletin des Courses périodiques.* When a sufficient series is available we shall attempt to demonstrate the relationship between the conditions of water as shown by these records and the fluctuations of the fisheries indicated by statistics, which in regard to all the principal centres of the mackerel and herring fisheries appear to be reasonably exact. Already we have indications of such inconstancy in annual water conditions as would seem to offer ample explanation for corresponding variation in fish-supply, but I do not think we are yet in a position to attempt forecasts. The defects of our physical observations are their limited range, and, in the case of most observing stations, infrequency of record, but to some extent both these defects are remedied by observations made by the officers of ocean-going ships for the hydrographic department of the International Bureau. In dealing with the fish statistics I anticipate that the principal difficulty will be found in making allowance for suspension of fishing during periods when the price falls low. Obviously the price in some sense reflects the supply, but locally it may be dependent on extra-local conditions or on more or less artificial circumstances.

The examination of mackerel is now restricted to small samples probably sufficient, in view of extensive examination in previous years, to apprise us of any noteworthy departure from the normal seasonal habit of the fish.

Examination of herring is made for us on a considerable scale by the Ulster Fisheries and Biological Association, and is now directed chiefly to the skeletal characters of the fish, with a view to the possible existence of local races. As yet, the result appears to be of a negative character in so far as concerns the different parts of the Irish littoral, but the evidence deduced from size and condition is of some interest in view of the alleged migrations of shoals.

Oyster Fisheries.—In one sense the Irish oyster industry appears to be in a satisfactory condition, in that, taking one district with another, the demand seems to be greater than the supply; but in reality such a state of things is dangerous, for if the demand cannot be satisfied in one quarter it passes to another, and this country, if found unreliable in supply, runs some risk of neglect. Our great difficulty, as I have mentioned in previous reports, is found in the practical extinction, before the Fishery Authority had any means of enforcing its regulations, of many of the natural beds which produced oysters of good table quality. For some reason the public bed in Tralee Bay escaped the common fate, and under the supervision of the Department's bailiff has now been brought to a satisfactory condition, and is increasing in productive area. From unsorted dredgings forwarded to the office it is evident that there was a good fall of spat in 1904 and 1905, and as the great increment in price has now convinced the local dredgers of the impolicy of evading the regulations as to size limit, the bed seems to have every prospect of future prosperity. It has, however, an advantage which is not general, in that the dredgers are comparatively few and are not infrequently diverted, during the open season, to lightering and other pursuits more profitable than dredging. The bay, moreover, is rather exposed, and the weather adds a good many days to the close season.

I referred in my last Report to the Inquiry held at Clarenbridge in February, 1905, and to the measures taken by alteration of the previous by-laws to secure the protection of the public bed at that place. While the size limit has been reduced from 3 to 2¾ inches, the Department has taken power to close defined areas for the purpose of re-stocking; but in view of the urgency of the case, pending the usual delay in confirmation of by-laws, I was directed to take steps to re-stock the bed by a method which would not necessitate closing any part of it. Such a method was found in the laying down of seed oysters so small that they would not reach the size-limit by December (the open season) of 1905, though some would spat in that season, while all survivors would be of generatively mature size in the spatting season of 1906.

The summer of 1905 was so exceptionally favourable that my computation of the probable growth of the seed was considerably exceeded by the result, as many of the oysters, easily recognisable by the mark of the tile, came very near to the legal size, though not thick enough to contain a good fish. Great interest was taken in this matter by the local dredgers, and the new regulations appear to have been most faithfully observed. To some extent this may have been due to the confidence inspired in the bailiffs of the Clarenbridge Committee by the presence of an experienced officer sent down by the Department.

The yield of the December dredging was, in view of previous depletion of the bed, naturally rather small, amounting to some 97,000, but the quality of the oysters was excellent and the price most satisfactory, the average being about 2*s.* per long hundred in advance of that of any previous year.

The cost of our re-stocking operations was inconsiderable, and while we certainly derived most valuable information as to the biological result of laying seed oysters on a natural bed, I think I may say that our action has had a still more desirable result in dispelling the suspicion with which any sort of interference by the central authority was locally regarded.

The fall of spat in 1905 seems to have been much above the average, but not sufficient, in my estimation, for the complete recuperation of a bed so depleted by previous adverse circumstances, natural and artificial. It was accordingly decided to repeat the re-stocking operation in the spring of 1906, and at the suggestion of the local dredgers I caused most of the stock to be laid on the outer part of the ground, which was reported to be very thinly populated. In 1905, as already reported, some 135,000 seed were laid—eighteen months' Brittany oysters from caisses. In 1906 we laid 110,000 of the same origin and age but from ground layings. These are supposed by French cultivators to be superior to the caisse oysters, and certainly appear to be of better quality, probably because the spat placed in caisses is crowded beyond the possibility of adequate nourishment for all. Samples of both kinds, purchased in 1906, are under observation at Ardfry with a view to determining whether or no the somewhat higher price of the ground seed is justified in this district by superior growth and vitality.

The public beds in Clew Bay, as I have mentioned in previous Reports, have for some time been in very poor condition, and the possibility of improving them has been the subject of discussion in this office on many occasions. It is quite clear that the deterioration is absolutely attributable to over-dredging, and a peculiar feature of the case is that at one time the cultch seems to have commanded a ready market for the preparation of private beds, with the result that the powers of recuperation of the natural beds may have been seriously prejudiced. The great difficulty in the way of remedial measures lies in the scattered nature of the productive ground. The most considerable patch lies in Inislyre Harbour, to the south of the anchorage, but strips of good ground occur here and there in the innumerable channels between the Westport owles, and it would require a very large force of bailiffs to prevent the infringement of regulations at one part or another.

To some extent the prospects of successful restoration have been improved by action on the part of the local dredgers, who have asked the Department to take over the beds and manage them in such way as may seem best for the public interest. Though there are difficulties in the way of acceding to this request, it may no doubt be taken as an indication that the dredgers will regard with some confidence whatever steps it may be possible for us to take.

For the present it has been decided to concentrate the work of restoration on the Inislyre basin, as that is an area which permits of adequate watching at a reasonable cost, and on this ground we have laid down, in April, 1906, some 140,000 Brittany seed of the same quality as was used in the Clarenbridge laying of 1905. Measures of a more extensive nature are in contemplation.

To my mind the greatest difficulty in the way of preserving a public oyster fishery or of restoring it to a substantially profitable condition lies in the very fact of its being public. While the policing of a bed during the open season is not usually a matter of great difficulty or expense, its protection during the close season must to a large extent depend on the regular local dredgers, and in the open season also it is obvious that the regular fishermen will readily observe regulations (of which they well understand the theoretical benefits) as long as themselves are sure of reaping advantage therefrom. But if, from whatever cause, a public bed improves in supply, it is subject to immediate invasion by a host of new boats, with the result that the regular local men perhaps get a smaller individual catch than at the time when the bed was less productive. Under such circumstances the local interest in the observance of regulations, which is the most potent factor in preservation, naturally tends to slacken. The possible yield of a natural bed is far below the demands that may be made on it by the fishing of an unlimited number of boats, and it may be impossible to put any of our western beds into really satisfactory condition unless some means can be found of vesting them in a limited number of fishermen who will be certain of a substantial interest in their proper care.

The open sea natural beds of Counties Wicklow and Wexford, owing to the present market conditions affecting the class of oyster which they produce, are not troubled by over-fishing, and the favourable summer of 1905 produced a marked improvement in the quality of the "fish," and must almost certainly have induced a good fall of spat, though as to the latter I have no actual evidence.

Our experiments in oyster-culture at Ardfry have been continued, and the fall of spat in the pond was very fair. The tiles yielded some 80,000 spat, and the latter was found on almost every object in the pond on which it could possibly secure lodgment. Our supply of tiles was quite inadequate, because I was unwilling to incur the expense of purchasing a large quantity until we should have met with some sort of success, but we are now well supplied for future seasons.

There was also a good fall of spat on the outer grounds, and the growth of our re-laid stock was excellent, while the mortality was small. A detailed report on the results of all our work at Ardfry is in preparation.

SCIENTIFIC PAPERS.

The appendix is largely devoted to recording in systematic form the results of our exploration of the Atlantic waters of this country. For the most part these, previous to the inception of the Department's work, were *aquae incognitae*, and in consequence we have to deal with a vast number of organisms, the presence of which on or near our coast was unsuspected or at least unrecorded, while many of them are new to human observation. Before proceeding to an orderly survey of the distributional relationships of these forms as elements of the whole fauna and to speculations as to their influence upon the present or probable future objects of commercial fisheries it is essential to obtain a knowledge of them individually. Their treatment, therefore, on a strictly zoological basis is to be regarded not as a diversion of the energies of fishery officials into the realms of what is called pure science, but as a preliminary to the necessary collation of all the factors which may affect the commercial fish supply.

In the course of preparation of an account of the deep-sea trawling grounds of the west coast, to which I made reference in my Report for 1904, it has been necessary for Mr. Byrne and myself to determine twenty-seven species of fishes which were previously unknown in the fauna of the British Islands. These are mentioned in Appendix, No. II. One species is new to science, and of the others one has only been recorded previously from the coast of North America, and another from off Patagonia. A full report of the result of trawling operations is in hand.

The Crustaceans are a group of which the economical importance, primary or secondary, is readily recognised. In Appendix, No. IV, Mr. Tattersall gives an account of the pelagic Amphipoda of our collections, which include four species new to science, and twenty-one species new to our fauna. As preliminary to a general account of the Macrura, Mr. Kemp, in Appendix, Nos. I and V, deals with the large pelagic prawns of the genus *Acanthephyra* and with other forms not previously known as inhabitants of our region.

Professor Hickson has been kind enough to examine our gatherings of corals, and records in Appendix, No. V, the occurrence of a species belonging to the precious kind, which, though itself of no value, suggests the not improbable occurrence of commercial corals in the same region. For the present it may seem to matter little to Irish fishermen whether the ocean floor some fifty miles from the coast is paved with sand or gold, but the tendency of modern fisheries is to progress seawards, and the presence or absence of precious coral at soundings of a few hundred fathoms is not likely to always remain unimportant. The gathering which included the coral was made in 1901, and it has happened that the *Helga* has never had the opportunity of further exploring the same ground.

To the Ulster Fisheries and Biological Association are due the papers contained in Appendix, Nos. III and VI. The first, by Mr. Gough, deals with the Foraminifera of the north-east coast. The second is a continuation of Mr. Pearson's summary of the records of Copepoda from Irish coasts.

In Appendix, No. VII, the Misses Delap continue their most valuable records of the pelagic organisms occurring in Valencia Harbour, which, as a trap for any oceanic creature drifted to our coast, is an important indicant of the movements of Atlantic waters. In the same number of the Appendix Miss M. J. Delap gives an account of the rearing of two of the large jelly-fishes which infest the coast. It is only by such work that we can acquire a knowledge of the probable influence of these creatures on the world of the sea.

INLAND FISHERIES.

Papers dealing with this subject will be found in No. VIII of the Appendix. Artificial propagation during the season of 1904-1905 was carried out most successfully, the season's yield of salmon fry being more than a million in excess of that of any previous year. I have thought it right to again direct the attention of owners and managers of hatcheries to the paramount importance of turning out the fry as soon as they require food, for though there is now no want of care in the selection of fry grounds nor in the transport of fry, it is probable that in some cases fry have been kept in hatcheries rather longer than is advisable, though never, so far as I am aware, so long as to cause serious risk. In this connection Mr. C. Green, with the permission of the author and editors, contributes a translation of a paper by Dr. W. Hein in the *Allgemeine Fischerei-Zeitung*, in which it is shown by experiment that the growth of trout fry is greatly affected by variation in the period after hatching at which they are first fed. No similar observations are available in regard to salmon, but the latter are so closely allied to trout that in this matter what applies to one kind is certainly applicable to the other, with this difference—that while the artificial feeding of trout fry is well understood, no general success has yet attended experiments in the artificial feeding of salmon fry. Attempts at artificial feeding in the hatchery are therefore not likely to be an effective substitute for release at the proper time.

Figures showing the very large increase in hatchery operations since the Department were placed in a position to subsidise private enterprise, are given in my detailed report, together with the total amount of our expenditure in this respect up to date. Considering the work accomplished the amount is trivial, and it is so because our scheme of assistance leaves the management in the hands of private owners, who make no demand upon public funds for their own indispensable services of supervision, and are able to procure the necessary labour on reasonable terms. If these private hatcheries were transferred to the State it would be necessary to pay a quite considerable salary to the manager of each, and for all labour in connection with hatching operations considerations of continuity alone would entail an advance on the local rate of wages; and, the element of local interest being eliminated, central administrative expenses would be vastly increased by the greater need of supervision from head-quarters. The gain to the fisheries as a whole would, I believe, be nil, since there has never been the slightest difficulty in inducing owners of hatcheries to carry out any alteration in their system of management which it has seemed necessary to advise.

The statistics kindly furnished, for publication in this Report, by the owners of certain salmon fisheries are all indicative of a serious failure of peal in the open season of 1905. I alluded in my Report for 1904 to the drift-net question on the north and north-west coasts, in which I was unable to find an explanation of a general shortage, though the inception or considerable increase of this method of fishing may quite conceivably, if not certainly, have reduced the takes of the fisheries of rivers outside of which the nets have been worked. In 1905 the operations of drift-nets were extended as far as Galway Bay, but the number which fished southwards of the usual north-west grounds was not large, and their take, as far as I can ascertain, was quite insignificant. Whatever be the cause of the *general* shortage of peal, it is reasonably certain that drift-netting cannot be held to blame at present, though its unrestricted practice may perhaps be considered an undue tax on a fish-supply which has for many years failed to yield a satisfactory average, and may, by lessening the interest in winter protection taken by owners of river fisheries, be ultimately the cause of destruction far greater than that which itself inflicts.

Though it is as yet impossible, by the tabulation of figures extending over a reasonably sufficient period, to say what may be the normal condition of the waters on our western seaboard and what may be the apparent relation between their physical condition and the statistical result of salmon fisheries, it is permissible to remark that in 1905 our physical records indicate the presence of water of a salinity not usual in this region, and it is perhaps noteworthy that while our peal fishery was a failure that of the Rhine was decidedly productive. It will, however, be remembered that our peal season of 1904 was practically no better, though the water conditions do not appear to have been exceptional in that year. Unless we assume the fortunes of the earlier stages of the salmon to be a constant, it is evident that in comparing one season with another it is necessary to take into account the conditions, fluviatile and marine, which may have affected the whole life-history of the individuals that come to net or gaff in any one season, and until we acquire some adequate means of making a scientific study of the fish I do not see how this is possible.

In certain years it is generally reported that the run of smolts has been unusually large, but it is very difficult to say to what extent such reports may have been due to unusually favourable opportunities of observation. If smolts when ready for the sea move as freely in heavy water as in times of drought, it is evident that they will be, to human observation, most numerous under the latter condition, since floods screen them from observation and prevent their accumulation in the head-races of mills, where they usually attract most attention.

The season of 1905 was exceptional in the general low state of the rivers while fry were running. In the case of one river which I had occasion to visit the water was so low that practically all of it went through a mill chiefly worked by a large slow-moving turbine with large ports and a fall of a few feet. The turbine is screened by fry-guards and a large undershot wheel is protected by a coarse grating, which has since been altered in pattern so as to be removable at short notice. A quantity of smolts had accumulated above the weir, and in their quest of means of descent a good many of them got sucked broadside-on against the fry-guards and so killed. The fish manifested great reluctance to pass through the grating of the undershot wheel (where they could take no possible harm) even after several bars had been knocked out; and the force of water was not sufficient to carry many of them through, though the turbine was stopped for this purpose. Since there was no sign of a change of weather, it was obvious that the whole run was in considerable risk of destruction in detail against the fry-guards, and having previously had some experience of passing fish through a similar turbine I took the responsibility of pulling up the fry-guards. The river is tidal below the weir, and, by surrounding the turbine outfall with such nets as were procurable, it was possible during low water to see what happened the fry that came through. Of a number of small shoals which made the passage at this period, when the fall was at its maximum, not one fish seemed any the worse.

The grating of turbines is provided for by statute law and is not susceptible of modification by permission of the Department, as in the case of mill-wheels. In my opinion it would be a matter of the greatest difficulty to decide whether a turbine of given pattern and fall is or is not harmful to fry without the most exact experiment in each particular case.

The exceptional drought during the smolt season of 1905 caused attention to be directed to the dangers arising in a limestone country from "swallow-holes." So far as concerns parr, *i.e.*, fry not ready to migrate, risk of destruction by the drying of parts of the river bed is common in any dry summer, and is, according to my information, a serious matter in the Clare-Galway river. Usually, however, when smolts are running, there is at least enough water in rivers to ensure a continuous passage to the sea. This was not the case in May of 1905 in the little Dunmoran river, which enters the sea to the west of Ballysodare Bay. Swallow-holes exist for some miles from the mouth, and in the upper part, where the bottom is gravelly, the riparian tenants staunch them with more or less success by heaving in any sort of rubbish that comes to hand, their object being to preserve water, and prevent pitfalls, for their cattle. In the lower part of the river there is a reach of more than a hundred yards which was altogether dry when I visited it. The bottom is rocky, and there are many transverse ledges which would hold water from seaward passage if it could not escape by vertical fissures. I did not see any smolts in any part of the river, but since there were plenty in the Sligo river at the time, I have no doubt that I was correctly informed that some had perished by the drying of this stream, which seems to be of considerable value for spawning purposes. The local people told me that a good fall of rain would at once carry the river over the dried portion, and as this portion did not seem of much value except during the passage of smolts, when it is almost invariably full of water, I doubt if its occasional drying is of sufficient importance to justify any large expenditure on remedial works, such as gratings to prevent the smolts from reaching the dangerous region when the stream falls low.

Salmon-marking has been continued on much the same scale as during the last few years, and some attempt has been made at the marking of smolts, but the labels used for this purpose have not proved satisfactory. We therefore propose to experiment on fish in confinement with a view to finding some more efficient means of marking smolts.

I have to express my acknowledgments to my colleagues, the Assistant Naturalists, and to the Technical Assistant, for most of the material upon which this Report is based. Mr. C. Green has prepared the index, and has, as usual, relieved me of most of the editorial cares.

I have the honour to be,

Sir,

Your obedient servant,

E. W. L. HOLT,

Scientific Adviser.

18th August, 1906.

APPENDIX

TO

REPORT

ON THE

SEA AND INLAND FISHERIES OF IRELAND

FOR THE YEAR 1905.

PART II.—SCIENTIFIC INVESTIGATIONS.

VIII. INLAND FISHERIES.

APPENDIX, No. I.

THE MARINE FAUNA OF THE COAST OF IRELAND

PART VII.

ON THE OCCURRENCE OF THE GENUS *ACANTHEPHYRA* IN DEEP WATER OFF THE WEST COAST OF IRELAND,

BY

STANLEY W. KEMP, B.A.

PLATES I and II.

Two species of *Acanthephyra* are here recorded for the first time from the West Coast of Ireland. One of them, *A. purpurea*, is extremely variable and, in the course of my investigations, I have been led to classify several more recently described forms as merely synonymous with this widely distributed species. I have endeavoured, possibly somewhat too fully, to detail my reasons for this step.

Towards the end of this paper will be found a synonymic list and also a diagnostic table which may assist in the identification of the many species of *Acanthephyra*, and together with these will be found tables of bathymetric and horizontal distribution.

I have to thank Dr. R. N. Wolfenden for his courtesy in placing at my disposal the Decapoda which he collected off the Irish coast in 1903; among this material I found a very fine example of *Acanthephyra debilis*.

FAMILY *HOPLOPHORIDAE*,[1] Faxon.

GENUS **Acanthephyra**, A. M.-Edw.

1881. *Acanthephyra*, A. M.-Edw. [**12**] p. 12.
1882. *Miersia*, Smith. [**24**] p. 66.
1884. *Acanthephyra*, Smith. [**25**] p. 372.
1888. *Acanthephyra*, Sp. Bate. [**28**] p. 730.
1888. *Systellaspis*, Sp. Bate. [**28**] p. 757.
1888. *Tropiocaris*, Sp. Bate (*partim*) [**28**] p. 834.
1888. *Hymenodora*, Sp. Bate (*partim*) [**28**] p. 838.
1895. *Acanthephyra*, Faxon. [**6**] p. 160.
1901. *Acanthephyra*, Alcock. [**3**] p. 75.
1905. *Acanthephyra*, Stebbing. [**29**] p. 106.

[1] Stebbing [**29**] gives a full account of the synonymy of this family. He regards *Miersiidae* as the more correct name; although I feel some compunction at differing from such a well-known authority on nomenclature, I cannot but think that *Hoplophoridae* will be found more convenient, at any rate until more is known of Kingsley's *Miersia*.

Acanthephyra purpurea, A. M.-Edw.

1881. *Acanthephyra purpurea*, A. M.-Edw. [**11**] p. 935.
1882. *Acanthephyra purpurea*, A. M.-Edw. [**13**] p. 37.
1882. *Miersia Agassizi*, Smith. [**24**] p. 67, pl. xi., figs. 5-7; pl. xii., figs. 1-4.
1883. *Acanthephyra purpurea*, A. M.-Edw. [**14**] pl. 33, fig. 3.
1884. *Acanthephyra Agassizi*, Smith. [**24**] p. 372, pl. viii. fig. 1.
1886. *Acanthephyra Agassizi*, Smith. [**27**] p. 667, pl. xv., figs. 1, 6, 7; pl. xvi., fig. 2.
1888. *Acanthephyra purpurea*, Sp. Bate. [**28**] p. 733, pl. cxxiv., fig. 1.
1888. *Acanthephyra sica*, Sp. Bate. [**28**] p. 739, pl. cxxv. fig. 1.
1888. *Acanthephyra acanthitelsonis*, Sp. Bate. [**28**] p. 745, pl. cxxv., fig. 3.
1895. *Acanthephyra purpurea*, Ortmann. [**17**] p. 43.
1895. *Acanthephyra Agassizi*, Faxon. [**6**] p. 161.
1896. *Acanthephyra purpurea*, Caullery. [**4**] p. 375.
1900. *Acanthephyra Agassizi*, Riggio. [**20**] p. 20.
1900. *Acanthephyra rectirostris*, Riggio. [**20**] p. 20.
1903. *Acanthephyra rectirostris*, Lo Bianco. [**10**] p. 186.
1905. *Acanthephyra Batei*, Stebbing. [**29**] p. 107, pl. xxiv. B.
1905. *Acanthephyra purpurea*, Riggio. [**21**] p. 35, tav. ii., figs. 12-15; tav. iii., fig. 18.
1905. *Acanthephyra rectirostris*, Riggio. [**21**] p. 40, tav. iii., figs. 1-17.
1905. *Acanthephyra Haeckeli*, Thiele. [**30**] p. 466.
1905. *Acanthephyra rectirostris*, Thiele. [**30**] p. 467.
1905. *Acanthephyra purpurea*. Coutière. [**4a**] p. 10, fig. 4.
1905. *Acanthephyra parva*, Coutière. [**4a**] p. 15, fig. 5.

The capture of twenty-five specimens, in deep water off the West Coast of Ireland, has led me to look closely into the claims to specific rank of the members of that group of the genus *Acanthephyra* comprising *purpurea* A. M.-Edw., *Agassizi* Smith *sica* Sp. Bate, *acanthitelsonis* Sp. Bate, *sanguinea* Wood-Mason, *Batei* Stebbing, and *rectirostris*, Riggio.

Through the courtesy of Dr. W. T. Calman I have been enabled to examine the specimens belonging to this genus, chiefly from the *Challenger* collection, contained in the British Museum; I wish, here, to express my gratitude to him for his unvarying kindness and ready help.

The present species was first described by Milne-Edwards in 1881 [**11**] when he published in a footnote a diagnosis occupying only four lines; he republished this description with the addition of a single sentence in the following year [**13**]. In that year, 1882, Smith [**24**] established a new genus *Miersia*, his type species being *M. Agassizi*, for three specimens taken in deep water off the east coast of the United States; he published a long and careful description with a number of figures.

The next year A. Milne-Edwards brought out his well-known "*Recueil*" [**14**], which includes a sketch of the specimen described in 1881.

In 1884 [**24**] Smith published an amended description of his *M. Agassizi* with more figures, and in 1886 issued a short note on the species, recording its occurrence at the surface [**27**].

Spence Bate in his *Challenger* Report [**28**] regards *Agassizi* as a synonym of *purpurea*, and refers three small specimens to this species; he gives a very inaccurate description, and figures a small specimen with a broken rostrum. When after reviewing a portion of this writer's work one sees the numberless mistakes and inconsistencies which disfigure it, one cannot but entertain the gravest suspicion as to the value of the other parts of his Report. Owing to some oversight he totally neglected to mention the existence of a large specimen, taken by the *Challenger* off Vigo, which he himself named *purpurea*, and which is at present with his other specimens in the British Museum. In spite of the fact that this specimen is somewhat damaged—the rostrum is entire but fractured at the base, and the third abdominal segment is rather crushed—it would certainly have provided him with better material than that which he used. Ortmann in 1893 [**17**] and Caullery in 1896 [**4**] place *Agassizi* as a synonym of *purpurea*, though they give no reasons for so doing, but Faxon in 1895 [**6**] on account of the supposed absence of a carina on the second abdominal tergite in *purpurea* (see Sp. Bate's description) and because of the greater length of the rostrum in that species, retains *Agassizi* as distinct.

Riggio in 1900 [**20**], when giving a very brief account of some Mediterranean crustacea, records the occurrence of *Acanthephyra Agassizi*, and distinguishes from it a closely allied form which he names *A. rectirostris*. In 1905 [**21**] he published a fuller account where he agrees with Ortmann and Caullery in regarding *Agassizi* as a synonym of *purpurea*: he still retains *rectirostris* as a distinct species, and gives rough figures of both it and *purpurea*. Stebbing, also in 1905 [**29**], records a number of South African crustacea, and describes a form which he calls *Acanthephyra Batei*, differing from *purpurea* chiefly in the armature of the rostrum and telson.

Thiele [**30**] has recently published some remarks on the old *Ephyra Haeckeli*, Martens. He has examined a specimen with a broken rostrum from the Mediterranean, which he considers the same as Riggio's *Agassizi* var. *mediterranea* [**20**]. On comparing this specimen with an *Ephyra Haeckeli*, he has decided that the two are identical. Coutière [**4a**] also has examined a co-type of *Haeckeli* in the Berlin museum; he is of the opinion that the specimen is an *Acanthephyra*, perhaps a new species.

The "*purpurea* group" of this genus may be briefly characterized thus:—Species of *Acanthephyra* in which the rostrum nearly reaches to, or surpasses, the antennal scale, and is armed dorsally throughout its length, and ventrally with at least three teeth. The eyes are wider than the eyestalks. The sixth abdominal somite is dorsally carinate and not twice as long as the fifth. The telson is armed with at least four pairs of spines.[1]

In the first place, to deal with Spence Bate's description of *purpurea*. On p. 733 of his Report he says—"pleon subcarinated from the posterior margin of the second somite to that of the sixth, the third, fifth and sixth being posteriorly produced to a tooth."

This certainly implies that no carina is found on the second somite, whereas, as a matter of fact, it is present in every one of the *Challenger* specimens referred by him to *purpurea*, although in the smaller specimens the carina is not so obvious on the second as on the following segments; "subcarinated," too, scarcely seems applicable to such a very pronounced carina.

It is doubtless due to some mistake that Milne-Edwards in his Recueil does not figure any carina on the second abdominal somite.

Spence Bate in his description implies that the fourth abdominal somite is not armed posteriorly with a spine, and this is true of the specimen from which he drew his figure; nevertheless, on referring to that figure the fourth abdominal somite is found to bear a short but very evident spine. This spine is also absent in the specimen taken N.W. of Bermuda, but, in the Vigo specimen —labelled *purpurea* it Sp. Bate's handwriting but not mentioned in his report—the spine on the fourth somite is prominent and as long as that on the fifth. The armature of the telson, too, would more correctly be described as consisting of stout spines rather than "minute spinules." I have drawn up a table giving the chief points of the specimens I have been able to examine which will, I hope, give a fairly adequate idea of the enormous range of variation among the individuals of this almost ubiquitous species. This table will, I think, be more especially useful in connection with the forms which I have been induced to consider merely varieties of *A. purpurea*.

I have not had an opportunity of examining specimens of Stebbing's *A. Batei* or Riggio's *A. rectirostris*, but, from the descriptions and figures they fall easily within the limits of variation of *A. purpurea*.

A. Agassizi.—Little need be said with regard to *Agassizi*, for all recent authors are agreed in placing it as a synonym of *purpurea*.

The rostral formula given in Smith's amended description is $6-10$ above and $1-7$ below.

The spine on the fourth abdominal somite was absent or nearly absent in two out of three of Smith's original specimens, while

[1] *A. approxima*, described by Spence Bate, from a single specimen with a broken rostrum, differs from the foregoing group in the extremely minute, sometimes obsolete, spinules on the telson, in the carinate carapace and first abdominal tergite, and in the disposition of the teeth on the dorsal border of the rostrum, at least five of which are placed behind the posterior tooth on the ventral border. Faxon [7] has doubtfully referred nine specimens from the Gulf of Panama and Galapagos Islands to this species.

in his later examples it seems to have been usually present. From the material taken by the *Helga* alone, it would be easy to select a series showing every gradation from the complete absence of this tooth to cases where it is as large or even larger than that on the fifth somite. With regard to the armature of the telson, Smith in his first account says there are four or five pairs of dorsal aculei, while two years later he gives five to twelve pairs as the limits of variation. Faxon, in 1895 [6], doubtfully refers to *Agassizi* two specimens from the Pacific which have only three pairs of spines on the telson. This writer furnishes two reasons for retaining *Agassizi* as distinct from *purpurea*, namely that the latter species possesses a larger rostrum and bears no carina on the second abdominal somite. The last of these two arguments is, as I have already shown, based on a mistake in Spence Bate's description, and the remaining feature, as may be seen from the comparative measurements of rostrum and carapace in the annexed table, is so variable that little reliance can be placed upon it as a specific character.

A. sica.—While working at the British Museum I was struck with the very close resemblance which specimens referred by Spence Bate to *Acanthephyra sica* bore to *A. purpurea*, and on examining the question I failed to find any constant characteristic by which the long series of *Challenger* specimens could be separated from that species. According to Spence Bate the chief distinction lies in the rostral armature, which he describes thus:—

"Rostrum, equal in length to the carapace, and armed on the "upper surface with nine or ten widely separated small teeth, "the posterior being closer to one another than the others, and "with five on the lower corresponding with the anterior five on "the dorsal surface."

Again, on the next page, he says:—

"The rostrum projects forwards to a length that is subequal "with the carapace, and is armed on the upper surface with ten "small teeth that are closer together near the frontal region and "more distant anteriorly; the under surface is armed with five "teeth that coincide with the same number, tooth for tooth, on "the upper surface, except the most anterior on the upper "surface, which has no corresponding tooth on the lower."

In other words, of the ten teeth on the upper surface of the rostrum, the posterior four are not paired with any teeth on the lower surface, and this is what is found in the type specimen of *A. sica*, which Spence Bate figures. This arrangement of teeth, however, by no means holds for the majority of specimens which he refers to *sica*; out of fourteen examples now in the British Museum only four possess exactly this type of armature. In most cases it is only the three posterior teeth on the dorsal surface which are unpaired with any below, and this is the arrangement which is the general rule with *purpurea*. I figure, p. 13, fig. 2, examples of rostra, some from Irish specimens and others from specimens referred by Spence Bate to *sica*, and the variation shown is sufficient to prove that although when treated broadly the form of the rostral armature is undoubtedly of great specific value, yet this character is not valid in such minute details as were held to distinguish *sica* from *purpurea*. Spence Bate himself seems to have had some doubts as to the correct identification of the specimen from st. 318 with very abnormal rostral armature (see p. 13, fig. 2); on p. 743 he calls it a variety of *A. sica* approximating to *acanthitelsonis*, while on p. 746 he refers to it as a variety of *purpurea*.

Another feature given as a distinction between *sica* and *purpurea* concerns the armature of the pleon. Spence Bate says "the four posterior somites terminating in small dorsal teeth of "which the anterior is occasionally the largest." Among the fourteen specimens examined there is only one in which these spines are equal, in every other case the spine on the third somite is larger than those on the following ones, often considerably so. In these specimens of *sica* the telson is about equal in length to the outer uropod, and is furnished with from four to ten pairs of lateral spines. In the examples collected by the *Helga* the telson is in some cases equal to, in others slightly longer than, in others considerably longer, than the outer uropod. Smith found similar variation among his *Agassizi*.

The oral appendages of Bate's *sica* appear to differ in no respect from those of *purpurea*.

A. acanthitelsonis.—This form is an extreme variety of *purpurea*, and may be referred to the var. *multispina* of Coutière. Spence Bate says "it may readily be distinguished by the shortness of the rostrum and the less important dental armature of the pleon, and, on closer inspection, by the more abundant and important spinules on the telson and the obtuse character of the scaphocerite." I have examined the two specimens, but confess myself unable to appreciate "the obtuse character of the scaphocerite."

If the apical cluster of spines on the telson is neglected and only the lateral ones counted (which is the method I have employed when recording variations of this appendage), then the greatest number present in *acanthitelsonis* is fifteen. This slight increase over the number normally present certainly does not justify its retention as a separate species. Spence Bate's figure is erroneous in one particular; in both his specimens the telson is considerably longer than the outer uropod, whereas he has drawn the two of approximately the same length.

A. Batei.—Stebbing [**29**] has recently described under the name of *Batei* a form of *Acanthephyra* from South African waters. Here, as well as in the case of *Agassizi*, Spence Bate's inaccurate description has proved a source of error.

The chief characteristics are the straight, slender rostrum, scarcely as long as the carapace and armed with seven spines above and four below, all well separated. The telson reaches beyond the uropods with five dorso-lateral pairs of spines.

The principal feature of this form is the small number of teeth on the rostrum, but when the extraordinary variation in the armature is considered, one cannot help regarding this small decrease from the normal number as insufficient to fix its specific identity when unsupported by other important structural details. One of the specimens taken off the west coast of Ireland has still fewer teeth, the rostral formula being $\frac{4}{3}$. It should be noted, too, that Faxon in 1895 [**6**] proposed the name *A. Batei* for the form described by Spence Bate as *A. brevirostris*, *A. brevirostris* of Smith being an entirely different species.

A. rectirostris.—Riggio has found two widely different forms of *A. purpurea* in the Mediterranean, and has, not unnaturally, come to the conclusion that they are separate species. One of these forms, which has a long rostrum, he assigns to *A. purpurea*, while the other, with a short rostrum, he describes as new under the name of *A. rectirostris*, although he admits that it bears a close resemblance to both *sica* and *acanthitelsonis*. Most of the characters relied on for the distinction of *A. rectirostris* are those very features which I have found to be so variable, but, in addition, the telson is slightly shorter than the outer uropods and the antennal scale has a rather different outline. Possibly his figure is in error in representing the scale to be so narrow and possessed of such a large apical spine.

A. parva.—Coutière, who has done such good work with the Alpheidae, has described [**4a**] a very small *Acanthephyra* from the collections made by the Prince of Monaco under the name of *parva*. He has written to me since stating that further material which has come into his hands enables him to state that *parva* is only a very young form of *purpurea*.[1]

Quite recently (Nov., 1905) a large number of these interesting immature specimens was taken by the *Helga*. The post-larval form with its extremely short rostrum scarcely longer than the eyestalks, and very long sixth abdominal somite, presents a remarkably dissimilar appearance to the adult.

The accompanying figure will show the system employed for measuring the lengths of rostrum and carapace—
Rostrum = AB.; Carapace = BC.

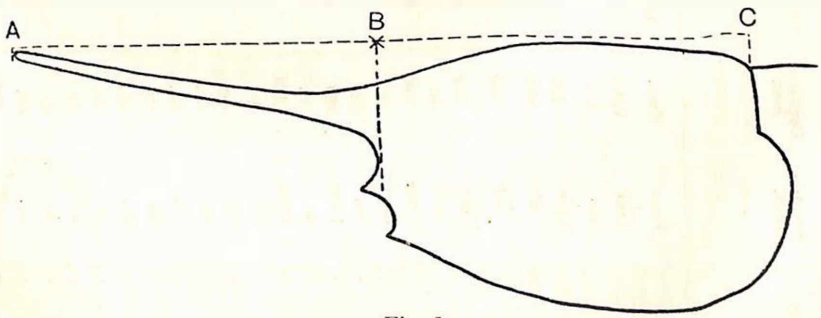


Fig. 1.

[1] Coutière, *Bull. Mus. Oceanog. Monaco*, No. 70, gives a full account of the development of this species.

TABLE showing Characteristics of the Larger Specimens caught off the Irish Coast.

Station.	Soundings.	Depth of Net.	Locality. Latitude N.	Locality. Longitude W.	Sex.	Rostral formula.	No. of teeth on dorsal surface of rostrum posterior to proximal ventral one.	Length of rostrum ÷ Length of carapace.	Spine on 4th abd. tergite as large as that on 5th (L), smaller (S), or absent (O).	Telson much longer (LL), longer than (L), or equal to (=) outer uropod.	No. of spines on telson. Right side.	No. of spines on telson. Left side.	Length from tip of rostrum to tip of telson.
	Fms.	Fms.											mm.
SR. 139, .	1,000	1,000	55° 0′	10° 48′	♂	8/5	3	·82	L	LL	8	9	103
SR. 139, .	do.	do.	do.	do.	♂	8/4	4	1·16*	O	..	9	9	59½
SR. 140, .	1,000	735	54° 50′	10° 45′	♂	9/[illegible]	4	·76*	L	LL	9	8	97
SR. 175, .	670	600	51° 53′	10° 42′	♀	8/[illegible]	3	1·12	S	=	9	9	52
SR. 193, .	650	630	54° 50′	10° 30′	♀	8/[illegible]	3	·78*	S	—	9	8	104
SR. 197, .	1,000	690	54° 57′	10° 51′	♀	8/[illegible]	3	·84*	L	L	10	9	101
SR. 197, .	do.	do.	do.	do.	♂	7/4	3	·89*	L	LL	10	9	93
SR. 224, .	860	700	53° 7′	15° 0′	♂	5/3	3	1·18	O	—	4	4	92
SR. 224, .	do.	do.	do.	do.	♂	8/[illegible]	3	1·37	S	L	8	8	76
SR. 224, .	do.	do.	do.	do.	♂	9/4	3	1·20	L	L	9	9	71
SR. 231, .	1,200	800	55° 1′	10° 45′	♀	8/[illegible]	3	1·17	L	=	9	9	73
SR. 231, .	do.	do.	do.	do.	♂	..	..	..	L	=	9	8	..
SR. 231, .	1,200	1,150	do.	do.	♂	8/[illegible]	3	·76	L	LL	9	8	112
SR. 231, .	do.	do.	do.	do.	♀	9/[illegible]	4	·92	L	LL	9	9	110
SR. 231, .	do.	do.	do.	do.	♂	[illegible]	2	·96	L	LL	9	9	103
SR. 231, .	do.	do.	do.	do.	♂	[illegible]	3	·87	L	LL	10	10	103
SR. 231, .	do.	do.	do.	do.	♂	8/[illegible]	3	·87	S	LL	10	10	101
SR. 231, .	do.	do.	do.	do.	♀	8/[illegible]	3	·96	L	L	12	10	100
SR. 231, .	do.	do.	do.	do.	♂	9	3	·92	L	LL	9	9	96
SR. 231, .	do.	do.	do.	do.	♂	8/[illegible]	3	1·11	L	L	9	9	95
SR. 231, .	do.	do.	do.	do.	♀	8/[illegible]	3	1·0	L	L	10	9	92
SR. 231, .	do.	do.	do.	do.	♀	9/[illegible]	3	·91	L	LL	9	9	91
SR. 231, .	do.	do.	do.	do.	..	9/[illegible]	3	1·07	..	—	9	8	41
SR. 270, .	470	350	50° 20′	11° 15′	♂	6/[illegible]	3	1·20	S	..	—	—	68
SR. 282, .	1,000	700	54° 59′	10° 55′	♀	11/5	4	1·0	L	LL	8	9	93

* Extreme apex of rostrum broken off.

TABLE showing Characteristics of Specimens examined in the British Museum.

STATION.	Soundings.	Name given to Specimen by Spence Bate.	Locality.	Sex.	Rostral formula.	No. of teeth on dorsal surface of rostrum posterior to proximal ventral one.	Length of rostrum. ÷ Length of carapace.	Spine on 4th abd. tergite as large as that on 5th (L), smaller (S), or absent (O).	Telson slightly longer than (L) equal to (=) or shorter than (S) outer uropod.	No. of spines on telson. Right side.	No. of spines on telson. Left side.	Length from tip of rostrum to tip of telson.
	Fms.											mm.
Chall., 354, .	1,675	*purpurea*, .	S.W. of Azores. (*Fig. Sp. B.*),	♂	..	2	..	O	..	5	5	43+
		purpurea, .	Off Vigo. (*not mentioned in Chall. Rep.*)	♂	9/5	3	·88	L	..	4+	4+	87+
Chall., 40, .	2,675	*purpurea*, .	N.W. of Bermuda. . .	♂	[illegible]/6	3	1·12	O	—	4	4	44
Chall., 87, .	1,675	*purpurea*, .	Off Canary Is. . .	♀ ?	..	—	..	O	..	3+	3+	27+
Chall., 168, .	1,100	*sica*, . .	Off New Zealand. (*type, fig. Sp. B.*)	♀	10/3	4	1·19	L	—	9	9	107
Chall., 168, .	do.	*sica*, . .	do., . . .	♀	10/3	4	1·28	S	..	4	5	74
Chall., 168, .	do.	*sica*, . .	do., . . .	♀	8/5	2	1·15	S	S	4	4	75
Chall., 168, .	do.	*sica*, . .	do., . . .	♂	[illegible]/4	3	1·30	S	=	4	4	80
Chall., 318, .	2,040	*sica*, .	N. of Falkland Is. Pl. fig.	♂	[illegible]	6	1·64	L	..	..	..	103
Chall., 230, .	2,425	*sica* . .	S. of Japan. . . .	♂	10/[illegible]	3	·98	S	—	4	4	85
Chall., 230. .	do.	*sica*, . . .	do., . . .	♂	9/6	3	1·23	S	—	4	4	77
Chall., 169, .	700	*sica*, . .	Near New Zealand, . .	♀	9/[illegible]	3	1·27	S	=	4	5	82
Chall., 169, .	do.	*sica*, . .	do., . .	♀	..	—	..	S	=	4	4	..
Chall., 169, .	do.	*sica*, . .	do., . .	♂	..	*A fragment only.*		..	..	..	..	..
Chall., 159, .	2,150	*sica*, . .	S. of Australia. . .	♂	10/[illegible]	4	1·32	L	=	9	8	85
Chall., 159, .	do.	*sica* . .	do., . .	♀	10/[illegible]	4	1·33	L	=	9	7	82
Chall., 170A, .	520	*sica*, . .	Off Kermadec Is. . .	♀	[illegible]	3	1·17	L	—	4	4	87
Chall., 181, .	2,450	*sica*, . .	Between Australia and Solomon Is.	♂	8/[illegible]	3	1·04	L	..	..	..	64+
Alb., 2,098, .	2,221	*Agassizi*,* .	Off E. coast of U.S.A. (*ex coll. A.M.N.*)	♀	8/[illegible]	2	·98	L	L	10	10	103
Alb., 2,098, .	do.	*Agassizi*,* .	do.	♂	10/4	3	·98	L	L	11	11	96

* This specimen was named by S. I. Smith.

The characteristics of *A. purpurea* most liable to variation may be arranged under five heads :—

1. Proportional length of rostrum.
2. Rostral formula.
3. Presence or absence of a spine on the posterior margin of the fourth abdominal tergite.
4. Comparative length of telson.
5. Number of dorso-lateral spines on telson.

It will be convenient to treat of each of these separately.

1. The smallest specimen caught off the Irish coast is about 12 mm. in length. Here the rostrum is shorter even than the eye-stalks (pl. II., fig. 1). In a specimen 23 mm. long the rostrum has grown considerably, and is nearly twice the length of the eyes (pl. II., fig. 3). In adolescent individuals of between 40 and 70 mm. in length the rostrum is as a rule longer than the carapace, while in the largest examples it is frequently rather the shorter. Wood-Mason has noted a parallel instance of rostral development in the case of *A. eximia* var. *brachytelsonis* **[32]**.

A glance at the tables on pages 10 and 11 will show that, of the specimens in the British Museum, those referred by Spence Bate to *sica* have the rostrum slightly longer than the carapace with a single exception, while in the majority of Irish examples of large size (*i.e.* those of 80 mm. in length and upwards) the rostrum is slightly shorter than the carapace.

2. The rostral formula shows a most unusual amount of variation. The post-larval forms that I have examined show that the teeth on the dorsal surface of the rostrum appear before there is any trace of corresponding teeth on the ventral surface; these develop at a slightly later stage (pl. II., figs. 1, 2, 3).

Mature specimens normally possess 8, 9, or 10 teeth above, and 4, 5, or 6 below, the three posterior ones above being placed behind the lower posterior tooth. Usually the teeth are fairly equally spaced along the dorsal and ventral borders, sometimes the posterior dorsal ones are more closely set. Many abnormal forms occur, and the specimens I have examined show thirteen different rostral formulae, *i.e.*—

$$\frac{5}{3}, \frac{6}{3}, \frac{9}{3}, \frac{7}{4}, \frac{9}{4}, \frac{10}{4}, \frac{7}{5}, \frac{8}{5}, \frac{9}{5}, \frac{10}{5}, \frac{11}{5}, \frac{8}{6}, \frac{9}{6}$$

5 – 11 above and 3 – 7 below probably represents the limits of variation.

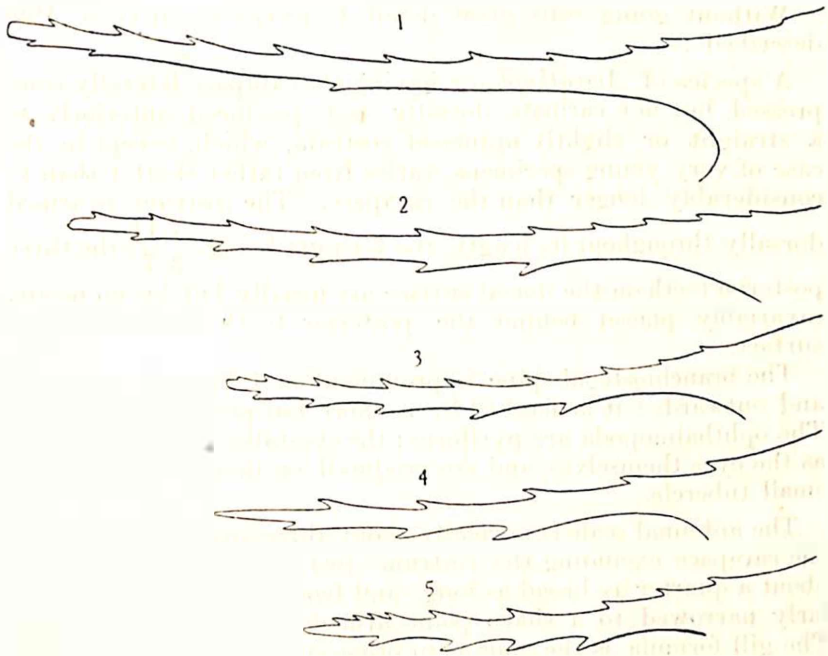


Fig. 2.

Forms of rostral armature in *A. purpurea.*

1. Rostrum of the specimen from st. 318, "Challenger" coll., referred by Sp. Bate to *A. sica.*
2. Rostrum of the type specimen of *A. sica.*
3. Rostrum of a specimen from st. 181, "Challenger" coll., referred by Sp. Bate to *A. sica.*
4, 5. Examples of abnormal rostra from specimens taken off the Irish Coast (st. 224).

3. The spine on the posterior dorsal margin of the fourth abdominal tergite may be present or absent. When present, it is generally considerably smaller than that on the fifth tergite in young specimens, while in some full-grown examples the spines on these two segments are of equal size. The absence of this spine in specimens of large size is apparently quite exceptional.

4. The comparative length of the telson and uropods is a feature which possibly does not differ much during individual growth. Among the Irish specimens the telson may surpass the outer uropod by as much as 2 mm., while in other cases the two are equal, and between these extremes every degree of variation exists. In specimens referred by Sp. Bate to *sica* the telson is always about equal in length to the outer uropod.

5. Smith **[24]** **[25]** described *Agassizi* as possessing from four to twelve pairs of lateral spines on the telson, while Faxon in 1895 **[6]** doubtfully referred to the same species two specimens with only three pairs of spines. Three to fifteen pairs probably represents the limits of variation.

In many cases these spines are very irregularly placed, and often there are more on one side of the telson than on the other (pl. I., fig. 2.)

Without going into great detail *A. purpurea* may be thus described[1]:—

A species of *Acanthephyra* having the carapace laterally compressed, but not carinate dorsally and produced anteriorly to a straight or slightly upturned rostrum, which, except in the case of very young specimens, varies from rather shorter than to considerably longer than the carapace. The rostrum is armed dorsally throughout its length, the formula being $\frac{5\text{–}11}{3\text{–}7}$, the three posterior teeth on the dorsal surface are usually, but by no means invariably, placed behind the posterior tooth on the ventral surface.

The branchiostegal spine is prominent and directed forwards and outwards: it is flanked by a short but pronounced carina. The ophthalmopoda are pyriform: the eyestalks are not so wide as the eyes themselves, and are produced on their inner side to a small tubercle.

The antennal scale is normally about three-quarters as long as the carapace excluding the rostrum; just above the base it is about a quarter as broad as long, and from this point it is regularly narrowed to a sharp point armed with an apical spine. The gill-formula is the same as in other species of *Acanthephyra*.

—	VII.	VIII.	IX.	X.	XI.	XII.	XIII	XIV.
Pleurobranchiae, .	..	..	..	1	1	1	1	1
Arthrobranchiae, .	..	..	2	1	1	1	1	..
Podobranchiae, .	..	1	..	..	..	..	..	..
Epipods, . .	1	1	1	1	1	1	..	..

All the pereiopods bear a long exopod. The first two pairs are chelate, the second being slightly longer than the first and having the carpus and chela more slender. The third and fourth pairs are nearly equal in length, the third reaching to the tips of the external maxillipedes when stretched forwards. The dactyli on these two pairs are rather more than one quarter the length of the carpus. The fifth pair of pereiopods are slightly shorter than the fourth, and the dactylus is very short, incurved, and almost hidden by a plume of setae. The posterior margin of the ischium and merus of the last three pairs of walking legs is furnished with a number of stout spines partially hidden by the long setae which fringe these appendages. The first abdominal tergite is rounded above, the posterior two-thirds of the second are strongly carinate dorsally, as are also the third, fourth, fifth, and sixth. In these last four tergites the carina is produced

[1] Smith in 1882 [**24**], and again in 1884 [**25**], published a long and careful description of this species under the name of *Agassizi*, and gives accurate figures of the oral appendages.

posteriorly to a sharp spine which overhangs the succeeding somite. The spine on the third tergite is nearly always the largest, but occasionally all are subequal. That on the fourth somite is sometimes very small and in rare cases obsolete.

The sixth somite is scarcely one and a half times as long as the fifth in mature specimens. The telson is subequal to, or longer than, the outer uropod, and is armed on its dorso-lateral margins with from three to twelve pairs of spines.

Perfect and well-preserved specimens of this species are found to have the pereiopods, antennal scale, pleopods, uropods, &c., densely clothed with setae; in examples caught in the trawl, these seem, in many instances, to be worn off.

The numerous luminous organs, which are present in some members of the genus, are in this species entirely absent.

More captures have been recorded of this form than of any other species of *Acanthephyra*, and yet its distribution, both horizontal and vertical, is by no means understood.

It has been found most often in the North Atlantic, numbers of specimens having been captured both on the east and west sides. In the Mediterranean it is apparently scarcer, while a few, sometimes only solitary, specimens have occurred in the S.W. Atlantic, the Gulf of Panama, and off the coasts of Australia, New Zealand, Japan, and the East Indies. It has not, so far, been found in the Indian Ocean; it seems probable that it is represented there by the closely allied form *A. sanguinea*.

Similar cases of an almost world-wide distribution have been observed in other free-swimming Crustacea, such as *Gennadas parvus*, Sp. Bate (*Amalopenaeus elegans*, Smith), *Bentheuphausia amblyops*, G. O. Sars, *Eucalanus crassus*, Giesbrecht, and many others.

Acanthephyra purpurea has once been recorded from the surface in soundings of about 1,000 fathoms [**27**.] Faxon is inclined to agree with Spence Bate that these normally deep-water forms rise to the surface in order to liberate their eggs. In some species, such as *A. lanceocaudata*, the egg is of a large size, which seems to indicate that the young pass through some of their metamorphoses before they are set free. In *purpurea*, however, this is not the case, and Faxon considers that the larvae, being very susceptible to cold, are liberated in the warmer waters near the surface, where they have the additional advantage of wide distribution by means of the ocean currents.

A. purpurea has been captured in midwater on many occasions at very varying depths, and has been trawled in such shallow water as 107 and 200 fathoms. There are many records of its occurrence from 300 down to the great depth of 2,949 fathoms, but in most of these cases the specimens may have been caught while the trawl was being hauled to the surface. The examples taken by the *Helga* off the Irish coast were captured either in a triangular net of coarse bolting silk, with an opening of 18 square feet, or in a Petersen midwater otter trawl, made of screw-cloth, and having an opening of about 50 square feet.

These nets were never used on the bottom as they are not suited to that class of work; both are open and consequently fish while being hauled to the surface.

This species when living is a most brilliant scarlet lake in colour, tending to carmine about the hepatic region. The fringes of setae which clothe the antennal scale legs, pleopods, &c., are of a more vermilion tone. The eyes are black, and the eggs carmine.

It has been shown that *Nika edulis* and *Hippolyte varians* turn to a red colour when kept in the dark, and Faxon considers that this affords an explanation of the bright red coloration so frequently met with among deep-sea crustacea. He is of the opinion that it is produced by a purely physical cause, *i.e.*, the absence of light, and regards the colour as being quite useless to the possessor.

Acanthephyra debilis, A. M.-Edw.

1881. *Acanthephyra debilis*, A. M.-Edw. **12**], p. 13.
1882. *Miersia gracilis*. Smith. [**24**], p. 70, pl. xi., fig. 4.
1883. *Acanthephyra debilis*, A. M.-Edw. [**14**], pl. 33, fig. 2.
1886. *Acanthephyra gracilis*, Smith. [**27**], p. 672.
1896. *Acanthephyra debilis*, Faxon. [**7**], p. 162.
1905. *Acanthephyra debilis*, Richard. [**18**], p. 17.
1905. *Systellaspis debilis*, Coutière. [**4a**], p. 5, fig. 2.
1905. *Systellaspis Bouvieri*, Coutière. [**4a**], p. 8, fig. 3.

This species was very briefly described by A. Milne-Edwards in 1881, from a single specimen taken in 500 fathoms in the Bahama Channel; in 1883 he figured this specimen in his "*Recueil.*" Owing to the brevity and incompleteness of his diagnosis, Smith, in 1882, described an identical form under the name of *Miersia gracilis*, giving a careful description and many figures. In 1886 he recorded another specimen as *Acanthephyra gracilis*, and since that date Faxon has noted the occurrence of a single example in the West Indies, and Coutière three from the neighbourhood of the Azores.

The occurrence of this apparently scarce species in the N.E. Atlantic is of special interest, and leads us to hope that we shall discover off the Irish coast many more of the deep-water macrura which Smith has so ably treated of from the east coast of the United States.

Acanthephyra debilis agrees with *A. lanceocaudata*, Sp. Bate, and *A. cristata*, Faxon, in having the sixth abdominal somite about twice as long as the fifth, and not dorsally carinate; the orbit, moreover, is evenly rounded and continuous with the antennal tooth, and is not interrupted by a small blunt projection or tooth, as is the case in species belonging to the "*purpurea* group." The eggs too are apparently larger than usual.

Spence Bate considers that these characteristics form a generic distinction, and proposed the name *Systellaspis* for the specimen of *lanceocaudata* collected by the *Challenger*. Subsequent authors have, however, with the exception of Coutière, consistently set this aside, and regard these forms as species of *Acanthephyra*.

The question as to what characteristic, or group of characteristics, constitute generic distinction has always been one of considerable difficulty, and, until our knowledge of these species is more extended than it is at present, it would seem convenient to retain these three forms under the old name of *Acanthephyra*.

A. debilis may be briefly described thus[1]:—

The carapace is furnished anteriorly with a carina, which gradually diminishes in size as it is followed backwards, and becomes quite obsolete shortly after passing the middle of the carapace. The carina is continued forwards to a long and delicate rostrum, trending upwards towards the apex It is at least twice the length of the carapace, and is armed below with nine or ten teeth, reaching from in front of the eye almost to the extreme tip. Dorsally, three to five teeth are situated on the elevated basal portion of the rostrum, or rostral crest, and in front of these there are nine or ten evenly-spaced teeth. The rostral formula thus is 13 – 15 above and 9 – 11 below.

The margin of the orbit is evenly rounded as far as the small antennular prominence or spine; the branchiostegal spine is sharp and points outwards; it is not flanked by any evident carina.

The eyes are large and wider than the eyestalks, and the antennal scale hardly reaches to half the length of the rostrum. The gill-formula is the same as in all other species of *Acanthephyra*, and all the pereiopods bear long exopods. The first two pairs of pereiopods are shorter than in *purpurea*, and do not reach to the tips of the external maxillipeds when stretched forwards. The dactylus of the last pair of legs is considerably longer and more conspicuous than in *A. purpurea*. Both ischia and meri of the last three pairs of pereiopods bear a series of short spines, but there are no long fringes of setae on any of the appendages.

All the abdominal segments are rounded above, with the exception of the third, which is strongly carinate and produced posteriorly to a stout dorsal spine. The fourth and fifth tergites are very slightly carinated on their extreme posterior edges, and are produced to a short dorsal tooth. The postero-lateral margins of segments four and five are crenate. This feature, however, differs somewhat in the specimens before me.

The sixth somite is about twice as long as the fifth. The telson is approximately equal in length to the outer uropod, and bears a rather peculiar type of spinulation (pl. II., fig. 7). Immediately behind the apex are four pairs of spines, and above these is a pair of very long spines reaching more than half-way towards the tip. Over the base of each large spine a smaller one projects, which points straight down and is not directed outwards like the rest. Behind this again there are four more pairs of spines.

[1] As in the case of *A. purpurea*, Smith [24] has given a long description of this species with figures.

All the five specimens which I have examined are small, measuring from 27 to 43 mm. in length. They differ in a few unimportant details from the type specimen figured by Milne Edwards.

It is a well-known fact that alcohol dissolves the deep violet pigment so frequently associated with luminous organs, and it is doubtless due to this fact that one of the specimens, which was preserved in a mixture of formalin and alcohol, shows no trace of these organs.

From the largest specimen, that taken by Dr. Wolfenden, I am enabled to make out forty of these structures on each side, and, in addition, three others which are unpaired (pl. II., figs. 4, 5, 6). I have, however, reason to believe that the number of photophores present increases with increased size,[1] so that the following description does not, I think, include the full number that would be found in larger individuals.

Luminous Organs.

On the upper surface of the ophthalmopods there is a streak running down the eyestalk for about two-thirds of its length, below which is a small spot, and, in addition, there is a single spot on the lower surface.

Close to the inferior border of the carapace, and situated on it, is an interrupted luminous line consisting of eight streaks. Three fainter spots are also present on each side of the carapace.

Above the base of the last walking leg, and running upwards from it, is a deep violet streak, which shows clearly through the carapace, and is by far the most noticeable photophore that the specimen possesses.

Abdominal somites 1 and 2 each bear one small spot in about the middle of their lateral aspect near the anterior edge.

Abdominal somites 2, 3, 4, and 5 each bear one small spot in about the middle of their lateral aspect near the posterior edge.

Somite 6 has, at about one-third of its length from the anterior edge, and in the mid-ventral line, a single unpaired spot, while another is present on each side at the lower posterior angle.

The telson (pl. II., fig. 7) bears two photophores in the mid-dorsal line, one about one-third the distance from the base, and the other situated just above the large pair of spines with which the telson is furnished near its apex.

The last pair of maxillipedes bear a clearly marked luminous streak on the under surface of the distal segment (pl. II., fig. 6).

The third, fourth, and fifth trunk-legs bear a spot at the proximal end of the carpus, while the fifth has in addition two photophores, one at the proximal and one at the distal end of the propodus (pl. II., fig. 5). Each of the exopodites attached to the outer maxillipedes and five pairs of trunk-legs bears a small photophore near the base.

A boss-shaped photophore is also present at the base of each pleopod.

[1] I am glad to hear that such a well-known authority as Prof. Coutière agrees with me on this point.

The specimens which have come under my notice are five in number. They are all very evidently immature, and were caught at the following localities:—

Station.	Soundings. Fms.	Depth of Net. Fms.	Position.		Length. mm.
			Lat. N.	Long. W.	
"*Silver Belle*,"	—	400	—	—	43
"*Helga*," S.R. 140. ...	1000	735	51° 50′	10° 45′	33
"*Helga*," S.R. 302. ...	450	300-250	51° 54′	11° 59′	33½
Do. ...	*do.*	*do.*	*do.*	*do.*	32½
Do. ...	*do.*	*do.*	*do.*	*do.*	27½

Other records of this species are far from numerous; they are as follows[1]:—

A. M.-Edwards.	Bahama Channel, W. Indies.	500 fms.	1 spec.
S. J. Smith.	S. of C. Hatteras.	1,632 fms.	1 spec.
S. J. Smith.	Between N. York and Bermuda.	2,512 fms.	1 ♀ ovig.
W. Faxon.	Old Bahama Channel, W. Indies.	428 fms.	1 spec.
H. Coutière (and Richard).	Off the Azores.	0–1,775 fms.	3 (2 ♀ ovig.)

Having had facilities for examining the majority of the species of *Acanthephyra* so far discovered, I have taken the opportunity to frame a table, which may assist in the identification of the various members of this somewhat unwieldy genus.

An examination of the specimens referred by Spence Bate to *Hymenodora* revealed the fact that two of the species must be transferred to *Acanthephyra*. Smith [27] has pointed out that in *Hymenodora* the endopod of the first maxillipede consists of two segments only, whereas three are present in *Acanthephyra*. This character seems to have escaped Sars' attention when first describing the genus—for his figure is not correct—and Spence Bate apparently did not know of Smith's paper in the U. S. Fish Commissioner's Report at the time he wrote his account of the *Challenger* Macrura.

In both *Hymenodora duplex* and *rostrata* I found the endopod of the 1st maxillipede to consist of three segments, and these species must consequently be referred to *Acanthephyra*. The first is undoubtedly synonymous with *A. brevirostris*, Smith, and it should be noted that there is a mistake in Spence Bate's description of this form; there is no trace of a carina on the 2nd abdominal tergite in the solitary *Challenger* specimen.

[1] Miss M. Rathbun, in a paper dealing with Hawaiian Crustacea, records the occurrence of a single specimen of *A. debilis* from near Kauai Island, 453–478 fathoms. This is the only record from the Pacific Ocean—(*v. U.S. Fish. Comm. Bull. for* 1903, *Pt. III.*, *p.* 922, 1906).

The three specimens of *rostrata* are in an extremely bad state of preservation, and during the brief time at my disposal I was unable to arrive at any definite opinion concerning the validity of the species.[1]

Spence Bate referred three specimens to *A. acutifrons.*

The type specimen is in good condition and easily recognised from other allied species, but the other two specimens are very obviously distinct from it, and I have but little hesitation in referring them to *A. curtirostris,* Wood-Mason. The presence in *A. curtirostris* of a pronounced carina, which flanks the branchio stegal spine and runs back as far as the hepatic groove, at once distinguishes that species from *A. acutifrons.*

Acanthephyra armata, A. M.-Edw.

1881. *Acanthephyra armata,* A. M.-Edw. **[12]** p. 13.
1883. *Acanthephyra armata,* A. M.-Edw. **[14]** p. 28, fig. 1.
1888. *Acanthephyra armata,* Sp. Bate. **[28]** p 744, pl. cxxv., fig. 2.
1892. *Acanthephyra armata,* Wood-Mason and Alcock. **[32]** p. 359, fig. 2, and **[8]** pl. iii., fig. 1.
1896. *Acanthephyra armata,* Faxon. **[7]** p. 162.
1901. *Acanthephyra armata,* Alcock. **[3]** p. 78.

Acanthephyra media, Sp. Bate.

1888. *Acanthephyra media,* Sp. Bate. **[28]** p. 736, pl. cxxiv., fig. 5.

Acanthephyra carinata, Sp. Bate.

1888. *Acanthephyra carinata,* Sp. Bate. **[28]** p. 748, pl. cxxvi., fig. 2.

Acanthephyra eximia, Smith.

1884. *Acanthephyra eximea (? recte eximia),* Smith. **[25]**. p. 376.
1886. *Acanthephyra eximea,* Smith. **[27]** p. 667, pl. xiv. fig. 1.
1888. *Acanthephyra Edwardsi,* Sp. Bate. **[28]** p. 747, pl. cxxvi., fig. 1.
1888. *Acanthephyra angusta,* Sp. Bate. **[28]** p. 737, pl cxxiv., fig. 6.
1892. *Acanthephyra eximia,* Wood-Mason and Alcock. **[32]** p. 361, fig. 3.
1901. *Acanthephyra eximia,* Alcock. **[3]** p. 76.

[1] Spence Bate's figure of the first maxillipede of *Hymenodora glauca* (Pl. cxxxvii., fig. 1, g.) is quite erroneous ; the endopod consists of a very short basal and long distal joint.

var. **brachytelsonis,** Sp. Bate.

1888. *Acanthephyra brachytelsonis,* Sp. Bate. [**28**] p. 753, pl. cxxvi., fig. 7.
1891. *Acanthephyra brachytelsonis,* Wood-Mason and Alcock. [**31**] p. 195.
1882. *Acanthephyra brachytelsonis,* Wood-Mason and Alcock. [**32**] p. 362, fig. 4.
1901. *Acanthephyra eximia* var. *brachytelsonis,* Alcock, [**3**] p. 78.

Acanthephyra pulchra, A. M.-Edw.

1890. *Acanthephyra pulchra,* A. M.-Edw. [**15**] p. 163.
1890. *Acanthephyra pulchra,* Monaco. [**16**] p. 1179.
1895. *Acanthephyra pulchra,* Riggio. [**19**] p. 244, tav. 1.
1898. *Acanthephyra pulchra,* Adensamer. [**1**] p. 625.
1903. *Acanthephyra pulchra,* Senna. [**23**] p. 296, tav. xiii.

Acanthephyra approxima, Sp. Bate.

1888. *Acanthephyra approxima,* Sp. Bate. [**28**] p. 755, pl. cxxvi., fig. 8.
1895. *Acanthephyra approxima* ?, Faxon. [**6**] p. 162.

Acanthephyra purpurea, A. M.-Edw.

(See page 4).

Acanthephyra sanguinea, Wood-Mason.

1892. *Acanthephyra sanguinea,* Wood-Mason and Alcock. [**32**], p. 358, fig. 1, and [**8**] pl iii., fig. 3.
1901. *Acanthephyra sanguinea,* Alcock. [**3**] p. 79.

Acanthephyra microphthalma, Smith.

1885. *Acanthephyra microphthalma,* Smith. [**26**] p. 502.
1886. *Acanthephyra microphthalma,* Smith. [**27**], p. 668, pl. xiii., fig. 3.
1888. *Acanthephyra longidens,* Sp. Bate. [**28**] p. 735, pl. cxxiv., fig. 4.
1892. *Acanthephyra microphthalma,* Wood-Mason and Alcock. [**32**] p. 361.
1901. *Acanthephyra microphthalmus,* Alcock. [**3**] p. 80.

Acanthephyra lanceocaudata (Sp. Bate).

1888. *Systellaspis lanceocaudata,* Sp. Bate. [**28**] p. 758, pl. cxxiv., fig. 7.

Acanthephyra affinis, Faxon.

1896. *Acanthephyra affinis,* Faxon. [**7**] p. 162, pl. ii., figs. 1-3.

Acanthephyra debilis, A. M.-Edw.

(See page 16).

Acanthephyra cristata, Faxon.

1893. *Acanthephyra cristata,* Faxon. [**5**] p. 206.
1895. *Acanthephyra cristata,* Faxon. [**6**] p. 162, pl. xliii. fig. 1.
1896. *Acanthephyra cristata,* Anderson. [**2**] p. 94 and [**9**] pl. xxv., fig. 2.
1901. *Acanthephyra cristata,* Alcock [**3**] p. 82.

Acanthephyra Batei, Faxon.

1888. *Acanthephyra brevirostris,* Sp. Bate. [**28**] p. 751, pl. cxxvi., fig. 3.
1895. *Acanthephyra Batei,* Faxon (*nom. nov. vice brevirostris praeoc.*) [**6**] p. 167.

Acanthephyra Kingsleyi, Sp. Bate.

1888. *Acanthephyra Kingsleyi,* Sp. Bate. [**28**] p. 751, pl. cxxvi., fig. 4.

Acanthephyra acutifrons, Sp. Bate.

1888. *Acanthephyra acutifrons,* Sp. Bate. [**28**] p. 749, pl. cxxvi., fig. 3.

Acanthephyra curtirostris, Wood-Mason.

1888. *Acanthepyhra acutifrons,* Sp. Bate. (*partim*) [**28**] p. 749.
1891. *Acanthephyra curtirostris,* Wood-Mason and Alcock. [**31**] p. 195.
1892. *Acanthephyra curtirostris,* Wood-Mason and Alcock. [**32**] p. 364, fig. 5, and [**8**] pl. iii., fig. 4.
1895. *Acanthephyra curtirostris,* Faxon. [**6**] p. 164, pl. xliii. figs. 2–5.
1901. *Acanthephyra curtirostris,* Alcock. [**3**] p. 81.

Acanthephyra tenuipes (Sp. Bate.)

1888. *Tropiocaris tenuipes,* Sp. Bate. [**28**] p. 836, pl. cxxxvi., fig. 2.
1895. *Acanthephyra tenuipes,* Faxon. [**6**] p. 166.

Acanthephyra cucullata, Faxon.

1893. *Acanthephyra cucullata,* Faxon. [**5**] p. 206.
1895. *Acanthephyra cucullata,* Faxon. [**6**] p. 167, pl. xliv., fig. 1.

Acanthephyra brevirostris, Smith, *nec* Sp. Bate.

1885. *Acanthephyra brevirostris,* Smith. **[26]** p. 504.
1886. *Acanthephyra brevirostris,* Smith. **[27]** p. 670, pl. xiv., fig. 2; pl. xv., figs. 2–8; pl. xvi., figs. 1, 6.
1888. *Hymenodora duplex,* Sp. Bate. **[28]** p. 843, pl. cxxxvi., fig. 3.
1895. *Acanthephyra brevirostris,* Faxon. **[6]** p. 167.

Sp. incert.

Acanthephyra rostrata (Sp. Bate.)

1888. *Hymenodora rostrata,* Sp. Bate. **[28]** p. 846, pl. cxxxvi., fig. 4.

Nomina nuda.

1888. *Acanthephyra Rouxi,* Sp. Bate. **[28]** p. 732.
? *Acanthephyra pellucida,* A. M.-Edw. *fide* Gadeau de Kerville.

TABLE OF SPECIES OF *ACANTHEPHYRA*.

A. Rostrum armed with more than two teeth on ventral border.
- I. Eyes wider than eyestalks.
  - *A*. 6th abdominal tergite carinate dorsally.
    - i. Anterior third, at least, of rostrum unarmed above.
      - A. 2nd abdominal tergite not carinate . . *pulchra.**
      - B. 2nd abdominal tergite carinate.
        - *a*. Four, rarely more, teeth on ventral border of rostrum . . . . . *eximia.*
        - *b*. Only three, rarely two, teeth on ventral border of rostrum . . . *eximia* v. *brachytelsonis.*
    - ii. Rostrum armed dorsally throughout its length.
      - A. Carapace and 1st abdominal somite carinate dorsally . . . . . *approxima.*
      - B. Carapace and 1st abdominal somite not carinate dorsally.
        - *a*. Branchiostegal spine prominent and buttressed by an evident carina . . *purpurea.*
        - *b*. Branchiostegal spine minute, not buttressed by any carina . . . . *sanguinea.*
  - *B*. 6th abdominal tergite not carinate dorsally.
    - i. Rostrum considerably longer than carapace.
      - A. Rostral crest with seven teeth.
        - *a*. Telson deeply grooved dorsally and as long as outer uropod . . . . *lanceocaudata.*
        - *b*. Telson not grooved dorsally and shorter than inner uropod . . . . *affinis.**
      - B. Rostral crest with three to five teeth . *debilis.*
    - ii. Rostrum considerably shorter than carapace *cristata.**

* Species not examined by the author.

II. Eyes narrower than eyestalks.
Dorsal tooth of 3rd abdominal tergite very long, reaching to posterior margin of 4th tergite . *microphthalma.*

B. Rostrum armed with one, rarely two, teeth on ventral border.

I. Rostrum extending considerably beyond apex of antennal scale.

A. Anterior three-quarters of rostrum unarmed dorsally, branchiostegal spine flanked by a very short carina . . . . *armata.*

B. Anterior three-quarters of rostrum bearing teeth dorsally, branchiostegal spine flanked by a long carina, reaching to hepatic groove *media.*

II. Rostrum scarcely reaching to, or falling considerably short of, apex of antennal scale.

A. Rostrum shallow at base, about one quarter as deep as long, 6-8 teeth on rostral crest . *carinata.*

B. Rostrum deep at base, nearly one half as deep as long.

i. Branchiostegal spine supported by a short rounded ridge, 1st abdominal tergite carinate dorsally, 11 teeth on rostral crest. *acutifrons.*

ii. Branchiostegal spine supported by a long pronounced carina, 1st abdominal tergite not carinate dorsally; 7-9 teeth on rostral crest . . . . *curtirostris.*

Rostrum unarmed below.†

I. Dorsal tooth of 3rd abdominal tergite not large, not reaching to middle of 4th tergite.

A. Rostrum deep at base, more than ½ as deep as long.

i. Rostrum reaching to terminal joint of antennal peduncle; rostral crest with 4-5 teeth . . . . *tenuipes.*

ii. Rostrum hardly reaching to extremity of eyestalks, rostral crest with 7 teeth . . *cucullata.**

B. Rostrum shallow at base, about ⅓ as deep as long.

i. Carapace not definitely carinate dorsally, rostrum armed above with 4 teeth . . *Kingsleyi.*

ii. Carapace with strong dorsal carina, rostrum armed above with 9 small teeth . . *Batei.*†

II. Dorsal tooth of 3rd abdominal tergite very large, reaching beyond posterior margin of 4th tergite *brevirostris.*

* Species not examined by the author.
† Of the two specimens of *A. Batei* known up to the present, one, the type specimen, has the rostrum unarmed below, while the other bears a single tooth on the ventral border.

HORIZONTAL DISTRIBUTION.

—	S.W. Atlantic.	S.W. of Sierra Leone.	West Indies.	Off E. Coast of U.S.A.	Off Canaries.	Off Azores.	Bay of Biscay.	Off Ireland.	Mediterranean.	W. of Cape Colony.	Arabian Sea.	Bay of Bengal.	Malay Archipelago.	Off Philippines.	S. of Japan.	Off New Zealand.	N.E. of Australia.	S. of Australia.	S. Pacific.	S.E. Pacific.	Off Galapagos Is.	Gulf of Panama.	Off Acapulco, Mexico.	Gulf of California.	Off Marion I.
A. armata,	:	:	×	:	:	:	:	:	:	:	×	×	×	:	:	:	:	:	:	:	:	:	:	:	:
A. media,	:	:	:	:	:	:	:	:	:	:	:	:	:	×	:	:	:	:	:	:	:	:	:	:	:
A. carinata,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	×	:	:	:	:	:
A. eximia,	:	×	:	×	:	:	:	:	:	:	×	×	×	:	:	:	:	:	:	:	:	:	:	:	:
v. *brachytelsonis*,	×	:	:	:	:	:	:	:	:	:	×	×	×	×	×	×	:	:	:	:	:	:	:	:	:
A. pulchra,	:	:	:	:	:	:	:	:	×	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
A. approxima,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	×	:	:	:	:	:
A. purpurea,	×	×	×	×	×	×	×	×	×	×	:	:	×	:	×	×	×	×	:	:	:	×	:	:	:
A. sanguinea,	:	:	:	:	:	:	:	:	:	:	×	×	:	:	:	:	:	:	:	:	:	:	:	:	:
A. micropthalma,	:	:	:	×	:	:	:	:	:	:	:	×	:	×	:	:	:	:	×	:	:	:	:	:	:
A. lanceocaudata,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	×	:	:	:	:	:	:	:	:	:	:
A. affinis,	:	:	×	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
A. debilis,	:	:	×	×	:	×	×	×	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
A. cristata,	:	:	:	:	:	:	:	:	:	:	×	:	:	:	:	:	:	:	:	:	:	×	:	:	:
A. Batei,	:	×	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
A. Kingsleyi,	:	×	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
A. acutifrons,	:	:	:	:	:	:	:	:	:	:	:	:	×	:	:	:	:	:	:	:	:	:	:	:	:
A. curtirostris,	:	:	:	:	:	:	:	:	:	:	×	×	:	×	:	:	:	:	:	:	×	×	×	×	:
A. tenuipes,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	×	:	:	:	:	:	:	:	:
A. cucullata,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	×	:	:	:
A. brevirostris,	:	:	:	×	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	×	:	:	×

VERTICAL DISTRIBUTION.

	FATHOMS.
A. armata,	200—475
A. media,	700
A. carinata,	400
A. eximia,	405—938
v. brachytelsonis,	200—2040
A. pulchra,	690—1545
A. approxima,	384—1168
A. purpurea,	0. 107—2949
A. sanguinea,	194—1748
A. microphthalma,	1748—2620
A. lanceocaudata,	345
A. affinis,	159
A. debilis,	500—2512
A. cristata,	890—1772
A. Batei,	1500
A. Kingsleyi,	2500
A. acutifrons,	800
A. curtirostris	364—2232
A. tenuipes,	1400
A. cucullata,	1772
A. brevirostris,	1395—2949

These figures must be accepted with caution, as in the large majority of cases open nets were used which fished while being hauled to the surface.

LIST OF AUTHORITIES QUOTED.

[1] Adensamer, Th., . *Decapoden gesammelt auf S.M.S. Pola in den Jahren* 1890-94. Denkschrift, mathem, naturwiss. classe akad. Wien. Bd. LXV. 1898.

[2] Anderson, . Journ. As. Soc., Bengal, LXV., pt. 2, 1896.

[3] Alcock, A., . A descriptive catalogue of the Indian deep sea Crustacea Decapoda Macrura and Anomala in the Indian museum—Calcutta. 1901.

[4] Caullery, M., . *Résultats scientifiques de la Campagne du "Caudan" dans le Golfe de Gascogne, Crustacées Schizopodes et Décapodes.* Ann. Univ. Lyon, 1896.

[4a] Coutière, H., . Bull. Mus. Oceanog. Monaco. no. 48.. 1905.

[5] Faxon, W., . Bull. Mus. Comp. Zool. Cambridge, Mass. XXIV. 1893.

[6] Faxon, W., . *Reports on an exploration off the west coasts of Mexico, Central and South America, etc., by U.S. Fish. Comm. steamer "Albatross," during* 1891. XV. *Stalk-eyed Crustacea.* Mem. Mus. Comp. Zool. Cambridge, Mass. Vol. XVIII. 1895.

[7] Faxon, W., . Bull. Mus. Comp. Zool. Cambridge, Mass. XXX. 1896.

[8] *Investigator,* . Ill. of the Zool. of R.I.M.S.S. "Investigator." Pt. I., pl. III. 1892.

[9] *Investigator,* . *Id* Pt. IV., pl. XXV. 1896.

[10] Lo Bianco, S., . *Le pesche abissali eseguite da F. A. Krupp col yacht "Puritan" nelle adiacenze di Capri ed in altre località del Mediterraneo.* Mittheil. Zool. Stat. Neapel. 16 Bd. 1 e 2 Heft. 1903.

[11] Milne-Edwards, A., Comptes Rendus., XCIII., p. 935. 1881.

[12] Milne-Edwards, A., *Descript. de quelques Crust. Mac. prov. de la mer des Antilles.* Ann. Sci. Nat. (6 ser.) vol. XI. 1881.

[13] Milne-Edwards, A., Archives des Missions scientifiques et littéraires. (3 ser.), t. IX., p. 37. 1882.

[14] Milne-Edwards, A., Recueil de figs. de Crust. nouveaux ou peu connus., pl. 33. 1883.

[15] Milne-Edwards, A., Bull. Soc. Zool., France, vol. 15. 1890.

[16] Monaco, Albert Ier Prince de, . Comptes Rendus., CX., p. 1179. 1890.

[17] Ortmann, A., . Decap. und Schizop. der Plankton-expedition, 1893.

[18] Richard, T., . Bull. Mus. Oceanog. Monaco. no. 41. 1905.

[19] Riggio, G., . . *Sul rinvenimento di nuovi Crostacei macruri nel mare di Sicilia.* Il Naturalista Siciliano. An. XIV., 1895, and An. I. (n.s.), 1896.

[20] Riggio, G., . . *Contrib. alla Carcin. del Mediterraneo (Sunto).* Monitore Zool. Ital. An. XI. (Supp.), 1900.

[21] Riggio, G., . . *Contrib. alla Carcin. del Mediterraneo. I. nota sopra alquanti crostacei del mare di Messina.* Il Naturalista Siciliano. Anno XVII. 1905.

[22] Sars, G. O., . The Norwegian North Atlantic Expedition, 1876-1878. Zoology, XIV.-XI., 1885-1886. *Crustacea.*

[23] Senna, A., . . *Le esplorazioni abissali nel Mediterraneo. II. Nota sui crostacei decapodi.* Bull. Soc. Etom. Ital. Anno XXXIV. tr. IV. 1902.

[24] Smith, S. I., . *Reports on the results of dredging off the E. Coast of U.S.A. in* 1880 *by the U.S. Coast Survey Steamer "Blake,"* XVII. *Pt. I. Decapoda.* Bull. Mus. Comp. Zool., Cambridge, Mass. X. 1882.

[25] Smith, S. I., . *Report on the Decapod Crustacea of the "Albatross" dredgings off the E. Coast of U.S.A. in* 1883. Rep. U.S. Fish Comm. for 1882. 1884.

[26] Smith, S. I., . Proc. U.S. Nat. Mus. VII. 1885.

[27] Smith, S. I., . *Report on the Decapod Crustacea of the "Albatross" dredgings off the E. Coast of U.S.A. in* 1884. Rep. U.S. Fish Comm. for 1885. 1886.

[28] Spence Bate, C., . Report on the Scientific Results of the exploring voyage of H.M.S. "Challenger," 1873-76. Vol. XXIV. *Crustacea macrura.* 1888.

[29] Stebbing, T. R. R., *South African Crustacea, Pt.* III. Marine Investigations in S. Africa. Department of Agriculture, C. of Good Hope. Vol. III. 1905.

[30] Thiele, Joh., . *Ueber einige stieläugige Krebse von Messina.* Zool. Jarbuchern. (Supp. VIII. Festschrift Mobius.) Jena. 1905.

[31] Wood - Mason, J., and A. Alcock, *Nat. Hist. notes from R.I.M.S.S. Investigator.* Ann. Mag. Nat. Hist., vol. 7. 1891.

[32] Wood - Mason, J., and A. Alcock, *Nat. Hist. notes from R.I.M.S.S. Investigator.* Ann. Mag. Nat. Hist., vol. 9. 1892.

EXPLANATION OF PLATES I AND II.

Plate I.

Acanthephyra purpurea, A. M.-Edw.

Fig. 1.—Ovigerous female, ... × 1·9.
Fig. 2.—Telson, ... × 6.

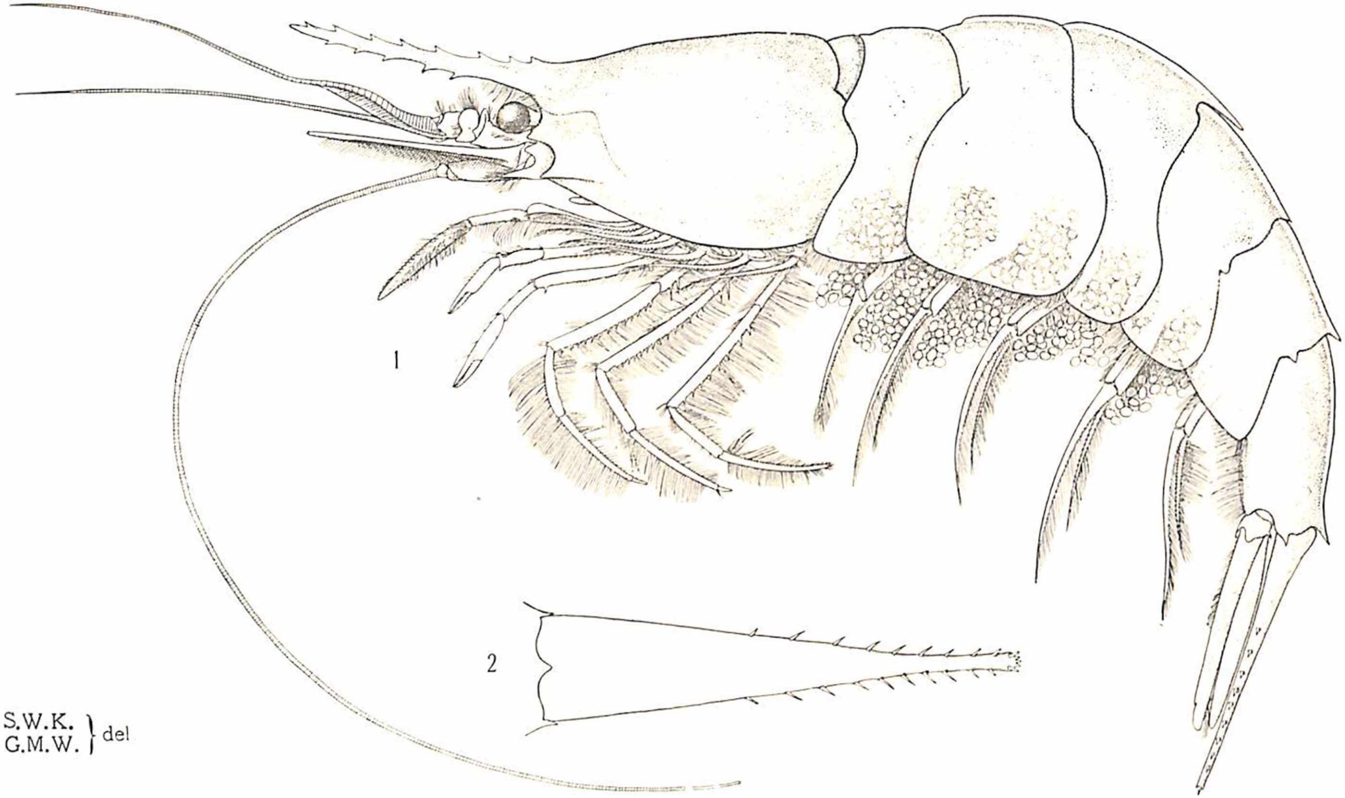
Plate II.

Acanthephyra purpurea, A. M.-Edw.

Fig. 1.—Eye and rostrum of a post-larval specimen 12 mm. in length.
Fig. 2. ,, ,, ,, ,, 17 mm. ,,
Fig. 3. ,, ,, ,, ,, 23 mm. ,,

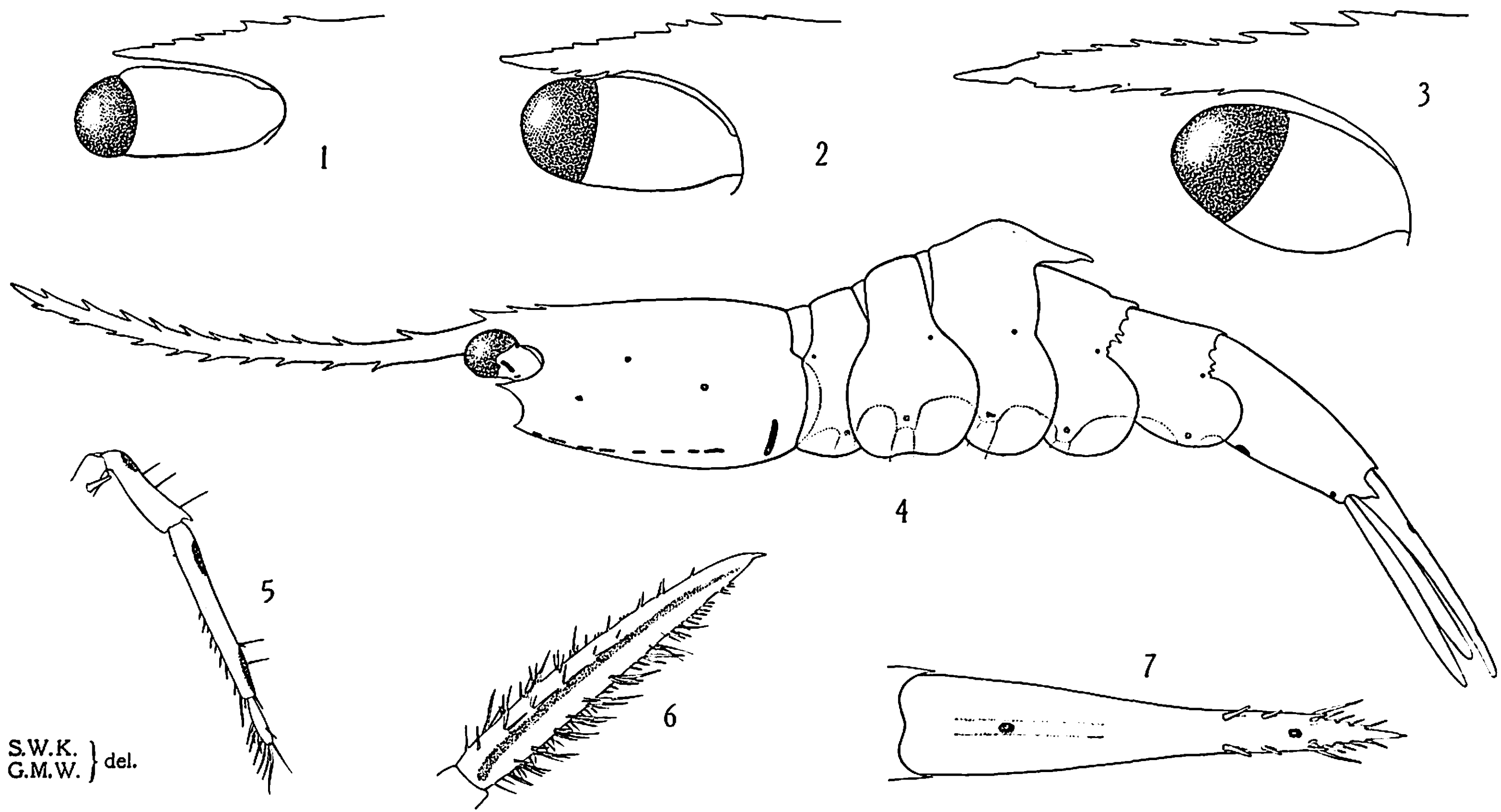
Acanthephyra debilis, A. M.-Edw.

Fig. 4.—Outline figure, showing photophores, . . . × 4·6.
Fig. 5.—Terminal joints of 5th walking leg, showing photophores, × 12·3.
Fig. 6.—Terminal joint of 3rd maxilliped from below, showing luminous streak, ... × 17.
Fig. 7.—Telson, ... × 15.



S.W.K. } del
G.M.W. }

Acanthephyra purpurea.



1–3, *Acanthephyra purpurea*.
4–7, *Acanthephyra debilis*.

Appendix, No. II.

THE MARINE FAUNA OF THE COAST OF IRELAND.

Part VIII.

FIRST REPORT ON THE FISHES OF THE IRISH ATLANTIC SLOPE,

BY

E. W. L. Holt and L. W. Byrne.

Plate I.

I.—Introduction.

The *Helga*, working regularly round the coast of Ireland since 1901, has naturally accumulated a very large number of records of fishes taken at various localities and depths, and with some few of these we have been able to deal in communications published in Part II. of the Annual Reports of the Sea and Inland Fisheries of Ireland for the years 1901 to 1903. Reports in which the results of every observation will be given in detail are in process of preparation, but much of the material consists of interrupted series of larvae which are only susceptible of intelligible description by means of illustrations which we have not yet found time to complete, and it seems to us that a very brief notice of the additions made by our records to knowledge of the fish fauna of the Irish section of the Atlantic coastal area may be of use, since all the nations of the north-east Atlantic are now occupied with fisheries research. We are therefore putting forward a diagnosis of the fishes in our collections which are either new to science or not readily recognisable by us in ichthyological literature, and also a very general account of the occurrence within the area under discussion of species either new to or hitherto seldom recorded from within its confines. We also take the opportunity to withdraw *Nettophichthys retropinnatus*, a spurious species founded by one of us on a mangled specimen of *Synaphobranchus pinnatus*.

While not attempting a strict definition, we take the Atlantic slope to commence at about the 50-fathom line, as that delimitation more or less excludes the regularly littoral fishes, though some of them, as is well known, go much deeper. Such species we omit from the list, unless found under circumstances of especial distributional interest.

For deep-water ground-exploration the *Helga* uses a beam trawl, the beam not exceeding thirty-five feet in length, and her trawling operations are limited by considerations of warp to depths of less than 500 fathoms. Drift-nets she cannot use, and any observations of fishes taken in these nets are from the

Fisheries, Ireland, Sci. Invest., 1905, *II*, [*Published, June*, 1906].

"Monica," a sailing drifter used for several years on the Cleggan fishing grounds. Attempt was made in the early days of the *Helga's* work to use long lines, but it has proved impracticable to continue this form of observation.

For pelagic species the engines employed have been open townets sunk to given depths and fished at these depths and thence to the surface. The townets vary in size from ordinary ring-nets, having a mouth-diameter of 12 inches, to otter-nets with a mouth 8 feet by 4 feet. The material is canvas, mosquito-net, cheese-cloth, grit gauze, or bolting silk, and in consequence none of the nets could travel fast enough to catch large pelagic fishes.

For our present purpose it is not necessary to exactly tabulate the localities and dates of occurrence of each species noted, nor do we attempt to associate with captures the circumstances of temperature and salinity which, at least in regard to pelagic forms, may have an importance equal to that of locality.

While it is probable that no biologist is seriously interested in the allocation of deep-sea organisms to small areas defined by territorial considerations, it is customary to keep a list of the marine fauna of this or that country. The western limit of the British area, which to avoid confusion we call the British-and-Irish area, was tentatively placed by Norman's Committee of the British Association at the 1,000-fathom line. Norman himself (1890) gave reasons for preferring the 1,500-fathom line, but since the lesser depth has been adopted in previous faunistic papers of the present series its retention seems to be convenient. The 1,000-fathom line, in the north, is about forty miles off the Mayo coast, while southwards, off County Clare, it ranges out to nearly five times that distance from land, again re-entering to about seventy miles S.W. of County Kerry. The limit, therefore, while possibly retaining some consistency in reference to the distribution of benthic animals, must vary considerably with latitude in any relation which it may have to the occurrence of pelagic forms, and it may be suspected that if a vertical line of separation from surface to bottom has a certain significance where the deep soundings come close to land such a line would require to incline more and more shorewards as the soundings recede.

Taking the limit as we find it, the following species may be added to the British-and-Irish list:—

Spinax niger.
Bathylagus atlanticus.
Bathytroctes rostratus[1].
Xenodermichthys socialis.
Gonostoma microdon.
Gonostoma bathyphilum.
Synaphobranchus pinnatus.

[1] *See* p. 27.

Scopelus elongatus.
Scopelus punctatus.
Scopelus Rafinesqui.
Scopelus crocodilus.
Notacanthus Bonaparti.
Trachyrhynchus trachyrhynchus.
Molva elongata.
Melamphaës eurylepis, sp. n.
Diretmus argenteus.

Among deep-sea fishes already known from other parts of the British-and-Irish area note may be made of those which do not seem to have been hitherto noted from within the area off the west coast of Ireland, viz. :—

Argentina silus.
Maurolicus borealis.
Stomias boa.
Scopelus glacialis.

Astronesthes Richardsoni, *Melamphaës crassiceps* and *Scopelus arcticus* have occurred near but not actually within the 1,000-fathom line.

Record, though not pertinent to the subject of these notes, of *Lumpenus lampetraeformis* (Walb.) from the Irish Sea may be of sufficient interest to excuse its intrusion.

Professor Collett's account of the fishes taken by the *Michael Sars* in 1900-1902 [1905] suggests, in the record from northern waters of fishes already known from the south, that our list of forms inhabiting the intermediate tract is still far from complete.

Before proceeding to the description of species we desire to thank Mr. Boulenger and Mr. C. Tate Regan for assistance in the comparison of specimens as well as for invariable courtesy in putting at our disposal the collections under their charge. To Dr. Scharff we are indebted for access to the material collected by deep-sea expeditions of the Royal Dublin Society and Royal Irish Academy, and to Dr. Johs. Schmidt for specimens taken by the Danish fisheries-investigation cruiser *Thor* westward of the British Islands. Our material has been also augmented by a few fishes collected by Dr. R. Norris Wolfenden in the same region. The *Helga* material is, with the exception of a few fishes taken previous to 1902, due to Mr. G. P. Farran and Mr. S. W. Kemp.

ii.—Description of Species.

In naming species of which the earliest descriptions seem to give reasonable ground for variety of interpretation we print the name of the traditional sponsor in antique characters, followed in brackets by the name of an author who has adopted the same nomenclature and reasonably perfected the diagnosis.

BATHYLAGUS ATLANTICUS, Günther, 1887.

Pl. I., Figs. 3 and 4.

This species has hitherto been known only from the type, a specimen measuring 165 mm. ($6\frac{1}{2}$ in.) taken by the *Challenger* in the South Atlantic. It is represented in our collections by several small examples, of which the largest measures 54 mm. without the caudal fin. Naturally it differs considerably in proportions from the adult, and may be described as follows :—

Form elongate, compressed, height rather suddenly reduced behind dorsal fin. Length of head about $3\frac{3}{4}$ in total length without caudal fin, considerably greater than height of body. Snout very abrupt, less than half as long as eye. Eyes nearly half as long as head, their horizontal axes set at a considerable angle to the long axis of the head, so that the verticals from their anterior edges are much closer together than those from their posterior edges. Least width of interorbital space about $\frac{2}{7}$ of height of eye. Lower edge of preoperculum separated from eye by a distance about equal to one-sixth of height of eye. Gape very short, scarcely extending beyond vertical from front of eye. Mouth terminal, somewhat oblique. Lower contour of head gently curved, not remarkably prominent. Origin of dorsal fin rather nearer to snout than to origin of caudal, its base shorter than that of anal fin and about as long as caudal peduncle. Height of caudal peduncle less than $\frac{1}{3}$ of length of head. Lateral line straight, with about 36 scales (from evidence of scale pouches). Transverse series in front of dorsal 6, in region of anal fin 6, including a row of small scales over the bases of anal rays. An additional row of small scales possibly present throughout the dorsum. No scales on the head or nape, nor ventrally in front of the pectoral fins. All scales (remaining in the specimen) extremely thin. Pectoral (apparently) small. D. 9, A. 15 (including a very slender anterior spine), V. 8. Caudal missing. Colouration black.

We have examined the type in which, as stated by Günther, the height of the body is a little less than the length of the head, which is $\frac{1}{4}$ of the total length without the caudal fin. It is therefore, as might be supposed from the difference in size, a much stouter form than the young specimen which we describe and figure. We are unable to agree with Günther that the scales of the lateral line series were about forty in number. All the scales were missing when the specimen was received at the Museum, but it appears to us that in the type, as in our smaller specimen, those anterior to the vertical from the dorsal fin were, on the present evidence of scale pouches, considerably larger than the posterior series. We read the number as about 36.

The interorbital width, given in the specific diagnosis as $\frac{2}{3}$ of the length of the eye, would seem to have been based upon the greatest distance between the eyes without regard to the bony orbital ridges. Even taken in this way the interorbital dimension seems, from the present condition of the specimen, to have been somewhat over-estimated. As in our young example (see Pl. I., fig. 4) the eyes in the type are set in anteriorly converging planes so that the interorbital or interocular width is difficult to define, the more so since the superficial bones are imperfectly ossified. Internal to what we suppose to be the true bony orbits the interorbital region of the type, which is absolutely devoid of skin, exhibits a pair of well-defined but delicate bony ridges indicated, but somewhat veiled by skin, in our largest example. In Goode and Bean's delineation of their *B. euryops* and *B. Benedicti* the anteroventral contour of the head is remarkably inflated. This is evidently due to *post-mortem* depression of the hyoid apparatus, which in a minor degree is noticeable in the type of *B. atlanticus*. It is probable that under normal conditions the ventral profile of the head in the west Atlantic species is in no way remarkable.

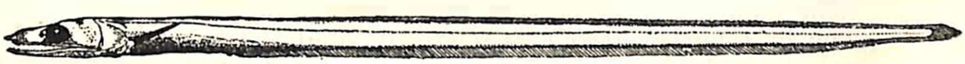
The type of *B. atlanticus* was taken by the *Challenger* at Station 318, 42° 32′ S., 56° 29′ W., east of North Patagonia, soundings 2,040 fathoms. The net, according to Sir John Murray, never touched bottom but probably went near it, and the damaged condition of the specimen suggests that it was caught far below the surface.

Our material—specimens from about 25 to 54 mm. in length—was obtained in May, August, and November, 1905, in townets fished off the coast of County Mayo at soundings ranging from over 1,000 to about 1,500 fathoms. No net went within less than 50 fathoms of the bottom, and one was not nearer than 300 fathoms to the bottom. *B. atlanticus* is therefore, so far as is at present known, a pelagic fish very widely distributed in the Atlantic.

SYNAPHOBRANCHUS PINNATUS (Gronow).

Nettophichthys retropinnatus, Holt, 1891.

Nettophichthys retropinnatus, Holt and Calderwood, 1895.



Young *Synaphobranchus pinnatus*, × ½

Nettophichthys retropinnatus was founded on a specimen of *S. pinnatus* taken by the *Fingal* in 1890. It was badly damaged, having the head nearly severed from the body and the dorsal and anal fins practically stripped off. Holt regarded the pectorals as naturally absent and the gill-apertures as lateral, and considered that there were traces in the regions of the dorsal and anal fins of slender and rather widely separated fin rays, as in the genus *Nettastoma* to which he supposed *Nettophichthys* to be closely allied. His drawing (Holt and Calderwood,* Pl. XLI.) was published without due acknowledgment of the extent to which the fins had been "restored," and in that respect and in the branchial and pectoral regions is entirely inaccurate.

The *Helga* examples are of about the same size, and being in perfect condition can be determined without difficulty as young *Synaphobranchi*, and referred, without reasonable doubt, to *S. pinnatus*.

The subjoined measurements are taken from the specimen caught at 454 fathoms :—

Total length,	118	mm.
,, without caudal fin,	115	,,
Length of head,	15	,,
,, snout	5	,,
,, narrow part of snout,	15	,,
,, eye,	3	,,
Snout to angle of preoperculum,	12	,,
Length of gape,	8	,,
Length of pectoral fin,	6	,,
Snout to origin of dorsal fin,	35	,,
,, ,, anal fin,	28	,,
Height of head,	5	,,
,, body at anus,	5	,,
Interorbital width,	2	,,
Width of postorbital part of head,	5	,,
Width of body,	3	,,

The length of the head is therefore contained about eight times in the total length without the caudal fin, the length of the snout three, and the length of the eye five times in the length of the head, which is three times as great as its height. The height of the body at the anus is about equal to the length of the snout, which is a little shorter than the pectoral fin. The eye is anterior by about its own length to the angle of the gape.

The adult, as may be seen from the diagnosis and figures given by Günther (1887), is relatively stouter, but the differences are only such as are normally associated with phases of growth.

In the young examples the median fin rays are set so closely together as to be practically uncountable even under the microscope. By counting, with more or less accuracy, short lengths

* Mr. Calderwood is in no way responsible, having had no opportunity of examining the specimen. E. W. L. H.

and multiplying by the total lengths one arrives at a computation of D. *ca.* 320, A. *ca.* 348, which may have some relation to the actual figures.

The gill openings are narrow and situate close together on the ventral side of the head, where, though overlooked in the original description, they may still be detected in the specimen called *Nettophichthys*.

The jaws are armed on the praemaxillae with a group of rather large teeth, somewhat abruptly reflected and with somewhat swollen bases. Behind this group are several smaller teeth in a single line. In the description of *Nettophichthys* the premaxillary teeth were regarded as belonging to the vomer, an error which may also prove to apply to descriptions of the dentition of *Nettastoma*.

The maxillae have a series of enlarged teeth internally; among these and external to them are a number of minute teeth not forming a regular series. The mandibles have a single series corresponding to the larger series of the maxillae, and in both maxillae and mandibles the anterior teeth are the larger.

The skin presents under the microscope a number of closely set oblique striae which may represent the incipience of such scales as *Synaphobranchus* possesses.

The natural colouration of young examples appears to be greyish, the snout, jaws, ventrum, and caudal fin rather dark.

Our sketch, p. 7, with the above notes, will probably suffice for the recognition of young stages. The characters of the adult may be summarised from Günther's description, which appears to be based on specimens 330 mm. (13 in.) to 685 mm. (27 in.) long:—Eye about half as long as snout; preanal length about half as long as postanal; pectoral half as long as head, its origin midway between snout and anus. Dorsal and anal fins low, especially the former. Colouration black or brown.

S. pinnatus is known from the Pacific and from both coasts of the Atlantic, extending on the eastern coast as far north as Norway. Its vertical range appears to lie between about 100 and 1,200 fathoms.

Our Irish records are from 144 fathoms, off County Mayo, 454 fathoms, off County Kerry, and 500 fathoms, near the Porcupine Bank.

SCOPELUS PUNCTATUS, Rafinesque, 1810, (Goode and Bean, 1895).

Myctophum punctatum, Goode and Bean, 1895.
,, ,, Brauer, 1904.
Scopelus caninianus, C. and V., 1848.
,, ,, Günther, 1864.
,, ,, Günther, 1887, *pars*.
,, ,, *pars*? Lütken, 1892.

The collection includes several small fishes which we regard as referable to the species which Goode and Bean and Brauer call *M. punctatum*, Rafin., but as opinions may differ as to the limitations of that species and as to the interpretation of its synonomy, it may be as well to give a description of our specimens :—

Scopeli measuring from 26 to 32.5 mm. without caudal fin and having the characters of *Myctophum* as defined by Goode and Bean. Colouration brownish black, the scales opalescent in certain lights. Form rather slender, but head and thoracic region somewhat elevated, eye large and snout obtusely rounded. Head about $3\frac{3}{4}$, greatest height of body about $4\frac{1}{3}$ in total length without caudal fin. Height of caudal peduncle about equal to length of eye and about $\frac{2}{5}$ of greatest height of body. Length of eye about twice that of snout, about $\frac{1}{3}$ of length of head and about $\frac{2}{3}$ of postorbital length of head. Origin of dorsal fin much nearer to snout than to caudal fin. Pectoral reaching beyond middle of ventral. Ventral not quite reaching origin of anal. Origin of adipose opposite last fourth of anal. Longest dorsal ray about equal to length of head without snout, longer than longest anal and caudal rays. Fin-ray formula D. *ca*. 12-14, A. *ca*. 20-22. Scales of lateral line *ca*. 44-45. Photophores—*mandibular* 3 ;—*opercular* 2, close together in a subvertical line a little above and behind angle of jaw ;—*pectoral* 3, the upper nearer to the lateral line than to the base of the pectoral fin ;—*antero-lateral* 1 ;—*medio-lateral* 3 in an almost straight subvertical line, the upper opposite the 17th scale of the lateral line and about opposite the origin of the anal fin ;—*postero-lateral* 1, opposite the 27th scale of the lateral line and distinctly anterior to the vertical from the origin of the adipose fin ;—*super-anal* (7?) 8—9 + 9 ; —*pre-caudal* 2 close together in slightly oblique line at the postero-inferior angle of the caudal base.

We have five specimens, measuring respectively, without the caudal fin, 26, 26, 28, 30, and 32.5 mm. The two largest which have nearly perfect tails are 37 and 40 mm. in total length, and in so far as it is possible to determine the measurements between perpendiculars of such small creatures by compasses and rule may be tabulated as follows :—

	mm.	mm.
Total length,	40	37
Total length without caudal fin,	32·5	30
Length of head,	9	8·5
Length of eye,	3	3
Length of snout,	1·5	1·3
Length to origin of dorsal fin,	13	13
Length to end of base of dorsal fin,	18	17
Length to origin of adipose fin,	24·75	23
Length to origin of anal fin,	18	17·5
Length between adipose and caudal fins,	6	5·5
Height of body at shoulder,	7	6·5
Height of caudal peduncle,	3	2·75

The fin-ray formula given above is taken from all five specimens, but an absolutely satisfactory count is difficult to us, and if it is equally so to other observers, differences of one or two fin-rays cannot be of much importance in specific diagnoses of *Scopeli*. We can count the scales of the lateral line, by scales or scale pouches, with reasonable certainty in the two largest specimens. Though no *Scopelus* has many scales a relatively large variation appears to be admitted to exist in species. The photophores are not deciduous and are practically perfect in all five specimens, though the three smallest have lost much of their skin. They are well developed, and remain fairly brilliant after preservation in alcohol and formaline. One specimen has only seven in the anterior section of the superanal series of one side. We think this is due to accident and that the normal superanal formula is 8 – 9 + 9. 9 + 9 occurs only on one side of one specimen. Brauer gives 7 – 9 + 7 – 11.

Goode and Bean do not formulate the super-anals of their *M. punctatum*, but show 6 + 9 in the figure. In other species they recognise a considerable latitude in the number of super-anals, and with such experience as we possess we regard 6—9 + 7 – 11 as probably characteristic of the species. Lütken's *S. caninianus* is excluded by Goode and Bean from *M. punctatum* because the postero-lateral is shown as at or near the vertical from the origin of the adipose fin. The super-anal formula is given as 8 – 9 + 8 – 9, and the difference in position of the postero-lateral, possibly due in part to circumstances of preservation, may, we think, be racial rather than specific. Its position is certainly not absolutely constant in the British Museum specimens.

Apart from the photophores our specimens agree well enough with Goode and Bean's definition of *M. punctatum* save in two particulars. The American authors state that the anal fin arises under the 21st scale of the lateral line. Their figure seems to show it arising below the 18th scale, and in our two largest specimens it seems to arise under the 17th scale. The specimen figured by Goode and Bean measures 90 mm., and a difference of one scale, or more, is quite possible in examples separated by 50 mm. of total length. If the authors mean that the anal fin arises at the base of the 21st oblique series of scales crossing the lateral line their description and figure are in accord and apply sufficiently to our material. They further state that the adipose fin is opposite the penultimate ray of the anal fin. Their figure agrees with our material in exhibiting the anterior end of the base of this fin somewhat further forward. In our specimens the ventral fins when perfect very nearly reach the anal. In *M. punctatum* they are described as far from reaching the anal. To this difference, real or apparent, we are disposed to attach no importance.

Our material agrees well enough with Messina specimens in the British Museum, 47 to 65 mm. in length without the caudal fin, catalogued by Dr. Günther as *S. caninianus*, and therefore referable, as we suppose, to the species which Goode and Bean prefer to call *punctatus*. These have the super-anal formula 7 – 9 + 7 – 9, and sometimes show the remains of dorsal and ventral pre-caudal, apparently luminous marginal bodies, sometimes one, sometimes both, and in one case neither being discernible.

There are in the British Museum three small *Scopeli* from the Pacific recorded as *S. caninianus*. The *Challenger* examples from between the Admiralty Islands and Papua seem to us to differ specifically from one another. One has three mediolateral photophores which form an obtuse-angled triangle, and is, we think, clearly not a specimen of *S. punctatus*. The other, if not *S. punctatus*, is very closely allied to it; the fin-ray formula appears to be D. 14, A. 20; there were once apparently some 38 scales in the lateral line, and the super-anal photophores are 8 + 6; there is a well-marked ventral marginal body, similar in type to that of *S. crocodilus*. The third specimen, from the surface of the Pacific, has its mediolateral photophores similarly disposed to those of the first *Challenger* specimen, and may well belong to the same species, whatever it be.

Lütken mentions records of his *S. caninianus* from the Pacific and Indian Oceans.

The specimens which form the subject of this note consist of several taken by the *Helga* off the coasts of County Kerry and County Mayo in nets sunk to 200 and 350 fathoms, and one taken by the *Thor* north of the Bay of Biscay in a net sunk to 164 fathoms.

SCOPELUS CROCODILUS (Risso, 1810), Lütken, 1892.

Pl. I., Fig. 5.

Myctophum crocodilum, Brauer, 1904, *nec* Cuvier and Valenciennes, 1848.

Lampanyctus crocodilus, Goode and Bean, 1895 (*pars*?).

Nyctophum Bonapartii, Cocco, "Lett. su Salmon."

Lampanyctus Bonapartii, Bonaparte, 1832-1841.

Some small fishes, taken in nets sunk to 75, 700, and 1,150 fathoms off the coasts of Counties Mayo and Kerry, and measuring from 26 to 44 mm. without the caudal fin appear to be referable to this species. Their photophores are extremely deciduous, and it is not possible to exactly determine what may have been the usual photophore formula in life.

Practically, the scales are entirely missing, and the determination of the number of the lateral line series from the remains of the scale pouches presents some difficulty. The fins are more or less broken, but in a few specimens they are almost perfect. Naturally the number of rays is not easy to count, as they are mostly depressed and very brittle.

The limits of species in *Scopelus* being by no means subject of agreement among ichthyologists, it seems as well to give a description of the specimens.

Form elongate and meagre, the ridges of the dorsal and anal fins somewhat projecting anteriorly. Colouration, in formaline, black with a slight tinge of blue rather than brown. Scales of the lateral line series about 34 or 35, with possibly 1 or 2 more. D. *ca* 14-15, A. *ca*. 17-18. Head snake-like; snout narrow and conical, generally shorter than eye. Jaw extending far beyond eye, pre-opercular keel oblique. Eye small, about $4\frac{1}{2}$ to $4\frac{3}{4}$ in head. Height of body about $1\frac{1}{3}$ to $1\frac{1}{2}$ in length of head.

Origin of dorsal fin rather nearer to snout than to caudal base; base of dorsal slightly overlapping base of anal, longest dorsal rays nearly as long as caudal, longer than anal rays, and nearly three-quarters as long as the head. Adipose fin opposite last few rays of anal. Pectoral and ventral fins reaching beyond the origin of anal.

Photophores—*mandibular* 3, indistinctly defined apparently luminous areas in the usual situation: a narrow anteriorly tapering white body internal to the proximal part of the mandible may also be part of the luminous apparatus;—*opercular* not exceeding 3 in any specimen, the upper and middle behind the eye, the lower some way above the jaw and somewhat in front of the vertical from the angle of the jaw. The three may be set in an oblique line, that nearest the angle of the jaw being the posterior, or the middle photophore be somewhat antero-ventral to a line between the upper and lower (the three represented in our material may not improbably be less than the full normal number, sometimes one and sometimes the other of two median members of a series of four being missing*);—*pectoral* not exceeding 3, the upper near the lateral line, the middle and lower respectively above and below the base of the fin;—*thoracic* 4, the first at a considerable interval from the second;—*abdominal* 4;—*super-anal* $6-7+7-8$, the first of the anterior series sometimes considerably in advance of the second;—*pre-caudal* $3+1$, the first separated by a short interval from the super-anal, the last widely separate from the preceding, and at the lateral line;—*antero-lateral* 3, the middle more or less above a line between the

* Most of our specimens have no opercular photophores at all, and from the condition of the skin it is impossible to tell whether they ever had any.

other two;—*medio-lateral* 2 in a sub-vertical row, the lower about opposite the origin of the anal fin;—*postero-lateral* 2 in a slightly oblique row continued below by the last or penultimate member of the first section of the super-anal series.

Marginal bodies apparently connected with the luminous apparatus comprise—(i.) a small mass of dead white matter on the front edge of the base of the adipose fin, which in its most perfect condition is rather sharply triangular in lateral contour, but does not seem to have a hard outer coating:—(ii.) on the caudal peduncle immediately in front of the anterior caudal rays a narrow keeled plate, apparently consisting of three coalesced scutes containing a dead white matter, which occupies less than half the distance between the caudal rays and the adipose fin:—(iii.) on the ventral edge of the peduncle a corresponding plate, between which and the anal fin is a series of about six distinct but slightly overlapping keeled scutes, all containing similar matter. In less perfect examples there are no distinct scutes, but merely strips of white matter of greater or less extent.

These bodies, when perfect, correspond almost exactly with those described and figured by Goode and Bean in *Lampanyctus gemmifer*. Since it is evident that their appearance is subject to great modification according to the condition of the specimen, they are probably of no great importance in the interpretation of diagnoses.

It will be seen that while closely approaching several species our specimens do not exactly agree with the descriptions of any, and it is only by comparison with the British Museum material of *S. crocodilus* that we have felt able to refer them to that species. The Museum series consists of a number of Mediterranean examples of different sizes: the smallest 75 mm. in length excluding, and 89 mm. including the caudal fin, and therefore considerably larger than any of ours; the largest of the full size of the species, viz., about 200 mm. without the caudal fin. There is also a large example taken from the stomach of another fish from the Atlantic, 31° N., 37° W. (off the Azores). While the larger are more regular in outline the smaller retain the characteristic meagre appearance shown in our figure. The fin-ray and scale formulae appear to be D. *ca*. 13–14, A. *ca*. 16–18, Sc. l. l. *ca*. 36. The pectoral, thoracic, ventral, antero-, medio-, and posterolateral photophores appear to be as in our figure. The photophores of the opercular series appear to be rather variable in position as well as in (present) number. Some specimens have as many as four.

A more important difference is found in the super-anal and pre-caudal series. Whereas in our specimens or at least in those of them in which the formulae can be read there is a small but well-marked break between the last super-anal and the first pre-caudal photophores, we cannot find such a break in any British Museum example which appears to have the photophores of this region perfect. The super-anal formula taken from six specimens is 7 - 8 (9) + 10 - 12, the second section including the first three photophores assigned in our material to the pre-caudal. The last pre-caudal is, as in our specimens, widely separated from the others. In Lütken's diagram, which seems to have been based on a large example, there is shown a small break between the super-anals and pre-caudals, which is well marked although smaller than in our specimens, while five opercular photophores are presented. The marginal bodies of the adipose fin and caudal peduncle are present in more or less perfect condition in some of the British Museum examples, and the condition of those of the ventral peduncular series in one suggests that they are normally covered by a transparent membrane. The dorsal partly overlaps the anal fin as in our specimens, in Lütken's diagram, and in Goode and Bean's figures of several species referred by those authors to the genus *Lampanyctus*, in which the dorsal is said not to overlap the anal. Their description of *L. crocodilus* is in other respects not in accordance with the figure which has been taken from a fish having D. 14, A. 17, instead of D. 12-13, A. 14, as stated in the text. It seems to us that their description relates, at least in part, to a fish other than the *S. crocodilus* of Lütken. Lütken and Brauer agree that *S. Bonaparti* of Cocco and Bonaparte is a synonym of *S. crocodilus*, Risso. Goode and Bean express no opinion on this point, but notice the resemblance of their *L. gemmifer* to *S. Bonaparti*. It differs (*teste* their figure) from the Museum series of *S. crocodilus* chiefly in having two photophores near the postero-lateral, which are not mentioned in the text, and in lacking the pre-caudal photophore at the lateral line. Between super-anals and pre-caudals there appears to be no break.

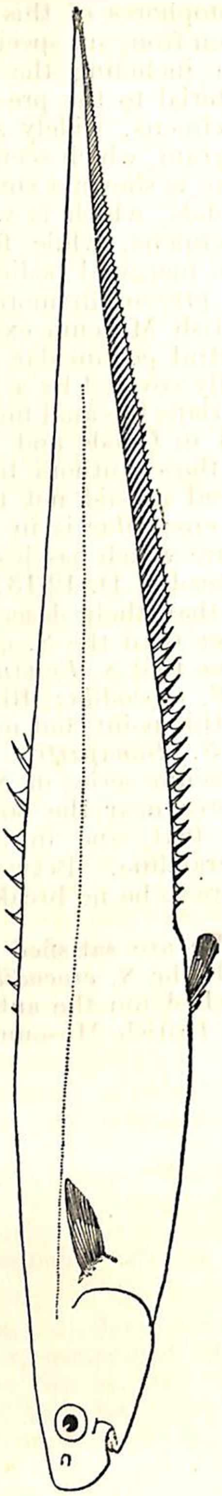
We are satisfied of the specific identity of our specimens with the *S. crocodilus* of Lütken and with the specimens so labelled (on the authority of Gal, Giglioli, and Boulenger) in the British Museum.

NOTACANTHUS BONAPARTI, Risso, 1840 (Collett, 1905.)

Notacanthus mediterraneus, De Filippi and Verany, 1857.

Notacanthus Bonaparti, Collett, 1905.

Body laterally compressed, about twice as high as wide, greatest height a little over 3½ to a little over 4½ in length from snout to anus. Head, 2⅔ to 3 in same distance, 6½ to 7½ in total length (without caudal fin). Anus anterior to median, opposite the 2nd or 3rd dorsal spines (when the anterior spines are present*), pre-anal to post-anal region about as 4 :7. Dorsal profile of head sub-horizontal, even or slightly curved. Snout rather obtusely pointed, not much compressed laterally, longer than the eye by about the distance between eye and nostril, or by about half the length of eye. Eye longer than high, length over 5 in head and about 1½ in interocular width. Mouth crescentic, about as wide as interocular width. End of maxilla below centre of eye, armed with a sharp spine usually (always normally?) concealed by skin. Lips thick, not forming a fold except at sides of lower jaw. Teeth in a single row, about 20 to 22 on each side on praemaxilla, 25 on mandible, 19-22 on palatine. Mandibular symphysis at or near vertical from between eye and nostrils. Gill membranes free from isthmus, uniting ventrally at an acute angle somewhat in front of vertical from upper extremities of gill opening and about 1½ or 1 eye-length behind vertical from hind margin of eye. D. VI-IX 1, consisting of spines set apart at distances about equal to height of eye, each bound to dorsum by a posterior triangular membrane, the last spine (usually) with a rudimentary soft ray arising immediately behind it and connected with it and with the



Notacanthus Bonaparti, × ½.

* The number of (and the position of the anterior and posterior) dorsal spines appears to us to be a character of doubtful specific value.

dorsum by membrane. Spines gradually increasing in size from in front backwards, the last in adults about as long as the eye, and in small examples (always?) considerably longer than the rest of the series. The first spine sometimes almost completely concealed by the skin. A. XI-XVIII 102-145 (observed total, 115-163), origin opposite 3rd or 4th dorsal spine, posterior spine or longest soft ray about as long as the eye; soft rays jointed but not branched; about 1-5 anal spines behind the last dorsal spine. P. *ca.* 14-15, less than half as long as head. V. III 6-8. 1st spine very short; 3rd, about or nearly as long as the eye, with bifid tip. Soft rays usually 6, not reaching vent. Inner insertions of the fins united.

Scales minute, about 25 longitudinal series between 1st dorsal spine and lateral line, about 40 between lateral line and anus, of nearly equal size all over body, slightly smaller on head. Lateral line well marked anteriorly, with a slight downward curve in region of dorsal spines, obsolescent towards the caudal extremity. Colouration brownish grey (or reddish grey?) after preservation, lips, mouth, pharynx and gill cavity more or less black. Hinder part of anal fin and corresponding ridge of dorsum blackish.

Locality. Station S. R. 171, 5—XI—'04. 48 mi. off the Tearaght, County Kerry, 52° 7′ N., 11° 58′ W., 337 fathoms, fine muddy sand. Trawl—One, 365 mm.

Station S. R. 212, 6—V—'05, 50 mi. off the Tearaght, 51° 54′ N., 11° 57′ W., 411 to 378 fathoms, fine sand. Trawl—One, 320 mm.

The diagnosis given above is chiefly based upon the notes which Collett has given of the characters of thirteen specimens taken by the *Michael Sars*, since the range of variation exhibited by his series is sufficient to include our material. Without this assistance we should have been disposed to institute a provisional species, as the Irish specimens did not seem exactly referable to published descriptions, nor certainly identical, on comparison, with species represented in the British Museum.

It is now apparent that species of *Notacanthus* are not susceptible of delimitation by small differences of proportions or of number and topographical relation of spines, and if it were possible to compare a considerable series, in reasonable state of preservation, of the various *Notacanthi* existing in literature it is likely that the number of species might be further reduced. For our present purpose it is sufficient to record that *N. Bonaparti*, previously known from the Mediterranean and from the sea between the Faröes and Hebrides, occurs also on the Irish coast. Collett regards it as probably identical with the Pacific *N. sexspinis*, Richardson, and very slight expansion of its diagnosis would serve to admit *N. annectens*, Boulenger, 1903, from the Cape of Good Hope.

NEROPHIS AEQUOREUS (Linn.), var. *EXILIS*, nov.

Nerophis aequoreus, Holt and Byrne, 1904.
Syngnathus, Koehler, 1896.

A *Nerophis* exceedingly common in the deep-sea region of the west coast of Ireland appears to us to be probably worthy of specific distinction from the common littoral *N. aequoreus*. It is at least entitled to varietal rank, and pending opportunity of comparison of a large series of littoral and deep-sea forms of comparable sizes we provisionally record it as a variety.

The annular formula is *ca.* 27-28 abdominal + *ca.* 57-62 caudal. The dorsal fin has *ca.* 40 rays on 8-9 abdominal and 3 caudal rings. The form is always meagre and attenuate. The maximum observed length is for females 240 mm., for males 185 mm. Males may be ovigerous at 135 mm., females may have a well-marked dorsal ridge at *ca.* 170 mm. The scutes of the annular series are distinct and conspicuously armed on the margins in specimens which have attained a length of 135 mm. (including ovigerous males), and in some cases in specimens exceeding 150 mm. in length. The pectoral and caudal fins are vestigial, and usually absent in adults. The colouration consists of alternate reddish or blackish-brown and pale bands throughout the body and tail except in large specimens, which are uniformly pale reddish brown without distinct bands. The horizontal range of the variety as evidenced by specimens which we have examined is from the north-west of Ireland to the Bay of Biscay, but we suppose that deep-water and off-shore *Nerophis*, recorded as *N. aequoreus* from a much wider area may probably be referable to this variety. We have found it benthic at 91 fathoms on the Porcupine Bank, and pelagic off the west coast of Ireland over soundings of about 50 to 1,500 fathoms, and about 2,000 fathoms off the Bay of Biscay.

Our present material suggests that there is considerable variation in the size at which the ridges of the dermal armature become obsolete, but they may remain in an adult (ovigerous) male as distinct as in *Syngnathus acus* or *S. rostellatus*. The young are freely pelagic, and we have received ovigerous males up to 184 mm., and females up to 204 mm. in townet gatherings made actually at the surface.

Our only evidence of a benthic habit is afforded by the capture of two large examples, one an ovigerous male, at about 91 fathoms in a dredge on the Porcupine Bank, and by the occurrence of a similar specimen, on the same occasion, in the stomach of a *Scyllium canicula*, which, so far as we know, is a fish which does not range far from the bottom. The two living *Nerophides* had the air-bladder distended, and could not leave the surface of the water in the vessel in which they were placed. It was of interest to note that they clung to each other (no other object being available) by the snake-like use of the tail familiar in littoral *N. aequoreus.* The dredge did not reveal much for them to cling to on the bank, the only excrescences from the stones being a very small colony of some hydroid resembling *Eudendrium*, and a few masses of a branching polyzoan, perhaps a species of *Smittia.*

So little is really known of the elasticity of characters in fishes that it is impossible to either affirm or deny that a littorally-bred *Nerophis* might by fortuitous drift into the ocean be so far modified in growth as to retain till a comparatively late period in life, or even until reproductive activity has commenced, the characters which are normally, or littorally, those of the young only. We propose, when sufficient material and time shall be available, a more exact comparison of the characters of *N. aequoreus* in its typical form and the variety *exilis*, which may serve to reveal distinctions which we have not as yet grasped. For the present it seems as if the two forms present an instance of a species in process of fission. *N. aequoreus*, var. *exilis*, might be supposed by the mere evidence of number captured, to be the most abundant pelagic fish of the Irish deep-sea region. Probably it is nothing of the sort, and is caught in quantity because it has, of all the fishes that lie in the track of our nets, the most inadequate means of evading them.

MELAMPHAES EURYLEPIS, sp. n.

Pl. I., Figs. 1 and 2.

Length of head less than 3 times in total length (without caudal fin) and greater than greatest height of body. Height of head, $\frac{2}{3}$ of its length. Eye small, $1\frac{1}{5}$ to $1\frac{1}{4}$ in snout, and about 6 times in head, separated vertically by more than its own length from top of head and gape respectively. Gape oblique, lower jaw very slightly projecting. Body highest immediately behind head, decreasing suddenly in height behind dorsal and anal fins. Caudal peduncle as long as head, its greatest height $2\frac{1}{3}$ to 3 times and its least height $3\frac{1}{3}$ to 4 times in its length.

D. II 10-11, commencing nearer to snout than to origin of caudal. A. I (II) 8, commencing a little behind middle of dorsal. Pectorals reaching to or beyond hind edge of base of anal. Ventrals set in the same vertical as pectorals.

Scales (nearly all missing in type and other specimens) very large,* thin and membranous (about 6 mm. in diameter in type), somewhat irregularly arranged on anterior part of body; about 13 to 15 in a longitudinal series; 3 in a transverse series on anterior part of body, possibly with a small scale above and below; 3 in a transverse series in caudal region, the median scale larger than those above and below it. Colouration

* Our figure purports to portray the scale pouches as they remain in the type specimen.

black. Length (of largest specimen) about 80 mm. Habit and distribution, pelagic in deep water in north-east Atlantic, near Ireland.

Our material consists of three specimens, of which two are in fair condition. The third is small and damaged, and though reasonably referable to the species was of no use for the purposes of the diagnosis given above. The circumstances of capture are as follows :—

1 (type). 79 mm. long (including damaged caudal), taken 12-II-'05, at St. S. R. 197, 54° 57′ N., 10° 5′ W., about 50 mi. W. by N. (magn.) of Eagle Island, County Mayo, in a large open townet lowered to 600 or 700 fathoms. Depth by Admiralty soundings about 1,300 fathoms.

2 (co-type). 76 mm. long (including damaged caudal), taken 20-V-'05, at St. S. R. 231 at the same place as the type in a pelagic otter-trawl lowered to about 1,150 fathoms.

3. About 14 mm. long (including damaged caudal), taken 3-XI-'04, 52° 6′ N., 12° 0½′ W., 50 mi. W.N.W.Nly. (magn.) of the Tearaght, County Kerry, in a large open townet lowered to about 350 fathoms. Depth by soundings, 375 fathoms.

M. eurylepis is distinct from any species of which we have seen a description, but comes rather near to *M. mizolepis*, Günther, known from two specimens. One (the type) was taken by the *Challenger* south of New Guinea, the other by the *Investigator* in the Bay of Bengal. We have examined the type, which is in the British Museum. The two species are, to the eye, obviously distinct, and the chief points of difference may be expressed as follows :—

(i.) The caudal peduncle in *M. eurylepis* is as long as the head, nearly three times as long as its own greatest, and four times as long as its own least height, while in *M. mizolepis* it is markedly shorter than the head, very little more than twice as long as its own greatest, and less than thrice as long as its own least height.

(ii.) The eye in *M. mizolepis* is about half as long as the snout; in *M. eurylepis* it is about two-thirds as long as the snout.

(iii.) In *M. eurylepis* the distance between the posterior extremity of the base of the anal fin and the base of the caudal fin is equal to the distance between the posterior edge of the pre-operculum and the posterior extremity of the base of the anal fin. In *M. mizolepis* the base of the pectoral fin must, in the same comparison, be substituted for the posterior edge of the pre-operculum.

(iv.) The head of *M. eurylepis* is distinctly larger and stouter than that of *M. mizolepis*, but we are unable to express this difference by comparative measurements.

(v.) The opercular flap in *M. eurylepis* has a rounded margin. In *M. mizolepis* it is produced into a feebly-marked angular projection.

(vi.) In *M. eurylepis* the pectoral fin when perfect extends beyond the bases of the dorsal and anal fins. In *M. mizolepis* it does not reach the posterior end of the base of the anal fin.

The scales of the type of *M. mizolepis* are now impossible to count, but may, as was computed by Günther, have been more numerous than those of *M. eurylepis*. The sculpture of the head bones is probably of no diagnostic importance in the genus since its appearance depends largely on the state of preservation of the skin, and its exact description and delineation is practically impossible. The bony cap shown in our figures of *M. eurylepis* may probably be entirely masked by skin in perfect specimens.

The habits of fishes of the genus *Melamphaes* (including *Plectromus*, Gill) are little known. Hitherto they seem to have been taken in nets which were fished at the bottom as well as on their way up to the surface. *M. eurylepis* appears to be pelagic. Our two largest examples were taken 50 miles off Eagle Island, County Mayo, at a place where the declivity is so steep that the depth cannot be exactly stated unless actual soundings are made. It varies within a very short horizontal distance from about 1,200 to about 1,500 fathoms. Here one specimen was taken in a net sunk to 1,150 fathoms, another in a net which did not go beyond 700 fathoms from the surface, and therefore certainly not nearer than 500 fathoms to the bottom. The third and smallest specimen was taken at soundings of 375 fathoms in a net sunk to 350 fathoms below the surface.

iii.—Summary of Recent Records of Fishes from the Irish Atlantic Slope.

It is unnecessary here to recapitulate the species which have already been noted from the region,* except in cases where some particular observation or lack of observation calls for remark. For present purposes locality may be sufficiently indicated by reference to soundings.

SCYLLIIDAE.

Scyllium canicula (Cuv.) appears to be abundant on the Porcupine Bank at soundings of about 91 fathoms.

Pristiurus melanostomus (Raf.) has been taken rather commonly, but *P. murinus*, Collett, has not yet been detected.

* Günther, 1874, 1889; Bourne, 1890; Scharff, 1891; Holt, 1891, 1892; Holt and Calderwood, 1895; Holt and Byrne, 1903, 1904, 1905.

SPINACIDAE.

Spinax niger, Bonap., already well known from localities to the north and south of our region, is represented by specimens from 100 to 200 fathoms *ca.*, but does not seem to be common.

CHIMAERIDAE.

We have not found any specimens referable to *C. mirabilis*, Collett, among the *Helga* Chimaeroids.

SALMONIDAE.

Argentina silus, Ascan., has been recorded by one of us *ex relatione piscatoris* from off the south coast of Ireland (Holt, 1898). It may now be added to the British-and-Irish fauna with certainty since the *Helga* has trawled a number of specimens at 105 and 164 fathoms, south of the Porcupine Bank. We may remark that *A. sphyraena*, Linn., seems to be commoner in the Irish Sea than on the west coast.

Bathylagus atlanticus, Gthr. See p. 6.

ALEPOCEPHALIDAE.

Alepocephalus Giardi, Koehler, is probably represented in our collection by larvae taken near the 300-fathom and 1,000-fathom lines. The species was originally described from the Bay of Biscay (Koehler, 1896), and has been recorded from off the Hebrides and Faröe by Collett.

Bathytroctes rostratus, Günther, has been taken in juvenile condition near the Porcupine Bank. While the adult characters seem to be sufficiently defined for specific determination our examples (not exceeding in length 32 mm. without the caudal fin) have on the postero-dorsal part of the gill-cover a skinny digitiform or tubular process which appears to be of a larval nature.[1]

Xenodermichthys socialis, Vaillant.—A single specimen taken in a beam-trawl unintentionally used as a townet, soundings 500 fathoms, about 70 mi. off the Fastnet.

STOMIATIDAE.

Stomias boa, Risso, has been taken on several occasions once in a net which did not descend below 200 fathoms from the surface, over soundings exceeding 1,000 fathoms.

Astronesthes Richardsoni, Poey (synon. *A. abyssorum*, Koehler). A small specimen was taken outside the 1,000-fathom line off County Mayo, at any depth between 1,150 and 0 fathoms.

Gonostoma microdon, Gthr., has frequently been taken in townets on either side of the 1,000-fathom line.

Gonostoma bathyphilum, Vaillant, was once taken between 700 or 800 and 0 fathoms, near the Porcupine Bank.

[1] See p. 27.

Maurolicus borealis, Nilsson, is not uncommon in townets ranging at least as far shorewards as the 100-fathom line.

Argyropelecus hemigymnus, Cocco. Larval and young specimens, provisionally referred to this species, are rather common on either side of the 1,000-fathom line. The synonomy of the species of this genus seems to require some revision.

ANGUILLIDAE.

Leptocephali of *Anguilla vulgaris*, Turton, have been taken on a number of occasions in deep water. They have been at once communicated to Dr. Johs. Schmidt, of the Danish Fisheries Staff, who is making a special study of the life-history of the species (see Schmidt, 1905).

SYNAPHOBRANCHIDAE.

Synaphobranchus pinnatus, Gronow. See p. 7.

SCOPELIDAE.

Scopelus glacialis, Reinhardt (*S. scoticus*, Günther, *Benthosema Mülleri*, Goode and Bean), is, with the possible exception of *Gonostoma microdon*, the commonest pelagic fish in our deep-water gatherings. It has usually been taken about the 1,000-fathom line, but has occurred on occasion in considerably shallower water.

S. arcticus, Lütken, is represented by a single specimen taken near the 1,000-fathom line off the coast of Mayo. Part of the head is missing, but the rest of the animal permits of certain determination.

S. punctatus, Rafinesque : see p. 9.

S. Rafinesqui, Cocco; a single specimen taken near the 1,000-fathom line.

S. elongatus, Costa, is represented by a single example trawled at 350 fathoms. The state of preservation is not such as to permit of certain reference to one or other of the species among which Goode and Bean have thought fit to partition the *Scopeli* which have the general characters of Lütken's *S. elongatus*.

S. crocodilus, Risso. See p. 12.

NOTACANTHIDAE.

Notacanthus Bonaparti, Risso. See p. 16.

FIERASFERIDAE.

Ova with fully-developed embryos and vexillifer larvae appear to be referable to *Fierasfer dentatus*, Cuv.

NEROPHIDAE.

Nerophis aequoreus, var. *exilis*, H. and B. See p. 18.

MACRURIDAE.

Macrurus caelorhynchus, Risso, *M. aequalis*, Günther, and *M. laevis*, Lowe, have proved to be common on the trawling ground at about 350 to 400 fathoms off the Tearaght, County Kerry.

Trachyrhynchus trachyrhynchus (Risso) is abundant on the same ground.

GADIDAE.

Gadus poutassou, Risso, was found in the stomachs of fish caught on the Porcupine Bank. Several young examples were taken in a fine-meshed drift net on the Cleggan mackerel grounds.

Phycis blennioides, Brunner, is common on the Tearaght trawling ground. The type specimens of *P. Aldrichii*, Bourne, appear to have been lost, but, from the description of them, we think that they would have been referred by us to *P. blennioides*.

Haloporphyrus eques, Günther. Common on the Tearaght trawling ground.

Mora mediterranea, Risso. Not uncommon on the same ground.

Molva elongata, Risso. A ling taken at 120 fathoms appears to so far combine the characters of the supposed Northern and Southern species of deep-sea ling (*M. abyssorum*, Nilsson, and *M. elongata*, Risso) as to render it reasonably certain that a single species is enough for the reception of both.

BERYCIDAE.

Trachichthys mediterraneus, C. and V. (*Hoplostethus mediterraneum*), is common on the Tearaght trawling ground.

Melamphaës crassiceps, Günther, has been taken once, outside the 1,000-fathom line off County Mayo, in a townet.

M. eurylepis, H. and B. See p. 19.

SERRANIDAE.

Pomatomus telescopium, Risso, has been trawled on several occasions, and seems to be a normal resident within the area.

DIRETMIDAE.

Diretmus argenteus, Johnson, is represented by a specimen measuring 83 mm. without the caudal fin. It was taken in a townet fishing between 350 and 0 fathoms over soundings of 470 fathoms, in November, 1905, S.W. of the Fastnet Rock.

NOTE ADDED IN PRESS

During May, 1906, Mr. Farran and Mr. Kemp have made further exploration of the deep-water grounds off the Tearaght Rock, extending the range of observation to about 900 fath. Among the fishes taken, in addition to many of the species listed above, may be noted the following, all of which, except *Macrurus rupestris*, are new to the British-and-Irish fauna, or are now first recorded on the evidence of adult examples taken within that area.

Centrophorus ringens (Boc. and Cap.).—Three, at soundings between 215 and 515 fath.

Chimaera mirabilis, Collett.—Nine, 550 to 893 fath.

Alepocephalus rostratus, Risso.—Several fine specimens, 610 to 680 fath.

Alepocephalus Giardi, Koehler.—A number of fine specimens (up to 770 mm., without caudal), 550 to 800 fath.

Conocara macroptera (Vaillant).—Five, 673 to 893 fath.

Scopelus punctatus (Rafinesque).—A number of specimens, taken at the surface at night over soundings of 500 to 768 fath.

Bathypterois dubius, Vaillant.—Three examples of the form with short ventral fins, 610 to 893 fath.

Macrurus rupestris (Gunner).—Several, 550 to 800 fath.

Macrurus mediterraneus (Giglioli). — A well-preserved *Macrurus* of 475 mm. appears to be the adult of this little-known species.

Macrurus labiatus, Koehler.—Eleven, 557 to 893 fath.

Macrurus Guentheri, Vaillant (*M. sclerorhynchus*, Günther).—One, 673 to 893 fath.

Antimora viola (Goode and Bean).—Two *Antimora* of about 140 mm. are probably of this species, 673 to 893 fath.

Scorpaena echinata, Koehler.—Two fine specimens, 550 to 800 fath.

All the above, except *Scopelus*, were caught in the trawl or in fine-meshed nets attached to the trawl.

LIST OF AUTHORITIES QUOTED.

Bonaparte, 1832–41.—Faun. Ital., Pesc.

Boulenger, 1903.—"New Deep-sea Fishes from S. Africa." Marine Investigations in S. Africa, II.

Bourne, 1890.—"H.M.S. *Research* off S.W. Ireland," Journ. M. B. Assoc., N.S., I.

Brauer, 1904.—"Die Gattung Myctophum." Zool. Anzeig., XXVIII., 10.

Cocco, 1820.—"Alcuni Salmoni." Messina.

Cocco, 1829.—"Lett. su Salmon." N. Ann. Sci. Nat. Bol.

Collett, 1905.—"Fishes of *Michael Sars*, 1900-2." Rep. Norw. Marine Invest.

Cuvier and Valenciennes, 1848.—Hist. Nat. Poiss, XXII.

De Filippi and Verany, 1857.—Mem. Ac. Sci. Torino, XVIII.

Goode and Bean, 1895.—Oceanic Ichthyology.

Günther, 1864.—Catalogue, V.

Günther, 1874.—"Fishes obtained at considerable Depths in N. Atlantic." Ann. Mag. Nat. Hist.

Günther, 1887.—"Deep Sea Fishes." *Challenger*, XXII.

Günther, 1889.—"Deep-sea Trawling off S. W. Ireland, Fishes." Ann. Mag. Nat. Hist.

Holt, 1891.—"Fishes of *Fingal*," Sci. Proc. R. Dub. Soc., VII.

Holt, 1892.—"Fishes of *Harlequin*," Sci. Proc. R. Dub. Soc., VII.

Holt, 1898.—"*Argentina silus*." Journ. M. B. Assoc., N.S., V.

Holt and Calderwood, 1895.—"Survey of Fishing Grounds, West Coast of Ireland, 1890-1. Fishes." Sci. Trans. R. Dub. Soc., S. II., V.

Holt and Byrne, 1904.—"Fishes of *Oceana*." Ann. Mag. Nat. Hist.

Holt and Byrne, 1903.—"British and Irish *Stromateidae*." Ann. Rep. Fish., Ireland, 1901, Pt. II., App., V.

Holt and Byrne, 1905.—"British and Irish Species of *Solea*." Ann. Rep. Fish., Ireland, 1902-3, Pt. II. App., V.

Koehler, 1896.—"Campagne du Caudan." Ann. Univ. Lyon.

Lütken, 1892.—"Spolia Atlantica," II., Vid. Selsk. Skr., Nat. Mat. Afd.

Norman, 1890.—"The British area in Marine Zoology," Ann. Mag. Nat. Hist.

Rafinesque, 1810.—"Indice d'Ittiol. Sicil." Palermo.

Risso, 1810.—"Ichth. Nice."

Scharff, 1891.—"Fishes of *Lord Bandon* and *Flying Falcon*." Proc. R. Irish Acad., 3rd S., I.

Schmidt, 1905.—"Life History of young Eel," Med. Kom. Havundersög., S. Fisk., I., No. 5.

ADDENDUM.

Scopelus Humboldti (Risso)

may be added to the British-and-Irish list, from a specimen taken in the South-West region.

E.W.L.H. and L.W.B.

EXPLANATION OF PLATE I.

Melamphaes eurylepis.

Fig. 1.—Type, 79 mm., magnified, showing remains of scale pouches.

Fig. 2.—Dorsal view of head.

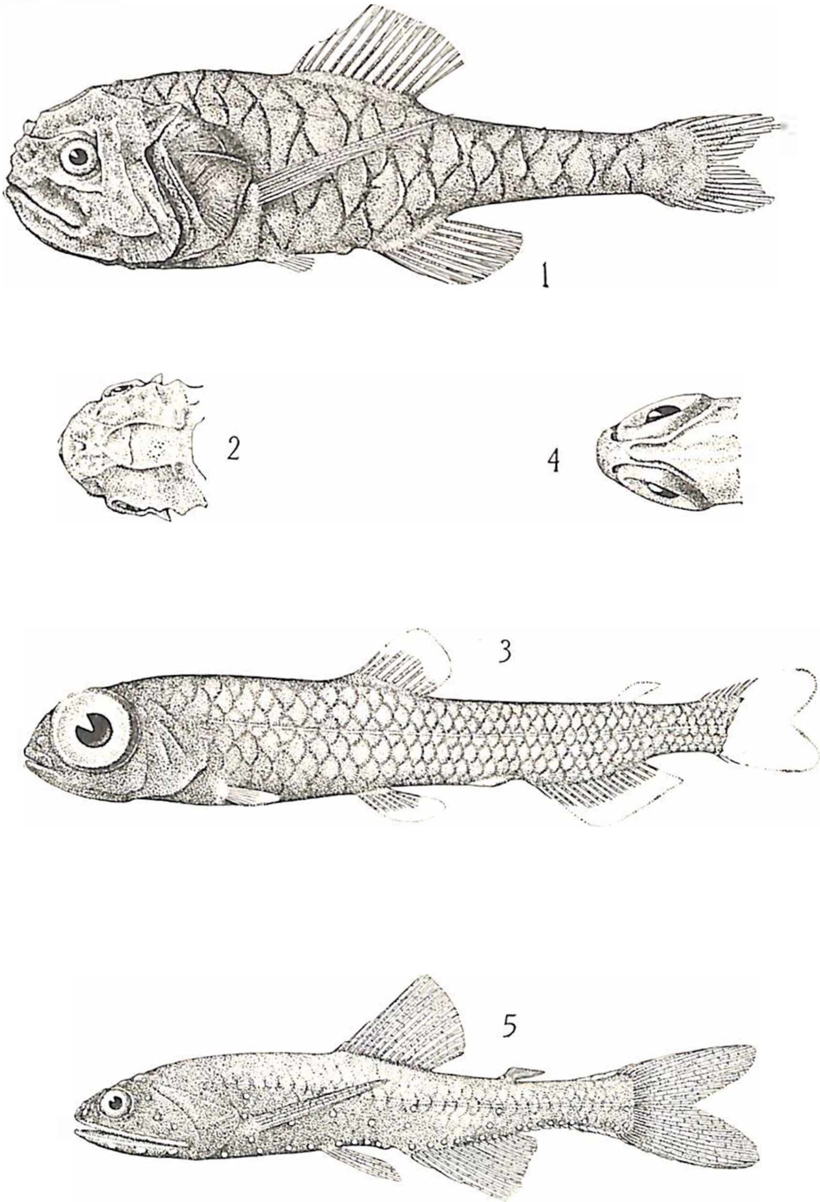
Bathylagus atlanticus.

Fig. 3.—Young example, 54 mm. (without caudal fin), magnified. Scales restored.

Fig. 4. Dorsal view of head.

Scopelus crocodilus.

Fig. 5. Young example of 44 mm. (without caudal fin), magnified. The photographs are restored from a series of smaller specimens.



G. M. Woodward, del.

1, 2. Melamphaes eurylepis.
3, 4. Bathylagus atlanticus.
5. Scopelus crocodilus.

APPENDIX, No. III.

THE FORAMINIFERA OF LARNE LOUGH AND DISTRICT.

BY

GEORGE C. GOUGH, B.Sc., A.R.C.Sc. (Lond.), F.G.S.

PLATE I.

Larne Lough, County Antrim, is a narrow land-locked inlet of the sea running N.W. to S.E. For the most part it is very shallow and much is uncovered at low water, but a deep channel runs up it which enables vessels to pass to the lower end. Up to the present only one part of the Lough has been thoroughly examined for Foraminifera, and this section, called J. by the Ulster Fishery Association, includes part of the deep channel near the mouth of the Lough. The depth is about 3½ fathoms at low water, so that this section has probably the deepest and purest water, the "bottom" being of medium sized sand mixed with calcareous débris such as broken shells. Taken as a whole the foraminifera are not particularly good specimens of their kind, but the fact that 88 species have been found shows that the order is well represented, and there is no doubt that future work in other parts of the Lough, where a different kind of bottom is present, will result in additions to the list. Although the majority of species found are common round our coasts, yet already a number of species new to the district, which I have taken to include the coast from Strangford Lough to Fair Head, have been found, and these I have marked by an asterisk (*). Two or three have also been noted by a dagger (†) as being new to the Irish List. Porcellanous, arenaceous and vitreous forms are all represented, but with one or two exceptions the arenaceous forms are rare inside the Lough, although plentiful in the open sea, for example, off the Gobbins.

Besides the dredgings from inside the Lough, samples have been examined from other parts, namely, from (i.) off the Gobbins, (ii.) Belfast Lough, off Holywood, and (iii.) Red Bay, County Antrim. The material from Red Bay was examined by Mr. J. Wright, F.G.S., and his list is appended. It is notable for the relative abundance of *Botellina labyrinthica*, Brady, which has hitherto only been met with at two or three localities, but which has been fairly abundant in each case.

The following notes on some of the rarer specimens recorded from the Lough may be of interest :—

Nubecularia lucifuga, Defrance, Pl. I., Figs. 1 and 2.—This parasitic form is now recorded for the first time as an Irish foraminifer. The young forms (Fig. 2) which were first found presented difficulty in naming, but the finding of older and more typical specimens cleared up any doubts.

Thurammina sp. (?), Pl. I., Fig. 9.—Quite a number of small flask-shaped arenaceous foraminifera were found, most of them being globular, but some being rather more irregular, each apparently having only one aperture at the end of a very short neck. They are not unlike Brady's figure (Chall. Voy. Vol. IX., Zoology, Pl. XVIII., Fig. 12) of *Saccammina sphaerica*, but are smaller and of finer texture. At the same time as *S. sphaerica* is a deep sea form they are more likely to be some species of Thurammina, which they very much resemble, and for the present it may serve to leave them as such and wait for further work before naming them more accurately.

Bulimina elongata, d'Orb.—This specimen, which is new to the Irish List, was recorded by me in the "Irish Naturalist" for February, 1904. At the time I believed it to be new to British seas, but I have lately found that it was recorded from the Southport district by Mr. Chaster in the Appendix to the First Report of the Southport Society of Natural Science, 1890-91. Since then it has also been found by Mr. Earland off the S.E. coast of England.[1] It is very like *B. pupoides*, but differs from it in that the latter chambers are smaller than those of *B. pupoides*, all the chambers being about the same size, thus giving a more even outline to *B. elongata*.

Bulimina convoluta, Will.—Two specimens of this foraminifer were found. The only other Irish record is one by Mr. Wright, who obtained it off the west coast of Ireland in the *Lord Bandon* cruise at a depth of between 38 and 44 fathoms.

Lagena rizzae, Seg., Pl. I., Fig. 3.—This form, which is rare around our coasts, but very common in the Estuarine Clay of the North of Ireland, especially at Limavady, has been described under several names, but especially as *Lagena bicarinata*, from which it differs principally in having a smooth rounded edge instead of the keeled edge of the latter.

Nodosaria simplex, Silvestri, Pl. I., Figs. 4 and 5.—The first specimen found was apparently broken (Fig. 5), so that exact determination was doubtful, but a second and apparently perfect specimen seems to show that this species may now be recorded as British. Brady only records it as found recent from off the Ki Islands, and off the W. coast of New Zealand.

Cristellaria rotulata (Lamk.), Pl. I., Fig. 6.—Typical specimens of the foraminifer are frequent in the Lough, but one form like the figure was found. I believe that it might be safely regarded as *C. gibba*, d'Orb., which has already been recorded by Mr. Chaster from the Southport district, but Mr. Wright prefers to regard it as an oblong form of *C. rotulata*.

[1] *Jour. Quekett Microscopical Club*, Nov., 1905.

Polymorphina rotundata (Born.), Pl. I., Fig. 7.—The normal examples are not uncommon, but the one illustrated is a curious abnormal form. It is almost triple in character, there being two well-marked and normal apertures, and indications of a third.

Discorbina minutissima, Chaster, Pl. I., Fig. 8.—This tiny foraminifer was first found and named by Mr. Chaster in the Southport area. It is now recorded for the first time from Ireland.

In conclusion I desire to acknowledge the great help and assistance I have received from my friend, Mr. Wright, F.G.S., especially in the determination of doubtful specimens.

LIST OF FORAMINIFERA OF LARNE LOUGH.

* Foraminifera new to the District; † Foraminifera new to Ireland.

v.r. = very rare; r. = rare; f. = frequent; c. = common; v.c. = very common.

Nubecularia, Defrance.

†*Nubecularia lucifuga*, Defr. f.

Biloculina, d'Orbigny.

**Biloculina irregularis*, d'Orb. v. r.
Biloculina elongata, d'Orb. r.
Biloculina depressa, d'Orb. r.

Biloculiaa, d'Orbigny.

Spiroloculina limbata, d'Orb. v. r.

Miliolina, Williamson.

Miliolina trigonula (Lamk.). f.
Miliolina tricarinata (d'Orb.). v. r.
Miliolina oblonga (Montag.). f.
Miliolina seminulum (Linné). v. c.
**Miliolina venusta* (Karrer). v. r.
Miliolina subrotunda (Montag.). v. c.
Miliolina circularis (Born.). r.
Miliolina bicornis (W. & J.). f.

Sigmoïlina, Schlumberger.

Sigmoïlina secans (d'Orb.). c.

Opthalmidium, Kübler.

Opthalmidium carinatum, B. & W. c.

Cornuspira, Schultze.

Cornuspira involvens, Rss. f.

Hyperammina, Brady.

Hyperammina arborescens (Norman). r.

Haplophragmium, Reuss.

Haplophragmium canariense (d'Orb.). c.
Haplophragmium globigeriforme (P. & J.). r.

Thurammina, Brady.

Thurammina (?) sp. f.

Trochammina, Parker & Jones.

Trochammina squamata (J. & P.). f.
Trochammina ochracea (Will.). r.

Textularia, Defrance.

Textularia gramen, d'Orb. v. r.
Textularia conica, d'Orb. f.

Verneuilina, d'Orbigny.

Verneuilina polystropha (Rss.). c.

Bulimina, d'Orbigny.

Bulimina pupoides, d'Orb. f.
†*Bulimina elongata*, d'Orb. v. r.
**Bulimina elegans*, d'Orb. r.
**Bulimina aculeata*, d'Orb. r.
Bulimina fusiformis, Will. f.
Bulimina marginata, d'Orb. f.
**Bulimina convoluta*, Will. v. r.
Bulimina subteres, Br. v. r.
Bulimina elegantissima, d'Orb. r.
**Bulimina minutissima*, Wright. v. r.

Bolivina, d'Orbigny.

Bolivina punctata, d'Orb. c.
Bolivina plicata, d'Orb. c.
Bolivina textilarioides, Rss. r.
Bolivina dilatata, Rss. f.
Bolivina difformis (Will.). v.c.

Cassidulina, d'Orbigny.

Cassidulina laevigata, d'Orb. r.
Cassidulina crassa, d'Orb. v. c.

Lagena, Walker & Boys.

Lagena globosa (Montag.). r.
Lagena laevis (Montag.) f.
Lagena aspera, Rss. v. r.
Lagena lineata (Will.). r.
Lagena sulcata (W. & J.). f.

Lagena Williamsoni (Alcock). v. c.
Lagena costata (Will.). v. r.
Lagena striata (d'Orb.). f.
Lagena semistriata Will. f.
Lagena squamosa (Montag.). c.
Lagena hexagona (Will.). c.
Lagena laevigata (Rss.). r.
Lagena laevigata, var. *lucida* (Will.). c.
Lagena quadricostulata, Rss. f.
Lagena marginata, W. & B. c.
Lagena rizzae (Seg.). v. r.
Lagena obignyana (Seg.). v.c.
Lagena lagenoides (Will.). v. r.

Nodosaria, Lamarck.

Nodosaria pyrula, d'Orb. r.
†*Nodosaria simplex*, Silvestri. v. r.

Lingulina, d'Orbigny.

Lingulina carinata, d'Orb. v. r.

Cristellaria, Lamarck.

Cristellaria rotulata (Lamk.). f.
Cristellaria rotulata, var. (?). v. r.

Polymorphina, d'Orbigny.

Polymorphina rotundata (Born.). r.

Uvigerina, d'Orbigny.

Uvigerina angulosa, Will. f.

Globigerina, d'Orbigny.

Globigerina bulloides, d'Orb. v. c.
Globigerina inflata, d'Orb. r.

Spirillina, Ehrenberg.

Spirillina vivipara, Ehr. f.

Patellina, Williamson.

Patellina corrugata, Will. v. c.

Discorbina, Parker & Jones.

Discorbina globularis (d'Orb.). c.
Discorbina rosacea (d'Orb.). v. c.
Discorbina orbicularis (Terq.). r.
Discorbina Bertheloti (d'Orb.). v. r.
**Discorbina obtusa* (d'Orb.). r.
†*Discorbina minutissima*, Chaster. v. r.

Planorbulina, d'Orbigny.

Planorbulina mediterranensis, d'Orb. c.

Truncatulina, d'Orbigny.

Truncatulina refulgens (Montf.) c.
Truncatulina lobatula (W. & J.). v. c.
**Truncatulina variabilis*, d'Orb. v. r.

Pulvinulina, Parker & Jones.

Pulvinulina repanda (F. & M.). f.
Pulvinulina Karsteni, Rss. v. r.

Rotalia, Lamarck.

Rotalia beccarii (Linnè). v. c.

Gypsina, Carter.

Gypsina inhaerens (Sch.). f.

Nonionina, d'Orbigny.

**Nonionina asterizans* (F. & M.). r.
Nonionina depressula (W. & J.). v. c.

Polystomella, Lamarck.

Polystomella crispa (Linnè). v. c.
Polystomella striato-punctata (F. & M.). c.
**Polystomella macella* (F. & M.). f.

LIST OF FORAMINIFERA FROM RED BAY, CO. ANTRIM [10 fath.].

* Foraminifera new to the district.

Spiroloculina limbata, d'Orb.
Spiroloculina excavata, d'Orb.
Miliolina oblonga (Montag.).
Miliolina seminulum (Linnè).
Miliolina contorta (d'Orb.).
Miliolina subrotunda (Montag.).
Miliolina Ferussacii (d'Orb.).
Miliolina bicornis, W. & J.
**Psammosphaera fusca*, Sch.
**Jaculella acuta*, Br.
**Botellina labyrinthica*, Br.
**Webbina hemisphaerica*, J. P. & B.
Textularia gramen, d'Orb.
Textularia conica, d'Orb.
Spiroplecta sagittula (Defr.).
Gaudyrina rudis, Wright.
Verneuilina polystropha (Rss.).

Bulimina pupoides, d'Orb.
Bulimina marginata, d'Orb.
Bolivina plicata, d'Orb.
Lagena Williamsoni (Alcock).
Lagena quadricostulata, Rss.
Lagena orbignyana (Seg.).
Polymorphina lactea ? (W. & J.).
Globigerina bulloides, d'Orb.
Spirillina vivipara, Ehr.
Discorbina globularis (d'Orb.).
Discorbina rosacea (d'Orb.).
Discorbina orbicularis (Terq.).
Discorbina Wrighti, Br.
Discorbina nitida (Will.).
Truncatulina lobatula (W. & J.).
Rotalia beccarii (Linné).
Nonionina depressula (W. & J.).
Nonionina pauperata, B. & W.
Polystomella crispa (Linné).
Polystomella striato-punctata (F. & M.).

LIST OF FORAMINIFERA FROM THE GOBBINS.

[12 fath.]

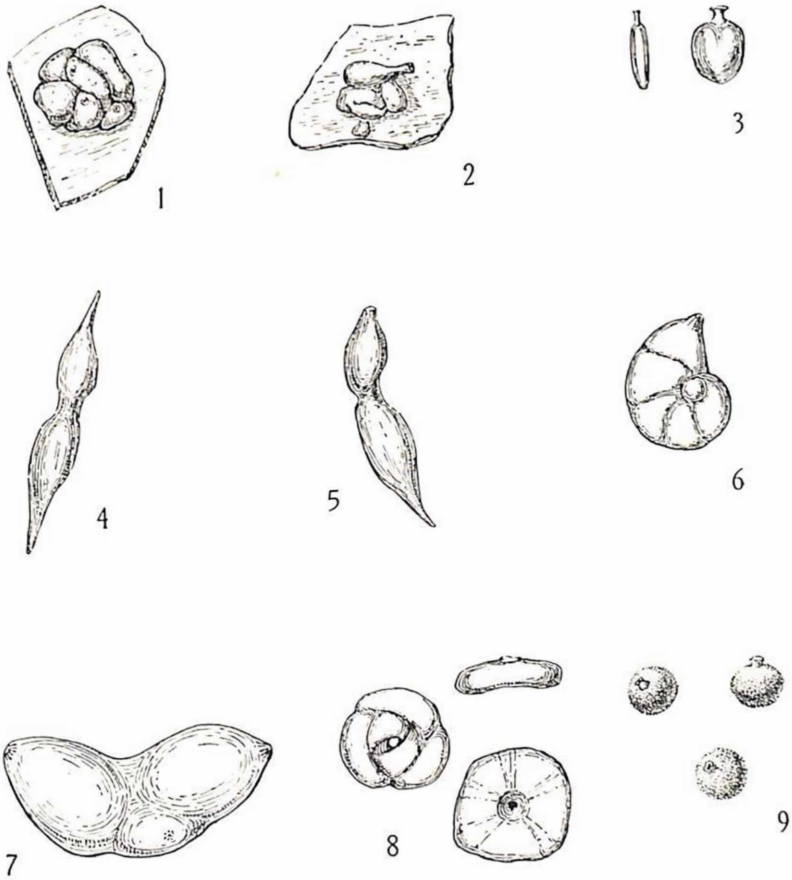
v.r. = very rare ; r. = rare ; f = frequent ; c. = common ; v.c. = very common.

Biloculina elongata, d'Orb. r.
Biloculina depressa, d'Orb. r.
Spiroloculina excavata, d'Orb. c.
Miliolina trigonula (Lamk.). c.
Miliolina seminulum (Linné). v.c.
Miliolina subrotunda (Montag.). f.
Miliolina bicornis (W. & J.) c.
Hyperammina arborescens (Norman). c.
Textularia gramen, d'Orb. v.c.
Spiroplecta sagittula (Defr.). c.
Gaudyrina rudis, Wright. f.
Bolivina punctata, d'Orb. f.
Cassidulina crassa, d'Orb. r.
Lagena costata (Will.). v.r.
Lagena orbignyana (Seg.). r.
Nodosaria? communis, d'Orb. r.
Vaginulina legumen (Linné). f.
Cristellaria rotulata (Lamk.). r.
Polymorphina gibba, d'Orb. f.
Polymorphina lanceolata, Rss. r.
Polymorphina rotundata (Born.). f.
Globigerina bulloides, d'Orb. c.
Patellina corrugata, Will. r.
Discorbina globularis (d'Orb.). f.
Discorbina rosacea (d'Orb.). c.

Truncatulina lobatula (W. & J.). v. c.
Pulvinulina repanda (F. & M.). r.
Rotalia beccarii (Linnè). v. c.
Gypsina inhaerens (Schultze). r.
Nonionina depressula (W. & J.) c.
Polystomella crispa (Linnè). v. c.
Polystomella striato-punctata (F. & M.). c.

FORAMINIFERA FROM BELFAST LOUGH, OFF HOLYWOOD.

Miliolina oblonga (Montag.). r.
Miliolina seminulum (Linnè). v.c.
Miliolina subrotunda (Montag.). c.
Sigmoïlina secans (d'Orb.). c.
Trochammina squamata, J. & P. r.
Gaudyrina filiformis, Berth. v. r.
Verneuilina polystropha (Rss.). v. c.
Bulimina pupoides, d'Orb. f.
**Bulimina elongata*, d'Orb. v. r.
Bulimina fusiformis, Will. f.
Bulimina marginata, d'Orb. f.
Bulimina elegantissima, d'Orb. r.
**Virgulina squamigera* (=*Bulimina squamigera*, d'Orb.). v. r.
Bolivina punctata, d'Orb. f.
Bolivina plicata, d'Orb. c.
Bolivina dilatata, Rss. f.
Cassidulina crassa, d'Orb. r.
Lagena laevis (Montag.). r.
Lagena sulcata (W. & J.). r.
Lagena Williamsoni (Alcock). f.
Lagena gracilis, Will. v. r.
Lagena semistriata, Will. r.
Lagena squamosa (Montag.). f.
Lagena lucida (Will.). f.
Lagena orbignyana (Seg.). f.
Uvigerina angulosa, Will. r.
Globigerina bulloides, d'Orb. v. c.
Patellina corrugata, Will. r.
Discorbina rosacea (d'Orb.). f.
Truncatulina lobatula (W. & J.). v. c.
Truncatulina ungeriana (d'Orb.). v. r.
Rotalia beccarii (Linnè). v. c.
Nonionina depressula (W. & J.). v. c.
Polystomella crispa (Linnè). v. c.
Polystomella striato-punctata (F. & M.). c.



G. C. G. del.

Fig. 1. *Nubecularia lucifuga*, Defrance, × 35.
,, 2. ditto, smaller and younger specimen.
,, 3. *Lagena rizzae* (Seg.) × 50.
,, 4. *Nodosaria simplex*, Silvestri, × 35.
,, 5. ditto, (broken specimen?).
,, 6. *Cristellaria rotulata* (Lamk.), × 35.
This specimen approaches *C. gibba*, d'Orb.
,, 7. *Polymorphina rotundata* (Born.), abnormal form.
,, 8. *Discorbina minutissima*, Chaster, × 100 (after Chaster).
,, 9. *Thurammina* sp.?, × 35.

APPENDIX, No. IV.

THE MARINE FAUNA OF THE COAST OF IRELAND.

PART VIII.

PELAGIC AMPHIPODA OF THE IRISH ATLANTIC SLOPE.

BY

W. M. TATTERSALL, B.Sc.

PLATES I to V.

This first contribution to a knowledge of the *Amphipoda* of Ireland deals mainly with the pelagic members of the order belonging to the tribe *Hyperiidea*. Four species of *Lysianassidae* are, however, included because, being pelagic in habitat and occurring, as they do, in the company of the *Hyperiidea* they can most conveniently be dealt with in this place.

The material examined is derived chiefly from the collections made by the Department's fishery cruiser *Helga* off the west coast of Ireland, but I have also been permitted to examine a small collection of *Amphipoda* made by Dr. Wolfenden in the eastern Atlantic, and some material collected by the Danish steamer *Thor* off the coast of Ireland, communicated by Dr. J. Schmidt of Copenhagen.

Norman (1900)[1] in his synopsis of the British and Irish members of the *Hyperiidea* enumerates nine species of this tribe as having been taken actually within the British and Irish marine area, and four additional species from the Faröe Channel which cannot be admitted as belonging to our fauna. To the British list Scott (1904) has since added *Hyperia medusarum* (O. F. Müller) and Walker (1903) *Hyperioides longipes*, Chevreux. In the following pages thirty-three species of *Hyperiidea* and four species of *Lysianassidae* are recorded of which thirty of the former and two of the latter were captured within the limits of the British-and-Irish marine area. The additions to the British-and-Irish list may be enumerated as follows :—

Parascina Fowleri, Stebbing.
Scina crassicornis (Fabricius).
Scina Vosseleri, sp. n.

[1] These dates refer to the list of authorities given on pp. 36-38.

Scina borealis (G. O. Sars).
Scina Rattrayi, Stebbing.
Scina oedicarpus, Stebbing.
Scina uncipes, Stebbing.
Scina submarginata, sp. n.
Acanthoscina acanthodes (Stebbing).
Vibilia propinqua, Stebbing.
Vibilia armata, Bovallius.
Lanceola aestiva, Stebbing.
Lanceola serrata, Bovallius.
Hyperia spinigera, Bovallius.
Phrosina semilunata, Risso.
Primno macropa, Guérin.
Brachyscelus crusculum, Sp. Bate.
Thamneus sp.
Paralycaea gracilis, Claus.
Platyscelus ovoides (Risso).
Metacyphocaris Helgae, gen. et sp. n.

The following species were taken only outside the limits of British-and-Irish waters, i.e., at or over soundings exceeding 1,000 fathoms :—

Scina pacifica (Bovallius).
Cystisoma spinosa (Fabricus).
Dairella latissima, Bovallius.
Crybelocephalus megalurus, gen. et sp. n.
Katius obesus, Chevreux.

In dealing with a group of pelagic organisms like the *Hyperiidea*, which, with very few exceptions, are essentially oceanic in habitat, it is a somewhat difficult matter to decide whether species, for the first time recorded from within the limits of any littoral or sub-littoral area, should be regarded as true *incolae* of that area or chance immigrants due to one or other of a variety of causes.

In the above list of additions to our fauna such species as *Scina borealis*, *Scina Rattrayi*, and one or two others, taken constantly during the last two or three years, may perhaps be legitimately looked upon as permanent residents in our waters, which had not previously been explored with suitable fishing engines. On the other hand, species like *Phrosina semilunata*, *Primno macropa*, and *Platyscelus ovoides*, only taken as solitary specimens on one or two occasions during the same period may rather be looked on as stragglers brought to our shores by currents, changes of temperature, or stress of weather. For instance during the summer and autumn of 1905 a large quantity of South Atlantic water is known to have travelled northwards to the Atlantic ocean off the west coast of Ireland, and may well have brought in with it such hitherto decidedly southern species as *Vibilia propinqua*, *Vibilia armata*, and *Cystisoma spinosa*, which were only captured during that period. Some such cause must also account for the increased numbers of *Brachyscelus crusculum* during the autumn of 1905. Previously only single specimens had been taken on odd occasions, but in two hauls in September and November, 1905, sixteen and ten specimens respectively were captured. At the same time it must be remembered that the Atlantic Ocean to the west of Ireland has been very little explored, and the species only occasionally met with in the area worked by the *Helga* may be regular inhabitants of the offshore waters of the same latitude, and may in reality be not infrequently carried shorewards by continuous westerly winds.

The economic importance of the *Hyperiidea* as a food of fishes is perhaps not sufficiently realised. Brook and Calderwood (1884) in a report on the food of the herring write of *Hyperia galba* :—"This species must be reckoned as one of the most important forms of herring food," and proceed to note that it is chiefly during the winter months from November to April that the herring feeds on Hyperids. It may be mentioned that in all probability the species that these authors had met with in the herring's stomachs was *Parathemisto oblivia* and not *Hyperia galba*.

Scott (1904) records *Parathemisto oblivia* as forming quite an important food of the whiting, and it is interesting to note that, as Brook and Calderwood found for the herring, it is chiefly during November and December that the whiting takes to a Hyperid diet.

On the west coast of Ireland the same species, *Parathemisto oblivia*, occasionally *Euthemisto compressa*, and more rarely *Hyperia galba* and *Tryphaena Malmi*, are found to form a very large part of the food of three of the principal food fishes, herring, mackerel, and sea trout, during the late autumn and early winter. Stomachs of these fishes examined during this period are often distended to almost bursting point with these Hyperids, which must occur in immense swarms just off the land at this time. The fact that it is only during the winter months that these fishes feed on Hyperids is distinctly interesting, and the reason for it not very clear. In the spring and summer mackerel and herring are found to be feeding almost entirely on Copepods and *Spirialis*, while sea trout devote attention to Euphausians, young fishes, and a variety of other organisms. The townet gatherings made during the last six years prove that *Parathemisto* is present all the year round in the offshore waters, but there seems to be distinct evidence of an inshore migration during the late autumn, since, except in the late autumn and winter, *Parathemisto* is absent from both inshore townettings and the stomachs of fish caught near the land. It may be added that the evidence from the contents of fishes' stomachs is confined to localities not exceeding ten miles from land, and it is impossible to say from this source of information what may be the relative abundance of *Parathemisto* at any time of the year on the offshore grounds.

In connection with the part which Hyperids play in the food of fishes, it is of great interest to note from our records the presence of *Tryphaena Malmi* in the stomach of a spur-dog, *Acanthias vulgaris.* It is probable however that the Hyperids came there through the dogfish having swallowed a herring or mackerel which had been feeding on them, rather than that it deliberately took to a Hyperid diet.

Records by Chevreux of the presence of *Brachyscelus crusculum* in the stomachs of the tunny only serve to emphasize the economic value of this group, and a knowledge of the distribution of the various species may be of first importance in considering the life-history of such fish as the herring and mackerel.

Of the four new species described in this paper, two, *Scina Vosseleri* and *Scina submarginata*, belong to the *Hyperiidea*, while the other two, *Metacyphocaris Helgae* and *Crybelocephalus megalurus*, are types of new and aberrant genera belonging to the *Lysianassidae*, and apparently modified for a bathypelagic semi-parasitic life.

The terminology adopted is that used by Sars in his account of the Amphipoda of Norway (1890), while the arrangement of the families of the *Hyperiidea* is that of Stebbing in his work on the *Challenger* Amphipoda, except that the genus *Dairella* is given family rank as proposed by Vosseler and the name of the family *Tryphaenidae* is changed to *Lycaeidae*.

I desire to express my thanks to M. Chevreux, Dr. Senna, Dr. Woltereck, Mr. Stebbing, and Mr. Walker, for kind assistance in the preparation of this paper. To Canon Norman I am especially indebted, both for the loan of specimens and for other valuable help which he has kindly rendered.

TRIBE *HYPERIIDEA*.

FAMILY *SCINIDAE*.

GENUS **Parascina,** Stebbing.

Parascina Fowleri, Stebbing, 1905.

P. Fowleri, Chevreux, 1905.

Helga.

88 mi. W.S.W. of Fastnet, Co. Cork, 470 fath., November, 1905, Petersen trawl at 350 fath.—One male.

The present specimen, a male, agrees in every way with Chevreux's account of the sexual differences exhibited by the species.

Distribution.—Bay of Biscay (Stebbing, Chevreux); Atlantic Ocean, between the Azores and Canaries (Chevreux).

GENUS **Scina,** Prestandrea.

Scina crassicornis (Fabricius).

Helga.

W. of Porcupine Bank, Lat. 53° 1′ N., Long. 14° 34′ W., 293 fath., May, 1905, townet on trawl.—One.

W. of Porcupine Bank, Lat. 53° 7′ N., Long., 15° 6′ W., 860 fath., May, 1905, Petersen trawl at 750 fath.—One.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,200 fath., May, 1905, Petersen trawl at 1,150 fath.—One.

Same station, large coarse townet at 750 fath.—One.

50 mi. W. ¾ N. of Tearaght, Co. Kerry, 411 fath., November, 1905, Petersen trawl at 350 fath.—One.

The synonymy of this species has recently been fully dealt with by Stebbing (1904), and the view therein set forth as to its correct name is here adopted.

In one specimen, otherwise agreeing well with published descriptions, the long tooth of the fifth pair of legs has four denticles on its front margin.

Distribution.—This species has a general and very wide distribution throughout the north and south Atlantic Ocean and the Mediterranean.

Scina Vosseleri, sp. n.

Pl. I., Figs. 1-8.

Helga.

W. of Porcupine Bank, Lat. 53° 7′ N., Long. 15° 6′ W., 860 fath., May, 1905, Petersen trawl at 750 fath.—One male.

Body very slender, semi-transparent, all the muscles showing plainly through the integument.

Head longer than the first segment of the mesosome, slightly emarginate in front.

Mesosome with the first segment the shortest, the fourth the longest, the second equal to the sixth and seventh, the third equal to the fifth.

Metasome with the first three segments subequal in length, and equal to the combined length of the last four segments of the mesosome; fifth and sixth segments coalesced; postero-lateral angles of the first three segments rounded.

Eyes of moderate size.

Superior antennae very long and slender, equal in length to the rest of the total length excluding the uropods; both margins of the elongate first joint of the flagellum armed with teeth, the inner in addition having a fringe of long filaments.

Inferior antennae (not yet fully developed in the specimen) short, crossed on the under side of the head; first three joints of the peduncle small, their combined length equal to that of the fourth joint; flagellum imperfectly three-jointed.

First gnathopods (Fig. 1) slender; basal joint the longest, second joint very short with a blunt spine on its inferior distal corner; third joint slightly longer than the second; carpus slightly shorter than the propodus; latter long and slender, tapering somewhat towards the distal end; dactylus rather more than one-third of the length of the propodus, slender and simple; whole limb armed along its inferior margin with a few setae.

Second gnathopods (Fig. 2) slender, very similar in structure to the first and of about the same length. The carpus is however slightly shorter and the dactylus rather longer than in the first pair.

Third and fourth pairs of legs (Figs. 3, 4) of similar structure, longer than either of the pairs of gnathopods and more robust, due to the large size and swollen nature of the carpus; merus in both pairs short; carpus large and oval in shape, much dilated and entirely glandular; propodus shorter than the carpus and much narrower; dactylus slender and simple.

Fifth pair of legs (Fig. 5) remarkably long and slender, almost as long as the body from the head to the telson; elongate basal joint less than half the total length of the limb and equal to the merus and carpus combined, its hind margin armed with about thirteen prominent teeth, its front margin likewise armed with about eleven teeth, and produced into a long spine-like process, having two teeth on its hind margin, and extending beyond the second joint of the limb; second joint short, its front margin produced into a short spinous process; of the next three joints the carpus is the longest, being very slightly longer than the propodus; latter very slender and of equal width throughout; dactylus simple and slender, with a comb of very fine setae on its inner margin.

Sixth pair of legs (Fig. 6) about four-fifths of the length of the fifth pair; basal joint with its front margin slightly produced into a short acute process; carpus longer than the merus, but slightly shorter than the propodus; latter elongate and very narrow; dactylus simple and slender with a brush of fine setae similar to that of the fifth pair.

Seventh pair of legs (Fig. 7) about five-eighths of the length of the sixth pair, rather more robust than either the fifth or sixth pairs; merus only about half as long as the carpus; latter a little shorter but more robust than the propodus; dactylus short, simple and slender.

Uropods (Fig. 8) very elongate, equal to one-half the total length of the body from the head to the telson.

First pair (Fig. 8) longer than the second and subequal to the third pair; peduncle longer than the inner ramus; outer ramus represented by a short spine; inner margin of the coalesced inner ramus and peduncle armed with eight teeth; outer margin of the inner ramus sharply serrate.

Second pair (Fig. 8) with the peduncle larger than the inner ramus; outer ramus represented by a stout spine longer than that of the first pair; inner margin of the coalesced inner ramus and peduncle minutely serrate.

Third pair (Fig. 8) with the peduncle longer than the rami; outer ramus well developed but slightly shorter than the inner; outer margin of the inner ramus and inner margin of the outer ramus minutely serrate.

Telson (Fig. 8) small, triangular in form.

Length from the tip of the antennae to the extremity of the third uropods, 10 mm.; of this length the first antennae measure 4 mm., the body 4 mm., and the uropods 2 mm.

This species is most nearly related to *Scina crassicornis*, Fabricius, and *S. stenopus*, Stebbing. From the former species it is distinguished by the presence of numerous teeth on the front margin of the basal joint of the fifth pair of legs, and the swollen nature of the carpus of the third and fourth pairs of legs. From *S. stenopus* the robust third and fourth pairs of legs with the swollen glandular carpi, as well as differences in the remaining legs and uropods, serve as distinguishing marks.

Scina borealis (G. O. Sars).

S. borealis, G. O. Sars, 1890.

Helga.

77 mi. W.N.W. of Achill Head, Co. Mayo, 382 fath., August, 1901, townets on trawl.—Three.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., August, 1904, large coarse townet at 1,000 fath.—Three.

Same station, medium silk townet at 800 fath.—One.

40 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., August, 1904, large coarse townet at 750 fath.—Three.

Same station, medium silk townet at 530 fath.—Two.

50 mi. W.N.W. of Tearaght, Co. Kerry, 375 fath., November, 1904, large coarse townet at 350 fath.—Three.

40 mi. N. by W. of Eagle Island, Co. Mayo, 730 fath., November, 1904, large coarse townet at 600 fath.—Three.

40 mi. N. by W. of Eagle Island, Co. Mayo, 650+fath., February, 1905, large coarse townet at 630 fath.—Two.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., February, 1905, coarse silk townet at 600 fath.—One.

50 mi. W. ¾ N. of Tearaght, Co. Kerry, 400 fath., May, 1905, townet on trawl.—Two.

W. of Porcupine Bank, Lat. 53° 7′ N., Long. 15° 6′ W., 860 fath., May, 1905, Petersen trawl at 750 fath.—Thirteen.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,200 fath., May, 1905, Petersen trawl at 1,150 fath.—Five.

50 mi. W. ¾ N. of Tearaght, Co. Kerry, 411 fath., November, 1905, Petersen trawl at 400 fath.—Three.

Distribution.—As far as its distribution is at present known, *Scina borealis* is confined to the eastern Atlantic, where it extends from the extreme north of Norway to the Azores and

Canary Islands. Chevreux (1905 (3)) records it as the commonest species of *Scina* in the gatherings of the *Princess Alice* in the neighbourhood of the Canary Islands. It shares this distinction with *S. Rattrayi* in the present collection. Both Vosseler and Chevreux record it from the Mediterranean. The previous nearest record to the British and Irish area is one by Norman from the Faröe Channel (1900).

Scina Rattrayi, Stebbing.

S. Rattrayi, Stebbing, 1895.

S. Bovalli, Vosseler, 1901.

S. Rattrayi, Stebbing, 1904.

Helga.

30 mi. N. by W. of Eagle Island, Co. Mayo, 588 fath., May, 1904, medium silk townet at bottom.—One.

Same station, medium silk townet at 250 fath.—Two.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+ fath., August, 1904, large coarse townet at 1,000 fath.—Six.

Same station, medium silk townet at 800 fath.—Four.

Same station, medium silk townet at 275 fath.—Two.

40 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+ fath., August, 1904, large coarse townet at 730 fath.—Six.

Same station, medium silk townet at 530 fath.—One.

Same station, medium silk townet at 330 fath.—Four.

50 mi. W.N.W. of Tearaght, Co. Kerry, 375 fath., November, 1904, large coarse townet at 350 fath.—Thirty.

40 mi. N. by W. of Eagle Island, Co. Mayo, 670 fath., November, 1904, large coarse townet at 600 fath.—Thirty-two.

40 mi. N. by W. of Eagle Island, Co. Mayo, 650+ fath., February, 1905, large coarse townet at 630 fath.—Twenty-six.

Same station, coarse silk townet at 450 fath.—Fourteen.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+ fath., February, 1905, large coarse townet at 700 fath.—Fourteen.

Same station, coarse silk townet at 600 fath.—Two.

Same station, coarse silk townet at 500 fath.—Thirteen.

Same station, coarse silk townet at 300 fath.—Seven.

W. of Porcupine Bank, Lat. 53° 1′ N., Long. 14° 34′ W., 293 fath., May, 1905, townet on trawl.—Three.

W. of Porcupine Bank, Lat. 53° 7′ N., Long. 15° 6′ W., 860 fath., May, 1905, Petersen trawl at 750 fath.—Twenty-one.

30 mi. N. by W. of Eagle Island, Co. Mayo, 730 fath., May, 1905, coarse silk townet at 200 fath.—One.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,200 fath., May, 1905, Petersen trawl at 1,150 fath.—Six.

Same station, coarse silk townet at 400 fath.—Two.

88 mi. W.S.W. of Fastnet, Co. Cork, 470 fath., November, 1905, Petersen trawl at 350 fath.—Four.

50 mi. W. ¾ N. of Tearaght, Co. Kerry, 411 fath., November, 1905, Petersen trawl at 400 fath.—Seven.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., November, 1905, large coarse townet at 700 fath.—Three.

For the full synonomy of this species Stebbing (1904) should be consulted. All my specimens differ from Stebbing's description (1895) and agree with that of *S. Bovalli* of Vosseler (1901) in having the front margin of the basal joint of the sixth pair of legs produced into an acute short spine. In response to my enquiries Mr. A. O. Walker and M. E. Chevreux have very kindly informed me that in specimens which they have recorded under the name *S. Rattrayi* the dentiform projection was also present but had escaped notice. *S. Rattrayi* therefore shares this character with *S. borealis*.

The figures given by Stebbing (1895), Chevreux (1900), and Vosseler (1901) of the sixth pair of legs are not in harmony with regard to the length of the sixth joint. Stebbing figures it as shorter than the fourth, Chevreux as equal, and Vosseler as longer, while Vosseler's description gives it as equal. Stebbing however (1904) notes in one specimen that the sixth joint is actually longer than the fourth in these limbs, and as I have found all conditions to obtain in the present collection it would seem to be a point in which the species exhibits considerable variation.

Distribution.—*S. Rattrayi* has a distribution generally wide over the North Atlantic and the Mediterranean. Walker's record (1903) of this species during the cruise of the *Oceana* is from just on the boundaries of the British-and-Irish area.

Scina oedicarpus, Stebbing, 1895.

S. oedicarpus, Stebbing, 1904.

S. oedicarpus, Chevreux, 1905 (3).

Helga.

50 mi. W. ¾ N. of Tearaght, Co. Kerry, 411 fath., November, 1905, Petersen trawl at 400 fath.—One.

This species is easily recognised by its transparent integument, through which the stomach appears of a bright red colour.

Distribution.—South Atlantic off the west coast of Africa (Stebbing and Chevreux); Bay of Biscay (Stebbing).

Scina uncipes, Stebbing, 1895.

S. spinosa, Vosseler, 1901

Helga.

W. of Porcupine Bank, Lat. 53° 7′ W., Long. 15° 6′ W., 860 fath., May, 1905, Petersen trawl at 750 fath.—One female.

Distribution.—South Atlantic (Stebbing and Vosseler).

Scina submarginata, sp. n

Pl. II., Figs. 1-8.

Helga.

40 mi. N. by W. of Eagle Island, Co. Mayo, 670 fath., November, 1904, large coarse townet at 600 fath.—One male.

W. of Porcupine Bank, Lat. 53° 7′ N., Long. 15° 6′ W., 860 fath., May, 1905, Petersen trawl at 750 fath.—Two females.

Head equal in length to the first segment of the mesosome, shallowly emarginate in front.

Mesosome with the first two segments shorter than any of the following, third and fourth segments the longest.

Metasome with the first segment the longest; second and third segments subequal in length; fifth and sixth segments coalesced; postero-lateral angles of the first three segments obtusely rounded.

Superior antennae shorter than the mesosome, about one-third of the length of the body from the head to the tip of the third uropods; outer edge as usual bearing many teeth; inner edge with a row of teeth like the outer and a fringe of numerous long filaments; terminal joint small.

Inferior antennae in the female rudimentary, placed far back on the head and not extending forwards beyond the eyes, the terminal joint rather sharply pointed; in the male (still immature) they are as long as the first antennae, the two basal joints of the peduncle small, the third joint as long as the basal two combined, fourth joint longer than the third, the flagellum equal in length to the peduncle and three-jointed, the first joint longer than the terminal two combined.

First gnathopods (Fig. 1) rather stoutly built; basal joint the longest with its inferior distal corner slightly produced; second joint short with a prominent spine on its distal inferior corner; third joint equal to the second, its inferior margin slightly serrate with a prominent spine at about the centre; carpus large and slightly expanded distally, its inferior margin fringed with a few moderately long setae; propodus very slightly shorter than the carpus, rather broad, its outer distal corner with a single prominent seta, its inner margin with the distal part minutely serrate, the proximal part with a few simple setae; dactylus about one-third of the length of the propodus, simple and slender.

Second gnathopods (Fig. 2) about as long as the first and of relatively the same stoutness; carpus considerably expanded distally, its inner margin with very few setae; propodus oval in form, longer than the carpus and slightly narrower than the latter, its outer margin with the distal one-third minutely serrate and the outer distal corner slightly produced, inner margin with the distal part minutely serrate, the proximal part bearing a few simple setae; dactylus about one-third of the length of the propodus, simple and slender.

Third pair of legs (Fig. 3) longer than either pair of gnathopods, stoutly built; carpus slightly swollen and longer than the merus; propodus shorter than the carpus and narrower, its inner margin fringed with a few small setae; dactylus small, simple, slender, and very slightly curved, with a comb of minute setae near the base of its inner margin.

Fourth pair of legs (Fig. 4) about equal in length to the third pair and of exactly similar structure, except that the carpus is somewhat less swollen.

Fifth pair of legs (Fig. 5) with the elongate basal joint less than half the total length of the limb and equal to the merus and carpus combined, its hind margin unarmed, its front margin armed with about nine teeth, and produced into a long stout spinous process considerably longer than the second joint of the limb; second joint very short with its front margin produced into a short blunt tooth; merus shorter than the carpus; propodus shorter than either the carpus or merus and narrower; dactylus very small with a swollen base.

Sixth pair of legs (Fig. 6) somewhat shorter than the fifth pair; basal joint shorter than the merus and carpus combined; carpus longer than either the merus or propodus; latter shorter than the merus; dactylus small with a swollen base. The whole limb is unarmed save for a single seta on the propodus at the base of the dactylus, and the proportions of its joints, with the exception of the basal one, are very similar to those of the fifth pair.

Seventh pair of legs (Fig. 7) about two-thirds of the length of the sixth pair and very similar in form, except that the carpus is relatively shorter.

Uropods (Fig. 8). First pair slightly longer than either of the remaining two, its peduncle longer than the inner branch; outer branch represented by a short stout spine: outer margin of the inner branch serrate.

Second pair (Fig. 8) similar to the first, but the outer margin of the inner branch is smooth and its inner margin very minutely serrate.

Third pair (Fig. 8) with the outer ramus well developed but shorter than the inner; the inner margin of the outer branch and the outer margin of the inner branch serrate.

Telson (Fig. 8) very small and triangular in shape.

Length, excluding antennae, 4·5 mm.

Of all species of *Scina* as yet described this species approaches most nearly to *S. marginata*, Bovallius, with which it agrees in the general build and robustness of its appendages. It differs however from the latter rather markedly in the structure of the first and second gnathopods. In *S. marginata* both gnathopods have the outer distal corner of the propodus produced into well-marked spinous processes. In *S. submarginata* on the other hand the first gnathopod has the propodus unproduced and the second gnathopod only slightly produced at the outer distal corner. Further, in *S. marginata* the peduncles of the uropods are shorter than the rami, while the reverse obtains in *S. submarginata*.

Of the type specimens of the latter one is a male and the other two females. The male, judging from the condition of the second antennae, is still immature. It is somewhat more slender in general build than the female.

Scina pacifica (Bovallius).

Tyro pacifica, Bovallius, 1887 (1) and (2).

Helga.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., August, 1904, medium silk townet at 400 fath.—One female.

40 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., August, 1904, medium silk townet at 730 fath.—One male.

Distribution.—Pacific Ocean off Nicaragua (Bovallius); South Atlantic (Stebbing, Chevreux, and Vosseler); Sargasso Sea (Vosseler).

GENUS **Acanthoscina,** Vosseler.

Acanthoscina acanthodes (Stebbing, 1895).

Scina acanthodes, Stebbing, 1895.

Acanthoscina serrata, Vosseler, 1901.

Acanthoscina acanthodes, Chevreux, 1905 (3).

Helga.

W. of Porcupine Bank, Lat. 53° 7′ N., Long. 15° 6′ W., 860 fath., May, 1905, Petersen trawl at 750 fath.—One female.

Distribution.—South Atlantic (Chevreux, Stebbing, and Vosseler).

A very considerable northern extension of the distribution of this species is indicated by its capture off the west coast of Ireland, the previous records not extending beyond 31° N.

FAMILY *VIBILIDAE.*

GENUS **Vibilia,** M.-Ed.

Vibilia propinqua, Stebbing, 1888.

V. propinqua, Vosseler, 1901.

V. propinqua, Stebbing, 1904.

Helga.

Porcupine Bank, Lat. 53° 15′ N., Long. 13° 17′ W., 116 fath., May, 1905, large coarse townet at surface.—One.

W. of Porcupine Bank, Lat. 53° 7′ N., Long. 15° 6′ W., 860 fath., May, 1905, Petersen trawl at 750 fath.—Seven.

88 mi. W.S.W. of Fastnet, Co. Cork, 470 fath., November, 1905, Petersen trawl at 350 fath.—Forty-one.

50 mi. W. ¾ N. of Tearaght, Co. Kerry, 411 fath., November, 1905, Petersen trawl at 75 fath.—One.

Same station, Petersen trawl at 400 fath.—Two.

10 mi. W. ¾ N. of Tearaght, Co. Kerry, 78 fath., November, 1905, Petersen trawl at 30 fath.—One.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., November, 1905, large coarse townet at 200 fath.—One.

Same station, large coarse townet at 700 fath.—One.

Thor.

Lat. 51° N., Long. 11° 43′ W., 738 fath., June, 1905, Petersen trawl at 656 fath.—Three.

No important difference between the present specimens and Stebbing's original description could be found. The males, like those of *V. Jeangardii*, and probably all other species of the genus, have relatively larger eyes than the females.

Numerous dark chromatophores are distributed all over the body and appendages, while the general ground colour appears to be a light red.

The sudden appearance of this species and *V. armata* in some numbers off the west coast of Ireland during the summer of 1905 may possibly be explained by the considerable influx of South Atlantic water to these shores which took place at that time, though the occurrence of both species in the Bay of Biscay in 1900 would seem to suggest that they were normal inhabitants of the North-east Atlantic.

Distribution.—North Pacific (Stebbing); South Atlantic and Sargasso Sea (Vosseler); Bay of Biscay (Stebbing).

Vibilia armata, Bovallius.

V. armata, Bovallius, 1887 (1) and (2).

Helga.

W. of Porcupine Bank, Lat. 53° 7′ N., Long. 15° 6′ W., 860 fath., May, 1905, Petersen trawl at 750 fath.—One.

88 mi. W.S.W. of Fastnet, Co. Cork, 470 fath., November, 1905, Petersen trawl at 350 fath.—One.

50 mi. W. ¾ N. of Tearaght, Co. Kerry, 411 fath., November, 1905, Petersen trawl at 75 fath.—Four.

Same station, Petersen trawl at 400 fath.—One.

10 mi. W. ¾ N. of Tearaght, Co. Kerry, 78 fath., November, 1905, Petersen trawl at 30 fath.—One.

Thor.

Lat. 51° N., Long. 11° 43′ W., 738 fath., June, 1905, Petersen trawl at 656 fath.—Eight.

Distribution.—Tropical and South Atlantic (Bovallius and Vosseler); Mediterranean (Vosseler); Bay of Biscay (Stebbing). The *Oceana* captured this species just on the borders of the British and Irish area (Walker, 1903).

Vibilia sp.

Helga.

W. of Porcupine Bank, Lat. 53° 1′ N., Long. 14° 34′ W. 293 fath., May, 1905, coarse silk tow-net at 100 fath.—Three

These three specimens measure only 3 mm. in length, and their general characters point to their being still immature. The telson is shaped exactly as in *V. antarctica*, Stebbing, but Vosseler (1901) has already pointed out that this feature varies with age, and cannot be relied on for specific distinction.

Family *LANCEOLIDAE.*

Genus **Lanceola,** Say.

Lanceola sayana, Bovallius.

Helga.

30 mi. N. by W. of Eagle Island, Co. Mayo, 588 fath., May, 1904, medium silk townet at bottom.—Two, young.

Same station, medium silk townet at 192 fath.—Two, young.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., August, 1904, large coarse townet at 1,000 fath.—One female, 20 mm.

W. of Porcupine Bank, Lat. 53° 7′ N., Long. 15° 6′ W., 860 fath., May, 1905, large coarse townet at surface.—One, young.

Same station, Petersen trawl at 750 fath.—Seven large, 8 to 20 mm.; fifty, young.

30 mi. N. by W. of Eagle Island, Co. Mayo, 730 fath., May, 1905, coarse silk townet at 200 fath.—One.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,200 fath., May, 1905, Petersen trawl at 1,150 fath.—One hundred and ten, all young.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., November, 1905, large coarse townet at 700 fath.—One female, 38 mm.

This species has proved to be rather abundant on the west coast of Ireland in the young state, though large specimens are rare.

The fine specimen recorded last in the above list of captures measured 38 mm. in total length, and was a beautiful pale pink colour all over. Most of the other specimens showed traces of pink colouration, while some had darker pigment.

Distribution.—North and South Atlantic (Bovallius); tropical Atlantic (Chevreux); South Atlantic and off Greenland (Vosseler); just south of Rockall (Norman). The last is the only previous British record.

Lanceola aestiva, Stebbing, 1888.

L. aestiva, Stebbing, 1904.

Helga.

77 mi. W.N.W. of Achill Head, Co. Mayo, 382 fath., August, 1901, townet on trawl.—One.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., August, 1904, medium silk townet at 400 fath.—One.

Same station, large coarse townet at 1,000 fath.—Seven.

40 mi. N. by W. of Eagle Island, Co. Mayo, 670 fath., November, 1904, large coarse townet at 600 fath.—Two.

W. of Porcupine Bank, Lat. 53° 7′ N., Long. 15° 6′ W., 860 fath., May, 1905, Petersen trawl at 750 fath.—Two.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,200 fath., May, 1905, Petersen trawl at 1,150 fath.—Two.

I am unable to distinguish these specimens in any particular from those described by Stebbing. All were very transparent, and the stomach appeared light red through the integument.

Distribution.—Tropical Atlantic and Bay of Biscay (Stebbing).

Lanceola serrata, Bovallius.

L. Suhmi, Stebbing, 1888.

Helga.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., August, 1904, large coarse townet at 1,000 fath.—One female, 18 mm.

W. of Porcupine Bank, Lat. 53° 7′ N., Long. 15° 6′ W., 860 fath., May, 1905, Petersen trawl at 750 fath.—Two females, 7 and 9 mm.

Stebbing (1904) has recently withdrawn his species, *L. Suhmi*, as synonymous with *L. serrata*. The present records considerably extend the distribution of this form, the hitherto known captures confining the species to the West Atlantic.

Distribution.—Davis Strait (Bovallius); off Nova Scotia (Stebbing).

FAMILY *CYSTISOMIDAE.*

GENUS **Cystisoma,** Guérin-Méneville.

Cystisoma spinosum (Fabricius).

Cystisoma spinosum, Stebbing, 1888.

Thaumatops spinosa, Bovallius, 1889.

Thaumatops spinosa, Vosseler, 1901.

Thaumatops spinosa, Woltereck, 1903.

Helga.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., November, 1905, large coarse townet at 700 fath.—One female, 50 mm.

I adopt the generic name *Cystisoma* as advocated by Stebbing in preference to the name *Thaumatops*, which is in more general use.

The single magnificent specimen here recorded was perfectly transparent and colourless.

Distribution.—This species has a very wide distribution throughout the seas of the world.

Physosoma larva of **Cystisoma.**

Helga.

50 mi. N. by W. of Eagle Island, 1,200 fath., May, 1905, coarse silk townet at 400 fath.—One, 5 mm.

The *Physosoma* larva is a type of larva recently defined by Woltereck (1904) belonging to the pelagic Amphipoda. It has been found so far in *Cystisoma*, *Lanceola*, and *Mimonectes*. Its characteristic points are the great swollen bladder-like form of the pereion and the union of more or fewer of the segments of the latter. The present specimen of the *Physosoma* larva of *Cystisoma* agrees exactly with Woltereck's type β.

FAMILY *DAIRELLIDAE.*

GENUS **Dairella,** Bovallius.

Dairella latissima, Bovallius.

D. Bovalli, Stebbing, 1888.

D. latissima, Vosseler, 1901.

Helga.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,200 fath., May, 1905, Petersen trawl at 1,150 fath.—One female, 6 mm.

The lateral parts of the pereion and the third to the seventh pairs of legs are flecked with numerous dark-red pigment spots.

Distribution.—Tropical and temperate regions of the North Atlantic (Bovallius and Vosseler); off the Cape Verde Islands (Stebbing); Mediterranean (Vosseler). The present record therefore indicates a considerable northern extension of its geographical range.

FAMILY *PHRONIMIDAE.*

GENUS **Phronima,** Latreille.

Phronima sedentaria (Forskal).

P. sedentaria, Vosseler, 1901.

Helga.

77 mi. W.N.W. of Achill Head, Co. Galway, 382 fath., August, 1901, townet on trawl.—One.

50 mi. W.N.W. of Tearaght, Co. Kerry, 290 fath., May, 1903, medium silk townet at 15 fath.—One.

75 mi. S.W. by W. ½ W. of Fastnet, Co. Cork, 199 fath., May, 1905, townet on trawl.—One.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., August, 1904, large coarse townet at 1,000 fath.—One.

40 mi. N. by W. of Eagle Island, Co. Mayo, 670 fath., November, 1904, large coarse townet at 600 fath.—One.

40 mi. N. by W. of Eagle Island, Co. Mayo, 650+fath., February, 1905, large coarse townet at 630 fath.—One.

50 mi. W. ¾ N. of Tearaght, Co. Kerry, 370 fath., May, 1905, trawl and townet on trawl.—Two.

W. of Porcupine Bank, Lat. 53° 1′ N., Long. 14° 34′ W., 293 fath., May, 1905, townet on trawl.—One.

W. of Porcupine Bank, Lat. 53° 7′ N., Long. 15° 6′ W., 860 fath., May, 1905, Petersen trawl at 750 fath.—Nine.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,200 fath., May, 1905, Petersen trawl at 1,150 fath.—Four.

88 mi. W.S.W. of Fastnet, Co. Cork, 470 fath., November, 1905, Petersen trawl at 350 fath.—One adult and fourteen quite small.

50 mi. W. ¾ N. of Tearaght, Co. Kerry, 411 fath., November, 1905, Petersen trawl at 400 fath.—Five young.

Same station, Petersen trawl at 75 fath.—Seven adult and 400 young.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., November, 1905, large coarse townet at 700 fath.—Three.

Same station, large coarse townet at 200 fath.—Two.

Thor.

Lat. 51° N., Long. 11° 43′ W., 738 fath., June, 1905, Petersen trawl at 656 fath.—Two.

The full synonomy of this species is given by Vosseler (1901).

The specimens here recorded agree well with the observations of Vosseler except that the adult males have the epimeral plates of the first three segments of the metasome ending in acute spines instead of being obtusely pointed, as in Vosseler's figure.

Twelve adult females were taken in their cylindrical jelly houses, which most nearly resembled "*Doliolum sulcatum*," Delle Chiaje, as figured by Bovallius (1889).

It is interesting to note the capture in November in a single haul of no fewer than four hundred young *P. sedentaria*, in addition to seven adult females with four houses. It seems probable that the young were at the time of the capture either actually lodged in the houses of the females or had just been set free, from which it would appear that the late autumn is the hatching season for *P. sedentaria* in the North Atlantic.

Furthermore, it is noteworthy that this particular haul was nearer the surface than any of the others. Chun has put forward the theory that the adult female *Phronima* rises to the surface to liberate her brood, which as time goes on sinks slowly to greater depths, and that the largest specimens are found at the greatest depths. The capture of so many young *Phronima* comparatively near the surface would seem to lend some support to this view. Walker (1903) writing of the *Oceana* Amphipods notes that the young *Phronima* in November, 1898, appeared to be still sinking, a fact which is in agreement with the view expressed above that the late autumn is the probable hatching season for the species.

Distribution.—World-wide in the temperate and tropical seas.

In the British area it has been recorded by Bate and Westwood from the Shetland Islands, and by Walker (1898) from the S.W. of Ireland during the R. I. A. expedition of 1890. Its most northern limit is the Shetland Islands.

Family *HYPERIIDAE*.

Genus **Hyperia,** Latreille.

Hyperia galba (Montagu).

Helga.

90 mi. W. by N. ½ N. of Cleggan Head, Co. Galway, 175 fath., June, 1901, coarse silk townet at surface.—One.

E. of same station, large coarse townet at surface.—Six.

33 mi. N.W. by W. ¼ W. of Cleggan Head, 72 fath., August, 1901, coarse silk townet at surface.—Nine.

50 mi. W.N.W. of Tearaght, Co. Kerry, 290 fath., May, 1903, medium silk townet at 15 fath.—One.

20 mi. N. by W. of Eagle Island, Co. Mayo, 73 fath., February, 1904, medium silk townet at 20 fath.—One.

70 mi. S.W. of Fastnet, Co. Cork, 85 fath., August, 190 , surface.—One.

10 mi. W. ½ S. of Tearaght, Co. Kerry, 76 fath., November, 1904, large coarse townet at surface.—Many.

40 mi. N. by W. of Eagle Island, Co. Mayo, 670 fath., November, 1904, large coarse townet at 600 fath.—Sixty-two.

20 mi. N.W. of Achill Head, Co. Galway, 102 fath., November, 1905, large coarse townet at surface.—Five.

40 mi. N.W. by W. ¾ W. of Cleggan Head, Co. Galway, 74 fath., November, 1904, dredge.—Two.

40 mi. N. by W. of Eagle Island, Co. Mayo, 650+fath., February, 1905, large coarse townet at 630 fath.—Four.

W. of Porcupine Bank, Lat. 53° 7′ N., Long. 15° 6′ W., 860 fath., May, 1905, Petersen trawl at 750 fath.—One.

50 mi. W.N.W. of Cleggan Head, Co. Galway, 120 fath., September, 1905, coarse silk townet at 50 fath.—One, from *Pelagia perla*.

50 mi. W. ¾ N. of Tearaght, Co. Kerry, 411 fath., November, 1905, Petersen trawl at 75 fath.—One.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., November, 1905, large coarse townet at 700 fath.—One.

Same station, large coarse townet at 200 fath.—One.

Thor.

Lat. 51° N., Long. 11° 43′ W., 738 fath., June, 1905, Petersen trawl at 656 fath.—Two.

Lat. 58° 42′ N., Long. 6° 13′ W., 66 fath., September, 1905, Petersen trawl at bottom.—One.

In addition to these offshore records I have note of the occurrence of *H. galba* in company with *Pelagia* in Ballynakill and Bofin Harbours and at Ardfry, not uncommonly with *Aurelia* and once with *Chrysaora*. As is well known, *Pelagia* is an oceanic form, but the other two belong essentially to the coastal region, *Aurelia* being more or less estuarine.

One of my specimens showed a close resemblance to Bovallius' figures of *H. Latreilli*, which he considers to be a species distinct from *H. galba*, a view which Vosseler (1901) adopts without comment. I follow Sars, Norman, and Hansen, however, in regarding *H. Latreilli* as a synonym of *H. galba*. I have examined specimens of the latter taken from under the umbrella of four species of Discomedusae, *Aurelia aurita*, *Chrysaora isoceles*, *Pelagia perla*, and *Rhizostoma pulmo*, while Meinert (1890) records it from a fifth species, *Cyanea capillata*.

Its commonest host on the west coast of Ireland is *Pelagia perla* and on the east coast *Aurelia aurita* and *Rhizostoma pulmo*. As noted above I have only once found it associated with *Chrysaora isosceles*, and I am not aware that it has previously been recorded from this medusa.

Distribution.—Widely distributed in the Arctic Ocean, North Sea, Baltic, and the Eastern Atlantic generally, as far south as the Azores. It has also been recorded from the Pacific in Puget Sound by Calman and quite recently from Ceylon by Walker.

In the British-and-Irish area it is known from practically all round the coast.

Hyperia medusarum (O. F. Muller).[1]

Helga.

30 mi. N. by W. of Eagle Island, Co. Mayo, 340 fath., February, 1904, medium silk townet at 100 fath.—One.

41 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., August, 1904, large coarse townet at surface.—Two.

50 mi. N. by W. of Eagle Island, Co. Mayo. 1,000+fath., August, 1904, large coarse townet at 1,000 fath.—One.

40 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., August, 1904, large coarse townet at 750 fath.—Three.

[1] For the synonymy of this species see Norman, 1900.

40 mi. N. by W. of Eagle Island, Co. Mayo, 670 fath., November, 1904, large coarse townet at 600 fath.—Eleven.

40 mi. N. by W. of Eagle Island, Co. Mayo, 650+fath., February, 1905, large coarse townet at 630 fath.—One.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., February, 1905, large coarse townet at 700 fath.—Two.

Same station, coarse silk townet at 600 fath.—One.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,200 fath., May, 1905, Petersen trawl at 1,150 fath.—Two.

50 mi. W. ¾ N. of Tearaght, Co. Kerry, 411 fath., November, 1905, Petersen trawl at 400 fath.—Five.

Same station, Petersen trawl at 75 fath.—Two.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., November, 1905, large coarse townet at 200 fath.—One.

Distribution.—General over the Arctic Ocean from Norway to Greenland; North Sea as far south as Belgium, and the Skagerack (Reports on the International Investigations).

The above list of records of *H. medusarum* from the west coast of Ireland, compared with that for *H. galba* from the same area, would appear to show that, generally speaking, the former species was a more distinctly oceanic form than *H. galba*. Only twice was *H. medusarum* met with inside the 1,000-fathom line, while on the contrary *H. galba* was only taken three times outside that limit. The occurrence of *H. medusarum* in the North Sea and the Skagerack does not, however, support this view.

The only previous British record is that of Scott (1904).

Hyperia spinigera, Bovallius.

H. spinigera, Vosseler, 1901.

Helga.

W. of Porcupine Bank, Lat. 53° 7′ N., Long. 15° 6′ W., 860 fath., May, 1905, Petersen trawl at 750 fath.—Two.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., November, 1905, large coarse townet at 700 fath.—One.

Norman (1900) has expressed the opinion that this species is synonymous with *H. galba*, but Vosseler (1901) without comment recognises its separate specific identity. I find myself unable to agree with Norman's view. One of the most easily recognised characters by which the two species may be distinguished is the shape of the epimera of the third segment of the metasome. In *H. galba* the postero-lateral angles of these epimera are sharply pointed, while in *H. spinigera* they are rounded. This, taken in conjunction with the differences in the first and second gnathopods already noted by Bovallius, appears sufficient to warrant the establishment of *H. spinigera* as a distinct species.

Distribution.—Spitzbergen (Bovallius); off Labrador (Vosseler); south coast of England (Bovallius).

Genus **Hyperioides**, Chevreux.

Hyperioides longipes, Chevreux.

H. longipes, Chevreux, 1900.

H. longipes, Walker, 1903.

H. longipes, Stebbing, 1904.

Helga.

Present in small numbers in thirty gatherings from practically all parts of the Atlantic off the west coast of Ireland, between soundings of about 200 and about 1,500 fathoms.

Stebbing (1904) has dealt with the synonymy of this species.

It is apparently a very abundant form in the Eastern Atlantic, certainly one of the best represented Hyperids in the present collection.

Distribution.—General over the temperate and tropical North Atlantic (Vosseler and Chevreux); Bay of Biscay (Stebbing); West Coast of Ireland (Walker); Mediterranean (Vosseler). Walker's record is from just on the boundaries of the British-and-Irish marine area.

Genus **Hyperoche**, Bovallius.

Hyperoche tauriformis (Bate and Westwood).

H. Lütkeni, Vosseler, 1901.

Helga.

10 mi. W. ½ S. of Tearaght, Co. Kerry, 76 fath., November, 1904, large coarse townet at surface.—Eleven.

10 mi. N. by W. of Eagle Island, Co. Mayo, 65 fath., May, 1905, coarse silk townet at 60 fath.—One.

1½ mi. N.W. of Black Head, Galway Bay, 17 fath., September, 1905, coarse townet at 8 fath.—One.

Thor.

Lat. 58° 42′ N., Long. 6° 13′ W., 60 fath., September, 1905, Petersen trawl at bottom.—One.

Distribution.—Widely distributed throughout the Arctic Ocean; North Sea, Skagerack, and English Channel (Reports on International Investigations).

In British waters it has been recorded from both east and west coasts of Scotland by Norman and Scott, and from Liverpool Bay by Walker. It would appear to be a wholly littoral and sub-littoral form rarely extending outside the 1,000-fathom line.

GENUS **Parathemisto,** Boeck.

Parathemisto oblivia (Kröyer).

Helga.

Taken, sometimes in immense numbers, in practically every townet gathering.

It is curious to note that the size of the present specimens rarely exceeds 6 mm., thus contrasting rather strongly with the large northern specimens recorded by Sars, which reach the great length of 17 mm.

Distribution.—General throughout the Atlantic and Arctic Oceans and in the North Sea. In the British-and-Irish area it has been met with at all points round the coast. On our west coast it appears, as noted on page 5, to migrate shorewards in late autumn.

GENUS **Euthemisto,** Bovallius.

Euthemisto compressa (Goes).

Helga.

Taken in numerous gatherings off all parts of the west coast at all seasons of the year, between soundings of less than 50 to about 500 fathoms, rarely in deeper water.

Distribution.—General throughout the North Atlantic and Arctic Oceans and the North Sea.

In the British-and-Irish area this species has only been previously met with on the east coast.

Euthemisto bispinosa (Boeck).

Helga.

Taken sparingly in numerous gatherings at all seasons of the year off all parts of the west coast in the deeper part of the area worked by the *Helga.*

Distribution.—The distribution of this species is practically the same as the preceding one.

FAMILY *PHROSINIDAE.*

GENUS **Phrosina,** Risso.

Phrosina semilunata, Risso.

Helga.

50 mi. W. ¾ N. of Tearaght, Co. Kerry, 350 fath., February, 1906, Petersen trawl at surface.—One female.

Distribution.—Mediterranean (Risso, Bovallius, Vosseler); North Atlantic (Stebbing, Chevreux, Bovallius, and Vosseler); Pacific and Indian Oceans (Bovallius). The present record indicates a considerable northern extension of its geographical range.

Genus **Primno,** Guérin.

Primno macropa, Guérin.

Euprimno macropus, Bovallius, 1887.

Primno macropa, Stebbing, 1904.

Helga.

64 mi. N.W. ½ W. of Cleggan Head, Co. Galway, 199 fath., August, 1901, townet on trawl.—One.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., November, 1905, large coarse townet at 700 fath.—One.

The latter of the above two specimens had numerous small red pigment spots on all the appendages of the mesosome.

Distribution.—General over the Atlantic and Pacific Oceans and the Mediterranean. The present records are the most northern ones as yet known for the species.

Family *TYPHIDAE.*

Genus **Platyscelus,** Sp. Bate.

Platyscelus ovoides (Risso).

Helga.

50 mi. W. ¾ N. of Tearaght, Co. Kerry, 350 fath., August, 1905, coarse silk townet at 50 fath.—One male.

Distribution.—Mediterranean (Claus and Vosseler); North Atlantic (Claus); North Pacific (Stebbing).

The present record is the most northerly yet known for the species.

Family *LYCAEIDAE.*

Genus **Tryphaena,** Boeck.

Tryphaena Malmi, Boeck.

Helga.

Taken in the majority of gatherings at all depths off the west coast, but never in large numbers.

Distribution.—Norway (Sars); North Sea off the coast of Scotland (Norman and Scott); Faroe Islands (Bovallius); North Atlantic (Stebbing and Chevreux).

Scott (1904) has already called attention to the paucity of notices of this species, but suggests that it is a commoner form than the records of it show. Its abundance off the west coast of Ireland quite confirms this view.

The only previous British records are those by Norman (1900) and Scott (1904), both on the east coast.

Genus **Brachyscelus,** Sp. Bate.

Brachyscelus crusculum, Sp. Bate.

Thamyris mediterranea, Claus, 1879.

Brachyscelus mediterraneus, Senna, 1903.

Helga.

50 mi. W.N.W. of Tearaght, Co. Kerry, 306 fath., August, 1903, medium silk townet at 30 fath.—One.

50 mi. W.N.W. of Tearaght, Co. Kerry, 396 fath., August, 1904, medium silk townet at 67 fath.—One.

50 mi. W.N.W. of Slyne Head, Co. Galway, 112 fath., August, 1904, townet on trawl.—One.

70 mi. S.W. ½ W. of Fastnet, Co. Cork, 91 fath., November, 1904, medium silk townet at 50 fath.—One.

50 mi. W.N.W. of Tearaght, Co. Kerry, 375 fath., November, 1904, large coarse townet at 350 fath.—One.

50 mi. W.N.W. of Cleggan Head, Co. Galway, 120 fath., September, 1905, coarse silk townet at 50 fath.—One.

88 mi. W.S.W. of Fastnet, Co. Cork, 470 fath., November, 1905, Petersen trawl at 350 fath.—Sixteen.

50 mi. W. ¾ N. of Tearaght, Co. Kerry, 411 fath., November, 1905, Petersen trawl at 75 fath.—Ten.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+ fath., November, 1905, large coarse townet at 700 fath.—Two.

Same station, large coarse townet at 200 fath.—Two.

Thor.

Lat. 51° N., Long. 11° 43′ W., 738 fath., June, 1905, Petersen trawl at 656 fath.—One.

I agree with Norman (1900) in regarding *B. crusculum* and *B. mediterraneus* as one species. Senna (1903) gives very full descriptions of the sexual differences exhibited by *B. mediterraneus*, which are entirely borne out by the present material. In the same paper Senna points out the differences which are supposed to exist between *B. mediterraneus* and *B. crusculum*, and, while noting that these are slight and founded on variable characters, he hesitates to unite the two. Further, he suggests that the *Orio zancleus* of Cocco is synonymous with *Brachyscelus mediterraneus*. If this suggestion is adopted the species will become *Brachyscelus zancleus* by the priority of the latter specific name, the genus *Orio* being synonymous in the type species with *Oxycephalus*, M.-Ed.

Distribution.—Mediterranean (Claus, Senna, Chevreux, and Vosseler); North Atlantic (Stebbing, Chevreux); west coast of Ireland (Walker); Faröe Channel (Norman); Pacific (Stebbing). Walker's record of *B. mediterraneus* (1903) is from just on the boundaries of the British-and-Irish area.

Genus **Thamneus**, Bovallius.

Thamneus sp.

Helga.

30 mi. W.N.W. of Cleggan Head, Co. Galway, 78 fath., November, 1905, medium silk townet at 21 fath.—One.

50 mi. W. ¾ N. of Tearaght, Co. Kerry, 410 fath., May, 1905, townet on trawl.—One.

The specimens apparently belonging to this genus are too immature to refer to any known species. Two species of the genus, *T. rostratus*, Bovallius, and *T. recurvirostris*, Chevreux, are known from the Eastern Atlantic.

Genus **Paralycaea** Claus.

Paralycaea gracilis, Claus.

P. gracilis, Claus, 1879.

P. gracilis, Claus, 1887.

P. gracilis, Stebbing, 1888.

Helga.

10 mi. W. ½ S. of Tearaght, Co. Kerry, 76 fath., November, 1904, large coarse townet at surface.—Five.

48 mi. N.W. by W. ¾ W. of Tearaght, Co. Kerry, 337 fath., November, 1904, townet on trawl.—Four.

30 mi. N. by W. of Eagle Island, Co. Mayo, 208 fath., November, 1904, medium silk townet at surface.—One.

40 mi. N. by W. of Eagle Island, Co. Mayo, 670 fath., November, 1904, large coarse townet at 600 fath.—Two.

20 mi. N.W. of Achill Head, Co. Galway, 102 fath., November, 1905, large coarse townet at surface.—Two.

40 mi. N. by W. of Eagle Island, Co. Mayo, 650+fath., February, 1905, large coarse townet at 630 fath.—One.

Same station, coarse silk townet at 500 fath.—One.

45 mi. N. of Eagle Island, Co. Mayo, February, 1905, large coarse townet at surface.—One.

These specimens agree very well with Claus' descriptions and figures. As additional points, it may be noted that the second antenna of the young male is very like that figured for the young male of *Tryphaena Malmi* by Sars. The females are devoid of mandibular palp as in many other genera and species of this group. From the present material it would appear that the reduced condition of the last pair of legs is characteristic only of completely adult specimens. In young males and females I find these appendages fully developed, with all the joints distinct and a very minute slender curved dactylus. They are proportionally much longer than in the adult, and appear to undergo gradual reduction as the adult stage is reached.

The locality of Claus' type specimen is unknown, and in spite of the fact that the only other known locality for the species is the Pacific, near Australia, I am convinced that my specimens belong to Claus' species. Bovallius records it from the tropical Atlantic, but Stebbing has already shown that Bovallius' description does not agree with that of Claus. In those points in which Bovallius' description differs from Claus', the present specimens are in agreement with the latter.

Distribution.—Pacific near Australia (Stebbing).

Tribe GAMMARIDEA.

Family *LYSIANASSIDAE.*

Genus **Cyphocaris,** Boeck.

Cyphocaris anonyx, Boeck.

C. micronyx, Stebbing, 1888.

C. anonyx, Walker, 1903.

Helga.

77 mi. W.N.W. of Achill Head, Co. Galway, 382 fath., August, 1901, townet on trawl.—One.

30 mi. N. by W. of Eagle Island, Co. Mayo, 588 fath., May, 1904, medium silk townet at 250 fath.—One.

40 mi. N. by W. of Eagle Island, Co. Mayo, 670 fath., November, 1904, large coarse townet at 600 fath.—Three.

40 mi. N. by W. of Eagle Island, Co. Mayo, 650+fath., February, 1905, coarse silk townet at 450 fath.—One.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., February, 1905, large coarse townet at 700 fath.—Two.

Same station, coarse silk townet at 300 fath.—One.

W. of Porcupine Bank, Lat. 53° 7′ N., Long. 15° 6′ W., 860 fath., May, 1905, Petersen trawl at 750 fath.—Seven.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,200 fath., May, 1905, coarse silk townet at 600 fath.—One.

Same station, coarse silk townet at 400 fath.—Three.

88 mi. W.S.W. of Fastnet, Co. Cork, 470 fath., November, 1905, Petersen trawl at 350 fath.—Three.

50 mi. W. ¾ N. of Tearaght, Co. Kerry, 411 fath., November, 1905, Petersen trawl at 400 fath.—One.

Distribution.—Greenland (Boeck); west coast of Ireland (Walker); Bay of Biscay (Stebbing); sub-tropical North Atlantic (Stebbing and Chevreux); South Pacific off Chile (Stebbing).

Genus **Katius**, Chevreux.

Katius obesus, Chevreux.

K. obesus, Chevreux, 1905 (2).

Helga.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,200 fath., May, 1905, Petersen trawl at 1,150 fath.—One.

I have nothing to add to Chevreux's adequate description and figures.

Distribution.—North Atlantic, Lat. 36° 17′ N., Long. 28° 53′ W. (Chevreux).

Genus **Metacyphocaris,** nov.

Mandibles without palp or molar tubercle.

First maxillae with the inner plate bearing two plumose setae; the palp with few teeth on its apical border.

Second maxillae with the outer plate slightly longer than the inner.

Maxillipedes with the inner plate reaching to the level of the apex of the first joint of the palp and having two blunt masticatory processes on the inner anterior corner; outer plate reaching to the level of the apex of the second joint of the palp, and having its inside edge furnished with a row of small rounded tubercles; palp well developed, four jointed.

Accessory appendage of the first antennae very small.

First gnathopods small, generally feebly developed and simple.

Third, fourth, and fifth pairs of legs developed as powerful organs of prehension.

Telson cleft.

This genus, instituted for the reception of the new species described below, is very closely allied to *Paracyphocaris* recently defined by Chevreux (1905 (1)), but is clearly generically distinguished by the absence of a palp to the mandible.

Metacyphocaris Helgae,[1] gen. et. sp. n.

Pl. III., Fig. 1. Pl. IV., Figs. 1-14.

Helga.

40 mi. N. by W. of Eagle Island, Co. Mayo, 1,000+fath., August, 1904, large coarse townet at 750 fath.—Four.

40 mi. N. by W. of Eagle Island, Co. Mayo, 650+fath., February, 1905, large coarse townet at 630 fath.—One.

W. of Porcupine Bank, Lat. 53° 7′ N., Long. 15° 6′ W., 860 fath., May, 1905, Petersen trawl at 750 fath.—Four.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,200 fath., May, 1905, Petersen trawl at 1,150 fath.—Seven.

[1] The Department's Fishery Cruiser *Helga*.

Same station, coarse silk townet at 600 fath.—One.

Body (Pl. III., Fig. 1) generally laterally compressed; integument thin, very slightly calcareous; colour in life a brilliant coral red.

Head (Pl. III., Fig. 1) very short, front recurved over the origin of the first antennae; lateral lobes rounded and not very prominent.

Coxal plates of the first two segments of the mesosome small and partly hidden by those of the third segment, which are large and rather strongly produced in front; those of the fourth segment about as deep as broad with their posterior border slightly excavated; those of the fifth segment with the posterior lobe produced much below the anterior; third segment of the metasome with its lateral angles rounded; first segment of the urosome with the dorsal posterior margin rather acutely produced over the second segment.

Eyes absent.

Superior antennae (Pl. IV., Fig. 1) short, about equal in length to the first two segments of the mesosome; first joint of the peduncle equal in length to the two following joints combined and stouter than either; third joint of the peduncle a little longer than the second; flagellum shorter than the peduncle and composed of four joints, the terminal one having a long seta equal in length to itself at the extremity; accessory appendage very minute and one-jointed.

Inferior antennae (Pl. IV., Fig. 2) much longer than the superior; fifth joint of the peduncle subequal to the fourth and slightly narrower than the latter; flagellum very short, four-jointed, the last joint terminated by a long seta.

Buccal mass not hidden by the coxal plates of the first segments of the mesosome and very prominent.

Mandibles (Pl. IV., Fig. 3) robust, without palp or molar tubercle; at the place where the mandibular palp usually arises is a very small rounded tubercular appendage, which may be the rudiment of a palp.

First maxillae (Pl. IV., Fig. 4) with the inner plate small, having two plumose setae at its apex; outer plate having about ten strong dentate spines at its apex and numerous setae on its internal margin; palp two-jointed, extending slightly beyond the outer plate, its apex bearing two spines and four teeth.

Second maxillae (Pl. IV., Fig. 5) with the inner plate shorter than the outer, both plates armed with numerous plumose setae.

Maxillipedes (Pl. IV., Fig. 6) well developed; inner plate reaching to the level of the extremity of the first joint of the palp, its anterior margin bearing five or six setae and two small masticatory tubercles near its inner edge; outer plate reaching to the extremity of the second joint of the palp, large and expanded with two strong plumose setae on its anterior margin, its inner edge furnished with a row of seven small rounded tubercles; palp four-jointed and well developed, second joint the largest.

First gnathopods (Pl. IV., Fig. 7) small, propodus a little shorter and narrower than the carpus; dactylus well developed with two setae near its tip; the propodus and dactylus combined do not form a subcheliform termination to the limb.

Second gnathopods (Pl. IV., Fig. 8) nearly twice as long as the first; basal joint very long; carpus about twice as long as the propodus, which is oval in shape; dactylus very small but distinct; carpus and propodus fringed with the usual short and numerous setae on both edges, the propodus having in addition numerous long setae at its apex covering the dactylus.

Third pair of legs (Pl. IV., Fig. 9) strongly developed as powerful prehensile limbs; basal joint large and massive; merus longer than the carpus; propodus longer than the carpus, expanded, its posterior margin near the dactylus bearing a row of very stout striated spines; dactylus very long and strongly curved.

Fourth pair of legs (Pl. IV., Fig. 10) not different in any noteworthy point from the third pair.

Fifth pair of legs (Pl. IV., Fig. 11) likewise developed as prehensile limbs; basal joint much expanded with the inferior lobe not much produced, its anterior margin bearing numerous small spines; merus longer than the carpus, armed with numerous spines on both margins; propodus longer than either the carpus or merus, slightly expanded, armed on its anterior margin near the dactylus by numerous short stout blunt striated spines; dactylus longer than half the length of the propodus and strongly curved.

Sixth pair of legs (Pl IV., Fig. 12) longer than the fifth pair but not prehensile in character; basal joint expanded with its inferior lobe slightly produced; merus equal in length to the carpus; propodus slightly longer than either and narrow; dactylus small; whole limb armed with numerous small spines on both margins.

Seventh pair of legs (Pl. IV., Fig. 13) longer than the sixth but very similar in form, distinguished by having the inferior lobe of the basal joint much more pronounced; merus as long as the carpus; propodus slightly longer and narrower than either; dactylus long and slender.

First pair of uropods (Pl. IV., Fig. 14) with the peduncle longer than the rami; latter subequal narrow and very acutely pointed; outer margin of the inner ramus and inner margin of the outer finely serrated; both rami with a small spine near the apex.

Second pair of uropods (Pl. IV., Fig. 14) with the peduncle equal to the rami; latter subequal, of the same form as those of the first pair except that here both margins of the inner ramus are finely serrated.

Third pair of uropods (Pl. IV., Fig. 14) with the peduncle short; outer ramus longer than the rami of the second pair, terminal joint small, narrow, and spiniform, both margins armed with a few spines, and the inner bearing a few long plumose setae near the peduncle; inner ramus very short, about one-fifth of the length of the outer, with a row of plumose setae on the inner margin.

Telson (Pl. IV., Fig. 14) about twice as long as broad at its base, reaching to the level of the extremity of the inner branch of the third uropods, cleft at its extremity, the cleft extending for about a quarter of the length of the telson; each lobe of the cleft bears at its apex a spine and a seta; two other small setae are situated a little way anterior to the lobes of the cleft on the lateral margins of the telson.

Length of the largest specimen from the head to the extremity of the third uropods, 11 mm. It is a curious fact that all the specimens captured appear to be males. At least no incubatory lamellae could be detected in any one of them.

This curious and somewhat aberrant Lysianassid has its nearest ally in *Paracyphocaris praedator*, Chevreux (1905 (1)), to which it bears a strong resemblance. It differs from the latter in the produced dorsal margin of the first segment of the urosome, in the relatively shorter antennae, the much shorter inner ramus to the third uropods, the less cleft telson, and finally in the absolute want of a mandibular palp. This latter peculiarity it shares with the next species, and these two are in this respect unlike any other described Lysianassid. *Metacyphocaris Helgae* belongs essentially to the bathypelagic fauna of the oceans, as shown both by its colour, absence of eyes, and general structure of its limbs as well as by its capture only in townets sunk to great depths. Chevreux (1905 (1)) has already noted that *Paracyphocaris praedator* is probably more or less parasitic on other pelagic animals, to which it clings with its powerful prehensile limbs. *Metacyphocaris Helgae*, with limbs of essentially the same structure, in all probability leads a similar existence.

GENUS **Crybelocephalus**, nov.

Mandibles without molar tubercle or palp.

First maxillae with the inner plate bearing a single plumose seta; palp with few teeth at its apex.

Second maxillae with the inner plate slightly shorter than the outer.

Maxillipedes with the inner plate reduced, only reaching to the level of the origin of the palp and having a single masticatory process on its anterior border; outer plate reaching to the level of the distal end of the second joint of the palp, and having its inner margin furnished with a row of small rounded tubercles; palp well developed, four-jointed.

Accessory appendage to the first antennae wanting.

First gnathopods small, slender, and feebly developed.

Third and fourth pairs of legs developed as powerful prehensile limbs.

Telson very large, not cleft.

This somewhat remarkable new genus does not bear any obviously close relationship to any as yet described member of the family. Its mouth organs agree very well on the whole with those of such genera as *Paracyphocaris*, Chevreux, and the new genus *Metacyphocaris* described above, but from both of these it is at once distinguished by the unusually large entire telson, while it appears to be unique among Lysianassidae in the complete absence of any trace of accessory appendages to the superior antennae.

Crybelocephalus megalurus, gen. et sp. n.

Pl. III., Fig. 2. Pl. V., Figs. 1-14.

Helga.

50 mi. N. by W. of Eagle Island, Co. Mayo, 1,200 fath., May, 1905, Petersen trawl at 1,150 fath.—Two.

Body (Pl. III., Fig. 2) remarkably obese; integument very thin and membranous, only very slightly if at all calcareous.

Head entirely concealed beneath the first segment of the mesosome, so short as to appear like a membranous plate, without prominent lateral lobes, evenly rounded in front.

First segment of the mesosome (Pl. III., Fig. 2) projecting in front over the concealed head as a pseudo-rostrum which in dorsal view is broadly rounded in outline and in lateral view somewhat pointed and very slightly curved.

Coxal plates of the first two segments of the mesosome small and partly covered by those of the third segment; the latter large and somewhat strongly produced anteriorly; those of the fourth segment deeper than the body, a little wider than deep, with their posterior border excavated; those of the fifth segment with the posterior lobe produced much below the anterior; third segment of the metasome with the postero-lateral angles rounded; the urosome about half the length of the metasome.

Eyes absent.

Superior antennae (Pl. V., Fig. 1) very short, about as long as the first segment of the mesosome; first joint of the peduncle slightly swollen, longer and wider than the second joint, with its hind margin produced so as to partly overlap the second joint; latter wider than the third joint and nearly double its length, its hind margin somewhat acutely produced; flagellum shorter than the peduncle, composed of four joints subequal in length but successively decreasing in breadth, last joint tipped by a single seta; accessory appendage apparently wanting.

Inferior antennae (Pl. V., Fig. 2) very little longer than the superior; two basal joints of the peduncle small, third, fourth, and fifth joints successively increasing in length; flagellum shorter than the combined length of the last two joints of the peduncle, four-jointed, the first joint the longest, the terminal joint very small and narrow.

Buccal mass almost completely hidden by the coxal plates of the third segment of the mesosome; lying completely apposed to the ventral surface of the body.

Mandibles (Pl. V., Fig. 3) robust, without molar tubercle or palp; a similar small rounded tubercular appendage to that already noted for *Metacyphocaris Helgae* (see p. 30) is also present here (Pl. V., Fig. 3).

First maxillae (Pl. V., Fig. 4) with the inner plate small and having a single plumose seta at its apex; outer plate having about six to eight strong dentate spines at its apex and numerous fine setae on its inner margin; palp well developed, two-jointed, extending beyond the outer plate, the apex of the second joint of the palp furnished with six short teeth and two setae.

Second maxillae (Pl. V., Fig. 5) with the inner plate shorter than the outer; both plates armed with few plumose setae.

Maxillipedes (Pl. V., Fig. 6) well developed; inner plate small, somewhat reduced, reaching only to the level of the origin of the palp, its anterior edge furnished with a few setae, a single masticatory process present on the anterior inner corner; outer plate reaching to the level of the apex of the second joint of the palp, somewhat expanded, its anterior and outside margin furnished with a few long plumose setae, its inner edge bearing a row of eight small rounded tubercles; palp well developed, four-jointed, the second joint the longest.

First gnathopods (Pl. V., Fig. 7) small, slender and feebly developed, not subcheliform; basal joint about as long as the remainder of the limb; merus short; carpus equal to the propodus; dactylus distinct and slightly curved.

Second gnathopods (Pl. V., Fig. 8) long and slender, about twice as long as the first pair; basal joint very long; carpus not twice the length of the propodus; dactylus small but distinct, hidden among the long setae at the extremity of the propodus; carpus and propodus with the usual fringe of numerous short fine setae on both margins, a similar fringe on the lower margin only of the merus.

Third and fourth pairs of legs (Pl. V., Figs. 9, 10) of similar structure, powerfully developed as prehensile limbs; basal joint as long as the combined length of the following three joints and rather stout; merus larger than the carpus and expanded somewhat distally; carpus small; propodus longer than the combined length of the carpus and merus, and having at the distal end of its lower margin near the nail four strong blunt striated spines; dactylus stout, curved, with its inner margin striated.

Fifth pair of legs (Pl. V., Fig. 11) longer than the third and fourth pairs and less powerfully developed; basal joint long and stout; merus a little longer and stouter than the carpus; propodus longer than either the merus or carpus and narrower, with a single rather strong spine on its inner distal corner at the base of the dactylus; latter rather more than one half the length of the propodus.

Sixth pair of legs (Pl. V., Fig. 12) very little longer than the fifth pair; basal joint expanded, the inferior lobe not much produced; merus slightly shorter but stouter than the carpus; propodus longer and narrower than the carpus; dactylus long and slender, very nearly as long as the propodus; inner margin of the joints of the limbs armed with a few short spiniform setae.

Seventh pair of legs (Pl. V., Fig. 13) equal in length to the sixth and of similar form; inferior lobe of the basal joint much produced and very obtusely rounded; merus and carpus equal in length; propodus longer and narrower than either; dactylus long and slender.

First pair of uropods (Pl. V., Fig. 14) with the peduncle equal in length to the outer ramus; both rami long, narrow, and acutely pointed, the inner longer than the outer with a small spine half way along its inner edge; both margins of the outer ramus minutely serrate; outer margin of the inner ramus minutely serrate, inner smooth.

Second pair of uropods (Pl. V., Fig. 14) with the peduncle slightly shorter than the subequal rami; outer margin of the outer ramus smooth, with two short spines about the centre of its length; inner margin of the outer ramus and both margins of the inner ramus minutely serrate; whole uropod not reaching to the level of the extremity of the inner ramus of the first pair.

Third pair of uropods (Pl. V., Fig. 14) barely reaching the level of the extremity of the rami of the second pair and of similar form; peduncle shorter than the subequal rami; terminal joint one quarter of the total length of the ramus in the inner and one-third of this length in the outer; both margins of the inner ramus minutely serrate; inner margin of the outer ramus smooth; outer margin with three setae on the proximal joint.

Telson (Pl. V., Fig. 14) unusually large and massive, not cleft, almost as wide at its base as the third segment of the urosome; its length very slightly shorter than the width at its base; triangular in shape, with an obtusely rounded apex tipped by two setae.

Length of the largest specimen, 11 mm. from the tip of the pseudo-rostrum to the tip of the telson. Both specimens appear to be males.

This curious Lysianassid presents no obvious affinity to any other species as yet described. The remarkably obese form of the body, the hidden head, the pseudo-rostrum formed by the first segment of the mesosome, and the large, massive, and uncleft telson combine to give it an unique position in the family, though the structure of the mouth parts and the prehensile nature of the third and fourth pairs of legs indicate its possible position near to *Metacyphocaris*. It would appear to be a true bathypelagic form of semi-parasitic habits.

NOTE ADDED IN PRESS.

While this paper was in the press Norman and Scott's work, "Crustacea of Devon and Cornwall" (Wesley and Son, London, 1906) has been received. In it the species *Euthemisto gracilipes*, Norman, previously only provisionally instituted, is now definitely established. The same form occurs rather frequently in the material dealt with above, but I prefer to regard it as a young stage of *Euthemisto compressa*, Goës.

Additional material of some of the above species has been received too late for inclusion in the list of captures, but it is not such as to materially affect the distribution, either vertical or horizontal, shown in the records.

LIST OF AUTHORITIES QUOTED.

Bate and Westwood, 1861–9.—"History of British Sessile-eyed Crustacea." Vol. II.

Bovallius, C., 1885 (1).—"On some forgotten genera among the Amphipodous Crustacea." Bih. Kongl. Svensk. Vet-Akad. Handl., Vol. X., no. 14.

1885 (2.)—"*Mimonectes*, a remarkable genus of Amphipoda Hyperidea." Nov. Act. Reg. Soc. Upsala, Vol. III.

1887 (1).—"Systematical list of Amphipoda Hyperiidea." Bih. Kongl. Svensk. Vet-Akad. Handl., Vol. XI., no. 16.

1887 (2).—"Contributions to a Monograph of the Amphipoda Hyperiidea, Part I." Kongl. Svensk. Vet-Akad. Handl., Vol. XXI., no. 5.

1889.—"Monograph Amphipoda Hyperiidea, Part II." Kongl. Svensk. Vet-Akad. Handl. Vol. XXII., no. 7.

Brook, G., and Calderwood, W. L., 1884.—"Report on the food of the Herring." 4th Report Fishery Board, Scotland.

Chevreux, Ed., 1900.—"Amphipodes de l'Hirondelle." Résult. Camp. Scient. Monaco, Fasc. XVI.

1905 (1).—"*Paracyphocaris praedator.*" Bull. Mus. Océan. Monaco, no. 32.

1905 (2).—"Description d'un amphipode, *Katius obesus.*" Bull. Mus. Ocean. Monaco, no. 35.

1905 (3).—"Liste des Scinidae de la *Princess Alice.*" Bull. Mus. Ocean. Monaco, no. 37.

Claus, C., 1879.—"Die Gattung und Arten der Platysceliden." Arbeit. des Zool. Inst. zu Wien, Vol. 2.

1887.— Die Platysceliden.

Lo Bianco, S., 1901.—"Le pesche pelagische abissali eseguite dal *Maia* nelle vicinanze di Capri." Mitt. Zool. Stat. Neapel, Bd. XV. (Amphipoda by Vosseler).

1903.—"Le pesche pelagische abissali eseguite dal *Puritan.*" Mitt. Zool. Stat. Neapel, Bd. XVII. (Amphipoda by Vosseler).

Meinert, Fr., 1890.—Crustacea Malacostraca in Petersen's "Det Vidensk. Udbytte '*Hauchs*' Togter i de Danske Have indenfor Skagen," 1883-86.

Norman, A. M., 1900.—"British Amphipoda of the Tribe Hyperiidea." Ann. Mag. Nat. Hist., Ser. 7, Vol. V.

Reports on the International Investigations.—Bull. Result. acquis pendant les courses périodiques. 1903-5.

Sars, G. O., 1890.—Crustacea of Norway, Vol. I.

Scott, T., 1902.—"Observations on the Food of Fishes." 20th Report Fishery Board, Scotland.

1904.—"Notes on Crustacea." 22nd Report Fishery Board, Scotland.

Senna, A., 1903.—"Su alcuni Anfipodi iperini del museo zoologico di Napoli." Ann. Mus. Zool. Univ. Napoli, New Series, Vol. I., no. 6.

Stebbing, T. R. R., 1888.—*Challenger* Amphipoda. Reports, Zool. Vol. 29.

1895.—"Descriptions of nine new species of Amphipodous Crustacea from the tropical Atlantic." Trans. Zool. Soc. London, Vol. 13, part 10.

1904.—Biscayan Plankton. Pt. II. Amphipoda and Cladocera. Trans. Linn. Soc. London; Ser. II., Vol. X., part 2.

Vosseler, J., 1901.—Die Amphipoden der Plankton Expedition.

Walker, A. O., 1895.—"Revision of the Amphipoda of the L. M. B. C. district." Trans. Liverpool Biol. Soc., Vol. IX.

1898.—"Malacostraca from the West Coast of Ireland." Trans. Liverpool Biol. Soc., Vol. XII.

1903.—"Report on the Amphipoda of the *Oceana.*" Ann. Mag. Nat. Hist., Ser. 7, Vol. XII.

Woltereck, R., 1903.—"Bemerk. ü. den Amphipoda Hyperiidea der Deutschen Tiefsee Expedition, I., Thaumatopsidae." Zool. Anz. Bd. XXVI., no. 700.

1904.—Same. Pt. II., "Physosoma larva." Zool. Anz Bd. XXVII., no. 18.

1904.—Same. Pt. III., "*Sphaeromimonectes Valdiviae.*" Zool. Anz. Bd. XXVII., no. 20 and 21.

EXPLANATION OF PLATES I-V.

Plate I.

Scina Vossleri, sp. n.

Fig. 1.—Male, first gnathopod.
Fig. 2. ,, second gnathopod.
Fig. 3. ,, third leg.
Fig. 4. ,, fourth leg.
Fig. 5. ,, fifth leg.
Fig. 6. ,, sixth leg.
Fig. 7. ,, seventh leg.
Fig. 8. ,, telson and uropods.

Plate II.

Scina submarginata, sp. n.

Fig. 1.—Female, first gnathopod.
Fig. 2. ,, second gnathopod.
Fig. 3. ,, third leg.
Fig. 4. ,, fourth leg.
Fig. 5. ,, fifth leg.
Fig. 6. ,, sixth leg.
Fig. 7. ,, seventh leg.
Fig. 7A. ,, seventh leg, dactylus enlarged.
Fig. 8. ,, telson and uropods.

Plate III.

Fig. 1. ,, *Metacyphocaris Helgae*, gen. et sp. n., male, lateral view.
Fig. 2. ,, *Crybelocephalus megalurus*, gen. et sp. n., male, lateral view.

Plate IV.

Metacyphocaris Helgae, gen. et sp. n.

Fig. 1.—Male, superior antenna.
Fig. 2. ,, inferior antenna.
Fig. 3. ,, mandible.
Fig. 4. ,, first maxilla.
Fig. 5. ,, second maxilla.
Fig. 6. ,, maxillipede.
Fig. 7. ,, first gnathopod.
Fig. 8. ,, second gnathopod.
Fig. 9. ,, third leg.
Fig. 10. ,, fourth leg.
Fig. 11. ,, fifth leg.
Fig. 12. ,, sixth leg.
Fig. 13. ,, seventh leg.
Fig. 14. ,, urosome, telson and uropods.

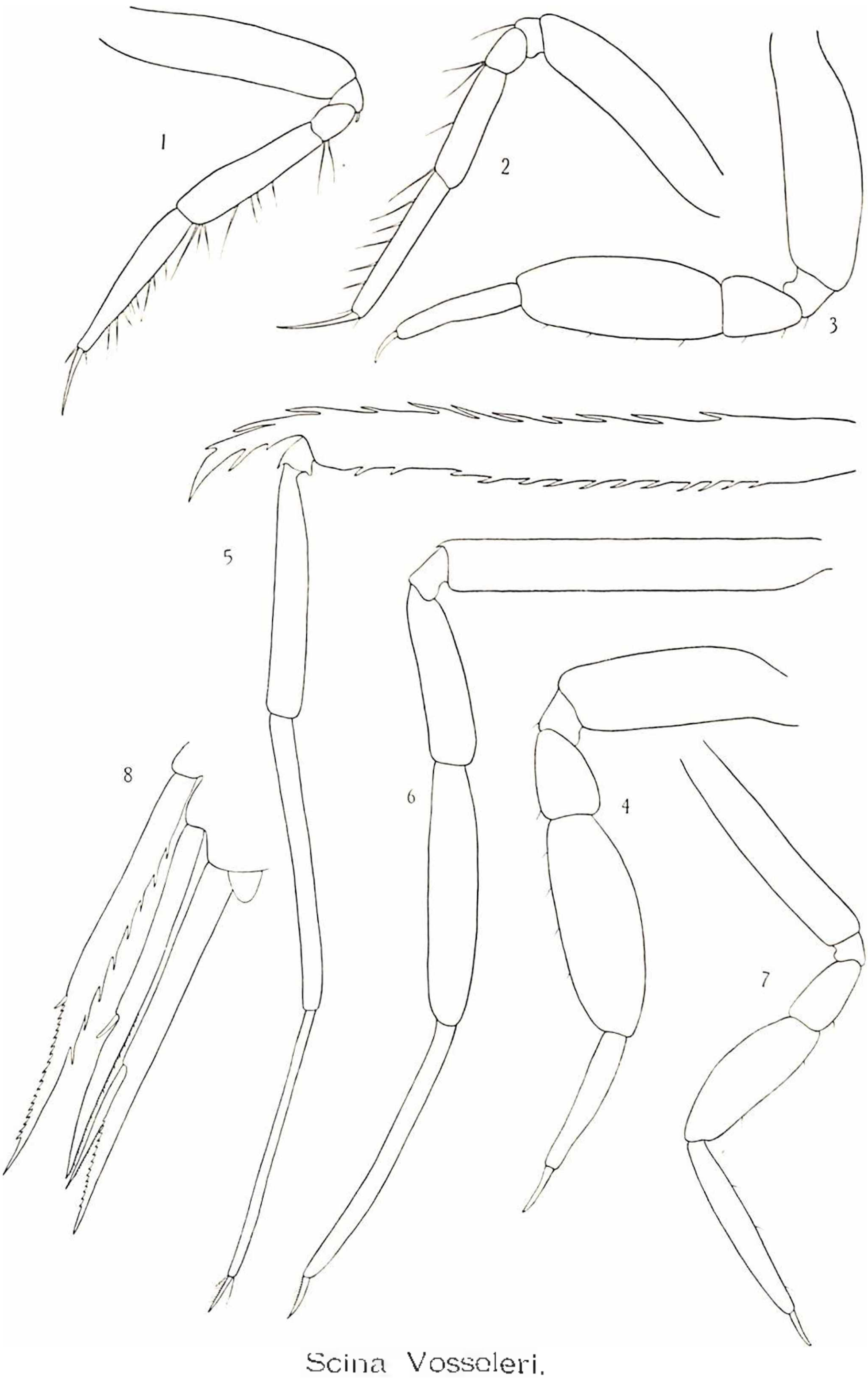
PLATE V.

Crybelocephalus megalurus, gen. et sp. n.

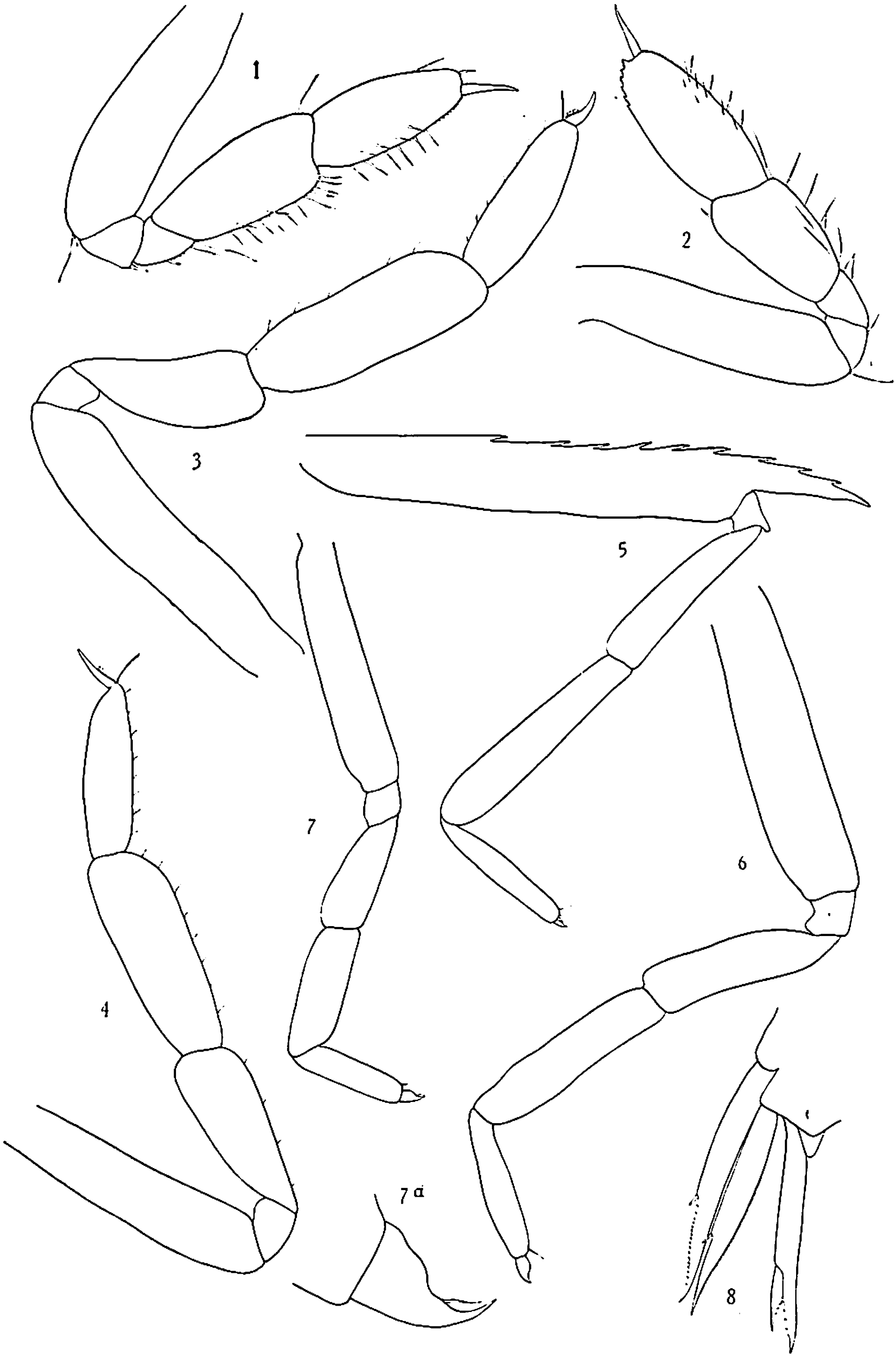
Fig. 1.—Male, superior antenna.
Fig. 2. ,, inferior antenna.
Fig. 3. ,, mandible.
Fig. 4. ,, first maxilla.
Fig. 5. ,, second maxilla.
Fig. 6. ,, maxillipede.
Fig. 7. ,, first gnathopod.
Fig. 8. ,, second gnathopod.
Fig. 9. ,, third leg.
Fig. 10. ,, fourth leg.
Fig. 11. ,, fifth leg.
Fig. 12. ,, sixth leg.
Fig. 13. ,, seventh leg.
Fig. 14. ,, urosome, telson and uropods.

The plates were drawn by W. M. Tattersall and G. M. Woodward.

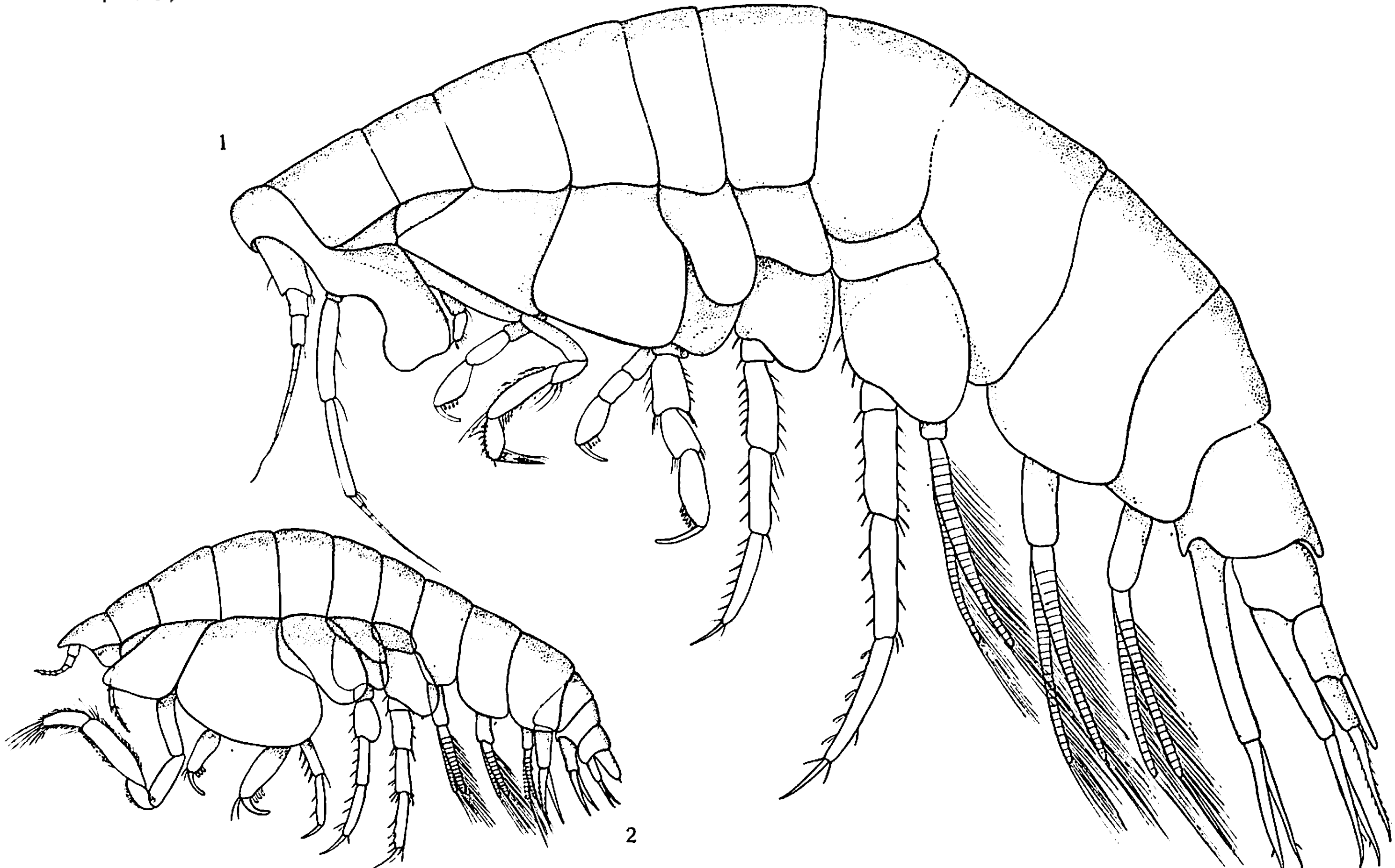
Pl. I.



Scina Vossleri.

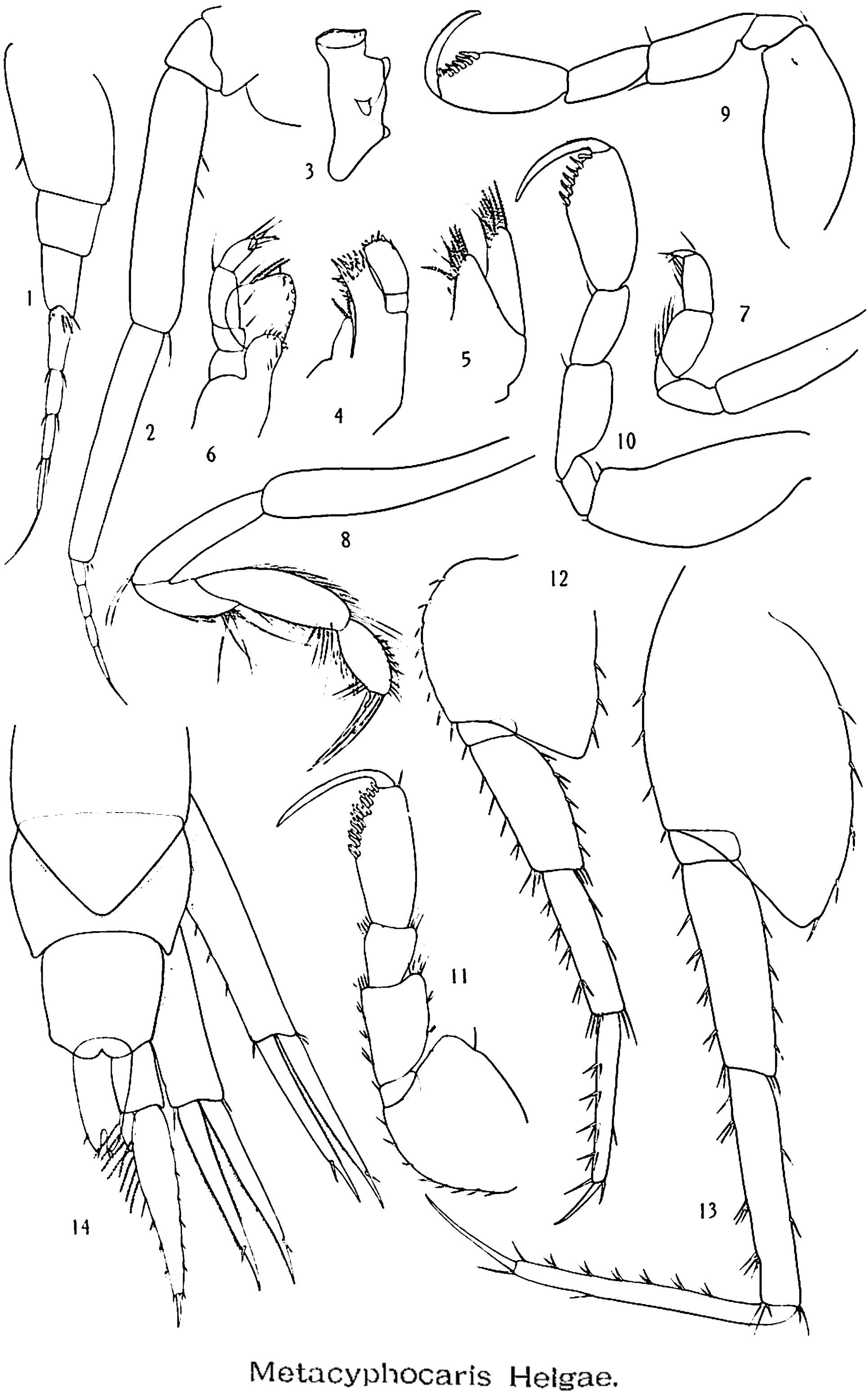


Scina submarginata.

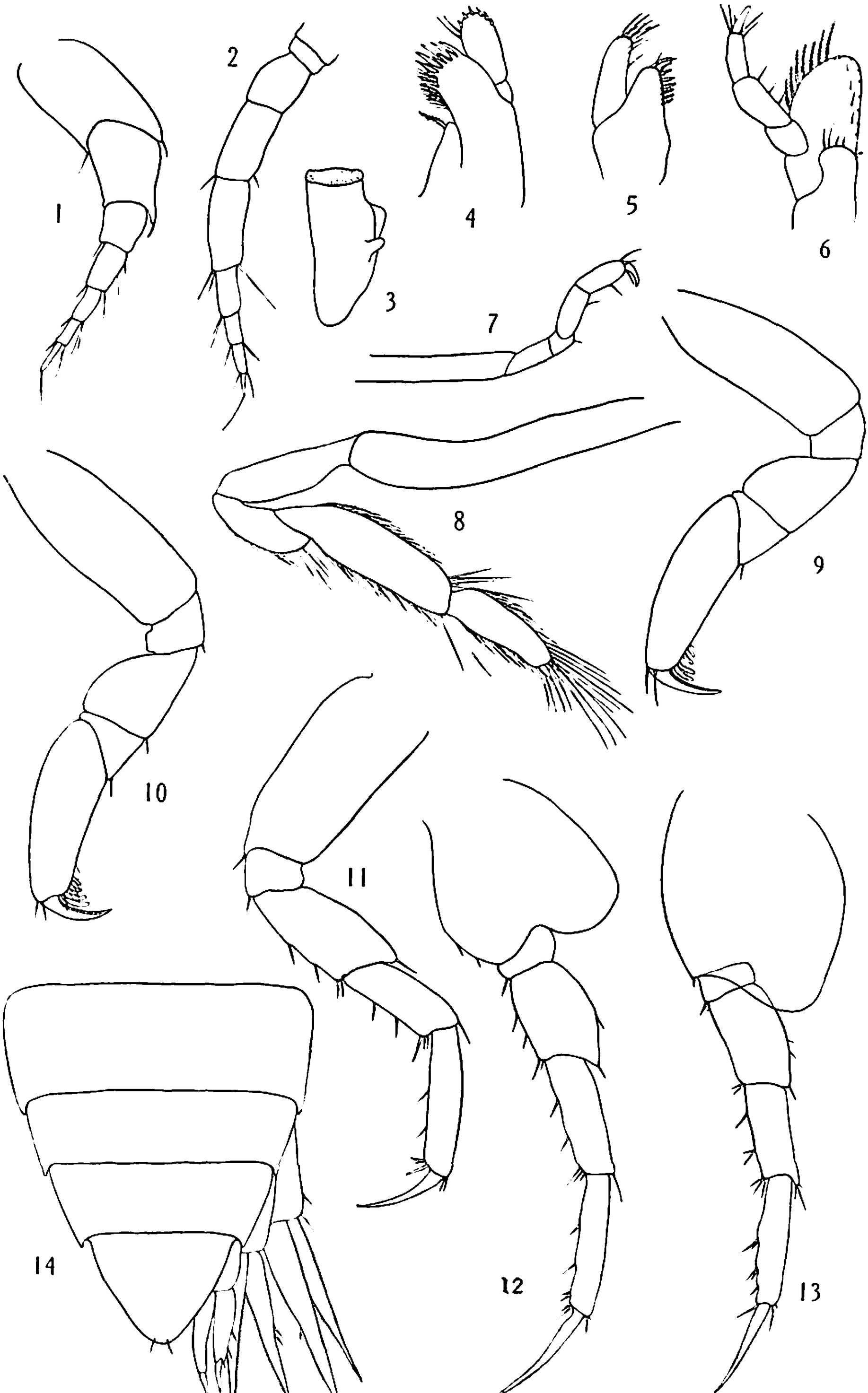


1. Metacyphocaris Helgae.

2. Crybelocephalus megalurus.



Metacyphocaris Helgae.



Crybelocephalus megalurus.

APPENDIX, No. V.

THE MARINE FAUNA OF THE COAST OF IRELAND.

MISCELLANEOUS NOTES.

i.—REMARKABLE COELENTERATA FROM THE WEST COAST OF IRELAND,*

by SYDNEY J. HICKSON, F.R.S.,
Victoria University of Manchester.

I have been allowed to examine a small collection of Alcyonaria and Antipatharia that has been obtained by the fisheries branch of the Department of Agriculture for Ireland from deep water off the west coast of Ireland, and as this reveals some features of special interest I should be glad of an opportunity to write a short preliminary note upon it pending the examination of the species in detail.

The most interesting feature, perhaps, is the Coralliid, *Pleurocorallium Johnsoni*, from 382 fathoms, about sixty miles off Achill Island. The family of precious corals to which this species belongs has hitherto only been obtained in the Mediterranean Sea, the Japanese seas, off Madeira and the Cape Verde Islands, and in the Banda Sea. The specimens obtained by the *Challenger* in the Banda Sea were "dead," but I have recently published a preliminary note on a new species of precious coral from deep water off the coast of Timor, which was captured "alive" by the naturalists of the *Siboga* Expedition.

The distinction between the genus Corallium, to which *C. nobile*, the precious coral of the Mediterranean, *C. japonicum*, and *C. reginae*, the new species from Timor, belong, and the genus Pleurocorallium is not a distinction of very great importance, and, as recently pointed out by Kishinouye, cannot, with convenience, be much longer maintained. If, however, for the present we retain the two generic names, it must be noted that Corallium no longer maintains its monopoly of corals

* Reprinted from "*Nature*," No. 1879, Vol. 73, 1905, p. 5, by kind permission of the Editor.

that are precious, as the species *Pleurocorallium elatius* yields some of the most valuable classes of coral obtained in the Japanese fishery. Both in Japanese waters and off the Cape Verde Islands the valuable and the commercially worthless Coralliidae occur in the same fishing area, and consequently it would not be a matter for surprise if a renewed investigation of the locality from which the Irish Fishery Department obtained its specimen of *Pleurocorallium Johnsoni* yielded some specimens of commercial value.

I should not like to suggest the prospect of a coral fishery off the coast of Ireland, as the sea is too stormy and the water too deep at the station from which the specimen came to render any such fishery commercially successful, but it would be a matter of considerable scientific interest to find that precious corals are growing within a few miles of our British coasts.

The second feature of interest is the occurrence in these waters of at least three species of Antipatharia. This group of Coelenterata is one which I thought was entirely exotic. I can find no mention of any Antipatharians in any of the lists of the British marine fauna that I have examined, but perhaps some of your readers could inform me if I have overlooked any references to them. The species are, I believe, *Cirrhipathes spiralis*, *Antipathella gracilis*, and a species which I think must be new, but is allied to *Stichopathes Lütkeni* in some respects.

Among the other interesting things in the collection are representatives of the alcyonarian genera Ceratoisis, Stachyodes, and Eunephthya, which I believe are new to the British fauna. The two pennatulid genera Kophobelemnon and Umbellula were obtained in deep water off the west coast of Scotland by the *Knight Errant* (Kophobelemnon only) in 1880, and by the *Triton* in 1882. These also have now been found off the west coast of Ireland. Although these genera may now be included in the British fauna as being found within the British area as defined by the British Association Committee of 1888, they really represent the fauna that is common to the "mud line" of Murray of the eastern side of the North Atlantic Ocean.

Thus Pleurocorallium occurs off the Cape Verde Islands, Stachyodes off the Azores, *Ceratoisis Grayii* off the coast of Portugal, *Antipathella gracilis* off the coast of Madeira, Kophobelemnon and Umbellula off the west coast of Scotland. These genera, with many others that live with them, constitute a fauna which is quite distinct from the ordinary shallow-water fauna of the British area.

ii.—**Branchellion torpedinis**, Savigny,

by E. W. L. Holt.

I refer to this species a *Branchellion* taken by Mr. W. I. Beaumont and myself in Blacksod Bay in March, 1899. It was attached to the upper surface of the pelvic fin of a thornback (*Raia clavata*, Linn.) of the small variety which is only known to me as frequenting shallow water quite near the coast. *B. torpedinis* is easily distinguished from other fish-parasites of the leech kind known from our coasts by the semi-lunar plate-like lateral processes of the larger segments of the body. It is well described and fairly well figured by Moquin Tandon in his "Monographie des Hirudinées" (Paris, 1846). A figure, reproduced from Cuvier, in the "Cambridge Natural History" is less characteristic, while the lateral processes of the genus are alluded to in different parts of the text as "arborescent" and "leaf-like." I am not aware of any previous record of *Branchellion* from the Irish coast, but Johnston, on the authority of J. E. Gray, mentions it in his British Museum "Catalogue of British Non-parasitic Worms" (1865) as "English, with soles." It seems to be usually a parasite on torpedoes, of which one, *Torpedo nobiliana*, Bonap., is so far known within the domain of Irish fisheries as to have acquired the colloquial name of "Mum-ray" (Ringsend, *ex relatione piscatoris*, 1891), an obvious corruption of "Numb-ray." Torpedoes are, however, very far from common on our coast, and if a *Branchellion* were to quit a host of this kind for reproductive purposes (cf. *Pontobdella*, Journ. M. B. Assoc., N.S., V., 1897, p. 195) it might be long ere she and her family could take passage on another, and they might perforce put up with a substitute of a different genus. *Pontobdella*, according to Gibbs (tom cit. p. 330), would sooner starve than touch anything except a *Raia*. *Branchellion* seems to be less particular.

iii.—**Lamellaria pellucida,** Verrill, var. **Gouldi,** Verrill,

by G. P. Farran, B.A.

A single specimen, a female, of the above was taken in May, 1904, in a haul of a trawl made 75 mi. S.W. by W. ½ W. of Fastnet Rock, Co. Cork, in 181 fathoms, on a bottom of fine sand.

The specimen was put into a mixture of spirit and formaline, and when examined three months subsequently did not appear to have altered in size or form. It then measured 5·1 cm. by 3·5 cm. by 2·7 cm. in height. The form of the body was ovate, slightly broader in front. The mantle was firm, tough and coarsely and irregularly tuberculate, and was marked by two deep furrows, one starting above the inhalent mantle notch a little to the right of the anterior margin of the mantle and running backwards in a slightly diagonal direction, the other running transversely from the exhalent lateral notch, about the middle of the right margin of the mantle, and crossing the first furrow at about the posterior third of the body. The margins of the mantle were drawn in towards the foot.

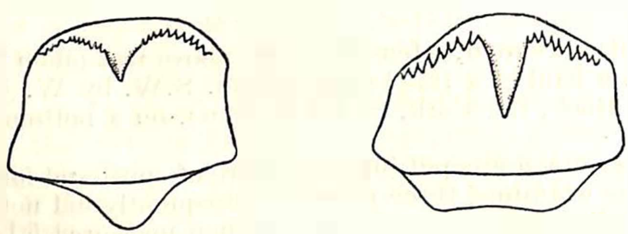
The specimen, when taken, was of a dirty white colour, somewhat translucent, with more opaque spots on the summit of the tubercles. From its rugged firm texture and nodular appearance it might easily have passed without examination for a simple ascidian rather than a mollusc.

The shell, when examined, was in a fragmentary state, being naturally very thin and having been crushed by the quantity of sea-urchins (*Spatangus*) in the net, the spines of which were embedded in the animal's skin. It measured, as far as could be ascertained, 2·6 cm. by 1·35 cm., with a height of 1·3 cm.

The species was first described by Prof. Verrill* from specimens dredged off Martha's Vineyard from 200 to 400 fathoms, and was afterwards dealt with in greater detail by Bergh† from specimens from the same locality. Though it has not been previously taken in British waters, it has already been recorded from the E. shore of the Atlantic by Vayssière,‡ who examined several specimens taken by the "Caudan" near the centre of the Bay of Biscay in 98 to 218 fath.

I have referred my specimen to the variety *Gouldi*, Verrill, as it appears to approach more nearly to it than to the typical form, though the distinctions between the two seem to be rather subtle, and intermediate forms are said by Verrill to have been found. Vayssière also considers the Biscayan specimens to belong to that variety.

It seems evident that the European forms belong to a much larger race than the American, as the size of the latter given by Verrill, who obtained large numbers, is 1·8 cm. by 1·2 cm., while Vayssière's largest reached 4·2 cm. by 3·4 cm. Another difference, at any rate between the specimen here dealt with and those described by Bergh, lies in the shape of the median tooth plate. While both possess the same characteristic general form, the basal process, which in Bergh's specimens extends across almost the complete width of the tooth, is in mine only a small central projection.



1 2

Lamellaria pellucida, Verrill, var. *Gouldi*.

(1.) Median plate of radula of Irish specimen × 75.

(2.) Median plate of American specimen, after Bergh.

The text figures show this difference more clearly than description can do, Fig. 1 being a camera lucida drawing from the Irish example, and Fig. 2 being taken from Bergh's figures of *Marsenia pellucida* var. *Gouldi*.§ There are other apparent

* *Amer. Jour. Science*, XX, 1880, p. 395, *Trans. Connecticut. Acad.* V. 2. 1882, p. 518.

† *Malacol. Untersuch., Die Marseniaden.* in Semper's *Reisen in Archipel der Philippinen.*

‡ *Ann. Univ. Lyon.* XXV., p. 243.

§ Loc. cit. Pl. S. fig. 27.

differences in form, but much weight cannot be attached to them, as the outline of the tooth varies somewhat with the exact angle from which it is viewed. The number of denticles present on the median plates in my specimen was 10 to 14 on either side, while the lateral plates had about 12 on each margin of the hook.

iv.—MACRURA FROM THE WEST COAST OF IRELAND,

by Stanley W. Kemp, B.A.

In addition to the two species of *Acanthephyra* already dealt with in *Fisheries, Ireland, Sci. Invest.*, 1905, *I.*, ten other Macrura hitherto unrecorded from the British-and-Irish area have been taken by the ss. *Helga* off the West Coast of Ireland.

Six of these are nectic forms, and have been caught at various depths from 450 to 1,200 fathoms off the Mayo coast; they are :—

Gennadas parvus, Sp. Bate.
Sergestes arcticus, Kröyer.
Sergia robusta, Smith.
Pasiphaē tarda, Kröyer.
Parapasiphaē sulcatifrons, Smith.
Hymenodora glacialis, Buchholz.

These species have all been recorded from the E. coast of the United States, and are for the most part well-known N. Atlantic forms.

An examination of the type specimen of *Gennadas parvus* in the British Museum revealed the presence of many mistakes in Spence Bate's description, in consequence of which most recent authors have recorded this species under the name of *Amalopenaeus elegans*, Smith. *A. elegans* is undoubtedly synonymous with *G. parvus*, and Dr. Hansen informs me that, when working at the British Museum some years ago, he arrived at a similar conclusion.

Four species have been trawled in 350 to 700 fathoms off the Kerry coast, viz. :—

Plesionika martia, A. M.-Edw.
Pontophilus norvegicus, M. Sars.
Polycheles typhlops, Heller.
Richardina spinicincta, A. M.-E.

P. martia has been several times recorded from the Mediterranean and N. Atlantic, and also from the Gulf of Bengal and Arabian Sea.

P. norvegicus has been taken in the Bay of Biscay, and also near the Norwegian coast; its occurrence off the Irish coast is not therefore surprising.

P. typhlops has apparently not been found hitherto outside the Mediterranean.

R. spinicincta is the first representative of the Stenopidae which has been found within the British-and-Irish area.

APPENDIX, No. VI.

A LIST OF THE MARINE COPEPODA OF IRELAND.

PART II.—PELAGIC SPECIES,

BY

JOSEPH PEARSON, M.Sc.

Until within the last few years the number of pelagic Copepoda recorded from Irish waters was comparatively small. Recently many noteworthy additions have been made to the list of Irish species owing mainly to the investigations of the *Helga* (8)[1] the *Oceana* (18), and to the collections made by Dr. Wolfenden (19) (20). These gatherings were made in deep water at some distance from the West Coast of Ireland.

The *Helga* worked at five stations, viz.:—

1. "Porcupine Bank, III.," lat. 53° 24′ N., long. 13° 34′ W., various depths down to 100 fathoms.
2. "Porcupine Bank, IV.," lat, 53° 23′ N., long. 13° 12′ W., 120 fathoms.
3. "Porcupine Bank, V.," lat. 53° 23′ N., long. 12° 43′ W., down to 175 fathoms.
4. "*Helga* CXX.," lat. 53° 58′ N., long. 12° 28′ W., down to 382 fathoms.
5. "*Helga* CXXI.," lat. 53° 52′ N., long. 11° 56′ W., 199 fathoms.

The *Oceana* collections were made at various stations at a considerable distance from the west coast, and I have thought it advisable only to include those species taken at the two most easterly stations, viz.:—

1. Lat. 52°4′·5 N., long. 11° 20′·1 W., down to 50 fathoms.
2. Lat. 52°4′·5 N., long. 12° 27′ W., down to 650 fathoms.

Dr. Wolfenden's cruise extended from Valentia to the Faröe channel, and here I have selected the 17 stations between lat. 51°46′ N., long. 12°15′ W., and lat. 56°37′ N., long. 9°48′ W. I have used the term "deep water off the West Coast of Ireland" to distinguish the collections made by Dr. Wolfenden.

[1] The numbers in brackets refer to the list of references on p. 37.

Fisheries, Ireland, Sci. Invest., 1905, *VI.* [*Published, December,* 1906].

The vertical distribution of Copepoda affords an interesting study, and it is noteworthy to find that species formerly regarded as distinct surface forms have now been obtained from very great depths. The above-mentioned investigations have added considerably to our knowledge in this respect. In the following lists the vertical range of each species is given when known, but it is as well to remember that many of these data are only approximately true. It is quite obvious that in those instances where the ordinary open townet was used for deep sea work, it is impossible to state with any degree of certainty the depth at which a given species was obtained.

A few alterations in nomenclature have been made with regard to the records of Farran and Wolfenden included in this paper. Farran's report (8) in 1905 was published a short time after the publication of the preliminary notes of the "Monaco" Copepoda by Sars.[1] Some of the species described by these two authors appear to be identical, so that, as Mr. Farran points out in the addendum to his paper, some of his names must give place to those proposed by Sars.

A single specimen of *Chiridius Poppei* was recorded by Mr. Farran from lat. 53°58′ N., long. 12°28′ W., at a depth of 382 fathoms (8). He has now informed me that this record is incorrect, and that the specimen probably represents a new species.

In addition to the species given in these lists the following five species also occurred as pelagic forms, but they have already been included in the first part of this paper[2] as littoral forms :—

(?) *Longipedia coronata*, Claus.
Thorellia brunnea, Boeck.
Lichomolgus liber, Brady and Robertson.
Idya furcata (Baird).
Ectinosoma atlanticum (Brady and Robertson).

I have to thank Mr. Andrew Scott for his kindness in looking over the following list and making many valuable suggestions.

Family *CALANIDAE*.

Genus **Calanus**, Leach, 1816.

Calanus helgoandicus (Claus).

Cetochilus helgolandicus, Claus, 1863.
Calanus finmarchicus, Brady and others (not Gunnerus).
Calanus helgolandicus, Sars, 1901.

According to Sars, the species described as *Calanus finmarchicus* from British and Irish waters really belongs to the above

[1] G. O. Sars. *Bull. Mus. Oceanograph. Monaco* No. 26. 20 March, 1905.

[2] J. Pearson.—Marine Copepoda of Ireland, Part I. Littoral forms and fish parasites. *Fisheries, Ireland, Sci. Invest.*, 1904, *III.* [1905.]

species. He believes *C. finmarchicus* to be a distinct Arctic species, differing from the more southern form in various characters, which though unimportant individually, together form sufficient reason for the recognition of two distinct species. Dr. Wolfenden believes that the characters, claimed by Sars as being of specific value, are inconstant and he will not recognise two distinct species. Mr. Andrew Scott, however, believes Sars to be correct, and I have followed his advice in placing the forms recorded from Ireland in Claus' species.

This form has been recorded from all parts of the Irish coast under the name *C. finmarchicus*. It occurs in the open sea as well as in sheltered bays, and it has a wide vertical distribution ranging from the surface down to nearly 2,000 fathoms. It probably forms an important part of the food of the mackerel and herring around the Irish coasts.

General distribution.—Very common in the North Atlantic but not extending to the cold area. Mediterranean Sea.

Vertical range.—From the surface down to 1,700 fathoms.

Calanus propinquus, Brady.

Calanus propinquus, Brady, 1883.

Valentia (16). Surface.

General distribution.—Atlantic, Pacific, and Indian Oceans.

Calanus tenuicornis, Dana.

Calanus tenuicornis, Dana, 1849.

Helga, Porcupine Bank, lat. 53° 24′ N., long. 13° 34′ W., 50 fathoms (8). Deep water off the west coast, depth about 500 fathoms, lat. 54°-56° N., long. 12° W. (19).

This species appears to occur only very sparingly in the North Atlantic.

General distribution.—Atlantic and Pacific Oceans (between 55° N. and 3° S). Mediterranean.

Vertical range.—Down to 600 fathoms.

Calanus gracilis, Dana.

Calanus gracilis, Dana, 1849.
Hemicalanus longicornis, Dana, 1852.
Cetochilus longiremis, Claus, 1863.
Calanus americanus, Herrick, 1887.

Cruise of the *Oceana,* lat. 52° 4·5′ N., long. 12° 27′ W., 270 fathoms (18).

General distribution.—Atlantic and Pacific Oceans (53° N. to 13° S.) Mediterranean. It has been found down to a depth of 700 fathoms.

Vertical range.—From the surface down to 1,600 fathoms.

GENUS **Megacalanus,** Wolfenden, 1904.

(= *Macrocalanus*, Sars, 1905).

Megacalanus princeps (Brady).

Calanus princeps, Brady, 1883.
Megacalanus princeps, Wolfenden, 1905 (*not* Wolfenden, 1904).
Macrocalanus princeps, Sars, 1905.

Deep water off the South-west of Ireland (20).
General distribution.—North Atlantic.
Vertical range.—Down to 600 fathoms.

Megacalanus longicornis (Sars).

Macrocalanus longicornis, Sars, 1905.
Megacalanus princeps, Wolfenden, 1904.
Megacalanus Bradyi, Wolfenden, 1905.

Deep water off the South-west Coast of Ireland. (19), (20).
General distribution.—North Atlantic.
Vertical range.—Down to 500 fathoms.

The above species in the short space of twelve months from its first description in 1904, became the possessor of a complicated synonymy. Originally described by Wolfenden in 1904 under the name *Megacalanus princeps*, this name had to give place in the following year to *Calanus princeps*, Brady, which Wolfenden removed to the genus *Megacalanus*. Wolfenden, therefore, re-named his species *Megacalanus Bradyi*. The latter specific name, however, will have to be withdrawn in favour of the name given by Sars[1] a few months previously to a form described by him as *Macrocalanus longicornis*, which is evidently the same as Wolfenden's species, so far as one can ascertain from the short preliminary description.

GENUS **Eucalanus,** Dana, 1849.

Eucalanus elongatus, (Dana).

Calanus elongatus, Dana, 1849.
Eucalanus elongatus, Dana, 1852.
Calanus erythrochilus, Leuckart, 1859.
Calanella hyalina, Claus, 1866.

[1] G. O. Sars. *Bull. Mus. Oceanograph. Monaco.* No. 26, 20th March, 1905, p. 7.

Eucalanus elongatus, var. *hyalinus* —— var. *inermis* —— var. *bungii*	Giesbrecht, 1892.

? *Eucalanus spinifer*, Th. Scott, 1893.

Off Cleggan, County Galway (7), bottom townet; *Helga*, Porcupine Bank, 3 stations, viz.:—Lat. 53° 24′ N., long. 13° 34′ W., down to 100 fathoms; lat. 53° 23′ N., long. 13° 12′ W., 120 fathoms; lat. 53° 23′ N., long. 12° 43′ W., down to 175 fathoms (8); *Helga*, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8). Deep water off the West Coast (51° to 56° N. and 12° to 9° W.) occurring to a depth of 800 fathoms (19).

A fairly abundant Atlantic species occurring at all depths, down to about 800 fathoms.

General distribution—Atlantic and Pacific Oceans (between 61° N. and 33° S.) Mediterranean Sea.

Vertical range.—From the surface down to 2,000 fathoms.

Eucalanus attenuatus (Dana).

Calanus attenuatus, Dana, 1849.
Eucalanus attenuatus, Dana, 1852.
Calanus miriabilis, Lubbock, 1856.
Calanella mediterranea, Claus, 1863.
Eucalanus attenuatus, Giesbrecht, 1892.

40 miles off Achill Head, 200 fathoms (12); cruise of *Oceana* (lat. 52° 4·5′ N., long. 12° 27′ W.) 620 fathoms (18).

General distribution.—Pacific, Atlantic, Mediterranean.

Vertical range.—Down to 1,700 fathoms.

Eucalanus crassus, Giesbrecht.

Eucalanus crassus, Giesbrecht, 1888.

Helga, Porcupine Bank, 3 stations, viz.:—Lat. 53° 24′ N., long. 13° 34′ W., 100 fathoms. Lat. 53° 23′ N., long. 13° 12′ W., 120 fathoms. Lat. 53° 23′ N., long. 12° 43′ W., 90 fathoms (8). *Helga*, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8); *Helga*, lat. 53° 52′ N., long. 11° 56′ W., 199 fathoms (8); deep water off the North Coast (56° 11′ N., 9° 50′ W.), depth of 200 fathoms (19).

General distribution.—This species is found in both cold and warm areas. Atlantic and Pacific Oceans; Faröe Channel, Mediterranean, Indian Ocean.

Vertical range.—Down to 50 fathoms.

GENUS **Rhincalanus,** Dana, 1852.

Rhincalanus cornutus (Dana).

Calanus cornutus } Dana, 1849.
Calanus rostrifrons }

Rhincalanus cornutus } Dana, 1852.
Rhincalanus rostrifrons }

Rhincalanus cornutus, Giesbrecht, 1892.

Valentia (16), surface townet.

General distribution.—Atlantic and Pacific Oceans, Indian Ocean,

Vertical range.—Down to 1,710 fathoms.

Rhincalanus nasutus, Giesbrecht.

Rhincalanus nasutus, Giesbrecht, 1892.

40 miles N.N.W. of Achill Head, 220 fathoms (12). *Helga*, Porcupine Bank, 3 stations, viz.:—Lat. 53° 24′ N., long. 13° 34′ W., down to 100 fathoms. Lat. 53° 23′ N., long. 13° 12′ W., 120 fathoms. Lat. 53° 23′ N., long. 12° 43′ W., 90 fathoms (8). *Helga*, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8); *Helga*, lat. 53° 52′ N., long. 11° 56′ W., 199 fathoms (8). Deep water off West and North Coasts (51° to 57° N. and 12° to 9° W.), all depths down to 1,000 fathoms (19).

General distribution.—An abundant species ranging from 58° N. to 52° S. Atlantic, Pacific, and Indian Oceans.

Vertical range.—Down to 1,710 fathoms.

GENUS **Mecynocera,** I. C. Thompson, 1888.

Mecynocera Clausi, I. C. Thompson.

Mecynocera Clausii, I. C. Thompson, 1888.

Leptocalanus filicornis, Giesbrecht, 1888.

Cruise of the *Oceana*, lat. 52° 4·5′ N., long. 12° 27′ W. 650 fathoms (18).

General distribution.—Atlantic and Pacific Oceans, Mediterranean.

Vertical range.—Down to 1,300 fathoms.

GENUS **Paracalanus,** Boeck, 1864.

Paracalanus parvus (Claus).

Calanus parvus, Claus, 1863.

Paracalanus parvus, Boeck, 1864.

Cleggan. Surface and bottom townets (7); in stomachs of herring and mackerel (7). *Helga*, Porcupine Bank, 2 stations, viz.:—Lat. 53° 24′ N., long. 13° 34′ W., 100 fathoms. Lat. 53°

specimens (8); at various stations off the West Coast of Ireland from 51° to 56° N., and 10° to 12° 30′ W., from 300 fathoms to 800 fathoms (19).

General distribution.—Deep water off the West Coast of Ireland.

Vertical range.—Down to 1,000 fathoms.

GENUS **Aetideus**, Brady, 1883.

Aetideus armatus (Boeck).

Pseudocalanus armatus, Boeck, 1872.

Aetideus armatus, Sars, 1901.

Helga, Porcupine Bank, two stations, viz.:—Lat. 53° 24′ N., long. 13° 34′ W., 50 and 100 fathoms; and lat. 53° 23′ N., long. 12° 43′ W., 90 fathoms (8). *Helga*, lat. 53° 58′ N., long. 12° 28′ W., 200 and 382 fathoms (8). *Helga*, lat. 53° 52′ N., long. 11° 56′ W., 199 fathoms (8); cruise of the *Oceana*, lat. 52° 4′ N., long. 12° 27′ W., 650 fathoms (18). Deep water off the west coast of Ireland, lat. 51° to 56° N., and between long. 10° W. and 12° 30′ W., down to 800 fathoms (19).

General distribution.—Atlantic and Pacific Oceans, Indian Ocean.

Vertical range.—All depths down to 1,700 fathoms.

GENUS **Pseudaetideus**, Wolfenden, 1904.

Pseudaetideus armatus (Boeck).

Euchaeta armata, Boeck, 1872.

Chiridius armatus, Sars, 1903.

Pseudaetideus armatus, Wolfenden, 1904.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8); *Helga*, lat. 53° 52′ N., long. 11° 56′ W., 199 fathoms (8). Deep water off the west coast of Ireland, between lat. 51° and 56° N., and between long. 10° to 12° 30′ W., down to 800 fathoms (19); Cleggan, surface (7).

General distribution.—Atlantic Ocean; Arctic Ocean (?).

Vertical range.—Down to 800 fathoms.

GENUS **Bradyidius**, Giesbrecht, 1897.

Bradyidius armatus, Giesbrecht.

Pseudocalanus armatus, Brady (not Boeck), 1874.

Undinopsis Bradyi, Sars (nom. nud.), 1884.

Bradyidius armatus, Giesbrecht, 1897

Bradyanus armatus, Vanhoffen, 1897.

Cleggan, surface (7); *Helga*, Porcupine Bank, two stations viz. :—Lat. 53° 24′ N., long. 13° 34′ W., 91 fathoms, and lat. 53° 23′ N., long. 12° 43′ W., 175 fathoms (8). *Helga*, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8). *Helga*, lat. 53° 52′ N., long. 11° 56′ W., 199 fathoms (8). Deep water off the west coast of Ireland, lat. 51° 56′ N., long. 11° 21′ W., down to 500 fathoms (19); Valentia, surface (16).

General distribution.—British Isles, Greenland, Norway, North Atlantic.

Vertical range.—Down to 1,670 fathoms. Generally lives in the mud at moderate depths.

Genus **Bradyetes**, Farran, 1905.

Bradyetes inermis, Farran.

Bradyetes inermis, ♀, Farran, 1905.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8).

General distribution.—West of Ireland.

Vertical range.—382 fathoms.

Genus **Bryaxis**, Sars, 1902 (Boeck MS.).

Bryaxis brevicornis, Sars.

Bryaxis brevicornis, Sars, 1902 (Boeck MS.)

Helga, lat. 53° 52′ N., long. 11° 56′ W., 199 fathoms (8).

General distribution.—North Atlantic. Generally found in the mud and sand on the bottom.

Vertical range.—Down to 200 fathoms.

Bryaxis minor, Farran.

Bryaxis minor, Farran, 1905.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms, a few female specimens (8).

General distribution.—West of Ireland.

Vertical range.—382 fathoms.

Genus **Gaidius**, Giesbrecht, 1895.

Gaidius pungens, Giesbrecht.

Gaidius pungens, Giesbrecht, 1895.

Lat. 55° N., 12° W., 500 fathoms (19).

General distribution.—Pacific Ocean, North Atlantic.

Vertical range.—Down to 1,300 fathoms.

Gaidius brevispinus, (Sars).

Chiridius brevispinus, Sars, 1900.
Gaidius brevispinus, Sars, 1903.
Gaidius major, Wolfenden, 1903.

Lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms, one specimen (8).

Wolfenden believes his species *Gaidius major* to be identical with the above species; so that the specific name *major* must give way to the older name *brevispinus* given by Sars in 1900.

General distribution.—North Atlantic.

Vertical range.—Down to 400 fathoms.

Gaidius tenuispinus (Sars).

Chiridius tenuispinus, Sars, 1900.
Gaidius boreale, Wolfenden, 1902.
Gaidius tenuispinus, Sars, 1903.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms, four female specimens (8).

This species is very similar to *Gaidius pungens,* Giesbrecht. Here again Dr. Wolfenden's specific name *boreale* is displaced by the older name *tenuispinus* given by Sars two years before.

General distribution.—North Atlantic.

Vertical range.—Down to 400 fathoms.

GENUS **Faroella,** Wolfenden, 1904.

Faroella multiserrata, Wolfenden.

Faroella multiserrata, Wolfenden, 1904.

Deep water off the west coast of Ireland, lat. 51° to 52° N., long. 11° 21′ to 12° 30′ W., in depths of 300 and 400 fathoms (19).

Dr. Wolfenden believes this form to be identical with *Aetideopsis rostrata,* Sars. Mr. Farran informed me that he sent a specimen to Wolfenden, who identified as it *Faroella multiserrata.* The specimen was also sent to G. O. Sars, who said it was not *Aetideopsis rostrata.* Thus it would appear that these two species are distinct.

General distribution.—West Coast of Ireland, Faroe Channel.

Vertical range.—Down to 1,000 fathoms.

GENUS **Gaetanus,** Giesbrecht, 1888.

Gaetanus Caudani, Canu.

Gaetanus Caudani, Canu, 1896.
Gaetanus pileatus, Farran, 1901.

Cleggan, a single specimen taken from the stomach of a mackerel (7); *Helga*, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8). Deep water off the west coast of Ireland, between lat. 51° and 56° N., long. 10° to 12° W., 200 to 600 fathoms (19).

General distribution.—North Atlantic.

Vertical range.—Down to 600 fathoms.

Gaetanus armiger, Giesbrecht.

Gaetanus armiger, Giesbrecht, 1888.

Aetidius armiger, T. Scott, 1893.

Deep water off the west coast of Ireland, between lat. 51° and 56° N., long. 10° and 12° W., 200 to 600 fathoms (19).

General distribution.—Pacific Ocean, Gulf of Guinea, North Atlantic.

Vertical range.—Down to 1,500 fathoms.

Gaetanus major, Wolfenden.

Gaetanus major, Wolfenden, 1903.

Deep water off the west coast of Ireland, between lat. 54° and 56° N., long. 10° to 12° W., 300 fathoms (19).

General distribution.—Faröe Channel. West of Ireland.

Vertical range.—Down to 400 fathoms.

Gaetanus miles, Giesbrecht.

Gaetanus miles, Giesbrecht, 1888.

Cruise of the *Oceana*, lat. 52° 4·5′ N., long. 12° 27′ W., 620 fathoms (18).

General distribution.—Pacific Ocean, Atlantic Ocean.

Vertical range.—Down to 1,600 fathoms.

Gaetanus latifrons, Sars.

Gaetanus latifrons, Sars, 1905.

Gaetanus Holti, Farran, 1905.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms, one specimen (8).

General distribution.—West Coast of Ireland.

Vertical range.—382 fathoms.

Gaetanus minor, Farran.

Gaetanus minor, Farran, 1905.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms, two specimens (8).

General distribution.—West Coast of Ireland.

Vertical range.—382 fathoms.

GENUS **Undeuchaeta,** Giesbrecht, 1888.

Undeuchaeta major, Giesbrecht.

? *Euchaeta australis,*
Euchaeta pulchra (not Lubbock, 1856), } Brady, 1883.
? *Euchaeta australis*, T. Scott, 1893.
Undeuchaeta major, Giesbrecht, 1888.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8). Deep water off west coast of Ireland, lat. 54° 30′ N., long., 12° W., 300 fathoms (19): also between lat. 51°—52° N., long. 11° 20′—12° 30′ W. (19).

General distribution.—Pacific Ocean, Indian Ocean, North Atlantic.

Vertical.—Down to 400 fathoms.

Undeuchaeta minor, Giesbrecht.

Undeuchaeta minor, Giesbrecht, 1888.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8). *Helga,* lat. 53° 52′ N., long. 11° 56′ W., 199 fathoms (8). Deep water off west coast of Ireland, lat. 54° 30′ N., long 12° W., 300 fathoms (19): also between lat. 51° and 52° N., and long 11° 20′ and 12° 30′ W. (19).

General distribution.—Atlantic and Pacific Oceans.

Vertical range.—Down to 800 fathoms.

GENUS **Euchirella,** Giesbrecht, 1888.

Euchirella rostrata (Claus).

Undina rostrata, Claus, 1866.
? *Euchaeta hessei* (part), Brady, 1883.
Euchirella rostrata, Giesbrecht, 1892.

Helga, Porcupine Bank, lat. 53° 23′ N., long. 12° 43′ W., 90 fathoms (8).

General distribution.—Mediterranean, Atlantic Ocean

Vertical range.—Down to 1,400 fathoms.

Euchirella curticauda, Giesbrecht.

Euchirella curticauda, Giesbrecht, 1888.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8).

General distribution.—Pacific Ocean, Atlantic Ocean.

Vertical range.—Down to 1,700 fathoms.

Euchirella curticauda, var. **atlantica,** Wolfenden.

Euchirella curticauda, var. *atlantica,* Wolfenden, 1904.

Deep water off West Coast of Ireland, lat. 52° N., long. 12° W., 300 fathoms (19).

GENUS **Chirundina,** Giesbrecht, 1895.

Chirundina Streetsi, Giesbrecht.

Chirundina Streetsi, Giesbrecht, 1895.
Euchirella carinata, Wolfenden, 1902.

Deep water off the West Coast of Ireland between lat. 55° and 56° N., and long. 10° and 12° 30′ W., 500 fathoms (19); also lat. 54° N., long. 12° W., 400 fathoms (19).

General distribution.—North Atlantic.

Vertical range.—Down to 400 fathoms.

GENUS **Euchaeta,** Philippi, 1843.

Euchaeta marina (Prestandrea).

Cyclops marinus, Prestandrea, 1833.
Euchaeta Prestandreae, Philippi, 1843.
Euchaeta communis, Dana, 1849.
Euchaeta atlantica, } Lubbock, 1856.
Euchaeta Sutherlandii, }
Euchaeta marina, Giesbrecht, 1892.

Valentia, townet (16); cruise of *Oceana,* lat. 52° 4′ N., long. 12° 27′ W., 270-374 fathoms (18).

General distribution.—Atlantic, Pacific, and Indian Oceans.

Vertical range.—Down to 2,000 fathoms.

Euchaeta norvegica, Boeck.

? *Euchaeta Prestandreae,* Boeck, 1864.
Euchaeta norvegica, Boeck, 1872.
Euchaeta carinata, Möbius, 1875.
Euchaeta atlantica, Sars, 1877.
Euchaeta glacialis, Hansen, 1886.

Deep water off West Coast of Ireland between lat. 51° and 56° N., and long 10° and 12° 30′ W., down to 1,000 fathoms (19) *Helga,* lat. 53° 58′ N., long. 12° 28′ W., 200 to 382 fathoms (8) *Helga,* lat. 53° 52′ N., long. 11° 56′ W., 199 fathoms (8).

General distribution.—North Atlantic.

Vertical range.—Down to 1,000 fathoms.

Euchaeta barbata, Brady.

Euchaeta barbata, Brady, 1883.

? *Euchaeta hebes* var. *valida* ♂, T. Scott, 1893.

Deep water off West Coast of Ireland, between lat. 55° and 56° N., and long. 10° to 12° 30′ W., 500 fathoms (19).

General distribution.—Atlantic Ocean.

Vertical range.—Down to 500 fathoms.

Euchaeta acuta, Giesbrecht.

Euchaeta acuta, Giesbrecht, 1892.

Helga, Porcupine Bank, lat. 53° 23′ N., long. 12° 43′ W., 90 fathoms (8). *Helga*, lat. 53° 52′ N., long. 11° 56′ W., 199 fathoms (8).

General distribution.—Atlantic Ocean, Mediterranean.

Vertical range.—Down to 1,275 fathoms.

Euchaeta tonsa, Giesbrecht.

Euchaeta tonsa, Giesbrecht, 1895.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8).

General distribution.—Pacific Ocean, North Atlantic.

Vertical range.—Down to 400 fathoms.

GENUS **Amallophora,** T. Scott, 1893.

Amallophora magna, T. Scott.

Amallophora magna, T. Scott, 1893.

Scolecithrix cristata, Giesbrecht, 1895.

Scaphocalanus acrocephalus, Sars, 1900.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8).

General distribution.—Gulf of Guinea, Pacific Ocean, North Atlantic.

Vertical range.—Down to 400 fathoms.

Amallophora obtusifrons, G. O. Sars.

Amallophora obtusifrons, G.O. Sars, 1905.

Scolecithrix emarginata, Farran, 1905.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8).

I have been informed by Mr. Farran that he sent specimens of his *Scolecithrix emarginata* to G. O. Sars, who pronounced them to be identical with *Amallophora obtusifrons*.

General distribution.—North Atlantic.

Vertical range.—382 fathoms.

Amallophora echinata (Farran).

Scolecithrix echinata, Farran, 1905.

Helga, Porcupine Bank, lat. 53° 24′ N., long. 13° 34′ W. 100 fathoms (8).

If the diagnosis of the genus *Scolecithrix* given by Sars be accepted, the above species cannot be included in that genus. The character of the 1st maxillipedes and of the 5th pair of feet justify the removal of this species to this genus *Amallophora*.

General distribution.—West Coast of Ireland.

Vertical range.—Down to 100 fathoms.

GENUS **Scolecithricella,** Sars, 1902.

Scolecithricella minor (Brady).

Scolecithrix minor, Brady, 1883.

Scolecithricella minor, Sars, 1902.

Helga, Porcupine Bank, lat. 53° 24′ N., long. 13° 34′ W., 100 fathoms (8). *Helga*, Porcupine Bank, lat. 53° 23′ N., long. 12° 43′ W., 175 fathoms (8). *Helga*, lat. 53° 58′ N., long. 12° 28′ W., 200 fathoms (8). Deep water off West Coast of Ireland between latitudes 51° and 56° N., and longitudes 10° to 12° 30′ W., 100 to 500 fathoms (19).

General distribution.—North Atlantic, Gulf of Guinea, Indian Ocean.

Vertical range.—Down to 500 fathoms.

Scolecithricella dentata (Giesbrecht).

Scolecithrix dentata, Giesbrecht, 1892.

Helga, Porcupine Bank, lat. 53° 24′ N., long. 13° 34′ W., 100 fathoms (8). *Helga*, Porcupine Bank, lat. 53° 23′ N., long. 12° 43′ W., 175 fathoms (8). *Helga*, lat. 53° 58′ N., long. 12° 28′ W., 200 fathoms (8).

General distribution.—North Atlantic, Mediterranean.

Vertical range.—Down to 200 fathoms.

Scolecithricella ovata (Farran).

Scolecithrix ovata, Farran, 1905.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8).

General distribution.—West Coast of Ireland.

Vertical range.—382 fathoms.

GENUS **Onchocalanus,** Sars, 1905.

Onchocalanus chelifer (I. C. Thompson).

Scolecithrix chelifer ♂, Thompson, 1903.
? *Onchocalanus trigoniceps* ♀, Sars, 1905.
Scolecithrix chelifer ♀, Farran, 1905.
Xanthocalanus chelifer, Farran, 1905.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8).

General distribution.—North Atlantic.

Vertical range.—Down to 1,200 fathoms.

GENUS **Scottocalanus,** Sars, 1905.

Scottocalanus securifrons (T. Scott).

Scolecithrix securifrons, T. Scott, 1893.
Lophothrix securifrons, Wolfenden, 1904.
Scottocalanus securifrons, Sars, 1905.

Forty miles N.N.W. of Achill Head, 200 fathoms (12).

General distribution.—North Atlantic, G. of Guinea.

Vertical range.—Down to 1,200 fathoms.

GENUS **Lophothrix,** Giesbrecht, 1895.

Lophothrix frontalis, Giesbrecht.

Lophothrix frontalis, Giesbrecht, 1895.
Scolecithrix frontalis, Giesbrecht, 1898.

Deep water off west coast of Ireland, between lat. 51° and 52° N., and long. 11° 20′ and 12° W., 500 fathoms (19).

General distribution.—Pacific Ocean, Atlantic Ocean.

Vertical range.—Down to 1,500 fathoms.

GENUS **Diaixis,** Sars, 1902.

Diaixis pygmaea (T. Scott).

Scolecithrix pygmaea, T. Scott.
Diaixis pygmaea, Sars, 1902.

Cleggan, townet (7).

General distribution.—British Isles.

Diaixis hibernica (A. Scott).

Scolecithrix hibernica, A. Scott, 1896.
Diaixis hibernica, Sars, 1903.

"In deep water off the County Down coast between Dundrum and Dundalk Bays" (14).

General distribution.—British Isles, Norway.

Genus **Xanthocalanus,** Giesbrecht, 1892.

Xanthocalanus cristatus, Wolfenden, 1904.

Xanthocalanus cristatus, Wolfenden, 1904.

Off south-west of Ireland, 300 to 700 fathoms (19).

General distribution.—West of Ireland.

Vertical range.—Down to 700 fathoms.

Xanthocalanus borealis, G. O. Sars.

Xanthocalanus borealis, Sars, 1900.

Helga, Porcupine Bank, lat. 53° 23′ N., long. 13° 12′ W. 120 fathoms (8). *Helga*, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8). *Helga*, lat. 53° 52′ N., long. 11° 56′ W., 199 fathoms (8).

General distribution.—North Atlantic, Arctic Seas.

Vertical range.—Down to 400 fathoms.

Xanthocalanus Greeni, Farran.

Xanthocalanus Greeni, Farran, 1905.

Helga, lat. 53° 58′ N., long. 12° 28 W., 382 fathoms (8).

General distribution.—North Atlantic.

Vertical range.—382 fathoms.

This species may prove to be the same as *Xanthocalanus muticus,* Sars.

Xanthocalanus pinguis, Farran.

Xanthocalanus pinguis, Farran, 1905.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8).

General distribution.—West Coast of Ireland.

Vertical range.—382 fathoms.

Xanthocalanus obtusus, Farran.

Xanthocalanus obtusus, Farran, 1905.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8).

General distribution.—West Coast of Ireland.

Vertical range.—382 fathoms.

Genus **Brachycalanus,** Farran, 1905.

Brachycalanus atlanticus (Wolfenden).

Xanthocalanus atlanticus, Wolfenden, 1904.

Brachycalanus atlanticus, Farran, 1905.

Helga, lat. 53° 52' N., long. 11° 56′ W., 199 fathoms (8); west of Valentia, 375 fathoms (19); deep water off West Coast of Ireland, lat. 55° N., long. 12° W., 400 fathoms (19).

General distribution.—West Coast of Ireland.

Vertical range.—Down to 400 fathoms.

Genus **Oöthrix,** Farran, 1905.

Oöthrix bidentata, Farran.

Oöthrix bidentata, Farran, 1905.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8).

Helga, lat. 53° 52′ N., long. 11° 56′ W., 199 fathoms (8).

General distribution.—West Coast of Ireland.

Vertical range.—Down to 382 fathoms.

Genus **Phaënna,** Claus, 1863.

Phaënna spinifera, Claus.

Phaënna spinifera, Claus, 1863.

Helga, Porcupine Bank, lat. 53° 23′ N., long. 12° 43′ W., 90 fathoms (8). *Helga*, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8). Cruise of *Oceana*, lat. 52° 4′ N., long, 12° 27′ W., 270 fathoms to 620 fathoms (18). Deep water off West Coast of Ireland, lat. 51° N., long. 12° W., 100 fathoms to 400 fathoms (19).

General distribution.—Atlantic and Pacific Oceans; Mediterranean and Indian Ocean.

Vertical range.—Down to 1,600 fathoms.

Family *CENTROPAGIDAE.*

Genus **Centropages,** Kröyer.

Centropages typicus, Kröyer.

Centropages typicus, Kröyer, 1849.
Ichthyophorba denticornis, Claus, 1863.

West Coast of Ireland, open sea, surface townet (4) (6). Galway Bay, surface townet (9); Mouth of the Shannon, surface townet (9); off S.W. of Ireland, surface (2) 11); Cleggan, surface townet (7); Larne, surface townet (13); Valentia, surface townet (16); *Helga*, Porcupine Bank, lat. 53° 24′ N., long. 13° 34′ W., 50 and 100 fathoms (8); *Helga*, Porcupine Bank, lat. 53° 23′ N., long. 12° 43′ W., down to 175 fathoms (8); Cruise of *Oceana*, lat. 52° 4′ N., long. 12° 27′ W., surface townet and down to 620 fathoms (18).

General distribution.—Atlantic Ocean British Seas, Mediterranean.

Vertical range.—Down to 1,700 fathoms.

Centropages hamatus (Lilljeborg).

Ichthyophorba hamata, Lilljeborg, 1853.
Diaptomus bateanus, Lubbock, 1857.
Ichthyophorba angustata, Claus, 1863.
Centropages hamatus, Boeck, 1864.

Bantry Bay, surface (9); Mouth of the Shannon, surface (9). Galway Bay, surface (9); Killybegs, surface (9); Gola Island, Donegal, surface (9); Cleggan, surface (7); off West Coast of Ireland, surface (6); Lough Foyle, surface (10); Larne Lough, surface (13); Valentia, surface (16); Cruise of the *Oceana*, lat. 52° 4′ N., long. 11° 20′ W., surface (18); Cruise of the *Oceana*, lat. 52° 4′ N., long. 12° 27′ W., surface and 270 fathoms (18).

General distribution.—North Atlantic.

Vertical range.—Down to 270 fathoms.

Centropages Chierchiae, Giesbrecht.

Centropages Chierchiae, Giesbrecht, 1889.

Cruise of the *Oceana*, lat. 52° 4′ N., long, 11° 20′ W., surface (18).

General distribution.—Mediterranean, West Coast of Ireland.

GENUS **Temora,** Baird, 1850.

Temora longicornis (Muller).

Cyclops longicornis, Muller, 1785.
Temora finmarchica, Baird, 1850.
Diaptomus longicaudatus, Lubbock, 1857.
Temora longicornis, Boeck, 1864.
Halitemora longicornis, Giesbrecht, 1882.

This ubiquitous species occurs all around the Irish coast, both in tidal pools and in the open sea. It is one of the commonest species present in the plankton during the summer months, but is rarely present in the winter.

General distribution.—North Sea, North Atlantic, Indian Ocean. Generally found near the surface, close to land.

GENUS **Isias,** Boeck, 1864.

Isias clavipes, Boeck.

Isias clavipes, Boeck, 1864.
Isias Bonnieri, Canu, 1888.

Clifden Bay, surface (4) (6); Roundstone Bay, surface (4) (6); Lough Swilly, surface (4); Killybegs (4); Gola Island, Donegal, surface (9); Mouth of the Shannon, surface (9); Kenmare Bay surface (9); Bantry Bay, surface (9); Newcastle, County Down (5); off Whitehead, County Antrim (21); Cleggan, surface (7); Valentia, surface, (16).

General distribution.—Mediterranean, North Atlantic.

Genus **Metridia,** Boeck, 1864.

Metridia longa (Lubbock).

Calanus longus, Lubbock, 1854.

Metridia armata, Boeck, 1864.

Metridia longa, Giesbrecht, 1892.

Deep water off West Coast of Ireland, between lat. 55° and 55° 47′ N., and between long. 10° 12′ and 12° W., 200 and 500 fathoms (19).

Thompson's record of this species (18) probably refers to *Metridia lucens*

General distribution.—North Atlantic.

Vertical range.—Down to 1,770 fathoms.

Metridia lucens, Boeck.

Metridia lucens, Boeck, 1864.

Paracalanus hibernicus, Brady and Robertson, 1873.

Metridia armata, Brady, 1878.

Metridia hibernica, Giesbrecht, 1892.

Mouth of the Shannon, surface (6); Galway Bay, surface (6); near Valentia, surface (6); Dingle Bay, surface (6); Loup Hd., surface (6); Cleggan, surface, also in stomachs of mackerel (7). *Helga*, Porcupine Bank and various stations off the West Coast of Ireland, down to a depth of 382 fathoms (8); deep water off the West Coast of Ireland, various places between lat. 51° and 56° N., and between long. 10° and 12° 30′ W., down to a depth of 1,000 fathoms (19); (?) Cruise of the *Oceana*, lat. 52° 4′ N., long. 12° 27′ W., down to 650 fathoms (18).

General distribution.—North Atlantic, Arctic Ocean, Pacific Ocean.

Vertical range.—Down to 1,000 fathoms.

Metridia venusta, Giesbrecht.

Metridia venusta ♀, Giesbrecht, 1889.

? *Metridia Normani* ♂, Giesbrecht, 1892.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8) deep water off the West Coast of Ireland, various places between lat. 51° and 56° N., and between long. 10° and 12° 30′ W., down to a depth of 800 fathoms (19); off Achill Island, 200 fathoms (12.)

General distribution.—Pacific Ocean ; North Atlantic.

Vertical range.—Down to 1,570 fathoms.

It is almost certain that *Metridia Normani* described by Giesbrecht from a female specimen in 1892 is merely the female of *Metridia venusta*, the male of which only is known under the latter name.

Metridia princeps, Giesbrecht.

Metridia princeps, Giesbrecht, 1889.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8).

General distribution.—Pacific Ocean ; North Atlantic.

Vertical range.—Down to 1,600 fathoms.

Metridia brevicauda, Giesbrecht.

Metridia brevicauda, Giesbrecht, 1889.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8).

General distribution.—Pacific Ocean ; North Atlantic.

Vertical range.—Down to 2,000 fathoms.

GENUS **Pleuromamma**, Giesbrecht. 1898.
(= *Pleuromma*, Claus).

Pleuromamma robusta (Dahl).

Pleuromma robustum, Dahl, 1893.

Pleuromamma robusta, Giesbrecht, 1898.

Helga, Porcupine Bank, lat. 53° 23′ N., long. 13° 12′ W., 120 fathoms (8); *Helga*, Porcupine Bank, lat. 53° 23′ N., long. 12° 43′ W., 90 fathoms (8); *Helga*, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8); *Helga*, lat. 53° 52′ N., long. 11° 56′ W., 199 fathoms (8); deep water off West Coast of Ireland between lat. 51° and 55° N., and long. 10° to 12° W., down to 1,000 fathoms (19); 40 miles N.N.W. of Achill Island, 200 fathoms (12).

General distribution.—North Atlantic.

Vertical range.—Down to 1,200 fathoms.

Pleuromamma abdominalis (Lubbock).

Diaptomus abdominalis, Lubbock, 1856.

Pleuromma abdominale, Claus, 1863.

Pleuromma abdominalis, var. *abyssalis*, Giesbrecht, 1892.

Pleuromamma abdominalis, Giesbrecht, 1898.

Cruise of the *Oceana*, lat. 52° 4′ N., long. 12° 27′ W., down to 650 fathoms (18); deep water off West Coast of Ireland, lat. 54° N., long. 12° W., 200 and 800 fathoms (19).

General distribution.—Mediterranean, Red Sea, Indian Ocean, Atlantic Ocean, Pacific Ocean.

Vertical range.—Down to 2,000 fathoms.

GENUS **Lucicutia,** Giesbrecht, 1898.
(= *Leuckartia*, Claus).

Lucicutia flavicornis (Claus).

Leuckartia flavicornis, Claus, 1863.

Lucicutia flavicornis, Giesbrecht, 1898.

Helga, Porcupine Bank, lat. 53° 24′ N., long. 13° 34′ W., 100 fathoms (8); deep water off the West Coast of Ireland, between lat 54° and 56° N., and long. 10° to 12° 30′ W., down to 600 fathoms (19).

General distribution.—Atlantic and Pacific Oceans, Mediterranean.

Vertical range.—Down to 1,800 fathoms.

Lucicutia grandis (Giesbrecht).

Leuckartia grandis ♂, Giesbrecht, 1895.

Lucicutia grandis ♂, Giesbrecht, 1898.

Lucicutia grandis ♀, Wolfenden, 1904.

Lucicutia maxima, Steuer, 1904.

Deep water off West Coast of Ireland, lat. 51° N., long. 12° W., 700 fathoms (19), (20).

General distribution.—Pacific Ocean; North Atlantic.

Vertical range.—Down to 700 fathoms.

Lucicutia curta, Farran.

Lucicutia curta, Farran, 1905.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8).

General distribution.—West Coast of Ireland.

Vertical range.—382 fathoms.

Lucicutia atlantica, Wolfenden.

Lucicutia atlantica, Wolfenden, 1904.

Helga, Porcupine Bank, lat. 53° 23′ N., long. 13° 12′ W., 120 fathoms (8); deep water off West Coast of Ireland, lat. 55° 47′ N., long. 12° 28′ W. (19).

Wolfenden formed the above species from the examination of a female specimen, and he suggests that on further examination it may prove to be the female of *Lucicutia magna*.

General distribution.—West Coast of Ireland.

GENUS **Heterorhabdus**, Giesbrecht, 1898.
(= *Heterochaeta*, Claus).

Heterorhabdus norvegicus (Boeck).

Heterochaeta norvegica, Boeck, 1872.

Heterorhabdus norvegicus, Giesbrecht, 1898.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8); *Helga*, lat. 53° 52′ N., long. 11° 56′ W., 199 fathoms (8); deep water off West Coast of Ireland, between lat. 51° to 55° N., and long. 10° 12′ to 12° W., down to 1,000 fathoms (19); 40 miles off Achill Island, 220 fathoms (12).

General distribution.—Polar Basin; North Atlantic.

Vertical range.—Down to 1,000 fathoms.

Heterorhabdus grandis, Wolfenden.

Heterorhabdus grandis, Wolfenden, 1904.

Deep water off West Coast of Ireland, between lat. 55° and 56° N., long. 10° to 12° W., 400 and 700 fathoms (19).

General distribution.—West Coast of Ireland.

Vertical range.—Down to 700 fathoms.

Heterorhabdus longicornis (Giesbrecht).

Heterochaeta longicornis, Giesbrecht, 1889.

Heterorhabdus longicornis, Giesbrecht, 1898.

Deep water off West Coast of Ireland, between lat. 51° and 55° N., and long. 11° 31′ to 12° 30′ W., 300 and 400 fathoms (19).

Helga, lat. 53° 58′., long. 12° 28′ W., 382 fathoms (8).

General distribution.—Atlantic and Pacific Oceans.

Vertical range.—Down to 2,000 fathoms.

Heterorhabdus vipera (Giesbrecht).

Heterochaeta vipera, Giesbrecht, 1889.

Heterorhabdus vipera, Giesbrecht, 1898.

Helga, lat. 53° 58′., long. 12° 28′ W., 382 fathoms (8); deep water off West Coast of Ireland, lat. 51° N., long. 12° W., 200 and 300 fathoms (19).

General distribution.—Atlantic and Pacific Oceans.

Vertical range.—Down to 2,000 fathoms.

Heterorhabdus abyssalis (Giesbrecht).

Heterochaeta abyssalis, Giesbrecht, 1889.

Heterorhabdus abyssalis, Giesbrecht, 1898.

Helga, Porcupine Bank, lat. 53° 23′ N., long. 13° 12′ W., 120 fathoms (8); *Helga*, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8); deep water off the West Coast of Ireland, lat. 51° N., long. 12° W., 300 and 800 fathoms (19 .

General distribution.—Atlantic Ocean.

Vertical range.—Down to 2,000 fathoms.

Heterorhabdus spinifrons (Claus).

Heterochaeta spinifrons, Claus, 1863.
Heterorhabdus spinifrons, Giesbrecht, 1898.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8).

General distribution.—Atlantic and Pacific Oceans, Mediterranean.

Vertical range.—Down to 1,770 fathoms.

Heterorhabdus atlanticus, Wolfenden.

Heterorhabdus atlanticus, Wolfenden, 1905.

Deep water off West Coast of Ireland, lat. 55° 47′ N., long. 12° 28′ W., 600 fathoms (19).

General distribution.—West of Ireland.

Vertical range.—600 fathoms.

GENUS **Mesorhabdus**, G. O. Sars, 1905.

Mesorhabdus annectens, G. O. Sars.

Mesorhabdus annectens, G. O. Sars, 1905.
Heterorhabdus brevicaudatus, Wolfenden, 1905.

South West of Valentia, 375 fathoms (20).

General distribution.—North Atlantic.

Vertical range.—Down to 375 fathoms.

GENUS **Haloptilus**, Giesbrecht, 1898.

(= *Hemicalanus*, Claus).

Haloptilus longicornis (Claus).

Hemicalanus longicornis, Claus, 1863.
Haloptilus longicornis, Giesbrecht, 1898.

Helga, Porcupine Bank, lat. 53° 23′ N., long. 13° 12′ W., 175 fathoms (8). Cruise of the *Oceana*, lat. 52° 4′ N., long. 12° 27′ W., 620 fathoms (18). Deep water off the West Coast of Ireland, from lat. 51° to 55° N., and long. 11° 30′ to 12° 30′ W., down to 400 fathoms (19).

General distribution.—Atlantic and Pacific Oceans, Mediterranean.

Vertical range.—Down to 1,770 fathoms.

Haloptilus acutifrons (Giesbrecht).

Hemicalanus acutifrons, Giesbrecht, 1892.
Haloptilus acutifrons, Giesbrecht, 1898.

Helga, Porcupine Bank, lat. 53° 23′ N., long. 13° 12′ W., 120 fathoms (8); deep water off West Coast of Ireland, lat. 51° N., long. 12° W., down to 200 fathoms (19).

General distribution.—North Atlantic, Mediterranean.

Vertical range.—Down to 300 fathoms.

Genus **Augaptilus,** Giesbrecht, 1889.

Augaptilus longicaudatus (Claus).

Hemicalanus longicaudatus, Claus, 1863.
Augaptilus longicaudatus, Giesbrecht, 1892.

Deep water off West Coast of Ireland, from lat. 51° to 54° N., long. 11° 30′ to 12° 30′ W., down to 400 fathoms (19).

General distribution.—Atlantic Ocean, Pacific Ocean, Gulf of Guinea, Mediterranean.

Vertical range.—Down to 1,670 fathoms.

Augaptilus magnus, Wolfenden.

Augaptilus magnus, Wolfenden, 1904.

Deep water off West Coast of Ireland, lat. 51° N., long. 12° W., 500 fathoms (19).

General distribution.—West of Ireland.

Vertical range.—Down to 500 fathoms.

Augaptilus gibbus, Wolfenden.

Augaptilus gibbus, Wolfenden, 1904.

Deep water off West Coast of Ireland, lat. 51° N., long. 12° W., 400 fathoms (19).

General distribution.—West of Ireland.

Vertical range.—400 fathoms.

GENUS **Phyllopus,** Brady, 1883.

Phyllopus bidentatus, Brady.

Phyllopus bidentatus, Brady, 1883.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8); deep water off West Coast of Ireland, from lat. 51° to 54° N. and long. 11° 30′ to 12° 31′ W., down to 800 fathoms (19).

General distribution.—Atlantic and Pacific Oceans.

Vertical range.—Down to 2,650 fathoms.

FAMILY *PSEUDOCYCLOPIDAE.*

GENUS **Pseudocyclops.**

Pseudocyclops obtusatus, Brady and Robertson.

Pseudocyclops obtusatus, B. and R., 873.

Roundstone Bay, surface (4), (5), (6); Donegal, amongst laminaria (4); Bantry Bay, surface (9).

General distribution.—British Seas, Norway.

This species appears to be a shallow water form.

FAMILY *CANDACIIDAE.*

GENUS **Candacia,** Dana, 1846.

Candacia armata, Boeck.

Candace armata, Boeck, 1872.

Candace pectinata, Brady, 1878.

Valentia, surface (16); Cleggan, surface (7).

General distribution.—Mediterranean, Atlantic and Pacific Oceans.

Candacia norvegica, Boeck.

Candace norvegica, Boeck, 1864.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8) Deep water off West Coast of Ireland from lat 51° to 56° N. and long. 10° to 12° 30′ W., down to 500 fathoms (19).

General distribution.—North Atlantic.

Vertical range.—Down to 500 fathoms.

Candacia elongata, Boeck.

Candacia elongata, Boeck, 1864.

Candacia rotunda, Wolfenden, 1904.

? Deep water off the West Coast of Ireland, lat. 54° N., long. 12° W., 300 and 500 fathoms (19).

General distribution.—North Atlantic.

Vertical range.—Down to 500 fathoms.

FAMILY *PONTELLIDAE.*

GENUS **Labidocera,** Lubbock, 1853

Labidocera Kröyeri (Brady).

Pontella Kröyeri, Brady, 1883.
Labidocera Kröyeri, Giesbrecht, 1892.

Valentia, surface (17).

General distribution.—British seas (rare), Philippines, Hong Kong.

Labidocera Wollastoni (Lubbock).

Pontella Wollastoni, Lubbock, 1857.
Pontella helgolandica, Claus, 1863.
Labidocera Wollastoni, Giesbrecht, 1892.

Mouth of the Shannon, surface (9).

General distribution.—Mediterranean, Atlantic Ocean.

GENUS **Anomalocera,** Templeton, 1837.

Anomalocera Pattersoni, Templeton.

Anomalocera Pattersonii, Templeton, 1837.
Irenaeus Pattersonii, Goodsir, 1843.
Pontia Pattersonii, Kröyer, 1849.
Pontella eugeniae, Leuckart, 1859.

This species has been recorded from all parts of the Irish coast.

General distribution.—North Sea, Atlantic, Mediterranean. Pacific (Puget Sound).

Vertical range.—Down to 400 fathoms.

GENUS **Acartia,** Dana, 1846.

Acartia Clausi, Giesbrecht.

? *Calanus euchaeta*, Lubbock, 1857.
Acartia Clausi, Giesbrecht, 1889.
? *Acartia gaboonensis*, T. Scott, 1893.
Dias longiremis, Claus (not Lilljeborg), 1863.

Helga, various stations on the Porcupine Bank and in deep water off the West of Ireland, mainly mid-water (8); Donegal, surface (9); Killybegs, surface (9); Killeany, Galway Bay, surface (9); Mouth of the Shannon (9); Kenmare Bay, surface (9); Bantry

Bay, surface (9); Cleggan, surface (7); Lough Foyle, surface (10); Larne, surface (13); Valentia, surface (16); deep water off West Coast of Ireland, between lat. 51° and 56° N., and long. 10° and 12° 30′ W., surface, and down to 800 fathoms (19).

General distribution.—Mediterranean, Atlantic, Pacific (Puget Sound).

Vertical range.—Down to 1,700 fathoms.

Acartia longiremis (Lilljeborg).

Dias longiremis, Lilljeborg, 1853.

? *Calanus euchaeta*, Lubbock, 1857.

Acartia longiremis, Giesbrecht, 1892.

(?) West of Ireland, "open sea and between tidemarks" (6); (?) S.W. of Ireland, surface (2), (11); (?) Newcastle, Co. Down, (5); (?) Kinsale Harbour, surface (3); Larne, surface (13). Cruise of the *Oceana*, lat. 52° 4′ N., long. 11° 20′ W., and lat. 52° 4′ N.; long. 12° 27′ W., down to 50 fathoms (18).

The species recorded on several occasions by I. C. Thompson, from the West of Ireland as *Acartia longiremis* was probably *A. Clausi.*

General distribution.—North Sea, Baltic Sea, South Greenland, West of Ireland.

Acartia discaudata (Giesbrecht).

Dias discaudata, Giesbrecht, 1881.

Acartia discaudata, Giesbrecht, 1892.

Mouth of the Shannon, surface (9); Bantry Bay, surface (9); Valentia, surface (16); Roundstone Bay, surface (5); Cleggan, surface (7). Cruise of the *Oceana*, lat. 52° 4′ N., long. 12° 27′ W., 374 fathoms (18).

General distribution.—North Sea, Baltic Sea, British Seas.

Vertical range.—Down to 374 fathoms.

FAMILY *MORMONILLIDAE.*

GENUS **Mormonilla,** Giesbrecht, 1891.

Mormonilla atlantica, Wolfenden.

Mormonilla atlantica, Wolfenden, 1905.

Deep water off the West Coast of Ireland, lat. 50° 56′ N., long. 12° 6′ W., 500 fathoms (20).

General distribution.—West of Ireland.

Vertical range.—500 fathoms.

FAMILY *CYCLOPIDAE*.

GENUS **Oithona**, Baird, 1843.

Oithona similis, Claus.

Oithona similis, Claus, 1866.
Oithona spinirostris, Lilljeborg, 1875.
Oithona pygmaea, Lilljeborg, 1875.
Oithona spinifrons, Brady, 1878.
Oithonella helgolandica, Sars, 1886.

This well known oceanic species has been recorded from all parts of the Irish coast. Found in surface gatherings, and also down to a considerable depth; this form was also obtained in the stomach of herrings and mackerel at Cleggan (7).

General distribution.—North Atlantic, Mediterranean, Indian Ocean.

Vertical range.—Down to 1,800 fathoms.

Oithona plumifera, Baird.

Oithona plumifera, Baird, 1843.
Scribella scriba, Dana, 1849.
Oithona spinirostris, Claus, 1863 (not Lilljeborg).
Oithona challengeri, Brady, 1883.

Cleggan, surface (7); *Helga*, 3 stations on the Porcupine Bank, viz.:—Lat. 53° 24′ N., long. 13° 34′ W., 50 and 110 fathoms; lat. 53° 23′ N., long. 13° 12′ W., 120 fathoms; lat. 53° 23′ N., long 12° 43′ W., 90 and 175 fathoms (8).

General distribution.—North Atlantic, Mediterranean, Indian Ocean.

Vertical range—Down to 200 fathoms.

Oithona helgolandica, Claus.

Oithona helgolandica, Claus, 1863.
Oithona nana, Giesbrecht, 1892.

Cleggan (8); Ballynakill, surface (8).

General distribution.—West of Ireland, Mediterranean, Indian Ocean.

Vertical range.—Down to 1,600 fathoms.

Family *MONSTRILLIDAE.*

Genus **Monstrilla,** Dana, 1848.

Monstrilla Danae, Claparède.

Monstrilla Danae, Claparède (not Möbius), 1863.

Valentia, surface (16) (17).

General distribution.—British Isles, North Atlantic.

The species of the Monstrillidae are generally found near the surface.

Monstrilla longicornis, I. C. Thompson.

Monstrilla longicornis, I. C. Thompson, 1890.
? *Monstrilla helgolandica,* Bourne, 1890.
Monstrilla longiremis, Giesbrecht, 1892.
Monstrilla longicornis, Scott, 1904.

Larne Lough, surface, one female and 20 males (13).

General distribution.—British seas, Mediterranean.

Genus **Thaumaleus,** Kröyer, 1849.

Thaumaleus rigidus (I. C. Thompson).

Cymbasoma rigida, I. C. Thompson, 1888.
Monstrilla rigida, Bourne, 1890.
Thaumaleus Claparèdii, Giesbrecht, 1892.
Thaumaleus rigidus, Scott, 1904.

Gola Islands, Donegal, surface (9); Valentia, surface, and two fathoms (15) (16).

General distribution.—British Isles, Madeira, Mediterranean.

Thaumaleus Thompsoni, Giesbrecht.

Thaumaleus Thompsoni, Giesbrecht, 1892.
Monstrilla Danae, Möbius, 1884.

Valentia, surface (16).

General distribution.—British Isles, Mediterranean.

Family *CORYCAEIDAE.*

Genus **Corycaeus,** Dana, 1845.

Corycaeus anglicus, Lubbock.

Corycaeus anglicus, Lubbock, 1857.
Corycaeus germanus, Leuckart, 1859.

Dingle Bay, surface (4); Kinsale Harbour, surface (3) (4); Valentia, surface (4) (16) (17); Cleggan (7); Cruise of the *Oceana*, lat. 52° 4′ N., long. 12° 27′ W., down to 374 fathoms (18).

General distribution.—British Isles, Heligoland, Mediterranean.

Vertical range.—Down to 400 fathoms.

Corycaeus speciosus, Dana.

Corycaeus speciosus, Dana, 1849.

? *Corycaeus remiger*, Dana, 1849.

Valentia, surface (16) (17).

General distribution.—British Isles, Canary Islands, South America, Mediterranean, Indian Ocean.

Corycaeus venustus, Dana.

Corycaeus venustus, Dana, 1849.

Corycaeus limbatus, Brady, 1883.

(not *Corycaeus venustus*, Brady, 1883).

Cruise of the *Oceana*, lat. 52° 4′ N., long. 12° 27′ W., 650 fathoms.

General distribution.—Kingsmill Islands, Canary Islands, West of Ireland.

Vertical range.—Down to 650 fathoms.

Family *ONCAEIDAE*.

Genus **Oncaea,** Philippi, 1843.

Oncaea venusta, Philippi.

Oncaea venusta, Philippi, 1843.
Antaria obtusa, Dana, 1849.
Antaria crassimana, Dana, 1849.
Oncaea pyriformis, Lubbock, 1860.
Antaria coerulescens, Claus, 1866.
Oncaea obtusa, Brady, 1883 (part).

Off the S.W. of Ireland, surface (2).

General distribution.—Atlantic, Pacific, and Indian Oceans; Mediterranean.

Oncaea mediterranea (Claus).

Antaria mediterranea, Claus, 1863.

? *Oncaea obtusa*, Brady, 1883 (part).

Oncaea mediterranea, Bourne, 1889.

Valentia, surface (16).

General distribution.—British Isles, Mediterranean, Indian Ocean.

Oncaea media, Giesbrecht.

? *Antaria mediterranea*, Claus, 1866 (part).

Oncaea media, Giesbrecht, 1891.

Cleggan, surface (7).

General distribution.—West of Ireland, Mediterranean, Indian Ocean.

Oncaea conifera, Giesbrecht.

Antaria mediterranea, Claus, 1866 (part).

Oncaea conifera, Giesbrecht, 1891.

Cleggan, surface, also taken in the stomachs of herring and mackerel (7); *Helga*, Porcupine Bank (3 stations), viz. :—Lat. 53° 24′ N., long. 13° 34′ W., 50 and 110 fathoms; lat. 53° 23′ N., long. 13° 12′ W., 120 fathoms; lat. 53° 23′ N., long. 12° 43′ W., down to 175 fathoms (8). *Helga*, lat. 53° 58′ N., long. 12° 28′ W., 200 fathoms (8).

General distribution.—West of Ireland, Mediterranean, Indian Ocean.

Vertical range.—Down to 200 fathoms.

Genus Conaea, Giesbrecht, 1891.

Conaea rapax, Giesbrecht.

Conaea rapax, Giesbrecht, 1891.

Helga, Porcupine Bank, lat. 53° 24′ N., long. 13° 34′ W., 100 fathoms (8); Cruise of the *Oceana*, lat. 52° 4′ N., long. 12° 27′ W., down to 650 fathoms (18).

General distribution.—Pacific; West of Ireland.

Vertical range.—Down to 1,700 fathoms.

Family *HARPACTICIDAE.*

Genus **Aegisthus,** Giesbrecht, 1891.

Aegisthus mucronatus, Giesbrecht.

Aegisthus mucronatus, Giesbrecht, 1891.

Helga, Porcupine Bank, lat. 53° 23′ N., long. 13° 12′ W., 120 fathoms (8); Cruise of the *Oceana,* lat. 52° 4′ N., long. 12° 27′ W., 620 fathoms (18).

General distribution.—Pacific; West of Ireland.

Vertical range.—Down to 1,570 fathoms.

Aegisthus spinulosus, Farran.

Aegisthus spinulosus, Farran, 1905.

Helga, lat. 53° 58′ N., long. 12° 28′ W., 382 fathoms (8).

General distribution.—West of Ireland.

Vertical range.—382 fathoms.

Aegisthus atlanticus, Wolfenden.

Aegisthus atlanticus, Wolfenden, 1902.

Deep water off West Coast of Ireland, lat. 51° N. long, 12° W., 300 fathoms (19).

Wolfenden believes that the forms described by Thompson from the *Oceana* collection as *Aegisthus mucronatus,* are identical with the above species.

General distribution.—West of Ireland.

Vertical range.—Down to 300 fathoms.

REFERENCES TO PUBLICATIONS RECORDING IRISH PELAGIC COPEPODA.

(1) **Baird,**—British Entomostraca. Ray Society. [1850.]

(2) **Bourne, G. C.**—Journ. Mar. Biol. Assoc., Vol. I. (N.S.), pp. 306-323. [1889.]

(3) ,, Journ. Mar. Biol. Assoc., Vol. I. (N.S.), p. 380. [1889.]

(4) **Brady, G. S.**—Monograph of British Copepoda. Ray Society. 3 Vols. [1878–81.]

(5) ,, Nat. Hist. Tr., Northumberland, Durham, and Newcastle. Vol. XIV, p. 54. [1902.]

(6) **Brady and Robertson.**—Ann. & Mag. Nat. Hist., Ser. 4, Vol. XII. [1873.]

(7) **Farran, G. P.**—Ann. Rep. Fisheries, Ireland, 1901, Pt. II., App., VII. [1903.]

(8) ,, Ann. Rep. Fisheries, Ireland, 1902-3, Pt. II., App., II. [1905.]

(9) **Herdman, W. A., and I. C. Thompson.**—Trans. Liv. Biol. Soc., Vol. V., pp. 181-212. [1891.]

(10) **Herdman, W. A., and I. C. Thompson.**—Trans. Liv. Biol. Soc., Vol. XII., pp. 33-90. [1898.]

(11) **Malcolmson.**—Proc. Roy. Irish Acad., Ser. 2, Vol. IV., No. 5. pp. 599-638. [1886.]

(12) **Norman, A. M.**—Journ. Linn. Soc. (Zoology), Vol. 29, No. 188, p. 133. [1903.]

(13) **Pearson, J.**—Copepoda of Larne District (MS.). [1904.]

(14) **Scott, A.**—Ann. & Mag. Nat. Hist., Ser. 6., Vol. 18, p. 362. [1896].

(15) **Thompson, I. C.**—Trans. Liv. Biol. Soc., Vol. X., pp. 92-102. [1896.]

(16) ,, Proc. Roy. Irish Acad., Ser. 3, Vol. 5, p. 737. [1896.]

(17) ,, Trans. Liv. Biol. Soc., Vol. XI., pp. 127-131. [1897.]

(18) ,, Ann. & Mag. Nat. Hist., Series 7, Vol. XII., pp. 1-36. [1903.]

(19) **Wolfenden, R. N.**—Journ. Mar. Biol. Assoc., Vol. VII. (N.S.) No. 1, pp. 110-146. [1904.]

(20) ,, Plankton Studies, Part I., Copepoda. [1905.]

(21) **Brady, G. S.**—Copepoda of Larne District (MS.). [1904.]

Appendix, No. VII.

i.—Notes on the Plankton of Valencia Harbour, 1902–1905, by M. and C. Delap.

ii.—Notes on the Rearing, in an Aquarium, of *Aurelia aurita*, L. and *Pelagia perla* (Slabber), by M. J. Delap.

i.—NOTES ON THE PLANKTON OF VALENCIA HARBOUR 1902-1905.

BY

M. and C. Delap.

Townetting in Valencia Harbour has now been carried on for ten years. It was commenced in 1895, when Mr. E. T. Browne and his friends made their first visit to the island. Their reports[1] on the pelagic fauna were for the years 1895-1898, and our previous notes[2] on the plankton dealt with the years 1899-1901.

As we are unable to identify all the organisms taken in the townets, we have confined our records to those animals which we know or which have been identified for us. The record for the jelly-fishes is almost a complete one; some of the rarer ones have been sent to Mr. Browne, who has kindly identified them for us, and an account of them will be published later.

Two tables are appended showing the monthly distribution of the Medusae and other pelagic animals. The absence of records for some of the winter months is partly due to the weather on this stormy coast, and occasionally, as in the beginning of 1902 to our absence from home.

The winter of 1902-03 was very severe—bad gales and very heavy seas. Very few days were favourable for townetting from an open boat, and the hauls showed a great scarcity of pelagic organisms. Medusae were scarce in the following summer; possibly this was due to the severity of the winter. The winter of 1903-1904 was not so stormy, and better results were obtained. In May and June, 1904, several large drifts from the ocean entered the Harbour. In the drifts were many Velella barnacles, and a hollow-stemmed Laminaria-like sea-weed. The local fishermen call this weed "Canada wrack," and say that they

[1] Browne, E. T., and others, 1900,—"The Fauna and Flora of Valencia Harbour." *P.R.I.* 4. Ser. 3, V., pp. 667–854.

[2] Delap M. and C., 1905,—"Notes on the Plankton of Valencia Harbour, 1899–1901." *Ann. Rep. Fish. Ireland*, 1902–1903, Pt. II., App., I., pp. 1–19.

always notice shoals of hake following it. Medusae were fairly plentiful during the summer and autumn months. The winter of 1904-1905 was stormy, with frequently very heavy seas, and though the following summer was unusually fine and warm, jellyfishes were not plentiful, and nothing out of the common was seen.

On certain occasions the Harbour was invaded by great shoals of various animals which quickly filled the townet; at other times diatoms and other minute floating algae were so thick that the net was soon choked.

On the following dates noteworthy shoals appeared :—

1902.—May 23rd, early stages of *Chrysaora* and Pteropods.
July 24th, *Obelia*, *Dipleurosoma* and *Pleurobrachia*.
September 29th, *Pleurobrachia*, *Bolina*, and *Beroe*.

1903.—April 18th, Diatoms and floating green algae ; this shoal remained for three weeks.
Aug. 10th–Sept. 7th, Blue Salps (*Thalia*).
October 8th, *Cupulita*.

1904.—May, green algae, throughout the month.
May 14th–19th, *Oikopleura* and Copepods.
May 24th, *Calanus*.
June 2nd and 21st, *Calanus*.
June 29th, *Calanus* and *Oikopleura*.
July 12th, *Oikopleura*.

1905.—May 24th, *Pleurobrachia* and *Calanus*.
June 21st and 22nd, *Oikopleura*.
October 2nd, *Noctiluca*.
October 6th, *Noctiluca* and *Pleurobrachia*.
October 13th, *Cupulita* and *Beroe*.

PROTOZOA. (Table I.)

Radiolaria.

Acanthometron sp.

1902.—On July 26th a considerable shoal appeared. It was also taken in October and November.

1903.—Only seen in small numbers on October 8th.

1904.—It appeared on August 24th, and was taken in small numbers until October 19th.

1905.—On August 1st and 15th, and in the week following it was plentiful. Few seen during September and first week in October.

Thalassicola sp. ?

1905.—A specimen taken on September 16th, and another on the 20th.

CYSTOFLAGELLATA.

Noctiluca miliaris, Suriray.

1902-1904.—None were seen during these three years.

1905.—It was first seen on August 23rd. During September and October there was a dense shoal in the Harbour. Last seen on December 13th.

COELENTERATA.

HYDROMEDUSAE.

ANTHOMEDUSAE. (Table II.)

Amphinema dinema (Péron et Lesueur).

1902.—One specimen on August 18th, and a few on September 23rd

1903.—On May 29th one was taken. On September 1st two very small ones, and another on October 14th.

1904.—One only was seen on July 7th.

1905.—One specimen on April 25th.

Corymorpha nutans, Sars.

1902.—A few taken on April 30th, and considerable numbers during May; scarce in July, and only one in August.

1903.—Very common in the last week of May, in small numbers during June and first week of July.

1904.—In the beginning of May there were a number of very young specimens seen. Shoals of adults occurred towards the end of the month. A few were seen in June.

1905.—From May 6th to end of month, but never in any quantity.

Cytaeandra areolata (Alder).

1902-1903.—None were seen.

1904.—One, young stage, was taken on May 3rd; another, with ova, on the 12th.

1905.—None seen.

Dipurena ophiogaster, Haeckel.

1902.—On July 16th one specimen was taken, one on August 18th, and another on September 24th, all adult specimens.

1903.—One on May 14th, two on June 24th; single specimens on August 6th, September 1st and 23rd.

1904.—Only one seen, on July 27th.

1905.—Three on June 22nd, one in July, and some young stages in September.

Dipurena halterata (Forbes).

1902.—None seen.

1903.—Several very young stages on July 1st, 7th, and 8th.

1904.—One on May 10th, a young specimen on June 30th, and another on August 16th.

1905.—None seen. No adult specimens were seen during these four years—all were young stages.

Ectopleura Dumortieri (Van Beneden).

1902.—A few were seen on May 8th, and one on October 28th.

1903.—One on April 18th; some very small ones in July, which measured less than ½ mm. in diameter. Two in October.

1904.—First taken on May 3rd; a number on May 10th; only two seen in August, one in September; a few on October 19th and on November 5th.

1905.—A few during May, June, July, and August, never many. On September 12th very few; one on December 13th.

Euphysa aurata, Forbes.

1902.—First seen in May, when a few were taken on the 8th and 13th; one on November 5th.

1903.—None seen.

1904.—One was taken in April, one in June, and one in August.

1905.—On April 25th one specimen, two in May, one in June, and another in August.

Gemmaria implexa (Alder).

1902–1903.—None seen.

1904.—A very young specimen, with two tentacles, on August 30th; another on September 3rd.

1905.—On July 19th two were taken, and another on July 23rd.

Hybocodon prolifer, L. Agassiz.

1902.—A few seen on May 8th.

1903.—None seen.

1904.—One on March 25th, and a few in May.

1905.—A few specimens on July 4th.

Lar sabellarum, Gosse.

1902.—A few were taken in July and also in November.

1903.—A few seen in April and May, common in July, only one in August, common in September and November.

1904.—Present in small numbers from March to November.

1905.—One in February, small numbers in May, June, and July, very scarce in August, more plentiful in September.

Lizzia blondina, Forbes.

1902.—Several young stages on August 8th, one on 16th, a few in September, and several on November 3rd.

1903.—One seen on May 4th.

1904.—On July 26th one with medusa buds.

1905.—A very young specimen on August 1st, and a few on 14th and 16th of same month.

Margelis.

Specimens were taken on various occasions during the years 1902-1905, but the species were not identified.

Margellium octopunctatum, Sars.

1902.—Only two specimens seen on May 8th and 13th respectively.

1903.—Two seen on May 8th, one on August 22nd, one on September 23rd, a few during October, and four on November 2nd.

1904.—A few in April, May, and August, one in September.

1905.—A considerable shoal appeared in April, fewer in May, and some young stages in September.

Podocoryne carnea, Sars.

1902.—One specimen taken on July 1st and another on 7th.

1903.—None seen.

1904.—Two very young stages on July 9th, a few with either 6, 7, or 8 tentacles on August 20th, and two more on 26th.

1905.—On July 19th one specimen, another on August 1st, both young stages.

Sarsia gemmifera, Forbes.

1902.—None seen.

1903.—One with medusa buds on August 1st.

1904.—On July 21st one specimen, three on 23rd, and two in August.

1905.—During the months of June and July a few were always in the townet; more plentiful in August; a few in September.

Sarsia eximia, Allman.

1902-1904.—None seen.

1905.—Three were taken on August 1st.

Sarsia prolifera, Forbes.

1902.—None seen.

1903.—On July 15th three were captured, one on 17th and two on 28th. They became more abundant in August, most of the specimens having medusa buds; one was seen in September.

1904.—One on July 7th, more were seen during the remainder of the month; fairly plentiful during August and September.

1905.—Only one in June; common in September.

Sarsia tubulosa, Sars

1902.—A good many were seen on May 7th, and a few in June.

1903.—Scarce during the last week in May, a few young specimens in June, scarce in July.

1904.—On April 26th two small specimens were taken, and a few during May, June, and July.

1905.—A fine adult specimen on May 9th, a few young stages on the 24th, scarce in June.

Tiara pileata, Forskal.

1902.—A few on May 8th, present in small numbers during June, July, and August, numerous on September 24th and 29th.

1903.—Appeared first on April 9th, very scarce during June, July, and August.

1904.—A small shoal appeared in June, common in July and August, one specimen in November.

1905.—Present in the Harbour in small numbers from the middle of May until October 13.

LEPTOMEDUSAE. (Table II.)

Agastra caliculata, Hincks.

1902.—None seen.

1903.—One was taken in the townet on June 25th. Two were taken on November 4th.

1904-1905.—None seen.

Dipleurosoma typicum, Boeck.

1902.—In June this medusa was in the Harbour in small shoals, very large shoals appeared in July, especially on the 24th present in considerable numbers in August and September, but scarcer in October.

1903.—Only one was seen on May 27th.

1904.—On July 28th a large shoal appeared, a few were seen in August, rather more in September.

1905.—A large shoal was noticed in August, especially on 16th and one specimen in October.

Euchilota pilosella (Forbes).

1902.—One was taken on May 6th, very few in June, July, and September.

1903.—None seen.

1904.—One on each of the following dates:—June 10th, August 16th, September 28th.

1905.—One on May 29th, one in June, and one in July.

Irene, sp.?

1902.—A small broken specimen on October 20th.

1903.—None seen.

1904.—Two were taken on August 16th, one with 5 tentacles and several bulbs, and 10–12 vesicles in each quadrant. On August 20th, a very young stage.

1905.—One was taken on August 14th, and another on 16th. Two large specimens on October 16th.

Eutima insignis (Keferstein).

1902.—One specimen only was taken, on September 24th; this was a small one with 4 tentacles.

1903.—On October 8th, a single specimen was captured.

1904.—Again only one was seen, and it was a small specimen, on August 26th.

1905.—None were seen.

Saphenia mirabilis (Wright).

1902.—A fine specimen, on July 24th, was the only one seen.

1903.—One on July 17th.

1904.—A very young stage on July 7th, and another on 9th. A large adult specimen on July 23rd, and a young stage on August 30th.

1905.—On July 3rd, a very small specimen.

Laodice calcarata, Agassiz.

1902.—Plentiful on August 18th and 20th; a few in September, during the last week.

1903.—From August 7th to 25th fairly plentiful, some very large specimens on 22nd.

1904.—A very young stage on May 21st, and another on 24th, and one on 31st. Some small ones on July 23rd, and a considerable shoal on 26th and 28th. Another shoal appeared on August 8th and two following days; the last seen was on August 26th.

1905.—A small shoal on August 16th, one specimen on September 4th, and one on October 31st.

Mitrocomium, sp.?

1902.—On November 3rd, one specimen was taken; it had 5 sense organs with 8 otoliths in each, 18 tentacles and bulbs.

1903.—One on October 19th, with 16 tentacles and bulbs, and smaller tentacles between the bulbs, and 8 sense organs.

1904--1905.—None seen.

Obelia nigra, Browne.

1902.—Present in the townet from April to November, most plentiful on July 24th, and on September 29th.

1903.—Taken from April to November, most numerous in April.

1904.—From April to November, with the exception of June, it was present in the Harbour; very plentiful on July 28th.

1905.—Common from April to October, most numerous April 25th and August 14th.

Octorchis Gegenbauri, Haeckel.

1902.—One on July 21st and another August 8th, both with 4 tentacles; a very fine one on September 23rd.

1903—1905.—None seen.

Phialidium cymbaloideum (Van Beneden).

1902.—A few in April; common in May, and present until the end of October.

1903.—One taken February 1st, constantly taken from April to the middle of November.

1904.—From March to end of October, most numerous in July.

1905.—Present in townet from April to end of October.

Phialidium temporarium, Browne.

1902.—At the end of April and during May, June, July, and September fairly plentiful; none seen in August.

1903.—From April to November, few in August, most numerous in October.

1904.—Taken each month from March to November, plentiful in May, June, and July.

1905.—A few in January, very young stages; common in April and May, especially in the latter month: few in June and July; common from August to December.

Phialidium buskianum (Gosse).

1902.—A good specimen on September 29th.

1903.—One was taken on July 3rd.

1904.—On September 21st one, and another on 28th; two on October 19th and three on 26th; three on November 18th.

1905.—A few seen on April 25th, and small numbers from August 14th to October 6th. One fine adult specimen on September 2nd, with ova, from which hydroids were obtained.

Polycanna forskalea, Peron.

1902.—On July 24th a small specimen was captured; it had 117 tentacles and bulbs.

1903--1905.—None seen.

TRACHOMEDUSAE. (Table II.)

Aglantha rosea (Forbes).

1902.—Four specimens were taken on July 16th.

1903.—A few in June, one in July, one in October, very small and rather damaged; one on December 26th.

1904.—During May a few small stages were taken; some very young ones in September, and about a dozen specimens on October 19th, the largest of which measured 9 mm. in height, and 5 mm. in width.

1905.—A few in May, also in August, September, and October; and six very small specimens on December 13th.

Gossea circinata, Haeckel.

1902.—Only one small specimen was taken on October 20th.

1903-1905.—None were seen.

NARCOMEDUSAE. (Table II.)

Solmaris corona (Keferstein et Ehlers).

1902.—A small shoal was seen on August 18th, and one specimen on 31st.

1903.—One broken specimen on October 14th.

1904.—Two on November 5th.

905.—None seen.

SIPHONOPHORA. (Table I.)

Velella spirans (Forskal).

1902.—On July 14th five were taken, and two more on August 26th.

1903.—In October they were very numerous, with some very large specimens amongst them. One was found on November 30th, and another on December 3rd.

1904.—Very common in June—nearly all stages from very tiny ones measuring about ·5 mm. in diameter, up to large specimens about 50 mm. in length. Fairly common in July and throughout August.

These very young Velella are nearly round in shape, with a high crest in proportion to their length, and about 12 tentacles Some specimens were taken with the crest set from right to left; it is generally set from left to right.

1905—On January 7th a number of live Velella were found stranded on the rocks. In April a shoal of very small ones appeared in a drift along with quantities of barnacles, the air-bladders of the Sargassum weed and several shells of *Spirula Peroni*. On June 6th a small shoal appeared, and a few were seen on July 24th.

Muggiaea atlantica, Cunningham.

1902.—One specimen was found on May 8th, another on August 16th. More plentiful in September, a few in October, and in the first week of November.

1903.—None seen.

1904.—In September large shoals appeared and continued in the Harbour until November 18th.

1905.—None were seen.

Galeolaria, sp.?

1902.—A single nectocalyx was found on May 1st.

1903.—On April 27th seven very fine specimens were taken.

1904.—Seven large ones seen on July 26th.

1905.—A few taken on September 19th.

Cupulita Sarsi, Haeckel.

1902.—One specimen was taken on May 1st, and another on the 8th; they became more plentiful towards the end of the month. A few were seen in June, common in July and August. Very large shoals at the end of September especially on 23rd. One large one measured 3 feet when fully extended, and had twenty pairs of nectocalyces.

1903.—A few very young specimens were seen at the end of June, and the first week of July. Only one seen in August, a shoal of large ones in September, a very large shoal on October 8th; scarcer to the end of the month, and in the first week in November.

1904.—Present in the Harbour in small shoals from May 10th until November 16th. Small specimens in the early part of the year, and larger ones in September.

1905.—Appeared first in May, rather scarce in June, July, and August: large shoals in October.

Agalmopsis elegans, Sars.

1902.—On August 20th a fine specimen was captured; it had ten nectocalyces, very thick bracts and tricornuate tentilla. Another broken specimen was also found.

ACRASPEDA.

Scyphomedusae. (Table II.)

Aurelia aurita, Linn.

1902.—A very small specimen on May 7th measured only one inch in diameter, a few more were seen on 8th and 23rd of same month, and one on June 10th.

1903–1905.—None were seen.

Chrysaora isosceles (Linn.)

1902.—One small one on May 7th, very common at the end of month and during the early part of June; plentiful in July. Those in May and June were young stages from one to three inches across; large adult specimens in July.

1903.—A few small broken specimens in July.

1904.—None seen.

1905.—One was seen on October 10th.

Cyanea Lamarcki, Peron et Lesueur.

1902.—A considerable number seen on May 8th, from $\frac{3}{4}$-inch to double that size, all young stages. One on September 23rd.

1903-1905.—None seen.

Pelagia perla (Slabber).

1902.—On December 31st a small shoal was stranded on the rocks.

1903.—Large shoals in the Harbour from August 10th to 23rd, a few in September, October, and November.

1904.—Small shoals from August 9th to end of the month. Early in September, a number of the Ephyra stage were taken and young stages up till the middle of October.

1905.—None were seen.

Rhizostoma octopus, Linn.

1902.—None seen.

1903.—A large specimen on September 12th, and three in October.

1904.—None seen.

1905.—A few in August; very plentiful all through September and October.

ANTHOZOA. (Table I.)

Arachnactis Bournei, Fowler.

1902.—None were seen.

1903.—A few were taken in April and early in May.

1904.—Very scarce during May.

1905.—On April 25th a few were taken in the townet.

Halcampa chrysanthellum (Peach).

The larval form is often found attached to jellyfish, especially to Phialidium. It is common during the summer.

CTENOPHORA. (Table 1.)

Pleurobrachia pileus, Modeer.

1902.—Fairly plentiful from April 30th, throughout May, June, and July; very plentiful at the end of July; common in August and September, and a few in November.

1903.—One was seen in February, a few in May, very few in June and July; more numerous toward the end of August and in September and October. A few taken on December 2nd.

1904.—Common from May 10th until the end of September rather scarce in October.

1905.—A few in March, common in April, very common in May, June, and July, and until the middle of October. One was taken on December 13th.

On several occasions a very small ctenophore was taken, quite different in form and in tentacles from the common Pleurobrachia.

This ctenophore is oval, not round, compressed in the stomachal plane, higher in proportion to width than *P. pileus.* The tentacles are not altogether retracted, but the lateral filaments are drawn up in a tight bunch. The filaments are carried in a tight spiral, and very seldom unfolded. The largest specimen seen was 3 mm. high and 2 mm. wide.

1902.—On August 8th several very small specimens were found and a larger one on 16th. The latter measured 1 mm. in diameter and about 1·5 in height, and had 20 filaments on each tentacle.

1903.—On November 2nd three specimens were taken.

1904.—None seen.

1905.—A small one on August 9th had 20 filaments on its tentacles. Two more specimens on September 5th and 16th, and one on October 6th.

? Mnemiopsis.

1903.—One small ctenophore with four ciliated lobes and tentacles was taken on June 5th, five more on 27th, and several on 29th. In July several specimens were taken.

1905.—On September 4th one was seen. These ctenophores are rather like small *Bolina*, but even more fragile; and were very often broken in the townet.

Bolina norvegica (Sars).

1902.—Taken first on April 30th, also in May, July, August, and September: most numerous in the latter month when very large specimens were seen.

1903.—Only two were seen in May, a few in July, more common in August and October. One seen on November 18th.

1904.—A shoal of large ones appeared in the end of June, common during July and August; a few in September, and a shoal of very large ones on November 5th.

1905.—Very numerous in the Harbour during May, June, August, and October: immense shoals on October 13th.

Beroe ovata, Eschscholtz.

1902.—A few seen in May: fairly common in July, very plentiful in August and September; a few seen in October.

1903.—One very small specimen on April 27th: very scarce in May; a few in July, August, and September.

1904.—Only one seen in May, some very large specimens on June 21st; common towards the end of July and during August; very scarce in September.

1905.—A very young specimen on January 3rd. Scarce in May and July, common in August and September; very numerous about the middle of October.

ECHINODERMATA. (Table I.)

Bipinnaria.

1902.—None were seen.

1903.—On April 27th one was taken, two small specimens on October 14th.

1904.—One seen on May 12th, and a considerable shoal on November 5th. These were large specimens containing a well-developed starfish. In a few days the starfishes commenced to creep about, while their cast-off tails swam as vigorously as before, and some of them remained active until the end of January, almost three months.

Three of the starfishes remained alive, but after a short time one of them ate the other two. It was supplied with various kinds of food and chose young brittle stars. By the end of May it had grown to 15 mm. across the arms, and continued faithful to the small grey brittle stars and would eat no other food. It lost all its rays, but immediately new ones began to grow, and by the end of July it measured 25 mm. In September it had reached 50 mm., and by the middle of October was 70 mm. across the arms. At the end of December it measured 95 mm. This starfish was kindly identified by Mr. Kemp as *Luidia Sarsi*.

1905.—On August 1st some very young *Bipinnaria* were taken in the townet; two more on September 4th.

POLYCHAETA. (Table I.)

Tomopteris onisciformis, Eschscholtz.

1902.—Present in the townet from May to October.

1903.—One taken on February 13th very few in June, July, and August; more numerous in September, October, November, and early part of December.

1904.—A few in May, July, and August, common in September and October, and a few seen in November.

1905.—On January 3rd a few were taken, scarce in June and July, common in August and following months until the middle of December.

Sagitta bipunctata, Quoy et Gaimard.

1902.—Fairly common from April to November.

1903.—Few seen in February. From May to December nearly always present, but never plentiful.

1904.—It appeared in March, and was taken in small numbers until November.

1905.—Scarce in January, and common from May to December very numerous on October 10th.

MOLLUSCA. (Table I.)

Ianthina communis, Lamarck.

1904.—One specimen found cast ashore on Beginnis Island on August 12th.

Spirula Peroni, Lamarck.

1903.—Two perfect shells and five broken ones found on Beginnis Island on October 27th, along with a large drift of Velella

1905.—On April 7th four perfect shells and two fragments were found on the shore of Valencia along with quantities of Velella and the air bladders of the Sargassum weed.

Limacina retroversa, Fleming

1902.—Taken in the townet from May to November, never in any numbers.

1903.—From June to November, fairly common.

1904.—Scarce in May, July, and September, few in November.

1905.—One taken on January 3rd, fairly common from May to September, scarcer in October, November, and December.

Clione limacina, Phipps.

1902.—On July 5th and 16th common, a large number on August 20th and following week, scarcer during September and October; a few seen on November 3rd and 5th.

1903.—A few in June, common in July and to the end of October.

1904.—Taken in May, July, September, and November, but never plentiful.

1905.—Very few seen in September, October, and first week of December.

TUNICATA. (Table 1.)

Thalia democratica-mucronata, Forskal.

1903.—From August 10th until September 7th immense numbers were in the Harbour, making it almost impossible to use the townet. Two were seen on October 14th.

Salpa runcinata-fusiformis, Chamisso-Cuvier.

1903.—On September 7th a few were seen.

1905.—A considerable number on June 20th and 21st, and two on October 10th.

Doliolum, sp.?

1904.—One specimen on September 27th.

1905.—On August 14th one specimen was taken, three more on 16th, two on September 2nd, and two more on the 4th,

These were all small specimens with buds on the stolon. Two were captured on September 2nd with wide muscle bands, and on September 20th two very small ones were taken.

Oikopleura, sp.?

1902.—Present from April to November, very plentiful in May.

1903.—From April to July in small numbers Common in August.

1904.—Taken from April to October; in great quantities in June, choking the townet on several occasions.

1905.—From May to October, very common in June.

TABLE

MONTHLY DISTRIBUTION OF PELAGIC ANIMALS

	1902.												1903.											
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Acanthometron sp.?	–	–	–	–	–	–	–	–	–	×	×	–	–	–	–	–	–	–	–	–	–	×	–	–
Thalassicola sp.?	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Noctiluca miliaris,	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Velella spirans,	–	–	–	–	–	–	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×	×
Muggiaea atlantica,	–	–	–	–	×	–	–	×	×	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–
Galeolaria sp.?	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–	×	–	–	–	–	–	–	–	–
Cupulita Sarsi,	–	–	–	–	×	×	×	×	×	–	–	–	–	–	–	–	–	×	×	×	×	×	×	–
Agalmopsis elegans,	–	–	–	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Arachnactis Bournei,	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×	–	–	–	–	–	–	–
Pleurobrachia pileus,	–	–	–	×	×	×	×	×	×	–	×	–	–	×	–	×	×	×	×	×	×	×	×	×
Bolina norvegica,	–	–	–	×	×	–	×	×	×	–	–	–	–	–	–	–	×	–	×	×	–	×	×	–
Beroe ovata,	–	–	–	–	×	–	×	×	×	×	–	–	–	–	–	×	×	–	×	×	×	–	–	–
Bipinnaria sp.?	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	–	–	–	–	–	×	–	–
Pluteus,	–	–	–	–	–	×	–	–	×	×	–	–	–	–	–	×	–	–	×	–	–	×	–	–
Tomopteris onisciformis.	–	–	–	–	×	×	×	×	×	×	–	–	–	×	–	–	–	×	×	×	×	×	×	×
Sagitta bipunctata,	–	–	–	×	×	×	×	×	×	×	×	–	–	×	–	–	×	×	×	×	×	×	×	×
Ianthina communis,	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Spirula Peroni,	–	–	–	–	–	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Limacina retroversa,	–	–	–	–	×	×	×	×	×	×	×	–	–	–	–	–	–	×	×	×	×	×	×	–
Clione limacina,	–	–	–	–	–	–	×	×	×	×	×	–	–	–	–	–	–	×	×	×	×	×	–	–
Thalia mucronata,	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×	×	–	–
Salpa fusiformis,	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	–	–	–
Doliolum sp.?	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Oikopleura sp.?	–	–	–	×	×	×	×	×	×	×	×	–	–	–	–	×	×	×	×	×	–	–	–	–

I.

IN VALENCIA HARBOUR FOR 1902–1905.

1904.												1905.											
January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
-	-	-	-	-	-	-	×	×	×	-	-	-	-	-	-	-	-	-	×	×	×	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	×	×	-	×
-	-	-	-	-	×	×	×	-	-	-	-	×	-	-	×	-	×	×	-	-	-	-	-
-	-	-	-	-	-	-	-	×	×	×	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	×	-	-	-	-	-	-	-	-	-	-	-	-	-	×	-	-	-
-	-	-	-	×	×	×	×	×	×	×	-	-	-	-	-	×	×	×	×	×	×	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	×	-	-	-	-	-	-	-	-	-	-	×	-	-	-	-	-	-	-	-
-	-	-	-	×	×	×	×	×	×	-	-	-	-	×	×	×	×	×	×	-	×	-	×
-	-	-	-	-	×	×	×	×	-	×	-	-	-	-	-	×	×	-	×	-	×	-	-
-	-	-	-	×	×	×	×	×	-	-	-	×	-	-	-	×	-	×	×	×	×	-	-
-	-	-	-	×	-	-	-	-	-	×	-	-	-	-	-	-	-	-	×	×	-	-	-
-	-	-	-	-	-	-	×	×	×	-	-	-	-	-	×	-	×	×	×	×	-	-	-
-	-	-	-	×	-	×	×	×	×	×	-	×	-	-	-	-	×	×	×	×	×	×	×
-	-	×	×	×	-	×	-	×	×	×	-	×	-	-	-	×	×	×	×	×	×	×	×
-	-	-	-	-	-	-	×	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	×	-	-	-	-	-	-	-	-
-	-	-	-	×	-	×	-	×	-	×	-	×	-	-	-	×	×	-	×	×	×	×	×
-	-	-	-	×	-	×	-	×	-	×	-	-	-	-	-	-	-	-	-	×	×	-	×
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	×	-	-	-	×	-	-
-	-	-	-	-	-	-	-	×	-	-	-	-	-	-	-	-	-	-	×	×	-	-	-
-	-	-	×	×	×	×	-	×	×	-	-	-	-	-	-	×	×	×	×	×	×	-	-

TABLE

MONTHLY DISTRIBUTION OF MEDUSAE

—	1902. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	1903. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
ANTHOMEDUSAE.																								
Amphinema dinema, .	–	–	–	–	–	–	–	×	×	–	–	–	–	–	–	–	×	–	–	–	×	×	–	–
Corymorpha nutans,	–	–	–	×	×	–	×	×	–	–	–	–	–	–	–	–	×	×	–	–	–	–	–	–
Cytaeandra areolata. .	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Dipurena ophiogaster,	–	–	–	–		–	×	×	×	–	–	–	–	–	–	–	×	×	–	×	×	–	–	–
„ halterata, .	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	–	–	–	–	–
Ectopleura Dumortieri.	–	–	–	–	–	–	–	–	–	×	–	–	–	–	–	×	–	–	×	–	–	×	–	–
Euphysa aurata.	–	–	–	–	×	–	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–
Gemmaria implexa. .	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Hybocodon prolifer. .	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Lar sabellarum. .		–	–	–	–	–	–	–	–	–	×	–	–	–	–	×	×	–	×	×	×	–	–	–
Lizzia blondina. .	–	–	–	–	–	–	–	×	×	–	×	–	–	–	–	–	×	–	–	–	–	–	–	–
Margelis, .	–	–	–	–	×	–	–	–	–	–	×	–	–	–	–	×	×	–	×	–	–	–	–	–
Margellium octopunctatum.	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–	–	×	–	–	×	×	×	×	–
Podocoryne carnea. .	–	–	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sarsia gemmifera, .	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
„ eximia, .	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
„ prolifera, .	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×	×	–	–	–
„ tubulosa, .	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–	–	×	×	–	–	–	–	–	–
Tiara pileata. .	–	–	–	–	×	×	×	×	×	–	–	–	–	–	–	×	–	×	×	×	–	–	–	–
LEPTOMEDUSAE.																								
Agastra caliculata	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	–	–	–	–	×	–
Diplourosoma typicum,	–	–	–	–	–	×	×	×	×	×	–	–		–	–	–	×	–	–	–	–	–	–	–
Euchilota pilosella.		–	–	–	×	×	×	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Irene sp.? .	–	–			–	–	–	–	–	×	–		–	–	–	–	–	–	–	–	–	–	–	–
Eutima insignis. .		–	–	–		–	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Saphenia mirabilis, .	–	–	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–	–	×	–	–	–	–	–
Laodice calcarata. .	–	–	–	–	–	–	–	×	×	–	–	–	–	–	–	–	–	–	–	×	–	–	–	–
Mitrocomium sp ? .	–	–	–	–	–	–	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–	×	–	–
Obelia nigra, .	–	–	–	×	×	×	×	×	×	×	×	–	–	–	–	×	×	×	×	×	×	×	×	–
Octorchis Gegenbauri.	–	–	–	–	–	–	×	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Phialidium cymbaloideum.	–	–	–	×	×	×	×	×	×	×	×	–	–	×	–	×	×	×	×	×	×	×	×	–
„ temporarium,	–	–	–	×	×	×	×	–	×	–	–	–	–	–	–	×	×	×	×	×	×	×	–	–
„ buskianum, .	–	–	–	–	–	–	–	–	×	–	–	–	–	–	–	–	–	–	×	–	–	–	–	–
Polycanna forskalea. .	–	–	–	–	–	–	×		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
TRACHOMEDUSAE.																								
Aglanthea rosea. .	–	–	–	–	–	–	×	–		–	–	–	–	–	–	–	–	×	×	–	–	×		×
Gossea circinata. .	–	–	–		–	–	–	–	–	×	–	–	–	–	–	–	–		–	–	–	–	–	–
NARCOMEDUSAE.																								
Solmaris corona. .	–	–	–		–		–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	×	–	–
SCYPHOMEDUSAE.																								
Aurelia aurita. .	–			–	×	×	–	–	–	–	–		–	–	–	–	–	–	–	–	–	–	–	–
Chrysaora isosceles. .	–	–	–		×	×	×			–	–	–	–	–	–	–	–	–	×	–	–	–	–	–
Cyanea Lamarcki, .	–	–	–	–	×		–	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pelagia perla, .	–	–	–	–	–	–	–	–	–	–	–	×	–	–		–	–	–	–	×	×	×	×	–
Rhizostoma octopus. .	–	–	–	–	–	–	–	–		–		–	–	–	–	–	–	–	–	–	×	×	–	–

II.

IN VALENCIA HARBOUR, 1902–1905.

1904.												1905.											
January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
-	-	-	-	-	-	×	-	-	-	-	-	-	-	-	×	-	-	-	-	-	-	-	-
-	-	-	-	×	×	-	-	-	-	-	-	-	-	-	-	×	-	-	-	-	-	-	-
-	-	-	-	×	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	×	-	-	-	-	-	-	-	-	-	-	×	×	-	×	-	-	-
-	-	-	-	×	×	-	×	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	×	-	-	×	×	×	×	-	-	-	-	-	×	×	×	×	×	-	-	×
-	-	-	×	-	×	-	×	-	-	-	-	-	-	-	×	×	×	-	×	-	-	-	-
-	-	-	-	-	-	-	×	×	-	-	-	-	-	-	-	-	-	×	-	-	-	-	-
-	-	×	-	×	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	×	×	×	×	×	×	×	×	×	-	-	×	-	-	×	×	×	×	×	-	-	-
-	-	-	-	-	-	×	-	-	-	-	-	-	-	-	-	-	-	-	×	-	-	-	-
-	-	×	-	×	-	×	×	-	-	-	-	-	-	-	-	×	-	-	-	-	-	-	-
-	-	-	×	×	-	-	×	×	-	-	-	-	-	-	×	×	-	-	-	×	-	-	-
-	-	-	-	-	-	×	×	-	-	-	-	-	-	-	-	-	-	×	×	-	-	-	-
-	-	-	-	-	-	×	×	-	-	-	-	-	-	-	-	-	×	×	×	×	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	×	-	-	-	-
-	-	-	-	-	-	×	×	×	-	-	-	-	-	-	-	-	×	-	-	×	-	-	-
-	-	-	×	×	×	×	-	-	-	-	-	-	-	-	-	×	×	-	-	-	-	-	-
-	-	-	-	-	-	×	×	-	-	×	-	-	-	-	-	×	×	-	×	×	×	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	×	×	×	-	-	-	-	-	-	-	-	-	-	×	-	×	-	-
-	-	-	-	-	×	-	×	×	-	-	-	-	-	-	-	×	×	×	-	-	-	-	-
-	-	-	-	-	-	-	×	-	-	-	-	-	-	-	-	-	-	-	×	-	×	-	-
-	-	-	-	-	-	-	×	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	×	×	-	-	-	-	-	-	-	-	-	-	×	-	-	-	-	-
-	-	-	-	×	-	×	×	-	-	-	-	-	-	-	-	-	-	-	×	×	×	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	×	×	-	×	×	×	×	×	-	-	-	-	×	×	×	×	×	×	×	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	×	×	×	×	×	×	×	×	-	-	-	-	-	×	×	×	×	×	×	×	-	-
-	-	×	×	×	×	×	×	×	×	×	-	×	-	-	×	×	×	×	×	×	×	×	×
-	-	-	-	-	-	-	-	×	×	×	-	-	-	-	×	-	-	-	×	×	×	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	×	-	-	-	×	×	-	-	-	-	-	-	×	-	-	×	×	×	-	×
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	×	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	×	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	×	×	×	-	-	-	-	-	-	-	-	-	×	×	×	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

ii.—NOTES ON THE REARING, IN AN AQUARIUM, OF *AURELIA AURITA*, L. AND *PELAGIA PERLA* (Slabber).

BY

M. J. DELAP.

PLATES I. and II.

Aurelia aurita, Linnaeus.

Pl. I. Fig. 1.

During the months of May and June large shoals of *Aurelia aurita* are common off the south-west coast of Ireland, and the fishermen often complain of the "88's being very bad" Occasionally a small shoal comes into Valencia Harbour, and this happened in May, 1901, when some large adults appeared on May 21st. One was captured which measured ten inches in diameter. It was pale grey in colour, and its oral arms were loaded with Planulae.

THE SCYPHISTOMA AND STROBILA STAGES, 1901--1903.

In a few days some of these Planulae had attached themselves to various objects in a small aquarium and on the glass sides, where they could be easily observed. The Planulae soon passed into the Scyphistoma stage. In six days many individuals had four or six tentacles, and three days later, eight tentacles. The number of tentacles increased rapidly, and in four weeks many of the Scyphistoma had twenty-five tentacles.

The Scyphistoma of *Aurelia* is smaller than that of *Chrysaora* or *Cyanea*: it increases very rapidly by budding or fission. Sometimes it throws out long processes from its base or from the body; these fasten on to any object within reach, and in a few days a young Scyphistoma appears. The Scyphistoma can lengthen its stalk to four times its usual length, and can also detach itself altogether and float upside down, with the base attached to the surface film of the water and the tentacles hanging down, fully extended.

It will float about in this way until it touches some suitable object, when it attaches itself again. One was observed to extend itself to a length of 18 mm.; it attached the mouth to the side of the jar and next day detached itself, leaving a small fragment of the mouth on the glass which in a few days became a perfect Scyphistoma.

During 1902, the Scyphistoma increased greatly in numbers and spread all over the aquarium, but showed no further development. Several Scyphistoma of unknown parentage had appeared in the aquarium in August 1901, the Planulae probably entering with fresh sea-water. Two of these Scyphistoma strobilized in February, 1902, liberating fourteen Ephyrae, which then proved to be young *Aurelia*. One of these Ephyrae had eleven arms the others were normal.

On March 17, 1903, one of the Scyphistoma, belonging to the brood of 1901, was observed to have changed in appearance. It had become opaque and cylindrical in shape from the base to the oral extremity. In two days the first or uppermost segment was formed, next day another appeared, and so on until the 25th when eight segments were completed, the two uppermost having their edges scalloped.

The tentacles remained unchanged until March 27th, when they commenced to shrink and disappear. They were grouped thus:—two tentacles on the top of each scallop of the uppermost segment, the sense organ just visible between the bases of the tentacles, the remaining tentacles pushed in towards the mouth as the scalloped edge unfolded and the lappets of the Ephyra-arms opened.

On March 29th, the lappets of the uppermost Ephyra were unfolded, and only eight shrunken tentacles remained between the lappets and the mouth of the Ephyra, the tentacles on the arms having quite disappeared.

The Scyphistoma on this day produced 8 new tentacles just below the ninth segment, and on the following day the number was increased to 16 tentacles.

On March 30th several of the Ephyrae had their lappets unfolded. On April 4th the first Ephyra was liberated, and four others soon after. The first Ephyra had 12 arms and 12 sense organs it measured 4 mm. in diameter; the other Ephyrae had the normal number of arms and sense organs, namely 8, and were a little smaller than the first.

Many of the Scyphistoma, after strobilizing, survived, and a few Ephyrae appeared in the aquarium in December, 1903, but as no food was obtainable they soon died.

Scyphistoma and Strobila stages, 1904.

On February 3rd, 1904, several of the Scyphistoma, belonging to the brood of 1901, were seen to be strobilizing, one having thirteen segments already formed. On the 16th this Strobila had fifteen segments, and in two days more the proximal tentacles had disappeared, and new tentacles were growing near the base. On February 13th the first Ephyra was liberated, but got lost in the tank; the rest were liberated in a few days. Several more commenced to strobilize, and were carefully watched. On March 4th a Strobila liberated its first or uppermost Ephyra, which had 10 arms; all the others on the Strobila were normal. On March 17th a Strobila was examined which had 10 arms on the first segment, the other segments all normal. On March 19th a Strobila was seen with a nine-armed Ephyra on the first segment. On March 24th a Strobila with nine segments examined —the first Ephyra had 10 arms and 10 sense organs, 4 gastric filaments, and 4 lips, the other Ephyrae all normal. Another Strobila liberated six or seven Ephyrae ; the first Ephyra had 12 arms, 12 sense organs, 4 gastric filaments, and 4 lips ; all the others were normal. Besides these specially observed Strobilae the strobilization of others was also noted.

On March 15th a Strobila liberated 4 Ephyrae, one of which was a 12-armed specimen. This Strobila was somewhere on the bottom of the tank and had escaped observation. In March, 1902, out of two batches of Ephyrae one had 11 arms and the others were normal.

On December 28th, 1903, a Strobila liberated 4 Ephyrae ; one of these was 11-armed and the rest normal. On March 23rd, 1904, a Strobila was observed to have all the Ephyrae with the normal number of arms.

From these eleven Strobilae under observation it would appear that the uppermost segment of a Strobila is usually abnormal, only one having all the segments normal ; and in every one the lower segments were all normal.

The rearing of th Ephyrae up to the adult stage, 1903.

The Ephyrae were placed in a jar with plenty of clean seawater and various kinds of food. They commenced at once to eat some very young *Obelia*, and in a few days ate other young jellyfishes, such as *Phialidium*, and sometimes small copepods. In two weeks several of them measured 5 mm. in diameter, and on April 29th one was 9 mm. in diameter, its canals were developing, and three tentacles had grown between every two arms. On May 8th the largest Ephyra measured 12 mm. and had five tentacles in each space between the arms ; the mouth had become longer and was divided into four lips. They continued healthy for a few weeks, but their favourite food (small medusae) was scarce, and they did not thrive on anything else, though they would eat copepods if nothing else was available. On June 6th the larger Ephyrae were preserved in formaline, as it seemed hopeless to try and keep them alive any longer, and only three small ones were kept, one of which soon disappeared. Jellyfishes continued very scarce in the Harbour during June, and the surviving *Aurelia* had a hungry time until a shoal of *Clione* and *Limacina* appeared on June 25th. It was fortunate that the pteropods arrived just at this time, and the young *Aurelia* eagerly devoured them and made rapid growth. On July 5th the largest *Aurelia* measured 35 mm. ($1\frac{3}{8}$ inches) in diameter, on the 10th 45 mm., and on the 15th 60 mm. ($2\frac{3}{8}$ inches). A hot spell of weather and scarcity of food soon proved too much for both, and they had to be transferred to formaline on July 18th.

The rearing of the Ephyrae in 1904.

Some of the Ephyrae liberated on March 24th, 1904, were placed in fresh sea-water and given a supply of food. They commenced at once to eat young *Obelia*, and one was seen to have stowed away twenty-five *Obelia* like rows of plates in the stomach cavity and down the arms. Food was rather scarce during April, and the young Ephyrae did not grow much in consequence, but in May, when food became more plentiful, they grew more rapidly. The 12-armed one grew quickly to 30 mm. in diameter, and on June 8th it measured 50 mm. In spite of bad weather and consequent scarcity of food supplies, it reached 70 mm. diameter on June 16th, and its greatest diameter, 85 mm. ($3\frac{3}{8}$ inches) on July 4th.

Food again became scarce, and as the jellyfish was failing rapidly, it was transferred to formaline on July 18th.

The food supply is the only difficulty in rearing *Aurelia*, as it is sometimes impossible to get the food that they like. At first they eat young *Obelia*, *Phialidium*, and small copepods, fish eggs, etc., then small ctenophores, *Pleurobrachia* and *Bolina*; pteropods, both *Limacina* and *Clione*, and big *Calanus*, which are generally fairly common in May.

Above all, they like variety; two or three days with only one kind of food quite upset their digestion.

The temperature of the tank was kept as near as possible to that of the sea.

Pelagia perla (Slabber).

Pl. I., Figs. 2, 3, and Pl. II.

On August 10th, 1903, a large shoal of *Pelagia* appeared in the Harbour along with a huge drift of Blue Salps (*Thalia mucronata*), on which they were feeding.

A large *Pelagia* was captured and ova obtained on August 22nd. Three days after the ova developed into ciliated Planulae. The Planula (Pl. II., fig. 1), has a dark spot at either end and is clear in the middle, and moves about rapidly. On August 27th the shape of the Planulae began to change. The widest, or hindmost end when swimming, became broader, and a ring of small knobs appeared (fig. 2). A dome-shaped inner chamber, the stomach, began to grow upwards from this ring towards the top or foremost end of the Planulae. Next day the circle of knobs began to divide into lobes, eight in number, with a sense organ on each lobe or arm (fig. 3). These were the arms of the future Ephyra. The inner chamber grew higher and the whole animal had become bell-shaped (fig. 4); it was still moving about by means of cilia.

On August 29th it had become quite the shape of an Ephyra, the arms were unfolded and the mouth had appeared in the centre of the hindmost end below the arms. The stomach had almost reached the top of the umbrella, and the whole animal was the shape of an Ephyra with a pointed top (fig. 5). It was still only able to move by means of cilia. Two of the Ephyrae had nine, and two had ten arms; the largest was only 1 mm. in diameter. By September 23rd the largest Ephyra (Pl. I., fig. 2), measured 3 mm. in diameter, it had 4 gastric filaments, a very wide stomach cavity, but no tentacles.

Their food was young *Obelia* and other small jellyfishes, but these were hard to find at this time of year, and, owing to the scarcity of food, the Ephyrae only lived until October 10th.

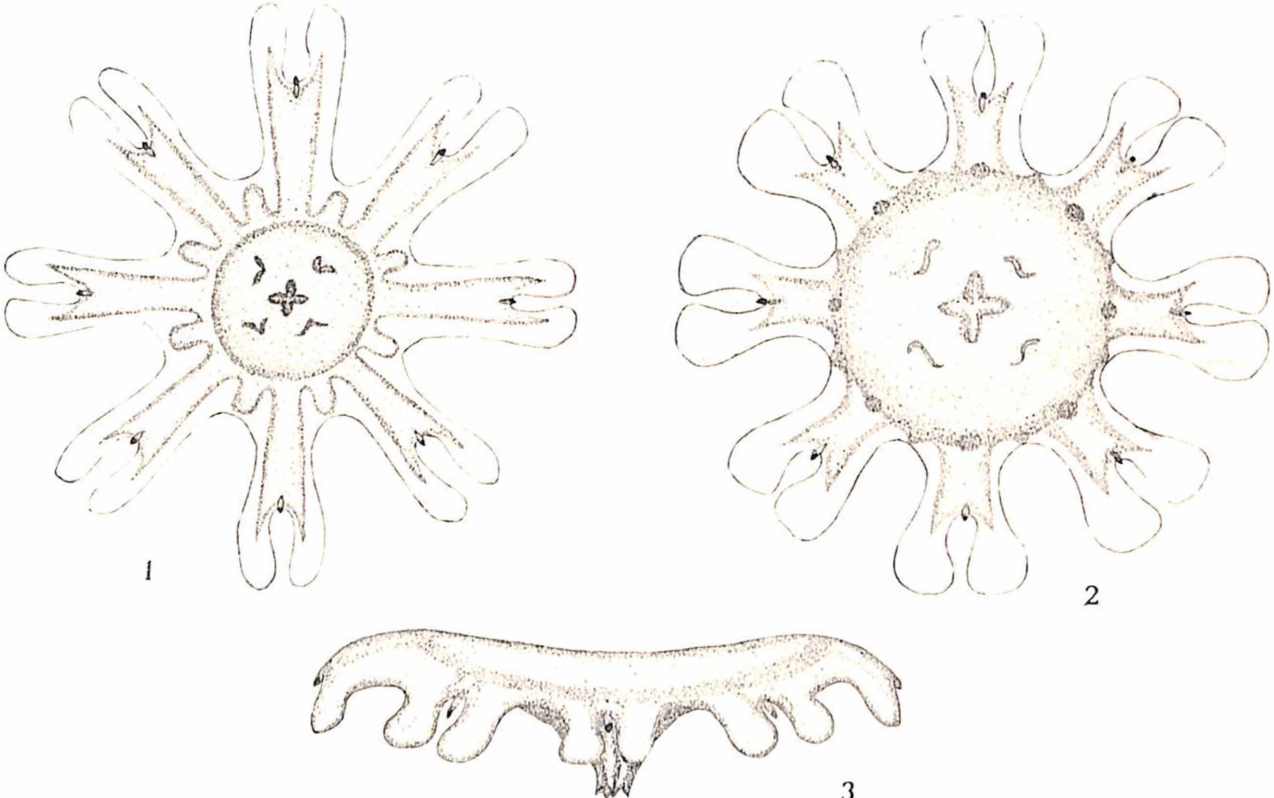
EXPLANATION OF PLATES I. and II.

Plate I.

Fig. 1. *Aurelia aurita*, oral view of Ephyra, × 25.
Fig. 2. *Pelagia perla*, oral view of Ephyra, three weeks old, × 25.
Fig. 3. „ „ lateral view of Ephyra, three weeks old, × 25

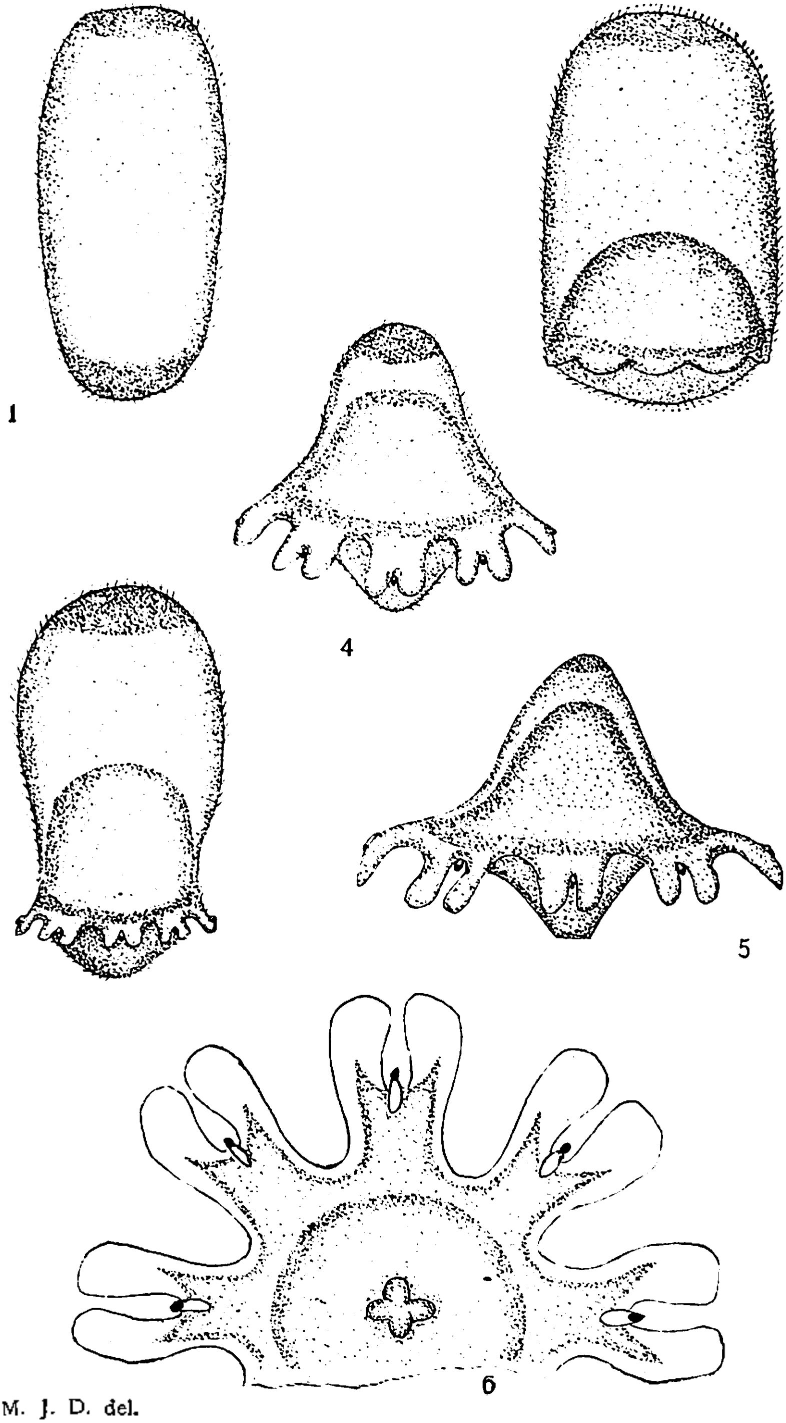
Plate II.

Fig. 1. *Pelagia perla*, Planula, × 100.
Fig. 2. „ „ Planula, second day, × 100.
Fig. 3. „ „ Planula, third day, × 100.
Fig. 4. „ „ Planula, third day, × 100.
Fig. 5. „ „ lateral view of Ephyra, fourth day × 60.
Fig. 6 „ „ oral view of Ephyra, fourth day, × 80.



M. J. D. del.

1. Aurelia aurita. 2, 3. Pelagia perla.



M. J. D. del.

Pelagia perla.

Appendix, No. VIII.

i.—Investigations into the food requirements of brown trout fry in the hatching trough and in the artificial redd, by Dr. Walter Hein, Royal Bavarian Biological laboratory for Fisheries, Munich. (Translation).

ii.—Report on the artificial propagation of Salmonidae during the season of 1905-1906, by E. W. L. Holt.

iii.—Statistical information relating to the Salmon Fisheries.

iv.—Substance of reports received from Clerks of Conservators relative to Salmon Fisheries.

i.—A CONTRIBUTION TO THE BIOLOGY OF TROUT FRY.

Investigations into the Food Requirements of Brown Trout Fry in the Hatching Trough and in the Artificial Redd.[1]

BY

Dr. Walter Hein,

Royal Bavarian Biological Laboratory for Fisheries, Munich.

Plates I and II.

Among practical fish-culturists occupied in rearing trout fry some uncertainty prevails regarding the period at which feeding should be commenced, and very various opinions on the subject are met with.

The belief is widely held that the large yolk-sac carried by the young fish contains food material capable, up to the moment of its complete absorption, of supplying every element requisite to development and health.[2] The yolk-sac is looked

[1] Translated from the "*Allgemeine Fischerei-Zeitung,*" Vol. XXXI., 1906, Nos. 10 and 11, with the kind permission of the Author and of the Editor, by C. Green, B.A.

[2] In lay circles it is commonly supposed that the yolk-sac lies embedded in the intestine, or is surrounded by the latter, in such a way as to prevent the passage of other bodies and so render the taking of food impossible. This would be readily understood, if it were actually the case that fry are unable to take food before the almost complete absorption of the yolk, and it would consequently be not only unprofitable but useless to expend labour on supplying food.

The present opportunity must be taken to combat such a notion. In all bony fishes—among which trout are included—the intestine is developed as a compact thickened ridge on the inner germinal layer, dorsal to the body-cavity. Later, a tubular lumen is formed through the separation of the cells of this ridge and develops into the intestinal canal. There consequently exists at no stage any direct connection between yolk-sac and intestine or stomach. The assimilation of the yolk from the yolk-sac occurs simply and solely through the operation of the blood-vessels which enclose the mass of yolk in a close-meshed network and convey the nutritive substances absorbed there to the parts where they are made use of.

Fisheries, Ireland, Sci. Invest., 1905, *VIII.* [*Published, January,* 1907].

on as a reservoir of nourishment which renders unnecessary any addition from without. The consequence of this assumption is that the fry are left without food in the troughs or watercourses till the yolk-sac disappears, and not till then is artificial feeding begun. Some authors go even further, and would have the supplying of food postponed till some time, as much as two or three weeks, after the final disappearance of the yolk-sac. Others, however, uphold an earlier commencement of feeding, at a stage when vestiges of the yolk-sac can still be plainly seen.[1] They regard it as a hoard of subsistence sufficient only for a short time after hatching, to be gradually supplanted by the fish's independent capture of food.

In the literature of the subject there is no lack of researches and experiments designed to determine the most suitable period for first supplying food to young salmonidae, but these appear, for the most part, to have been undertaken from a single point of view, so that the unavoidable sources of error in one experiment were not exposed by a differently organised line of research.

In order to solve the problem of the proper time at which to begin feeding trout fry, some investigations were undertaken in the Royal Bavarian Biological Laboratory for Fisheries, the results of which are described below. I have to thank the Director, Dr. Hofer, for suggesting this problem, and also the Bavarian Fishery Society for generously placing at my disposal, through the intervention of Dr. Hofer, the material necessary for the investigations.

Answers were sought to the following questions:—

(1.) When are the digestive organs of the fry sufficiently complete to render digestion possible?
(2.) When is the presence of the secretions necessary to digestion capable of being demonstrated?
(3.) When does the young fish begin to seize food?
(4.) What is to be learnt from the history of the fry under natural conditions?

Experiment I.

The brown trout fry selected for the experiment were hatched on the 7th and 8th January, 1906, at the fish farm of the Bavarian Fishery Society at Starnberg, and were sent on the 9th January, 1906, to the Royal Bavarian Fisheries Laboratory, divided there into two lots of 500 each, and placed in shaded tanks with a well-aerated water supply. The temperature of both tanks varied during the period of the experiment between 8·1° and 9° C., and was, within these limits, almost equal.

[1] Oltramare.—La résorption de la vésicule chez les Salmonides. Le moment où il convient de les alimenter. *Bull. Soc. Cent. d'Aquiculture et de Pêche,* Vol. 17, No. 11, 1905, and in "*Le Pêcheur,*" Vol. 16, 1905, &c.

At first the fry, on account of the bulky yolk-sac, lay upon their sides, save for an occasional spasmodic dart in one direction or another, especially when exposed to light; this complete helplessness, however, began to disappear on the 25th-27th January (after about 19 days), and at first a few little fish, in a few days all, began to hold themselves upright on the bottom of the tank, with movements more regular and less awkward than during the first days after hatching. The upright position is achieved with the help of the pectoral fins, which at this period are sufficiently developed to be able to support the body in that position. The young fish then rests on the bottom of the tank on three points: the weight of the body is supported on the ventral surface of the yolk-sac, while the pectoral fins act as props to steady it. The yolk-sac is by this time reduced in girth by about one-third to two-fifths.

As soon as the fry had, in general, assumed the upright position, one lot were fed, while the rest were left to themselves, without artificial food, for daily observation of diseases, losses, and so forth (28th January, 1906).

At first small Daphnidae and Cyclopidae were supplied; then, since living food-material was not to be had in sufficient quantity and was required for other purposes, spleen was substituted (6th February, 1906), and small crustaceans were only given occasionally, along with the spleen, according as the supply allowed.

During the early stages, while the young fish lay for the most part quietly on the bottom, the spleen for feeding was prepared in the following way:—A small portion of spleen was scraped off and wrapped in the corner of a finely-woven cloth, so as to form a little bag, which was then dipped into a glass vessel of water and carefully kneaded and squeezed out; the food material contained in the spleen being thus obtained in a state of exceedingly fine division. Scarcely anything but the blood-corpuscles of the spleen is found in the water, which quickly acquires a deep red colour. If any larger particles escape through the meshes of the cloth, they sink to the bottom of the vessel, and, by carefully pouring out the fluid, can be reserved for feeding somewhat older fish or fry.

The water, reddened with blood-corpuscles from the spleen, was then carefully added to the water in the tank.

As the young fish grew more independent (15th February, 1906), this somewhat troublesome proceeding was replaced by simply dividing the spleen very finely and rubbing it between the fingers.

The method of preparation with the cloth has, especially in experimental work, the great advantage that remnants of food which may putrefy are almost altogether avoided. The unconsumed fragments remain in suspension and are carried off in the course of time through the overflow.[1]

[1] On the 7th and 8th February an unusual number of deaths occurred in both tanks (eight and ten respectively), and investigation disclosed an infection with *Chilodon*, in all probability introduced with instruments and nets which had been used elsewhere.

Daily observations were made, in the first place, of the state of nourishment and of feeding. In this connection more weight was attached to physiological and anatomical examination of the fish itself than to external observation, which, as is well known, leads to contradictory results according to the nature and temperament of the observer.

Whether little fish of the size of fry about twenty-five days old snap at a minute Daphnid or not can be determined beyond doubt at the cost merely of the necessary time; on the other hand, whether their short, impulsive movements are instigated by hunger, as some maintain, or, according to others, simply by the desire for movement, is a question as yet unsolved by scientific observation.

In order to preclude, as far as possible, any illusions in regard to the condition of nourishment the intestine, or rather the whole alimentary canal, of individual fish was examined at short intervals. Preparations easily made under a lens with two needles or a fine pair of scissors and a needle yield very interesting and important information.[1]

The first point to be decided is at what period the alimentary canal is generally in a condition to receive food and to digest it.

As a primary condition to this end it must be determined that the intestine of the fish opens freely at its ends through mouth and vent. Moreover, the secretions which prepare the nutritive material for absorption by the blood must be present, at least in part.

Preparations of quite young, newly-hatched trout fry show, on close examination, that the anus and also the urethra, an organ of very complex development, are fully formed. By simply injecting Prussian blue solution through mouth or anus, it can be very easily demonstrated that, immediately

The infusoria had attached themselves on and under the gill-covers of the fry, and the consequent irritation had produced a copious secretion which, with the particles of spleen caught in it, formed a fertile nidus for fungi. The young fish had, as was evident from the distended mouth, died of suffocation; the fungus-hyphae, mixed with the mucus of the gills, formed a glutinous obstruction which rendered normal respiration impossible.

Examination of the surviving fish likewise revealed the commencement of infection, and a general bath of 2½ per cent. salt solution was applied for half an hour, while the tanks were concurrently treated with strong antiseptics (8th February, 1906).

The young fish stood the treatment quite well except one which, in consequence of advanced Chilodoniasis, died the next day, and further losses through this infection were prevented.

[1] The preparations are best made in a small glass dish, in 0·6 per cent. aqueous salt solution, which does not coagulate the yolk as plain water does. The young fish having been killed by an incision made with a sharp knife in the cranium, which produces immediate paralysis, an opening is carefully made into the body-cavity, on the ventral surface of the yolk-sac. The yolk-sac can then be easily removed—generally without rupturing the membrane inclosing the yolk—and separated from the intestine and from the somewhat more closely adherent liver. On further opening the body-cavity, the conditions about to be described here can be easily reviewed.

after hatching, the intestine is traversable by foreign bodies, since the fluid injected at one opening flows freely through and out at the other.

A few days after hatching, the intestine displays contents of a bright greenish yellow colour, which by gentle pressure can be expelled through the vent. Its colour identifies this substance at once with bile secreted by the liver.

In removing the yolk-sac from the body-cavity there will have been noticed, on the right side and towards the head, a lobed organ clinging somewhat tightly to the yolk membrane. At the root of this organ, the liver, there is found, about fifteen days after hatching, a bladder coloured greenish yellow like the contents of the intestine, and more or less distended : this is the gall-bladder.

Though the colour of the contents of the intestine and the presence of a gall-bladder leave no room to doubt the presence of bile, by which the alkaline intestinal digestion is effected, teased preparations of a series of lower intestines of quite young trout fry with azolithmin prove unquestionably the alkaline reaction of the greenish yellow matter. In these young fish, therefore, at least partial digestion must be possible.

The acid secretion of the stomach necessary to normal digestion cannot be demonstrated in trout fry at this stage with the help of azolithmin, although the fine histological structure of the mucous membrane of the stomach suggests that it may be present, at least in its elements.

For our present purpose it is sufficient to have determined that in newly-hatched fry there is no impediment to digestion, even though the latter may be incomplete and feeble.

If, however, the fry during the first period after hatching in no way utilize their powers of digestion, the cause is apparently to be found in the smallness of their wants and in the great helplessness brought about by the relatively enormous yolk-sac. They live on the food-supply provided in the yolk with the aid of the close-meshed network of blood-vessels spread over the sac.

Returning to the fish themselves—it has already been mentioned that they were first fed with small crustacea on the 28th January; they were then about twenty-one days old (at 8·1°—9° C.).

On the 30th January, 1906, a little fish—one of eight examined—proved to have swallowed a daphnid, as the latter was found in its lower intestine. Although the digestive juices had destroyed the shape of the crustacean, the limbs could be recognised with certainty.

From the 30th January onwards, during the comparatively short time in which crustaceans continued available, I found their remains in three cases in the contents of intestines examined. From the commencement of feeding with spleen (6th February) in almost all the intestines examined it was possible to determine the presence of blood-corpuscles derived from the food. It must, of course, be noted that the period at which the individual fish begin to take food to any considerable extent is spread over some days. Some appear to begin feeding sooner than others. It can, nevertheless, be safely asserted that all the brown trout of the stock investigated and under the methods of feeding employed had begun to feed by the 7th February at the latest.

For the sake of completeness it should be mentioned here that the examination of stomachs and intestines was carried out about fifteen to twenty minutes after feeding each day.

At this stage, now that the fry not only are able to feed, but also, as I assert, require to do so, an illustration will demonstrate more precisely than description the condition of the fish and the state of the yolk-sac. Plate I., fig. 1, has accordingly been prepared from a photograph and is true to life.

With the aid of this picture, and taking into consideration the accumulated temperature, which will be different in different cases, the period at which brown trout fry are capable of feeding can be fairly accurately determined.

The photograph was taken on the 4th February. The fish were 26-27 days old and 22-23 mm. ($\frac{7}{8}$-inch) long. The temperature during the period of their development amounted to about $26 \times 8{\cdot}5$ = about 221 C. day-degrees.

Obviously it is not sufficient for the fish-culturist to have proof of their ability to take food or of the fact that they do so —the establishment of these points leads immediately to the larger question of whether the fry derive benefit from being fed at the earliest possible stage. On this, also, a matter of great practical importance, the present investigation throws some light, though not, of course, affording a final solution.

In the first place it is not easy to find a criterion by which the superficial observer can determine whether the fry which have been fed are healthier or thrive better than those which have not. It is usual to speak of "big-headed" fry, meaning thereby lean, undeveloped or badly-developed fish. If the want of proportion is not conspicuous, and the profile of the head passes without a sharp division into that of the body, the fry are regarded as well nourished. Undoubtedly this distinction is well founded; on the other hand, it must be acknowledged that "big-headedness" can only be recognised as the commencement of a progressive want of nourishment when the young animals have for some time suffered an excess of loss over gain in their physiological economy. If, moreover, the relative degeneration and mortality of the fed and unfed fry remains almost equal, there is nothing for it but to wait and see which section, that dependent for nourishment on the yolk-sac alone, or that which receives food in addition, surpasses the other in after life.

In a comparison, instituted on the 15th February, between the two lots of fry used for investigation, an unprejudiced observer, after viewing carefully the fish which were laid before him in two dishes, was able to distinguish those which had been fed from those which had not; the unfed lot were leaner and more slender, those which had been fed were stronger, more compact, and on an average perhaps somewhat larger. The size of the yolk-sac appeared to be the same in both lots. This observation permitted the conjecture that the difference between the fish, comparatively small to outward appearance, would be more marked in the development of their individual organs.

When the state of development of the organs of a few fish from each section had been compared, it was at once seen that the unfed fish were, in general, unmistakeably inferior. In those which had been fed, the liver was further developed, also the intestine, and in many cases there was even a band of fat along the intestine, while in the unfed fish fatty tissues were hardly to be found.

An organ specially useful for comparison of the condition and state of development of young fry is the air-bladder. It is visible immediately after hatching as a shallow pouch on the dorsal side of the oesophagus, and develops in the course of the yolk-sac period to its final form. This pouch grows slowly backwards between the intestine and the kidneys, forming a tubular appendage to the oesophagus, and gradually, with the appearance of gas in its interior, widens to form the air-bladder.

The first formation of gas in the air-bladder of fish which had been fed could be determined after thirty-eight days. From the forty-fifth day onwards all the specimens examined had that organ more or less distended with gas. At the same time in the unfed fish its development was remarkably less advanced : its general appearance at this stage was that of an empty thick-walled sac, the length of which alone was sufficient to distinguish it from the air-bladder of the fish which had been fed. Naturally the development of the other organs in the young fish of both sections showed differences similar to the above. The air-bladder alone is specially considered here, since its growth in length and, consequent on the secretion of gas, in thickness, can easily be observed in carefully made preparations, and its early or late development, as well as its size at any given time, affords an indication of the state of nourishment of the fry.

In Pl. II., figs. 1 and 2, which are taken from fish of the same age, from the fed and unfed sections respectively, the differences mentioned above are clearly shown. Both specimens were taken without previous selection from among their fellows, and were dissected on the 23rd February, being therefore forty-six days old ($46 \times$ about $8{\cdot}5^{\circ}$ = about 390 C. day-degrees). Besides the especially striking difference in development of the air-bladders, that of the intestines, livers, and gall-bladders is also remarkable. In fig. 2 a line or band of fat is visible along the intestine.[1]

Although the results of the experiments up to this point appeared to lend support to the opinion favouring early feeding of young salmonidae, it seemed of interest to keep the fry under observation for a further period.

[1] In fig. 1 the liver is swung back from its normal position below the intestine, to simplify the view of the organs. It lies normally as in fig. 2.

After the 7th March, the fish which had not as yet been fed, and had grown very thin, were fed at first for five days with spleen-washings, and then, on the 12th March, were united with their contemporaries in one tank, where they were fed daily with minced spleen.

The differences between the young fish reared on the two systems were so great that in mixing them in one receptacle no question of confusion could arise.

The appetites of both lots were, from the moment of their being united, equally good.

On the 16th March a fresh infection with *Chilodon* made its appearance, and it was possible, this time without specially designed examination, to observe that the fish which had not been fed in their younger stages were, almost without exception, inferior to their fellows in power of resistance as well as in size; they died in greater numbers, while of those which had been fed only a few perished through the parasites and their after-effects—an observation which was not made during the previous attack of *Chilodon* on the 7th and 8th February. Baths of salt solution, though not with uniform effects, prevented excessive losses.

Considerations of other experiments compelled the interruption of the observations on the 8th April. The little fish were by this time fairly well developed, and some specimens—taken at random—of the two originally separate lots were photographed. The three upper fish in Pl. I., fig. 2, belonged to the unfed, the three lower to the fed section. The differences arising from the different treatment are sufficiently obvious not to need further description.

To summarise the experiment:—Both lots of fry were hatched from one and the same batch of eggs on the 7th and 8th January, and on the 9th January were transferred to the Royal Bavarian Biological Station for the purpose of the experiment: the material of the experiment was, on the 28th January, 1906, after the fish had assumed an upright position in the water, divided into two equal sections, of which one (to which the upper specimens in Pl. I., fig. 2, belong) was fed on the 7th March, *i.e.*, fifty-eight days after hatching, with spleen-washings and regularly from the 12th March onwards with minced spleen, while the other (to which the lower three specimens in the fig. belong) were fed from the twenty-first day onwards partly with small crustaceans (28th January to about 6th February) and partly with spleen-washings and minced spleen.

On the day when the last photograph was taken the fish represented were ninety days old, those which had been kept longer without feeding being 22-24 mm., the others 27-28 mm. long ($\frac{7}{8}$–$\frac{15}{16}$ and $1\frac{1}{8}$ inch, approximately).

Before we proceed to draw any deductions of theoretical or practical bearing from this investigation, mention must be made of another research, designed to complete, in many respects, the results of the first.

Experiment II.

With the investigation above described of the time to begin feeding young brown trout fry was connected the question of the behaviour of fry under natural conditions.

As is well known, the trout buries its eggs in a previously-prepared bed,—and, indeed, these redds, which, on account of the brightness and cleanness of their pebbles, remain for months more or less remarkable in the bed of the stream, have often been excavated, and eggs have been found in them. Regarding the state of development and condition in which the fry leave the redd,—whether soon after hatching out, with the yolk-sac partly absorbed or as fully formed little fish—observations are apparently wanting, for reasons which will be evident.

Since it was obviously out of the question to seek out a large number of trout-redds in streams and to excavate them, other means were sought to enable the behaviour of fry in the natural state to be observed, at least approximately.

It was to be expected that the alevins or fry would not emerge from their hiding places among the stones and gravel of a river-bed until they were conscious of the desire for food, which they could not obtain among those surroundings. Accordingly, in order to imitate as far as possible the living conditions of the natural redd in a stream, an aquarium supplied with well-aerated water was partly filled with thoroughly-washed gravel and 300 eggs were carefully buried therein.[1]

The brown trout eggs used in the experiment were brought on the 19th February from the hatchery at Starnberg, and half of them were on the same day buried in the artificial redd. The other half were laid, as a control, in a hatching-trough. The water-temperature is the same as in Experiment I., 8·1°—9° C. daily.

The eggs of the control-experiment hatched out, as was to be expected, on the 1st-3rd March,[2] and developed well. No specially remarkable losses occurred.

[1] The aquarium used in the experiment had about 50 × 30 cm. (20 × 12 inches) superficial area, and about 32 cm. (12½ inches) depth of water. The gravel had an average depth of 25 cm. (10 inches), so that beneath the eggs, which were buried to a depth of 15–18 cm., there still lay a layer of gravel 7–10 cm. deep. The eggs were spread over a relatively small area of about 80–90 square centimetres (12½-14 sq. ins.) and the spot noted. The water-supply entered at one end of the aquarium, under the gravel, close to the bottom; the outlet was at the opposite end, at the surface, so that there could be no doubt in regard to good aeration and a plentiful distribution of water to the eggs and fry. Notwithstanding that at least 10 cm. of gravel (at the sides) was interposed between the fry and the light, the aquarium was further darkened.

[2] The experiment being designed for the study of a yolk-sac period passed under natural conditions, it was desired that the alevins should remain no longer than could be helped in the egg: accordingly, eggs were asked for and sent from the hatchery which were fully incubated, but yet so far capable of being transported that no premature hatching was to be feared as a consequence.

As the artificial redd appeared on the 3rd April to be still as lifeless as on the 19th February when the eggs were laid down, while the fry of the control-section (31-33 days old) had already absorbed most of the yolk-sac, there arose a reasonable doubt whether the experiment was going to lead to any result. It therefore seemed advisable to carefully remove the gravel and to see whether, perchance, an attack of fungus or some unwelcome parasites had frustrated the expected result of the natural incubation.

The removal of the gravel was begun near the outlet at the point furthest from the eggs. Scarcely, however, had a few handfuls of gravel been lifted out of the aquarium, when a young trout was seen through the glass under water, startled from his hiding-place by the noise or the vibration unavoidably caused, and swimming excitedly hither and thither among the stones, apparently in search of some more agreeable retreat.

The removal of gravel was immediately abandoned, and presently a second and third, and, after a time, a fourth young trout were observed swimming in the open water above the gravel.

Three specimens of these alevins were captured for comparison with those of the control-section. In order, however, to avoid further interference with the course of the experiment, they were replaced and soon disappeared in the crevices of the gravel.

While the fry of the control-section, kept without food equally with those of the artificial redd, had almost completely absorbed the yolk and had, in consequence of the light to which they were exposed, assumed a dark colour, the fry of the redd had not only a paler colour but also a very considerable remnant of the yolk-sac. The latter were at least as large as the fish of the control-section and gave an impression of greater vigour and liveliness. If any of the fish could at this period be said to be thin, it was among those of the control-section.

On the two following days nothing further was to be seen through the sides of the aquarium: the fry had, apparently, retreated again into the depths of the gravel.

On the morning of the 7th April two young fish were found swimming about gaily in the water above the gravel and snapping at the little air-bubbles which rose slowly in a glistening stream above the water-inlet. A slight shock to the tank caused them to retire hastily among the stones. They emerged again, however, in a short time, and immediately resumed their chase after the air-bubbles. After a few repetitions of the shock, the reaction ceased, the fish appearing accustomed to it. Through the glass it was possible to observe the occasional appearance of a young trout here and there even in the deepest layers of the gravel. They could often be watched lying for hours among the stones or partially in contact with the glass, quite quiet and motionless save for the regular movements of breathing. Now and then one or another would work its way along between the stones and the glass or disappear into the nooks and crannies of the gravel.

Two days later (9th April) there were four little fish swimming about in the open, and the number of those visible through the glass on all sides of the aquarium had considerably increased. Hitherto, no food in any form whatever had been supplied to them, and the washed gravel was apparently, so far as food for the fry or animal life was concerned, absolutely sterile. On the 10th April, accordingly, Daphnidae were introduced into the aquarium, and the free-swimming fry abandoned almost forthwith their interest in the air-bubbles and attacked the minute crustaceans with great avidity. Immediately after the introduction of the food-organisms it could be frequently observed—indeed, I have had the opportunity as many as twelve to fifteen times in a few minutes—that the little fish were able to seize the crustaceans with great precision and without hesitation.[1]

On the following day six or seven little fish had emerged, and a large number lay, as could be seen through the side of the tank, beneath the uppermost layers of gravel. They seemed to have slowly worked their way through the gravel, in search of open water. In some cases they had travelled under the gravel nearly as much as 30 cm. (12 in.) in a straight line from the place where the eggs had been buried, and would perhaps have wandered still further obliquely upwards had not the sides of the aquarium altered their course.

From the 10th April onwards, the control-section was also fed daily—from the 12th April with spleen.

On the 17th April the experiment had to be interrupted. The redd was carefully unbuilt and the gravel removed. An enumeration of the young fish gave 291 quite strong, healthy fry, one deformed (spirally curved), but lively, individual and six dead eggs heavily attacked by fungus, in the depths of the artificial redd. Two eggs, the offspring of which could not be found, may be considered a small experimental loss in view of the quantity of pebbles and stones of greater weight which was handled in building and taking down the redd. The total loss of fry, therefore, during the fifty-seven days of the experiment (which, judged by the control-experiment, may be taken to represent about twelve days before and forty-five days after hatching), reckoning the deformed one as lost, amounted to 3 per cent.

In Plate II., fig. 3, which has been prepared from a photograph, there are three fish taken from the control-section and four from the artificial redd. The photograph was taken on the 10th April, when all the fish were fifty days old. The upper fish, from the control-experiment, averaged 24 mm. ($1\frac{1}{16}$

[1] An "education" of the young fish, in the sense of some authors, up to the rapidity and irregularity of the crustaceans' movements, was, therefore, unnecessary. The moment that their prey appeared for the first time before their eyes, the fish knew what was to be done with it, and they were sufficiently endowed with agility and power of judging distance to enter on the chase nimbly and successfully. It admittedly remains in doubt whether they would have reacted so readily to a supply of artificial food.

inch), the lower, from the gravel, 25·6 mm. (1 in.) in length.[1] The remarkable differences in development of the fish are illustrated in the figure.

At first sight, the results of this experiment with the artificial redd, viz., the late appearance of the fry in the water and their advanced growth in comparison with the hatching-trough fish, will appear strange. They become, however, quite comprehensible when we examine more closely the conditions under which the two sections were reared.

In the hatching-trough, in which we are accustomed to see the fry hatch out and develop, an attempt is made to approximate to the natural conditions of the river-bed. The richly-oxygenated water is delivered to the eggs or alevins in sufficient quantity, and the covers of the troughs prevent light from entering and exercising a continual stimulus on the fish. It is obvious that both eggs and fry should be handled as sparingly as possible, but for many practical and in part quite necessary reasons this can only be effected up to a certain point. Apart altogether from the questions of transport and of counting and picking over the eggs and fry, the inspection and care thereof causes disturbance. Even lifting the cover of a trough, as anyone knows who has ever looked into a trough stocked with fry, gives rise to a panic among the little animals. This is due partly to the shock given to the trough in lifting the cover, partly, and perhaps more particularly, to the sudden admission of light.

It is known that daylight alone has an accelerating effect, though an artificial and therefore quite unsuitable one, on the development of the embryo in the egg; the fish-culturist, when the incubation of the eggs is far advanced and he requires fry as soon as possible, opens the trough and exposes the eggs to daylight in order to hasten the process of hatching. Whether the proceeding is advisable may for the present remain undecided; it suffices to prove that fry on the point of hatching are irritated by light even in the egg and react readily to the comparatively weak illumination possible in most hatcheries.

Later on, the fry swim about in the trough, and with continual exertion crowd together, many layers deep, in the darker corners, being frequently, even daily, disturbed by vibrations and light. All these disturbances, however justifiable and necessary, are nevertheless, it must be remembered, derangements of the life of the organism, at the expense of its strength and endurance, indirectly at the expense of its nutrition and growth.

In the artificial redd, on the other hand, and to a still greater extent in the natural one, these causes of disturbance are, of course, absent, and the embryo has the opportunity of developing in perfect quiet, unaffected by varying light stimuli or vibrations. The fry have no need to expend muscular energy in frantic rushes to the cover of dark corners, they are not irritated by sudden exposure to light, and any serious attempts

[1] Average of twelve of each kind.

at swimming are restrained by the circumstances of their environment. They lie restful and quiet among the stones, utilising the food-material provided in the yolk-sac to build up their constitutions naturally, until the day breaks on which they feel their strength sufficient to make their way, slowly and by easy stages, out of their hiding place in order to begin their predatory existence. The little fish brings with it into the open water a reserve of nourishment in the yolk-sac which lasts until it has found a place of abode where the stream can be exclusively depended upon to supply sufficient food for further progress.

These investigations reveal the reasons why the fry in the hatching-trough absorb the nutritive contents of the yolk-sac more rapidly without more rapid growth, and why they must be placed within reach of artificial food, in order not to be retarded in their development, sooner than those of the same age in the artificial redd.

The young fry, in fact even the eggs, under artificial conditions in the hatching trough are exposed to a most various series of influences and disturbances which increase the fish's consumption of nutritive substance without any advantage to its development or strength. In the artificial redd, and still more in the natural state, the fish has the opportunity of utilising fully the food material with which it is supplied in the yolk-sac, with the least possible waste.

The attempt to find a practical application of the two experiments described above, in view of the demonstration that there is no anatomical or physiological reason why the newly-hatched fry should not take food, and that they did so on the 22nd-23rd day, leads to the following conclusions:—

(1.) Feeding should be begun early. The moment when food is required by the fry is in most cases near to or coincident with the period when they cease to lie on their sides and begin to hold themselves upright. Too early feeding, especially with non-living food, leads to putrefaction of the unconsumed remnants. It is therefore best to begin with the smallest possible rations, in order that none may be left uneaten. The use of spleen-washings proved successful in the experiments, as it left almost no remnants, and what there were could easily be washed away by a timely increase in the water-supply.

(2.) The first experiment also shows that early feeding advantageously influences the development of the alevins (cf. Pl. I., fig. 2), and that the fry are likely to thrive better to an extent which will compensate for the labour and trouble involved.

The second experiment should impress on the fishculturist the necessity of taking care that, along with the most sparing and careful handling of both eggs and fry,

(3.) the fry are kept as peaceful and quiet as possible, and that

(4.) strong and sudden illumination or disturbance, which are a continual drain on the muscular energy of the fry, are reduced to the minimum consistent with proper attention.

The less the alevins are disturbed or annoyed by exposure to light, the more fully they will profit by their yolk-material. While in nature the yolk-sac suffices for the development of the alevin into the little fish, and even after that is at hand to supplement its food, in artificial culture of the trout it is advisable that we should make up for the unavoidable disturbances incident thereto, at least in part, by assisting the fry as early as possible with suitable food.

The fact that fry in the hatching-trough, as was shown, take food after 21-22 days, while those in the redd only proceed slowly to seek it after more than double that time, shows how much artificial influences have deranged the normal course of life of the developing fish. It is for us to remedy the effects of this interference, to minimise its causes, and where obstacles to that end exist to remove them.

EXPLANATION OF PLATES I. AND II.

Plate I.

Fig. 1. Brown Trout fry ready to feed, 26–27 days after hatching (at 8·1°–9° C. water-temperature). × [illegible].

Fig. 2. Brown Trout fry 90 days after hatching. The three upper fish were fed from the 58th day onwards, the three lower from the 21st day. × $\frac{3}{2}$.

Plate II.

Fig. 1. Alimentary canal of an unfed brown trout, 46 days after hatching. The liver, with the gall bladder, is turned back above. × 7.

Fig. 2. Alimentary canal of a brown trout, 46 days after hatching fed from about the 21st day. × [illegible].

Fig. 3. Unfed brown trout fry about 50 days after hatching. The three upper were taken from the hatching trough, the lower from the artificial redd. × $\frac{3}{2}$.

[Plates I. and II.

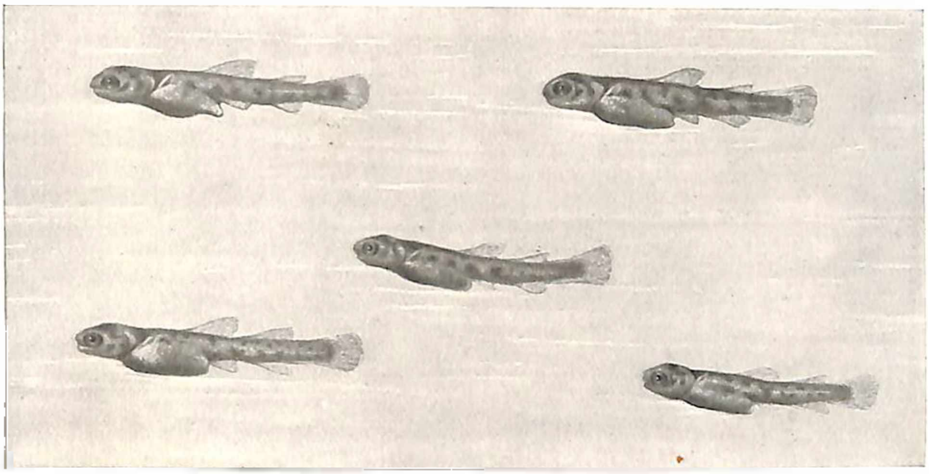


Fig. 1.

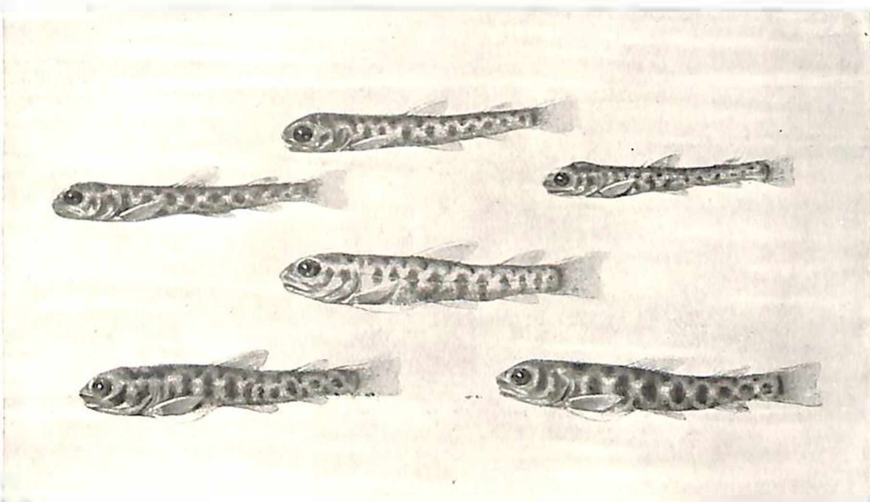


Fig. 2.

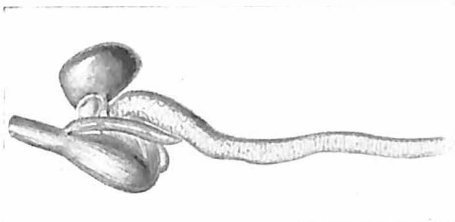


Fig. 1.

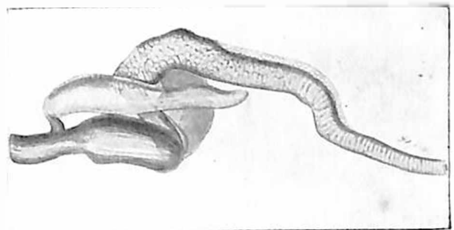


Fig. 2.

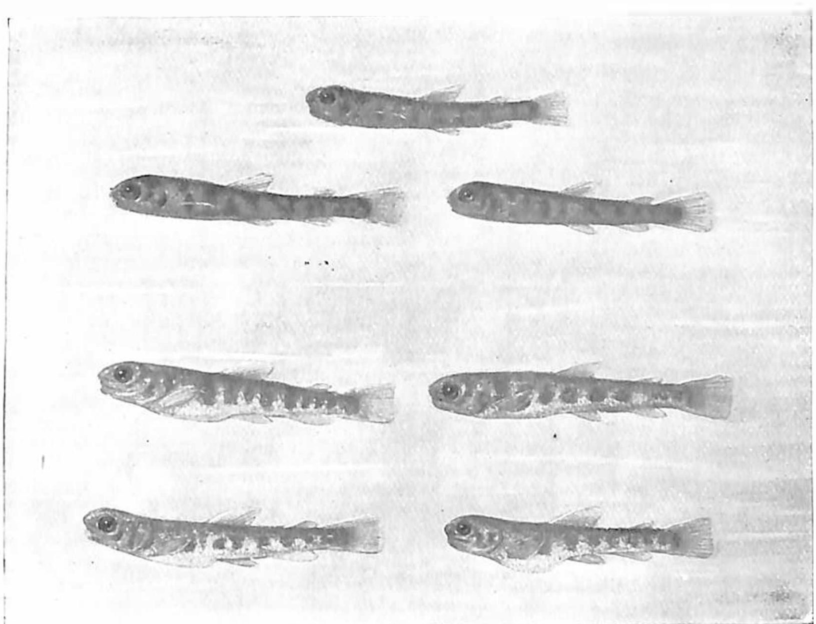


Fig. 3.

ii.—REPORT ON THE ARTIFICIAL PROPAGATION OF SALMONIDAE DURING THE SEASON OF 1905-1906.

BY

E. W. L. Holt.

I estimate the hatchery output for this season at 6,827,750 salmon and 582,000 white trout fry. For brown trout we have record of 381,000 fry, but this is probably short of the total.

The output of salmon fry exceeds the highest in any previous season (1902-1903) by about a million, and is, as usual, largely due to the Lismore and Blackcastle hatcheries.

It may be of interest to recapitulate the annual outputs of salmon fry since 1890, so far as it is possible to ascertain the actual figures previous to 1900. For these earlier years we have only returns furnished by proprietors or managers of the number of ova estimated to have been laid down at their hatcheries, and in some cases it is certain that the method of estimate was productive of very considerable exaggeration, while the only factor which it has been possible to apply is a deduction for ordinary mortality to reduce ova to fry.

The returns for the later years may be taken as substantially accurate, as in the case of all hatcheries of considerable size the numbers have either been calculated on inspection, or means have been found to check the estimates furnished. Any errors in the way of exaggeration are confined to returns so small as not to affect the totals appreciably, and are probably counteracted by moderation in calculating the larger numbers. The system of assisting hatching operations by subsidy and by contribution towards the erection or improvement of hatcheries dates from the season of 1900-1901, and the figures below indicate that it has been successful in increasing the output.

Output of Salmon Fry in Ireland, 1890 to 1906.

Year.	Number.	Year.	Number.
1890-1891, ...	605,400	1898-1899, ...	1,117,860
1891-1892, ...	1,032,000	1899-1900, ...	2,200,400
1892-1893, ...	1,261,000	1900-1901, ...	2,415,400
1893-1894, ...	1,312,200	1901-1902, ...	3,333,500
1894-1895, ...	2,224,000	1902-1903, ...	5,739,000
1895-1896, ...	2,770,550	1903-1904, ...	4,093,600
1896-1897, ...	2,851,600	1904-1905, ...	4,647,500
1897-1898, ...	2,148,400	1905-1906, ...	6,827,750

OUTPUT OF SALMON AND TROUT

HATCHERY.	River System.	All Salmon.	
		1904-5.	1905-6.
Lough Dan, ...	Ovoca, ...	—	—
Newtownbarry, ...	Slaney, ...	—	95,000
Inistioge, ...	Nore, ...	70,000[a]	137,000[a]
Cahir, ...	Suir, ...	31,000	140,000
Lismore, ...	Blackwater, ...	1,387,000[a]	2,033,000[a]
Rockmills, ...	Blackwater, ...	–	244,000[a]
St. Ann's, ...	Lee, ...	—	—
Inishannon, ...	Bandon, ...	—	—
Skibbereen, ...	Ilen, ...	—	35,000
Glenhazel, ...	Kerry Blackwater, ...	25,000	—
Caragh Lake, ...	Caragh, ...	—	—
Killorglin, ...	Laune, ...	140,000[a]	150,000[a]
Killarney, ...	Laune, ...	58,000[a]	65,000[a]
Muckross, ...	Laune, ...	68,000[a]	50,000[a]
Ballinruddery, ...	Cashen, ...	—	35,000
Adare, ...	Maigue, ...	77,600	120,000
Castlerea, ...	Shannon, ...	—	—
Kilronan, ...	Shannon, ...	—	—
Lough Sheelin, ...	Shannon, ...	—	—
Costello, ...	Costello, ...	—	—
Screebe, ...	Screebe, ...	265,500[a]	292,000[a]
Inver, ...	Galway Inver, ...	15,000	15,000
Kylemore, ...	Dawros, ...	130,000	—
Ballysodare, ...	Unshin, ...	30,000	65,000
Bundrowes, ...	Drowes, ...	400	65,000 (g)
Belleek, ...	Erne, ...	124,000[a]	336,000[a]
Glenties, ...	Owenea, ...	173,000	38,500
Dunglow, ...	Dunglow, ...	—	—
Newtownstewart, ...	Foyle, ...	240,000[a]	692,000[a]
Kilrea, ...	Bann, ...	468,000[a]	560,000[a]
Lough Neagh, ...	Bann, ...	—	—
Blackcastle, ...	Boyne, ...	1,345,000[a]	1,660,250[a]
TOTALS, ...	—	4,047,500	6,827,750

[a] Estimated by Officers

Fry in Ireland, 1904–5 and 1905–6.

Foreign Salmon.		White Trout.		Brown Trout.		Remarks.
1904-5.	1905-6.	1904-5.	1905-6.	1904-5.	1905-6.	
—	—	—	—	12,000	6,000(a)	(a) From Howietoun, also 6,000 from Killarney.
—	—	—	—	—	5,000(b)	(b) Lochlevens.
—	—	—	—	—	—	
—	—	—	—	—	—	
—	—	—	—	—	—	
—	—	—	—	—	—	
—	—	—	—	5,000	4,000	
—	—	—	—	75,000(c)	150,000(c)	(c) Including 25,000 and 50,000 Lochlevens.
—	35,000(d)	—	—	—	—	(d) From Weser.
—	—	—	—	—	—	
—	—	—	—	40,000	—	
—	80,000(d)	—	—	—	—	(d) From Weser.
—	—	—	—	—	12,000	
—	—	—	—	—	—	
—	35,000(d)	—	—	—	—	(d) From Weser.
—	—	—	—	137,080	100,000(e)	(e) 30,000 Itchen, 50,000 Lochleven cross. Yearlings from Inishannon.
—	—	—	—	1,500	—	
—	—	—	—	2,500	6,000	
—	—	—	—	—	10,000(f)	(f) From Inishannon.
—	—	320,000	310,000	—	—	
—	—	65,000(g)	65,000(g)	—	—	
—	—	135,000	117,000	—	—	
—	—	—	—	—	—	
30,000	40,000(d)	—	—	—	—	(d) from Weser.
—	—	—	—	—	—	(g) 6,000 from Scotland.
—	—	—	—	—	—	
—	—	—	—	—	—	
—	—	60,000	60,000	—	—	
—	—	—	—	—	—	
—	—	—	—	—	—	
—	—	—	—	75,000	78,000	
—	—	—	—	—	10,000	
30,000	190,000	580,000	582,000	348,080	381,000	

of the Department.

Of even more importance, perhaps, is the increased attention that has been paid to the proper planting of the fry. Further care in this respect is still desirable, for the importance of getting the alevins into suitable waters as soon as they require food is not so well recognised as it should be. The fry, it seems, can feed from the time they cease to lie on their sides, and they certainly require food as soon as they leave the bottom of the hatching apparatus and begin swimming about, though this happens some considerable time before the yolk is fully absorbed. There is, of course, risk in transporting the fry to distant streams while the yolk is still large; but any time after the fourth week from hatching they appear to be fit to travel, and every one of them ought to be out before the completion of the sixth week.

Where there are good fry grounds, reasonably free from trout and other enemies, quite near to the hatchery, there would seem to be no risk in stocking them with fry of less than four weeks, and where floating redds are used in the streams intended to be stocked the possibility of damage in transport does not, of course, arise.

Any efficient feeding of fry in hatching boxes or floating redds is hardly practicable where large numbers are dealt with, as it is an operation requiring the skill and care of a larger staff than can usually be employed.

The season of 1905-1906 was very much like the last in its relation to natural and artificial propagation. The rivers generally were low, and the smaller tributaries accordingly not accessible to breeding fish. The effects of such water conditions were discussed at some length in my last report.

A small hatching station has been established at Ballinruddery, on the Feale, and the Department is indebted to Mr. Finch-Hatton for kindly undertaking the duties of management. It was stocked with salmon ova from the Weser.

At Lough Sheelin the local association started trout-hatching operations on a modest scale with 10,000 ova derived from the Munster trout farm at Innishannon. The object was the introduction of fresh blood, and as the association at the same time took means, by policing the tributaries, to safeguard the interests of the native stock, it may be hoped that the fishery will improve.

The Department have commenced salmon-hatching operations, under the immediate control of their officers, at Rockmills, on the Funshion, a tributary of the Cork Blackwater. At this place there is a weir under which it is not difficult to take fish, and in effect if the conservators' bailiffs prevented poaching at this point the only result was to let the objects of their care pass into streams of the Galtee ranges where their protection is impossible, and where, as would seem from the paucity of either smolts or returning slats, they came to a bad end.

The object of the hatchery is to obtain some return in fry from these fish which would otherwise go to waste, and to utilise the fry in part for the stocking of the Funshion head-waters, and in part for streams in other districts, as may seem to be desirable. The slats, after stripping, are impounded until a flood assures their safe descent to the main river.

The hatching apparatus consists entirely of floating redds moored in the head-race of the Rockmills mill, which is not working at present. The redds are accessible by means of planks laid on cross-beams. It appears from our experience of the first season's working that ova laid down in floating redds give much the same result as if laid in hatching boxes, provided that the redds receive the same attention as the boxes. Naturally, the care of a box raised on trestles to a convenient height in a covered building entails less discomfort than that of a redd, to reach which the attendant has to kneel on a plank a few inches above water level, without any sort of protection from the weather; but as between the redd system and the Kerry system of boxes laid on the ground in the open, there is not a great deal of difference in the matter of comfort.

We did not secure many ova at Rockmills, partly because the season was altogether exceptional in the practical absence of floods in the Funshion, and partly because the holding ponds were not finished in time, and failed to hold some of the fish taken at the weir. We had supposed that a grating of rods set two inches apart would hold any spawning salmon, but a fish of at least 7 lbs. was seen to pass without much effort through such a grating, and for next season's work all grating apertures have been reduced to one inch. Apart from the nuisance of losing fish which we had been at some pains to capture, the inadequacy of the gratings was probably the cause of a rather heavy mortality of slats from "fungus," to the attack of which they had been rendered liable by scratches contracted in trying to squeeze through bars not sufficiently close to preclude all hope of such enterprise.

We also gained some exact knowledge of the number of ova which can safely be placed in a floating redd, if the fry are to be left there until they are old enough to be set free. In a hatching box, with an ample supply of water controlled by a tap, some degree of over-crowding is remediable by turning on the tap, so long as the flow be not sufficient to upset the ova out of the trays or to carry the fry down against the outlet screen. In a redd, however, the flow must not be strong enough to agitate the apparatus or the ova will be spilled out of the trays and smothered in the silt which inevitably accumulates at the bottom of the apparatus; and though some degree of agitation would probably do no harm to alevins, there will almost always be in the same redd-pond some redds which contain ova, so that the flow allowed to all must be only that which suits the requirements of the apparatus which contains the stock most liable to injury by disturbance.

It follows that the flow through a redd-pond must be very gentle, and the weakness of current greatly facilitates the choking of the perforations of the zinc ends and sides of the redd by silt as well as by the growth of algoid matter. Given such obstruction, the constant removal of which is not easy to secure by supervision of the operations of the attendant, and given, as in the case of the latter part of the past hatching season, sharp frost by night and intense sunshine by day, it is obvious that the water in the redds may become subject to rather violent changes of temperature, which salmon fry are not, by the circumstances of their evolution, too well fitted to endure. In the Rockmills redd-pond the surface flow was, but is no longer, interrupted by the cross-beams bearing the platform planks, with the result that the surface of each division of the pond was practically dead water in calm weather. The redds which contained the ova taken at Rockmills were lightly stocked, and, as stripping took place early, the fry were disposed of without any serious loss before Easter, a season which was characterised by the alternation of frosty nights and sunny days already mentioned. During this time the pond was occupied by redds containing the latest products of the Lismore hatchery, and the mortality was certainly excessive. *In initio* this seems to have been due to overcrowding of the trays and to some neglect in clearing out dead ova, a difficult operation when several layers are present; and although the weather, and circumstances of the pond, were undoubtedly most unfavourable, I believe that the effects would have been much less serious if the redds had contained a more easily manageable stock. My conclusion is that the utmost care should be taken to prevent the choking of the perforated zinc of the redds and to secure an even flow through all parts of the redd-pond, and that the trays should not be stocked with more than a single and not too close layer of ova. The removal every day of all dead ova or fry is, of course, indispensable, and if sediment has accumulated at the bottom of the redd, it should be cleared out shortly before the ova are due to hatch. After the fry are hatched and turned out of the trays their movements appear to be sufficient to prevent silting.

Experience has shown that the open-work form of lid used in the original Sandfort pattern of redd illustrated in the treatise on hatchery apparatus (Rep. Fisheries, Ireland, 1901, Pt. II., App., No. XIV.) is better replaced by solid lids not permeable to the sun's action. This and other modifications of apparatus will be dealt with in a new edition of the treatise, which Mr. C. Green has in hand.

The little hatchery at Skibbereen, idle during two seasons for reasons which do not here concern us, has been removed to a new site, and was stocked, as in former years, with ova from Germany. Mr. O'Shea appears to have devoted great attention to their care and to the distribution of the fry.

Owing to the scarcity of late-run fish great difficulty was experienced in stocking the hatcheries of the Laune system, and as German ova were exceptionally cheap, the Department purchased 80,000, which were committed to Mr. Power's care, and hatched with very little loss.

So far the Department has had little opportunity of assisting in the artificial propagation of white trout, as these are chiefly cultivated in hatcheries which the proprietors have preferred to conduct at their proper charges. In fact the only public contribution has been that involved in the enlargement of the Screebe hatchery, from which Mr. St. George annually turns out a large number of white trout as well as salmon fry, though the subsidy is limited to the latter.

Having regard to the habits of white trout, in so far as they are known, and to the circumstances of the white trout fisheries, it is in general difficult to prove such a public interest in the capture of this fish as would justify the expenditure of public money on their propagation. More or fewer of them are, no doubt, taken in the sea, accidentally and perhaps otherwise by nets not licensed *ad hoc*, but it is hardly possible to recognise in these captures the exercise of a public right of fishery. There are, however, cases in which valuable, or valued, rights of white trout angling are exercised by the public without hindrance or imposition of payment by the riparian proprietors, and in such cases the Department is not precluded from contributing to the up-keep of the stock. Such conditions are presented by the fishery of Lough Currane at Waterville, and negotiations are in progress for the establishment at Waterville of a salmon and white trout hatchery designed for an annual output of 500,000 salmon and 400,000 white trout fry.

The works in connection with the Aasleagh salmon hatchery, on the Erriff, in Co. Mayo, are in a forward state, and should permit of the commencement of operations next season.

Unexpected difficulties have been met with in the case of the proposed hatchery at Carlow, and it is doubtful whether a solution will be found in time to admit of a start next winter.

Negotiations are in progress in respect to the establishment or improvement of hatcheries at several other places, but are not so far advanced as to justify their discussion in this report.

The amount expended by the Department during the past year on constructional or capital purposes was about £125, while the subsidies, with some minor contributions for annual purposes, amounted to about £550. The total amounts spent during the six years of the Department's existence are—for capital purposes about £1,230, and for annual purposes about £1,815.

III.—STATISTICAL INFORMATION RELATING TO THE SALMON FISHERIES.

By the courtesy of the gentlemen whose names appear below, it is possible to give the following Returns in continuation of those which appeared in our Reports for 1900-1904, and in the Report of the Irish Inland Fisheries Commission (Appendix, Part II., xxiii.) :—

PERCENTAGES OF TAKE ABOVE AND BELOW AN AVERAGE FOR TWENTY-FIVE YEARS ENDING 1899 :—

Blackwater, Lismore. { Mr. R. FOLEY. Mr. J. GODFREY.

1904. . . .	50 per cent. below.
1905, . . .	50 ,, ,,

Mr. Godfrey reports that in 1905 the salmon were 55 per cent., and the grilse 72 per cent., below the average of nine years ending 1899. The killing hatch in Lismore weir was kept open during February, March, and April of 1904 and 1905.

Blackwater, Co. Kerry. Mr. R. M'CLURE.

1904, . . .	82·8 per cent. below.
1905, . . .	84·7 ,, ,,

Waterville, Co. Kerry. Mr. W. J. DELAP.

1904, . . .	41·6 per cent. below.
1905, . . .	54·3 ,, ,,

Laune, below Killorglin Bridge. Mr. R. POWER.

1904, . . .	47 per cent. below the average of the twenty-four years ending 1898.
1905, . . .	57 per cent. below ditto.

Mr. Power notes that the decrease was almost altogether in peal, the catch in July not being one-tenth of normal. The fishing was as bad in the sea as in the estuary, and no local cause was apparent.

Lax Weir (including weir and nets), Shannon.		Mr. J. A. Place.
1904,	. . .	57 per cent. below the average of the twenty-three years ending 1899.
1905,	. . .	25 per cent. below ditto.
Bann Nets.		Mr. T. M'Dermott.
1904,	. . .	8·5 per cent. below.
1905,	. . .	27 ,, ,,
Foyle Nets.		Mr. T. M'Dermott.
1904,	. . .	6·5 per cent. below.
1905,	. . .	51·5 ,, ,,
Erne Nets.		Mr. T. M'Dermott.
1904,	. . .	65 per cent. below.
1905,	. . .	34 ,, ,,
Erne Angling.		Mr. T. M'Dermott.
1904,	. . .	32 per cent. below.
1905,	. . .	22 ,, ,,
Moy Tidal.		Mr. J. Garvey.
1904,	. . .	45 per cent. below.
1905,	. . .	40 ,, ,,

Mr. Garvey notes that the run of spring fish and first run of grilse indicated fair prospects for the season, but about the middle of June the fishing fell off completely. The drought was very severe from end of May to close of season, and the Moy and its tributaries were so low that fish would not come forward, and even when they came into the estuary they as suddenly fell out to sea again. Remark is also made of the increase of drift nets on the Donegal and Sligo coasts.

Other Returns.

Blackwater.—Dromana Fishery. Mr. Villiers Stuart.

—	Salmon.	Peal.	Total.
1904, ...	426	386	812
1905, ...	270	441	711

Castleconnell Angling. Messrs. JOHN ENRIGHT & SON.

—		Salmon.		Peal.		Total for Season, Salmon.	Total for Season, Peal.	Total.
		1st Feb. to 31st May.	1st June to 31st Oct.	1st Feb. to 31st May.	1st June to 31st Oct.			
Worldsend and Erinagh.	1904	23	5	—	2	28	2	30
	1905	17	2	—	9	19	9	28
Newgarden,	1904	26	3	—	34	29	34	63
	1905	26	3	—	61	29	61	90
Summerhill and Castle.	1904	37	12	—	13	49	13	62
	1905	40	7	—	13	47	13	60
Woodlands,	1904	10	4	—	3	14	3	17
	1905	20	2	—	2	22	2	24
Doonass,	1904	54	11	—	30	65	30	95
	1905	3	3	—	18	40	18	58
Hermitage,	1904	31	2	—	17	33	17	50
	1905	26	4	—	30	30	30	60
Landscape,	1904	8	—	—	—	8	—	8
	1905	9	—	—	—	—	—	9*
Prospect,	1904	20	3	—	20	23	20	43
	1905	26	7	—	32	33	32	65

* To 31st May only.

Messrs Enright remark:—"The waters were not fully fished, and there was very little fishing done in the autumn."

Suir.—Cahir Park and Neddin's Water. Mr. W. ROCHFORT.

Cahir Park—1904, 48 salmon, weighing 606 lbs.
1905, 49 ,, ,, 666¼ ,,

Neddin's Water—1904, 46 ,, ,, 730 ,,
1905, 24 ,, ,, 384 ,,

Waterville Salmon Fishery. Mr. W. J. DELAP.

—	Jan. 1st to 15th.	Jan. 16th to 31st.	February.	March.	April.	May.	June.	July.	Total.
1904, ..	65	30	67	40	47	29	68	31	367
1905, ..	23	26	23	41	22	14	12	18	287

RETURN OF IRISH SALMON FROM BILLINGSGATE.

Mr. J. Wrench Towse.

—	Number of Boxes of Irish Salmon.		Average Price per lb.		Number of Boxes from all sources.*	
	1904.	1905.	1904.	1905.	1904.	1905.
			s. d.	s. d.		
January ..	42	37	4 2½	4 0	112	82
February ..	238	432	2 3	2 1	918	996
March	481	463	2 3½	2 6½	1,527	1,481
April, ...	711	787	2 1¼	2 3	2,145	1,911
May, ...	964	1,114	1 0	1 6¼	3,267	3,665
June, ...	1,916	2,267	1 5½	1 4	5,768	6,803
July, ...	1,941	800	1 2¼	1 2½	8,610	7,152
August, ..	232	59	1 5¼	1 4	3,377	2,745
September, ..	3	—	2 0	—	427	567
October, ...	—	—	—	—	41	48
November, ..	—	—	—	—	25	50
December, ..	—	—	—	—	47	98
	6,528	5,979	—	—	26,264	25,607

* Including English, Scotch, Irish, Dutch, Norwegian, French, Danish, and Canadian.

iv.—SUBSTANCE OF REPORTS RECEIVED FROM CLERKS

DISTRICT.	What is the general state of the Salmon Fisheries in this District? Are they as a rule improving or declining?	
	1904.	1905.
Dublin, ...	Fair; about the same as last year, ..	No improvement, ...
Wexford, ...	Improving, ...	Declining, ...
Waterford, ..	Fairly satisfactory; improving, ..	Satisfactory, ...
Lismore, ...	Good; improving, ...	Improving, ...
Cork, ...	Fairly good; slight improvement, ..	Fairly good. About the same as last year,
Cork (Bandon), ..	Fair; showing tendency to improve, ..	Fair. Improving, ...
Skibbereen, ..	Very poor; great falling off from last year.	Declining, ...
Bantry, ...	Bad; declining, ...	Bad. Declining .. .. ..
Kenmare, ...	Very bad; declining, ...	Very bad; declining, ...
Waterville,	Fairly good; improving, ...	Only fair; if anything, declining, ..
Killarney, ..	Poor; not improving, ...	Poor; not improving, ...
Limerick, ..	Unsatisfactory, especially for peal—worse than the average of preceding years.	On the whole not up to average, ..
Galway, ...	Not so good as last year either as to supply or capture.	Not at all good; slight improvement on last year.
Connemara, ..	Fair; improving, ...	Fair all round; improving a little, ..
Ballinakill, ..	Very bad; declining, ...	Bad; slightly better than last year, ..
Bangor, ...	Very bad; declining, ...	Very bad; declining, ...
Ballina, ...	Very bad, ...	Very bad; declining, ...
Sligo, ...	Fairly good; inclined to improve, ..	Fairly good; slight improvement, ..
Ballyshannon, ..	Not so good in the estuaries; sea fishing better.	A good deal better than last year; as a rule improved.
Letterkenny, ..	Prospect very fair; no remarkable change,	Prospect very fair; an apparent change for the better in some rivers.
Londonderry, ..	Fair; about average, ...	Not good; declining, ...
Coleraine, ...	Improving, ...	Declining, ...
Ballycastle, ..	Improvement, ...	As a rule on the decline, ...
Dundalk, ...	Fair; not so good for angling, but better for netting.	Satisfactory generally · improving ..
Drogheda,.. ..	Fair; improving, ...	Declining, ...

OF CONSERVATORS RELATIVE TO SALMON FISHERIES.

Has the take of Salmon and Grilse by nets and weirs throughout the district been more or less productive in the present year than in the past one? 1904.	1905.	DISTRICT.
More spring fish taken, but much less Grilse.	Less, ...	Dublin.
More Salmon; less Grilse, ...	Less by nets, ...	Wexford.
Somewhat less productive, especially as regards Grilse.	Salmon—more as regards nets; Grilse—less as run did not occur before end of open season.	Waterford.
The take of Salmon very good; the take of Grilse poor.	Take of Salmon good; take of Grilse very poor.	Lismore.
Less; little or no Grilse taken by nets ..	Less, ...	Cork.
About the same, ...	Salmon, more; Grilse, less, ...	Cork (Bandon).
Less productive, ...	Less, ...	Skibbereen.
Less productive, ...	Less, ...	Bantry.
Less productive in present year, ..	Less, ...	Kenmare.
Net fishing poor in consequence of inclement weather; weir much improved.	Less, ...	Waterville.
Less productive, ...	Less, ...	Killarney.
Take of Salmon something less, but that of Grilse enormously less.	Salmon—more; Grilse, season very unsatisfactory, but on the whole better than last year.	Limerick.
Less productive, ...	Slightly more, ...	Galway.
—	—	Connemara.
Very much less productive, ...	A little more, ...	Ballinakill.
Very much more productive, ...	Very much less, ...	Bangor.
Considerably less productive, ...	About the same, ...	Ballina.
About the same, ...	Slightly on the increase, ...	Sligo.
Less in the rivers, ...	More, ...	Ballyshannon.
Very much more productive, ...	Less, ...	Letterkenny.
Somewhat less productive, ...	Less, ...	Londonderry.
More productive, ...	Less, ...	Coleraine.
More productive, ...	Very changeable. Some better than last year, some not so good.	Ballycastle.
More productive, ...	More in Dee and Glyde. Less in Castletown River.	Dundalk.
More productive; marked increase, ..	Less, ...	Drogheda.

SUBSTANCE OF REPORTS received from CLERK

DISTRICT.	Has the take of Sea Trout by nets and weirs been more, or less, productive this year than in the past one?	
	1904.	1905.
Dublin, ...	More productive, ...	Less, ...
Wexford, ...	Less productive, ...	Less by nets, ...
Waterford, ..	No record of any Sea Trout taken in this District.	No record of take of Sea Trout, ..
Lismore, ...	More productive, ...	Very poor, and a small class of fish, ..
Cork, ...	Less, ...	None taken in this District, ...
Cork (Bandon), ..	About the same, ...	None taken, ...
Skibbereen, ..	About the same, ...	Less, ...
Bantry, ...	More productive, ...	Less, ...
Kenmare, ...	No netting for Sea Trout in the district,	No netting for Sea Trout in this District,
Waterville, ..	Net fishing poor in consequence of inclement weather; weir much improved.	About the same, ...
Killarney, ..	No nets or weirs for capture of Sea Trout in District.	No nets or weirs for capture of Sea Trout in District.
Limerick, ...	None taken in Shannon for commercial purposes.	None taken in Shannon, ...
Galway, ...	About the same, ...	More, ...
Connemara, ..	—	—
Ballinakill, ..	Very much less productive, ...	More, ...
Bangor, ...	Less productive, ...	Less, ...
Ballina	An average, ...	Same as last year, ...
Sligo, ...	Better this year, ...	Much more. Owing to low water in July and August fish could not get to fresh water.
Ballyshannon, ..	More productive in River Erne, ..	A good deal more, ...
Letterkenny, ..	Much more productive, ...	No apparent change, ...
Londonderry, ..	Somewhat less productive, ...	No change, ...
Coleraine, ...	No perceptible difference, ...	About the same, ...
Ballycastle, ..	About the same, ...	Very few taken .. .. ..
Dundalk, ...	About the same, ...	Less generally, ...
Drogheda, ..	Less productive by one-half, ...	Less, ...

of CONSERVATORS relative to SALMON FISHERIES—*continued.*

Has any peculiarity been observed in the date which fish have appeared in the rivers this season? 1904.	1905.	DISTRICT.
No Grilse were taken in July, ..	——	Dublin.
Grilse were late, ...	——	Wexford.
No, ...	No, ...	Waterford.
No, ...	No, ...	Lismore.
None, except some Spring Salmon observed in December.	No, ...	Cork.
No, ...	No, ...	Cork (Bandon).
Yes: Salmon appeared this year in April,	Numerous fish in September, ...	Skibbereen.
No, ...	No, ...	Bantry.
No, ...	No, ...	Kenmare.
No, ...	Sea Trout appeared rather earlier than usual.	Waterville.
No, ...	No	Killarney.
No, ...	Peal fishing began well and early, but completely collapsed by June 20th—a month earlier than usual.	Limerick.
Grilse commenced to run earlier than usual.	No, ...	Galway.
No, ...	No, ...	Connemara.
No, ...	No, ...	Ballinakill.
No, ...	No, ...	Bangor.
No, but the Grilse came in small and poor condition.	First run of Grilse good, but fishing fell off hopelessly afterwards.	Ballina.
No, ...	No, ...	Sligo.
Yes; appeared later, ...	Yes. A little earlier, ...	Ballyshannon.
No, ...	No, ...	Letterkenny.
No, ...	Run of breeding fish later than usual ..	Londonderry.
No, ...	No, ...	Coleraine.
An earlier run of Spring fish appeared in the Bush than usual.	No, ...	Ballycastle.
No, ...	No, ...	Dundalk.
Runs poor in February and March, ..	Later than in previous season ..	Drogheda.

SUBSTANCE OF REPORTS received from CLERKS

DISTRICT.	Between what dates did the principal migration of Smolts take place? Was it larger or smaller than usual? 1904.	1905.
Dublin, ..	May and June. Not larger than usual,	April 28 and June 20. Smaller, ..
Wexford, ...	March, April, and May. About same as last year.	April and May. Average, ...
Waterford, ..	Early part of April and May, Larger,	March, April, and May. Larger, ..
Lismore, ...	From middle of March to end of April. Larger than usual.	Middle of March to May. Larger, ..
Cork, ...	Between middle of March and 1st May, .. Larger.	March 17 to April 12. Average, ..
Cork (Bandon), ..	25th March and 4th May. Larger, ..	April 12 to May 10. Larger, ...
Skibbereen, ..	10th April and 10th May. Same as usual,	About May 1. Smaller, ...
Bantry, ...	April and May. As usual.	April and May. Smaller, ...
Kenmare, ..	March and April. Cannot say, ..	March and April. Cannot say, ..
Waterville, ..	April and May. Larger, ...	April 15 to May 15. Larger, ...
Killarney, ..	March to May. About same, ...	March, April, and May. About same, ..
Limerick, ...	April and May. Up to usual average, ..	April 15 to May 15. Probably larger, ..
Galway, ...	April and May, ...	April and May. Much larger, ..
Connemara, ..	April to May. About the same, ..	April and May. About the same ..
Ballinakill, ..	Cannot ascertain, ...	Cannot say, ...
Bangor, ...	End of April and May, ...	April 20 to June 20. Up to average, ..
Ballina, ..	April and May. Smaller, ...	April and May. Smaller, ...
Sligo, ...	April, May, and first week in June. More numerous.	May 7 to 28. Immense quantities, ..
Ballyshannon, ..	Middle of April to end of May. Larger,	Middle of April to end of May. About the same.
Letterkenny, ..	Could not be ascertained, ...	Cannot say, ...
Londonderry, ..	1st April to 15th June. About the same,	April 1 to middle of June. About the same.
Coleraine, ...	1st April to end of June. Larger, ..	April 1 to July 1. Much larger, ..
Ballycastle, ..	Rivers are generally clear before end of June. Larger.	End of May and beginning of June. About the same.
Dundalk, ...	May. No change, ...	April and May. Larger in Dee and Glyde. No change observed in other rivers.
Drogheda, ..	April and May. Average, ...	April and May. About the same, ..

of CONSERVATORS relative to SALMON FISHERIES—*continued.*

Has there been observed more than one migration of Smolts to the sea during the season? If so, state dates when these migrations took place. 1904.	1905.	DISTRICT.
Not this year, ...	No, ...	Dublin.
No, ...	One more, ...	Wexford.
No.	Yes. On the Suir in June, ..	Waterford.
No, ...	No, ...	Lismore.
No, ...	No, ...	Cork.
No.	No, ...	Cork (Bandon).
No, ...	No, ...	Skibbereen.
No, ...	No, ...	Bantry.
No, ...	No, ...	Kenmare.
No, ...	No, ...	Waterville.
No.	No, ...	Killarney.
Yes; there is an Autumn run, chiefly in September	Yes. There is an Autumn run, ..	Limerick.
Yes; small run in October, not as numerous as usual.	Yes. Small migration in September and October.	Galway.
No	No, ...	Connemara.
—	—	Ballinakill.
No, ...	Yes; April 20, May 12, and June 20, ..	Bangor.
Smolts were not observed to any extent,	—	Ballina.
Yes: about end of August, ...	Yes; May and end of September. Very few in latter month.	Sligo.
No, ...	No, ...	Ballyshannon.
No, ...	No, ...	Letterkenny.
Yes; cannot give dates, ...	Several migrations observed in the Summer—dates not recorded.	Londonderry.
Several migrations with each flood from 1st April to end of June.	Several migrations, the principal was that in the last week of April.	Coleraine.
No, ...	No, ...	Ballycastle.
No, ...	No, ...	Dundalk.
Yes; the run continued for some time in June.	No, ...	Drogheda.

SUBSTANCE OF REPORTS received from CLERKS

DISTRICT.	In your opinion was the weather favourable or (1). To Netting.	
	1904.	1905.
Dublin, ...	Favourable, ...	Favourable, ...
Wexford, ...	Unfavourable, ...	Favourable, ...
Waterford, ..	Favourable, ...	Generally favourable. Unfavourable to drift nets in estuary owing to fine weather.
Lismore, ...	Favourable, ...	Favourable; February to May, ..
Cork, ...	Unfavourable, ...	Favourable on the whole, ...
Cork (Bandon), ..	Favourable, ...	Favourable, ...
Skibbereen, ..	Unfavourable, ...	Favourable, ...
Bantry, ...	Unfavourable, ...	Favourable, ...
Kenmare, ...	Unfavourable, ...	Favourable, ...
Waterville, ..	Unfavourable, ...	Favourable, ...
Killarney, ...	Favourable, ...	Favourable, ...
Limerick, ...	Unfavourable in Spring; favourable in peal season.	Favourable, ...
Galway, ...	Generally favourable, ...	Generally favourable, ...
Connemara, ..	Unfavourable, ...	Unfavourable, ...
Ballinakill, ..	Unfavourable, ...	Favourable, ...
Bangor, ...	Favourable, ...	Unfavourable up to July; favourable from that to end of season. ..
Ballina, ...	Favourable, ...	Unfavourable, ...
Sligo, ...	Favourable, ...	Fairly favourable, ...
Ballyshannon, ..	About same as usual, ...	Favourable, ...
Letterkenny, ..	Unfavourable, ...	Very favourable, ...
Londonderry, ..	Favourable, ...	Unfavourable, ...
Coleraine, ...	At sea unfavourable. In tidal and upper waters favourable.	Unfavourable, ...
Ballycastle, ..	Favourable, ...	Unfavourable, ...
Dundalk, ...	Favourable, ...	Favourable during early part of season, but unfavourable towards the end.
Drogheda, ..	Favourable, ...	Favourable, ...

of CONSERVATORS relative to SALMON FISHERIES—*continued.*

unfavourable in each month of the open season ? (II). To Angling.		DISTRICT.
1904.	1905.	
Unfavourable, ...	Unfavourable, ...	Dublin.
Favourable, ...	Unfavourable, ...	Wexford.
Favourable in early part of season, ..	Unfavourable, except in the Spring, ..	Waterford
Very favourable, ...	Favourable, February to May ; Unfavourable, June to September.	Lismore.
Unfavourable, ...	Favourable on the whole, ...	Cork.
Favourable, ...	Favourable to May—then unfavourable,	Cork (Bandon).
Unfavourable, ...	Unfavourable, ...	Skibbereen.
Favourable, ...	Unfavourable, ...	Bantry.
Unfavourable, ...	Favourable, ...	Kenmare.
On the whole rather unfavourable, ..	Favourable, ...	Waterville.
Favourable, ...	Favourable, ...	Killarney.
Favourable in Spring ; fairly so in Summer,	Favourable in Spring, ...	Limerick.
Generally favourable, ...	Favourable, March to June. Unfavourable, July and August.	Galway.
Favourable, ...	Favourable, ...	Connemara.
Favourable, ...	Unfavourable, ...	Ballinakill.
Favourable, except in Newport River, ..	Unfavourable up to July ; favourable from that on to end of season.	Bangor.
Favourable, ...	Unfavourable, ...	Ballina.
Not quite so favourable, ...	Unfavourable, ...	Sligo.
Favourable, ...	Unfavourable, ...	Ballyshannon.
Unfavourable during part of season, ..	Favourable, ...	Letterkenny.
Favourable, ...	Unfavourable, ...	Londonderry.
Favourable in River Bann ; unfavourable in small rivers.	Favourable to end of June ; from that on unfavourable.	Coleraine.
Favourable, ...	Unfavourable up to April, then fair and subsequently very favourable.	Ballycastle
Favourable, ...	Favourable during early part of season, unfavourable towards the end.	Dundalk.
Favourable, ...	Favourable, ...	Drogheda.

Substance of Reports received from Clerks

District.	At what period of the year is Grilse first taken?	
	1904.	1905.
Dublin, ...	July, ...	July, ...
Wexford, ...	June	June. .. ..
Waterford, ..	About May, ...	May, ...
Lismore, ...	2nd May, ...	April 19, ...
Cork, ...	About 1st May, ...	May, ...
Cork (Bandon), ..	Early in June.	First week in June, ...
Skibbereen, ..	Middle of April, ...	——
Bantry, ...	July, ...	July, ...
Kenmare, ...	June, ...	June, ...
Waterville, ..	Middle of May, ...	July 5, ...
Killarney, ..	End of May, ...	End of May, ...
Limerick, ...	End of May, ...	End of May, ...
Galway, ...	12th April, ...	June, ...
Connemara, ..	Ballinahinch early in June—other fisheries, middle to end of June.	June, ...
Ballinakill, ..	21st June, ...	First week in June, ...
Bangor, ...	June, ...	May, ...
Ballina, ...	——	May, ...
Sligo	May and June in Sligo division; July and August in Ballisodare.	About May 30, ...
Ballyshannon, ..	End of June, ...	End of June, ...
Letterkenny, ..	Between middle of June and August, ..	June to August, ...
Londonderry, ..	Beginning of June, ...	May 23, ...
Coleraine, ..	End of May, June, and July, ...	Last week of May, ...
Ballycastle, ..	First or second week in May, ...	Latter end of May, ...
Dundalk, ...	June, ...	July, ...
Drogheda, ..	June, ...	June, ...

of CONSERVATORS relative to SALMON FISHERIES—*continued.*

During what months is the greatest quantity observed or taken? 1904.	1905.	DISTRICT.
July, ...	July, ...	Dublin.
July, ...	July, ...	Wexford.
End of July and beginning of August, ..	Very few taken. Run did not occur until close of netting season.	Waterford.
June and July, ...	June and July, ...	Lismore.
Middle of June and July, ...	July, ...	Cork.
Middle of June to middle of July, ..	End of June, and early in July, ..	Cork (Bandon).
August, ...	——	Skibbereen.
July, ...	July, ...	Bantry.
July, ...	July, ...	Kenmare.
June, ...	August, ...	Waterville.
June and July, ...	June, ...	Killarney.
June, ...	June, ...	Limerick.
June and July, ...	June, ...	Galway.
Ballinahinch, June—other fisheries, July	Ballynahinch, June; in other fisheries, July.	Connemara.
Last week in June and first fortnight in July.	June 13 to 30, ...	Ballinakill.
July, ...	June and July, ...	Bangor.
——	June and July, ...	Ballina.
May and June in Sligo division; July and August in Ballisodare	June and July, ...	Sligo.
July, ...	June, ...	Ballyshannon.
Between middle of June and August, ..	August, ...	Letterkenny.
July, ...	July, ...	Londonderry
June and July, ...	July, ...	Coleraine.
24th June and 12th July, ...	Middle of June to first week in July, ..	Ballycastle.
July, ...	August, ...	Dundalk.
July, ...	July, ...	Drogheda.

SUBSTANCE OF REPORTS received from CLERKS

DISTRICT.	During what months are many Salmon taken with the Grilse, and are these Salmon on an average heavier or lighter than at other periods? 1904.	1905.
Dublin, ...	July; about the same as last year, ..	July. Heavier, ...
Wexford, ...	June and July; heavier, ...	June, July, August. Heavier, ..
Waterford ..	July and August; lighter as a rule, ..	July and August. Generally lighter, ..
Lismore, ...	May and June, ...	May and June, ...
Cork, ...	April and May; about the same weight,	June and July. About average size, ..
Cork (Bandon), ..	June and July; average, ...	Early in July. Heavier, ...
Skibbereen, ..	July and August; heavier, ...	August. Lighter, ...
Bantry, ...	June and July, ...	June. Lighter, ...
Kenmare, ...	June and July, ...	June and July, ...
Waterville, ..	May and June; somewhat lighter, ..	August and September. Rather lighter,
Killarney, ...	End of May and beginning of June; about same.	End of May and beginning of June. On an average heavier.
Limerick, ...	May; lighter, ...	May. Lighter, ...
Galway, ...	July; lighter, ...	June and July, ...
Connemara, ..	July and August; much the same weight as during the rest of the season.	July and August. About the same as in other months.
Ballinakill, ..	June; much the same, ...	First week in June. Somewhat heavier,
Bangor, ...	May and June; no change, ...	May and June. About the same, ..
Ballina, ...	Not known; smaller, ...	June and July. Average, ...
Sligo, ...	May and June; average weight better, ..	June, July, and early in August. Heavier,
Ballyshannon, ..	End of June; lighter, ...	From June on, ...
Letterkenny, ..	June and July; heavier, ...	June and July. Heavier, ...
Londonderry, ..	June, July, and August, ...	June, July, and August, ...
Coleraine, ...	June and August; heavier in tidal waters,	July. Weight about same as in other months.
Ballycastle, ..	Fish were observed to be getting heavier after 20th July.	Heavy Salmon ran in April and towards the end of the season.
Dundalk, ...	July and August; lighter, ...	July and August. Lighter, ...
Drogheda, ..	July; lighter, ...	July. Lighter, ...

of CONSERVATORS relative to SALMON FISHERIES—*continued.*

In what months are the greatest quantities of Salmon (not Grilse) taken?		DISTRICT.
1904.	1905.	
June, ...	June, ...	Dublin.
April and May, ...	May, ...	Wexford.
February, March, April, and May, ..	February to May, ...	Waterford.
February to June, ...	February, March, and April, ...	Lismore.
April, ...	February, March, and April, ...	Cork.
April and May, ...	March and April, ...	Cork (Bandon).
August and September, ...	August and September, ...	Skibbereen.
June, ...	June, ...	Bantry.
July, ...	July, ...	Kenmare.
February, March, and April, ...	February, March, and April, ..	Waterville.
January to April, ...	February, March, and April, ..	Killarney.
April and May, ...	April and May, ...	Limerick.
April, ...	March, April, and May, ...	Galway.
July, August, September, and October,	July to October, ...	Connemara.
First week in June, ...	May, ...	Ballinakill.
April and May, ...	April and May, ...	Bangor.
To end of May, ...	May and June, ...	Ballina.
June, ...	January to March, Sligo Division. June in Ballysodare Division.	Sligo.
May and June, ...	May, ...	Ballyshannon.
July and August, ...	July and August, ...	Letterkenny.
July and August, ...	July and August, ...	Londonderry.
May, June, and July, ...	May and June, ...	Coleraine.
20th May and 20th July, ...	From beginning of season to May 1, and from middle of July to end of season.	Ballycastle.
April, May, and August, ...	March, April, and May, ...	Dundalk.
April and May, ...	April and May, ...	Drogheda.

SUBSTANCE OF REPORTS received from CLERKS

DISTRICT.	Can it be ascertained what proportion the capture of Grilse bears to the capture of Salmon?	
	1904.	1905.
Dublin, ...	About equal numbers taken, ...	About 8 to 1, ...
Wexford, ...	No; bad year for Grilse, ...	About 1 to 3, ...
Waterford, ..	No; but take of Grilse less than that of Salmon.	About 1 to 10, ...
Lismore, ...	Cannot be ascertained, ...	No, ...
Cork, ...	Cannot be ascertained, ...	No. But more Salmon are taken, ..
Cork (Bandon), ..	No, ...	No, ...
Skibbereen, ..	About equal, ...	No, ...
Bantry, ...	10 to 1, ...	15 to 1, ...
Kenmare, ...	10 to 1, ...	10 to 1 .. ..
Waterville, ..	1 to 5. Fishermen at Grilse season go in more for White Trout fishing—hence the proportion.	1 to 3 .. ..
Killarney, ...	2 to 1, ...	2 to 1 .. ..
Limerick, ...	About 3 or 4 to 1, ...	5 to 1, ...
Galway, ...	11 to 2, ...	5 to 1 .. ..
Connemara, ..	On Ballinahinch and Screebe about equal. Other fisheries 3 to 1.	Equal on Ballinahinch and Screebe; 1 to 3 on other fisheries.
Ballinakill, ..	3 to 1, ...	6 to 1, ...
Bangor, ...	20 to 1, ...	4 to 1, ...
Ballina, ...	No; but greater portion were Grilse, ..	No, but best Grilse more numerous than Salmon.
Sligo, ...	Sligo Division, 3 to 1; Ballisodare, 6 to 1,	Sligo, 3 to 1; Ballysodare, 4 to 1, ..
Ballyshannon, ..	2 to 1, ...	Erne, 1 to 2; other rivers Grilse more numerous than Salmon.
Letterkenny, ..	5 to 1, ...	5 to 1, ...
Londonderry, ..	Majority Grilse, ...	The majority of fish taken are Grilse, ..
Coleraine, ...	2 to 1, ...	2 to 1, ...
Ballycastle, ..	Cannot be ascertained, ...	Not ascertained, ...
Dundalk, ...	Cannot be ascertained, ...	No, ...
Drogheda, ..	Capture of Salmon far in excess of that of Grilse.	Salmon far exceed Grilse in numbers, ..

of CONSERVATORS relative to SALMON FISHERIES—*continued*.

Is there any increase in the average size of Spring Salmon or Grilse? Give average weight of Salmon and Grilse in the season of this year, as far as practicable. 1904.	1905.	DISTRICT.
Increase in case of Spring Salmon. Salmon, 11 lbs.; Grilse, 5 lbs.	Spring Salmon, 11 lbs.; Grilse, 4 lbs., ..	Dublin.
Salmon, 11 or 12 lbs.; Grilse, 5 lbs., ..	Spring Salmon, smaller; salmon, 12 lbs.; Grilse, 6 lbs.	Wexford.
No. Salmon, 12 lbs.; Grilse, 5 lbs., ..	No general increase, but some large fish up to 46 lbs. taken. Salmon, 12 to 14 lbs.; Grilse, 4 to 6 lbs.	Waterford.
No. Salmon, 7 to 27 lbs.; Grilse, 6 to 7 lbs.	Salmon, 10 to 17 lbs.; Grilse, 5 to 7 lbs.,	Lismore.
Spring Salmon, 9 lbs.; Grilse, 3 lbs., ..	Yes. Salmon, 10 lbs.; Grilse, 3 lbs., ..	Cork.
No. Salmon, 12 lbs.; Grilse, 5 lbs., ..	Yes, in Salmon, but not in Grilse. Salmon 15 lbs.; Grilse, 5 lbs.	Cork (Bandon).
No. 10 lbs., ...	No. Salmon, 8 lbs., ...	Skibbereen.
No. Salmon, 16 lbs.; Grilse, 6 lbs., ..	Salmon, 12 lbs.; Grilse, 5 lbs., ..	Bantry.
Salmon, 10 lbs.; Grilse, 5 lbs., ..	Salmon, 10 lbs.; Grilse, 5 lbs., ..	Kenmare.
Yes. Salmon, 14 lbs.; Grilse, 6 lbs., ..	No. Salmon, 11 lbs.; Grilse, 5 lbs., ..	Waterville.
No. Salmon, 11 lbs.; Grilse, 5½ lbs., ..	No. Salmon, 11 lbs.; Grilse, 5 lbs., ..	Killarney.
Yes. Salmon, 15 to 70 lbs.; Grilse, 4 to 8 lbs.	Slight improvement in Salmon and Grilse. Salmon, 16½ lbs.; Grilse, 5½ lbs.	Limerick.
Spring Salmon about the same. Salmon, about 14 lbs.; Grilse, 6 lbs.	Slight improvement in Salmon. Salmon, 14½ lbs.; Grilse, 6 lbs.	Galway.
No. Salmon, 10 lbs.; Grilse, 7 lbs., ..	No. Salmon, 10 lbs.; Grilse, 7 lbs. ..	Connemara.
Spring Salmon, 11 lbs.; Grilse, 6 lbs., ..	Salmon, 12½ lbs.; Grilse, 6 lbs., ..	Ballinakill.
Yes. Salmon 8½ lbs.; Grilse, 4½ lbs., ..	Slight increase. Salmon, 9 lbs; Grilse [illegible] lbs.	Bangor.
No. 10 lbs. to 6 lbs., ...	No. Salmon, 10½ lbs.; Grilse, 6 lbs., ..	Ballina.
Yes. Salmon, 9 lbs.; Grilse, 4 lbs., ..	Salmon, 6 to 18 or 20 lbs.; Grilse, 2 to 6 lbs.	Sligo.
Salmon, 15 lbs.; Grilse, heavier—6 lbs.,	No. Salmon, 16 lbs.; Grilse, 6 lbs., ..	Ballyshannon.
Yes; in Spring Salmon, ...	Slightly on the increase, ...	Letterkenny.
No. Salmon, 10 lbs.; Grilse, 6 lbs., ..	No. Salmon, 10 lbs.; Grilse, 6½ lbs., ..	Londonderry.
No. Salmon, 12 lbs.; Grilse, 6 lbs., ..	No. Salmon, 10 lbs.; Grilse, 6 lbs., ..	Coleraine.
Yes. Salmon, 10 to 12 lbs.; Grilse, 5 to 6½ lbs.	Probably none. Salmon, 9 to 18 lbs.; Grilse, 4½ to 7 lbs.	Ballycastle.
No. Salmon, 14 lbs.; Grilse, 5 lbs., ..	No. Salmon, 14 lbs.; Grilse 8 lbs., ..	Dundalk.
Salmon, 14 lbs.; Grilse, 6 lbs., ..	Salmon, 15 lbs.; Grilse, 5 lbs., ..	Drogheda.

SUBSTANCE OF REPORTS received from CLERKS

DISTRICT.	Has any sign of disease been observed among the Salmon during the year? If so, describe it, and state if it has prevailed to any extent, and where? 1904.	1905.
Dublin, ..	No, ...	No, ...
Wexford, ..	No, ...	No, ...
Waterford, ..	Yes; at Carlow during spawning season,	Yes, on the Barrow at Carlow, during January, when the Salmon were numerous, at the weir. The disease was diagnosed as Saprolegnia.
Lismore, ..	No, ...	No, ...
Cork ..	No, ...	No, ...
Cork (Bandon), ..	No, ...	No, ...
Skibbereen, ..	No, ...	No, ...
Bantry, ..	No, ...	No, ...
Kenmare ..	No, ...	No, ...
Waterville, ..	No, ...	No, ...
Killarney, ..	No, ...	No, ...
Limerick, ..	No, ...	No, ...
Galway, ..	No, ...	No, ...
Connemara, ..	No, ...	No, ...
Ballinakill, ..	No, ...	No, ...
Bangor ..	No, ...	No, ...
Ballina, ..	No, ...	No, ...
Sligo, ..	No, ...	Yes a few diseased fish, ...
Ballyshannon, ..	No, ...	No, ...
Letterkenny, ..	No, ...	No, ...
Londonderry, ..	No, ...	No, ...
Coleraine, ..	No, ...	No, ...
Ballycastle, ..	No, ...	No, ...
Dundalk, ..	No, ...	No, ...
Drogheda, ..	No	No, ...

of CONSERVATORS relative to SALMON FISHERIES—*continued.*

Can you give any information about the run of Salmon and Grilse in each month of the close season? 1904.	1905.	DISTRICT.
No.	No.	Dublin.
The principal run of Salmon ascends in November and December. Grilse go up earlier.	Salmon and Grilse run in the Slaney, &c., during November, December, and January.	Wexford.
With suitable freshes the principal run of spawners is from latter end of October to end of November, and first part of December.	Owing to exceptionally dry winter very few Salmon ran.	Waterford.
A very large run of Salmon took place in October. The fish appeared to be much smaller than usual. The run continued to end of November.	From October 1 to November 20 there was a large run of both Salmon and Grilse. The number of spawning fish in the Blackwater was above the average.	Lismore.
No Grilse run in the close season; large quantity of breeding fish run in November and December.	No	Cork.
Salmon run from October to December. Grilse do not run in any great numbers.	No.	Cork (Bandon)
No.	No.	Skibbereen.
No.	No.	Bantry.
No.	No.	Kenmare.
The run of Spring Salmon does not commence till middle or end of December.	Spring Salmon commenced to run into Lough Currane in November.	Waterville.
Run of Salmon and Grilse was bad in August, September, and October.	The run of Salmon and Grilse from August to November was poor; up to Christmas, fair; after Christmas, poor.	Killarney.
Cannot answer question satisfactorily, ..	Entirely depends upon the weather, ..	Limerick.
No run until January, ...	Practically no run in the close season, until the Spring fish begin to run early in the year.	Galway.
No.	No.	Connemara.
No.	No.	Ballinakill.
No.	No	Bangor.
No.	No.	Ballina.
Salmon and Grilse often run in Sligo River in August and September, and a good number in October, November, and December.	Salmon run in November and December.	Sligo.
A late run of Salmon took place during close season.	No.	Ballyshannon.
No.	No.	Letterkenny.
Largest run in October and November, but much depends on state of rivers.	The principal run in the Foyle was in December; included many bright, clean fish as if fresh from the sea.	Londonderry.
No.	A heavy run of fish in the Bann at the end of August, and again in October.	Coleraine.
No.	No.	Ballycastle.
A great run noticed in November and December; was larger than in former years.	Salmon ran in November and December.	Dundalk.
No.	No.	Drogheda.

SUBSTANCE OF REPORTS received from CLERKS

DISTRICT.	Have there been any cases of poisoning the rivers in the District? If so, give particulars of the different cases, and if by Lime, Spurge, or Flax Water. 1904.	1905.
Dublin, ...	One case in Liffey at Island Bridge. ..	One alleged case at Island Bridge, River Liffey, by discharge of creosote.
Wexford, ...	No, ...	No, ...
Waterford, ..	No, ...	A few by lime or chloride of lime, ..
Lismore, ...	Yes. One attempt at Kingwilliamstown,	No, ...
Cork, ...	No, ...	No, ...
Cork (Bandon), ..	No, ...	No, ...
Skibbereen, ..	No, ...	Yes, several, ...
Bantry, ...	No, ...	One case in Coomhola River by Spurge.
Kenmare, ...	Slaheny River, tributary to River Roughty, poisoned once by spurge.	Two cases in River Roughty by spurge,
Waterville, ..	No, ...	No, ...
Killarney, ..	Brown Flesk poisoned by lime on one occasion.	No, ...
Limerick, ...	Some poisoning took place in Feale and Cashen, but unable to get evidence to secure conviction.	Three cases—two by lime at Rathkeale, and Abbeyfeale, and one by spurge at Duagh.
Galway, ...	No, ...	No proved cases, but there is a deleterious discharge from a factory at Galway.
Connemara, ..	No, ...	No, ...
Ballinakill, ..	No, ...	No, ...
Bangor, ...	No, ...	No, ...
Ballina, ...	No, ...	No, ...
Sligo, ...	No, ...	Alleged case of use of dynamite at Ballysodare.
Ballyshannon, ..	Two cases by flax water; one by lime. ..	No, ...
Letterkenny, ..	Three cases of poisoning by flax water, ..	None, except from flax water, ..
Londonderry, ..	No serious case, except by flax water, ..	One case in tributary of Roe by lime; much damage done by flax water owing to dry year.
Coleraine, ...	Eight cases of pollution by mills, and about twenty cases of flax water pollution.	Two cases in Sixmilewater by chloride of lime; forty-three cases by flax water.
Ballycastle, ..	Almost disappeared. No prosecutions for flax water.	A few by flax water, ...
Dundalk, ...	A few cases of flax water pollution. ..	Twenty cases by flax water, ...
Drogheda, ..	No, ...	One by flax water, ...

of CONSERVATORS relative to SALMON FISHERIES—*continued.*

Has the quantity of Breeding Fish observed in the rivers in your District during this winter been greater or less as compared with last winter? 1904.	1905.	DISTRICT.
Less, ...	Greater, ...	Dublin.
Less, ...	Far greater, ...	Wexford.
Greater, ...	Less in tributaries, ...	Waterford.
Greater, ...	Greater, ...	Lismore.
About the same, ...	Greater, ...	Cork.
Slightly less, ...	About the same.	Cork (Bandon).
Less, ...	Greater, ...	Skibbereen.
Less, ...	Greater, ...	Bantry.
Greater, ...	Greater in some, less in others, ..	Kenmare.
Slightly greater, ...	Greater, ...	Waterville.
Much less, ...	Less, ...	Killarney.
No change noticed	Greater in the main rivers, ...	Limerick.
Less	Less, ...	Galway.
Greater, ...	Slightly greater, ...	Connemara.
About the same, ...	Much the same, ...	Ballinakill.
Greater, ...	About the same, ...	Bangor.
Greater, ...	About the same, ...	Ballina.
Much greater in Manorhamilton Division; less in Ballisodare.	Greater, ...	Sligo.
Greater in some rivers, ...	Much greater, ...	Ballyshannon.
Greater, ...	No remarkable change, ...	Letterkenny.
Greater, ...	Less, ...	Londonderry.
Much greater, ...	Much greater, ...	Coleraine.
Greater, ...	A little above average, ...	Ballycastle.
Greater, ...	Somewhat greater, ...	Dundalk.
No replies received, ...	Greater, ...	Drogheda.

SUBSTANCE OF REPORTS received from CLERKS

DISTRICT.	In what Rivers has the quantity increased?	
	1904.	1905.
Dublin, ...	Liffey, ...	Liffey, ...
Wexford, ...	Slaney, Boro, Urrin, and Bann, ..	Slaney and Boro. .. .. ..
Waterford, ..	Suir and Barrow. The Nore was as well stocked as last year.	Lower tributaries of the Barrow and the King's River.
Lismore, ...	In all tributaries and main river, ..	Main river, ...
Cork, ...	None, ...	Lee and Salanne, ...
Cork (Bandon), ..	None, ...	None, ...
Skibbereen, ..	None, ...	Ilen, ...
Bantry, ...	None, ...	All rivers, ...
Kenmare, ...	In all rivers in the district, ...	Derreen district and Sneem river, ..
Waterville, ..	In all rivers, ...	All rivers, ...
Killarney, ..	None, ...	None, ...
Limerick, ...	No increase in any river, ...	Main river (part) and Mulkear, ..
Galway, ...	None, ...	Tributaries of Clare and Oughterard rivers.
Connemara, ..	Gowla, Ballinahinch, Inver, Screebe, Costello, and Skannive.	Ballinahinch, Inver, Gowla, Screebe, and Costello.
Ballinakill, ..	None, ...	None, ...
Bangor, ...	In all rivers, ...	None, ...
Ballina, ...	In the main rivers and middle portions of the tributaries.	Moy and its main tributaries, ..
Sligo, ...	Bonnett and tributaries, ...	All rivers, ...
Ballyshannon, ..	Erne and Bundrowes, ...	Erne and tributaries, and Bundrowes. ..
Letterkenny, ..	Lennan and Swilly, ...	Swilly and Clady, ...
Londonderry, ..	In all, ...	None, ...
Coleraine, ...	Maine, Blackwater, Ballinderry, Clady, and Moyola.	All rivers, ...
Ballycastle, ..	In all Salmon Rivers, ...	Ballycastle and Bush, ...
Dundalk, ...	Glyde and Dee, ...	All rivers, ...
Drogheda, ...	No replies received, ...	All rivers, ...

of Conservators relative to Salmon Fisheries—*continued.*

In what Rivers has the quantity decreased?		District.
1904.	1905.	
Bray, ...	Bray, ...	Dublin.
Derry, and small tributaries of Slaney, ..	Urrin and Blackwater, ...	Wexford.
In the lowest tributaries, owing to absence of floods.	In the higher tributaries generally, ..	Waterford.
None, ...	All the tributaries, ...	Lismore.
None, ...	None, ...	Cork.
Bandon and Argideen, ...	None, ...	Cork (Bandon).
Ileu, ...	No information, ...	Skibbereen.
In all rivers in the district, ...	None, ...	Bantry.
None, ...	Sheen and Blackwater, ...	Kenmare.
None, ...	None, ...	Waterville.
Laune, Flesk, Maine, and tributaries, ..	All rivers, ...	Killarney.
No decrease in any river, ...	All tributaries, ...	Limerick.
Rather less in all rivers, ...	All other rivers, ...	Galway.
Doohulla, ...	Skannive and Doohulla, ...	Connemara.
None, ...	Culfin and Dawros, ...	Ballinakill.
None, ...	Tributaries of Carrowmore Lake, ..	Bangor.
None, ...	Rathfran, Easky, Pulaheeny, and one tributary of Moy.	Ballina.
Ballisodare and tributaries, ...	None, ...	Sligo.
Eske and Inver, ...	None, ...	Ballyshannon.
None, ...	None, ...	Letterkenny.
None, ...	All rivers, ...	Londonderry
None, ...	None, ...	Coleraine.
None, ...	None, ...	Ballycastle.
No decrease noticed, ...	None, ...	Dundalk.
No replies received, ...	None, ...	Drogheda.

DISTRICT.	Was the state of the rivers favourable or unfavourable to spawning, and to the protection of spawning, and spent fish, and young fry?	
	1904.	1905.
Dublin, ...	Liffey very favourable, ...	Liffey favourable. Bray unfavourable,
Wexford, ...	Favourable in all rivers, ...	Slaney Boro, and Bann favourable. Urrin and Blackwater unfavourable.
Waterford, ..	Unfavourable in tributaries owing to absence of floods preventing the fish getting up.	Generally favourable in main rivers, as fish were prevented from entering dangerous tributaries.
Lismore, ...	Favourable, ...	Favourable to protection of fish ..
Cork, ...	Favourable, ...	Fairly favourable, ...
Cork (Bandon), ..	Favourable in Bandon and Argideen, ..	Early Winter unfavourable to run of spawners—later favourable.
Skibbereen, ..	Very favourable, ...	Very favourable .. .. ..
Bantry, ...	Favourable, ...	Favourable to spawning and protection,
Kenmare, ...	Favourable, ...	Favourable, ...
Waterville, ..	Favourable, ...	Very favourable for spawning, ..
Killarney, ..	Unfavourable in the smaller rivers owing to dry weather.	Generally favourable, ...
Limerick, ...	Favourable, ...	Unfavourable to spawning; spawners and spent fish fairly well protected.
Galway, ...	Favourable for spawning. Favourable for descent of spent fish.	Generally favourable, ...
Connemara, ..	Favourable, ...	Favourable, ...
Ballinakill, ..	Favourable in all rivers, ..	Very favourable, ...
Bangor, ...	Most favourable, ...	Favourable to all, ...
Ballina, ...	Very unfavourable for three weeks in December.	Very favourable for spawning, ..
Sligo, ...	Favourable for Bonet, Ballisodare, and Ballinascorrow.	Favourable for spawning and spent fish; low water unfavourable for fry.
Ballyshannon, ..	Favourable, ...	Generally favourable, ...
Letterkenny, ..	Favourable owing to high water, ..	Very favourable in all rivers owing to high water.
Londonderry, ..	Very favourable, ...	Favourable, ...
Coleraine, ..	Favourable, ...	Most favourable owing to high water, and mild weather.
Ballycastle, ..	Favourable, ...	Favourable owing to high water, ..
Dundalk, ...	Favourable owing to continued floods. The run of fish on the Fane was later than in other rivers.	Favourable in all rivers, ...
Drogheda, ..	No replies received, ...	Favourable generally, ..

of Conservators relative to Salmon Fisheries—*continued.*

Any particular observations? 1904.	Any particular observations? 1905.	District.
—	—	Dublin.
—	Low water kept spawners out of the smaller rivers.	Wexford.
—	Unusual absence of floods during spawning season.	Waterford.
—	—	Lismore.
Remarkable increase of large red fish on the spawning beds.	—	Cork.
—	—	Cork (Bandon).
—	—	Skibbereen.
—	Heavy floods in January destroyed much spawn.	Bantry.
—	—	Kenmare.
—	More breeding fish observed than for past ten years.	Waterville.
—	No run of spawners after Christmas. ..	Killarney.
—	—	Limerick.
—	—	Galway.
—	—	Connemara.
—	—	Ballinakill.
—	The run of fish was late this winter, ..	Bangor.
Very mild weather during spawning season. Winter very favourable. All conditions good.	—	Ballina.
Damage caused by carelessness of mill-owners and poaching along sea coast.	—	Sligo.
—	Spawning fish were fourteen days earlier,	Ballyshannon.
—	—	Letterkenny.
—	Run of breeding fish later than usual, ..	Londonderry.
Spawning Salmon are larger than usual, and more plentiful than for last fifteen years.	Fish larger than usual, and spawned earlier.	Coleraine.
—	A little better than an average year, ..	Ballycastle.
—	—	Dundalk.
—	—	Drogheda.

INDEX.

NOTE.—The references expressed in Roman numerals are to the separate numbers of "Scientific Investigations, 1905," to which the divisions of this appendix correspond. The Arabic numerals which follow refer to the pagination of each number.

The Arabic numerals in square brackets refer to the continuous pagination of the appendix, at foot of each page.

A.

B.

C.

D.

E.

F.

G.

H.

I.

K.

L.

M.

N.

O.

P.

R.

S.

T.

U.

V.

W.

X.

DUBLIN CASTLE,

17th May, 1907.

SIR,

I have to acknowledge the receipt of your letter of the 16th instant forwarding, for submission to His Excellency the Lord Lieutenant, the Report on the Sea and Inland Fishereis of Ireland for the year 1905, Part II., Scientific Investigations.

I am,

Sir,

Your obedient servant,

A. P. MACDONNELL.

THE SECRETARY,

DEPARTMENT OF AGRICULTURE

AND TECHNICAL INSTRUCTION,

UPPER MERRION-STREET, DUBLIN.

DUBLIN: Printed for His Majesty's Stationery Office,
By ALEX. THOM & CO. (Limited), 87, 88 & 89 Middle Abbey-street