

# The Sargasso Sea Eel Expedition 1979

F.-W. Tesch

*Biologische Anstalt Helgoland (Zentrale);  
Notkestr. 31, D-2000 Hamburg 52, Federal Republic of Germany*

**ABSTRACT:** The background and aims of the Sargasso Sea Expedition for exploring the reproduction of the eel (*Anguilla* spp.) in the North Atlantic are described. The ships used for the investigations in the Sargasso Sea and during transects across the North Atlantic were F. R. V. "Anton Dohrn" and R. V. "Friedrich Heincke", provided by the Federal Republic of Germany. Their technical and scientific equipment and their staffs are described. The courses of the cruises are mapped and the geographical positions of the investigations as well as the different instruments employed are tabulated as a source of basic data for more specialized papers published in this issue or elsewhere. Reference is also given to relevant papers which have been published elsewhere. Important but unpublished preliminary results are mentioned. Suggestions for future research needs are made.

## INTRODUCTION

The 1979 Sargasso Sea Eel Expedition was initiated by a resolution of the Eel Symposium 1976 in Helsinki and organized by the International Council for the Exploration of the Sea (ICES) and the European Inland Fishery Advisory Commission (EIFAC) of the FAO. A planning group was established by the ICES to organize an international multiship expedition, but it proved impossible for different countries to contribute shipping time at appropriate dates. For this reason, the international project was split into a series of national cruises to the Sargasso Sea.

The first expedition on a national basis was undertaken in spring 1979 by two ships of the Federal Republic of Germany. One, the F. R. V. "Anton Dohrn", was sponsored by the DWK (German Scientific Commission for the Exploration of the Sea); the other, R. V. "Friedrich Heincke", is attached to the Biologische Anstalt Helgoland which organized the expedition.

## SCIENTIFIC BACKGROUND AND MAJOR OBJECTIVES

The classical work by J. Schmidt (1924) in the early 1900's on the life history of European and American eels (*Anguilla anguilla* and *A. rostrata*) produced indirect evidence that the European eel spawns in the Sargasso Sea and suggested also that the spawning area for the American eel was to the southwest. These spawning areas were apparently attained by active migration of the adults, whereas the larvae were presumed to drift with major North Atlantic current systems to repopulate European and American waters.

Spawning or maturing eels have not been caught in the Sargasso Sea or anywhere off the continents. The spawning area of the European eel has been roughly defined on the basis of small larvae, but no similar collections are available for the American eel. Naturally spawned eel eggs are unknown, as are migration routes, spawning conditions, behaviour and spawning times of the adults. The same is true for movements, species separation, feeding and growth of the larvae.

It is obvious that one or two cruises could not resolve all these questions. The investigations of the two German research vessels, therefore, were in the aid of reconnaissance. The major objective was to study the problems of sampling techniques and egg and larval identification as recommended by the ICES planning group. Other important samplings and measurements could be performed as well, such as oceanographic studies in the Sargasso Sea at that time of the year, the plankton environment and experimental investigations of the movement of adult (hormone-treated) eels. In addition, the collections with different equipment presented an opportunity to study other groups of animals and plants for various purposes.

#### TECHNICAL AND SCIENTIFIC EQUIPMENT

##### Fishery Research Vessel "Anton Dohrn"

Type: Stern trawler; length: 74 m; displacement (cwl): 2,283 t; power: 1,680 kw.

Scientific instruments used during the cruise: Multisonde; Hydrocast; Expendable Bathythermograph (XBT); Midwater trawl, 1,600 meshes circumference (MT 1,600); Isaacs Kidd Midwater Trawl (IKMT), opening 6 m<sup>2</sup>, meshsize 500 µm with time-depth recorder; Multiple Opening and Closing Net and Environmental Factor Sensing System (MOCNESS), opening 1 m<sup>2</sup>, meshsize 350 µm; Multiple Closing Net (MCN) opening 0.25 m<sup>2</sup>, meshsize 350 µm; Neuston Net 335 µm.

##### Research Vessel "Friedrich Heincke"

Type: Stern trawler; length 38 m; displacement (cwl): 466 t; power: 676 kw.

Scientific instruments used during the cruise: Hydrocast; Niskin bottles for plankton collections; Expendable Bathythermograph (XBT); Midwater trawl, 650 meshes circumference (MT 650); Isaacs Kidd Midwater Trawl (IKMT), opening 2 m<sup>2</sup>, meshsize 850 µm with time depth recorder and pinger; Multiple Closing Net (MCN), opening 0.25 m<sup>2</sup>, meshsize 100 µm; Apstein net 55 µm; Neuston net 335 µm; Ultrasonic receiver for tracking eels and for depth recording of gear.

#### Scientific staff

##### *F. R. V. "Anton Dohrn"*

Scientist in charge: Dr. F.-W. Tesch (19/III – 9/V), Biologische Anstalt Helgoland, Hamburg (BAH).

Oceanography: G. Wegner (19/III – 9/V), Deutsche Wissenschaftliche Kommission für Meeresforschung, Hamburg; P. Wöckel, Deutsches Hydrographisches Institut, Hamburg.

Systematics and sorting of Anguilliformes larvae: Dr. J. Boëtius (19/III – 17/IV), Danmark Fiskeri- og Havundersøgelser, Charlottenlund; Dr. A. Comparini (19/III – 17/IV; identification of species by electrophoresis), Istituto di Biologia Animale, Università degli Studi di Padua; Dr. G. Peters (19/III – 17/IV), Institut für Hydrobiologie und Fischereiwissenschaft, Universität Hamburg; M. Schoth (19/III – 9/V), BAH; Dr. D. G. Smith (19/III – 17/IV), Marine Biomedical Institute, University of Texas, Galveston.

Predation of fishes on leptocephali: S. Appelbaum (19/III – 9/V), BAH.

Systematics of fish larvae from neuston and opening and closing nets: Dr. H. C. John (19/III – 9/V), BAH.

Systematics of adolescent to adult fishes: Dr. E. Bertelsen (18/IV – 9/V), Zoologisk Museum, Copenhagen; Dr. R. H. Gibbs (19/III – 17/IV), Department of Vertebrate Zoology, National Museum of Natural History, Washington, D. C.; Dr. P. A. Hulley (18/IV – 9/V), South African Museum, Capetown; Dr. C. Karrer (19/III – 9/V), Zoologisches Institut, Universität Hamburg; Dr. G. Krefft (18/IV – 9/V), Institut für Seefischerei, Hamburg (ISF); Dr. J. Nielsen (18/IV – 9/V), Zoologisk Museum, Copenhagen; Dr. A. Post (18/IV – 9/V), ISF.

Systematics of Amphipods: Dr. H. G. Andres (19/III – 9/V), BAH.

Fungi of the seawater and of the Sargassum algae: Dr. A. Ulken (19/III – 17/IV), Institut für Meeresforschung, Bremerhaven.

Technical Assistance: J. Gomon (19/III – 9/V), Department of Vertebrate Zoology, National Museum of Natural History, Washington, D. C.; T. Minde (19/III – 17/IV) BAH; F. Ullah (18/IV – 9/V), ISF; U. Viebach (18/IV – 9/V), ISF.

#### R. V. "Friedrich Heincke"

Scientist in charge: Dr. F.-W. Tesch (12/II – 15/III), BAH; Prof. Dr. D. Schnack (16/III – 28/III), Institut für Hydrobiologie und Fischereiwissenschaft, Universität Hamburg; Dr. K.-H. Moebus (29/III – 26/IV), BAH.

Plankton investigations: R. Böttger (29/III – 18/IV), BAH; Dr. S. Muzavor (29/III – 9/IV), Instituto Universitario dos Acores, Ponta Delgada.

Systematics and sorting of Anguilliformes larvae, tracking of adult eels: R. Kracht (12/II – 26/IV), BAH.

Technical Assistance: K.-L. Lange (21/II – 15/III), BAH.

#### CRUISE REPORT

In order to perform the Sargasso Sea program, F. R. V. "Anton Dohrn" left Bermuda on April 9 at the beginning of the second part of cruise No. 210/92. During the first part of its cruise the ship had been engaged in herring investigations in the N. W. Atlantic. The second part was divided into two sections. The first began and ended at Bermuda and included 7 North-South and one East-West transects through the presumed spawning area of *Anguilla anguilla* (Fig. 2). The second section crossed the eastern part of the eel spawning area once again and then the North Atlantic in the direction of the Bay of Biscay (Fig. 1).

Our original intention was to pass well to the north of the Azores, so as to include the

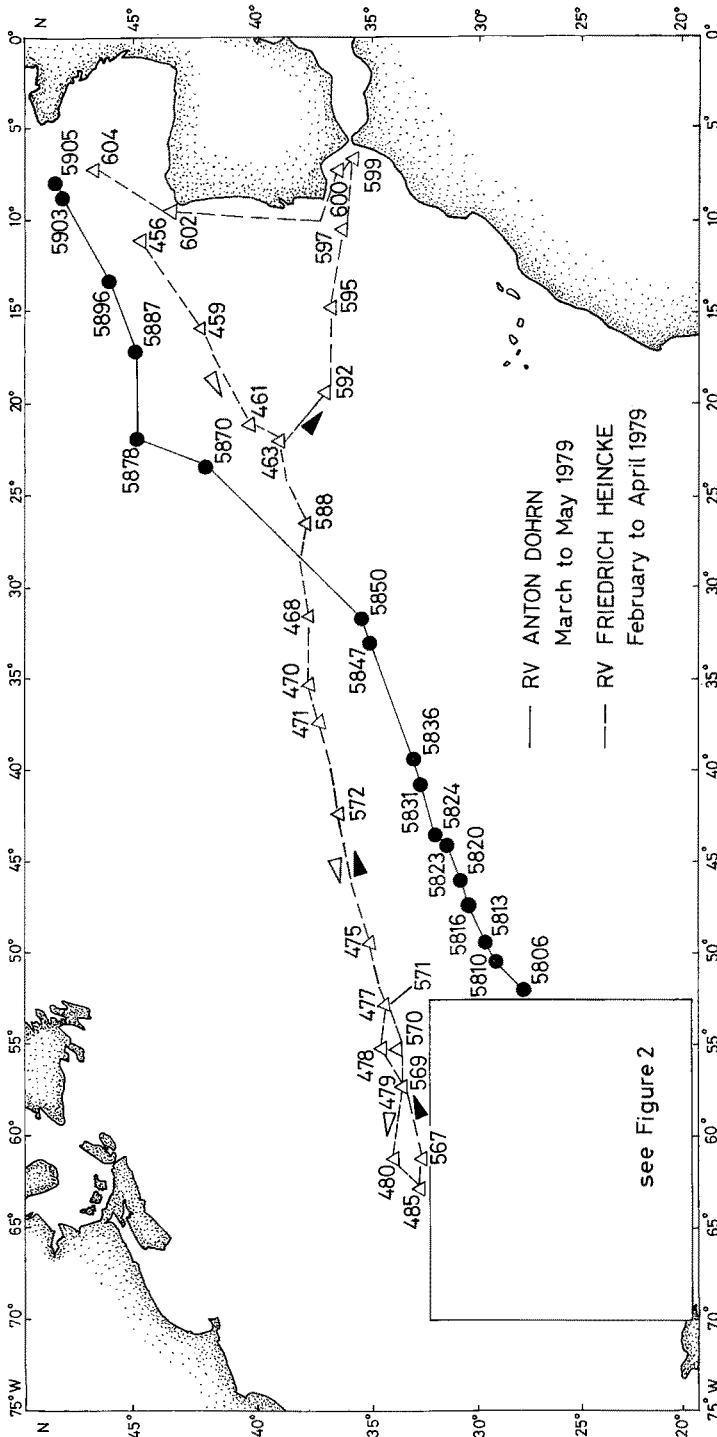


Fig. 1. Courses of F. R. V. "Anton Dohrn" and R. V. "Friedrich Heintcke" between Europe and the Sargasso Sea with selected stations. Arrows show direction of R. V. "Friedrich Heintcke" to and from the Sargasso Sea using the same route. Open square: sample stations in the Sargasso Sea (see Fig. 2)

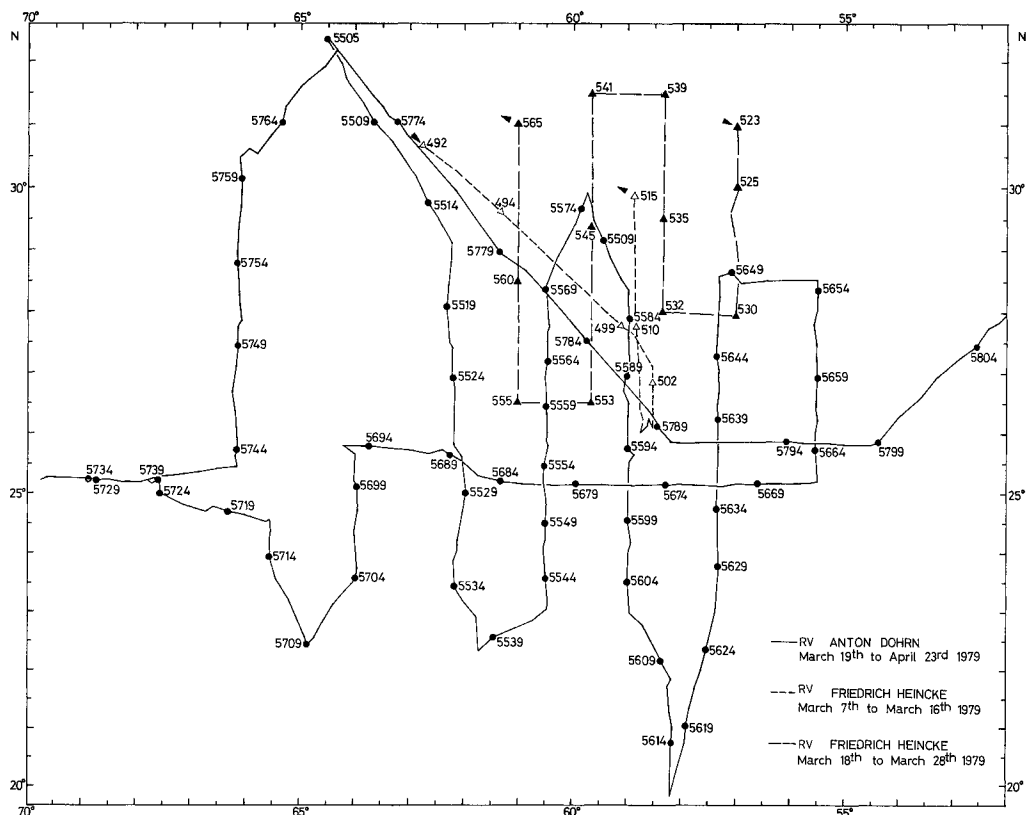


Fig. 2. Network of stations and routes of F. R. V. "Anton Dohrn" and R. V. "Friedrich Heincke" in the Sargasso Sea. The numbered black circles indicate each fifth station during the cruise of F. R. V. "Anton Dohrn"; the white and black triangles selected stations and the arrows the course of R. V. "Friedrich Heines" to and from Bermuda to the sample stations

"North Atlantic drift". But because of an accident to a crew member the ship had to call at the southern Azores Island St. Miguel. The transect therefore covered the region south of the "North Atlantic drift", but a stretch of 400 miles could not be investigated because permission had not been obtained for the 200 mile limit of the Azores.

The weather conditions were generally good except for two to three days in the Sargasso Sea area. A few hauls had to be cancelled, which had only a slight effect on the continuity of IKMT transects in the northern central Sargasso Sea near Bermuda. The geographic positions of the sampling stations with equipment used is presented in Table 1. XBT Stations which took place at least every two hours are not included.

The two transects made by R. V. "Friedrich Heincke" across the North Atlantic are shown in Figure 1, and the network of stations in the Sargasso Sea in Figure 2. The cruise was divided into seven phases with different compositions of the scientific staff in each. During the whole cruise beyond the continental shelf, eel larvae were sampled with the Isaacs Kidd Midwater Trawl, and bacteriophages with a microbiological bottle; hydrocasts and XBT measurements were made.

Table 1a. Station list of F.R.V. "Anton Dohrn" Cruise No. 210/92, Part 2 (Sargasso Sea)

| Station No. | Date 1979 (day/month) | Time GTM - 5h (local time) | Latitude (°N) | Longitude (°W) | Multi-sonde | Neu-son | IKMT (haul No./m depth) | MOC-NESS (haul No.) | MCN | Mid-water trawl (m depth) | Sargas-sum collection |
|-------------|-----------------------|----------------------------|---------------|----------------|-------------|---------|-------------------------|---------------------|-----|---------------------------|-----------------------|
| 5507        | 20/3                  | 00.00                      | 31°57'        | 64°16'         | 1           | 1       |                         |                     | 1   |                           |                       |
| 5511        | 20/3                  | 09.00                      | 30°24'        | 63°05'         |             | 1       |                         |                     |     |                           |                       |
| 5512        | 20/3                  | 10.30                      | 30°12'        | 62°55'         |             | 1       |                         |                     | 1   |                           |                       |
| 5513        | 20/3                  | 12.30                      | 29°37'        | 62°35'         | 1           |         |                         |                     |     |                           |                       |
| 5519        | 21/3                  | 01.30                      | 28°06'        | 62°18'         | 1           | 1       |                         |                     | 1   |                           |                       |
| 5522        | 21/3                  | 08.45                      | 27°04'        | 62°14'         |             | 2       |                         |                     | 1   |                           |                       |
| 5526        | 21/3                  | 16.00                      | 25°48'        | 62°10'         | 1           | 1       |                         | 1                   |     | 600                       |                       |
| 5527        | 21/3                  | 21.00                      | 25°37'        | 61°56'         |             | 2       | 1/ 70                   |                     | 1   | 80                        |                       |
| 5534        | 22/3                  | 09.00                      | 23°25'        | 62°10'         | 1           | 1       |                         | 2                   | 1   |                           |                       |
| 5538        | 22/3                  | 19.55                      | 22°21'        | 61°42'         | 1           | 2       | 2/130                   | 3                   | 1   |                           |                       |
| 5543        | 23/3                  | 08.55                      | 23°13'        | 60°28'         |             | 1       |                         |                     | 1   |                           | 1                     |
| 5550        | 23/3                  | 18.50                      | 24°42'        | 60°30'         | 1           | 2       | 3/ 43                   | 4                   | 1   | 150                       |                       |
| 5556        | 24/3                  | 08.00                      | 25°53'        | 60°30'         | 1           | 1       |                         | 5                   | 1   |                           | 1                     |
| 5558        | 24/3                  | 15.35                      | 26°16'        | 60°30'         | 1           |         |                         |                     |     |                           |                       |
| 5560        | 24/3                  | 18.17                      | 26°35'        | 60°30'         | 1           | 1       |                         |                     | 1   | 600                       |                       |
| 5561        | 24/3                  | 21.23                      | 26°42'        | 60°30'         | 1           |         |                         |                     |     | 150                       |                       |
| 5562        | 24/3                  | 22.52                      | 26°51'        | 60°30'         |             | 1       | 4/105                   |                     |     |                           |                       |
| 5565        | 25/3                  | 04.00                      | 27°32'        | 60°29'         | 1           |         |                         |                     |     |                           |                       |
| 5569        | 25/3                  | 09.00                      | 28°21'        | 60°31'         | 1           | 1       |                         |                     | 1   |                           |                       |
| 5572        | 25/3                  | 15.30                      | 29°16'        | 60°03'         |             | 1       |                         |                     |     |                           |                       |
| 5576        | 25/3                  | 20.00                      | 29°53'        | 59°45'         | 1           | 1       | 5/100                   |                     | 1   |                           |                       |
| 5582        | 26/3                  | 08.30                      | 28°21'        | 59°59'         | 1           | 1       |                         |                     | 1   |                           |                       |
| 5588        | 26/3                  | 17.30                      | 27°02'        | 58°58'         | 1           | 3       | 6/100                   | 6                   | 1   | 600                       |                       |
| 5594        | 27/3                  | 08.00                      | 25°45'        | 59°00'         | 1           | 3       |                         | 7                   | 1   | 1200                      | 1                     |
| 5596        | 27/3                  | 18.00                      | 25°32'        | 58°59'         | 1           | 2       | 7/148                   | 8                   | 1   | 100                       |                       |
| 5600        | 28/3                  | 08.00                      | 24°09'        | 59°00'         | 1           | 1       |                         | 9                   | 1   |                           |                       |
| 5602        | 28/3                  | 15.42                      | 23°46'        | 58°59'         |             | 1       |                         |                     |     | 1200                      |                       |
| 5603        | 28/3                  | 18.30                      | 23°37'        | 58°59'         | 1           | 2       | 8/ 88                   |                     | 1   |                           |                       |
| 5605        | 28/3                  | 23.00                      | 23°15'        | 58°59'         | 1           |         |                         |                     |     |                           |                       |
| 5610        | 29/3                  | 08.00                      | 21°50'        | 58°10'         | 2           | 2       | 9/130                   |                     | 1   |                           | 1                     |
| 5614        | 29/3                  | 17.15                      | 20°45'        | 58°10'         | 1           | 1       |                         |                     | 1   |                           |                       |
| 5615        | 29/3                  | 22.00                      | 19°51'        | 58°10'         | 1           |         | 10/ 90                  |                     |     |                           |                       |
| 5619        | 30/3                  | 08.00                      | 21°03'        | 57°54'         | 1           | 2       | 11/150                  |                     | 1   |                           |                       |
| 5623        | 30/3                  | 18.04                      | 22°12'        | 57°35'         |             | 2       | 12/150                  |                     | 1   |                           |                       |
| 5627        | 31/3                  | 03.55                      | 23°16'        | 57°21'         |             | 1       |                         |                     |     | 1800                      |                       |
| 5628        | 31/3                  | 08.35                      | 23°31'        | 57°20'         | 1           | 2       | 13/185                  |                     | 2   |                           | 1                     |
| 5632        | 31/3                  | 17.25                      | 24°23'        | 57°20'         | 1           | 3       | 14/100                  |                     |     | 100                       |                       |
| 5638        | 01/4                  | 08.00                      | 26°07'        | 57°22'         | 1           | 2       | 15/190                  |                     | 1   |                           |                       |
| 5641        | 01/4                  | 14.40                      | 26°44'        | 57°20'         |             | 1       |                         |                     |     | 600                       |                       |
| 5643        | 01/4                  | 17.30                      | 27°01'        | 57°20'         | 1           | 2       | 16/100                  | 10                  | 2   |                           |                       |
| 5648        | 02/4                  | 08.00                      | 28°44'        | 57°20'         | 1           | 1       |                         |                     | 1   |                           |                       |
| 5652        | 02/4                  | 16.00                      | 28°31'        | 56°00'         |             | 2       |                         |                     | 1   |                           |                       |
| 5653        | 02/4                  | 18.05                      | 28°31'        | 55°30'         | 1           |         | 17/ 75                  |                     |     |                           |                       |
| 5661        | 03/4                  | 08.00                      | 26°23'        | 55°31'         | 1           | 2       | 18/185                  |                     | 1   |                           | 1                     |
| 5666        | 03/4                  | 17.10                      | 25°12'        | 55°31'         | 1           | 4       | 19/ 90                  | 11                  | 1   | 800                       |                       |
| 5670        | 04/4                  | 08.00                      | 25°10'        | 57°00'         | 1           | 2       | 20/205                  |                     | 1   |                           | 1                     |
| 5674        | 04/4                  | 16.30                      | 25°09'        | 58°07'         | 1           | 3       | 21/100                  | 12                  |     | 1200                      |                       |

Table 1a (continued)

| Station No. | Date 1979 (day/month) | Time GTM - 5h (local time) | Latitude (°N) | Longitude (°W) | Multi-sonde | Neuston | IKMT (haul No./m depth) | MOC-NESS (haul No.) | MCN | Mid-water trawl (m depth) | Sargassum collection |
|-------------|-----------------------|----------------------------|---------------|----------------|-------------|---------|-------------------------|---------------------|-----|---------------------------|----------------------|
| 5679        | 05/4                  | 08.00                      | 25°09'        | 59°56'         | 1           | 2       | 22/150                  |                     |     |                           |                      |
| 5684        | 05/4                  | 18.00                      | 25°11'        | 61°19'         | 1           | 2       | 23/ 88                  | 13                  | 1   |                           |                      |
| 5688        | 06/4                  | 08.42                      | 25°38'        | 62°15'         | 2           | 2       | 24/175                  | 14                  |     |                           |                      |
| 5689        | 06/4                  | 18.28                      | 25°38'        | 62°13'         |             | 2       | 25/ 90                  | 15                  | 1   |                           |                      |
| 5695        | 07/4                  | 08.00                      | 25°47'        | 64°12'         | 1           | 2       | 26/ 20                  | 16                  | 1   |                           | 1                    |
| 5698        | 07/4                  | 18.35                      | 25°13'        | 64°00'         | 1           | 2       | 27/110                  |                     | 1   |                           |                      |
| 5702        | 08/4                  | 03.55                      | 23°55'        | 63°38'         |             | 1       |                         |                     |     | 1800                      |                      |
| 5703        | 08/4                  | 08.10                      | 23°42'        | 63°58'         | 1           | 2       | 28/195                  |                     | 1   |                           | 1                    |
| 5709        | 08/4                  | 18.37                      | 22°27'        | 64°51'         | 1           | 2       | 29/135                  |                     | 1   |                           |                      |
| 5715        | 09/4                  | 08.00                      | 24°15'        | 65°35'         | 1           | 2       | 30/180                  | 17                  | 1   |                           |                      |
| 5717        | 09/4                  | 16.55                      | 24°33'        | 65°34'         |             | 2       | 31/ 90                  | 18                  | 1   |                           |                      |
| 5720        | 10/4                  | 04.00                      | 24°41'        | 66°20'         |             |         |                         |                     |     | 1800                      |                      |
| 5721        | 10/4                  | 08.20                      | 24°46'        | 66°37'         | 1           | 2       | 32/200                  |                     | 1   |                           | 1                    |
| 5722        | 10/4                  | 12.00                      | 24°42'        | 66°45'         |             |         |                         |                     |     | 1800                      |                      |
| 5724        | 10/4                  | 16.00                      | 25°60'        | 67°33'         |             |         |                         |                     |     | 1800                      |                      |
| 5725        | 10/4                  | 19.55                      | 25°02'        | 67°38'         | 1           | 2       | 33/ 85                  |                     | 1   |                           |                      |
| 5731        | 11/4                  | 08.00                      | 25°15'        | 69°43'         | 1           | 2       | 34/200                  |                     | 1   |                           | 1                    |
| 5736        | 11/4                  | 19.00                      | 25°13'        | 68°26'         |             | 1       |                         |                     |     |                           |                      |
| 5738        | 12/4                  | 01.45                      | 25°08'        | 67°39'         |             | 2       | 35/ 90                  | 19                  |     | 1800                      |                      |
| 5738        | 12/4                  | 12.50                      | 25°08'        | 67°39'         | 1           | 1       | 36/160                  | 20                  | 1   | 1800                      |                      |
| 5738        | 12/4                  | 18.20                      | 25°08'        | 67°39'         |             | 1       | 37/ 90                  | 21/22               | 1   |                           |                      |
| 5743        | 13/4                  | 08.00                      | 25°26'        | 66°10'         | 1           | 2       | 38/160                  | 23                  |     |                           |                      |
| 5746        | 13/4                  | 18.45                      | 26°12'        | 66°11'         | 1           | 2       | 39/ 85                  | 24                  | 1   |                           |                      |
| 5750        | 14/4                  | 08.00                      | 27°46'        | 66°09'         | 1           | 2       | 40/200                  |                     | 1   |                           |                      |
| 5756        | 14/4                  | 18.45                      | 29°09'        | 66°10'         | 1           | 2       | 41/ 85                  |                     | 1   |                           |                      |
| 5760        | 15/4                  | 04.05                      | 30°27'        | 66°08'         |             | 1       |                         |                     |     | 1800                      |                      |
| 5761        | 15/4                  | 08.17                      | 30°35'        | 65°59'         | 1           | 2       | 42/375                  | 25                  | 1   | 1800                      |                      |
| 5764        | 15/4                  | 19.30                      | 31°00'        | 65°22'         | 1           |         |                         |                     |     |                           |                      |

The phases of the cruise are listed below, together with the special investigations: (1) Cuxhaven – Ponta Delgada (Azores) 12/II – 20/II, (2) Ponta Delgada – Bermuda 23/II – 5/III, (3) Bermuda – Bermuda 7/III – 16/III (tracking of hormon treated eels, sampling for adult eels by midwater trawl), (4) Bermuda – Bermuda 18/III – 28/III (plankton and neuston investigations), (5) Bermuda – Ponta Delgada 31/III – 9/IV (plankton and neuston investigations), (6) Ponta Delgada – Portimao (Southportugal), (7) Portimao – Cuxhaven.

Geographic positions of the different stations and equipment used are shown in Table 2. Only a few of the planned hauls of the IKMT during the transect had to be cancelled because of bad weather. Unfavourable weather conditions were encountered during the plankton investigations of the fourth phase, which caused some problems particularly for operations with the Multiple Closing Net. Generally, the weather in the northern central Sargasso Sea was more adverse than in the southern part so that the R. V. "Friedrich Heincke", operating in the northern area, had to work under more

Table 1b. Station list F. R. V. "Anton Dohrn" Cruise No. 210/92, Part 2 (Sargasso Sea – Bay of Biscay)

| Station No. | Date 1979 (day/month) | Local time | GMT  | Latitude (°N) | Longitude (°W) | Multi-sonde | Neu-son | IKMT (haul No./m depth) | Midwater trawl (m depth) |
|-------------|-----------------------|------------|------|---------------|----------------|-------------|---------|-------------------------|--------------------------|
| 5772        | 19/4                  | 13.15      | +4 h | 31°11'        | 63°32'         | 1           | 1       |                         | 1650                     |
| 5773        | 19/4                  | 19.30      | +4 h | 31°15'        | 63°23'         | 1           | 1       |                         | 170                      |
| 5774        | 19/4                  | 20.30      | +4 h | 31°01'        | 63°15'         | 1           | 1       |                         | 250                      |
| 5778        | 20/4                  | 05.30      | +4 h | 29°54'        | 62°08'         | 1           | 1       |                         |                          |
| 5780        | 20/4                  | 14.30      | +4 h | 28°41'        | 60°59'         | 1           | 2       |                         | 2000                     |
| 5781        | 20/4                  | 21.00      | +4 h | 28°20'        | 60°33'         |             | 2       | 43/ 55                  |                          |
| 5786        | 21/4                  | 09.00      | +4 h | 26°46'        | 59°02'         | 1           | 1       | 44/380                  |                          |
| 5788        | 21/4                  | 14.30      | +4 h | 26°11'        | 58°26'         | 1           | 1       |                         | 1800                     |
| 5789        | 21/4                  | 18.20      | +4 h | 26°06'        | 58°26'         | 1           | 2       |                         |                          |
| 5790        | 21/4                  | 20.03      | +4 h | 25°52'        | 58°12'         |             |         | 45/ 95                  |                          |
| 5795        | 22/4                  | 09.00      | +4 h | 25°51'        | 55°42'         | 1           | 1       | 46/208                  |                          |
| 5797        | 22/4                  | 14.30      | +4 h | 25°49'        | 54°48'         | 1           | 2       |                         | 2000                     |
| 5798        | 22/4                  | 20.05      | +4 h | 25°49'        | 54°31'         |             | 1       | 47/100                  |                          |
| 5803        | 23/4                  | 09.25      | +4 h | 27°12'        | 52°55'         | 1           | 1       | 48/200                  |                          |
| 5805        | 23/4                  | 14.15      | +4 h | 27°38'        | 52°22'         | 1           | 2       |                         | 2000                     |
| 5806        | 23/4                  | 19.00      | +4 h | 27°49'        | 52°13'         |             | 2       | 49/100                  | 250                      |
| 5810        | 24/4                  | 08.30      | +4 h | 29°16'        | 50°30'         | 1           | 1       | 50/185                  |                          |
| 5812        | 24/4                  | 15.00      | +4 h | 29°40'        | 49°38'         |             | 1       |                         | 2000                     |
| 5813        | 24/4                  | 17.50      | +4 h | 29°41'        | 49°27'         | 1           | 3       | 51/ 95                  | 110                      |
| 5816        | 25/4                  | 09.00      | +3 h | 30°22'        | 47°25'         |             | 1       | 52/245                  |                          |
| 5817        | 25/4                  | 16.00      | +3 h | 30°43'        | 46°16'         | 1           | 2       |                         | 2000                     |
| 5818        | 25/4                  | 20.00      | +3 h | 30°43'        | 46°16'         |             | 1       |                         | 195                      |
| 5819        | 25/4                  | 21.00      | +3 h | 30°47'        | 46°04'         |             | 1       |                         | 310                      |
| 5820        | 25/4                  | 21.55      | +3 h | 30°48'        | 46°02'         |             | 1       | 53/ 40                  |                          |
| 5823        | 26/4                  | 08.30      | +3 h | 31°31'        | 44°02'         | 1           | 1       | 54/324                  |                          |
| 5825        | 26/4                  | 15.50      | +3 h | 31°51'        | 42°55'         | 1           | 3       |                         | 2000                     |
| 5826        | 26/4                  | 20.45      | +3 h | 31°55'        | 42°46'         |             | 1       |                         | 200                      |
| 5828        | 26/4                  | 21.46      | +3 h | 31°56'        | 42°43'         |             | 1       | 54/ 50                  |                          |
| 5831        | 27/4                  | 08.30      | +3 h | 32°45'        | 40°39'         | 1           | 1       | 55/235                  |                          |
| 5833        | 27/4                  | 15.00      | +3 h | 32°50'        | 39°49'         |             | 2       |                         | 2000                     |
| 5834        | 27/4                  | 18.15      | +3 h | 33°01'        | 39°34'         | 1           | 1       | 56/235                  | 185                      |
| 5835        | 27/4                  | 20.30      | +3 h | 33°04'        | 39°29'         |             | 1       |                         | 345                      |
| 5836        | 27/4                  | 21.34      | +3 h | 33°04'        | 39°27'         |             |         | 57/ 40                  |                          |
| 5839        | 28/4                  | 08.30      | +2 h | 33°52'        | 37°11'         | 1           | 1       |                         |                          |
| 5842        | 28/4                  | 16.30      | +2 h | 34°21'        | 35°22'         | 1           | 2       |                         | 1300                     |
| 5843        | 28/4                  | 20.20      | +2 h | 34°20'        | 35°24'         |             | 1       |                         | 170                      |
| 5844        | 28/4                  | 21.20      | +2 h | 34°21'        | 35°22'         |             | 1       |                         | 320                      |
| 5847        | 29/4                  | 08.30      | +2 h | 35°06'        | 33°09'         | 1           | 1       | 58/281                  |                          |
| 5849        | 29/4                  | 16.20      | +2 h | 35°24'        | 32°01'         | 1           | 2       |                         | 2000                     |
| 5850        | 29/4                  | 20.05      | +2 h | 35°24'        | 31°53'         |             | 2       | 59/ 35                  | 350                      |
| 5852        | 30/4                  | 06.00      | +2 h | 35°20'        | 30°16'         | 1           | 1       |                         | 2000                     |
| 5855        | 30/4                  | 19.00      | +2 h | 36°37'        | 28°13'         | 1           |         |                         |                          |
| 5861        | 01/5                  | 16.00      | +1 h | 38°33'        | 24°50'         | 1           |         |                         |                          |
| 5864        | 02/5                  | 09.30      | +1 h | 40°48'        | 23°59'         | 1           |         |                         |                          |
| 5865        | 02/5                  | 11.00      | +1 h | 41°02'        | 23°52'         |             | 1       |                         | 2000                     |
| 5867        | 02/5                  | 18.30      | +1 h | 42°00'        | 23°32'         | 1           | 1       |                         | 1900                     |
| 5868        | 02/5                  | 19.10      | +1 h | 42°05'        | 23°30'         |             | 1       |                         | 200                      |
| 5869        | 02/5                  | 20.15      | +1 h | 42°07'        | 23°30'         |             | 1       |                         | 400                      |
| 5870        | 02/5                  | 21.56      | +1 h | 42°08'        | 23°29'         |             | 1       | 60/ 42                  |                          |



Table 1b (continued)

| Station No. | Date 1979 (day/month) | Local time | GMT | Latitude (°N) | Longitude (°W) | Multi-sonde | Neuston | IKMT (haul No./m depth) | Midwater trawl (m depth) |
|-------------|-----------------------|------------|-----|---------------|----------------|-------------|---------|-------------------------|--------------------------|
| 5873        | 03/5                  | 08.30      |     | 43°53'        | 22°45'         | 1           | 1       |                         |                          |
| 5875        | 03/5                  | 16.00      |     | 44°54'        | 22°16'         | 1           | 2       |                         | 2000                     |
| 5876        | 03/5                  | 20.00      |     | 44°56'        | 22°00'         |             |         |                         | 175                      |
| 5877        | 03/5                  | 21.00      |     | 44°56'        | 21°57'         |             | 1       |                         | 340                      |
| 5878        | 03/5                  | 21.36      |     | 44°56'        | 21°55'         |             | 1       | 61/ 45                  |                          |
| 5881        | 04/5                  | 08.30      |     | 44°58'        | 19°18'         | 1           | 1       |                         |                          |
| 5884        | 04/5                  | 16.45      |     | 44°55'        | 17°34'         | 1           | 1       |                         | 2000                     |
| 5885        | 04/5                  | 20.45      |     | 44°55'        | 17°22'         |             | 1       |                         | 205                      |
| 5886        | 04/5                  | 21.40      |     | 44°56'        | 17°18'         |             | 1       |                         | 350                      |
| 5887        | 04/5                  | 22.45      |     | 44°56'        | 17°17'         |             |         | 62/ 50                  |                          |
| 5889        | 05/5                  | 04.30      |     | 45°00'        | 16°00'         | 1           | 1       |                         |                          |
| 5890        | 05/5                  | 08.30      |     | 45°14'        | 15°25'         | 1           |         |                         |                          |
| 5893        | 05/5                  | 16.25      |     | 45°51'        | 13°42'         | 1           | 2       |                         | 2000                     |
| 5894        | 05/5                  | 20.33      |     | 45°54'        | 13°30'         |             | 1       |                         | 205                      |
| 5895        | 05/5                  | 21.13      |     | 45°53'        | 13°27'         |             | 1       |                         | 350                      |
| 5896        | 05/5                  | 22.17      |     | 45°56'        | 13°25'         |             | 1       | 63/ 38                  |                          |
| 5898        | 06/5                  | 08.30      |     | 46°44'        | 11°11'         | 1           | 1       |                         |                          |
| 5900        | 06/5                  | 15.00      |     | 47°23'        | 09°54'         |             | 1       |                         |                          |
| 5901        | 06/5                  | 18.00      |     | 47°42'        | 09°08'         |             | 1       |                         | 2000                     |
| 5902        | 06/5                  | 21.03      |     | 47°45'        | 08°58'         |             | 1       | 64/ 40                  |                          |
| 5903        | 06/5                  | 22.15      |     | 47°46'        | 08°56'         | 1           |         |                         |                          |
| 5904        | 07/5                  | 02.00      |     | 47°58'        | 08°16'         |             |         | 65/ 40                  |                          |

unfavourable conditions than the F. R. V. "Anton Dohrn" operating at the same time in the south.

#### RESULTS AND FURTHER RESEARCH

The results of the 1979 eel expedition, included in this issue of the journal "Helgoländer Meeresuntersuchungen", are mainly concerned with eel research; earlier publications and mimeographed papers of this matter are available by Comparini (1980a, b), Comparini & Rodino (1980), Kracht & Tesch (1981), McCleave & Harden Jones (1979), Schoth (1981), Stibane (1981), Tesch (1980a, b, 1982), Tesch et al. (1979), Wegner (1979a). Scientific results in other fields have been published by John (1982), Moebus (1980), Moebus & Nattkemper (1981), Ulken (1980), Wegner (1979b). Additional material is currently being evaluated and will be published in this journal or elsewhere.

Promising but very preliminary results were obtained by treating silver eels with pituitary extracts on board and by tracking four of these specimens north of and in the centre of the spawning area of *A. anguilla*. The specimens could be observed swimming at a maximum depth of 700 m but also just below the surface. Three specimens showed a mean swimming direction of WSW; but one of these specimens, tracked in the central spawning area, exhibited a more random directional tendency. Technically, the Sargasso Sea area offered favourable conditions for tracking with ultrasonic methods because the thermo- and salinoclines were weak at that time of the year.



Table 2 (continued)

| Station No. | Date 1979 (day/month) | Local time  | GMT  | Latitude (°N) | Longitude (°W) | Microbiological bottle |     |             |                |                |     |             |             |  |
|-------------|-----------------------|-------------|------|---------------|----------------|------------------------|-----|-------------|----------------|----------------|-----|-------------|-------------|--|
|             |                       |             |      |               |                | Hydrocast              | XBT | Secchi disk | IKMT           | Midwater trawl | MCN | Apstein net | Neuston net |  |
| 498         | 10/3                  | 18.00-18.50 | +4 h | 27°47'        | 59°07'         | 1                      |     |             |                |                |     |             |             |  |
| 499         | 10/3                  | 20.15-22.05 | +4 h | 27°38'        | 58°53'         |                        |     |             | 2              |                |     |             |             |  |
| 500         | 10/3                  | 22.25-06.00 | +4 h | 27°35'        | 58°52'         |                        |     |             |                | 1              |     |             |             |  |
| 501         | 11/3                  | 07.30-07.35 | +4 h | 27°07'        | 58°33'         | 1                      |     |             |                |                |     |             |             |  |
| 502         | 11/3                  | 08.55-09.05 | +4 h | 26°53'        | 58°31'         |                        | 1   | 1           |                |                |     |             |             |  |
| 503         | 11/3                  | 13.54-      | +4 h | 26°05'        | 58°34'         |                        |     |             |                |                |     |             |             |  |
|             | 12/3                  | -05.30      | +4 h | 26°03'        | 58°35'         |                        |     |             | eel tracking   |                |     |             |             |  |
| 504         | 12/3                  | 07.20-11.00 | +4 h | 26°06'        | 58°35'         | 1                      |     |             |                | 1              |     |             |             |  |
| 505         | 12/3                  | 11.40-19.15 | +4 h | 26°14'        | 58°36'         | 1                      |     |             |                | 1              |     |             |             |  |
| 506         | 12/3                  | 19.25-23.45 | +4 h | 26°01'        | 58°47'         |                        |     |             | 4              |                |     |             |             |  |
| 507         | 13/3                  | 00.00-06.00 | +4 h | 26°05'        | 58°40'         |                        |     |             |                | 1              |     |             |             |  |
| 508         | 13/3                  | 07.30-07.45 | +4 h | 26°25'        | 58°47'         | 1                      |     | 1           |                |                |     |             |             |  |
| 509         | 13/3                  | 10.45-11.30 | +4 h | 26°55'        | 58°47'         | 1                      |     |             |                |                |     |             |             |  |
| 510         | 13/3                  | 18.15-18.50 | +4 h | 27°44'        | 58°52'         |                        |     |             | technical test |                |     |             |             |  |
| 511         | 13/3                  | 19.35       | +4 h | 27°47'        | 58°50'         |                        | 1   |             |                |                |     |             |             |  |
| 512         | 14/3                  | 05.20       | +4 h | 29°15'        | 58°53'         |                        | 1   |             |                |                |     |             |             |  |
| 513         | 14/3                  | 07.30-07.35 | +4 h | 29°37'        | 58°53'         | 1                      |     |             |                |                |     |             |             |  |
| 514         | 14/3                  | 07.40       | +4 h | 29°37'        | 58°53'         |                        | 1   |             |                |                |     |             |             |  |
| 515         | 14/3                  | 09.40-10.20 | +4 h | 29°53'        | 58°53'         | 1                      |     | 1           |                |                |     |             |             |  |
| 516         | 14/3                  | 20.00-22.30 | +4 h | 30°41'        | 60°48'         |                        |     |             | 2              |                |     |             |             |  |
| 517         | 14/3                  | 22.50-23.50 | +4 h | 30°35'        | 60°45'         |                        |     |             |                | 1              |     |             |             |  |
| 518         | 15/3                  | 07.30-07.35 | +4 h | 31°12'        | 62°01'         | 1                      |     |             |                |                |     |             |             |  |
| 519         | 15/3                  | 13.55-18.30 | +4 h | 31°41'        | 63°07'         |                        |     |             | eel tracking   |                |     |             |             |  |
| 520         | 15/3                  | 20.00-23.35 | +4 h | 31°43'        | 63°15'         |                        |     |             | 3              |                |     |             |             |  |
| 521         | 16/3                  | 06.00-06.15 | +4 h | 32°20'        | 64°35'         |                        |     |             | 1              |                |     |             |             |  |
| 522         | 20/3                  | 08.00-08.10 | +4 h | 31°04'        | 57°18'         | 1                      |     |             |                |                |     |             |             |  |
| 523         | 20/3                  | 10.00-15.50 | +4 h | 31°00'        | 57°00'         | 1                      | 1   |             |                |                | 2   | 1           | 1           |  |
| 524         | 20/3                  | 18.50-20.45 | +4 h | 30°30'        | 57°00'         |                        |     |             |                |                | 1   |             | 1           |  |
| 525         | 20/3                  | 23.15-01.00 | +4 h | 30°00'        | 57°00'         |                        | 1   |             |                |                | 1   | 1           |             |  |
| 526         | 21/3                  | 08.00-08.05 | +4 h | 29°36'        | 57°05'         | 1                      |     |             |                |                |     |             |             |  |
| 527         | 21/3                  | 10.45-12.40 | +4 h | 29°36'        | 57°15'         |                        |     |             |                |                |     | 4           | 1           |  |
| 528         | 21/3                  | 15.40-17.20 | +4 h | 29°00'        | 57°00'         |                        |     |             |                |                | 1   |             | 1           |  |
| 529         | 21/3                  | 20.00-21.40 | +4 h | 28°30'        | 57°00'         |                        |     |             |                |                |     | 2           | 1           |  |
| 530         | 22/3                  | 01.30-02.40 | +4 h | 28°00'        | 57°00'         |                        |     | 1           |                |                |     | 2           | 1           |  |
| 531         | 22/3                  | 08.00-08.05 | +4 h | 27°56'        | 57°44'         | 1                      |     |             |                |                |     |             |             |  |
| 532         | 22/3                  | 13.00-15.00 | +4 h | 28°00'        | 58°20'         | 1                      |     |             |                |                | 1   | 1           | 1           |  |
| 533         | 22/3                  | 19.05-20.30 | +4 h | 28°30'        | 58°20'         |                        | 1   |             |                |                |     | 3           | 1           |  |
| 534         | 22/3                  | 23.40-00.40 | +4 h | 29°00'        | 58°20'         |                        |     |             |                |                |     | 2           | 1           |  |
| 535         | 23/3                  | 03.50-05.05 | +4 h | 29°30'        | 58°20'         | 1                      |     |             |                |                |     | 2           | 1           |  |
| 536         | 23/3                  | 08.45-10.05 | +4 h | 30°00'        | 58°20'         | 1                      |     |             |                |                |     | 2           | 1           |  |
| 537         | 23/3                  | 12.30-15.30 | +4 h | 30°30'        | 58°20'         |                        |     |             |                |                | 2   | 2           | 1           |  |
| 538         | 23/3                  | 18.45-20.00 | +4 h | 31°00'        | 58°20'         |                        |     |             |                |                |     | 2           | 1           |  |
| 539         | 23/3                  | 22.45-01.00 | +4 h | 31°30'        | 58°20'         |                        |     |             |                |                | 1   | 2           | 1           |  |
| 540         | 24/3                  | 04.00-05.00 | +4 h | 31°29'        | 58°53'         |                        |     |             | 1              |                |     |             |             |  |

Table 2 (continued)

| Station No. | Date 1979<br>(day/month) | Local time  | GMT  | Latitude<br>(°N) | Longitude<br>(°W) | Microbiological bottle |     | Secchi disk | IKMT | Midwater trawl | MCN | Apstein net | Neuston net |
|-------------|--------------------------|-------------|------|------------------|-------------------|------------------------|-----|-------------|------|----------------|-----|-------------|-------------|
|             |                          |             |      |                  |                   | Hydrocast              | XBT |             |      |                |     |             |             |
| 541         | 24/3                     | 08.15-11.30 | +4 h | 31°30'           | 59°40'            | 1                      | 1   | 1           |      |                | 1   | 2           | 1           |
| 542         | 24/3                     | 14.15-15.55 | +4 h | 31°00'           | 59°40'            |                        |     |             |      |                | 1   | 1           | 1           |
| 543         | 24/3                     | 18.10-19.40 | +4 h | 30°30'           | 59°40'            |                        |     | 1           |      |                | 1   | 1           | 1           |
| 544         | 24/3                     | 22.30-23.50 | +4 h | 30°00'           | 59°40'            |                        |     | 1           |      |                | 1   | 1           | 1           |
| 545         | 25/3                     | 02.35-03.45 | +4 h | 29°30'           | 59°40'            |                        |     |             |      |                | 1   | 1           | 1           |
| 546         | 25/3                     | 06.00-07.55 | +4 h | 29°00'           | 59°40'            |                        |     | 1           |      |                | 1   | 1           | 1           |
| 547         | 25/3                     | 08.45-08.50 | +4 h | 28°50'           | 59°38'            | 1                      |     |             |      |                |     |             |             |
| 548         | 25/3                     | 10.30-11.45 | +4 h | 28°30'           | 59°40'            |                        |     | 1           |      |                | 1   | 1           | 1           |
| 549         | 25/3                     | 14.30-15.55 | +4 h | 28°00'           | 59°40'            |                        |     |             |      |                | 1   | 1           | 1           |
| 550         | 25/3                     | 18.45-20.15 | +4 h | 27°30'           | 59°40'            |                        |     | 1           |      |                | 1   | 1           | 1           |
| 551         | 25/3                     | 21.45-22.50 | +4 h | 27°13'           | 59°40'            |                        |     |             | 1    |                |     |             |             |
| 552         | 25/3                     | 23.35-00.50 | +4 h | 27°00'           | 59°40'            |                        |     | 1           |      |                | 1   | 1           | 1           |
| 553         | 26/3                     | 03.30-06.15 | +4 h | 26°30'           | 59°40'            |                        | 1   | 1           |      |                | 2   | 1           | 1           |
| 554         | 26/3                     | 08.45-08.50 | +4 h | 26°31'           | 60°14'            | 1                      |     |             |      |                |     |             |             |
| 555         | 26/3                     | 12.35-15.50 | +4 h | 26°30'           | 61°00'            |                        | 1   |             |      |                | 2   | 1           | 1           |
| 556         | 26/3                     | 18.20-19.44 | +4 h | 27°00'           | 61°00'            |                        |     | 1           |      |                | 1   | 1           | 1           |
| 557         | 26/3                     | 19.53-21.40 | +4 h | 27°00'           | 61°00'            |                        |     |             | 3    |                |     |             |             |
| 558         | 26/3                     | 23.45-00.55 | +4 h | 27°30'           | 61°00'            |                        |     | 1           |      |                | 1   | 1           | 1           |
| 559         | 27/3                     | 03.40-04.45 | +4 h | 28°00'           | 61°00'            |                        |     |             |      |                | 1   | 1           | 1           |
| 560         | 27/3                     | 07.40-09.05 | +4 h | 28°30'           | 61°00'            | 1                      |     |             |      |                | 1   | 1           | 1           |
| 561         | 27/3                     | 12.00-13.25 | +4 h | 29°00'           | 61°00'            |                        |     |             |      |                | 1   | 1           | 1           |
| 562         | 27/3                     | 16.20-17.40 | +4 h | 29°30'           | 61°00'            |                        |     |             |      |                | 1   | 1           | 1           |
| 563         | 27/3                     | 20.30-23.10 | +4 h | 30°00'           | 61°00'            |                        |     | 1           | 1    |                | 1   | 1           | 1           |
| 564         | 28/3                     | 01.40-04.05 | +4 h | 30°30'           | 61°00'            |                        |     | 1           |      |                | 2   | 1           | 1           |
| 565a        | 28/3                     | 06.45-09.55 | +4 h | 31°00'           | 61°00'            | 1                      | 1   | 1           |      |                | 2   | 1           | 1           |
| 565b        | 31/3                     | 08.10-08.15 | +4 h | 32°20'           | 64°38'            | 1                      |     |             |      |                |     |             |             |
| 566         | 31/3                     | 16.45-18.55 | +3 h | 32°33'           | 63°01'            |                        |     | 1           | 1    |                | 1   |             | 1           |
| 567         | 01/4                     | 02.00-03.35 | +3 h | 32°50'           | 61°20'            |                        |     | 1           | 1    |                | 1   |             | 1           |
| 568         | 01/4                     | 09.15-09.20 | +3 h | 33°03'           | 59°59'            | 1                      |     |             |      |                |     |             |             |
| 569         | 01/4                     | 21.00-23.50 | +3 h | 33°39'           | 57°22'            |                        |     | 1           | 2    |                | 1   |             | 2           |
| 570         | 02/4                     | 08.15-11.45 | +3 h | 34°01'           | 55°15'            | 1                      | 1   |             | 1    |                | 2   |             | 1           |
| 571         | 02/4                     | 22.35-00.00 | +3 h | 34°29'           | 52°58'            |                        |     |             | 1    |                |     |             |             |
| 572         | 05/4                     | 07.15-11.45 | +2 h | 36°03'           | 42°28'            | 1                      |     |             | 1    |                |     |             |             |
| 573         | 05/4                     | 12.50-16.40 | +2 h | 36°09'           | 42°17'            |                        |     |             |      |                | 2   |             | 1           |
| 574         | 05/4                     | 21.00-21.30 | +2 h | 36°15'           | 41°13'            |                        |     |             |      |                |     |             | 1           |
| 575         | 06/4                     | 03.00-03.30 | +2 h | 36°23'           | 40°08'            |                        |     |             |      |                |     |             | 1           |
| 576         | 06/4                     | 08.15-08.25 | +2 h | 36°26'           | 39°04'            | 1                      |     |             |      |                |     |             |             |
| 577         | 06/4                     | 09.00-09.40 | +2 h | 36°27'           | 38°52'            |                        |     |             |      |                |     |             | 1           |
| 578         | 06/4                     | 15.00-15.30 | +2 h | 36°31'           | 37°46'            |                        |     |             |      |                |     |             | 1           |
| 579         | 06/4                     | 21.00-21.30 | +2 h | 36°40'           | 36°35'            |                        |     |             |      |                |     |             | 1           |
| 580         | 07/4                     | 03.00-03.30 | +2 h | 36°53'           | 35°26'            |                        |     |             |      |                |     |             | 1           |
| 581         | 07/4                     | 08.15-08.25 | +2 h | 37°03'           | 34°21'            | 1                      |     |             |      |                |     |             |             |
| 582         | 07/4                     | 09.05-09.45 | +2 h | 37°04'           | 34°11'            |                        |     |             |      |                | 1   |             | 1           |
| 583         | 07/4                     | 14.00-15.35 | +2 h | 37°09'           | 33°34'            |                        |     |             |      |                | 2   |             | 1           |

Table 2 (continued)

| Station No. | Date 1979 (day/month) | Local time  | GMT  | Latitude (°N) | Longitude (°W) | Microbiological bottle | Hydrocast | XBT | Secchi disk | IKMT | Midwater trawl | MCN | Apstein net | Neuston net |
|-------------|-----------------------|-------------|------|---------------|----------------|------------------------|-----------|-----|-------------|------|----------------|-----|-------------|-------------|
| 584         | 07/4                  | 20.00–21.20 | +2 h | 37°22'        | 32°41'         |                        |           |     |             |      |                |     | 2           | 1           |
| 585         | 08/4                  | 16.00       | +2 h | 37°57'        | 29°27'         |                        |           | 1   |             |      |                |     |             |             |
| 586         | 08/4                  | 20.00–21.00 | +2 h | 37°56'        | 28°31'         |                        |           |     |             |      |                |     | 2           | 1           |
| 587         | 09/4                  | 03.00–03.50 | +2 h | 37°52'        | 27°21'         |                        |           |     |             |      |                |     | 2           | 1           |
| 588         | 09/4                  | 08.00–09.35 | +2 h | 37°46'        | 26°22'         | 1                      |           |     |             |      |                |     | 3           | 1           |
| 589         | 09/4                  | 12.00–12.55 | +2 h | 37°44'        | 25°47'         |                        |           |     |             |      |                |     | 2           | 1           |
| 590         | 12/4                  | 08.45–08.50 | +2 h | 37°20'        | 22°02'         | 1                      |           |     |             |      |                |     |             |             |
| 591         | 12/4                  | 10.20       | +2 h | 37°18'        | 21°38'         |                        |           |     |             |      | turtle capture |     |             |             |
| 592         | 12/4                  | 20.45–00.15 | +2 h | 37°02'        | 19°26'         |                        |           |     |             |      | 4              |     |             |             |
| 593         | 13/4                  | 08.45–08.55 | +2 h | 36°51'        | 17°25'         | 1                      |           |     |             |      |                |     |             |             |
| 594         | 13/4                  | 09.50       | +2 h | 36°50'        | 17°10'         |                        |           |     |             |      | turtle capture |     |             |             |
| 595         | 13/4                  | 20.30–00.00 | +2 h | 36°38'        | 14°49'         |                        |           | 1   |             |      | 4              |     |             |             |
| 596         | 14/4                  | 08.45–08.55 | +2 h | 36°30'        | 13°00'         | 1                      |           |     |             |      |                |     |             |             |
| 597         | 14/4                  | 20.00–23.45 | +2 h | 36°19'        | 10°39'         |                        | 1         | 1   |             | 4    |                |     |             |             |
| 598         | 15/4                  | 08.45–08.55 | +2 h | 36°07'        | 08°43'         | 1                      |           |     |             |      |                |     |             |             |
| 599         | 15/4                  | 17.20–22.45 | +2 h | 35°51'        | 06°58'         |                        | 1         | 1   |             | 4    |                |     |             |             |
| 600         | 16/4                  | 03.00–11.50 | +2 h | 36°20'        | 07°28'         | 1                      | 2         | 1   |             | 6    |                |     |             |             |
| 601         | 21/4                  | 08.00–08.10 | –1 h | 41°35'        | 10°20'         | 1                      |           |     |             |      |                |     |             |             |
| 602         | 21/4                  | 20.00–00.15 | –1 h | 43°37'        | 09°34'         | 1                      | 1         | 1   |             | 3    |                |     |             |             |
| 603         | 22/4                  | 08.00–08.10 | –1 h | 44°47'        | 08°50'         | 1                      |           |     |             |      |                |     |             |             |
| 604         | 22/4                  | 20.00–00.05 | –1 h | 46°23'        | 07°16'         |                        | 1         |     |             | 3    |                |     |             |             |
| 605         | 23/4                  | 08.00–08.10 | –1 h | 47°32'        | 06°17'         | 1                      |           |     |             |      |                |     |             |             |

Besides other organisms, fish eggs were also sorted out from the IKMT catches (Table 1) simultaneously with the leptocephali. More than 7000 eggs were structurally classified (Stibane, 1981), but the taxonomic determination was very limited. Publication without detailed analysis is therefore unsuitable. It is very likely that in the sorted samples no eggs of *Anguilla* sp. were found but probably a great number of other anguilliform fish eggs (23%). This coincides with the comparatively great numbers of anguilliform 0-group fish larvae, e.g. *Serrivomer* sp. and *Nemichthys scolopaceus*, in the spawning area of *Anguilla* sp. (Tesch et al., 1979).

As a consequence of the 1979 eel expedition, one additional transect across the North Atlantic for the collection of leptocephali was made in autumn 1979 by F. R. V. "Anton Dohrn" (Kracht & Tesch, 1981; Kracht, 1982). The results of an earlier investigation involving collections of eel larvae along transects through the Gulf Stream are included in this issue (Kleckner & McCleave, 1982).

In Spring 1981, there were two further cruises into the Sargasso Sea. One U. S. American and one German (FRG) ship, both collecting larvae, cooperated in order to cover the southeastern area of the Sargasso Sea and to investigate the beginning of the spawning season (Tesch, 1980a). One of the main objectives of R. V. "Friedrich Heincke"

on its second visit to the Sargasso Sea was to investigate the patchiness of 0-group larvae occurrence. Two transects across the Atlantic were included, one of which covered the southern limits of I- and II-group larvae.

Discussions about future research on Atlantic eel reproduction (Tesch, 1980a) revealed that there is great need for further sampling of eel larvae over a wide area and over many months of the year. Considerations about the effort required to cover these wide areas disclosed that, at present, research is not possible because resources are insufficient. Since sampling is restricted by this limitation, the best solution would be to sample a smaller area intensively over a longer period of time. Oceanographic investigations in the presumed spawning area should be included. It is evident, especially since the 1981 expedition but also from evidence supplied by earlier cruises, that 0-group larvae occur in patches which are more than 30 nautical miles in diameter. Analysis of these patches in regard to time and space, species and age composition is necessary. The investigation of the transatlantic migration of the larvae is also of major importance. This requires intensive sampling on the routes between the Sargasso Sea and Europe, Greenland and North America. Electrophoretic studies of 0-group larvae should be repeated. The search for adult eels has been unsuccessful. Trawl catches, therefore, should not be continued, but other techniques should be applied or developed, e.g. the tracking of hormonally treated eels, use of hormonally matured females as lures or the direct use of a possible eel pheromone, use of light as an attractant, and television.

Greater efforts are necessary if these questions are to be solved on a larger scale. For a better understanding of the biology of eel reproduction, a multiship activity (as internationally, originally planned) and many single, specially equipped cruises are indispensable. One step towards better fundamental knowledge of eel migration is the present international, intensive investigation of the North Atlantic circulation (ICES and SCOR).

Eel reproduction is regarded mainly as a problem of biological research. Sea fishery research which is in a position to carry out the considerable shipping effort and to apply the techniques needed for the aforementioned studies does not focus on eel research. Commercial sea fisheries exploit only a small part of the total amount of the world eel production. The total world yield of eel, according to the available statistics (FAO), amounts to ca. 100,000 t. The actual world yield, however, exceeds this amount; the statistics are not complete. With regard to its high commercial value, per total world yield, the eel ranks 6th–8th in importance when compared with other fish. In price, per unit weight, however, the eel occupies the second position after the salmon. This high yield is due mainly to the progress made in recent years in aquaculture, and the increase is far above average compared with the results gained with other fish. The supply of young fish for eel production is still provided by the exceptionally large natural resources (e.g. from the Sargasso Sea spawning area) and not yet by aquaculture. We, therefore, have good reason to intensify research activities on eel reproduction. This is not only necessary with respect to the surveillance of natural resources but also to increase our knowledge especially for developing artificial spawning methods.

*Acknowledgements.* The investigations carried out during and following the Sargasso Sea Eel Expedition 1979 were supported by the Bundesministerium für Forschung und Technologie (MFE0336), Bonn (FRG).

## LITERATURE CITED

- Comparini, A., 1980a. Distribuzione dei genotipi della malico deidrogenasi (MDH) en un campione di leptocephali di *Anguilla* del Mar dei Sargasso. – Atti Ass. genet. ital. 25.
- Comparini, A., 1980b. Variabilita enzimatica nelle anguilli. Primi dati su leptocephali di *Anguilla anguilla* (L.) e *Anguilla rostrata* (Lesueur). – Boll. Zool. (Suppl.) 46, 239–240.
- Comparini, A. & Rodino, E., 1980. Electrophoretic evidence for the two species of *Anguilla* leptocephali in the Sargasso Sea. – Nature, Lond. 287, 435–437.
- John, H.-C., 1982. Distribution of *Halobates micans* (Heteroptera, Gerridae) in the Northern Atlantic during Spring, with comments on its catchability in neuston nets. – "Meteor" Forsch. Ergebn. (D), 34, 31–36.
- Kleckner, R. C. & McCleave, J. D., 1982. Entry of migrating American eel leptocephali into the Gulf Stream system. – Helgoländer Meeresunters. 35, 329–339.
- Kracht, R. & Tesch, F.-W., 1981. Progress report on the eel expedition of R. V. "Anton Dohrn" and R. C. "Friedrich Heincke" to the Sargasso Sea 1979. – Envir. Biol. Fish. 6, 311–375.
- Kracht, R. 1982. On the geographic distribution and migration of I- and II-group eel larvae as studied during the 1979 Sargasso Sea Expedition. – Helgoländer Meeresunters. 35, 321–327.
- McCleave, J. D. & Harden Jones, F. R., 1979. Eels: new interest in an old problem. – Nature, Lond. 278, 782–3.
- Moebus, K., 1980. A method for the detection of bacteriophages from ocean water. – Helgoländer Meeresunters. 34, 1–14.
- Moebus, K. & Nattkemper, H., 1981. Bacteriophage sensitivity patterns among bacteria isolated from marine waters. – Helgoländer Meeresunters. 34, 275–385.
- Schmidt, J., 1924. The breeding places of the eel. – A. Rep. Smithsonian Instn 1924, 279–316.
- Schoth, M., 1981. Die Verteilung der frühen Leptocephalusstadien des Atlantischen Aales der deutschen Sargassomeer-Expedition 1979. Dipl.-Arb., Univ. Hamburg, 103 pp. (unpubl.).
- Stibane, F., 1981. Die Verteilung pelagischer Fischeier aus Fängen der deutschen Sargassosee-Expedition 1979. Dipl.-Arb., Univ. Hamburg, 127 pp. (unpubl.).
- Tesch, F.-W., 1980a. Report on the available data of the Atlantic *Anguilla* larvae, presented to the ICES Planning Group for the Atlantic Eel Expedition. – C.M./ICES/M 7, 1–10.
- Tesch, F.-W., 1980b. Report of the international eel expedition planning group. – C. M./ICES/M 43, 1–2.
- Tesch, F.-W., 1982. Neues aus der Aalforschung. – Fisch u. Fang 23, 606–608.
- Tesch, F.-W., Kracht, R., Schoth, M., Smith, D. G. & Wegner, G., 1979. Report on the eel expedition of FRV "Anton Dohrn" and R. K. "Friedrich Heincke" to the Sargasso Sea 1979. – C.M./ICES/M 6, 1–29.
- Ulken, A., 1980. Phycomycetenfunde in der Sargassosee. – Veröff. Inst. Meeresforsch. Bremerh. 18, 21–27.
- Wegner, G., 1979a. First hydrographic results from the Sargasso Sea expedition with F. R. V. "Anton Dohrn" 19. 3. to 9. 5. 1979. – C.M./ICES/C 5, 1–14.
- Wegner, G., 1979b. F. R. V. "Anton Dohrn" XBT sections in the North Atlantic Ocean between January and May 1979. – Polymode News/70, 3–7.