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Ichthyoneuston in the Kiel Bay

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Introduction:

The importance of the surface water layer as a special habitat for fish eggs and larvae is almost unknown in Kiel Bay. Already HENSEN (1887) caught plankton regulary at the surface in this area but he did not deal with this special problem.

First ZAITSEV (1960) and later several other authors dealt with the special biological situation in the upper few centimeters of the water column. A review about the neuston literature is given by HEMPEL & WEIKERT (1962).

HEMPEL & NELLEN (1969) compared samples of ichthyoneuston from the North Sea and the Baltic and noted that in Kiel Bay fish larvae are much less abundant than in the North Sea but the number of species is about same. Only few typical neuston fish were found in the North Sea and the Baltic: Onos, Trachinus and Scomber.

A more comprehensive investigation about the abundance and distribution of fish eggs and larvae in Kiel Bay was carried out in 1970-1971. Some preliminary results about the neuston are given in the present paper.

In the Kiel Bay, the transition area between North Sea and Baltic, the presence of fish eggs in the neuston is depending on the surface salinity: at least 10 ‰ salinity is necessary to keep most kinds of fish eggs floating (KÄNDLER & TANN, 1965). On a few cruises, during strong outflow periods, surface salinities were below 10 ‰ ; at those times, only very few eggs were found in the plankton. During the main spawning season 1970-1971 the surface salinity was higher than 10 ‰ .

Material and Methods:

Sampling of neuston was carried out by the research vessels "H. Wattenberg" and "Alkor" during 17 cruises in 1970 und 1971 (see also MÜLLER, 1973).

The gear in use was a modified DAVID neuston net with two nets one

on top of the other the nets size was 500 u. The net was towed alongside the ship at a standard speed of 5 knots for 20 minutes. During that time about 90 m^3 water were strained by the upper net and 130 m^3 by the lower net assuming 100 % filtration efficiency.

After each neuston haul an oblique tow with a modified 60 cm bongo net was made at a standard speed of 3 knots. The amount of water filtered per haul varied between 100 and 350 m^3 as estimated from flowmeter readings or from the lenght of the tow.

The samples from 232 tows of both neuston and bongo were sorted for fish eggs and larvae. Their abundance is given as numbers per 100 m^3 of water.

It is not possible to give characteristic hydrographic charts for a season in the Kiel Bay because the situation change in short irregular interval.

From the numerous hydrographical measurements made during all cruises only 4 charts are given, to demonstrate different characteristic conditions at the surface (fig. 2). During the inflow period the surface salinity may raise to 20 ‰ (east of Fehmarn), and during long outflow periods salinity may fall below 10 ‰.

A change from an outflow to an inflow condition may take few days only. The neuston organisms have to cope with high variations in salinity up to 10 ‰ in a very short time, whereas organisms in the western part of the Kiel Bay are exposed to slow variations in salinity only.

A correlation between distribution of species and the isohalines was not found.

During the cruises the wind force was 3 to 7 Beaufort.

Results:

Fish eggs: No concentration of fish eggs were observed at the surface

compared to the whole water column. Total numbers of eggs per volume filtered by the upper and lower neuston net were not significantly different, whereas the fish larvae were significantly more abundant in the upper layer.

The species of fish eggs which have been found are listed in table 1 and 3. They all belong to the common fish species of the Kiel Bay. Most abundant are the eggs of cod, followed by flounder and dab.

Dense concentrations of eggs which indicate a spawning area have been found in the northern part of the Kiel Bay for cod and plaice and in the southern part for rockling. All other eggs were found more or less dispersed over the whole area.

Fish larvae: All fish larvae which have been caught in the both nets are listed in table 1 and 2. By separation into day and night hauls a first impression about the daily vertical migration was intended, but because only few night hauls were made and the high variance in abundance of the more important species no specifis conclusions can be drawn in this respect.

In 1970/71 the high rate of gobiids was very surprising: more than 51 % of the fish larvae caught during the two years are gobiids while in 1965 (MÜLLER, 1970) their share was only 10 %.

In 1965 a total number of 34 species were observed, 9 of which occurred in some significant numbers and 5 species mounted to more than some 10 % of the total number.

Garpike and stickleback were not caught in 1965 because they are typical neuston fish, and the neuston net was not used then.

The relative abundance in % of the more abundant fish larvae in Kiel Bay are given in table 2.

In 1970/71 the abundance of only 2 species (Bongo + Neuston) exceeded the 10 % level. It may not be decided whether these differences in results between both periods of investigation reflect

Table 1.: Number of fisheggs and -larvae per 100 m^3. Kiel Bay 1970/71

year/month	number of stations day	(night)	day neuston upper eggs	day neuston upper larvae	day neuston lower eggs	day neuston lower larvae	night neuston upper eggs	night neuston upper larvae	night neuston lower eggs	night neuston lower larvae	day bongo eggs	day bongo larvae	night bongo eggs	night bongo larvae
1970														
January	5	(2)	0	0	1	0	2	1	1	0	4	1	3	1
March/April	7	(7)	36	0	51	0	16	0	24	3	122	2	34	1
April/May	13	(2)	127	1	86	1	11	3	3	1	155	2	311	3
June	15	(0)	23	4	20	0	-	-	-	-	71	3	-	-
July	12	(2)	13	8	2	1	0	6	0	1	24	3	15	10
August	12	(2)	0	4	0	0	0	36	0	21	6	7	4	8
September	10	(4)	0	0	0	0	0	13	0	2	1	3	4	5
October	8	(7)	0	1	0	0	6	7	5	2	0	1	5	4
November	5	(8)	0	0	0	0	0	0	0	0	0	1	0	3
December	6	(9)	1	10	1	1	1	2	0	1	6	1	1	2
1971														
January	9	(5)	12	4	20	2	1	0	1	0	21	6	7	7
February	7	(8)	14	0	15	7	9	1	10	1	142	1	22	3
March	8	(8)	9	2	1	0	2	9	3	4	54	4	8	3
May	7	(0)	22	0	12	0	-	-	-	-	29	2	-	-
July	10	(4)	4	48	0	76	2	23	0	158	41	56	19	132
October	9	(6)	0	1	0	0	0	3	0	1	0	6	0	13
December	7	(8)	0	2	0	0	1	3	0	0	0	2	0	3

Table 2.: Occurrence of fishlarvae in the different gears, Kiel Bay 1970/71. (Total number and percentage)

Species	NU	%	NL	%	BO	%	Neuston + Bongo	%
Clupea harengus	153	11,7	71	6,6	258	16,2	482	12,1
Sprattus sprattus	2		2		77	4,8	81	2,0
Belone belone	78	6,0	10		-		88	2,2
Siphonostoma typhle	1		4		-		5	
Syngnathus rostellatus	18		-		15		33	
Nerophis ophidion	9		3		7		19	
Gasterosteus aculeatus	86	6,6	31	2,9	7		124	3,1
Gadus morhua	7		10		20		37	
Merlangius merlangus	-		-		2		2	
Onos spec.	108	8,3	31	2,9	127	7,9	266	6,7
Trachurus trachurus	-		1		-		1	
Ctenolabrus rupestris	3		3		1		7	
Ammodytidae spec.	179	13,7	63	5,9	84	5,2	326	8,2
Callionymus lyra	-		-		1		1	
Scomber scombrus	-		2		1		3	
Chirolophis ascanii	11		1		9		21	
Lumpaenus lampretaeformis	3		16		-		19	
Pholis gunellus	7		13		177	11,1	197	5,0
Pomatoschistus minutus	581	44,6	784	73,4	672	42,1	2037	51,4
Gobius niger	28		2		-		30	
Aphia minuta	1		1		10		12	
Acanthocottus scorpius	-		-		6		6	
Agonus cataphractus	4		-		12		16	
Cyclopterus lumpus	19		3		1		23	
Liparis liparis	-		-		3		3	
Psetta maxima	-		-		1		1	
Scophthalmus rhombus	4		1		1		6	
Arnoglossus laterna	-		-		1		1	
Limanda limanda	-		16		89	5,6	105	2,6
Pleuronectes platessa	-		-		4		4	
Platichthys flesus	1		-		7		8	
Microstomus kitt	-		-		2		2	

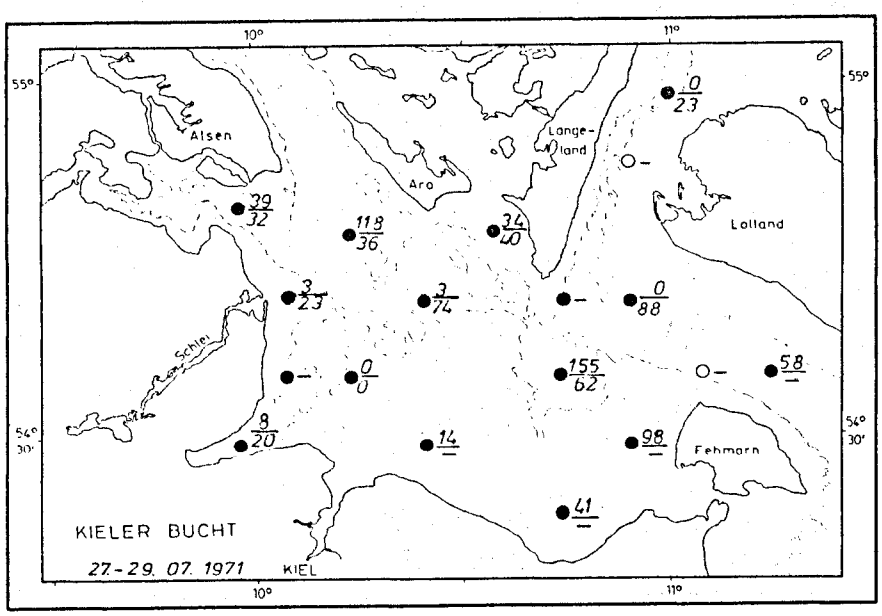
NU = neuston upper; NL = neuston lower; BO = Bongo

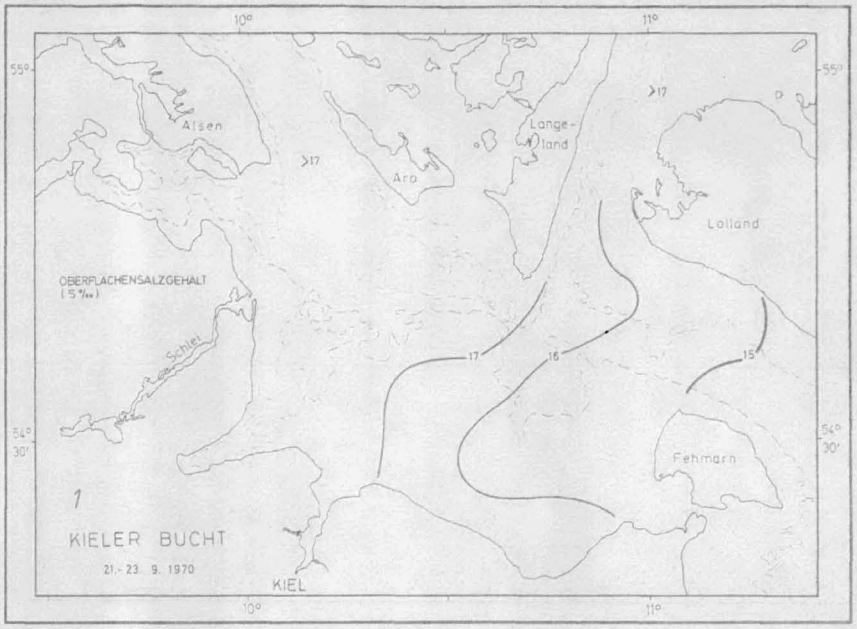
Table 3.: Occurrence of fisheggs in the different gears, Kiel Bay 1970/71. (Total number and percentage)

Species	NU	%	NL	%	BO	%	Neuston + Bongo	%
Sprattus sprattus	350	13,5	300	9,3	2263	16,1	2913	14,7
Gadus morhua	492	19,0	850	26,2	2928	20,8	4270	21,5
Onos spec.	933	36,1	723	22,3	623	4,5	2279	11,5
Ctenolabrus rupestris	-		-		614	4,4	614	3,1
Limanda limanda	73	2,8	64	2,0	3030	21,6	3167	15,9
Pleuronectes platessa	312	12,0	690	21,3	1974	14,1	2976	15,0
Platichthys flesus	430	16,6	611	18,9	2607	18,5	3648	18,3

NU = neuston upper; NL = neuston lower; BO = Bongo

Fig. 1.: Distribution and occurrence of Pomatoschistus minutus. Number of individuals per 100 m^3 in surface layer (upper number - neuston) and total water column (lower number - bongo)





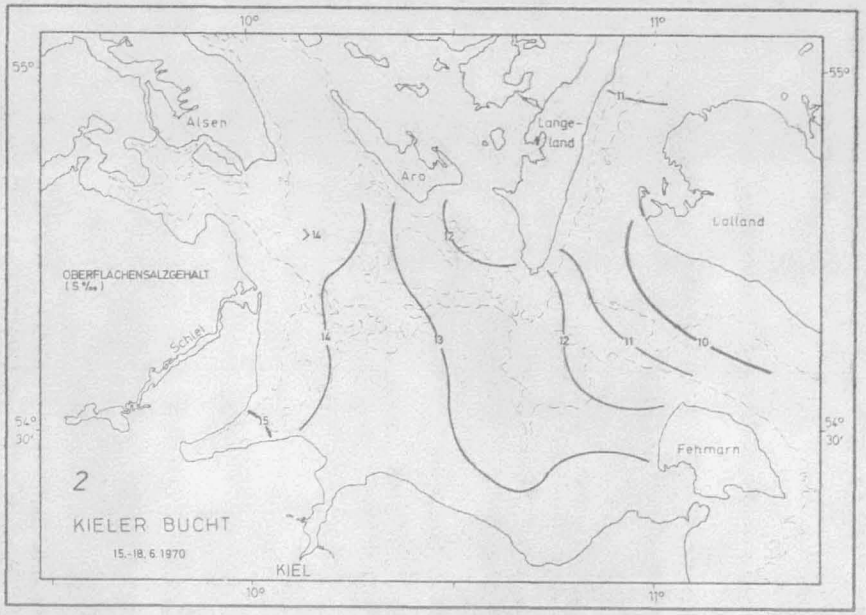


Fig. 2.: Distribution of surface salinity: inflow of Kattegat water (chart 1); outflow of Baltic water (chart 2,3) and transient condition (chart 4)