International Council for the Exploration of the Sea

C.M. 1974/F:32
Demersal Fish (Northern) Committee

Some results of cod tagging experiments of the GDR in the Baltic 1968 - 1971

by

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Partly as a contribution to the international cod tagging programme in the Baltic in the period 1968 - 1971 9 successful tagging experiments were done and 7 978 cods have been tagged, 4 493 in the Baltic proper and 3 485 in the Mecklenburg Bay.

Material and method

The tagging localities and dates as well as the tag types, the mean length of the cod and the percentage returns in the first year may be seen in table 1.

In all cases trawl-caught cod was used, and the fish was kept in a tank filled with sea water before tagging. The time of trawling was limited to one hour, and only normally swimming or sinking cod was used. The tagging was performed on board of the searching vessel "Gadus" in 1968, on board of commercial vessels in 1969 and 1970, and on board of the FRV "Eisbär" in 1971. In the experiments no.1-4 the tags used were Lea tags of polystyrol with a white plastic flag for better visibility, fixed to the fish by green perlon thread. In the tagging experiments no. 5 - 9 red celluloid tags were fixed by perlon monofil.

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Percentage returns

The returns in the first year change from 3,4 to 31,4 % (table 1). There seems to be a dependence on the mean length of the tagged cod, on the tag type, on fishing intensity in the tagging area soon after tagging, on the weather and the vessel, its length and trawling gear.

In the tagging experiments no. 5 for example a low length of cod and a new tag type are combined with rather few returns. On the other side the tagging experiments no. 3 and 4 in the Mecklenburg Bay mainly differ by tagging locality and therefore by fishing intensity, being high in the eastern area during and after tagging 1969 and causing 28,0 % returns in the eastern experiment. More to the west cod was rare in summer and autumn 1969, and the low fishing intensity restricted returns to 13,5 %. In 1970 cod, fishing intensity and percentage returns are more regularly distributed to the eastern and western Mecklenburg Bay. Experiment no. 2 is characterised by high fishing intensity soon after tagging in the same way as no. 4. The very low percentage returns of the experiments no. 8 and 9 are combined with a new tag type, a low fishing intensity after tagging, a larger vessel with larger trawl and sunshine.

Migrations

Table 2 shows the relation between the length of cod and the distance of migrations. In table 3 may be seen the distance and direction of migrations and in table 4 the regional distribution. The distribution of recaptures in time appears from table 5.

Bornholm Basin

The tagging experiment no. 2 in the southern Bornholm Sea started at the beginning of December 1968. In December and January a very intensive cod fishery near the tagging locality brought a lot of recaptures (table 5). In this time there was only a little migration to the north, but the northern direction attained more importance in February and March. From the end of March onward there were many

spawning migrations to the northern Bornholm Basin. As usually to the Arkona Sea in the west and to the Gotland Sea in the east the number of migrations was not great (table 4), nevertheless the longest migrations were noticed to the west and the east (table 3). To the north the cod migrated no more than 80 n.m. It appears from table 4 that the cod didn't undertake migrations of 80 n.m. and more before having reached a length of 40 cm.

In the second decade of May 1971 another tagging experiment (no.9) in the northern Bornholm Sea started, which was carried through at the end of the cod season on midwater spawning cod. The number of returns altogether was low, but in the first two months, when spawning still continued, somewhat more abundant. As in experiment no. 2 the cod migrated long distances only to the east and the west (table 3), but a little more to the east as in no. 2 (table 4). The southern migrations reached 80 n.m. Distances of 90 n.m. and more were undertaken by cod of at least 40 cm length.

On the whole the cod of the Bornholm Sea in all experiments left the region only to a low percentage (0 - 23 %), while migrations from the southern to the northern Bornholm Sea and reverse are common.

Arkona Basin

The tagging experiment no. 1 took place at the end of November 1968 in the southern Arkona Basin at a depth of about 46 m. In November and December there are several returns between the place of release and Rügen. The southern migration was most strongly marked in the first ten days after tagging. Later on the cod left this locality and spread over the whole Arkona Basin, the western Bornholm Basin, the southern and northern Belt Sea, and the southern Kattegat. In the first year no more than 62 % of the returns came from Arkona Basin and 26 % came from regions to the west and northwest of Arkona Basin (table 4). From table 3 appears that all distant migrations

were done in western direction. The most distant recapture came from eastern Skagerrak. A cod of 67 cm length migrated 345 n.m. in 76 days. All distant migrations were mostly spawning migrations and agree with spawning migrations in other years.

It appears from table 2 that only cod of 40 cm length and more likes to migrate long distances above 80 - 90 n.m. The want for distant migrations increases from the 40 - 49 cm group to the 50 - 59 cm group.

This also is valid for the cod tagged in experiment no. 5 at the beginning of October 1969 south-east of Sassnitz in the southern Arkona Basin at a depth of nearly 21 m, but this was rather little cod and therefore distant migrations are more rare. In the first two months a limited migration to the north could be noticed. Thereafter the cod spread over the Arkona and Bornholm Basin and to some extent over the Belt Sea(table 4). Migrations of long distance were noticed to the east and mainly to the north (table 3).

In May 1971 tagging experiment no. 9 was carried out in the Bornholm Gat (northern Arkona Basin) at a depth of about 42 m on feeding cod. This experiment gave without difference in the whole first year very few recaptures. The cod spread mostly over the northern Arkona Basin and to some extent over the Bornholm Basin (table 4). Distant migrations were done in eastern and western direction (table 3) and by cod over 40 cm in length.

Generally an emigration of cod more strongly is marked in the Arkona Basin than in the Bornholm Basin. It ranged in all experiments in the first year from 15 to 57 %, the low percentages being combined with a low mean length of cod and therefore with a lot of juvenile cod. In feeding time there exist northern and southern feeding concentrations, which show little mixing except in spawning time.

Mecklenburg Bay

The tagging experiment no. 3 at the end of July 1969 in the western Mecklenburg Bay was not very numerous. At this time most of the cod

had already finished the feeding migration to the Darss, and the western Mecklenburg Bay was rather empty of cod. The experiment reveals a feeding migration to the east (23%) and from January onward a spawning migration to the north-west (12 % in the first year).

At the same time (July 1969) dense feeding concentrations existed in the eastern Bay between Gedser Rev and Darss, which gave the Basis for tagging experiment no. 4. The tagged cod remained near the tagging place till December, but before the end of December there is a migration to the Fehmarn Belt. From January onwards a distinct spawning migration sets in, and much returns are reported from the Fehmarn Belt, the Kiel Bay, the Great Belt and the Samsö Belt (table 4). Generally however, a great part of the cod remained the whole first year in the eastern Bay, and the emigration amounts exceptionally to no more than 23 %.

In the next year (1970) at the same place in the eastern Mecklenburg Bay tagging experiment no. 7 was done in the second half of November. In this case the emigration amounted to 51 %, a quite normal value, for in most years in December/January sets in a wintering and spawning migration from eastern Bay to the deeper western Bay. Thus in this experiment 42 % of the recaptures came from western Mecklenburg Bay. In October/November 1970 also in western Mecklenburg Bay the rather numerous tagging experiment no.6 was done. In the first month after tagging there was a high fishing intensity near the tagging place, and the number of recaptures rised unusually (table 5). At the same time the first migrations to eastern Bay could be noticed. Spawning migrations to the Kiel Bay and the Great Belt were concentrated in January and February. In summer 1971 there was distinct migration to the eastern Bay.

The low mean length of cod in all experiments in Mecklenburg Bay in 1969 and 1970 restricted the percentage of distant migrations, especially in 1970. In table 4 may be seen that in the western Bay the migration in all experiments was from western part 20 - 46 %

and from the whole Bay 9 - 31 %. In the eastern Bay the emigration from eastern part was 23 - 67 % and from the whole Bay 9 - 44 %.

The percentage of emigration in all experiments and regions is determined by mean length of cod. For a mean length of about 40 cm the emigration may be perhaps for the Bornholm Basin 8 %, for the Arkona Basin 33 % and for the Mecklenburg Bay 31 - 35 %. This confrontation shows the distinctions, existing between the Bornholm Basin and the western areas and being established in first line by quality of spawning places and racial differences of cod.

In all experiments in the Mecklenburg Bay distant migrations are concentrated to the length-groups of 40 - 49 cm and 50 - 49 cm (table 2). In some cases, when length-group 30 - 39 cm is especially numerous, also in this group exist sporadic migrations over 100 - 140 n.m.

The most frequented directions of migration are in the western Bay eastward and in the eastern Bay southward and westward. Distant migrations are mainly restricted to west and east.

Fishing mortality

Some calculations of fishing mortality F are quoted in table 5 (Beverton and Holt). The values for calculation are taken from the calculated regression line of the five first natural logarithms of three month returns.

Moreover the fishing mortality of all marking experiments was calculated in the same way. The calculations may be summarized by regions (without the results of 1971) and then gives the following mean data:

Year	Month	Mean length in cm	F
Bornholm Basin			
1959	IV	57	0,39
1966	IX/X	44	0,43
1968	XII	41	1.17
Mean 59 - 68		47	0,66
Mean 66 - 68		43	0,80
Arkona Basin			
1959	IV	63	0,60
1962	III	53	0,31
1966	IX	34	0,54
1967	IX	42	0,31
1968	XI	43	0,75
1969	X	33	0,77
Mean 59 - 69		45	0,55
Mean 66 - 69		37	0,59
Western Mecklenburg Bay			
1965	VIII	37	0,93
1967	IX	40	0,78
1969	VII	39	0,29
1970	X/XI	33	0,47
Mean 65 - 70		37	0,62
Eastern Mecklenburg Bay			
1962	VII	44	0,29
1967	"	38	0,53
1969	VII/VIII	36	1,07
1970	XI/XII	34	0,49
Mean 62 - 70		38	0,50

In Mecklenburg Bay the mean length of the marked cod is nearly the same as that of the yearly analysed cod, which gives from age-groupII onward in the last 10 years a total mortality Z of 0,90 weighted mean from age composition. When Z is 0,90 and F 0,60 or 0,62, the natural mortality M will be 0,30 or 0,28, a quite normal estimation for the Baltic.

In the Arkona Basin Z is for the last 10 years 1,01 (beginning with age-group II). When F is 0,55 , M will be 0,46, which is a somewhat high estimation. But if we take only the tagging experiments of 1966 - 1969 and also the analysed cod of the years 1966 - 1970, the data are better fitted in time and in length. Then F is 0,59, Z is 0,92 and M will be 0,33.

If we take in the southern Bornholm Basin the tagging experiments of the years 1966 - 1968 and the analysed material of 1967 - 1969, F is 0,80 from age group III onward , Z is 1,03 and M is therefore 0,23. This estimation may be a bit too low due to the fact, that the mean length of the tagged cod (43 cm) is rather high, compared with the mean length of cod of age groups III^+ in the yearly material. With growing length Z also grows, age groupIII being not completely recruted. From age-group IV onward instead of 1,03 Z will be 1,57. Therefore Z = 1,03 may be a bit too low in cod with a mean length of 43 cm.

On the whole, in all regions the calculated mean estimations of fishing mortality seem to be rather valid, compared to total mortality of cod, which has nearly the same length-composition. Nevertheless the separated tagging experiments show rather different mortalities.

Table 1 Tagging experiments in the period 1968 - 1971

Experiment no.	Date of tagging	Tagging locality	Position	Number tagged	Mean length cm	Recaptured 1st year in %	Tag type
1	21.11.- 27.11.68	Arkona Basin S	54°53'N 13°54'E	954	42,8	26,7	LEA - tags polystryrol
2	1.12. - 4.12.68	Bornholm Basin S	54°33'N 15°42'E	984	40,8	31,4	LEA - tags polystyrol
3	24.7.- 25.7.69	Mecklenburg Bay W	54°15'N 11°45'E	318	38,9	13,5	LEA - tags polystyrol
4	26.7.- 1.8.69	Mecklenburg Bay E	54°26'N 12°12'E	1611	36,8	28,0	LEA - tags polystyrol
5	8.10.- 11.10.69	Arkona Basin S	54°27'N 13°45'E	786	33,1	17,3	Red tags celluloid
6	21.10.- 23.11.70	Mecklenburg Bay W	54°15'N 11°40'E	737	32,7	24,6	Red tags celluloid
7	17.11.- 1.12.70	Mecklenburg Bay E	54°25'N 12°10'E	819	33,6	21,4	Red tags celluloid
8	10.5.- 11.5.71	Arkona Basin N	55°15'N 14°28'E	801	34,2	3,4	Red tags celluloid
9	18.5.- 20.5.71	Bornholm Basin N	55°30'N 15°18'E	968	48,3	6,5	Red tags celluloid

Table 2 Length of cod[+)] and distance of migrations in tagging experiments no. 1 - 9 in the first year

Exp. no.	Length group cm	from to	Straigth line distance in n. m. 0 9	10 19	20 29	30 39	40 49	50 59	60 69	70 79	80 89	90 99	100 109	110 119	120 129	130 139	140 149	150 199	200 249	250 299	>299	Total
1	20-29		1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	30-39		16	21	8	3	4	1	4	1	1	-	-	-	-	-	-	-	-	-	-	59
	40-49		15	28	8	2	4	3	3	2	-	1	1	3	2	1	-	3	1	-	-	77
	50-59		6	14	2	5	3	3	4	2	1	-	1	2	2	-	1	4	2	-	-	52
	> 59		3	4	9	1	2	3	1	2	1	-	1	-	2	-	1	2	2	-	1	35
	Total		41	67	27	11	13	10	12	7	3	1	3	5	6	1	2	9	5	-	1	224
2	30-39		40	19	13	6	2	1	2	2	-	-	-	-	-	-	-	-	-	-	-	85
	40-49		49	42	25	15	8	10	2	4	-	-	-	-	-	-	-	1	-	-	-	156
	50-59		9	8	8	5	3	5	6	-	-	-	-	2	-	-	-	1	-	-	-	47
	> 59		2	-	-	-	1	-	-	2	1	2	-	-	-	-	-	-	-	-	-	8
	Total		100	69	46	26	14	16	10	8	1	2	-	2	-	-	-	2	-	-	-	296
3	20-29		-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	30-39		2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
	40-49		5	9	3	3	1	-	1	1	-	-	-	-	-	-	-	2	-	-	-	25
	50-59		1	2	4	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
	> 59		-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Total		8	15	7	3	2	1	1	1	-	-	-	-	-	-	-	2	-	-	-	40
4	20-29		10	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
	30-39		77	11	5	3	2	1	-	-	-	-	-	-	1	1	-	-	-	-	-	101
	40-49		133	8	7	7	2	4	1	3	1	2	1	-	-	1	-	-	-	-	-	170
	50-59		68	5	2	4	-	4	3	2	3	3	2	3	2	1	1	-	-	-	-	129
	> 59		17	-	-	-	-	1	-	2	1	-	-	2	1	-	-	-	-	-	-	24
	Total		325	26	16	14	4	10	4	7	5	5	3	5	4	3	1	-	-	-	-	438
5	20-29		1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	30-39		25	25	8	7	1	3	1	-	-	1	-	-	-	4	-	2	-	-	-	77
	40-49		4	6	8	7	3	6	5	2	-	1	2	-	2	-	-	-	1	-	-	47
	> 49		-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Total		30	32	16	15	4	9	6	2	-	2	2	-	2	4	-	2	1	-	-	127

Table 2 (continued)

Exp. no.	Length group cm	from to	Straigth line distance in n. m. 0 9	10 19	20 29	30 39	40 49	50 59	60 69	70 79	80 89	90 99	100 109	110 119	120 129	130 139	140 149	150 199	200 249	250 299	> 299	Total
6	20-29		5	6	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	15
	30-39		33	86	14	2	3	2	1	-	1	-	-	-	-	-	-	-	-	-	-	142
	40-49		4	4	3	-	1	-	1	1	-	-	1	-	1	-	-	-	-	-	-	16
	> 49		1	1	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	4
	Total		43	97	20	2	5	3	2	2	1	-	1	-	1	-	-	-	-	-	-	177
7	20-29		3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
	30-39		61	45	11	4	2	1	2	1	2	-	1	1	-	-	-	-	-	-	-	131
	40-49		14	8	3	-	2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	28
	49		2	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	3
	Total		80	53	14	4	4	1	2	2	3	-	1	1	-	-	-	-	-	-	-	165
8	20-29		-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	30-39		3	1	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
	40-49		3	2	2	-	-	1	1	-	-	-	-	-	-	2	-	-	-	-	-	11
	> 49		-	2	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
	Total		6	6	3	2	3	1	1	-	-	-	-	-	-	2	-	-	-	-	-	24
9	30-39		1	1	2	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	5
	40-49		-	2	7	4	5	3	4	-	-	-	-	-	-	-	-	-	1	-	-	26
	50-59		1	4	13	1	5	1	1	2	-	-	-	-	-	1	-	-	-	-	-	29
	60-69		-	1	1	3	1	1	-	-	-	-	-	-	1	-	-	-	1	-	-	9
	> 69		-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Total		2	8	24	8	11	5	5	2	1	-	-	-	1	1	-	-	2	-	-	70

+) Length at return

Table 3 Distance and direction of migrations in marking experiments no. 1 – 9 in the first year

Exp. No.	Direction	from / to	Straigth line distance in n. m. 0 9	10 19	20 29	30 39	40 49	50 59	60 69	70 79	80 89	90 99	100 109	110 119	120 129	130 139	140 149	150 199	200 249	250 299	>299	Tot.	Without recapture local.	To-tal
1	E +)		3	9	10	2	5	4	10	3	1	–	–	–	–	–	–	–	–	–	–	47		
	S		20	21	3	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	46		
	W		11	26	10	5	7	4	2	2	2	1	3	5	6	1	2	9	5	–	1	102		
	N		7	11	4	3	1	1	–	2	–	–	–	–	–	–	–	–	–	–	–	29		
	Total		41	67	27	11	13	10	12	7	3	1	3	5	6	1	2	9	5	–	1	224	31	255
2	E		27	7	1	–	2	–	2	3	–	1	–	1	–	–	–	–	–	–	–	44		
	S		11	24	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	35		
	W		51	9	12	9	2	2	2	4	1	1	–	1	–	–	–	2	–	–	–	96		
	N		11	29	32	17	10	14	6	2	–	–	–	–	–	–	–	–	–	–	–	122		
	Total		100	69	46	26	14	16	10	9	1	2	–	2	–	–	–	2	–	–	–	297	12	309
3	E		5	11	3	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	22		
	S		–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1		
	W		1	1	2	3	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8		
	N		2	2	2	–	–	1	–	1	–	–	–	–	–	–	–	1	–	–	–	9		
	Total		8	15	7	3	2	1	1	1	–	–	–	–	–	–	–	1	–	–	–	40	3	43
4	E		41	8	1	3	1	1	2	2	–	3	–	–	1	2	–	–	–	–	–	65		
	S		178	8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	186		
	W		82	8	14	7	3	9	2	5	5	2	3	5	3	1	1	–	–	–	–	150		
	N		24	2	1	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	31		
	Total		325	26	16	14	4	10	4	7	5	5	3	5	4	3	1	–	–	–	–	432	14	446
5	E		5	8	1	–	–	2	3	2	–	1	1	–	2	1	–	–	–	–	–	26		
	S		6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6		
	W		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
	N		19	24	15	15	4	7	3	–	–	1	1	–	–	3	–	2	1	–	–	95		
	Total		30	32	16	15	4	9	6	2	–	2	2	–	2	4	–	2	1	–	–	127	5	132

+) E = 46 – 135° W = 226 – 315°
S = 136 – 225° N = 316 – 45°

Table 3 (continued)

Exp. No.	Direction	Straigth line distance in n. m. from 0 to 9	10 19	20 29	30 39	40 49	50 59	60 69	70 79	80 89	90 99	100 109	110 119	120 129	130 139	140 149	150 199	200 249	250 299	>299	Total	Without recapture local.	Total
6	E +)	31	92	17	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	144		
	S	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6		
	W	2	3	1	-	3	2	1	-	-	-	1	-	-	-	-	-	-	-	-	13		
	N	4	2	2	-	1	-	1	2	1	-	-	-	1	-	-	-	-	-	-	14		
	Total	43	97	20	2	5	3	2	2	1	-	1	-	1	-	-	-	-	-	-	177	4	181
7	E	22	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	24		
	S	57	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80		
	W	1	28	14	4	4	1	1	2	3	-	1	1	-	-	-	-	-	-	-	60		
	N	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1		
	Total	80	53	14	4	4	1	2	2	3	-	1	1	-	-	-	-	-	-	-	165	10	175
8	E	1	-	-	1	1	1	1	-	-	-	-	-	-	1	-	-	-	-	-	6		
	S	5	1	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8		
	W	-	3	1	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	6		
	N	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4		
	Total	6	6	3	2	3	1	1	-	-	-	-	-	-	2	-	-	-	-	-	24	3	27
9	E	-	2	12	3	4	-	1	1	1	-	-	-	1	1	-	-	1	-	-	27		
	S	2	3	9	3	7	5	4	1	-	-	-	-	-	-	-	-	-	-	-	34		
	W	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	4		
	N	-	3	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5		
	Total	2	8	24	8	11	5	5	2	1	-	-	-	1	1	-	-	2	-	-	70	6	76

+) E = 46 - 135°
S = 136 - 225°
W = 226 - 315°
N = 316 - 45°

Table 4: (Continued)

Tagging date and Locality	Skagerrak	Kattegat	Northern Baltsee	Kiel Bay	Meckl. Bay W	Meckl. Bay E	Arkona Basin	Bornholm Sea	Gotland Sea	Complete recaptures	Mean distance in n.m.	Mean length at tagging in cm
	Region of recaptures											
Eastern Mecklenburg Bay 1962 - 1970												
17.11.-1.12.70 Meckl. Bay E	-	-	3	5	42	49	1	-	-	165	15	34
26.7.-1.8.69 Meckl. Bay E	-	1	5	4	10	77	2	1	-	432	16	36
25.-28.9.67 Meckl. Bay E	-	3	18	13	32	33	-	1	-	71	44	38
11.7.1962 Meckl. Bay E	-	-	5	10	14	42	19	10	-	21	43	44
Western Mecklenburg Bay 1965 - 1970												
21.10.-23.11.70 Meckl. Bay W	-	-	4	5	80	11	-	-	-	177	16	33
24.-25.7.69 Meckl. Bay W	-	2	5	5	60	23	3	2	-	40	28	39
21.-24.9.67 Meckl. Bay W	-	2	10	17	69	-	2	-	-	41	30	40
5.-11-8.65 "	-	2	6	12	54	24	1	1	-	198	23	37

Table 4: Regional distribution of recaptures in tagging experiments of GDR in the first year in %

Tagging date and Locality	Region of recaptures: Skagerrak	Kattegat	Northern Baltic Sea	Kiel Bay	Mecklenburg Bay W	Mecklenburg Bay E	Arkona Basin	Bornholm Sea	Gotland Sea	Complete recaptures	Mean distance in n.m.	Mean length at tagging in cm
Bornholm Basin 1959-1971												
18.-20.5.1971 Bornh.Bas. N	-	-	1	-	-	-	4	86	9	70	44	48
1.- 4.12.68 Bornh.Bas. S	-	-	-	-	1	1	4	92	2	297	24	41
29.9.-2.10.66 Bornh.Bas. S	-	-	-	4	2	-	17	77	-	47	44	44
14.4.1959 Bornh.Bas.N/S	-	-	-	-	-	-	-	100	-	12	16	57
Arkona Basin 1959-1971												
10.-11.5.71 Ark.Bas.N.	-	-	-	4	-	-	71	21	4	24	32	34
8.-11.10.69 Ark.Bas. S	-	1	4	1	1	5	78	10	-	127	35	33
21.-27.11.68 Ark.Bas.S	1	2	5	5	2	11	62	12	-	224	44	43
30.9.67 Ark.Bas.N	-	2	6	-	5	3	67	15	2	63	44	42
26.-30.9.66 Ark.Bas.N	-	-	-	-	2	3	85	9	1	134	25	34
1.-2.3.62 Ark.Bas. S	-	-	-	4	6	10	55	25	-	49	53	53
21.-22.4.59 Ark.Bas.N/S	-	-	-	-	-	7	43	50	-	14	50	63

Table 5 Monthly number of returns and fishing mortality

Exp. no.	Locality and time	Number tagged	Months: 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Fishing mortal. coeff. F
			Days: from	0	30	61	91	122	152	183	213	244	274	305	335	366	396	427	
			to	29	60	90	121	151	182	212	243	273	304	334	365	395	426	456	
1	Arkona Bas.S Nov. 1968	954		51	56	54	34	15	19	12	4	2	4	-	1	6	2	4	0,75
2	Bornholm Bas.S Dec. 1968	984		70	77	55	39	32	19	7	5	3	-	2	-	2	-	4	1,17
3	Meckl. Bay W July 1969	318		1	3	11	7	8	5	4	2	-	2	-	-	3	1	-	0,29
4	Meckl. Bay E July 1969	1611		40	49	115	73	70	35	22	24	14	3	3	3	1	3	5	1,07
5	Arkona Bas.S Oct. 1969	786		21	43	19	14	9	20	5	-	1	1	2	1	-	1	-	0,77
6	Meckl. Bay W Oct/Nov.1970	737		126	19	9	12	-	3	-	2	3	2	2	3	2	-	3	0,47
7	Meckl. Bay E Nov. 1970	819		84	12	12	21	8	9	4	2	9	7	4	3	6	1	3	0,49
8	Arkona Bas.N May 1971	801		3	3	4	3	2	1	1	3	3	1	1	2	1	3	-	0,05
9	Bornholm Bas.N May 1971	968		18	14	4	4	3	1	3	6	3	6	8	6	4	1	1	0,11