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RECOVERIES OF CODED WIRE MICROTAGS FROM SALMON CAUGHT AT WEST GREENLAND IN 1990

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ABSTRACT

The microtag recovery programme at West Greenland in 1990 was organised as in previous years. Scientists from Denmark, Canada and the USA carried out the catch scanning and the UK Fisheries Laboratory at Lowestoft acted as the tag clearing house. However, the catch at West Greenland in 1990 was particularly poor, so scanning effort was targeted at those ports with the highest landings at the time that scanning took place. A total of 6,410 fish (7.6% of the nominal catch) was examined at Maniitsoq, Nuuk and Paamiut between 3 and 20 August; 201 adipose fin-clipped fish were observed and 54 microtags recovered. These microtags originated from: the USA (37), Canada (9), Ireland (3), Iceland (3), and England and Wales (2). The proportions of fish having fin clips and microtags were higher in 1990 then in any preceding year.

By using appropriate scaling factors it is estimated that 864 microtagged salmon (1.03% of the nominal catch) were caught at West Greenland in 1990. This is almost twice the estimated proportion of microtagged fish seen in the catches over the period 1987 to 1989. The estimated totals for each country in 1990 were: USA (579), Canada (165), Ireland (45), Iceland (49) and England and Wales (26). As in most previous years, with the exception of 1988, there were marked differences in the distribution in the West Greenland fishery area of salmon originating from different countries. The proportions of microtagged fish from the USA and Canada were higher in catches in the north of the fishery and decreased progressively to the south. Recoveries of European origin fish were too few in number to permit any differences in distribution to be identified.

THE SCANNING PROGRAMME FOR SALMON CAUGHT AT WEST GREENLAND

Scanning of commercial salmon catches at West Greenland has been carried out each year since 1985 (Potter et al., 1986, 1987, 1988; Russell et al., 1989, 1990).

In 1990, catches at West Greenland were particularly poor and scanning effort had to be targeted at those ports where fish were being landed in reasonable numbers. The area covered by the scanning programme was thus reduced on previous years, and was only carried out at Maniitsoq (NAFO Division 1C), Nuuk (NAFO Division 1D) and Paamiut (NAFO Division 1E). Fish landed at these ports, during the scanning period, were sampled for biological data and were also checked for adipose fin clips and for the presence of microtags.

In common with previous years, catches at each of the sampling sites were sorted into three weight categories (≤ 2.99 kg, 3.00-4.99 kg, and ≥ 5.00 kg) prior to examination. The sampling periods and the numbers of fish examined in each of the weight categories at the three ports are shown in Table 1.

All salmon with adipose fin clips were checked for the presence of a microtag, these were then removed from the nose of the fish with a 2.5 cm corer, and the cores stored in 95% alcohol. Records were kept on the size of the sample screened, the number of adipose fin-clipped fish found, and the daily landings by size category. A summary of these data also appears in Table 1. The preserved cores were sent to the Lowestoft Fisheries Laboratory, UK for the microtags to be removed and decoded. When the cores were dissected, an attempt was made to estimate the position the tag had been in the head of the fish. Tags were read independently by two readers before being forwarded to the country of origin for final validation.

The fishery at West Greenland in 1990 opened on 1 August and ended in November, although the official closing date was 31 December. The total nominal catch was only 227 tonnes, 110 tonnes less than in 1989, and the lowest recorded catch since 1961. Scanning effort was concentrated in the early part of the fishing season when peak catches are normally expected. Over the period 1980 to 1989, an average of 60% of the annual catch has been taken during the first two weeks of the season (Anon., 1991). However, in 1990, only 16.7% of the total catch was taken during this period. As a result, sampling programmes did not always coincide with peak catches and it was only possible to scan relatively small proportions of the landings in certain areas.

The number of tags recovered in a given area and time period are multiplied by a 'raising factor' to estimate the total number of tagged fish caught; the 'raising factor' is calculated by dividing the total catch in that area and period by the number of fish scanned for tags. In 1990, catch scanning was limited to NAFO Divisions 1C, 1D and 1E, and did not cover catches in Divisions 1A, 1B or 1F. Scanning data for Division 1C have therefore been applied to catches in the whole northern area (Divisions 1A, 1B and 1C), and similarly, data for Division 1b have been applied to both Divisions 1E and 1F.

In previous years, scanning in the first week of the sampling programme has been applied to catches up to and including that week; similarly, scanning in the last week of the sampling programme has been applied to catches from then onwards. However, in 1990 only a small proportion of the catches in some areas were landed during the sampling programme. As a result, some raising factors calculated in the above way would have been very large, heavily weighting some tag recoveries. Data for all areas except NAFO Division 1D were therefore aggregated further to ensure that no raising factor exceeded an arbitrary limit of 40. Thus, for Divisions 1A, 1B and 1C a single raising factor was derived for the whole period of the fishery. For Divisions 1E and 1F, two raising factors were derived for weeks 31-32 and 33-47 respectively.

Standard deviations for the estimates of tags recovered have been calculated using the estimate of variance given by Cochran (1977) and as agreed by the ICES North Atlantic Salmon Working Group (Anon., 1988a).

RESULTS

A total of 6410 salmon was examined from the landings of commercial fishing vessels at West Greenland in 1990 (Table 1). Of this sample, 201 (3.14%) had adipose fin clips and 54 (0.84%) had microtags. The numbers of fish scanned, and fin-clipped and microtagged fish observed, at West Greenland over the period 1985-1990 are summarised in Table 2. The overall proportion of fin-clipped and microtagged fish in the catch sample in 1990 was higher than in any previous year.

The proportion of fish sampled at each port having fin clips and microtags differed significantly from an even distribution ($\chi^2 = 31.2$ and 9.6 respectively) and, in common with most other years since 1985 (1988 excepted), decreased progressively from the north (NAFO Divison 1C) to the south (NAFO Division 1E). In 1988, the proportion of fish sampled having microtags had shown an even distribution through the fishery.

The proportion of adipose fin-clipped fish containing microtags (26.9%) was similar to that seen in the previous three years (1987-89). However, in contrast to 1989, marked differences were apparent in the proportion of fin-clipped fish with tags in the different divisions. In 1990, the highest proportion of fin-clipped fish with tags was noted at Nuuk (30.5%), but only 16.7% of the fin-clipped fish were found to be tagged at Paamiut. The overall proportion of untagged adipose fin-cliped fish among the sampled fish was higher in 1990 than in any previous year (Table 2).

The 54 microtags recovered at West Greenland originated from salmon tagged as parr or smolts in the USA (37), Canada (9), Ireland (3), Iceland (3), and England and Wales (2). The majority of fish were released as hatchery-reared smolts in 1989, although 2 were released as hatchery-origin parr in 1988 (1 Ireland and 1 Wales) and one fish had been tagged as a wild smolt in England in 1989. All of the tags were recovered from one-sea-winter salmon.

The origin of microtags recovered at each sampling site in 1990 is given in Table 3 along with the recovery rates (tags recovered per 1000 fish scanned) by country of origin. This shows a decrease in the proportion of North Amercian tagged fish in catches from the north to the south of the fishery. Similar distributions of tag recovery rates have been observed in some previous years for fish from North America and Ireland (Table 4). No consistent trends are apparent in the recoveries of tags from England and Wales, and there were insufficient tag recoveries from other European countries to identify differences.

The mean lengths and weights of tagged fish originating from different release areas are also given in Table 3. In the past, N American fish have been consistently shorter and lighter than those of European origin (Anon., 1991). The 1990 data, with the possible exception of Iceland, appear to conform to this observation.

The raising factors for estimating the total numbers of microtagged fish caught from the numbers recovered in the scanning programme are calculated in Table 5. As only the weights of landed catches are recorded by the markets, the numbers caught are estimated by dividing these by the mean weights of fish in the biological samples for each NAFO Division (Reddin & Short, 1991).

Estimates of the numbers of microtagged fish from different countries caught in the West Greenland fishery in 1990, together with the standard deviations of these estimates, are given in Table 6 by NAFO Division and calendar week. Estimated totals were: USA (579), Canada (165), Ireland (45), England and Wales (26) and Iceland (49).

Table 7 summarises the numbers of fish tagged (1987-89) and the numbers of tags recovered at West Greenland (1988-90) by country of origin. Recapture rates, expressed as numbers of tags recovered per 1000 fish scanned at West Greenland per 1000 fish tagged in the preceding year (by country of origin) are also included for comparison purposes. Recapture rates for fish of hatchery origin have been highest for batches of fish released in Canada. Recapture rates for wild fish have been higher than those of hatchery-origin released in the same country.

The position of the microtags in the fish head cores was compared for the different tagging agencies. On the whole, tag placement in 1990 appeared to be satisfactory, although, in common with previous years, a proportion of the fish of USA origin (23%) had tags located in the epidermal layer at the top of the core. A similar proportion of Canadian origin fish (22%) also displayed such tag placement in 1990.

DISCUSSION

As in 1989, the total nominal catch in the West Greenland fishery in 1990 was particularly poor, and well below the permitted quota for the year. However, while the scanning rate, measured as the proportion of landings checked, had risen to an all time high of 13.2% in 1989, the poor catches at the time scanning took place reduced the rate to only 7.6% in 1990. This was broadly similar to previous years (1985-88), when the scanning rate fell in the range 7.7 to 9.5%. The proportions of fish having fin clips and microtags (Table 2) were higher in 1990 than in any preceding year, and probably reflects the greater abundance of fish of North American origin in the fishery area. Overall, North American tags comprised 85% of the tags recovered in 1990, an increase on previous years. It is estimated that North American fish comprised 75% of the landings at West Greenland in 1990 (Anon., 1991).

The proportion of adipose fin-clipped fish without microtags (2.29% of those sampled) was also higher in 1990 than in any previous year (Table 2). While a small proportion of these fish will have lost external tags or microtags, the majority are believed to have been released without tags in various stocking investigations around the North Atlantic. Anon (1990) gives details of microtagged and adipose fin-clipped fish released in the North Atlantic in 1989, and reveals that substantial numbers of untagged adipose fin-clipped fish were released from the USA and Canada in particular. The Canadian releases of such fish rose almost threefold between 1988 and 1989 to 1.2 million, and it is thought that these, together with smaller releases from elsewhere, adequately account for the increase in the numbers of untagged adipose fin-clipped fish seen.

As in most previous years, there were marked differences in the distribution in the West Greenland fishery area of salmon originating from different countries (Table 4). Only in one year, 1988, has a fairly even distribution of tag recaptures been noted through the fishery. Anon (1991) confirms that significantly higher proportions of North American salmon were recorded in Divisions 1C and 1D of the fishery than in Division 1E. The reasons for the differences in distribution are not known, although they are likely to be related to variation in the timing and routes of migration of the various stocks from year to year. The particularly low catch in 1990 presumably reflected a reduction in the numbers of fish available to the fishery, and this is also likely to have affected tag recovery patterns.

Microtagged fish comprised 1.03% of the nominal catch in 1990, almost twice that recorded over the period 1987-89 (0.50 to 0.54%). This may be accounted for, in part at least, by a disproportionate decrease of stocks of European origin in the fishery in 1990. It is widely believed that the large tagging programmes in N American result in a much greater proportion of N American salmon being microtagged than commonly occurs in Europe. It is a speculated (Anon., 1991) that the low catches of one-sea-winter salmon in Europe in 1990, and the poor contribution by European fish to the West Greenland fishery in 1990 (90% of the catches at Greenland belong to the same year class as grilse) may have resulted from a high post-smolt mortality in 1989.

An indication of the relative abundance of fish from different countries within the fishery area is presented in Table 7 as numbers of fish recaptured per one thousand fish scanned per one thousand fish tagged in the preceding year. It is stressed, however, that these recapture rate data to not take any account of differences between release groups and should be treated with caution. No attempt has been made to calculate recapture rates for hatchery fish of England and Wales origin as many of these have been tagged as parr destined to spend a further year in the river of release prior to migration. The same sources of error may apply to small numbers of hatchery origin fish or wild parr tagged in other countries (e.g. Scotland), and this may have been a factor in some of the low recovery rates observed.

The recapture rate data cannot be used to draw firm conclusions given the above caveats, however, some interesting differences are apparent. For hatchery fish, recapture rates for batches from Canada have been at least twice those for any other country. There was also an increase in the recovery rate recaptures of Canadian fish in 1990, suggesting higher abundance of some N.American stocks within the fishery area. Recoveries of hatchery origin fish of European origin were very low in 1990. However, the limited data indicate little change in the recapture rates from previous years, which remain generally lower than those for N American stocks.

Most wild smolts have been tagged in Europe and there have been relatively few recaptures; only one such tag was recovered in 1990. Recapture rates for wild fish have been many times greater than their hatchery counterparts, and it is thought these differences largely reflect the greater viability of wild fish. However, it is also possible that the multi-sea-winter salmon components in the particular stocks which have been tagged have tended to be greater for wild than hatchery reared groups.

Problems relating to microtag placement appear to be broadly similar to those observed in previous years (Russell *et al.*, 1989, 1990). A number of tags of USA origin continue to be placed in the epidermal layers at the top of the head, and this proportion increased slightly in 1990 (23%) over that in 1989 (14%). A similar problem was also apparent for fish of Canadian origin in 1990, 22% of fish were recorded with epidermal tag placement. It is not known whether such tag placement affects tag retention; this will require confirmation from home-water scanning programmes.

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Table 1. The number and percentage of fin-clipped and microtagged Atlantic salmon observed during the sampling programme at West Greenland in1990.

SAMPLING SITE (sampling period)	NAFO DIV.	NO. SALMON EXAMINED Weight category <3 Kg	3-5 Kg	>5 Kg	Total	NO. AFC's OBSERVED Weight category <3 Kg	3-5 Kg	>5 Kg	Total	% AFC'S	NO.CWT's RECOVERED Weight category <3 Kg	3-5 Kg	>5 Kg	Total	% CWT's	% AFC's with CWT's	No.untagged AFC Fish	% untagged
MANIITSOQ (8-15 Aug)	1C	1088	54	14	1156	63	3	0	66	5.71	16	1	0	17	1.47	25.76	49	4.24
NUUK (3-20 Aug)	1D	3606	188	33	3827	97	8	0	105	2.74	29	3	0	32	0.84	30.48	73	1.91
PAAMIUT (5-18 Aug)	1E	1334	81	12	1427	29	1	0	30	2.10	5	0	0	5	0.35	16.67	25	1.75
TOTAL		6028	323	59	6410	189	12	0	201	3.14	50	4	0	54	0.84	26.87	147	2.29
%		94.04	5.04	0.92		94.03	5.97	0			92.59	7.41	0					

AFC = Adipose fin clip.
CWT = Coded wire microtag.

Table 2. The number of salmon examined and the number and percentage of fin-clipped and microtagged fish observed at West Greenland, 1985-90.

YEAR	NO. SALMON EXAMINED	NO. AFC's OBSERVED	% AFC's	NO. CWT's RECOVERED	% CWT's	% AFC FISH WITH CWT's	NO. UNTAGGED AFC FISH	% UNTAGGED
1985	14319	223	1.56	36	0.25	16.1	187	1.31
1986	30360	410	1.35	70	0.23	17.1	340	1.12
1987	25047	493	1.97	146	0.58	29.6	347	1.39
1988	22327	404	1.81	111	0.50	27.5	293	1.31
1989	15588	331	2.12	100	0.64	30.2	231	1.48
1990	6410	201	3.14	54	0.84	26.9	147	2.29

AFC = Adipose fin clip.
CWT = Coded wire microtag.

Table3. Mean lengths, weights and distributions of recaptures at West Greenland of microtagged salmon from different release areas. Recovery rates per 1000 fish examined are also given for each NAFO Division.

COUNTRY	RELEASE SITE	RELEASE STAGE	TOT. NO. RECOVS.	RECOVS. BY NAFO DIV. 1C	1D	1E	MEAN FORK LENGTH (mm)	MEAN GUTTED WEIGHT (Kg)
USA	Connecticut R.	'89 HS	7	3	4	0	637	2.37
	Penobscot R.	'89 HS	20	5	14	1	621	2.33
	Merrimack R.	'89 HS	9	4	5	0	624	2.51
	Narragansett Bay	'89 HS	1	0	1	0	600	2.20
	Total		37	12	24	1	624	2.37
	Recovery rate		5.8	10.4	6.3	0.7		
CANADA	St. John R., N.B.	'89 HS	7	4	3	0	645	2.46
	Stewart Brook, N.B.	'89 HS	2	0	2	0	580	1.90
	Total		9	4	5	0	636	2.38
	Recovery rate		1.4	3.5	1.3	0		
IRELAND	Castleconnell R.	'89 HS	1	1	0	0	690	3.23
	R. Boluisce	'88 HP	1	0	1	0	610	2.36
	R. Corrib	'89 HS	1	0	0	1	630	2.36
	Total		3	1	1	1	643	2.65
	Recovery rate		0.5	0.9	0.3	0.7		
ENGLAND & WALES	R. Wear	'89 WS	1	0	0	1	640	2.40
	R. Ebbw	'88 HP	1	0	1	0	660	2.41
	Total		2	0	1	1	650	2.41
	Recovery rate		0.3	0	0.3	0.7		
ICELAND	Hraunsfjordur	'89 HS	1	0	0	1	610	2.20
	Vogalax	'89 HS	1	0	1	0	620	2.11
	Rangar	'89 HS	1	0	0	1	570	1.88
	Total		3	0	1	2	600	2.06
	Recovery rate		0.5	0	0.3	1.4		

KEY: '89 HS = 1989 Hatchery smolt release.
'89 WS = 1989 Wild smolt release.
'88 HP = 1988 Hatchery parr release.

Table 4. Distributions of recaptures and recovery rates (per 1000 fish examined) of microtagged salmon from different countries caught in the West Greenland fishery, 1986-90.

COUNTRY	YEAR	TOT. NO.	No. Recovs by NAFO Division						Recovery rate (per 1000 fish)					
		RECOVS	1A	1B	1C	1D	1E	1F	1A	1B	1C	1D	1E	1F
USA	1986	7	-	6	-	1	0	0	-	0.8	-	0.1	0	0
	1987	82	-	26	-	35	7	14	-	4.3	-	3.8	1.1	3.9
	1988	58	1	18	-	30	8	1	1.9	2.5	-	3.0	2.1	1.1
	1989	70	-	31	-	33	6	-	-	8.5	-	4.3	1.4	-
	1990	37	-	-	12	24	1	-	-	-	10.4	6.3	0.7	-
CANADA	1986	19	-	4	-	10	4	1	-	0.5	-	1.0	0.5	0.2
	1987	21	-	7	-	8	4	2	-	1.2	-	0.9	0.7	0.6
	1988	23	1	7	-	10	4	1	1.9	1.0	-	1.0	1.0	1.1
	1989	2	-	0	-	1	1	-	-	0	-	0.1	0.2	-
	1990	9	-	-	4	5	0	-	-	-	3.5	1.3	0	-
IRELAND	1986	18	-	8	-	8	2	0	-	1.1	-	0.8	0.3	0
	1987	24	-	6	-	9	6	3	-	1.0	-	1.0	1.0	0.8
	1988	17	1	6	-	7	2	1	1.9	0.8	-	0.7	0.5	1.1
	1989	12	-	6	-	5	1	-	-	1.6	-	0.7	0.2	-
	1990	3	-	-	1	1	1	-	-	-	0.9	0.3	0.7	-
ENGLAND & WALES	1986	22	-	6	-	11	1	4	-	0.8	-	1.1	0.1	0.7
	1987	17	-	7	-	8	0	2	-	1.2	-	0.9	0	0.6
	1988	8	0	2	-	2	4	0	0	0.3	-	0.2	1.0	0
	1989	12	-	2	-	4	6	-	-	0.5	-	0.5	1.4	-
	1990	2	-	-	0	1	1	-	-	-	0	0.3	0.7	-
SCOTLAND	1986	2	-	0	-	2	0	0	-	0	-	0.2	0.0	0
	1987	2	-	0	-	1	1	0	-	0	-	0.1	0.2	0
	1988	1	0	1	-	0	0	0	0	0.1	-	0	0	0
	1989	2	-	1	-	1	0	-	-	0.3	-	0.1	0	-
ICELAND	1986	2	-	1	-	0	1	0	-	0.1	-	0	0.1	0
	1988	3	0	1	-	2	0	0	0	0.1	-	0.2	0	0
	1990	3	-	-	0	1	2	-	-	-	0	0.3	1.4	-
N.IRELAND	1989	1	-	1	-	0	0	-	-	0.3	-	0	0	-

Notes: A dash represents no scanning undertaken.
Years in which no tags were recovered from a particilar country are not included.

Table5. Estimated raising factors for microtag recoveries at West Greenland in 1990 by NAFO Division and week number.

NAFO Division	Calendar Week (week 32 = 6-12 August)	Wt. (tonnes) of Salmon landed	Mean Wt. (Kg)	Estimated No. of Salmon landed	No. of Salmon scanned	Raising Factor
1A+1B+1C	31-47	120.9	2.71	44613	1156	38.6
1D	<= 31	1.3		483	291	1.7
	32	8.2		3048	1119	2.7
	33	8.4		3123	1958	1.6
	>=34	26.2		9740	459	21.2
	Total	44.1	2.69	16394	3827	
1E+1F	<= 32	5.3		1985	532	3.7
	>= 33	56.6		21198	895	23.7
	Total	61.9	2.67	23183	1427	
Whole area		226.9	2.69	84190	6410	

Table 6. Estimated total number of microtagged salmon caught at West Greenland in 1990, by country of origin.

NAFO Division	Calendar Week	Raising Factor	USA R	USA C	Canada R	Canada C	Ireland R	Ireland C	E & W R	E & W C	Iceland R	Iceland C	Total R	Total C
1A+1B+1C	31-47	38.6	12	463.2	4	154.4	1	38.6	0	0	0	0	17	656.2
1D	<=31	1.7	1	1.7	0	0	0	0	0	0	0	0	1	1.7
	32	2.7	13	35.1	2	5.4	1	2.7	1	2.7	0	0	17	45.9
	33	1.6	7	11.2	3	4.8	0	0	0	0	1	1.6	11	17.6
	>=34	21.2	3	63.6	0	0	0	0	0	0	0	0	3	63.6
	Total		24	111.6	5	10.2	1	2.7	1	2.7	1	1.6	32	128.8
1E+1F	<=32	3.7	1	3.7	0	0	1	3.7	0	0	0	0	2	7.4
	>=33	23.7	0	0	0	0	0	0	1	23.7	2	47.4	3	71.1
	Total		1	3.7	0	0	1	3.7	1	23.7	2	47.4	5	78.5
Whole area *			37	578.7	9	164.6	3	45.1	2	26.4	3	49	54	863.8
S.D.				136.4		76.2		38.3		23.3		32.8		165.3

KEY:
R = Number of tags recovered.
C = Estimated number of tags in catch.
* = Whole area totals have been calculated from unrounded data.

Table 7. Numbers of fish tagged (1987-89), numbers of tags recovered (1988-90) and [illegible] recapture rate (expressed as no. of tags recovered per 1000 fish scanned, per 1000 fish tagged in the preceding year) by country of origin.

COUNTRY	Hatchery/ Wild	No. CWT's in 1987 (a)	No. Recovs in 1988	Recapture rate (x1000)	No. CWT's in 1988 (b)	No. Recovs in 1989	Recapture rate (x1000)	No. CWT's in 1989 (c)	No. Recovs in 1990	Recapture rate (x1000)
USA	H	640,400	58	4.1	723,400	70	6.2	660,932	37	8.7
	W	0	-	-	0	-	-	0	-	-
CANADA	H	62,900	23	16.4	9,160	2	14.0	59,178	9	23.7
	W	0	-	-	4,162	0	0	0	-	-
IRELAND	H	128,660	15	5.2	157,158	8	3.3	144,125	3	3.2
	W	3,240	2	27.7	8,683	4	29.6	3,216	0	0
ENGLAND & WALES	H	178,830	4	(d)	173,498	5	(d)	246,405	1	(d)
	W	19,447	4	9.2	16,415	7	27.4	9,937	1	15.7
SCOTLAND	H	17,192	1	2.6	27,210	1	2.4	24,852	0	0
	W	3,684	0	0	4,121	1	15.6	5,436	0	0
ICELAND	H	116,233	3	1.2	231,036	0	0	405,363	3	1.2
	W	2,933	0	0	7,021	0	0	2,341	0	0
N.IRELAND	H	17,208	0	0	16,054	0	0	7,854	0	0
	W	3,193	0	0	4,546	1	14.1	1,958	0	0

KEY:
(a) Data from Anon., (1988b).
(b) Data from Anon., (1989).
(c) Data from Anon., (1990).
(d) Recapture rates have not been calculated for England and Wales as many of the fish have been tagged as parr, which are destined to spend a further year, at least, in fresh water before migrating as smolts.