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FISHERIES TECHNICAL REPORT

STOCK ASSESSMENT REVIEW ON THE
RIVER DART.

MAY 1999
FRCN/99/07

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STOCK ASSESSMENT REVIEW ON THE RIVER DART.

This paper gives details of the assessment of the salmon and sea trout stocks for the River Dart from the 1950's to date. It also gives for the salmon population the results of the compliance to egg spawning target assessment according to the Environment Agency national guidelines.

Data used to evaluate the stocks include rod catches returns, net catches returns and juvenile survey.

1- Net catches.

Monthly total catches were available since 1953.

SALMON CATCHES:

Total salmon catches have been declining significantly since the beginning of the 1980s to date. The slope of -78 is significantly different to 0 ($p=0.003$) and $R^2 = 0.40$. This was following an increase in catches from the 1970's when UDN occurred (Fig. 1 and 2). Catches level is now at its lowest, lower value observed is in 1998 with 251 fish caught and the highest value was observed in 1987 with 2356 fish caught (Table 1).

Early season catches (from the start of the netting season to end of May) have been significantly declining from the 1950's to date. The slope of -10.25 is significantly different to 0 ($p<<0.01$) and $R^2 = 0.44$ (fig. 3).

SEA TROUT CATCHES:

Total sea trout catches have been decreasing slowly since the beginning 1980's and have been quite variable. The slope of -17 is significantly different to 0 ($p<0.05$) and $R^2 = 0.31$. The reduction in sea trout catches is less abrupt than in salmon. This reduction was following an increase in catches in the 1970's when UDN occurred (Fig. 4 and 5). Catches remain in their overall average level (from the 1950's to date) which is equal to 552 fish caught (Table 2).

There is no significant trend in a change in the number sea trout caught in the early season since 1950's to date. From 1972 to date the number of fish caught in early months has been increasing slowly and have been quite variable. The slope of $+ 6.5$ is significantly different to 0 ($p<0.05$) and $R^2 = 0.23$ (Fig. 6).

From 1951 to 1994, 18 nets have been operating most of the time with 15 in 1970, 17 in 1972. In 1995 15 nets have operated, in 1996 13, in 1997 15 and in 1998 14.

The salmon pre-june net catches are compared to the sea trout pre-june net catches since netting effort on these two species is the same. The slight increase in sea trout catches together with the reduction of salmon catches in the early season suggest that the spring salmon population is declining and that the spring sea trout population is not declining as much as salmon.

2- Rod catches.

Monthly total catches were available since 1966.

SALMON CATCHES.

There is no significant trend in a change in salmon rod catches since the middle 1960's nor since middle 1980's (Fig. 7 and Table 3).

Early season rod salmon catches have been declining significantly middle 1960's to date. The slope of -4.6 is significantly different to 0 ($p < 0.001$) and $R^2 = 0.54$ (Fig. 8). The proportion of fish caught in the early season turned from 60% to nowadays 10%.

SEA TROUT CATCHES.

Sea trout catches have been increasing significantly since the 1970's to date. The slope of $+ 21$ is significantly different to 0 ($p = 0.0012$) and $R^2 = 0.38$. The catches remain at their highest level as 30 years ago (Fig. 9, 10 and Table 4).

Early season catches (up to end of May) are increasing slowly from 1966 to date (slope of $+ 3.2$ and $p = 0.009$) but are very variable ($R^2 = 0.19$).

NB. Without any detailed information on the changes in net and rod fishing efforts from the 1950's to date it is difficult to interpret the observed trends in the rod and net catches.

3-Sea age composition for salmon population.

Analysis of individual weight distributions from 1973 to 1997 of net salmon caught show that the proportion of multi-sea-winter fish is decreasing significantly (Percentage of MSW (Y) against years (X), slope of -0.017 , $p < 0.01$) from a maximum of 70% (in 1978) to a minimum of 12% (in 1997) (Peress 1998).

Scale reading carried out in the 1960's and in the early 1970's showed that the proportions of multi-sea-winter fish caught were at their highest equal to 95.7% in 1966 and at their lowest equal to 64.5% in 1967 (Hamilton *et al* 1997).

The decline in the number of early season catches together with scale reading and weight distribution analysis of the total catches lead to the conclusion that multi-sea-winter fish population is declining in the river Dart.

4-Salmon spawning target and compliance assessment.

The spawning target for the river Dart is 297 eggs/100 m² of accessible area for salmon. This density converted with the total accessible area of 1 316 649 m² is equal to 3.9 million eggs (Peress 1998).

Compliance with this target has been assessed from 1962 to date based on annual rod catches and weight distribution analysis of net caught fish (Peress 1998).

Target has been reached in the 1960's and in the mid and late 1980's.

Periods of failure to meet the spawning target are identified according to the Environment Agency national guidelines. The assessment shows that the River Dart has failed to comply in the last ten years (Fig. 11).

5-Juvenile survey.

Juvenile monitoring with electric fishing has been carried out since 1965. Electric fishing was undertaken in sites randomly distributed throughout the catchment. In some year, the number of sites surveyed were small and have been omitted from the analysis (1975, 80, 94).

1-The analysis presented in Hamilton *et al* 1997 shows that salmon and trout were well distributed throughout the catchment.

2-Analysis of estimated average densities of juvenile salmon has been carried out to compare salmon parr population between years and salmon fry population. Average density was estimated separately for parr and fry and all the sites where salmon had access were included.

METHOD:

The null hypothesis is there no significant difference in salmon densities between years. Years are linked between them as the surveys are done at the same site each year. The data set is unbalanced as not all sites have been surveyed each year (summary data in Table 5).

Preliminary analysis of variance showed that the data sets for both fry and parr are not normal. Friedmann test, a non parametric alternative analysis of variance for linked samples, was then performed on the data sets which have been balanced (Table 6). This was tested for 1987, 1993 and 1996 for both age classes.

RESULTS:

This test showed that for both fry and parr that there is a significant difference in estimated densities between the examined years (fry $P < 5\%$ and parr $P < 5\%$).

The juvenile salmon population seems to have reached a maximum in 1987. This is confirmed by the 1985 and 1986 egg deposition.

6-References.

Environment Agency, 1996. Salmon Action Plan Guidelines, Version 1. Environment Agency.

Hamilton, R.M., Broad, K.J. and Bird, D., 1997. Review of fishery regulations on the River Dart. Environment Agency Report FRCN/97/02.

Peress, J.N., 1998. River Dart salmon spawning target and compliance assessment. Environment Agency Report FRCN/98/05

Steel, S., 1997. River Dart fisheries survey 1996. Environment Agency Report DEV/FRCN/10/97

FIGURE 1: NET SALMON CATCHES FROM 1953 TO 1998 - RIVER DART

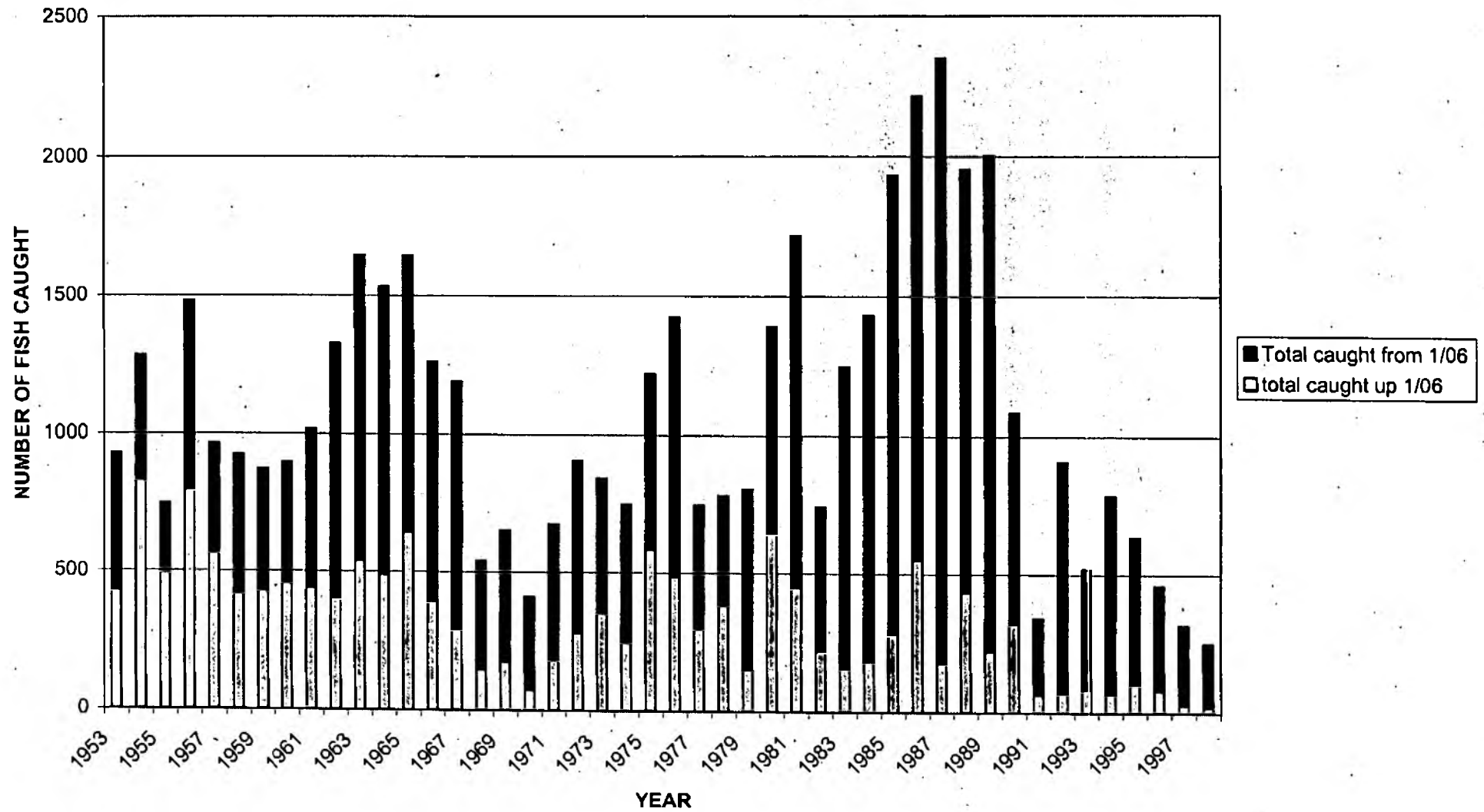


FIGURE 2: TOTAL SALMON NET CATCHES FROM 1953 TO 1998- RIVER DART

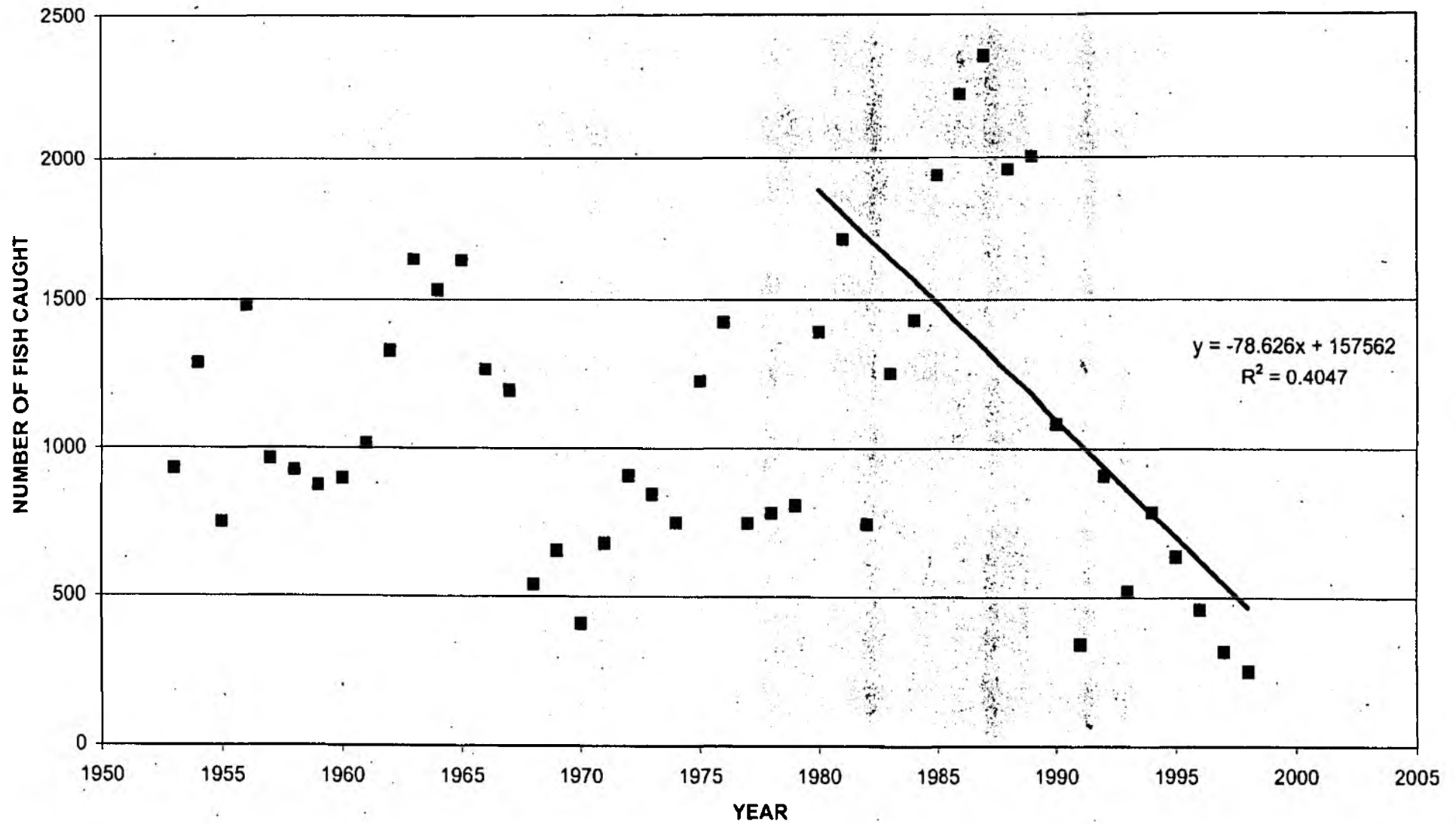


FIGURE 3: PREJUNE NET SALMON CATCHES FROM 1953 TO 1998 - RIVER DART

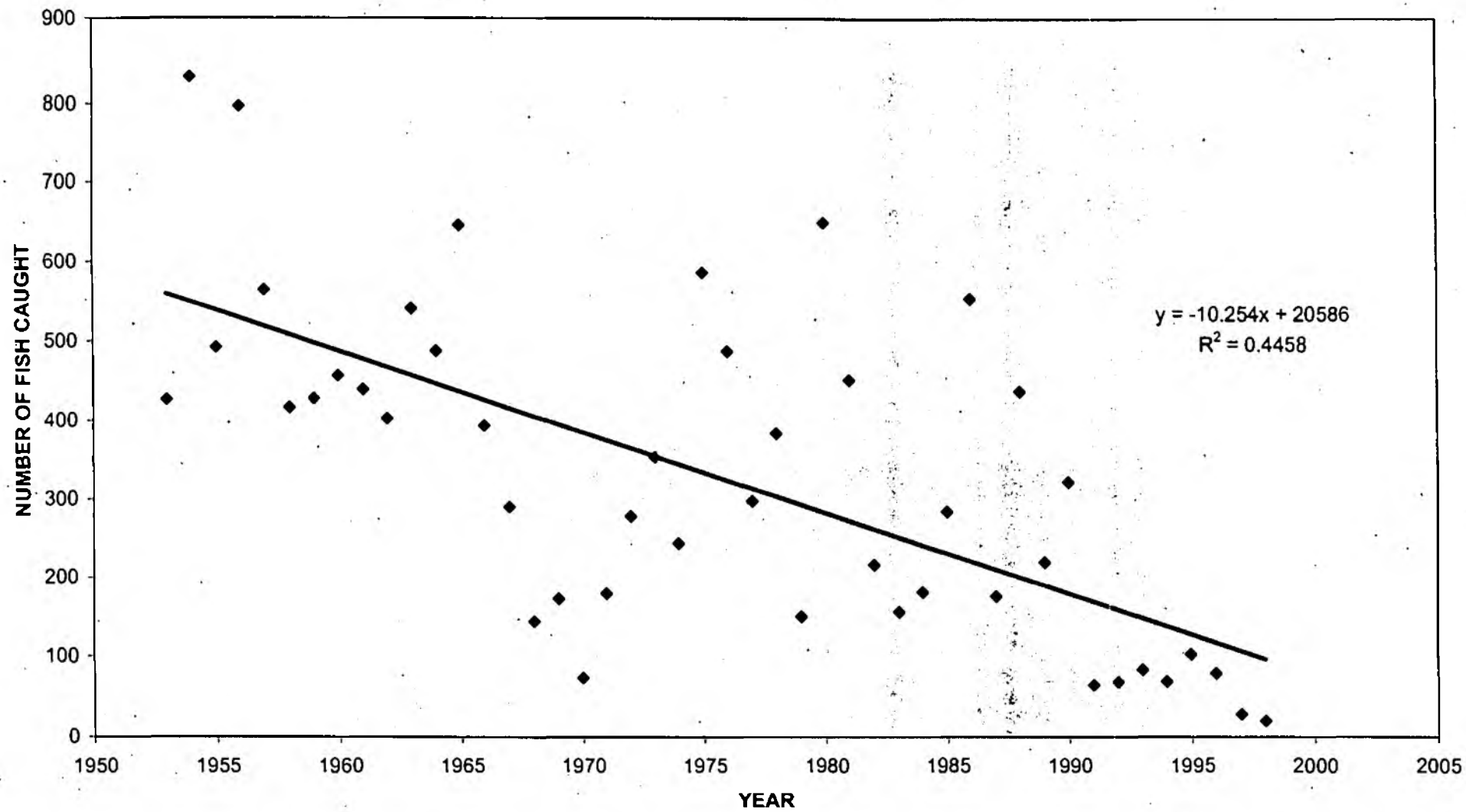


FIGURE 4: NET SEA TROUT CATCHES FROM 1953 TO 1998 - RIVER DART

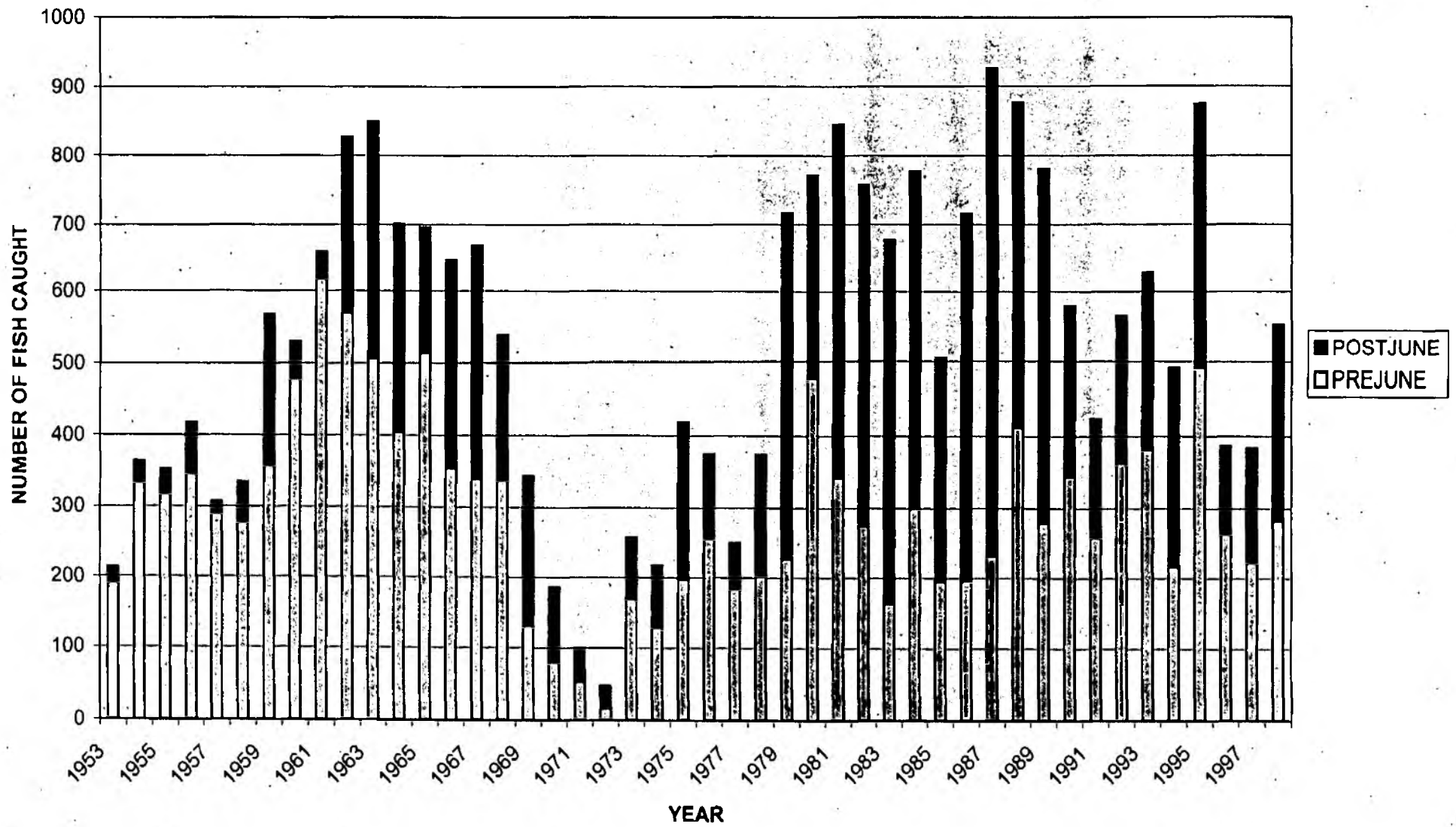


FIGURE 5: TOTAL SEA TROUT NET CATCHES FROM 1953 TO 1998 - RIVER DART

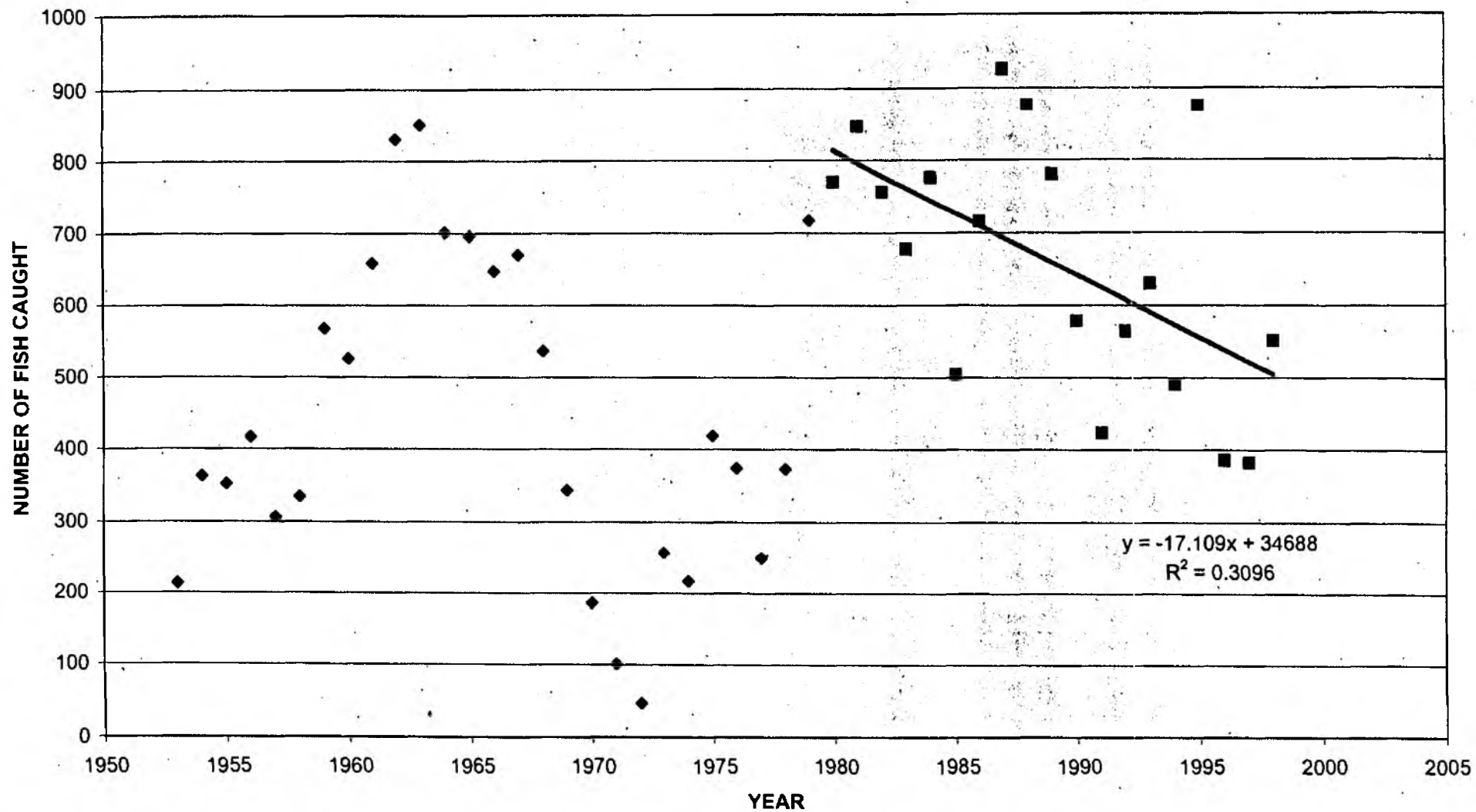


FIGURE 6: SEA TROUT PREJUNE NET CATCHES FROM 1953 TO 1998 - RIVER DART

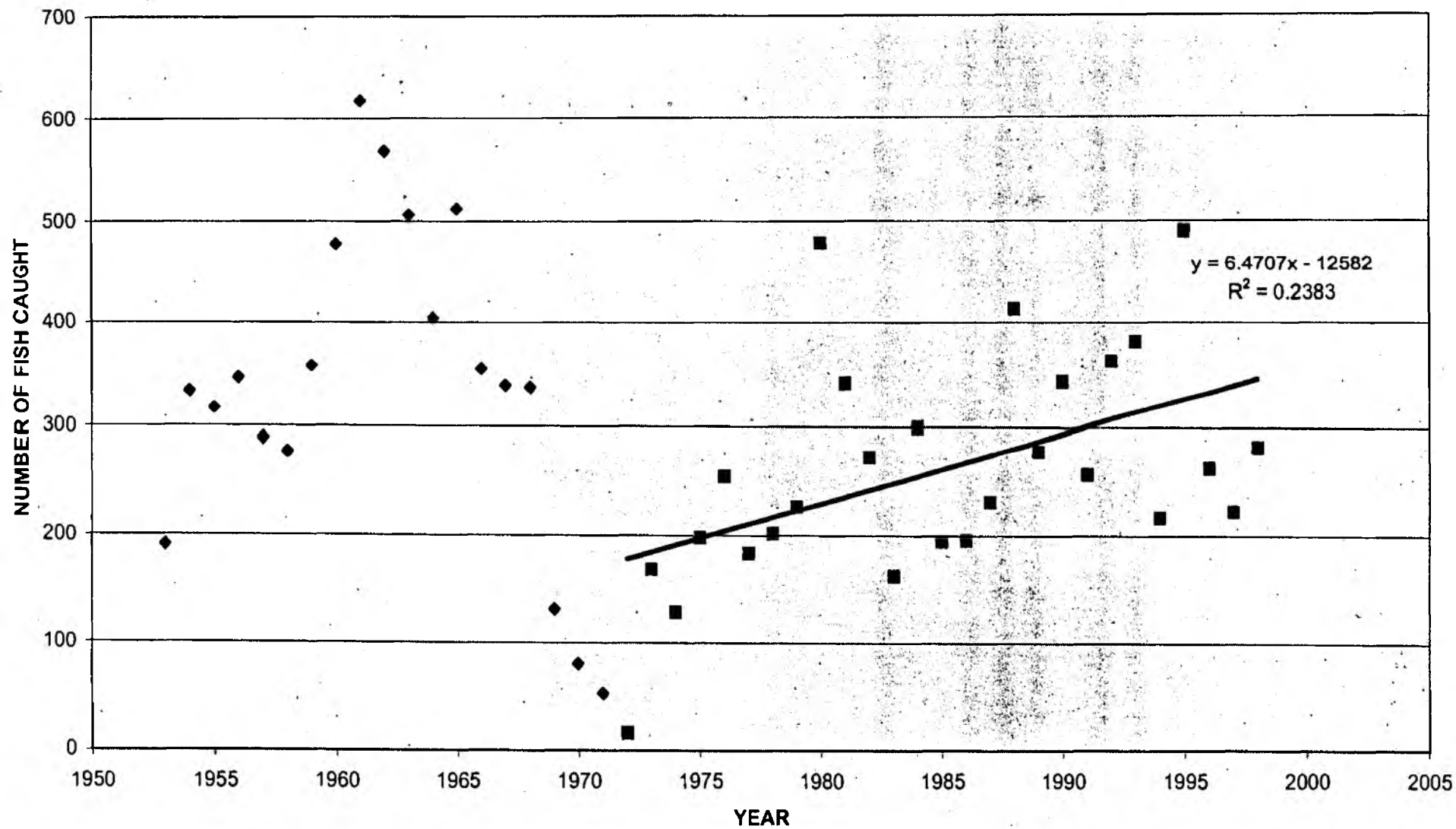


FIGURE 7: ROD SALMON CATCHES FROM 1966 TO 1998 - RIVER DART

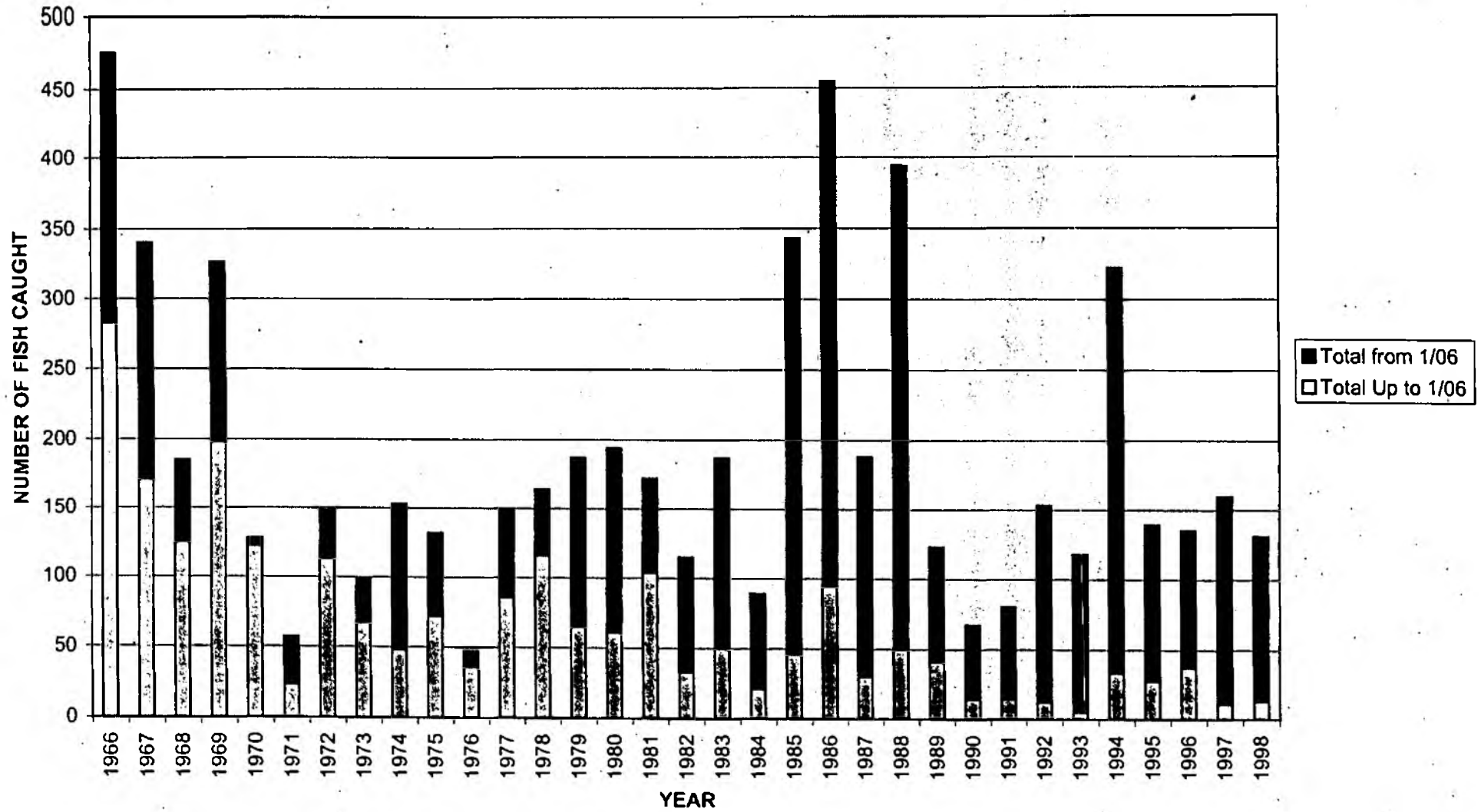


FIGURE 8: PREJUNE ROD SALMON CATCHES FROM 1966 TO 1998 - RIVER DART

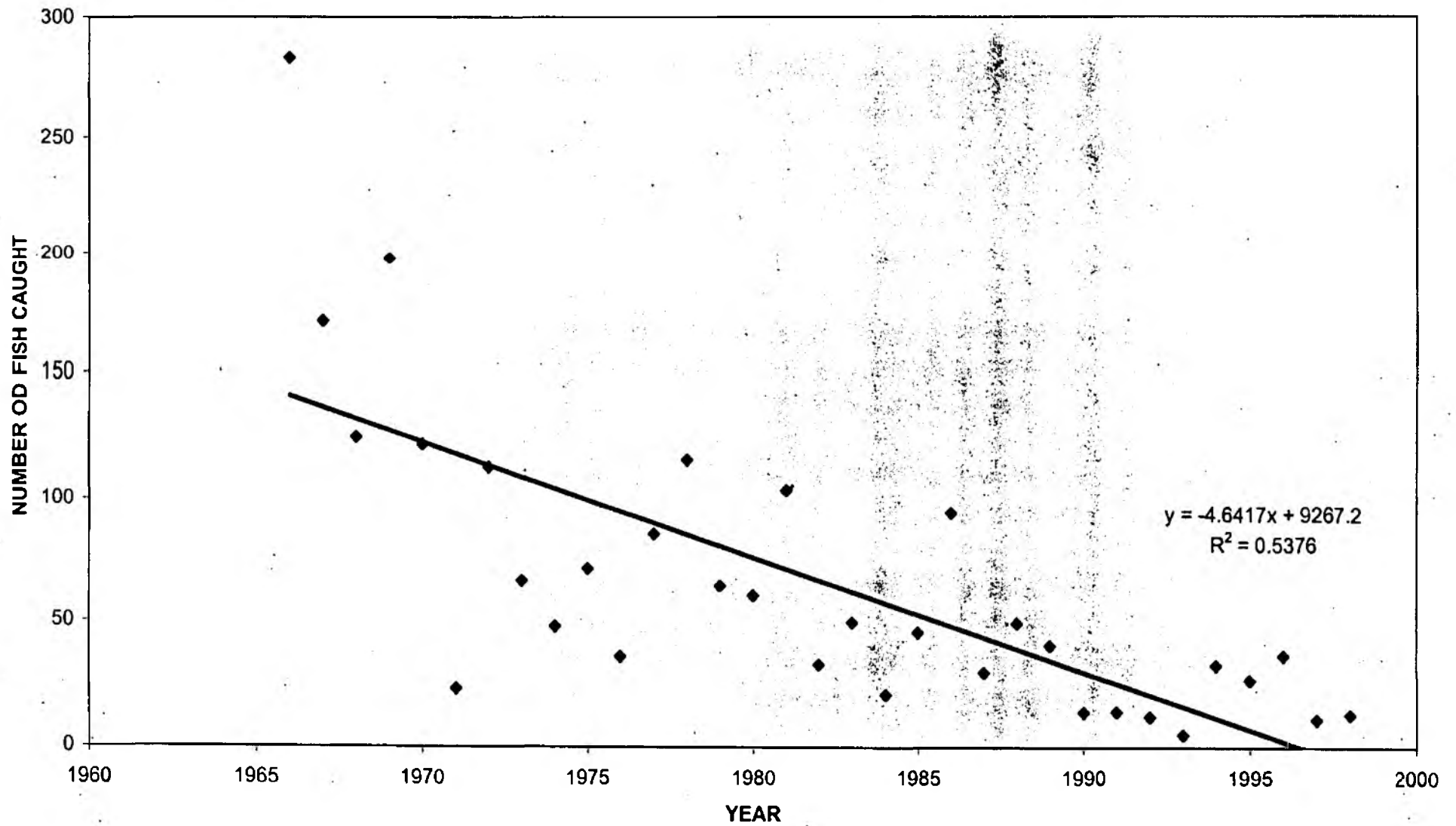


FIGURE 9: SEA TROUT ROD CATCHES FROM 1966 TO 1998 - RIVER DART

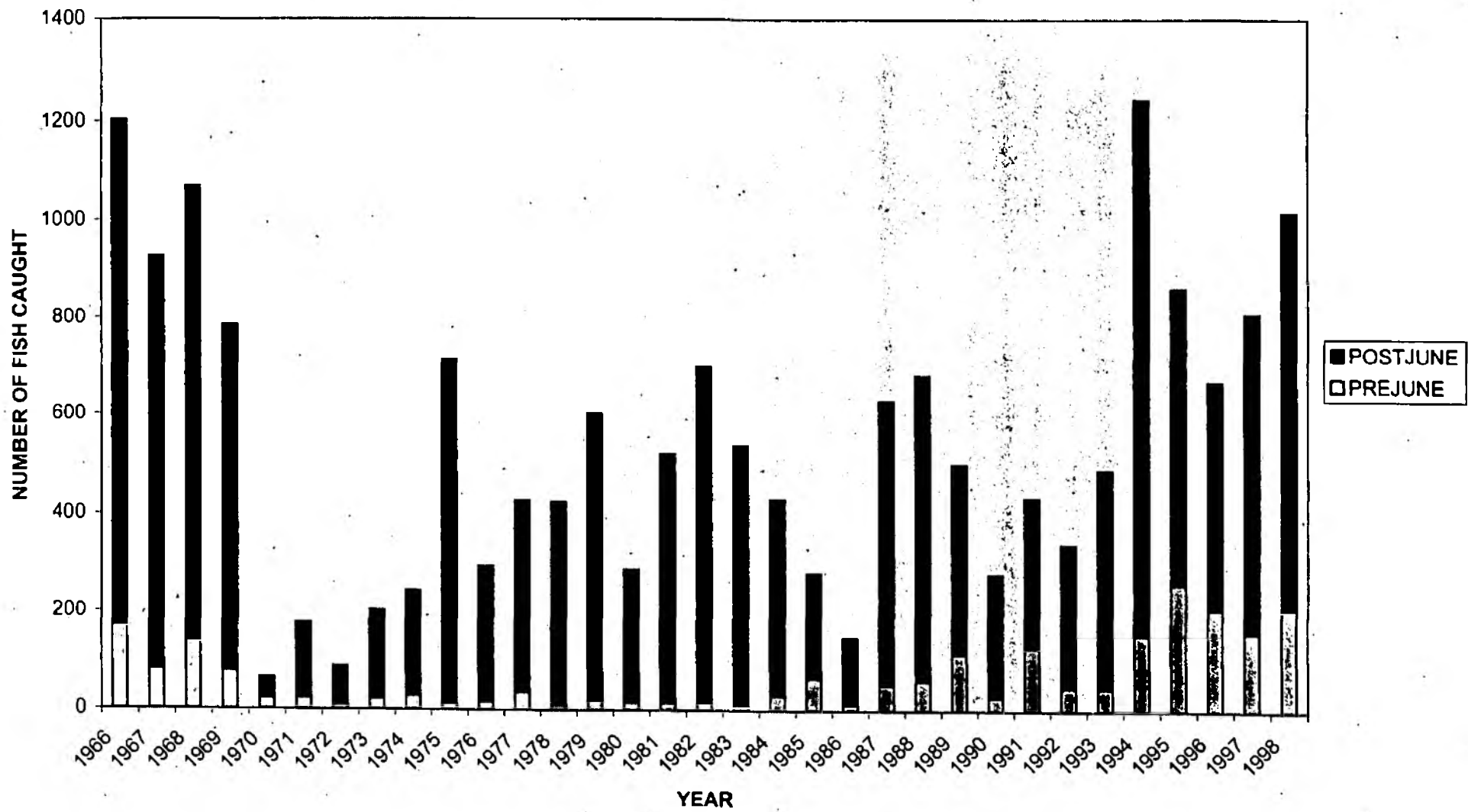


FIGURE 10: TOTAL SEA TROUT ROD CATCHES FROM 1966 TO 1998 - RIVER DART

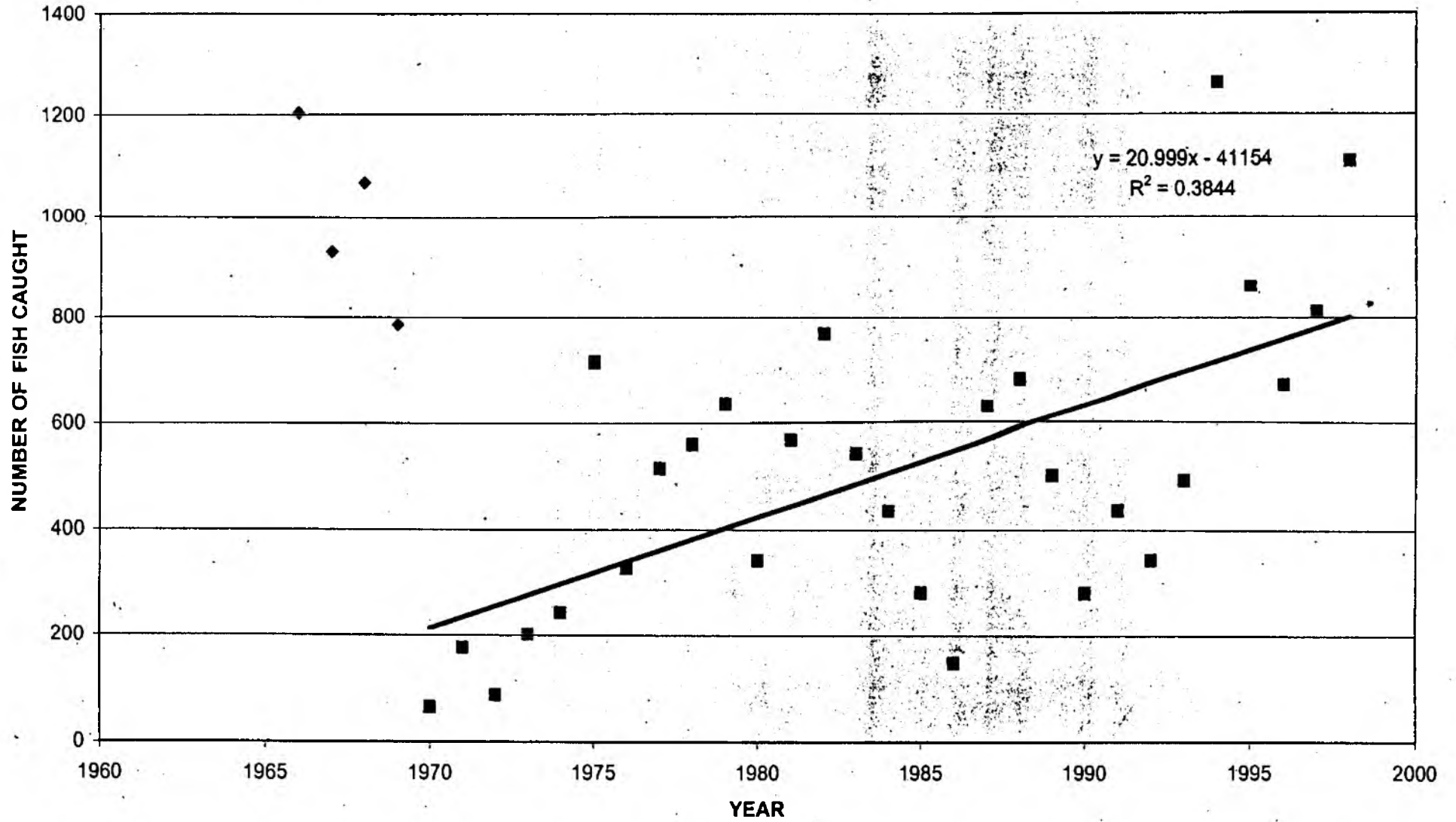


FIGURE 11: Compliance With Spawning Target
with salmon rod extant exploitation rate=21%,
1962-1998, River DART

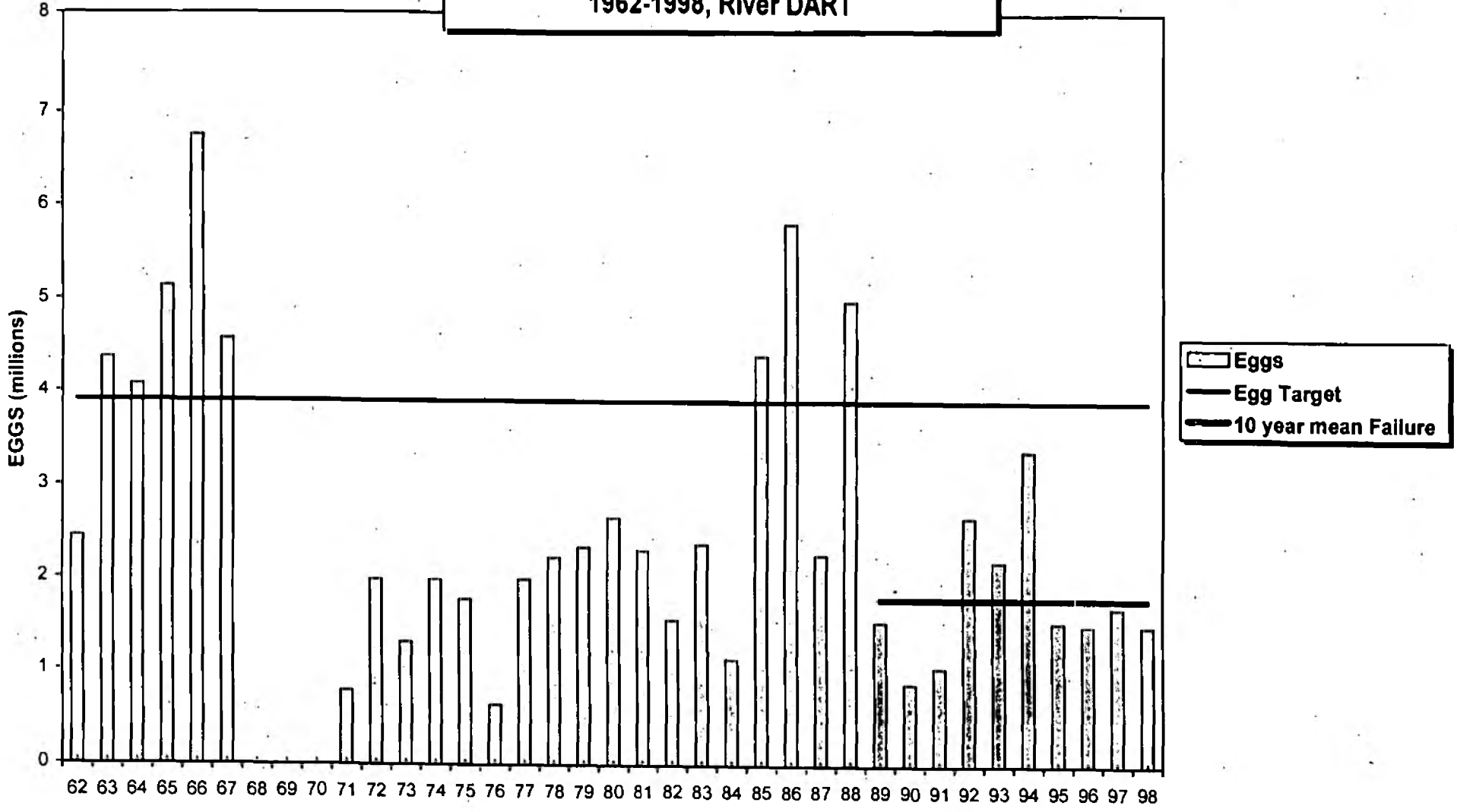


TABLE 1: RIVER DART - NET SALMON CATCHES

Year	Jan	Feb	Mar	Apr	May	Total							unknown	TOTAL	
						Jan to May	Jun	Jul	Aug	Sep	Oct	Nov			Dec
1953	0	0	35	82	310	427	333	150	22	0	0	0	0	505	932
1954	0	0	71	300	461	832	292	142	17	0	0	0	0	451	1283
1955	0	0	31	159	302	492	182	66	8	0	0	0	0	256	748
1956	0	0	39	175	583	797	401	237	46	0	0	0	0	684	1481
1957	0	0	27	116	422	565	308	76	17	0	0	0	0	401	966
1958	0	0	7	148	262	417	255	180	74	0	0	0	0	509	926
1959	0	0	16	107	305	428	243	140	64	0	0	0	0	447	875
1960	0	0	9	85	363	457	316	106	19	0	0	0	0	441	898
1961	0	0	63	112	264	439	363	179	37	0	0	0	0	579	1018
1962	0	0	38	115	250	403	380	419	124	0	0	0	0	923	1326
1963	0	0	6	151	383	540	433	447	223	0	0	0	0	1103	1643
1964	0	0	12	108	368	488	525	366	154	0	0	0	0	1045	1533
1965	0	0	26	143	476	645	562	320	113	0	0	0	0	995	1640
1966	0	0	31	63	300	394	495	283	90	0	0	0	0	868	1262
1967	0	0	6	77	207	290	300	390	208	0	0	0	0	898	1188
1968	0	0	17	45	82	144	183	154	60	0	0	0	0	397	541
1969	0	0	1	25	146	172	201	235	46	0	0	0	0	482	654
1970	0	0	2	13	59	74	116	208	12	0	0	0	0	336	410
1971	0	0	7	45	127	179	190	230	78	0	0	0	0	498	677
1972	0	0	21	51	206	278	207	299	124	0	0	0	0	630	908
1973	0	0	58	108	187	353	175	267	50	0	0	0	0	492	845
1974	0	0	16	69	159	244	170	253	82	0	0	0	0	505	749
1975	0	0	26	277	282	585	216	306	114	0	0	0	0	636	1221
1976	0	0	11	192	283	486	285	382	270	0	0	0	0	937	1423
1977	0	0	6	109	182	297	103	228	120	0	0	0	0	451	748
1978	0	0	4	116	263	383	167	167	66	0	0	0	0	400	783
1979	0	0	1	41	108	150	82	345	231	0	0	0	0	658	808
1980	0	0	12	114	520	646	333	260	151	0	0	0	0	744	1390
1981	0	0	7	112	331	450	439	635	191	0	0	0	0	1265	1715
1982	0	0	15	50	152	217	233	106	188	0	0	0	0	527	744
1983	0	0	13	54	89	156	272	533	288	0	0	0	0	1093	1249
1984	0	0	2	42	137	181	244	589	416	0	0	0	0	1249	1430
1985	0	0	0	12	272	284	425	962	265	0	0	0	0	1652	1936
1986	0	0	5	129	417	551	535	891	245	0	0	0	0	1671	2222
1987	0	0	5	33	138	176	560	1201	419	0	0	0	0	2180	2356
1988	0	0	22	114	300	436	354	799	367	0	0	0	0	1520	1956
1989	0	0	2	16	202	220	315	779	690	0	0	0	0	1784	2004
1990	0	0	2	63	256	321	190	317	257	0	0	0	0	764	1085
1991	0	0	1	5	60	66	77	115	83	0	0	0	0	275	341
1992	0	0	0	14	56	70	137	430	273	0	0	0	0	840	910
1993	0	0	1	11	73	85	53	214	168	0	0	0	0	435	520
1994	0	0	1	10	59	70	135	412	170	0	0	0	0	717	787
1995	0	0	0	16	88	104	112	238	182	0	0	0	0	532	636
1996	0	0	1	18	61	80	67	174	139	0	0	0	0	380	460
1997	0	0	1	8	20	29	15	172	101	0	0	0	0	288	317
1998			0	3	17	20	28	150	53					231	251

TABLE 2: RIVER DART - NET SEA TROUT CATCHES

Year	Total					Jan to May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total		TOTAL
	Jan	Feb	Mar	Apr	May									Jun to Dec	unknown	
1953	0	0	47	92	52	191	16	3	3	0	0	0	0	22	0	213
1954	0	0	57	170	107	334	29	1	0	0	0	0	0	30	0	364
1955	0	0	34	135	149	318	31	3	1	0	0	0	0	35	0	353
1956	0	0	41	168	137	346	60	11	0	0	0	0	0	71	0	417
1957	0	0	44	121	125	290	17	0	0	0	0	0	0	17	0	307
1958	0	0	0	159	119	278	48	9	0	0	0	0	0	57	0	335
1959	0	0	53	140	165	358	191	17	2	0	0	0	0	210	0	568
1960	0	0	28	239	212	479	45	2	0	0	0	0	0	47	0	526
1961	0	0	121	340	157	618	39	2	0	0	0	0	0	41	0	659
1962	0	0	74	251	244	569	200	56	3	0	0	0	0	259	0	828
1963	0	0	8	254	244	506	252	91	0	0	0	0	0	343	0	849
1964	0	0	11	148	245	404	249	48	0	0	0	0	0	297	0	701
1965	0	0	44	240	228	512	157	27	0	0	0	0	0	184	0	696
1966	0	0	32	94	229	355	244	45	3	0	0	0	0	292	0	647
1967	0	0	8	96	236	340	252	60	18	0	0	0	0	330	0	670
1968	0	0	16	132	190	338	173	23	3	0	0	0	0	199	0	537
1969	0	0	5	33	93	131	133	77	3	0	0	0	0	213	0	344
1970	0	0	1	25	54	80	78	28	0	0	0	0	0	106	0	186
1971	0	0	4	27	22	53	26	22	0	0	0	0	0	48	0	101
1972	0	0	0	8	8	16	7	23	1	0	0	0	0	31	0	47
1973	0	0	46	69	54	169	70	18	0	0	0	0	0	88	0	257
1974	0	0	13	59	57	129	43	37	8	0	0	0	0	88	0	217
1975	0	0	20	79	99	198	128	87	6	0	0	0	0	221	0	419
1976	0	0	16	126	114	256	84	35	0	0	0	0	0	119	0	375
1977	0	0	11	99	74	184	26	32	8	0	0	0	0	66	0	250
1978	0	0	5	66	131	202	77	82	13	0	0	0	0	172	0	374
1979	0	0	1	53	173	227	175	264	51	0	0	0	0	490	0	717
1980	0	0	21	249	210	480	175	91	25	0	0	0	0	291	0	771
1981	0	0	12	122	208	342	257	225	21	0	0	0	0	503	0	845
1982	0	0	18	103	153	274	334	141	8	0	0	0	0	483	0	757
1983	0	0	2	36	125	163	231	243	41	0	0	0	0	515	0	678
1984	0	0	2	98	200	300	238	208	31	0	0	0	0	477	0	777
1985	0	0	0	38	157	195	134	164	12	0	0	0	0	310	0	505
1986	0	0	3	24	169	196	213	272	35	0	0	0	0	520	0	716
1987	0	0	2	65	165	232	280	393	21	0	0	0	0	694	0	926
1988	0	0	7	80	326	413	345	112	7	0	0	0	0	464	0	877
1989	0	0	3	22	254	279	323	153	26	0	0	0	0	502	0	781
1990	0	0	0	32	312	344	160	65	10	0	0	0	0	235	0	579
1991	0	0	5	75	178	258	83	72	11	0	0	0	0	166	0	424
1992	0	0	15	172	176	363	123	70	9	0	0	0	0	202	0	565
1993	0	0	36	168	178	382	85	114	49	0	0	0	0	248	0	630
1994	0	0	6	68	143	217	146	121	7	0	0	0	0	274	0	491
1995	0	0	0	74	417	491	304	75	5	0	0	0	0	384	0	875
1996	0	0	5	107	152	264	89	32	2	0	0	0	0	123	0	387
1997	0	0	4	110	109	223	56	103	2	0	0	0	0	161	0	384
1998			0	76	207	283	90	149	30					269		552

TABLE 3: RIVER DART - ROD SALMON CATCHES

Year						Total								Total		unknown	TOTAL
	Jan	Feb	Mar	Apr	May	Jan to May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jun to Dec			
1966	0	30	34	89	130	283	72	37	66	17	0	0	0	192		475	
1967	0	12	31	21	107	171	42	27	55	45	0	0	0	169		340	
1968	0	12	29	38	46	125	28	19	8	5	0	0	0	60		185	
1969	0	6	57	34	101	198	49	26	34	19	0	0	0	128		326	
1970	0	21	55	37	9	122	2	0	2	2	0	0	0	6		128	
1971	0	6	6	5	6	23	9	8	15	2	0	0	0	34		57	
1972	0	19	40	27	27	113	18	7	6	4	0	0	0	35		148	
1973	0	17	25	8	17	67	4	5	22	1	0	0	0	32		99	
1974	0	6	19	7	16	48	2	5	46	52	0	0	0	105		153	
1975	0	12	36	13	11	72	8	11	15	26	0	0	0	60		132	
1976	0	8	14	7	7	36	5	1	2	3	0	0	0	11		47	
1977	0	10	26	25	25	86	15	7	23	19	0	0	0	64		150	
1978	0	9	53	35	19	116	8	27	11	2	0	0	0	48		164	
1979	0	4	28	16	17	65	30	15	64	13	0	0	0	122		187	
1980	0	9	15	24	13	61	36	25	37	35	0	0	0	133		194	
1981	0	12	21	18	53	104	28	18	6	16	0	0	0	68		172	
1982	0	8	14	5	6	33	17	19	8	38	0	0	0	82		115	
1983	0	7	9	16	18	50	15	6	16	100	0	0	0	137		187	
1984	0	9	4	6	2	21	6	6	28	28	0	0	0	68		89	
1985	0	5	9	19	13	46	29	28	163	77	0	0	0	297		343	
1986	0	4	5	17	69	95	44	55	182	79	0	0	0	360		455	
1987	0	2	10	7	11	30	45	49	13	51	0	0	0	158		188	
1988	0	3	11	12	24	50	30	72	125	117	0	0	0	344		394	
1989	0	2	4	21	14	41	10	4	11	57	0	0	0	82		123	
1990	0	3	3	7	1	14	12	23	6	12	0	0	0	53		67	
1991	0	1	4	6	3	14	15	19	17	15	0	0	0	66		80	
1992	0	1	2	4	5	12	1	5	50	85	0	0	0	141		153	
1993	0	1	0	2	2	5	9	12	17	71	4	0	0	113		118	
1994	0	7	4	9	13	33	19	18	49	193	10	0	0	289		322	
1995	0	4	8	7	8	27	14	4	13	78	3	0	0	112		139	
1996	0	5	6	6	20	37	17	8	40	33	0	0	0	98		135	
1997	0	1	3	2	5	11	24	13	31	77	4	0	0	149		160	
1998	0	1	0	6	6	13	12	28	15	63	0	0	0	118	2	133	

TABLE 4: RIVER DART - ROD SEA TROUT CATCHES

Year	Total					Jan to May	Total							unknown	TOTAL	
	Jan	Feb	Mar	Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec			Jun to Dec
1966	0	6	26	26	113	171	223	319	188	302	0	0	0	1032	0	1203
1967	0	0	2	41	38	81	147	169	344	185	0	0	0	845	0	926
1968	0	0	7	41	92	140	125	311	329	160	0	0	0	925	0	1065
1969	0	1	4	20	53	78	105	272	201	129	0	0	0	707	0	785
1970	0	0	4	12	7	23	15	7	9	11	0	0	0	42	0	65
1971	0	0	0	8	15	23	33	27	69	25	0	0	0	154	0	177
1972	0	0	0	3	6	9	3	6	58	12	0	0	0	79	0	88
1973	0	0	4	3	15	22	35	70	57	19	0	0	0	181	0	203
1974	0	0	2	15	11	28	26	55	105	30	0	0	0	216	0	244
1975	0	0	0	3	9	12	33	217	302	151	0	0	0	703	0	715
1976	0	0	4	8	4	16	19	84	77	98	0	0	0	278	34	328
1977	0	0	6	12	18	36	36	93	167	98	0	0	0	394	86	516
1978	0	0	3	0	6	9	18	86	208	106	0	0	0	418	134	561
1979	0	0	2	8	10	20	35	116	279	155	0	0	0	585	28	633
1980	0	0	1	8	6	15	32	91	81	70	0	0	0	274	54	343
1981	0	0	8	2	5	15	40	131	225	113	0	0	0	509	46	570
1982	0	0	2	7	7	16	37	216	285	147	0	0	0	685	69	770
1983	0	0	0	4	7	11	55	177	142	156	0	0	0	530	4	545
1984	0	0	0	6	24	30	50	105	149	99	0	0	0	403	4	437
1985	0	0	1	10	55	66	60	87	37	33	0	0	0	217	0	283
1986	0	0	0	0	12	12	12	35	61	29	0	0	0	137	0	149
1987	0	0	0	2	50	52	77	155	205	142	0	0	0	579	0	631
1988	0	0	0	15	46	61	114	159	239	109	0	0	0	621	1	683
1989	0	0	0	17	100	117	109	76	95	107	0	0	0	387	0	504
1990	0	0	0	8	19	27	41	60	78	76	0	0	0	255	0	282
1991	0	0	2	24	104	130	41	70	109	85	2	0	0	307	1	438
1992	0	0	3	20	24	47	18	109	112	57	0	0	0	296	1	344
1993	0	0	0	13	33	46	51	112	180	105	0	0	0	448	0	494
1994	0	0	0	54	103	157	109	309	461	207	0	0	0	1086	20	1263
1995	0	0	6	74	182	262	155	124	172	130	1	1	18	601	0	863
1996	0	0	0	30	180	210	78	109	140	135	0	0	0	462	0	672
1997	0	0	0	79	83	162	117	241	196	92	0	1	3	650	0	812
1998	0	0	0	23	189	212	75	152	377	200	0	0	0	804	92	1108

TABLE 5 : RIVER DART - SALMON JUVENILE SURVEY

= Species present (Semi-quantitative survey)

@ = Species absent (Semi-quantitative survey)

WATERCOURSE	SITE NAME	SALMON FRY(0+)			SALMON PARR AND OLDER(1+)				
		1987	1993	1996	1965	1969	1987	1993	1996
EAST DART RIVER	Hartland Tor	-	-	-	1.68	22.50	-	-	-
	Postbridge	28.92	1.02	2.64	10.44	22.40	29.02	12.29	15.17
	Belever	20.48	#	#	15.36	55.40	11.86	#	#
	Laughtier Hole	-	-	-	9.36	8.20	-	-	-
	Brimpt's Farm	-	-	-	2.16	3.50	-	-	-
RIVER DART	Badger's Holt	-	#	#	5.78	-	-	#	#
	Dartmeet	-	-	-	-	3.80	-	-	-
	New Bridge	-	-	-	7.32	9.50	-	-	-
	Holne Bridge	-	#	@	-	5.60	-	#	#
	Queen of the Dart	-	#	#	-	11.50	-	#	#
	Northwood	3.29	#	#	-	-	3.62	#	#
	Austin's Bridge	-	-	-	-	4.80	-	-	-
	Whortley Copse	0.00	-	-	-	-	0.06	-	-
STANNON BROOK	Staverton	-	#	#	-	0.30	-	#	@
	Stannon Bridge	-	37.81	0.00	-	-	-	4.81	5.18
DURY BROOK	Postbridge	204.35	76.50	85.46	-	-	37.61	8.39	32.56
	Dury Farm	67.80	21.29	14.54	-	-	5.29	1.28	12.18
WALLA BROOK	Statts Bridge	-	-	-	20.40	0.00	-	-	-
	Plzwell	-	-	-	12.60	12.80	-	-	-
	Runnage Bridge	220.35	145.13	183.16	-	8.40	13.61	10.83	34.66
	Riddon Farm	-	-	-	6.24	2.80	-	-	-
	Babeny	12.01	3.85	1.25	-	-	17.83	5.23	4.37
WEST DART RIVER	Sherril	-	-	-	7.20	22.60	-	-	-
	U/s Devonport Leat	-	0.00	0.00	-	-	-	0.00	0.00
	D/s Devonport Leat	-	0.00	0.00	-	-	-	0.41	0.00
	Crockern Tor	6.54	2.94	3.52	3.00	8.10	1.60	2.94	2.69
	Two Bridges	-	-	-	2.88	1.40	-	-	-
	Prince Hall	-	#	#	7.68	6.90	-	#	#
	U/s Swincombe Foot	-	-	-	-	11.70	-	-	-
COWSIC RIVER	Huccaby	-	#	#	16.68	5.20	-	#	#
	U/s Devonport leat intake	-	0.00	1.65	-	-	-	0.00	4.14
	Beardown Wood	-	-	-	-	-	-	-	-
BLACKBROOK RIVER	Beardown Farm	0.00	0.00	0.00	0.00	0.60	1.48	0.00	0.52
	A384 Road Bridge	-	-	-	12.88	8.40	-	-	-
	Blackbrook Bridge/Calms	-	22.81	25.17	36.00	12.50	-	45.37	8.75
	Oakery Bridge	77.49	11.54	21.78	-	-	23.11	35.58	15.06
	D/s Princetown S.t.w Discharge	-	-	40.69	-	-	-	-	13.52
CHERRY BROOK	U/s Powder Mills	-	-	-	-	10.50	-	-	-
	Powder Mills	-	28.70	7.73	5.28	-	-	22.49	13.03
	D/s Powder Mills	-	-	-	-	9.50	-	-	-
	Higher C.B. Bridge	0.00	87.99	15.66	-	-	7.18	22.62	13.50
	Smith Hill Farm	-	-	-	9.12	16.70	-	-	-
SWINCOMBE RIVER	Lower C.B. Bridge	114.61	35.92	182.00	-	-	19.88	17.47	15.87
	U/s Water Intake	39.50	5.71	2.38	-	4.50	22.60	9.34	9.01
	Swincombe Farm	-	-	-	11.88	10.00	-	-	-
	Sherberton Farm	-	-	-	10.56	5.00	-	-	-
STRANE RIVER	Wydemeat	49.60	1.68	1.64	-	-	19.75	8.91	8.15
	Whiteworks	12.49	8.48	0.00	-	-	14.32	4.43	14.81
O BROOK	Saddlers Br./Combstone Tor	0.00	0.00	0.00	-	-	0.00	0.00	0.00
EAST WEBBURN RIVER	Bag Park Bridge	-	-	-	-	2.80	-	-	-
	Wooder Manor	319.63	150.00	10.37	-	-	42.79	18.67	14.24
	Widdecombe Bridge	-	-	-	2.76	18.50	-	-	-
	Cockingford Bridge	41.01	39.77	21.89	22.44	8.70	48.72	27.49	11.14
RIVER WEBBURN	Mistresses Piece	4.79	1.51	3.20	-	-	20.76	10.83	12.10
	Lower Lodge Bridge	-	-	-	-	13.20	-	-	-
WEST WEBBURN RIVER	Challacombe Farm	-	39.88	9.96	-	-	-	4.03	28.68
	Grendon Bridge	41.60	88.69	41.42	12.84	12.10	8.88	12.93	10.80
	Cator Bridge	-	32.62	10.05	12.00	13.90	-	17.15	20.54
	Shallowford Bridge	-	-	-	14.78	12.30	-	-	-
	Ponsworthy	8.20	3.15	2.17	12.12	5.00	24.39	9.17	9.14
BROADAFORD STREAM	Broadaford Bridge	-	0.00	9.92	-	-	-	0.00	1.50
	Ruddy Cleave Water	-	0.00	0.00	-	-	-	0.00	0.00
	Pudsham Down Br.	-	0.00	0.00	-	-	-	0.00	0.00
HOLY BROOK	Greypark Wood	0.00	0.00	0.00	-	-	10.07	4.25	0.77
	Hawson Court	-	-	-	-	0.60	-	-	-
	Littlecombe	-	0.00	8.07	-	-	-	0.00	0.00
	Hembury Woods	28.45	12.54	0.00	-	-	25.11	4.52	1.50
RIVER ASHBURN	Rew	-	-	-	-	0.00	-	-	-
	Pridhamsleigh	4.04	0.00	0.00	8.78	5.00	0.00	0.00	2.36
RIVER MARDLE	Brook Mill Bridge/Brook Farm	-	0.00	0.00	0.00	-	-	0.00	3.82
	Bilberry Hill	-	-	-	-	0.00	-	-	-
	Merryfield	0.00	0.00	0.00	-	-	0.43	0.00	0.00

WATERCOURSE	SITE NAME	SALMON FRY(0+)			SALMON PARR AND OLDER(1+)				
		1987	1993	1996	1965	1969	1987	1993	1996
DEAN BURN	Lower Dean Bridge	6.37	0.00	0.00	-	-	1.46	0.00	0.00
WOOLSTON STREAM	D/s Lower Coombe	-	0.00	0.00	-	-	-	0.00	0.00
	Abham	0.00	0.00	0.00	-	-	0.00	0.00	0.00
BIDWELL BROOK	Dartington STW	0.00	0.00	0.63	-	-	4.11	1.88	2.67
RIVER HEMS	Blackler	-	-	-	-	-	-	-	-
	Gullford Bridge	-	0.00	0.00	-	-	-	0.00	0.00
	Porridge Bridge	0.00	0.00	0.00	-	-	0.00	0.00	0.00
	Bow Bridge	-	0.00	0.00	-	0.00	-	0.00	0.00
	Tally-ho	0.84	1.27	0.00	-	-	7.30	2.80	1.40
	Littlehempston	-	0.60	0.00	-	9.00	-	0.75	0.00
GATCOMBE BROOK	Afton Cross	-	0.00	0.00	-	-	-	0.00	0.00
	Pig and Whistle	0.00	0.00	0.00	-	-	19.16	3.94	1.98
STOKE GABRIEL ST.	D/s Churchwards Br.	-	0.00	0.00	-	-	-	0.00	0.00
	U/s Port Bridge	-	0.00	0.00	-	-	-	0.00	0.00
HARBOURNE RIVER	Harbourneford	0.00	0.00	0.00	-	-	0.00	0.00	0.00
	D/s Hatchlands	-	1.60	0.00	-	-	-	0.00	2.29
	Yeo Bridge	10.15	0.00	1.25	-	2.90	6.54	0.26	1.91
	Leigh Bridge	-	0.00	2.01	-	-	-	0.30	2.29
	Rolster	6.54	0.00	0.67	-	1.70	3.73	0.00	1.09
	Crowdy Mill	-	-	-	4.20	2.20	-	-	-
	Beenleigh	0.00	0.00	0.41	-	-	0.42	0.00	0.00
RIVER WASH	Washbourne	-	0.00	0.00	-	-	-	0.00	0.00
	Tuckenhay	0.00	0.00	0.00	-	-	0.00	0.00	0.00
DITTISHAM MILL STR.	Longacre Bridge	-	0.00	0.00	-	-	-	0.00	0.00
	East Comworthy	0.00	0.00	0.00	-	-	0.00	0.00	0.00
OLD MILL STREAM	D/s Reservoir Dam	-	0.00	0.00	-	-	-	0.00	0.00
DEVONPORT LEAT	Older Bridge	0.00	0.00	0.00	-	-	0.00	0.00	0.00
	Tor Royal	0.00	0.00	0.00	-	-	0.00	0.65	0.00
	Beardown Farm	0.00	0.00	0.00	-	-	0.00	0.00	0.00
	Holming Beam	-	0.00	0.00	-	-	-	0.71	0.00

TABLE 6 : RIVER DART - SALMON JUVENILE SURVEY- BALANCED DATA SET

SITE	FRY SALMON			PARR SALMON		
	1987	1993	1996	1987	1993	1996
1	28.92	1.02	2.64	29.02	12.29	15.17
2	204.35	76.50	85.46	37.61	8.39	32.56
3	67.80	21.29	14.54	5.29	1.28	12.18
4	220.35	145.13	183.16	13.61	10.83	34.66
5	12.01	3.85	1.25	17.83	5.23	4.37
6	6.54	2.94	3.52	1.60	2.94	2.69
7	0.00	0.00	0.00	1.48	0.00	0.52
8	77.49	11.54	21.76	23.11	35.58	15.06
9	0.00	67.99	15.66	7.18	22.62	13.50
10	114.61	35.92	182.00	19.88	17.47	15.87
11	39.50	5.71	2.36	22.60	9.34	9.01
12	49.60	1.66	1.64	19.75	8.91	8.15
13	12.49	8.48	0.00	14.32	4.43	14.81
14	0.00	0.00	0.00	0.00	0.00	0.00
15	319.63	150.00	10.37	42.79	16.67	14.24
16	41.01	39.77	21.89	48.72	27.49	11.14
17	4.79	1.51	3.20	20.76	10.83	12.10
18	41.60	88.69	41.42	8.88	12.93	10.80
19	8.20	3.15	2.17	24.39	9.17	9.14
20	0.00	0.00	0.00	10.07	4.25	0.77
21	26.45	12.54	0.00	25.11	4.52	1.50
22	4.04	0.00	0.00	0.00	0.00	2.38
23	0.00	0.00	0.00	0.43	0.00	0.00
24	6.37	0.00	0.00	1.46	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.63	0.00	0.00	0.00
27	0.00	0.00	0.00	4.11	1.88	2.67
28	0.84	1.27	0.00	7.30	2.80	1.40
29	0.00	0.00	0.00	19.16	3.94	1.98
30	0.00	0.00	0.00	0.00	0.00	0.00
31	10.15	0.00	1.25	6.54	0.26	1.91
32	6.54	0.00	0.67	3.73	0.00	1.09
33	0.00	0.00	0.41	0.42	0.00	0.00
34	0.00	0.00	0.00	0.00	0.00	0.00
35	0.00	0.00	0.00	0.00	0.00	0.00
36	0.00	0.00	0.00	0.00	0.00	0.00
37	0.00	0.00	0.00	0.00	0.65	0.00
38	0.00	0.00	0.00	0.00	0.00	0.00
average	34.30	17.87	15.68	11.50	6.18	6.57
standard deviation	69.97	38.04	42.84	13.14	8.49	8.63
confidence at 5 %	22.25	12.09	13.62	4.12	2.66	2.71