



FISH KILLS IN IRELAND
AN ANALYSIS OF INCIDENTS
IN 1983 AND 1984

by

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1983 and 1984

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Summary

An analysis is presented of 200 fish kills recorded in 1983 and 1984. The reports which originated from various sources were corroborated by the water pollution officers of the Regional Fishery Boards. The incidents are evaluated by reference to similar information gathered by the Environmental Protection Agency of the United States of America.

Shortcomings in the reporting of incidents include the lapse of time between the onset of a kill and its appraisal and the difficulties of establishing the facts retrospectively. The preponderance of trout among the mortalities might indicate a bias towards reporting incidents which involved this game species.

The vast majority of kills occurred in rivers and about 65% took place in June and July, a pattern resembling that in the United States. Where the size of kill was recorded it averaged 269 fish, very small by U.S. standards. The average channel length affected by a fish kill was approximately 2.8 km (1.7 miles) (ranging between 0.01 and 25 km; 0.006 and 16 miles) and there was no relationship between the channel lengths and the numbers of mortalities.

The incidence of fish kills correlates more strongly with the length of channel slightly or moderately polluted rather than with the unpolluted or seriously polluted channel length in a fishery district. A scenario for a fish kill is a moderately enriched stream whose circumstances temporarily deteriorate as a result of environmental stress brought about by high temperatures or low water. The suspected causes of mortality were mainly agricultural wastes and the

agency or mechanism in the majority of cases was oxygen depletion.

Introduction

Surveys of water quality in Ireland have been carried out by various individuals and institutions but the vast bulk of information has been assembled by An Foras Forbartha since 1971. The data collected by An Foras Forbartha reflect pollution of a chronic nature (Water Pollution Advisory Council, 1983). Fish kills are the extreme manifestation of stressful conditions in water but their relevance to chronic sub-lethal pollution is not known. That question is addressed in the following pages.

This analysis of fish kills in two recent years, 1983 and 1984, is based on a similar digest prepared by the Environmental Protection Agency (1975) and, as far as possible, the terms of reference of the EPA will be used.

Origin of Reports

Fish kills attract much public attention and they are often reported in the press and on television. The evaluation of their extent, cause and other characteristics requires skills and training and, as in the case of information gathered and collated by the EPA, it is considered important that trained personnel should have evaluated or vetted the reports which are considered for inclusion here. The agencies which are most immediately concerned with fish kills are the fishery boards (central and regional) and the local authorities but the officers of all of these institutions are frequently the last to be informed of an incident. The alarm is often raised by an angler or a farmer and the water pollution officer often comes on the scene some days after an incident has taken place. Reconstructing what happened at that stage is difficult. The fish have been dispersed downstream or eaten by birds. The pollutant is likely to have been diluted beyond detection. The account within these pages is therefore, more accurately, a review of reports of fish kills rather than an appraisal of the incidents themselves.

In all 200 reports (89 in 1983 and 111 in 1984) are considered in this account. They are presented strictly in the terms expressed by the officers who submitted the reports. The majority of the kills have been described by officers of the Regional Fisheries Boards; some twenty case histories have been submitted by the Central Fisheries Board. Additional reports from the regions have been submitted by the local authorities but in the majority of cases these duplicated or were duplicated by information submitted by the Regional Fisheries Boards.

Fish Kills: An Analysis

Where kills occurred:

The water bodies in which incidents were recorded were : canals (8); lakes or ponds (12); rivers and lakes (2); the balance in flowing waters. The actual water-bodies concerned are listed under Fishery District in Appendix A.

When

The distribution of kills in each of the two years is shown in Fig. 1. There is a unimodal distribution of incidents throughout the year, peaking in June and July. In 1983 61 (68.5%) and in 1984 67 (60.4%) occurred in these months. Between May and August inclusive 81 (91.0%) kills took place in 1983, 89 (80.2%) in this period of the following year.

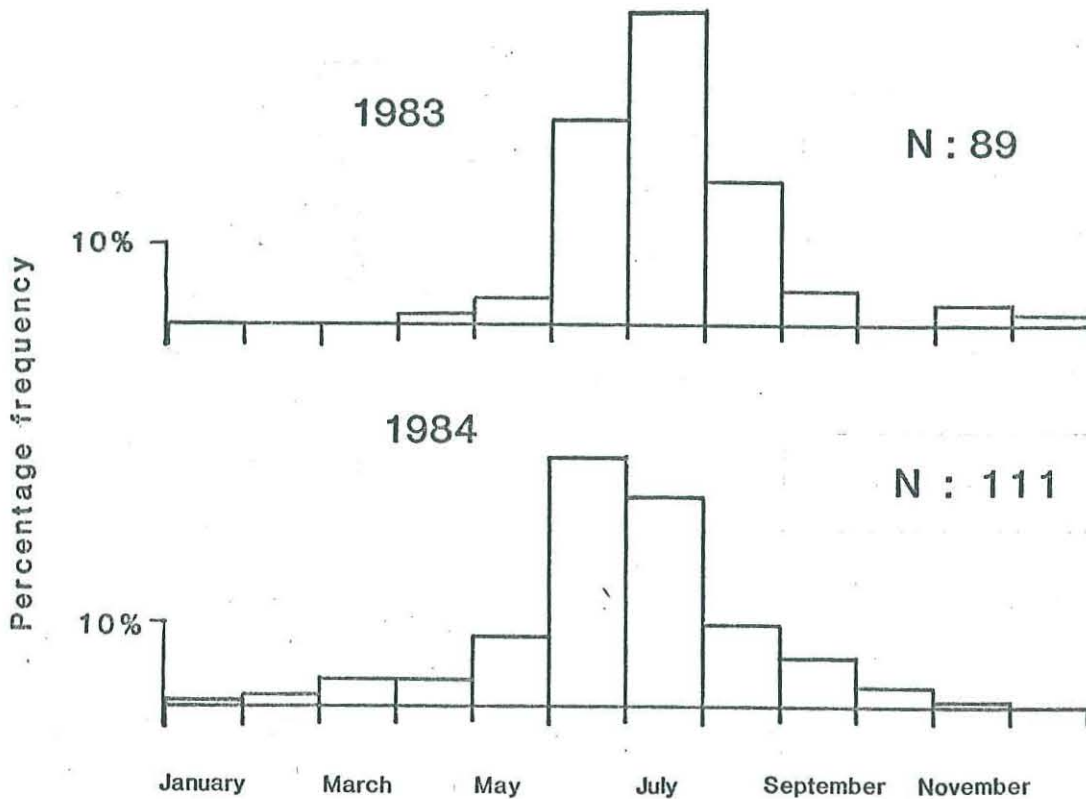


Fig. 1. Monthly percentage frequency distribution of fish kills in 1983 and 1984.

Numbers killed

Because of the inconsistent way in which fish kills are recorded the numbers affected (and other characteristics) were not always given. In some few cases the water pollution officer who filed the report did not see any dead fish; an earlier observer had raised the alarm and the mortalities had since dispersed.

It is appropriate to regard the majority, if not all, of the counts of fish killed as an underestimate of the true position. Observers contributing to the EPA accounts calculated that as many as 80% of mortalities may be concealed by turbid conditions.

The size of kill in the Irish circumstances is estimated from data submitted in the two years (combined) for which a total of 138 incidents included figures for the numbers of fish destroyed. The largest involved 10,000 fish; there were ten kills destroying more than 999 fish. In the smallest incident a single mortality was observed and the average kill in the two years was 269 fish.

The frequency distribution of kill size was as follows:

Numbers in kill	Percentage frequency
1 - 9	13.8
10 - 99	46.4
100 - 999	33.3
> 1000	6.5

Channel length affected

The length of channel marked by dead fish was reported in 126 cases and a breakdown of the figures is given hereunder. The monthly average is in km, the numbers of incidents in parentheses:

	1983	1984
June	4.5 (10)	2.0 (24)
July	2.3 (28)	2.9 (20)
August	1.5 (11)	2.2 (6)
Overall for year	2.9 (55)	2.7 (71)

There was no correlation between the length of channel affected by a fish kill and the number of mortalities observed.

Losses among species:

Reports of 72 kills identified species in which mortalities occurred. Most widely affected were salmonids, particularly "trout". The following were the records of dead salmonids in the 72 reports: "trout" in 36, "brown trout" in 18 and "sea trout" in 11. These references to trout were not necessarily distributed one per fish kill report. Some reports contained a reference to "brown" and "sea trout" having been destroyed in the same incident. The list of remaining species identified is given in Table 1.

Table 1 Species reported as mortalities in fish kills

SPECIES	NUMBER OF INCIDENTS
Salmon	20
Trout	48
Pike	14
Minnow	9
Roach	8
Bream	6
Stone loach	5
Gudgeon	2
Rudd	1
Eel	11
Three spined stickleback	6
Perch	8
Lamprey	1
Flounder	4
Bass	1
Grey mullet	1

Causes of mortality

Fish kills are usually associated with pollution but that is not invariably so. One report concerned cyprinids which were thought to have perished in an angler's keep net and were subsequently discarded.

In almost every case reported the precise cause of mortality was not established and it must always be a professional judgement by the water pollution officer. A court conviction would not necessarily establish a cause beyond doubt because various factors can combine to produce the final effect. Significant contributors to mortality are given in the following cases.

<u>Poaching by nets, poisons, etc.</u>	10 cases
<u>Agriculture by slurries, sheep dips, silage effluent and crop spraying</u>	69 cases
<u>Agricultural/Industrial includes poultry/ fish processing, meat factories, factory farming, creamery effluents and abbatoirs</u>	14 cases
<u>Local authority through tip leachate and sewage</u>	14 cases
<u>Industry</u>	9 cases
<u>Natural conditions, typical examples being high temperatures and low oxygen</u>	28 cases

A large further proportion of incidents was precipitated by a combination of causes (indeed the majority of those listed above involved more than one). In the remaining incidents the cause was unknown.

Some of the causes of mortality operated by a toxic mechanism; this would be true of "crop spraying" for example. But in the majority of cases the mechanism is likely to have been oxygen depletion which happened during the bio-degradation of organic wastes.

Discussion

Many aspects of the reports examined here are vague but such data as are available enable a characterisation of fish kills in Ireland and a comparison with the phenomenon in the United States. In 1975 the EPA reported that 75% of fish kills reported occurred within the period May to September inclusive, a pattern described as "usual". A concentration of 95.5% of incidents in Ireland in 1983 and 83.8% of the following year's kills into this period suggests that in Ireland the phenomenon is more related to summer conditions.

In the United States in 1975 84% of incidents recorded the size of kill at fewer than 10 000 fish and the total number of mortalities in kills of this size range amounted to less than four per cent of the 16.1m fish conservatively reported dead that year. In Ireland all fish kills in 1983 and 1984 belonged to this size range. In the EPA classification kills involving fewer than 10 000 fish are "small", greater than 100 000 are "large" and more than 1m, "massive".

The widespread implication of salmonids and especially trout is credible. Trout are widely distributed and they are more sensitive to oxygen depletion than cyprinids so they are more susceptible to pollution. However trout is also a species of greater interest to the angler and it is probable that a kill involving this species would stand a greater chance of being officially recorded. It is recognised here that fish kills are under-recorded anyway.

Concerning the surveys of An Foras Forbartha on water quality, the Water Pollution Advisory Council's 1983 publication describes their work as reflecting pollution of a chronic nature:

"Short term incidents though resulting in serious damage to fisheries or to other users of water, may not be detected in routine surveys. Thus "fish kills" which have occurred with increasing frequency in recent summers represent a form of pollution which cannot be detected, normally, in routine surveys.....However the serious consequences of such incidents for fisheries management are clear".

Various surveys of water quality by An Foras Forbartha investigated 6928.1km of channel length between 1979 and 1981. They distributed the channel lengths among three categories of water quality: unpolluted, slightly to moderately polluted and seriously polluted. The distribution of channel lengths among these three categories of water quality is shown alongside the number of fish kills recorded in 1983 and 1984 in sixteen Fishery Districts in

Table 2. (There are seventeen districts in all (Fig. 2) but Connemara is not included here, no water quality work or fish kills having been reported there). The quality of information presented does not permit a close comparison between fish kills and reported water quality. However the majority of kills came from waters already monitored by An Foras Forbartha who acknowledge that their surveys are initiated by concern over water pollution rather than being spontaneous checks on water quality.

A concern for endangered waters is reflected in the statistics in Table 2. Total channel lengths surveyed in each fishery district correlated highly significantly with the number of incidents reported there ($r = 0.8386$ $p < 0.001$). A lower level of significance between number of incidents and channel lengths of poor quality ($r = 0.6724$ $p < 0.01$) might have resulted from some of these waters being devoid of fish life. Channel lengths of good water quality correlated highly significantly with numbers of fish kills ($r = 0.8087$ $p < 0.001$) but the strongest correlation existed between the number of kills and the moderately polluted channel length ($r = 0.9010$ $p < 0.001$). Such waters are likely to be both fish bearing and stressed, a deterioration in water quality, typically in summer, precipitating a crisis.

REFERENCES

- Environmental Protection Agency (1976) Fish Kills caused by pollution in 1975 Report No. 16. Washington DC.
- Water Pollution Advisory Council (1983). A Review of water Pollution in Ireland Dublin; An Foras Forbartha.

Table 2 Fish kills and water quality Fishery Districts. (Water quality data from An Foras Forbartha)

Fishery District	Number of fish kills	Length of river channel surveyed	Water quality in channel lengths *		
			A	B	C
Dundalk	18	181.4	146.0	30.3	5.1
Drogheda	20	347.8	226.4	118.8	2.6
Dublin	11	260.8	155.3	89.5	16.0
Wexford	8	357.1	280.7	60.4	16.0
Waterford	34	1362.4	1166.1	173.6	22.7
Lismore	8	392.1	325.1	65.0	2.0
Cork	16	232.8	221.8	11.0	-
Kerry	2	84.0	84.0	-	-
Limerick	38	1703.5	1458.9	215.9	28.7
Galway	10	364.9	310.7	45.0	9.2
Ballinakill	0	59.4	58.9	0.5	-
Bangor	2	107.1	107.0	0.1	-
Ballina	6	459.7	420.2	25.1	12.6
Sligo	0	171.7	166.6	2.0	3.1
Ballyshannon	22	375.6	269.2	97.4	9.0
Letterkenny	6	391.3	366.1	18.4	6.8

* Water quality ratings: A, good; B, moderately polluted; C, seriously polluted



Fig. 2 Fishery Districts (thin lines; labelled) and Regions (heavy lines).

Details of fish kills reported in 1983 and 1984, grouped according to Fishery District

DUBLIN

Catchment	Name of River/Trib	Date	Notes on location
Dodder Liffey	Owendoher	7- 5-83	
	Brittas	8- 6-84	Manorkilbride, Co. Dublin
	Brittas Lake	15- 7-83	Lake margins
	Liffey	3- 6-83 7- 4-84	Tankardsgarden, Newbridge, Co. Kildare
Royal Canal	Royal Canal	13- 7-83	Leixlip to Blanchardstown
		6- 7-83	Ratoath Bridge, Cabra, Co. Dublin
		10-11-84	
Tolka	Tolka	26- 8-83	U/s of Blanchardstown Bridge, Co. Dublin

WEXFORD

Avonmore	Avonmore	20- 8-83	U/s Rathdrum, Co. Wicklow
Duncormick	Duncormick	12- 6-84	Ambrosetown, Co. Wexford
Killinick(Nr Rosslare)	Killinick	24- 7-84	
Owenavorrhagh	Owenavorrhagh	17- 8-83	Courtown, Co. Wexford
Slaney	Bann	21- 6-83	Monalee, Co. Wexford
		15- 6-84	Ballyandrew, Camolin, Co. Wexford
	Slaney	18- 5-84 6- 7-84	Tinakilla area, Co. Wexford

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WATERFORD

Catchment	Name of River/Trib	Date	Notes on location
Aherlow	Muskerry	14- 8-83	Rossadrehid, Bansha, Co. Tipperary
Barrow	Barrow	14-10-84	D/s of Carlow town
		23- 7-83	Mountmellick, Co. Laois
	Duiske	26- 6-84	
		21- 6-84	Graiguenamanagh, Co. Kilkenny
		17- 4-84	" "
	Owenass Triogue	8- 6-84	Clonboyne, Portlaoise, Co. Laois
8-6-84		" " "	
Mahon	Mahon	11- 2-84	Kilmacthomas to Bunmahon, Co. Waterford
Nore	Arigna	19- 6-83	
	Goul	19- 6-83	
	Gully	12- 6-84	
	Kings	21- 7-83	Lady's Well, Cotterellsrath, Co. Kilkenny
	Mountrath	5- 7-84	Rushin House, Mountrath
	Munster	18- 7-83	Ballyline, Callan, Co. Kilkenny
Suir	Black	4- 7-84	Two-Mile-Borris, Thurles, Co. Tipperary
	Blackwater	26- 7-83	Dunkitt, Co. Kilkenny
		24- 3-84	U/s Kilmacow, Co. Kilkenny
	Clashawley	2- 8-84	Coolmore, Fethard, Co. Tipperary
	Clonmore	16- 7-83	Templemore, Co. Tipperary
	Glenbrook	5- 9-83	Carrick-on-Suir, Co. Tipperary
	Killough	13- 7-83	Near Templemore, Co. Tipperary
	Lingaun	12- 7-84	Garrymorris townland, Co. Tipperary
	Suir	26- 8-83	Town Bridge, Thurles, Co. Tipperary
		24- 8-84	D/s Tipperary Town
		5-10-84	D/s Old Bridge, Clonmel Co. Tipperary
		8- 6-84	From Lenane Bridge to Loughmore Bridge, Co. Tipperary
		9- 6-84	Clonmore, Co. Tipperary
		7- 6-84	
		13- 7-83	Loughmore, near Templemore, Co. Tipperary
Till	19- 7-84		
Tributary	24- 8-84	D/s Cahir, Co. Tipperary	
Unnamed	31- 5-83		
Tintern Abbey	Tintern Abbey	17- 7-84	

Catchment	Name of River/Trib	Date	Notes on location
Blackwater	Allow	11- 6-84	Near Freemount, Co. Cork
	Blackwater	11- 6-84	
	Bride	27- 4-84	U/s Kean Bridge, Glanville, Co. Cork
	Dalua	8- 6-84	Near Meens, Newmarket, Co. Cork
	Glenaboy	28- 8-84	Tallow, Co. Waterford
Womanagh	Kiltha	17- 5-84	Mogeely, Castlemartyn, Co. Cork
		27- 5-84	" " "
		10- 5-84	" " "
CORK			
Bandon	Bandon	15- 7-83	Ballineen, Co. Cork
		23- 7-84	Phale Court, Dunmanway, Co. Cork
	Brinny	6-11-83	Rathcullen House, Co. Cork
Coomhola	Coomhola	21- 7-83	Coomhola Bridge, Co. Cork
Feagle	Feagle	8- 7-84	Clonakilty, Co. Cork
Lee		10- 9-83	
	Curraheen	27- 9-84	Clogheen, Cork,
		27- 7-84	Carrickgrohane, Co. Cork
	Glenanought	21- 7-83	Millfield, Cork
	Inniscarra	20-10-84	
	Lee	17- 5-84	South Channel, Cork City
Owenagearagh		6-12-83	
Owenaboy	Owenaboy	11- 6-84	Ballinhassig, Co. Cork
Owenacurra	Owenacurra	15- 7-83	D/s Midleton, Co. Cork
		27- 7-84	Avoncore, Co. Cork
		20- 7-84	Midleton, Co. Cork

KERRY

Catchment	Name of River/Trib	Date	Notes on location
Finnihy	Finnihy	19- 6-84	Kenmare, Co. Kerry
Lough Gill	Lough Gill	3- 7-84	Castlegregory, Co. Kerry
LIMERICK			
Camoge-Maigue	Ballinamona	16- 5-84	New Bridge, Co. Limerick
Deel	Bunoke Deel	7- 7-83	Ahawilk Bridge, Co. Limerick
		27- 9-84	Raheenagh to Newcastlewest, Co. Limerick
		17- 6-84	Mahoonagh, Newcastlewest, Co. Limerick
		14- 6-84	Fekins Bridge, Dromcolliher, Co. Limerick
		7- 6-84	Rathkeale, Newcastlewest, Co. Limerick
		30- 5-84	Deel Bridge to Grange Bridge, Newcastlewest, Co. Limerick
		5- 6-84	
		8- 9-84	Castlemahon, Co Limerick
		27- 6-83	Castlemahon Bridge, Co. Limerick
		25- 6-83	Milford, Co. Cork
Deel-Arra	Marsh	18- 6-83	Newcastlewest, Co. Limerick
Doonbeg	Doonbeg	9- 7-84	Doonbeg, Co. Clare
Feale	Feale	19- 6-84	Finuge Bridge, Co. Kerry
Grand Canal	Grand Canal	5- 9-84	Ballycumber to Rahan, Co. Offaly
Groody	Groody	26- 9-84	Killonan Bridge
Maigue		5- 7-83	Adare Manor, Co. Limerick
		24- 7-84	Rostemple Bridge, Bruree, Co. Limerick
		23- 7-84	Rostemple Bridge to Cherrygrove Bridge, Bruree-Croom, Co. Limerick
		22- 7-84	
		20- 7-84	
Morning Star	Morning Star	19- 6-83	Ballinvreena Cross Roads, Co. Limerick

Catchment	Name of River/Trib	Date	Notes on location	
Robertstown(Nr Aughinish)	Robertstown	11- 6-84	Bartholamews Bridge, Co. Limerick	
Shannon (Suck)	L Callow	27- 8-84	Whole lake, Kilconnell, Co. Galway	
Shannon	Ballyheelan	22- 7-84	Ballyhellan, Co. Longford	
	L Allen	25- 7-84	Drumshambo, Co. Leitrim	
	L Callow	29- 3-84		
	Nenagh	24- 8-84	Bennetts Bridge, Nenagh, Co. Tipperary	
	Shannon	25- 7-84	U/s of Corbally Bridge, Co. Clare	
Shannon-Lough Key	Lough Gara	29- 4-84	Tom Dohan's shore, Co. Sligo	
Shannon-Blackwater	Blackwater	2- 7-84	Confluence of Shannon and Blackwater, Giloge Bridge, Co. Clare	
Shannon-Camlin	Fallan	11- 6-84	Cloonmore townland, Co. Longford	
	Royal Canal	2- 4-83	Abbeysrule, Co. Longford	
Shannon-Inny-Sheelin	Clontyduffy	1- 3-84	Ballinrink Bridge, Co. Longford	
Shannon-Little Brosna	Little Brosna	20- 7-84	Mountheaton, Co. Offaly	
Shannon-Suck	Ballinure	10- 6-84	Aughrim, Co. Galway	
	Suck	26- 8-83	Between Cappagh Bridge and Kilmalaw Bridge, Co. Galway	
Shannon - Shiven	Castlegar	25- 7-84	Mountbellew, Co. Galway	
GALWAY				
Shannon	Clare	8- 7-83	Liskeery Bridge, Co. Galway	
		11- 8-83		
		25- 7-84	U/s of Claregalway Bridge, Co. Galway	
			18-11-83	
	Clare Dalgan	9- 8-83		
	Cloneen	19- 8-83	Headford town, Co. Galway	
	Curragh-Nanny	23- 8-84	U/s of Tuam, Co. Galway	
	Loughkip	14- 7-83	Kilagoola area, Co. Galway	

Catchment	Name of River/Trib	Date	Notes on Location
Dunkellin	Dunkellin	14- 7-84	Kilcolgan Castle, Kilcolgan, Co. Galway
	Raford	17- 8-84	Below Woodlawn House, Co. Galway
BANGOR			
Ballycroy	Ballycroy	14- 7-83	Ballycroy, Co. Mayo
Owenmore	Oweniny	14- 7-83	Bellacorick, Co. Mayo
BALLINA			
Moy	Manulla River	20- 7-83	Breaffy House, Castlebar, Co. Mayo
	Moy	28- 5-84	At Cloongee, Co. Mayo
	Rooskey	13- 7-83	Tanghil (between Kiltimagh and Knock) Co. Mayo
Moy-Deel	Castlehill River	26- 7-83	Ballymacredmond, Laherdan, Co. Mayo
Moy-Manulla	Rodney	22- 7-83	Brown Hall, Balla, Co. Mayo
Palmerstown	Cloonaghmore	22- 8-84	Rathowen, Killala, Co. Mayo

BALLYSHANNON

Catchment	Name of River/Trib	Date	Notes on Location
Abbey	Abbey	29- 1-84	Ardpatton Lake to the sea, Co. Donegal
Ballinamore Canal	Ballinamore Canal	8- 8-83	Ballinamore, Co. Leitrim
Bunduff	Ballintrillick	15- 7-84	Ballintrillick, Co. Sligo
	Bunduff	23- 8-83	Bunduff Bridge, Cliffony, Co. Sligo
Erne	Brosky	19- 6-83	Corrigan, Co. Cavan
	Cavan Town	7- 7-83	D/s of Green Lake
	Cavan Town	12- 6-83	D/s of Cavan town
		13- 6-83	D/s of Cavan town
		17- 5-84	D/s of Cavan town
	Dromore	2- 7-83	Ballybay area, Co. Monaghan
	Erne	6- 6-84	Belahallan Bridge, Co. Cavan
	Finn	1- 9-84	Annies Bridge, Co. Monaghan
		8- 6-84	Near Clones town, Co. Monaghan
		16- 7-84	Scotstown area, Co. Monaghan
	Finn/Magherarney	26- 7-83	Between Selco (Co.Monaghan) and Scorey Bridge (Clones)
Erne-Annalee	Bunoe	27- 6-83	
	Laragh	23- 8-83	Tullycoe, Laragh, Co. Cavan
		21- 8-83	Tullyvin area, Co. Cavan
		19- 6-83	Tullycoe
		20- 6-83	Laragh Village, Co. Cavan
Erne - Bards S.	Dromore R	23- 7-83	Ballybay, Co. Monaghan
Erne - Gowna	Carnagh L & R	1- 9-84	Carnagh Lake and inflowing river; Kilsaran Bridge, Co.Cavan
LETTERKENNY			
Inch Level	Inch Lough	1- 6-84	
	Inch Tributary	14- 6-84	Bent area, Co. Donegal
	Skeoge	3- 7-84	Burnfort, Co. Donegal
Lennon	Glashagh	2- 7-84	Kilmacrenan, Letterkenny, Co. Donegal
Mill (Buncrana)	Mill	28- 6-83	Buncrana, Co. Donegal
Unnamed (Cranford)	Unnamed	23- 3-84	Cranford, Co. Donegal

DUNDALK

Catchment	Name of River/Trib	Date	Notes on location
Blackwater	Blackwater	10- 8-83	U/s of Scotstown, Co. Monaghan
	Glenannon	17- 6-83	Between Emyvale and Glaslough, Co. Monaghan
	Lappan	9- 6-84	Castleshane, Co. Monaghan
		7- 7-83	Kingorry, Castleshane, Co. Monaghan
	Mountain Water	4- 7-83	Between Cornanure Bridge and Edenmore Bridge, Co. Monaghan
Castletown	Castletown	30- 7-83	Jeninstown, Dundalk, Co. Louth
Dee & Glyde	Dee	26- 6-84	Collon, Co. Louth
		19- 6-84	Drumconrath, Co. Louth
	Drumcar (Dee)	10- 9-84	Drumcar, Co. Louth
	Proules	19- 6-84	U/s Carrickmacross, Co. Monaghan
	Proules	16- 7-83	Killaney Bridge, d/s Carrickmacross, Co. Monaghan
	Proules (Lake Fed)	19- 7-83	Carrickmacross, Co. Monaghan
	White	25- 7-83	Dunleer, Co. Louth
Fane	Fane	12- 8-83	U/s of Iniskeen, Co. Monaghan
	Mulladuff	17- 6-83	North of Castleblaney, Co. Monaghan
Gallinagh		16- 6-84	On Border, Co. Monaghan
		7- 7-83	U/s Milltown Bridge, Monaghan town
Glyde	Glyde	5- 9-83	Between Kilsarn and Annaghassan, Co. Louth

DROGHEDA

Catchment	Name of River/Trib	Date	Notes on Location
Beaulieu	Beaulieu Pond	12- 6-83	Ballymakenny, Drogheda, Co. Louth
Blackwater	Blackwater	13- 7-83	Marry Mill, Kells, Co. Meath
Boyne	Athboy	5- 8-84	Mitchelstown House, Co. Meath
	Boyne	29- 2-84	Water Under, Drogheda, Co. Louth
	Breffney Stream	22- 6-83	Ballinamoney, Bailieborough, Co. Cavan
	Cruicetown Lake	22- 6-83	D/s of Ardlonan Bridge, Co. Louth
	Knightsbrook	9- 8-84	Between Daingean and Summerstown Bridge, Co. Offaly
			23- 7-84
	Riverstown	11- 7-83	D/s of Rathwire, Killucan, Co. Westmeath
Boyne-Blackwater	Causey	22- 6-83	Ardlonan Bridge, Co. Louth
Boyne-Blackwater- Nardreegeel	Billis	22- 6-84	D/s of Assan Bridge, Co. Meath
Boyne-Castle Lake System	Lear	10- 5-84	D/s of Lear Bridge, Co. Meath
Boyne-Moynalty	Annesbrook	24- 6-83	Kells, Co. Meath
	Corboggy	22- 6-83	Relaghbeg, Bailieborough, Co. Cavan
	Kilbeg	2- 7-83	Waterstown, near Moynalty, Co. Meath
Mosney Stream	Mosney Stream	18- 6-83	Mosney Holiday Centre, Co. Meath
Nanny	Hurley	26- 6-84	Rathfeigh, Navan, Co. Meath
	Nanny	28- 6-84	Big Bridge, Duleek, Co. Meath
		13- 3-84	Duleek, Co. Meath