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Angling Effort and the Rod Catches of Salmon (*Salmo salar* L.) and Sea Trout (*Salmo trutta* L.) on Seven Estates on the River Spey in 1992

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In Confidence

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INTRODUCTION

At its simplest, successful management of a rod fishery requires a reliable estimate of the catch over a numbers of years from which an indication of trends in the fishery may be derived.

Interpretation of rod catch statistics is complex, however. Analysis of annual catch statistics, for example, may conceal considerably more than it reveals. Shearer (1990) demonstrated that the timing of the return migration, and thus the availability of salmon to the fishery was highly structured, depending upon both sea and river age. In turn, the riverine migration pattern and eventual spawning position of the salmon are affected by return time together with sea age (Laughton, 1992; Laughton and Smith, 1991; Smith and Laughton, *in press*). Different components of the returning salmon stock may therefore be available to the rod fishery at different times of the angling season and may well exhibit different trends over time (Laughton and Smith, *in press*). Detailed catch records which allow analysis to be stratified according to time of year are thus required if an accurate indication of developments in each stock component is to be derived.

Identifying changes in salmon stocks from catch statistics is also fraught with difficulty. In particular, the degree of angling effort employed may greatly affect rod catch and some measure of effort is required if underlying trends in the stock are to be assessed with any degree of confidence. Both Shearer (1988) and Laughton and Smith (*in press*) for example identified a decrease in catches of Spring MSW salmon (multi sea-winter salmon caught before 1st May) and an increase in the catches of grilse (salmon returning after one winter at sea) in the Spey from the 1950s to the present day. In the absence of data on patterns of fishing effort, however, it is not clear how closely such trends in catch reflected changes in the salmon stocks over the same period.

In 1991 the Spey District Fishery Board (SDFB) together with the Scottish Office Agriculture and Fisheries Department (SOAFD) embarked upon a project with the aim of standardising the collection of both catch and effort data over a wide area of the River Spey. Catch return forms were devised in consultation with a number of estates on the river and distributed to 7 estates in time for the beginning of the 1992 angling season. This report provides a brief summary of the analysis of this first years returns.

MATERIALS AND METHODS

Table I indicates the distances upriver of the lowest and highest points of each estate whose catches formed the basis of the present study. Estates 6 and 7 were situated on a tributary of the River Spey.

The catch return forms are attached as Appendix 1. Both are designed to record the same data.

- Date
- Spot measurements of river temperature and height
- Name of each angler fishing
- Time each angler started and stopped fishing
- Number and weight of multi sea-winter salmon, grilse and sea trout taken in each pool by each angler. Classification of the fish was done by visual inspection, no scale samples were cross referenced to particular catches for subsequent confirmation of age.
- The bait/lure used.

The forms were designed to incorporate the information that had previously been collected by some estates. The information which was of particular interest for the present study were the daily records of catch and effort.

Two versions of the form were produced to suit the needs of different estates. Appendix 1a illustrates the form which was used in estates where ghillies were in day to day contact with all anglers. Appendix 1b illustrates the form which was given to individual anglers to complete, and was used on estates where the angling effort was dispersed over a wider area and where individual ghillies did not have day to day contact with individual anglers.

All estates completed forms noting catch and effort over the whole of their respective angling seasons. In addition, out of the 7 participating estates, one individually identified all anglers fishing the area, while another 5 individually identified those anglers which caught a fish on any given day.

RESULTS AND DISCUSSION

1. Annual Catch

Catches from 4 estates (1, 2, 5 and 6) over the period 1971 to 1992 were analysed previously (Laughton and Smith, in press) and demonstrated that annual catches in 1990 and 1991 had been particularly low in 3 out of the 4 estates. Figure 1 shows the annual catch in 1992 at each of the estates, together with the catches from the previous 22 years, indicating some slight improvement over recent years in the lower estates.

2. Catches of MSW Salmon and Grilse

The weight distributions of fish classified as salmon and grilse are shown in Figure 2, catches from all estates have been combined. Results are similar to an analysis of data from the years 1970 to 1991 (Laughton and Smith, in press) in that there is some indication of an increase in the weight of MSW salmon over the early months of the angling season, while grilse catches are restricted to the period between June and September.

An unexpected feature of the data is the clear reduction between June and July in the weights of fish designated as MSW salmon, a general reduction which continued until the end of the season. Whether this is evidence for misclassification of fish, "grilse error" (Shearer, 1985) or an indication of some interesting feature of the biology of the fish is not clear at present.

3. Seasonal Patterns of Fishing Effort

In order to investigate the relationship between seasonal patterns of catch and catch per unit effort (CPUE; the average numbers of fish taken for a given time spent fishing), the monthly catches of salmon and grilse averaged over all estates was calculated together with monthly averages of fishing effort and CPUE.

Figure 3 shows the monthly aggregate catch of MSW salmon plus grilse averaged over all estates. An indication of the variation between estates is given by the error bars (standard error). The data shows an initial peak in catches in the period April to June, followed by a much larger peak in August and September. Fishing effort did not closely mirror the catch. Indeed effort rose steadily through the angling season to a peak in July followed by a slight drop in August and September. The resulting seasonal pattern of CPUE appeared very similar to the simple catch data.

Figure 4 shows the seasonal patterns of fishing effort at each estate. Most variation was evident in the month when angling started and in the degree of fishing effort expended in the early months of the angling season. Apart from one or two clear exceptions, estate 2 in June and estate 4 in July for example, fishing effort was remarkably constant over much of the rest of the angling season.

This finding supports the conclusions of Wołos (1991) that much of the motivation for angling is as a recreational pursuit, and that fishing effort may not be closely tailored to optimise CPUE. A further consideration is that anglers on much of the River Spey are very likely to be constrained on where and when they can fish and thus their ability to vary fishing effort seasonally in response to catch may be severely limited.

Should we conclude, on the basis of these observations, therefore that the collection of data on angling effort, despite requiring considerable work from the ghillies and anglers who are being asked to record it, is of little value?

There are two ways in which the continued collection of angling effort can be justified. Firstly it is only by collection of such information that we can be sure that seasonal trends in catch and CPUE continue to mirror each other in the future. A much stronger justification is in relation to the management of the fishery, however. Of most interest in this regard is identification of trends in catch over a number of years, and further that such trends due to changes in angling effort can be distinguished from those which may reflect more fundamental changes in fish stocks. Collection of effort data is thus most valuable as a way of interpreting the year to year trends in catch and its true worth may only become apparent if it continues to be collected over a number of years.

4. Seasonal Patterns of MSW Salmon, Grilse and Sea Trout CPUE

Catch per unit effort of MSW salmon, grilse and sea trout, averaged over all estates studied on the river is given in Table II. The average number of fish caught per 100 hours fishing is indicated for each month of the angling season.

Table III shows the same data expressed as the expected effort required to land a fish, again averaged over all estates, for each month of the angling season.

Although it is clear that a number of factors including environmental conditions, fishing site and angler skill will play an important part in any given angler's success rate, the analysis is nevertheless of some interest. The data also compare favourably with an estimated seasonal average effort of 20.2 rod hours required to catch a salmon on the River Wye in 1977 and a range of between 18.8 and 40 rod hours from a further 6 Welsh rivers (Gee, 1980).

Figure 5 shows the monthly MSW salmon, grilse and sea trout CPUE data averaged over all estates, together with an indication of the variation between estates given by the error bars (standard error). Although data from a number of years will be required before seasonal patterns in the catch as well as effects of environmental factors may be determined with confidence, nevertheless some preliminary comments may be made at this stage.

MSW salmon catch per unit effort shows two peaks, one in May followed by a larger peak in August and September in the period leading up to spawning. The seasonal pattern in individual estates follows this same general pattern (Figure 6).

Grilse show a simpler seasonal pattern of CPUE. When the catches of all estates are combined (Figure 5), CPUE increases from June to a peak in August before experiencing a slight decline in September. Individual estates demonstrate this same single peak in CPUE (Figure 7), although the decline in September is more marked in the lower estates compared to those higher in the river system.

Sea trout catches averaged over all estates also show a single peak in CPUE, in June. Individual estates generally show a similar pattern (Fig. 8), although estates lower in the river may experience the best catches of sea trout earlier in the season than those higher in the system. Interpretation of the sea trout catch statistics may be made more complicated, however, by the fact that different estates may differ in the extent to which fishing specifically for sea trout is carried out.

CONCLUSIONS

- the exercise in 1992 has demonstrated that it is practical to collect complete statistics for catch and effort from a significant proportion of the Spey rod fishery and to process the data within a reasonable time scale.

- the data collected has provided a useful first indication of the seasonal pattern of catches on this important salmon river, although it will be necessary to collect the information for a number of years to estimate the variability of such patterns, and whether catches are undergoing significant trends with time.

- consideration should be given to extending to other fishing areas which are not covered by the present sampling regime, particularly high in the catchment. In this way we would intend to extend our understanding of the fishery while not increasing the data processing load unduly.

ACKNOWLEDGEMENTS

We are grateful to all landowners, ghillies and anglers who put in a considerable effort in helping us to both set up the study and also collect the data. The Spey District Fishery Board provided encouragement for the project and Dr Tony Hawkins provided useful comments on a draft of this report. The typists of the Marine Laboratory typed up the final manuscript.

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Table I. Distances of the estates from the mouth of the River Spey

Estate	Distance Upriver (km)	
	Lower Limit	Upper Limit
1	10.68	13.91
2	16.62	20.99
3	20.99	25.70
4	40.19	47.46
5	63.55	72.03
6	50.02	69.08
7	78.11	90.97

Table II. Catch per unit effort (catch per 100 rod hours)

	Salmon	Grilse	Salmon and Grilse	Sea Trout
February	0.44	-	0.44	-
March	0.57	-	0.57	0.03
April	1.66	-	1.66	0.47
May	3.24	-	3.24	3.11
June	2.03	1.31	3.34	6.64
July	1.53	5.01	6.54	3.88
August	5.68	7.88	13.56	1.23
September	6.49	6.19	12.68	0.45

Table III. Average effort required to catch a fish (rod hours)

	Salmon	Grilse	Salmon and Grilse	Sea Trout
February	227.3	-	227.3	-
March	175.4	-	175.4	2941.2
April	60.2	-	60.2	212.8
May	30.9	-	30.9	32.2
June	49.3	76.3	29.9	15.1
July	65.4	20.0	15.3	25.8
August	17.6	12.7	7.4	81.3
September	15.4	16.1	7.9	222.2

FIGURE LEGENDS

Figure 1. Annual aggregate catches of salmon and grilse at four sites on the River Spey between 1970 and 1992. Catches from estate 1 in 1976, 1976 and 1985 were not available.

Figure 2. Monthly frequency distributions of the weights of MSW salmon and grilse as characterised by external features. Catches from all estates have been combined.

Figure 3. Monthly mean MSW salmon and grilse catch, fishing effort and catch per unit effort averaged over all estates. Error bars indicate the standard error of each mean.

Figure 4. Monthly aggregate fishing effort for each estate.

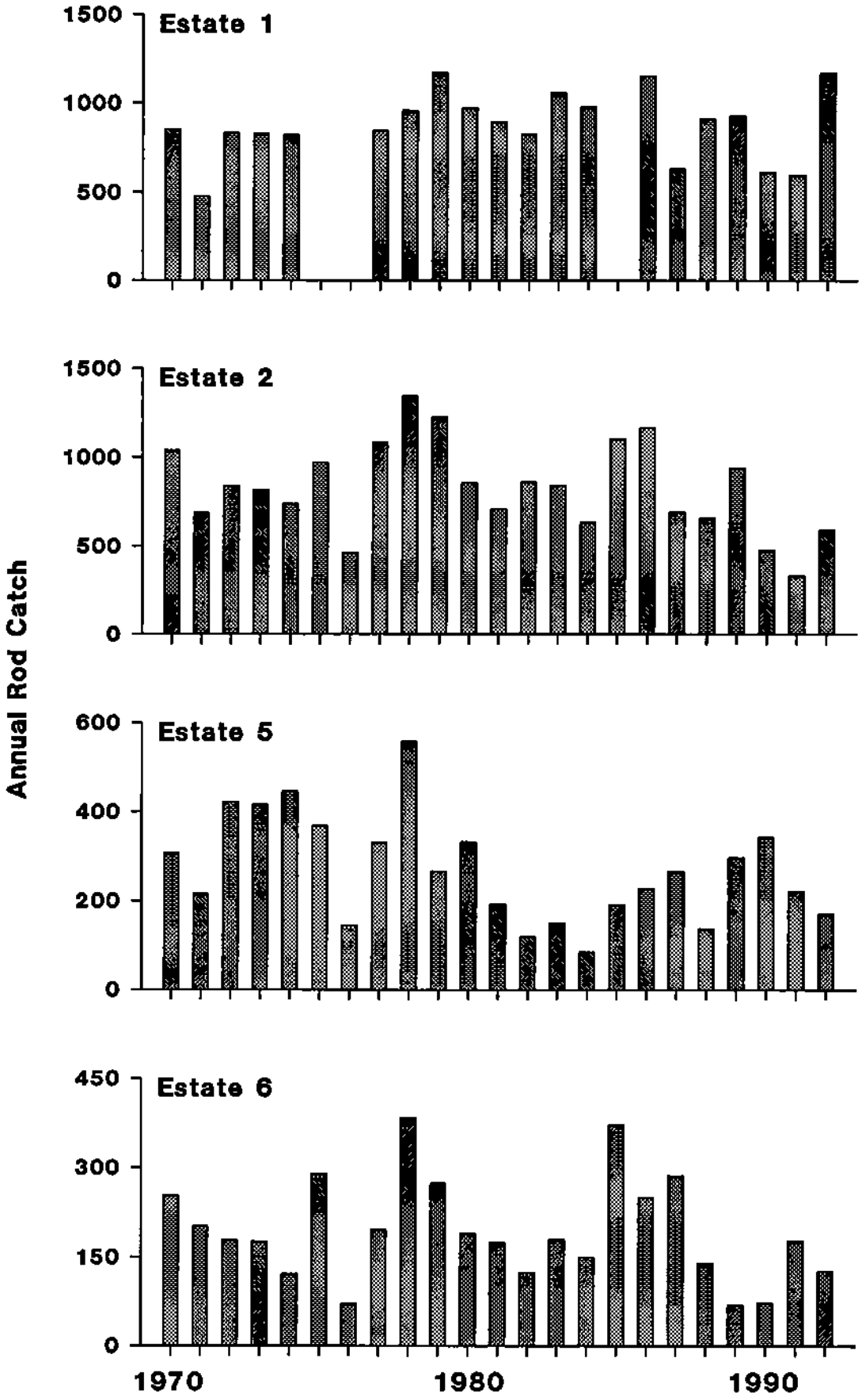
Figure 5. Monthly mean MSW salmon, grilse and sea trout catch per unit effort averaged over all estates. Error bars indicate the standard error associated with each mean.

Figure 6. Monthly mean MSW salmon catch per unit effort for each estate.

Figure 7. Monthly mean grilse catch per unit effort for each estate.

Figure 8. Monthly mean sea trout catch per unit effort for each estate.

Figure 1


Estate 1
1500
1000
500
0
Estate 2
1500
1000
500
0
Annual Rod Catch
Estate 5
600
400
200
0
Estate 6
450
300
150
0
1970
1980
1990

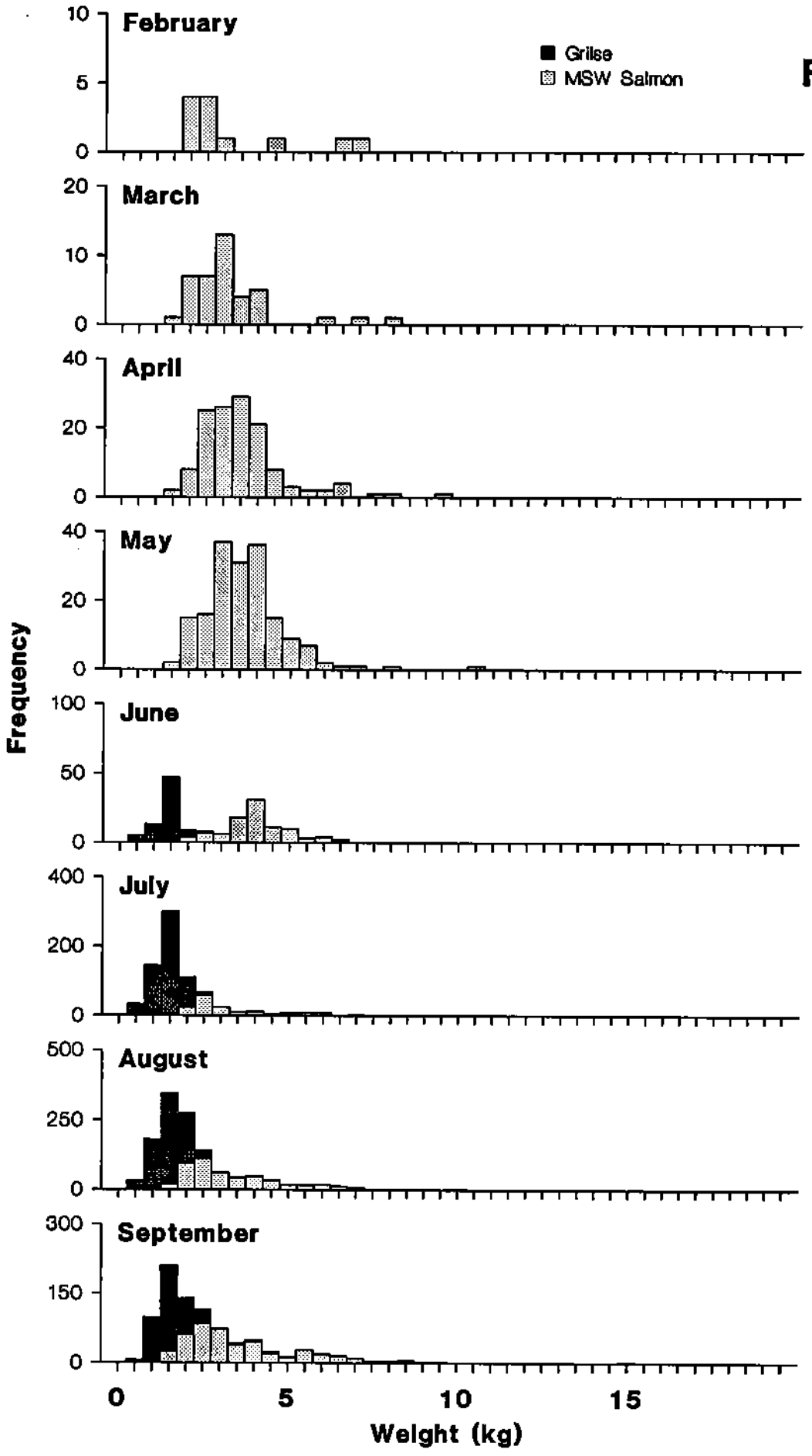

February
Grilse
MSW Salmon
March
April
May
June
July
August
September
Frequency
Weight (kg)
0
5
10
15

Figure 2

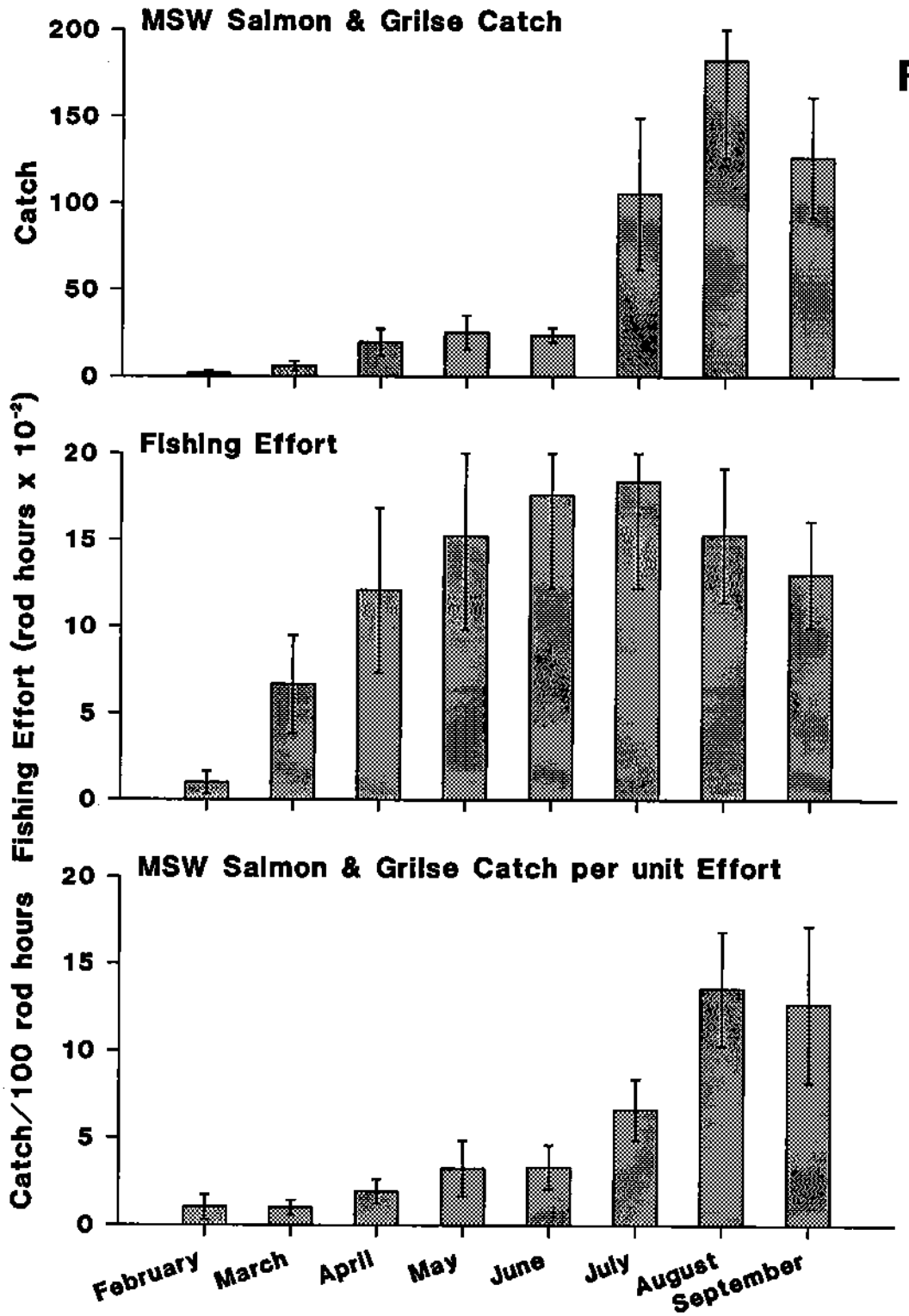

MSW Salmon & Grilse Catch
Catch
200
150
100
50
0
Fishing Effort
Fishing Effort (rod hours x 10⁻²)
20
15
10
5
0
MSW Salmon & Grilse Catch per unit Effort
Catch/100 rod hours
20
15
10
5
0
February
March
April
May
June
July
August
September

Figure 3

Figure 4

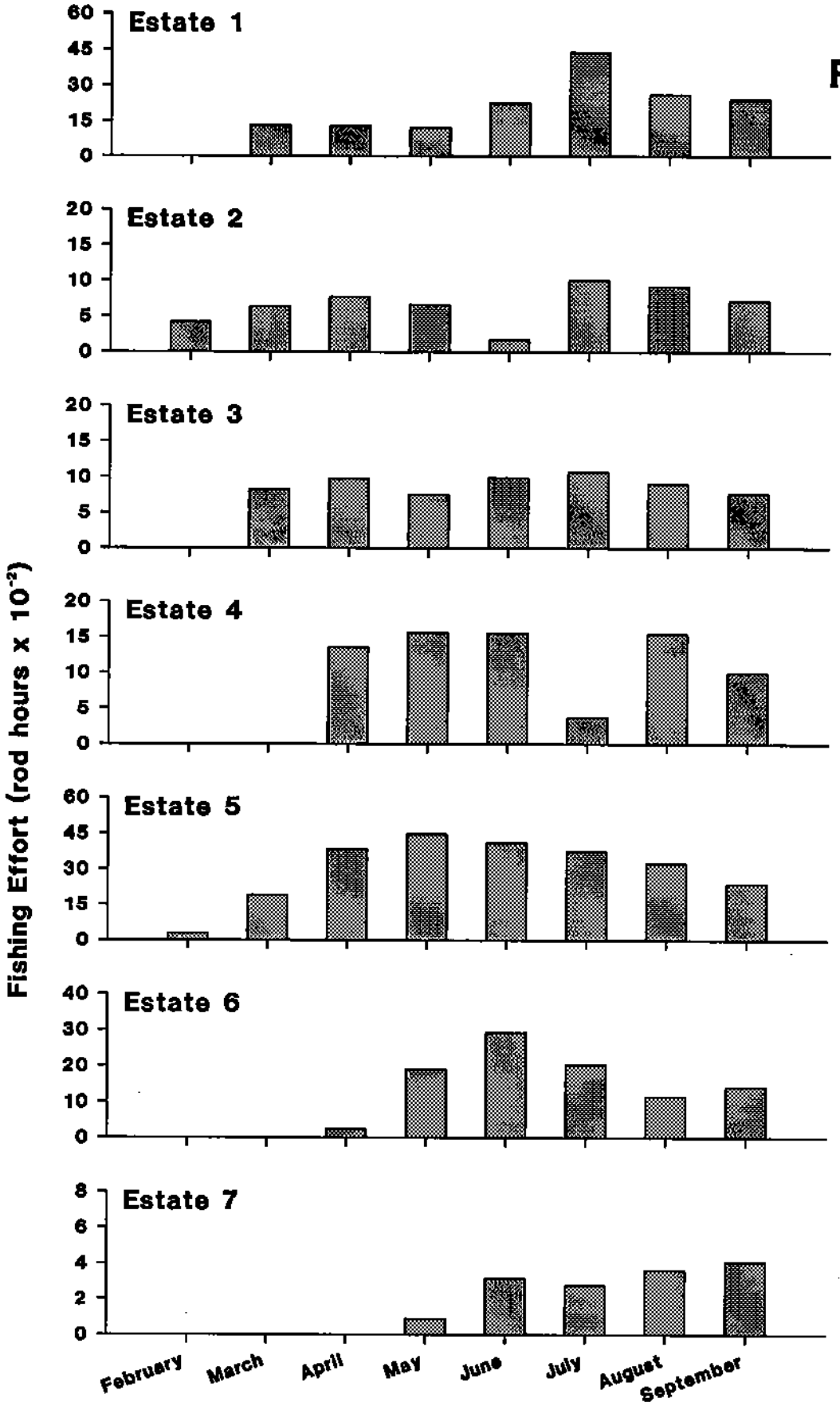
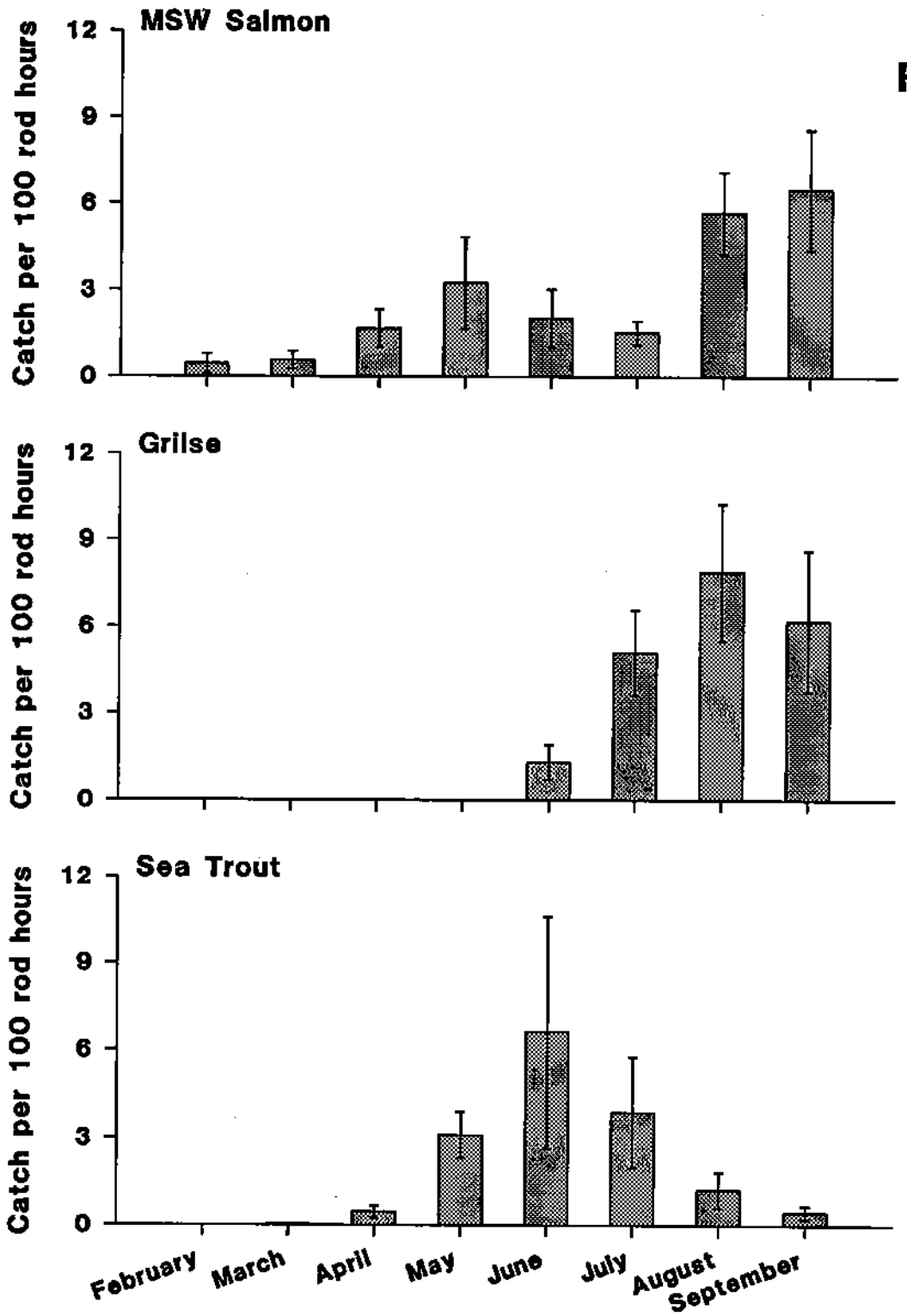

Estate 1
60
45
30
15
0
Estate 2
20
15
10
5
0
Estate 3
20
15
10
5
0
Estate 4
20
15
10
5
0
Estate 5
60
45
30
15
0
Estate 6
40
30
20
10
0
Estate 7
8
6
4
2
0
Fishing Effort (rod hours x 10⁻²)
February
March
April
May
June
July
August
September

Figure 5


MSW Salmon
Grilse
Sea Trout
Catch per 100 rod hours
0
3
6
9
12
February
March
April
May
June
July
August
September

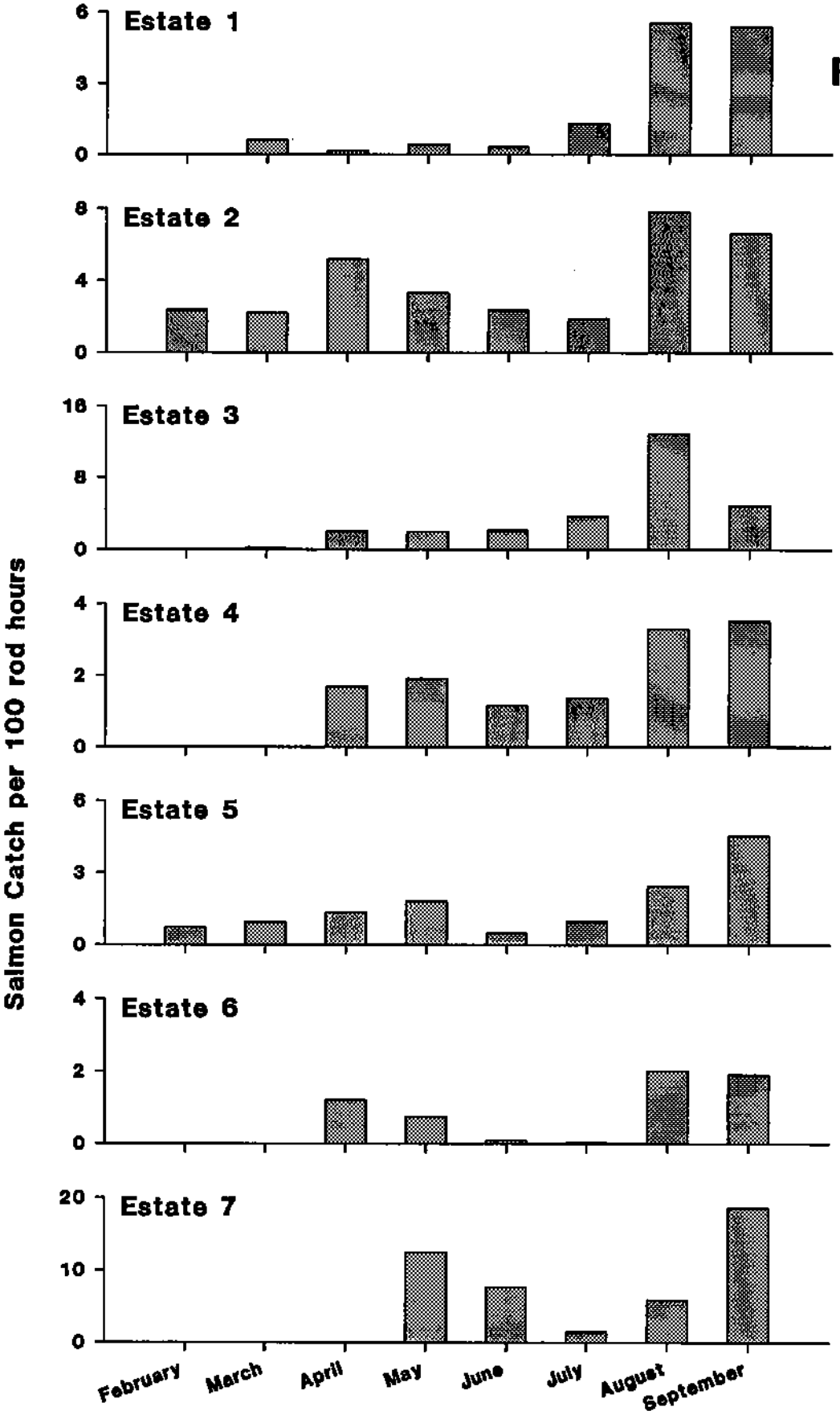

Estate 1
Estate 2
Estate 3
Estate 4
Estate 5
Estate 6
Estate 7
Salmon Catch per 100 rod hours
February
March
April
May
June
July
August
September

Figure 6

Figure 7

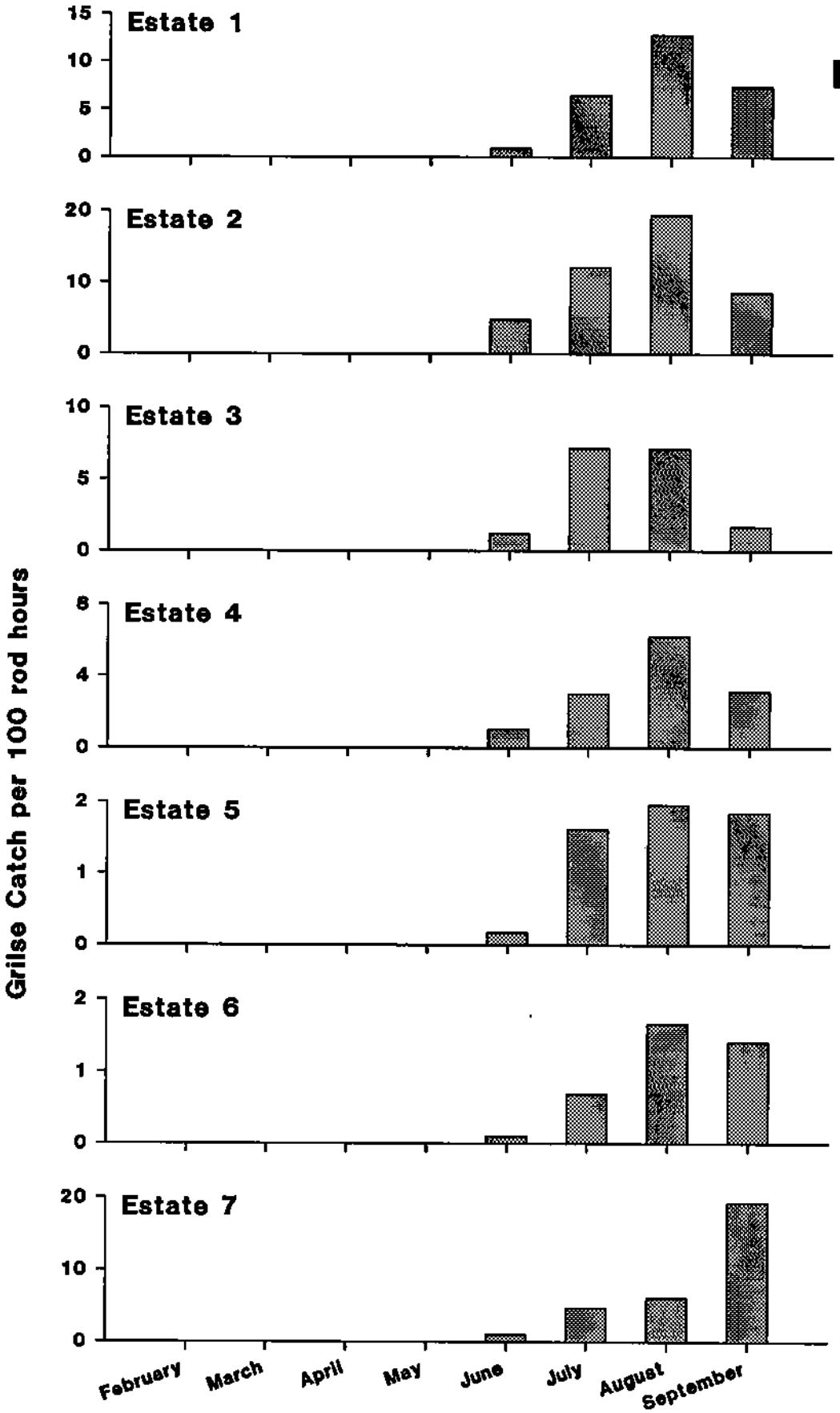
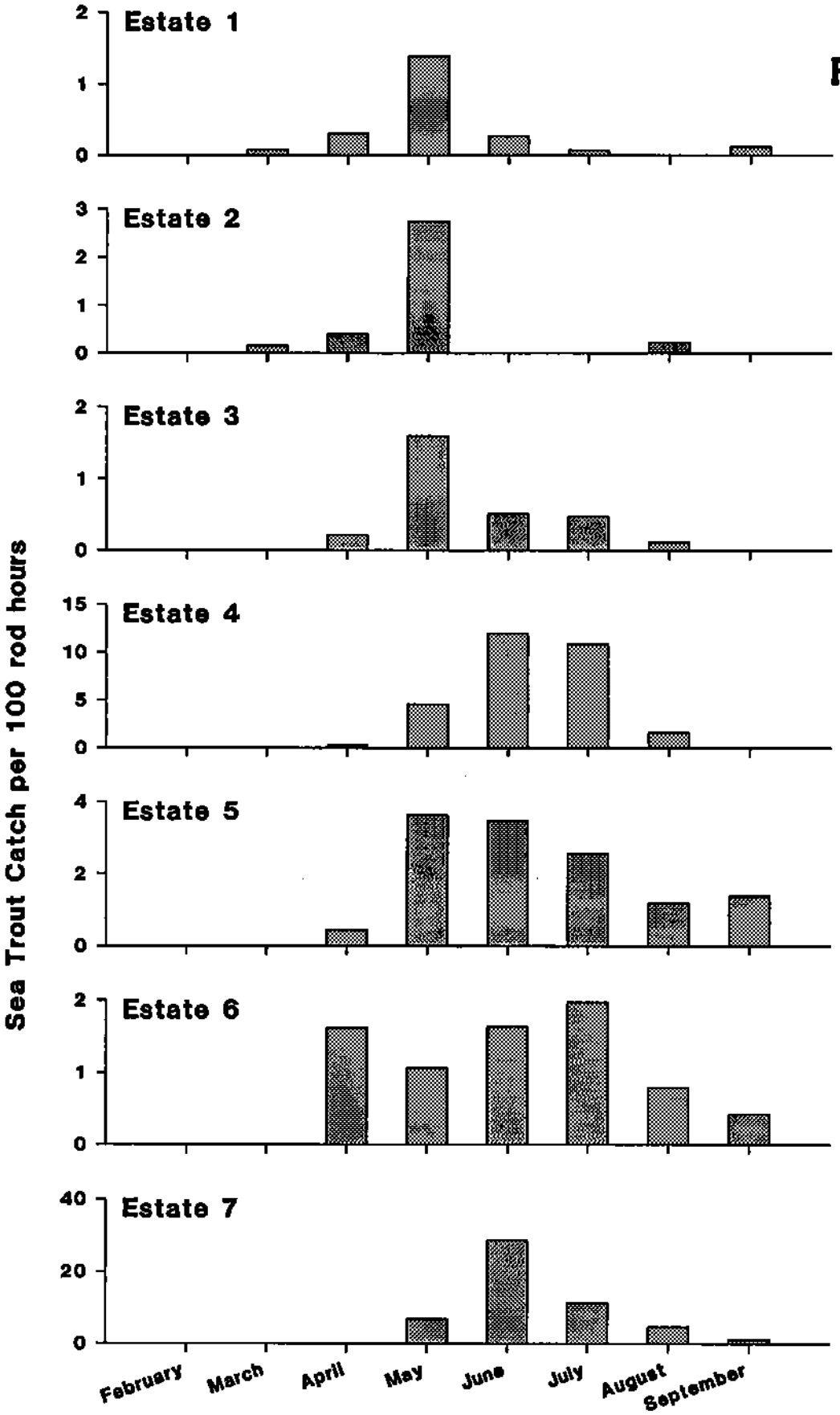

Estate 1
15
10
5
0
Estate 2
20
10
0
Estate 3
10
5
0
Estate 4
8
4
0
Estate 5
2
1
0
Estate 6
2
1
0
Estate 7
20
10
0
Grilse Catch per 100 rod hours
February
March
April
May
June
July
August
September

Figure 8


Estate 1
Estate 2
Estate 3
Estate 4
Estate 5
Estate 6
Estate 7
Sea Trout Catch per 100 rod hours
February
March
April
May
June
July
August
September

APPENDIX 1a

SPEY DISTRICT FISHERY BOARD: ANGLING EFFORT 1992

Beat:	Date:	River Temperature:
		River Height:

Angler Name	Start Time	End Time	Pool	Salmon		Grilse		Trout		Bait/ Lure
				No.	Wt.	No.	Wt.	No.	Wt	

Total Salmon:	Total Grilse:	Total Trout:

APPENDIX 1b

Estate:	Angler Name:	River Temperature:
		River Height:

Date	Start Time	End Time	Pool	Salmon		Grilse		Trout		Bait/ Lure
				No.	Wt.	No.	Wt.	No.	Wt.	

Total Salmon:	Total Grilse:	Total Trout: