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ABSTRACT

This paper studies moves to quantify Scotland's salmon catches, and the reactions and interpretations that these quantifications provoke. The first significant attempts to measure salmon catches developed in the late nineteenth century as fishery managers felt unable to test the effectiveness of management measures they had instituted. Legal provision for the collation of catch statistics was made in the mid-twentieth century. The paper gives a detailed study of what this collection and collation involves. In doing so, and in examining subsequent reactions and interpretations, it demonstrates that the statistics, originating in anglers' catches but being processed by a scientific laboratory, represent a hybrid knowledge form, which does not conform to traditional classifications of scientific or local. It also examines what happens to the salmon themselves through this process of quantification, individuals caught in various times and places united on a single graph as the total Scottish salmon resource. The paper argues that successful salmon management policies would re-focus on the role of individual fish, as it is these individuals that form the amalgamated catches and with which anglers interact.

KEY WORDS: Salmon management, Scotland, animal geographies, quantification, knowledge

INTRODUCTION

The legal and institutional framework for salmon management in Scotland has changed relatively little since the Salmon Fisheries (Scotland) Act, 1862. Although the state of salmon stocks, participation in angling, knowledge of the salmon's lifecycle and rural economies have all changed markedly in the years since, the framework of salmon management has remained remarkably stable. While the system has undergone minor adjustments in the past, the Scottish Parliament's Aquaculture and Fisheries (Scotland) Bill (which was introduced in June 2006) brings the potential of a rather more radical overhaul. It is, therefore, pertinent to consider some of the issues raised by the current system.

Media reports on salmon management in Scotland most frequently focus on the implications of aquaculture (e.g. Macaskill, 2002, p. 6; Smith & Cairns, 1999, p. 1). The environmental impact of aquaculture has been discussed widely elsewhere (e.g. Pearson & Black, 2001; McVicar, 1997; Scottish Association for Marine Science and Napier University, 2002; Porter, 2003). While salmon farming is, undoubtedly, an important issue, Scotland's aquaculture industry is located almost solely around the west coast, Western Isles and Northern Isles. Although farm escapees are sometimes caught on the eastern rivers, the numbers are not significant (a total of 42 escapees being reported as caught on north and east rivers in 2004 (Scottish Executive, 2005, p. 24). The east, meanwhile, is the location of many of Scotland's most famous salmon angling rivers, such as the Tweed, the Tay, the Spey and the Dee. The Dee in particular is renowned for its run of 'spring' salmon—those entering the river before May. The focus on west coast aquaculture has diverted attention from other significant debates around salmon management. This paper focuses on one of these debates, which is relevant to any salmon river in Scotland: what the knowledge base of this management should be. While aquaculture is likely to be at the centre of any new legislation, it is arguably these more general but fundamental areas of debate that should form the focus of new legislation. Here, the issues are approached through a study of the specific practice of counting salmon to assess stock health. While other examples of the management knowledge base—such as population genetics, habitat requirements and lifecycle studies, for instance—could have been chosen, catch statistics provide a particularly interesting example of data frequently perceived as 'scientific' but openly contested because of the potential social and cultural influences on it.

By examining the history of these statistics and by looking at more recent practice and discussion, the paper contributes to ongoing debates in human geography and other social sciences about the nature and utility of knowledge. These frequently focus on the dichotomy of local versus universal—the spatial scope of the knowledge where, 'science is seen as standardized, de-contextualised and universal' and 'local knowledge is strongly rooted in place' (Murdoch & Clark, 1994, p. 118). While much research has pointed to the value of 'local knowledge' (e.g. Harrison, Burgess & Clark, 1998; Feldman & Welsh, 1995), Murdoch & Clark warn astutely that 'local knowledge is not always sustainable knowledge' (1994, p. 125) and should, therefore, not be given undue emphasis over other types of knowledge.

Various attempts have been made to move beyond the local-scientific dichotomy. These have focused on, for instance, the place of knowledge production (Livingstone, 2000) and the practices involved in knowledge production (Ingold & Kurttila, 2000). Both these accounts are similar in that they reject an intrinsic epistemological differentiation between different knowledges. Livingstone, for instance, holds that, at least in terms of work in the field (as opposed to a laboratory), 'science is an inescapably local practice' (2000, p. 293). According to Livingstone's approach, scientific knowledge is local in a similar way to a farmer's knowledge of his fields or an angler's knowledge of salmon pools—despite its frequent portrayal as generalised and universal. A similar rejection of traditional boundaries is made by Actor Network Theory (ANT) (see Murdoch, 1997, for a detailed review). In relation to formations of knowledge, ANT offers two primary insights. First, one should not dichotomise between local and scientific knowledges; these labels are outcomes, rather than causes, of network relationships (Latour, 1993, p. 95; 2000, p. 113; Callon, 1986, pp. 200 – 201). Second, knowledge is fundamentally a *relational* concept in both its production and acceptance. This paper investigates one example of an attempt to produce knowledge and the reactions this attempt provokes. In both the production and discussion of catch statistics, boundaries between the labels of 'scientific' and 'local' become highly blurred.

A key issue concerning the statistics is how they relate to salmon themselves. A vibrant and growing literature has developed around 'animal geographies' following Wolch & Emel's (1995) call to 'bring the animals back in' (see, for instance, the edited collections of Philo & Wilbert [2000a] and Wolch & Emel [1998]). Despite Franklin's rather overstated suggestion that animals are 'beginning to occupy the centre stage once held by ''the environment''' (1999, p. 1), the idea that animals and their place in the world are worthy of study *by social scientists* has been increasingly accepted. Philo & Wilbert (2000b) summarise this new animal geography as attempting:

> to follow how animals have been socially defined, used as food, labelled as pets or pests, as useful or not, classed as sentient, as fish, as insect, or as irrational 'others' which are evidently not human, by differing peoples in differing periods and worldly contexts. It thereby endeavours to discern the many ways in which animals are 'placed' by human societies in their local material spaces . . . as well as in a host of imaginary, literary, psychological and even virtual spaces. It is thus not only the

> physical presence of animals which is of importance here, since animals also exist in our human imaginings . . . (Philo & Wilbert, 2000b, p. 5).

Catch statistics claim to transpose individual fish, caught at various times in various places, to single graphs that combine all salmon caught in Scotland. By looking at the process through which physically present animals become part of one particular graph, the paper addresses the concept of animal-becoming-knowledge. Through this focus, the paper questions the extent to which policy may follow recent work on animal geographies (e.g. Wolch, 2002), which has questioned the ways that animals are included in, and excluded from, management networks.

The next section provides a brief context for the remainder of the paper by summarising Scotland's salmon management system. Subsequent sections outline the background to producing salmon catch statistics, before looking in more depth at how this counting takes place and how the statistics are used and viewed on publication.

SALMON MANAGEMENT IN SCOTLAND

The most distinctive feature of the current salmon management system in Scotland is its fragmented structure. While salmon management in many countries is relatively centralised (much of the responsibility in England and Wales resting with the Environment Agency, for instance), in Scotland it is based around 57 District Salmon Fishery Boards (DSFBs) (ASFB, 2006). Each of these is composed of six proprietors of salmon fishing rights (these being private heritable rights [Scott Robinson, 1990; ASDSFB, 1977]) from a Fishery District, along with representatives of anglers, commercial net fishermen and, in some cases, representatives of Scottish Natural Heritage and the Scottish Environmental Protection Agency. Each Board has a life of three years, after which time a new membership is elected. The establishment of a DSFB within a District remains voluntary.

Some Districts have now amalgamated (generally those on the west coast but also others, such as the North and South Esks), but still only around 75% of Districts have constituted Boards (ASFB, 2006). The DSFBs are funded by the proprietors of fishing rights within the District, who pay a levy based on the rateable value of their fishery.

The Salmon Act, 1986, clarified the duties of a DSFB as:

> 1. the protection or improvement of the fisheries within their district;
>
> 2. the increase of salmon; or
>
> 3. the stocking of the waters of the district with salmon (1986 Act: Part I, Section 16, Paragraph 1).

To a large extent, these duties may be performed in any way that the DSFB sees fit. The 1997 *Report of the Scottish Salmon Strategy Task Force* commended this system for its local focus (SSSTF, 1997, p. 65), allowing people who know the Districts well to apply their local knowledge to issues that mattered most in each District. Equally, though, the system received criticism for its voluntary nature and for its haphazard approach to the use of science, with very few of the DSFBs employing their own scientists (SSSTF, 1997, p. 65). The economic relationship between angling and management has both positive and negative connotations. In order to attract anglers, the owners of fishing rights need to invest in their fisheries. Such investment, however, may be dependent on revenue from angling. In some cases, this may not be high enough to allow suitable management measures to be instituted.

Reference by the SSSTF to the relationship between local and scientific knowledge relates to debate amongst a much wider group of stakeholders. For example, one letter, from an angler, to *Trout and Salmon* magazine commented that:

> Twenty years of fisheries science has left us with stocks in almost terminal decline and a frustration among anglers that is almost palpable. Clearly the Neroesque approach of the scientists cannot go on indefinitely and at some stage (sooner rather than later) fishery proprietors and managers will have to take a rather more pragmatic approach to the management of their fisheries. (Williams, 2000, p. 23)

Catch statistics form a focus for critiques of the work of DSFBs. The next section examines the historical development of these figures, considering the rationale behind them and the uses to which they were to be put.

DEVELOPING A NEED TO QUANTIFY

Over the past half-century, the most prominent illustration of the salmon's decline has been in the form of catch statistics and graphs, published by the Scottish Executive and its predecessors (Figure 1). These graphs have frequently denoted a dramatic decrease in catches. Statistics on declining catches have often undergone a crucial process of translation in the printed media and among practising anglers. The result has been the frequent interpretation of statistics as representative of the decline of salmon *stocks*. While some scientists have argued that a correlation between the magnitude of catches and stocks is likely (Youngson et al., 2002, esp. pp. 843 – 847; Shelton & Heath, 2001, pp. 11 – 13) that connection would appear to have been drawn more keenly by non-scientists.

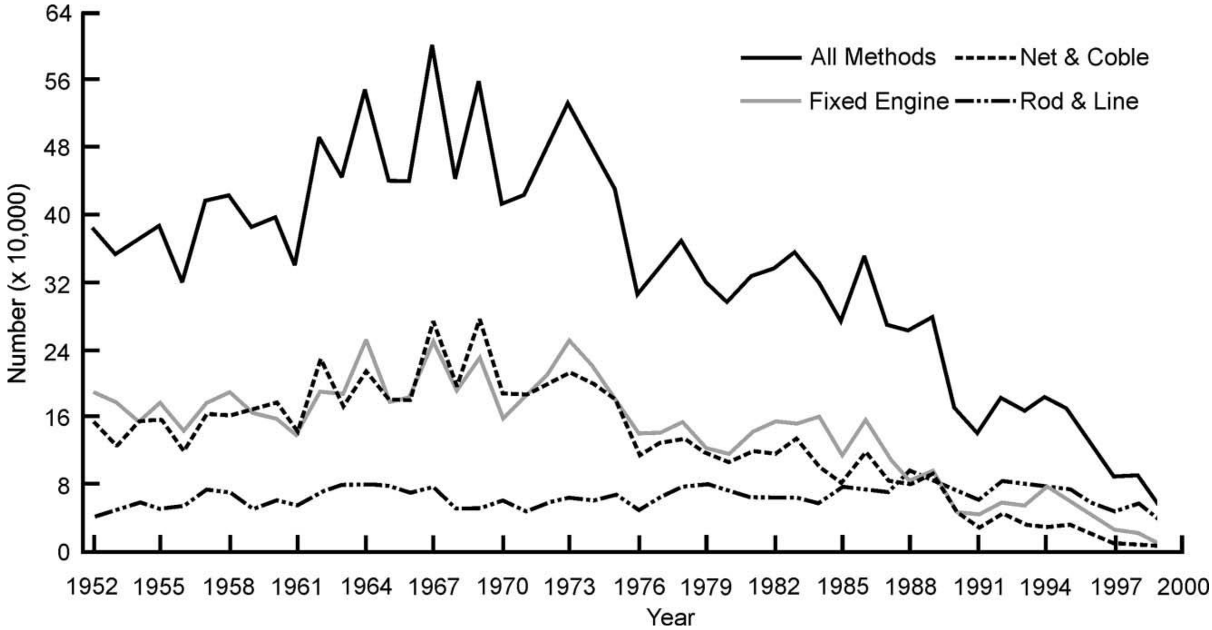


Figure 1. Salmon and grilse recorded as caught and retained, Scotland, 1952 – 1999. *Source*: Scottish Executive, 2000a.

Over the past three centuries, salmon have been measured in a variety of ways. Several motives for counting can be identified. The emergence of recreational angling as a popular pastime led to increased competition between anglers over who could catch the largest, or most, salmon (Calderwood, 1907, p. xvii). Records of such catches have, for centuries, been kept by many fishing estates (see Greenhalgh, 2001, for examples). As records of total catches, though, these are unreliable as there was, until 1952,[1] no legal requirement for the recording of catches; not all fish caught were registered. These informal records were generally unpublished, although occasionally they appear in angling literature (e.g. Grimble, 1913, pp. 11, 80, 228). By the end of the nineteenth century, there was a widely-held belief that salmon stocks were declining (Russel, 1864; Jopp, 1860; Young, 1854). As a result, when the Fishery Board for Scotland was formed in 1882, it was given the task of providing a statistical report of Scotland's fisheries (Fishery Board (Scotland) Act, 1882: Par 6).

Despite the requirement for 'a statistical account of the fisheries', very few means existed for the measurement of salmon stocks. The 'statistics' provided in the Board's early reports were almost wholly based on the number of boxes of salmon sent to market in London and informal reports of commercial net fishery catches, gained through personal contact with netters and fishing proprietors. While such figures provide an estimate of Scotland's total salmon catches, they do not show the angling catch and, more significantly, give little indication of catches at individual fisheries. Because of the variety of factors affecting salmon on different rivers, reports of national catches are of very limited use in providing management recommendations.

The Fishery Board for Scotland's inspectors, who were responsible for compiling the statistical reports, became increasingly frustrated by the paucity of information available on salmon catches and stocks. William Archer, who became the inspector in 1892, complained that:

> The initial step towards attaining knowledge appears to be to obtain full and accurate statistics of the take of fish and the number of instruments used in their capture, that the value of the regulations made for the improvement of the fisheries may be tested. (1892, p. xi)

In the previous year, Archer had been even more explicit while outlining the need for and purpose of more information on salmon stocks:

> The aim of such observations should be an endeavour to bring as far as possible the varying conditions affecting the fisheries *under control*, by recording from day to day, month to month, and year to year, the simplest everyday facts. (1891, p. 17, emphasis added)

Archer believed that it would in some way be possible to obtain full statistics of the salmon catch in Scotland and that, by doing so, the fisheries could, for the first time, be governed effectively. Archer's focus on *fisheries* is important: the statistics would not merely enable control of the fish themselves, but also the other activities that surround them (such as angling and commercial netting). Obtaining knowledge of animals, then, would indirectly lead to the governance of humans and their activities. Archer, however, was unable to assert this precise disciplinary control as there was a considerable lack of suitable information in 1891. As a result, calls for greater production of statistical information continued. A subsequent inspector, 15 years later, for instance, complained that:

> It is surely of the essence of government that there be adequate knowledge of the thing to be governed. For purposes of general administration we have no official collection of statistical information whatever. (Calderwood, 1916, p. 92)

The inspectors were also caught up in the wider trend towards a need to quantify in order to know and understand many issues. For Porter (1986, p. 11), the increasing use of numbers in the nineteenth century had significant 'impact on the character of the information people need to possess before they feel they understand something'. In Scottish salmon management, as in many other areas, numbers increasingly mattered. It was no longer sufficient to understand the lifecycle and habitat requirements of salmon and, as such, the importance of individual fish declined. Interest in quantifying total catches shifted interest more explicitly to maintaining the nation's stocks. As the need to quantify salmon developed alongside the institutions that were established to carry out management, certain people and institutions, such as the inspectors, came to be viewed (and, indeed, came to view themselves) as knowledgeable and, through their use of numbers and scientific studies, were seen to have at least the *potential* to arbitrate in certain controversies. In an attempt to overcome the lack of statistical data, a range of tactics was employed, from tagging hatchery-reared fish and counting the number that returned (Calderwood, 1901, p. 83) to an annual report from the Spey's superintendent in the *Fishery Board for Scotland Reports* from 1890 onwards on redd counts in the River Spey[2] (see Bear, 2003, for a more comprehensive summary).

The statistical reach of these various surveys remained largely the same until 1952. Sixty-nine years after the inspector was given the duty of producing a statistical report, the Salmon and Freshwater Fisheries (Protection) (Scotland) Act, 1951, provided the legal powers by which statistics could be collected. The new powers also had the potential to instigate a paradigm shift in salmon management, whereby the imposition of management measures could result from the known health of salmon stocks, as opposed to crude estimates. The new powers would enable carrying out the types of test that Archer (1892, p. xi) had called for.

By 1952, when the first 'official' catch statistics were published, the inspector, Cunningham, accorded them two lines of perfunctory reporting:

> According to the particulars supplied by proprietors and occupiers of salmon fisheries, the weight of salmon, grilse and sea trout captured in Scotland by all methods in 1952 was 1641 tons. (1952, p. 45)

Even at this early stage in the development of catch statistics, Cunningham appeared conscious of their possible inaccuracies. While previous inspectors had spoken factually of weights and numbers of salmon killed, Cunningham is far more cautious, noting that the figures are, 'according to the . . . proprietors'.

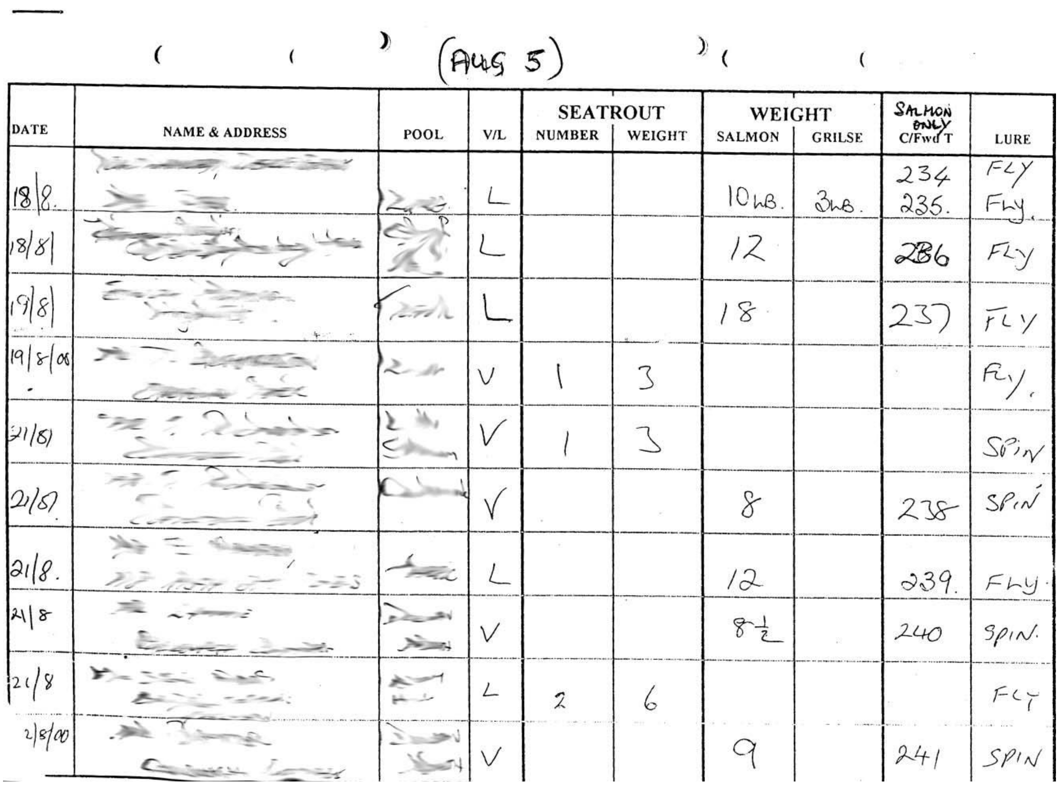
Although more than 50 years of salmon catch data now exist, Calderwood and Archer's visions of a statistic that would effectively end the need for debate on the state of salmon stocks has not been met. Aware of the inaccuracies and limitations inherent in catch statistics, scientists and salmon managers[3] have continued to search for a method that accurately counts salmon. While the methods for collecting 'official' catch information have remained largely the same over the past half-century, new technologies for counting fish have nonetheless emerged, including electro-fishing (often used to count the number of spawning adults in an individual spawning tributary) and 'automatic' counters (where three metal strips across a weir carry a low voltage current and measure the resistance of passing objects). In spite of this, the official catch statistics remain the most prominent, as these are the only truly national figures that should be fully comparable between rivers.

Having discussed the historical background of the figures, the next section examines the practicalities of recording salmon catches. It draws on broader research, involving interviews and participant observation, along with an analysis of responses to contemporaneous Scottish Executive consultation papers (*Protecting* *and Promoting* [Scottish Executive & SNH, 2000] and *The Conservation of Salmon and Sea Trout* [Scottish Executive, 2000b) and angling literature. Around 25 in-depth interviews were conducted with participants who included river managers, anglers, biologists, tackle shop owners and landowners on rivers in the north-east of Scotland. In the next section, ethnographic work and archival scrutiny are employed to provide a forensic investigation of a salmon from its capture by an angler, to its recording in estate records, its publishing in national catch statistics and the discussion and debate that follows.

COUNTING SALMON

From 1952 onwards, every proprietor of salmon fisheries in Scotland has been sent an annual form on which to record their catches for the previous season. This requires information for each month on the number and weight of fish caught and the method used in the capture. They are further divided into wild and farmed 'salmon', wild and farmed 'grilse' and sea trout up to and over 0.5 kg. The accepted definition of a grilse 'is an Atlantic salmon which has spent only one winter at sea before returning to the river' (Mills, Hadoke & Read, 1999, p. 5). In the case of fish caught by rod and line, they have, since 1994, also been divided into caught and retained and caught and released. As this form is only filled in once a year, detailed records must also be kept during the year.

In the case of a rod-and-line fishery, these records would often take the form of those in Figure 2. This is a record from one fishery. Noted on this table are the name of angler, date and pool of catch, the type and weight of fish, and the type of bait. The owner of the local tackle shop, at which the anglers should report their catches, completed this particular form. Other fisheries may require that records be kept in an estate office. In such a case, records may be completed by anglers themselves or by a ghillie. This record may be seen as a first stage of inscription (see Latour, 1999), where the salmon is first converted from living entity to a partial representation on paper.



(AUG 5)

DATE	NAME & ADDRESS	POOL	V/L	SEATROUT NUMBER	SEATROUT WEIGHT	WEIGHT SALMON	WEIGHT GRILSE	SALMON ONLY C/Fwd T	LURE
18/8.	[illegible]	[illegible]	L			10LB.	3LB.	234 235.	FLY FLY.
18/8	[illegible]	[illegible]	L			12		236	FLY
19/8	[illegible]	[illegible]	L			18		237	FLY
19/8/08	[illegible]	[illegible]	V	1	3				FLY.
21/8	[illegible]	[illegible]	V	1	3				SPIN
21/8	[illegible]	[illegible]	V			8		238	SPIN
21/8.	[illegible]	[illegible]	L			12		239.	FLY.
21/8	[illegible]	[illegible]	V			8½		240	SPIN.
21/8	[illegible]	[illegible]	L	2	6				FLY
21/8/00	[illegible]	[illegible]	V			9		241	SPIN

Figure 2. Extract from the catch records of one rod-and-line fishery (names and addresses of anglers and pools blurred for confidentiality). Source: President of an angling association, 30 April 2001.

At this early stage of data collection, although the salmon have been recorded as individual fish, they have already been classified into a small number of categories. Through the stages of inscription from living animal to recorded animal, a salmon's characteristics may have changed considerably. When recording catches, it is only possible to make an educated guess as to whether a fish is a grilse or a salmon. As a result, a relatively large fish that has only spent one winter at sea may be recorded as 'salmon' (see Freshwater Fisheries Laboratory, 1993, pp. 7 – 8). Similarly, catch-and-release policies are becoming more prevalent, and under these, fish should not be removed from the water when caught. Their weight, therefore, must be estimated by guessing, through experience, or with published conversion values (e.g. NASCO, date unknown).

In what appears to be a factual catch record, there are, then, many uncertainties. What is produced is not a record of the fish caught, but a personal *interpretation* of each fish. It is also not necessarily a true reflection of the total catch, as some fish may escape recording at this stage.

This record of salmon is further abstracted as a second degree of inscriptions is added. At the end of the fishing season, the first set of records is re-categorised and totalised. Monthly and yearly totals are given for each type of fish recorded (for instance, 20 salmon were caught in March, five of which were released; 32 grilse were caught, of which 19 were released and so forth), as they are transferred from the fishing record to the Scottish Executive catch form. At this stage, some of the fish may leave, or new fish may join the existing fish. It has been suggested that the economic underpinnings of fisheries ownership and management have occasionally led proprietors to tailor their input in certain ways—higher catches will give a higher rateable value of the fisheries, which leads to a higher levy being paid to the DSFB. The extent to which this takes place is not known. However, a senior government advisor stated in an interview that:

> . . . although people want to minimise their rate payment, they don't want to say, 'Oh, we didn't catch anything at all', because when advertising their fishing and certainly when trying to sell their fishing altogether, it's important that their catch is impressive. So being squeezed from both ends (interview, 24 January 2001).

The statistics, then (they are no longer merely records of salmon, but statistics), increasingly reflect not only living animals, but animals that have, for whatever reason, been imagined or forgotten, along with economic and political situations affecting the humans who attempt to manage the fish. A third degree of inscription is added when these figures are sent away to be collated. All catch return forms are sent to the Freshwater Laboratory's field station at Montrose. Here, the numerical representations of salmon from around Scotland are combined again and recalculated. The numbers are categorised into rivers, Fishery Districts, larger Fishery Regions and, finally, the national level.

Up until this point in the process the information (representations) has only passed through privileged hands. The data have travelled along carefully defined routes, from collector to collator to collator. In this way, the data's transformations have been controlled. At the next stage of the process—publication—this large-scale information will leave the controlled spaces and be subjected to new degrees of inscription, produced at various scales.

The Montrose field station publishes (through the Scottish Executive) an annual *Statistical Bulletin* of salmon and sea trout catches in Scotland. At the Fishery District level, tables are given for the number, weight and type of fish caught (retained and released) along with some seasonal information. The methods used for fishing are shown at the larger Fishery Region level. Further to this, a series of graphs is provided, along with brief commentary. A variety of responses ensues. Here, Latour offers a lead for understanding this process. He argues, '. . . these translations and representations may be disrupted, but this is not the point here' (1987, p. 234). In making this assertion, through reference to the case of a census office, he reminds us of the power generated in what he has categorised as 'centres of calculation':

> the point is that, in case of a dispute, other tallies, code words, indicators, metres and counters will allow dissenters to go back from the nth final inscription to the questionnaires kept in the archives and, from it, to the people in the land. That is, some two-way relations have been established that allow the director, if there is no dissenter, to engage in some controversies as if speaking in the name of his millions of well-arranged and nicely displayed allies. (1987, pp. 234 – 235)

In Scottish salmon management, 'dissenters'—those who do not believe that the statistics are an accurate representation of reality—can generally not go back to the original catch records. Rather, they may request further translations from the Freshwater Laboratory (more detailed or more analysed versions of the statistics, for instance) or perform their own calculations from other sources of information (such as catches from a particular fishery). Even if this further information is retrieved, it may not be enough to settle disputes. To do this, an actor may attempt to enrol others into his/her network, or to join another network. This may be done through new presentations of the statistics and accompanying arguments. The statistics produced in the centre of calculation are not, therefore, 'safe'. Here, the 'disruptions' and acceptances of the numerical representations and translations may be seen as the most important stage of the process. The following section studies what happens to the numbers next.

MULTIPLE TRANSLATIONS

The graphs in Figure 3 were published in *The Scotsman* newspaper (Chisholm, 2000), and show one of the new inscriptions that have been created from the *Statistical Bulletin*. Both graphs were copied almost directly from the *Bulletin*. During the move from *Bulletin* to newspaper, however, their meaning has been altered significantly. The length of the accompanying article also demonstrates that these statistics are used; they are no longer merely figures but have been given a new meaning. They no longer only represent individual salmon but also a declining rural economy, and not only declining catches but also declining stocks. Latour has guided us through the development of power in centres of calculation. How, though, do their *products* retain this power when released beyond their controlled domain? The statistical inscriptions give the scientists at Montrose (and elsewhere) the ability to 'bring the salmon in'. However, if, as Latour (1991; 1986) suggests, power is relational and cannot be *held* by a single person or organisation, this ability is not enough to meet the demands placed on statistics by the early inspectors. Power may only exist in the network when mobilisation (Callon, 1986) takes place. For this to happen, more actors need to be enrolled into the statistics' network. The Scottish Executive, through the publication of its *Statistical Bulletin*, promotes this situation. Processes of enrolment and mobilisation are, however, far from straightforward. On 'release' from the laboratories, the figures are brought into a variety of new networks, involving new transformations.

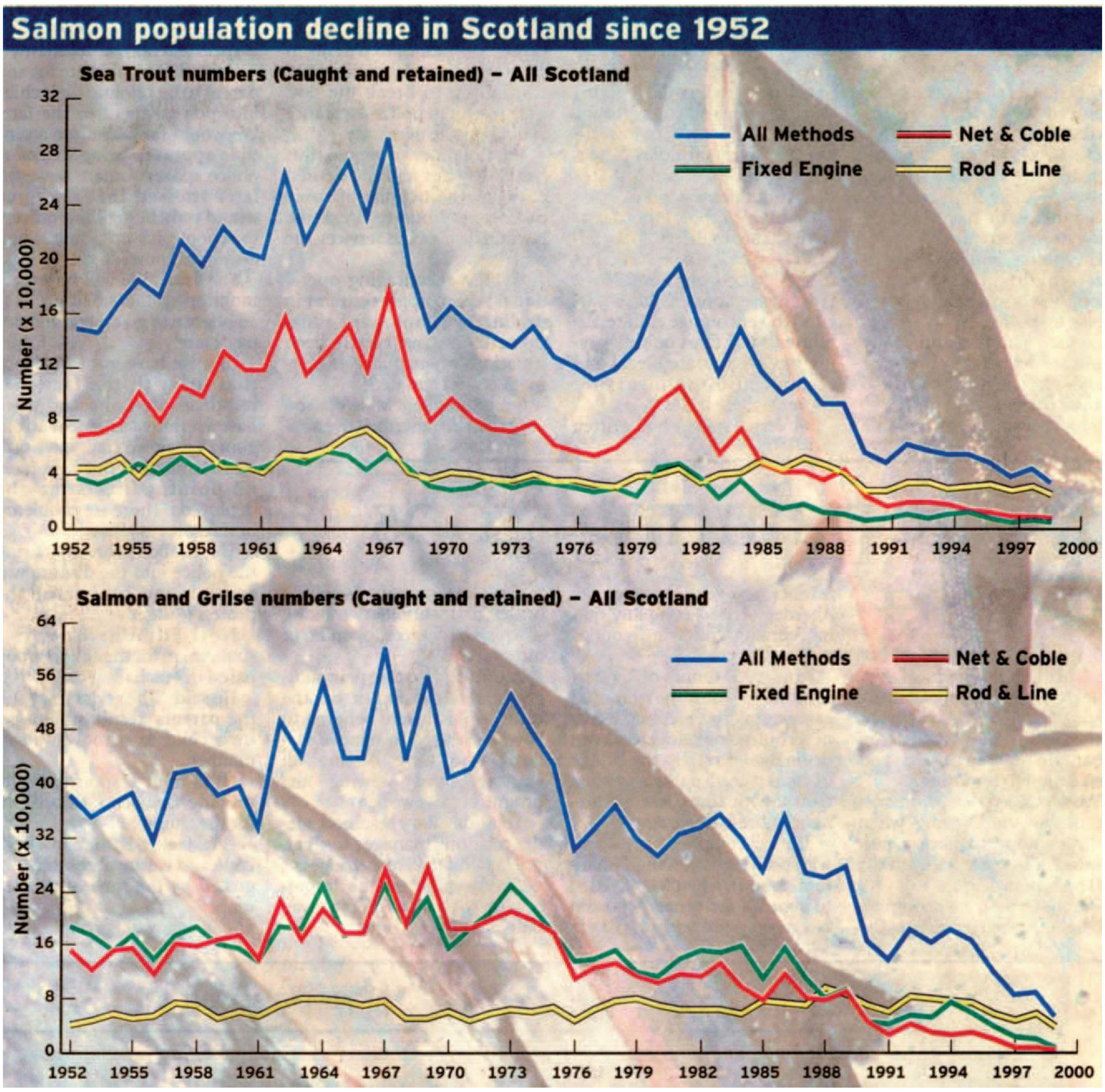


Figure 3. 'Salmon Population Decline in Scotland' as shown in *The Scotsman*. *Source*: Chisholm, 2000, p. 11.

The example from *The Scotsman* is particularly telling. The graphs are headlined, 'Salmon *population* decline in Scotland since 1952' (emphasis added), while the titles of the individual graphs refer to numbers *caught* and retained. It is not clear whether this is careless reporting, poor terminology or a deliberate use of the term 'population' so as to create a bigger story. The graphs, though, immediately become indicators of the decline, not just of salmon *catches*, but of the *entire species*. The original *Bulletin* notes a number of uncertainties with regard to the graph:

> The size of salmon catches is affected by the amount and quality of fishing effort, by the weather and by the timing of salmon runs . . . . Differences in catch between years are not necessarily an accurate guide to differences in the abundance of the populations from which the catch is derived. (Scottish Executive, 2000a, p. 2)

Such factors were similarly acknowledged in the Scottish Executive's press release at the publication of the *Bulletin* (Scottish Executive, 2000c). In the newspaper article, however, the representations are afforded the epistemic status of *fact*. Other reasons, such as the decline of the netting industry, were also ignored. While it might be unfair to expect the media to have a detailed working knowledge of the processes involved in the production of a set of figures, the translation of these graphs leads to yet more translations, leading to further inscriptions over the statistics originally presented by the field station at Montrose.

Other translations—perhaps the majority of them—are more subtle. These various translations result from users' understandings of the ways in which the figures are produced and the factors that may affect their collection. During the fieldwork for the larger study on which this paper draws, catch statistics were frequently employed by participants to give credence to their arguments about the necessity and form of various management measures. Their employment and translation of the statistics shows first that the interpretation offered by *The Scotsman* is far from being an isolated example of what happens once they have left the controlled spaces of estate offices and scientists' desks. Many of these examples differ, though, in that they combine the published figures with other sources of information.

The official figures were often used with confidence by participants, though uncertainties and reservations were frequently expressed. One estate proprietor, for example, complained that some anglers hold little regard for catch statistics, stating that 'when you start giving them fact, they don't want to know'. He went on to say:

> . . . you've got to base your salmon management on the best available data and statistics and that has been studied in great detail by the Freshwater Fisheries Laboratory (interview, 17 July 2000).

As the interview progressed, he also admitted to certain misgivings of his own about the accuracy of the statistics. Referring to figures from his own estate that he had shown me previously, he commented that, 'the statistics show that there were no autumn fish, whereas the fact is that [they were just not recorded]'. These were the figures that his estate had submitted for compilation into the national statistics. He felt that people would be more willing to record salmon catches when stocks were perceived to be lower. In the 1950s, he commented, 'there wasn't a shortage of salmon so why should we bother about them?', implying that catch records would be more accurate at times of low salmon availability. Despite his concerns over the accuracy of catch records, he quoted them throughout to depict the failing state of salmon stocks. The catch records may be inaccurate but they nonetheless provided an important and clear illustration—a way by which personal experiences could be turned into something tangible and transferable.

Reference to the social nature of statistics was made in a subsequent interview with the superintendent of another major angling river. While using the published statistics with confidence to discuss the state of his own river, he expressed less certainty about their voracity on a neighbouring river:

> I think here that we don't see the sort of chronic type decline that is reported for the [other river]. Alleged! We don't see that (interview, 2 February 2001).

While he had confidence in the way records were kept on his river, he was more doubtful about those of others. He felt that there was more of an economic imperative on this other river to show a more dramatic decline, whereas on his own, he was satisfied with the ways in which figures had been recorded.

Greater confidence was shown by another river superintendent, who described records as 'meticulously kept' since 1952. When questioned further, he acknowledged that under- and over-reporting did take place, but that catch statistics nonetheless provide a useful longitudinal record: as the misinterpreting happens every year, interannual inaccuracies are balanced out.

HYBRID KNOWLEDGES

The examples in the previous section, representative of the variety of views encountered in the study, along with that from *The Scotsman* (Figure 3), raise a series of critical issues. Most evident are the different ways in which different people and institutions have used the statistics. While all the participants referred to them in some capacity in discussing the decline of salmon stocks or catches, each attached to them a different validity. Two of the participants in particular expressed some doubt about their worth but continued to use them nonetheless.

The continued use of data can be explained by the fact that the participants have little other information on which to base their judgements. While some interviewees extolled the virtues of automatic counters, both the second and third participants in these examples expressed doubt over their robustness, the third being particularly outspoken. In a further unrecorded interview (22 August 2001), he described the problems inherent in the counters in use on his river, such as the difficulties of calibration, the poor range of its signal and its ineffectiveness in storm conditions. While traps were being used on two sections of the river system to count the number of salmon migrating to the sea, he did not feel that these gave a useful indication of stocks in the river as a whole; the smolt[4] production in these tributaries appeared highly susceptible to local conditions and varied considerably each year.

Enticott (2001), in his study of badgers, bovine tuberculosis and cattle, found three ways of understanding nature: a government agency attempted to calculate the link between the three through statistics; farmers' epistemology of nature focused on 'daily contact and observation' (p. 157); and wildlife groups contested the numerical understanding, preferring an 'ecological vision of nature' (p. 159). These findings are in direct contrast to the case of salmon management in Scotland. While Enticott suggests that, 'To understand natural identities requires tracing all those ecological and heterogeneous agents along networks as they define the TB problem' (p. 161), acknowledging that the three understandings may be linked in some way, it would seem very difficult to attempt to separate ways of understanding the salmon's decline in the first place.

The ways in which salmon statistics are used suggests that, in many ways, it is not possible to distinguish between what have been termed 'local' and 'scientific' knowledges in discourse involving the health of salmon stocks. The case of salmon statistics points to less dualistic ways of understanding knowledge. The statistics begin with the recording of salmon, to varying degrees of accuracy, by anglers. They are then calculated, through scientific method. Subsequently, some people view them as a product of 'science' while others question their accuracy, being aware of the methods of collection. Most people, however, would appear happy to use them in some way, perhaps on their own or perhaps combined with other sources of understanding. While the numbers are produced by the Freshwater Laboratory, in its role as a centre of calculation, it is not necessarily the Scottish Executive that subsequently uses them to bring the salmon under its control—the numbers, and the fish they represent, travel far more diverse and dispersed routes.

The salmon statistics, therefore, clearly fit into neither distinct category of 'local' or 'scientific' knowledge. Rather, these labels (connecting the statistics, for instance, specifically with the Freshwater Laboratory) are applied subsequently and often relate to the ways in which the statistics are perceived and consumed, as opposed to the ways in which they were actually produced. Their use and acceptance may subsequently be based on such labels and alliances. The examples in this paper showed, for instance, that one person was prepared to grant them a level of acceptance because they had been produced and studied by the Freshwater Laboratory. While he knew of the problems inherent in the collection of the numbers, he viewed them as the reliable output of 'science' because of the organisation that interprets them. In another of the examples, the participant was prepared to accept the figures for his own river, while questioning the validity of those for another. He knew the people who collected them on his river, and had cross-references with which to comparatively assess the figures. He was under no illusions as to the provenance of the figures and believed them not because of their place of calculation but because, based on other situated sources of knowing, he felt they provided a useful illustration of what he felt to be true. Both these cases, then, in different ways, may be seen to follow Livingstone's assertion that '. . . propositions are accepted as facts, at least in part because of the spaces in which factual assertions are made. Facts aren't uncovered *just anywhere*; they are only appropriately disclosed and displayed in very particular places' (2000, p. 294). In the one case, the statistics appeared believable to some extent because of their 'disclosure' in a scientific 'laboratory', whereas in the other case the disclosure of the original numbers had been performed by people the participant knew in places with which he was familiar. There is, here, no fundamental distinction between types of knowledge, but rather a focus on the sites at which it was produced and the skills of those who produced it.

Catch statistics, as has been noted, now pervade scientific and popular discourses surrounding the salmon. Perhaps more than any other formalised source of knowing connected to fisheries science, catch statistics has become ubiquitous. It is not clear, though, that salmon catch statistics followed the route found by Harrison & Burgess (1994) in their study of 'conflicts over the development of Rainham Marshes'. There, 'Opposing parties in dispute over the matter of nature at Rainham ''borrowed'' the rhetoric of other cultures in an effort to widen the public appeal of their respective causes' (p. 307). While the production of statistics may traditionally be understood as part of a 'scientific' culture, little respect is paid to those boundaries following their publication in this case. There is less a case of 'borrowing rhetoric' here than a total appropriation of information. Philo & Wilbert (2000b, p. 10) suggest that, '. . . non-expert peoples may also use and interpret expert knowledges of animals in ways running counter to what the popularisers of expert knowledges might wish'. As the examples in this paper demonstrate, however, the status of 'experts' is highly unstable and a variety of understandings of salmon stocks 'become sanctioned as ''proper''' (Philo & Wilbert, 2000b, p. 9) by different people. In what is perhaps a reflection of wider contemporary trends (Rose, 1991, p. 673), catch statistics move fluidly between spaces and places in both their production and use—riverbanks, laboratories, newspaper articles, anglers' houses, articles in magazines and journals.

QUANTIFICATION AND UNDERSTANDING ANIMALS

It is not just the epistemological classification of statistics that is of concern here. Barnes & Hannah (2001, p. 379) called for numbers to be taken seriously by human geographers: 'by disregarding them, we disregard large chunks of what we try to understand'. The ubiquity of catch statistics influences and provokes new understandings of the salmon. This paper has attempted to show that catch statistics give life to fish that have never been seen, and exclude others that have been caught. Others again, through the prevalence of catch-and-release policies, may be caught more than once. Fish that have spent only one winter at sea may be classified as 'salmon', whereas the standardised definition would suggest they were 'grilse'. A salmon caught in the Weaver Pool on the Dee becomes part of the *Scottish* catch.

The production of statistics, therefore, allows salmon from many different times and places to be brought together by centres of calculation and visualised in many ways—as a population or a number of populations, for instance. This was also revealed in the interview with the final superintendent, who expressed concern over the application of national data to the individual river level:

> The . . . thing that sometimes is disappointing, really, is that people take a look at figures overall for the Scottish catch, and each catch has to be managed on a catchment basis. You can't say what's good for the Spey is good for the Dee, though it's quite close, running off the Cairngorms. It's a completely different river system. It's a spring run river. And you can't compare the Don to the Dee for example. It's completely different. . . (interview, 4 June 2001).

Quantification of salmon can, then, be understood as a process that transforms individual fish to 'a flat surface of paper that can be archived, pinned on a wall and combined with others' (Latour, 1987, p. 227). Taking this argument further, salmon were not merely transformed into figures and lines on a flat surface of paper, but combined across space and time to be seen in new ways–notably, as the *salmon of Scotland*. Through processes of coding and inscription, what had previously been individual fish, or perhaps rivers or areas of fish, became distinctly national. All the salmon caught in Scotland in one year could (in theory) be seen as a single line or dot on a piece of paper. Through this process, salmon 'from different locations and times become contemporaries of one another . . . all visible under the same unifying gaze' (Latour, 1999, p. 38).

Demeritt (2001) refers to a similar theme. During the late nineteenth and early twentieth centuries in the US, forests were illustrated for the first time as a *national* forest resource, rather than as separate local woodlands (p. 438). For forests, we may here read salmon. The collection of statistics would transform the heterogeneous collection of Scotland's salmon rivers and populations into manageable units. These units were rendered manageable because they became calculable, making them 'available to new forms of precise disciplinary control and governmental power' (Demeritt, 2001, p. 455).

It is these processes, according to Latour (1987, p. 224), that allow the domination of 'faraway lands' by a 'centre'. This paper, however, has demonstrated that there is no single 'centre'. While the statistics, effectively, emanate from the Freshwater Laboratory, they are brought into new centres (tackle shops, riverbanks, estate offices and so forth), where further transformations and combinations with further inscriptions occur. The confusion resulting from this variety of centres means that any attempts to 'dominate' either salmon or other humans in the salmon management network will be futile. The statistics that were designed to bring salmon under control have, themselves, spun out of control. Abram et al. wrote that:

> . . . The collection of statistics and the proliferation of inscriptions, with their technologies for classifying and enumerating . . . become effective techniques of governmentality, allowing civil domains to be rendered visible, calculable and, therefore, governable. (1998, p. 238)

Salmon statistics have certainly appeared to render catches visible—and, in particular, render the *decline* of catches visible. This image has been readily adopted by a variety of actors, despite their differing opinions on the validity of the figures. Rather than quashing debate, as originally intended, the figures and graphs have provoked further discussion and argument about the state of salmon stocks and the benefits and drawbacks of salmon management strategies and tools. Further, some salmon managers have been prompted to react to the widely-held perception of a *national* decline of salmon stocks, whether or not they feel that the situation on their own river merits such an intervention. In this way, the catch statistics (which are, to a large extent, responsible for this perception) may be seen to have introduced new relationships between humans and salmon, where collections of fish are often understood in terms of their national significance as opposed to the intrinsic or ecological value of individuals.

This picturing of national stocks has important implications for the moral relationship between salmon and humans. While the statistics emphasise a concern for the species (or, at least, a considerable part of it), the everyday interactions of anglers are with individual fish. Philo (1998, p. 54) calls for texts to give ‘a sense of animals as animals’. This is not purely of academic concern. Amidst discussions over the reliability of the statistics, the individual fish disappear: whilst knowledge travels, in becoming knowledge the reality of animals is blurred. The imposition of management measures such as catch-and-release relies on an acceptance amongst anglers that salmon stocks are indeed declining. If the network surrounding the catch statistics has not, to borrow Latour’s term, been fully mobilised, and scepticism surrounds the statistics, the policy will immediately be less successful. This suggests that, in devising management measures, greater attention needs to be paid to what exactly is being managed. If it is individual fish that are weak and it is these individual fish that are being caught by anglers, management policies need to find a way to re-focus on the individual, rather than abstract and contested amalgamations of regional and national catches. Attempting such a move would go some way to meeting Wolch’s (2002) desire for a more inclusive democracy, which gives a more central role to animals.

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NOTES

1 Following the Salmon and Freshwater Fisheries (Protection) (Scotland) Act, 1951.

2 Redds are the gravel ‘nests’ in which female salmon lay their eggs. Counting the number of redds in a section of stream provides a guide to the extent and magnitude of the spawning stock. Such methods continue to be used today (see, for example, Spey District Fishery Board, 1998, p. 15).

3 The role of the Inspector for Salmon Fisheries of Scotland became increasingly policy-oriented and less involved with the scientific study of salmon; the job title was abolished in 2001.

4 Salmon are known as smolts at the stage when they begin to adapt to saltwater and subsequently leave their natal rivers.

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