



## Fisheries Management and the Tweed and Eye Fisheries District Fisheries Management Plan

### PART 1: INTRODUCTION TO THE PLAN

#### 7A.1: What is fisheries management for wild fish?

This is illustrated in Diagram 7.1 which shows how the work of this type of fisheries management is to take a product of the natural environment, wild fish, maximise their production, and “sell” them to the tourism and leisure industry. It therefore requires, and has an essential interest in, both the quality and quantity of the natural environment - and not just of its aquatic elements as everything that happens in a catchment affects its waters, which are its drains. Fisheries are therefore as much a land use as farming or forestry.

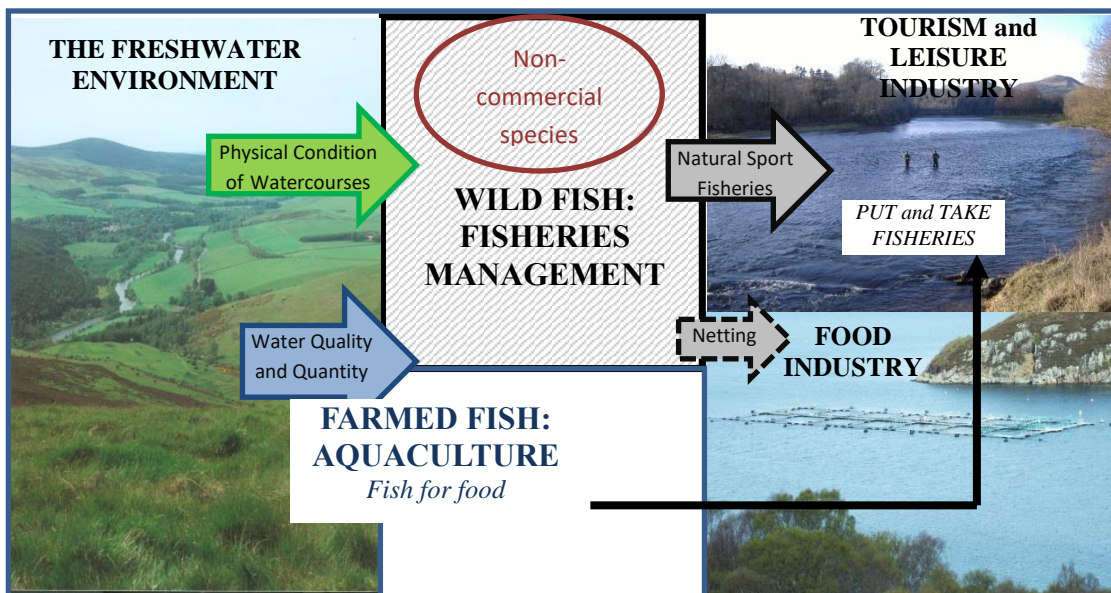


Diagram 7.1: What is Fisheries Management?

The role of wild fish, particularly for salmon, in providing food supplies, has now been almost entirely supplanted by farmed salmon, though in the past netting was a large scale source. While salmon farming shares the need for good quality and quantity of water with wild fish management, it has, obviously, no interest in the physical condition of watercourses as its fish are reared in factories and cages. There are minor interests of aquaculture in the provision of living fish (usually adult trout) for stocking into “Put and Take” fisheries and in the rearing of salmon smolts for release for artificial salmon fisheries (called “Ranching” but actually a form of “Put and Take”) which are both part of the Tourism and Leisure Industry.

Contained within the field is the conservation of non-commercial species. These are, obviously, not part of the “business” side of fisheries management but can be of major biological and natural historical interest. Unlike the commercial species, they do not earn revenue but (in most cases) they benefit from any protection and improvement of the general freshwater environment undertaken for the commercial species. In that respect they are subsidised by the business side of fisheries management which thus supports the conservation of fish species in general, not just of commercial species. Some of these “non-commercial” species, notably Lampreys and Eels, are actually important commercial species elsewhere in the world and could, if fashions change, become so in



Scotland, either as wild or farmed produce. Their present conservation as wildlife therefore contains an element of preservation for possible future economic value.

The “commercial” fish species have natural history value as well - the Salmon, for instance, is one of our largest native vertebrates (a 20lb Salmon is larger than the average Fox and a 40lb one is larger than the average Roe Deer) so fisheries management of salmon and trout has to balance the commercial and conservation aspects of these species. In that both these aspects benefit from any measures to increase the abundance of these species, there is mutual benefit as long as this is based on promoting their natural reproduction and the health of the environment on which they depend. Conflict does arise, however, if natural reproduction is abandoned as the source of fish for the fisheries and artificial stocking or ranching is adopted instead as these have genetic consequences for wild populations: hatchery rearing allows less fit individuals to survive and live to reproduce and cross-breeding between wild and farmed-strain fish can depress production in the wild as the hybrids produced are less likely to survive in the wild than pure wild strain fish. It is now known that even one generation of hatchery rearing reduces the fitness of fish. Additionally, factory methods of fish reproduction do not require any great attention to be given to the health of the freshwater environment on which all fish species depend, so they remove much of the support of the salmon and trout fisheries from the conservation of catchments.

## **7A.2: The Content of Freshwater Fisheries Management:**

Freshwater fisheries management is all about understanding how fish stocks “work” – or do not – within their catchments and over time. To do this evidence has to be collected by monitoring all the key factors that can affect fish and their fisheries and this is illustrated by the blue arrows in Diagram 7.2. Also shown in this diagram, by the red arrows, is how fisheries management can, on the basis of the evidences collected, operate at different levels, from catchment management planning up to the anglers themselves (“Evidence based fisheries management”). A key part of this is in providing information to people: to anglers to help them understand what they are finding in their catches (or lack of them) and to those who do the things in the catchments that can affect rivers and lochs – farmers, foresters, road-makers, industrialists. The work that they do can be done in ways that can be neutral or deleterious in different degrees (or even beneficial) to fish and it is an important part of the work of fisheries managers to inform them of the better ways that they can do what they need to do. Fisheries management is not actually about managing fish, fish do not need managing, they did perfectly well without it for millennia before humans appeared on the scene but they cannot cope with the things that humans do that make their lives difficult: over-fishing, blocking and polluting rivers, degrading catchments, introducing alien species, stocking with hatchery-reared fish that destroy the genetic adaptations of local populations, and so on. Fisheries management is therefore about managing the people who make the problems for the fish.

The role of a “Fisheries Manager” in this diagram is therefore to understand the impacts on fish stocks of the many natural and man-made factors that affect the freshwater environment (and therefore the fish) as well as the direct impact of any fisheries through such evidence gathering and then, on the basis of this, to respond appropriately. Such responses may include correcting unrealistic expectations of anglers if these are based on mistaken ideas about fish stocks in the past compared to the present, so the collection and analyses of historical catch data is also part of the work of a Fisheries Manager.

As is obvious from this diagram, “Fisheries Management” is a wide and varied field of many interconnections and parts, all of which need to be integrated for any effective, practical, programme – a Fisheries Management Plan.

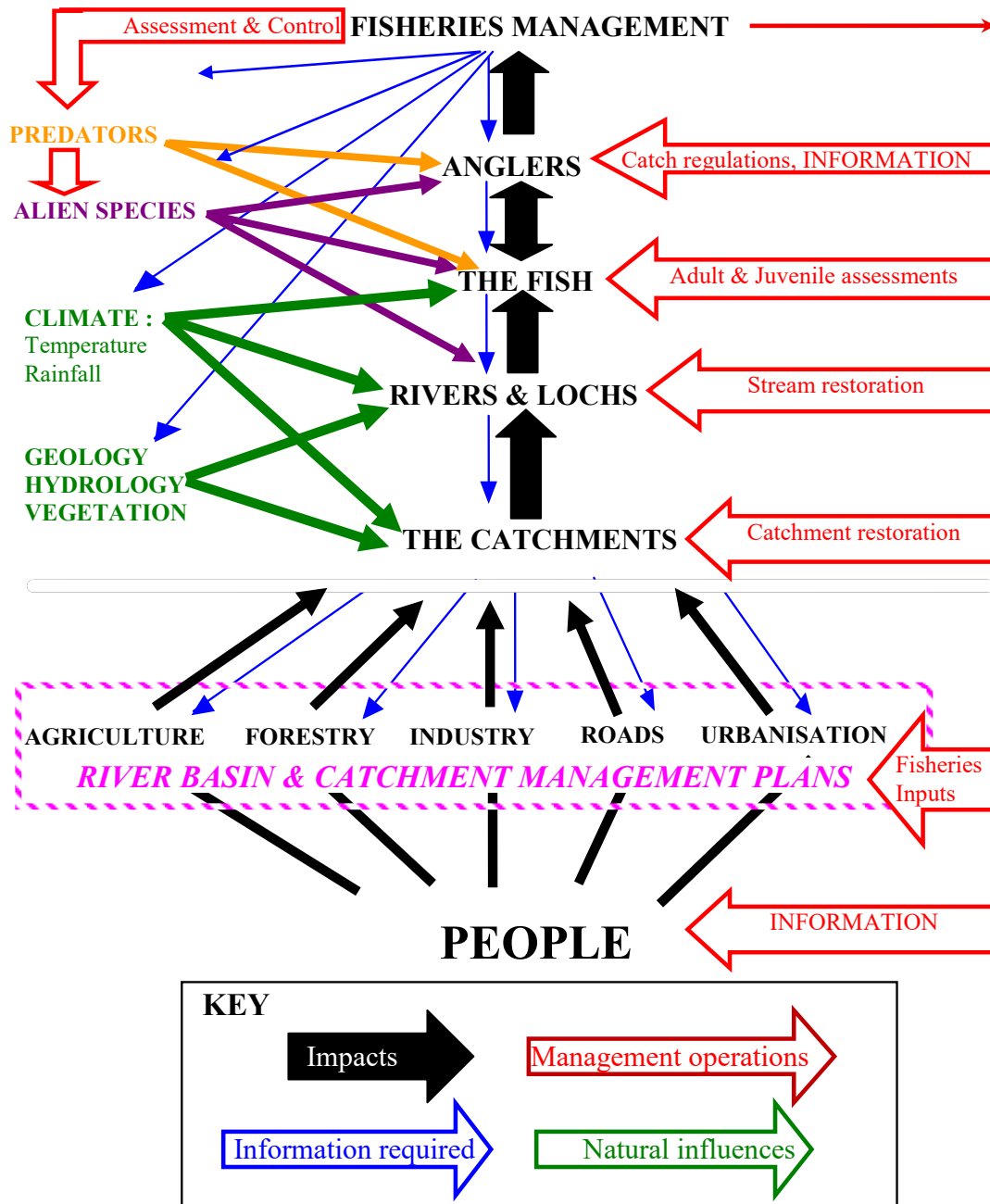


Diagram 7.2: The Content of Freshwater Fisheries Management

**7B: The Guiding Principles of the Fisheries Management Plan for the Tweed and Eye Fisheries District.**

These are consistent with: -

**(1) The NASCO guidelines for the management of salmon fisheries, 2012:**

NASCO and its Parties have agreed to adopt and apply a Precautionary Approach to the conservation, management and exploitation of salmon in order to protect the resource and preserve the environments in which



it lives. Accordingly, their objective for the management of salmon fisheries is to promote and protect the diversity and abundance of salmon stocks.

**(2) The EIFAC (European Inland Fisheries Advisory Committee) Code of Practice for Recreational Fisheries 2008: -**

Article 11.1: *The over-arching goal of recreational fisheries management is to ensure the long-term sustainability of fisheries resources thereby safeguarding the availability of these resources for future generations. Sustainability of fisheries resources includes conserving biodiversity at all levels, including genetic diversity, as well as supporting terrestrial and aquatic ecosystems.*

**(3) The Strategic Framework for Scottish Freshwater Fisheries (SFSFF): -**

a) *Scotland will have sustainably-managed freshwater fish and fisheries resources that provide significant economic and social benefits for its people.*

b) *Management decisions affecting freshwater fisheries and fish species should be underpinned by scientific evidence.*

**(4) The Environment Agency's Five Point Approach for the Restoration of Salmon**

and

**(5) The Resolution adopted by the River Tweed Commission (RTC) in March 2007 that: -**

*The Tweed and its tributaries should be wild fish fisheries.*

**and are that:**

1) Fisheries Management within the Tweed and Eye Fisheries District will aim to ensure robust, wild, stocks of those species that can be commercially exploited so that they can sustain angling pressures in the long term. This will be based on a thorough understanding of these stocks and how they are produced and affected by the local environment and by their fisheries as well as of how they might change naturally over time. The conservation of their genetic diversity will be as regarded as important an aim as the maintenance and increase of their numbers.

2) Those commercial species that are also of conservation value will be managed in accordance with that status.

3) Non-commercial native fish species of conservation value will be monitored and any problems affecting them dealt with as far as is practicable with the resources available.

The Tweed Fisheries Management Plan also operates within, and contributes to, the Solway Tweed River Basin Management plan of the E.U. Water Framework Directive and the Solway-Tweed Eel Management Plan. (*Note: the Eye Water is in the Scotland River Basin area.*)

**7C: The Structure and Function of the Tweed and Eye Fisheries Management Plan**

The Plan arranges and orders the gathering of the evidences needed to:

(a) assess the present conditions of the different stocks of the exploited fish species of the Tweed and, where possible, compare these with what they were in the past and

(b) assess if the stocks are at their full capacity or are able to reach this. On the basis of these assessments and comparisons, an appropriate Management Level for each stock is recommended to the RTC. The principal purpose of each of these Management Levels is to ensure enough spawners of each Salmon, Sea-trout and Brown trout run or population survive all the pressures on them to fully stock their spawning areas for their next generation



and to maximise their production of juveniles (Levels 4 and 5) or to make progress towards such conditions (Levels 1, 2 and 3). Ensuring sufficient spawning escapement is classified as "Output 1" of the fisheries management process and maximisation of juvenile survival as "Output 2". This procedure is illustrated in Fig 7.3.

These two outputs should result in both the preservation of the diversity of the Salmon, Sea-trout and Brown trout stocks and the maximisation of their abundances but the importance of conserving stock diversity in particular is recognised, i.e. no management action should assist stronger stocks to overwhelm or displace weaker ones. Stock diversity is the safeguard against a changing environment, the greater the range of stocks, the greater the adaptability and therefore resilience of the population to new factors and conditions. The diversity of Salmon stocks is also the basis for the long, ten months, Salmon fishing season of the Tweed. It is also clear that the relative abundance of different Salmon stocks varies over time, with Spring Salmon being dominant in some periods and Autumn fish in others and this changing context needs to be recognised as the natural phenomenon that it is and not regarded as a problem requiring management actions.

Defining the sort of management needed for each stock as a particular "Level" also provides a convenient and descriptive system for the members of a large organisation like the RTC to use to discuss fish stocks and their appropriate management.

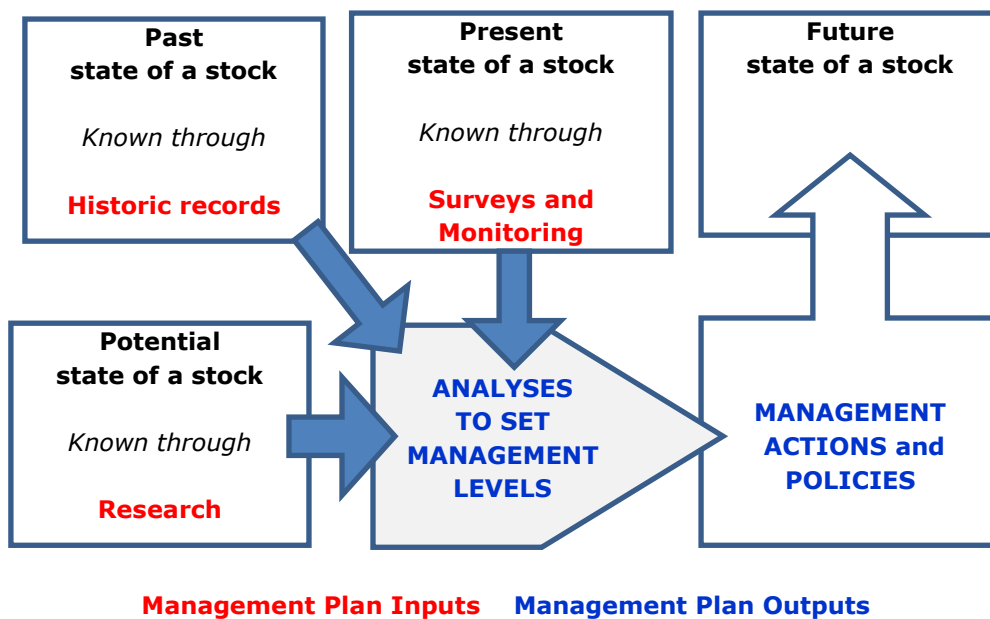


Fig 7.3: The processes of the Fisheries Management Plan

Each Section of the plan to do with fish is structured around the "Inputs" needed to make the assessment for each definable stock. These Inputs are information on:

- The different stocks of fish and their home areas.
- The quality and quantity of their nursery habitats (see Note A below).
- The extent and state of their juvenile stocks and trends in their abundance.
- The extent and effect of the fisheries on the adults and their stock structure and analysis of past catch records.
- The exploitation rate of the fisheries on each stock.
- and
- Where possible, the counting of adult populations to find if enough are escaping to spawn.

and they are applied to each exploited fish stock – Salmon, Sea-trout and Brown trout. Where there is evidence for distinct stocks or populations of species, e.g. Spring Salmon or the Whiting (Sea-trout) of the College Burn,



the aim is to set a separate Management Level for them if possible. This structure is illustrated in Fig 7.4. At present the other exploited stock, Grayling, cannot be managed in this way as their juveniles, which live in the main channels, cannot be electro-fished and assessed.

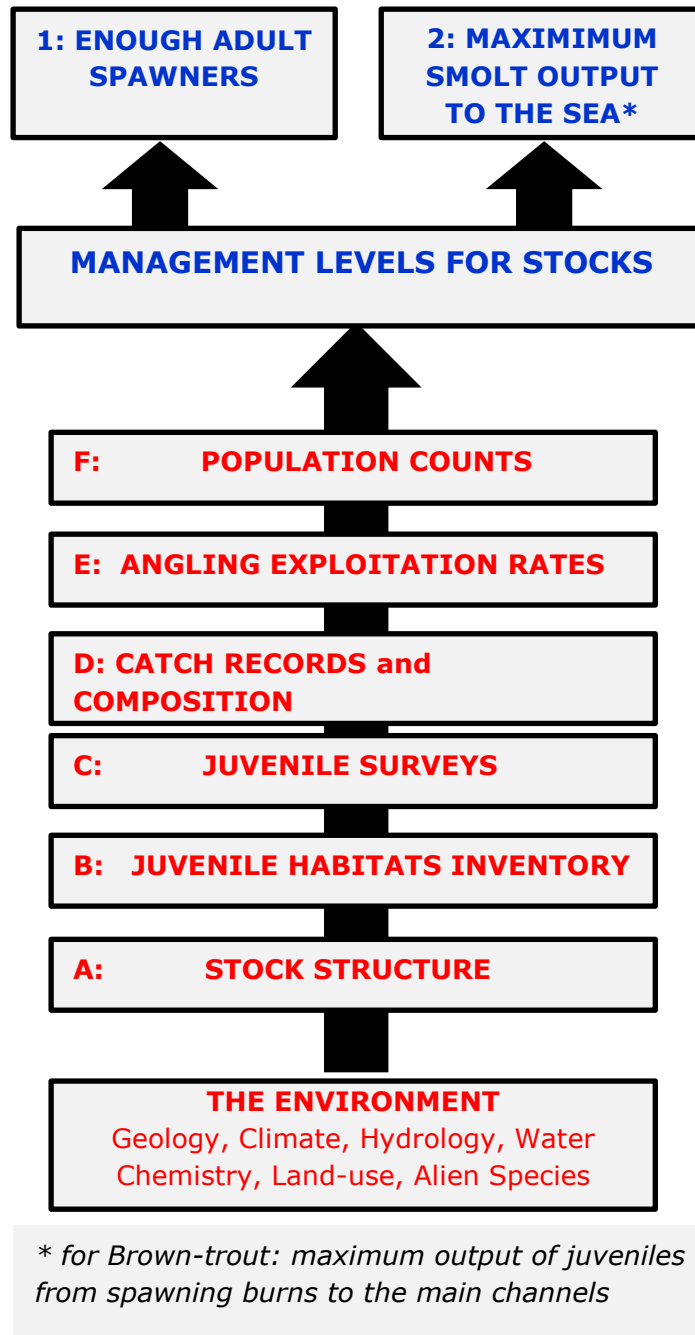


Fig 7.4: The structure of the Fisheries Management Plan sections  
Inputs are in red, Outputs in blue

The function of the Plan is to set out the policies to be followed over the next five years to gather the information needed as "Inputs". Not all the policies will be put into operation during this period, some may need particular



opportunities to arise before becoming practicable or more funding. Other policies may not run for the whole period of the Plan. Annual combined meetings of The Trustees of the Tweed Foundation and the Committee of the RTC are held each year to see if any further parts of the Plan should be executed and, if so, what the priorities will be. The "Outputs" are packages of policies and works aimed at achieving the two basic aims: - ensuring that enough spawners of each stock reach their spawning areas and maximising the output of smolts or juveniles from these - including minimising predation on them.

## **7D: Stock assessment and the Tweed management system**

As noted above, the approach taken for the Tweed is for each identified stock or population to be managed at one of five "*Management Levels*". A Management Level (ML) is the package of policies, work and regulations needed for a stock or population to achieve the two basic aims of fisheries management: (1) having enough adults to fully spawn its home area for the next generation and (2) maximum production of smolts, which includes the opening up any obstructed spawning areas, restoration of any damaged nursery habitat and minimising their losses to predation (for Brown trout the equivalent is output of juveniles from the spawning burns to the main rivers). The five levels and their relationship to stock assessments are shown in Fig 7.5: their relationship to Marine Scotland's Conservation Levels is straightforward:

1. MLs 1 and 2 equate to Conservation Level 3;
2. ML 2 to Conservation Level 2 and MLs 4 and 5 to Conservation Level 1.

The level of knowledge and data required for each ML actually increases as degree management intervention falls: when there are no fish, little management data is required, but simply to monitor a stock to ensure that it remains at full capacity requires considerable in-depth knowledge.

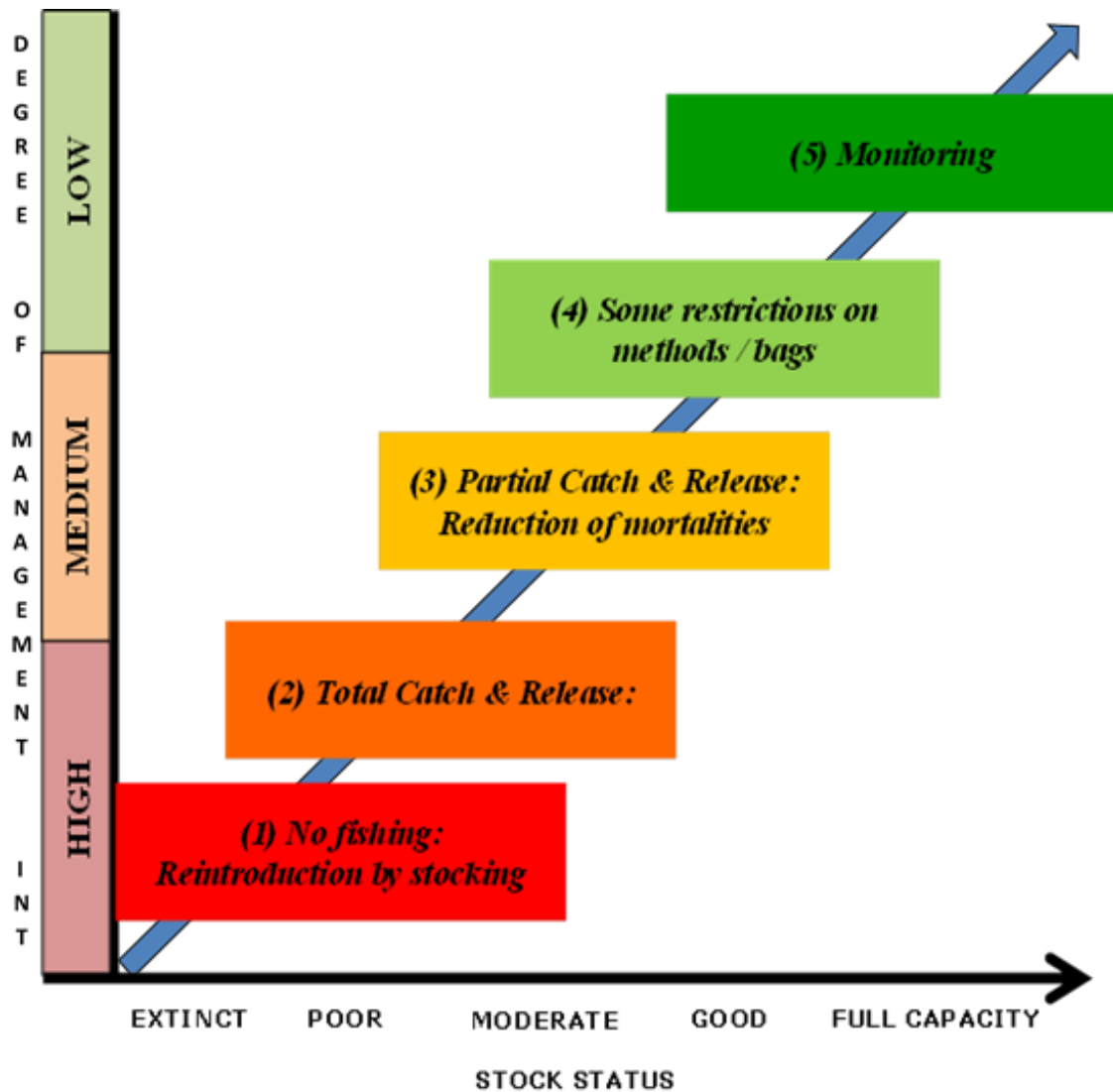


Fig 7.5: The Management Levels for Tweed fish stocks

These management levels also relate to different parts of the standard salmon Stock-Recruitment graph as shown in Fig 7.6a. A Stock-Recruitment graph describes the relationship between two parts of a life cycle – how many are “recruited” to the next stage from the previous, the “stock”. In Fig 7.6a the relationship is for the total freshwater phase of salmon life: how many smolts are produced from how many eggs. This is not a straight line relationship, it is curved because after a fairly low number of eggs are deposited in a river, the numbers of juveniles (and then smolts) produced levels off because young salmonids are territorial and there is always a limit to the number of territories that can be available in a river. The “bend” in the relationship is where more eggs will not produce more smolts and this is a key factor in management. Below the bend, where more eggs are needed, the priority is for there to be more spawners, so regulations reducing angling or netting kills are the priority. Above the bend, more eggs will not produce more smolts, so the management priority is to maximise the number of juveniles, firstly by minimising the losses to predation, especially the losses of smolts and secondly restoring damaged habitat (the former has a greater and more direct effect than the latter).



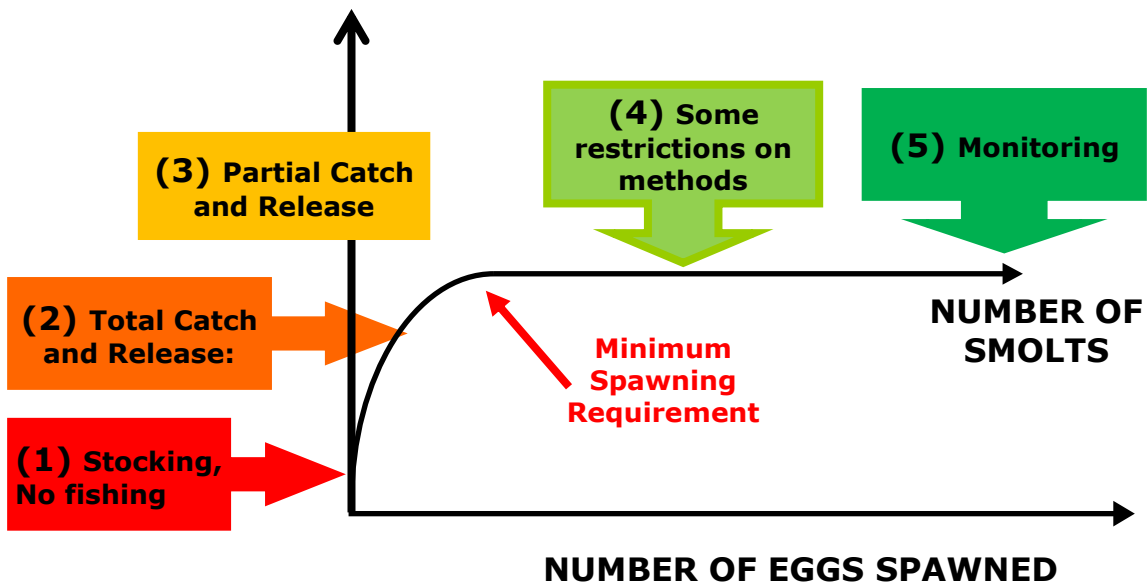


Fig 7.6a: The five management Levels and the Stock-Recruitment curve from eggs to smolts

This Stock / Recruitment relationship is crucial to understanding how fish populations work: it is the base on which many fisheries management actions take place, so an actual example is given in Fig. 7.6b below:

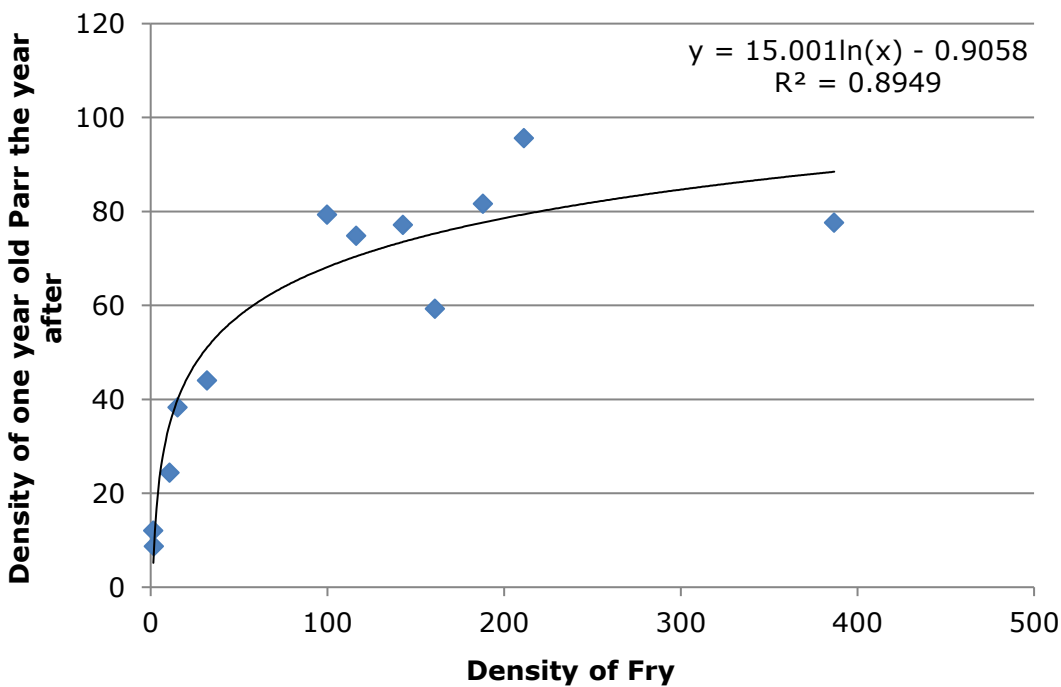


Fig 7.6b: The relationship between trout fry (0+, Young-of-the-Year) and one year old trout parr at the same sites on the Cardrona Kirkburn the year after (densities are numbers per 100m<sup>2</sup>).



What this shows is that beyond a density of around 100 per 100m<sup>2</sup> of fry, densities of one-year-old parr will not increase but will remain around the 80 per 100m<sup>2</sup> level, which can then be regarded as the "carrying capacity" of the burn for one-year-old trout. Below the 100 per 100m<sup>2</sup> fry density, more spawners and so more eggs and therefore more fry would make a difference to the numbers of parr, but once this level was reached more spawners would not.

**NOTE A: HABITAT WORK BACKGROUND AND STRATEGY:**

- 1 It is now over twenty years since The Tweed Foundation began its work on habitat and the context within which such work now takes place has changed greatly. In the early 1990s the whole field was unfamiliar to those working in fisheries in Scotland and a major part of the early work was importing the concepts from Ireland and North America and demonstrating that such ideas worked in this area. The Tweed Foundation then appointed its own Habitat Manager to undertake such work, and raised considerable sums of money for it.
- 2 The context is now quite different. Habitat work is now accepted as part of the proper work of fisheries management organisations, and indeed, in other environmental fields as well. Without good habitat, it has been realised, little can be done for the conservation of fish and other wildlife. Agricultural support mechanisms now take this into account, and will undoubtedly do more so in the future.
- 3 While obstacles to fish movement (Habitat Quantity) will always remain of particular interest to fisheries organisations such as the RTC (which has a statutory remit to improve fish passage), habitat quality in and around rivers is of much wider interest. Fencing of banksides to promote natural revegetation and create buffer zones to run-off is of interest to SEPA (from the pollution / run-off aspect), SNH (wildlife corridors), the Borders Forest Trust (riparian woodlands) and farmers and landowners (Rural Stewardship funding, etc.). All these bodies, and others, have to attract funding for such work, which contributes to the Tweed interest, the protection of the existing quality of nursery area habitat.
- 4 In this changed environment, the Tweed Foundation's approach to general riverside habitat work has also changed and is now largely indirect, encouraging other organisations and advising them on the fisheries aspects of such work. This involves:
  - a) Supplying other organisations with "added-on" fish reasons for their work. The Salmon is the Icon of the Tweed, as well as being very obviously an economic asset to the area that depends on good environmental quality.
  - b) Encouraging habitat protection and restoration at the policy and catchment levels, such as extensification of grazing, wetland restoration, native woodland regeneration and reduction in fertilizer run-off.
- 5 It should be noted that the current climate change predictions for this area are for wetter winters and drier summers, with more extreme storm events. Well-vegetated banks will protect against higher and more frequent spates increasing erosion and damaging habitat, giving some insurance for the fisheries of the catchment against the effects of climate change.
- 6 The Tweed Foundation's current tactics on habitat protection and restoration are therefore to undertake direct action only in areas of specific fish interests ("Attacking" problems directly affecting fish stocks of importance) and otherwise working indirectly through and with others to upgrade the habitat of the catchment generally ("defending" it against degradation and the impacts of climate change).