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Atlantic salmon life stage terminology-a review of existing usage and proposal for improvement

by

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ABSTRACT

A list of terms currently used in North America to refer to the different life stages of the Atlantic salmon is presented. The terminology list includes designations for alevin, fry, parr, precocious parr, smolt, post-smolt, salmon, virgin grilse, virgin multi-sea-winter salmon, kelt, as well as both grilse and multi-sea-winter salmon which have spawned either once previously or more than once in consecutive or alternate years. Certain designations have been subdivided by age with age of adult salmon being defined in sea-winters.

INTRODUCTION

The terminology currently used to describe the different life stages of the Atlantic salmon (*Salmo salar L.*) is confusing. This confusion is because of the complex life history of the salmon and lack of clear-cut definitions of the terms presently used. There is inconsistent and improper usage of existing terms which often causes misunderstanding of intent. In this paper, we attempt to clarify this situation by presenting what we believe

to be the most appropriate usage of terms. This is done in the interest of developing a greater degree of uniformity in explicitly describing Atlantic salmon life stages. This paper is presented to generate discussion and comment on the subject, with particular reference to the proposals we advance.

REVIEW OF TERMINOLOGY

The term Atlantic salmon is used in this review to refer to all life history stages of the species.

The first stage through which the salmon pass after hatching is termed the alevin. In general, this encompasses the period during which the young fish is entirely dependent upon the yolk sac for nutrition. This stage is usually found within the gravel.

The term fry is frequently used to designate the stage from complete absorption of the yolk sac to the end of the first year of post-hatching life. As stated by Allan (1967), this usage is not appropriate. One-year smolts occurring in southern England and suspected to be present in southern Nova Scotia would not have passed through the parr stage normally between the fry stage and the smolt stage. Also, as the distinct vertical dark markings of the parr are clearly discernible shortly after the fish emerge from the gravel, it seems inappropriate that these parr-like fish be called fry. We, therefore, suggest that the term fry be used to define that stage beginning with independence from the yolk sac as the primary source of nutrition and terminating with dispersal from the redd, i.e. the gravel bed in which the eggs were initially deposited. Fry are found over the redd after emergence from the gravel and are capable of feeding, although vestigial traces of the yolk-sac may remain. The duration of this stage is short and normally measured in days.

We find that the use of a calendar date to define the termination of the fry stage such as the June 30th date as proposed by Allan (1967) is inappropriate. This is because the use of a particular date to define the end of the fry stage is not considerate of the wide variation in growth and development rates over the geographic range of the species.

The parr stage, occurring after termination of the fry stage is often subdivided according to both age and size. Age designation is certainly the most precise usage but has limited practical application because of the time required for age determination in cases where samples are large and must be processed live. Size designation is less explicit but of more practical value when dealing with large numbers of fish as in the situation when estimates of stream resident populations are carried out. The samples collected for such population estimates are often divided into three categories: large parr, small parr and parr of age less than one year from time of hatch. Large parr are considered to be those fish which are large enough to smoltify the following spring. The large parr group is usually comprised of different age-classes, all exceeding a minimum operationally defined size limit which varies from river to river.

The term fingerling, although occurring in the literature, has been excluded from our terminology list since its usage is so inconsistent, i.e. it is applied to both size and age groupings.

Underyearling is a collective term used to designate any stage from time of hatch to one year thereafter, i.e. it includes alevins, fry and parr less than one year from time of hatch. This term is also omitted from our terminology list because, like fingerlings, it is nonspecific.

Smolts are defined as silvered fish migrating seaward in the spring, capable of surviving natural transition from fresh water to salt water. We note the occurrence of migrating parr into and out of various water impoundments at different times; these fish should not be designated as smolts.

The post-smolt stage refers to the first year of life at sea; a period extending from time of departure from river to the end of the first winter at sea.

With regard to the classification of adult fish, we suggest that the terminology consider both age and state of sexual maturity. Age of adult fish is designated by either the number of sea-winters or the number of sea-years. Both would appear to be appropriate, but the sea-winter designation is more specific than the sea-year.

Allan (1967) also used the sea-winter designation in the classification he proposed. Designation of sea-winters refers specifically to the number of winters elapsing since the fish initially entered the sea as a smolt and is used for reporting total sea age regardless of spawning history.

Use of the terms grilse and large salmon to describe both specific life stages as well as loosely defined groupings of fish has resulted in ambiguity with respect to their meaning.

We recognize grilse to be a definitive term representing adult fish which have first matured or are about to mature after one sea-winter. We also note that such fish may recover from spawning, return to the ocean and repeat the spawning cycle in a later year (or years). We contend that these fish remain grilse but may now be qualified as previous spawning grilse as opposed to being merely called large salmon as is current practice. Virgin grilse, i.e. one-sea-winter maturing fish, return to the river systems as comparatively small individuals, up to 5 lbs., (2.3 kg) in the Maritimes, or up to 6 lbs., (2.7 kg) in Newfoundland. A widespread practice developed whereby these small fish were designated "grilse" by reference to their weight. This division was made on the assumption that these were one-sea-winter maturing fish. Subsequently, usage of the term "grilse" was expanded to include all one-sea-winter fish (i.e., $\leq$ 2.3 kg or $\leq$ 2.7 kg) regardless of their location and without consideration as to state of sexual maturity. This latter size-class usage is often incorrect since one-sea-winter fish in the ocean form a group comprised of both sexually maturing and non-maturing fish. We propose that the loose grouping of presumed one-sea-winter fish from both river and ocean be referred to as small salmon.

The other loose grouping of fish comprised of individuals in excess of 2.3 kg or 2.7 kg may be referred to as large salmon. Where aging records are available, the components of this group should be identified as (1) previous spawning grilse and, (2) multi-sea-winter salmon. This latter segment is comprised of both virgin multi-sea-winter salmon and previous-spawning-multi-sea-winter salmon. Multi-sea-winter salmon constitute those adults spending two or more winters at sea before initial spawning.

We have chosen to introduce previous with respect to

spawning rather than to use "repeat", although the latter is widespread in current usage, because the term previous spawning may be applied to fish at any time after initial spawning. The use of "repeat" in this context is only appropriate after two or more spawnings.

The terminology designated for fish with a spawning history considers: (1) the age of the fish at initial spawning, (2) the temporal pattern of its spawning migrations, and (3) the number of previous spawnings. We suggest that previous spawning fish be categorized according to their designation at first spawning. This means that an adult fish which spawned initially as a grilse remains a grilse regardless of spawning history or age thereafter and is accordingly designated as a previous spawning grilse. The temporal pattern of successive spawnings is frequently consistent for an individual fish in that it spawns every year or every other year. Fish attaining sexual maturity in these two patterns are designated as consecutive or alternate spawners, respectively. The number of spawning occasions provides a further division (e.g. consecutive spawning grilse, second spawning).

We do not consider the terminology for feeding salmon in the sea proposed by Allan (1967) to be necessary. Instead, we suggest that these fish continue to be categorized according to their age, spawning history, and current state of sexual maturity.

TERMINOLOGY LIST

Atlantic salmon — Encompasses all stages described below.

Alevin — Stage from hatching to independent feeding.

Fry — Brief transitional stage beginning with independence from the yolk sac as the primary source of nutrition and terminating with dispersal from the area over the redd. Duration of this stage would normally be measured in days.

Parr — Stage initiated by dispersal from over the redd; parr markings usually discernible. This This stage lasts until fish become silvered and commence migration downriver to sea. Parr stage is subdivided by age:

o + parr are less than one year old
1 + parr are one to two years old
2 + parr are two to three years old
3 + parr are three to four years old
etc.

Parr stage may also be subdivided by size into large parr, small parr, and parr less than one year from time of hatch (0 + parr). Large parr are those fish which are expected to smoltify the following spring and therefore may be comprised of different age-classes. Zero + parr represent the current year's hatch.

Precocious parr — Sexually mature male parr.

Smolt — Silvered post-parr migrating seaward in the spring, capable of surviving natural transition from fresh water to salt water.

Post-smolt — Stage during first year of life at sea; period extending from time of departure from river to end of first winter at sea.

Salmon — All adult fish regardless of age or state of maturity; begins after the post-smolt stage. Age categories of adult fish described according to the number of sea-winters occurring after smolt migration and initial entry into the sea are 1-, 2-, 3-, and 4-sea-winter salmon, respectively. This system of designation is used to refer to the total sea age of the fish only, regardless of previous or future maturity status. Feeding salmon can be categorized by this system.

Apart from the case of precocious parr, sexual maturity is associated with age of adult fish and resulting categories are as follows:

Grilse are adult fish which first matured or are about to mature after one-sea-winter. Grilse collectively refers to virgin grilse and previous spawning grilse.

Virgin grilse refers to 1-sea-winter adult fish which mature or are destined to mature in same year. This term should only be applied to one-sea-year fish returning to river systems or whose advanced state of sexual maturity has been determined.

Previous spawning grilse refers to adult fish which matured initially as 1-sea-winter salmon. Previous spawning grilse spawning two times or more are further sub-divided according to whether they mature in consecutive or alternate years. Consecutive spawning grilse spawn each year while alternate spawning grilse feed one year at sea before a subsequent spawning. Previous spawning grilse spawning multiple times and not following consistent consecutive or alternate year spawning patterns are few and therefore are not designated to specific groupings.

Multi-sea-winter salmon are adult fish which first matured or are about to mature after having spent two, three or four winters at sea and are correspondingly categorized as 2-sea-winter, 3-sea-winter and 4-sea-winter salmon.

The preceding categories may refer to either virgin multi-sea-winter salmon or previous-spawning multi-sea-winter salmon; the latter can be further subdivided according to the pattern of spawning repetition into consecutive spawning multi-sea-winter salmon and alternate spawning multi-sea-winter salmon. Previous spawning multi-sea-winter salmon not following consistent consecutive or alternate year spawning patterns are few and therefore are not designated to specific groupings.

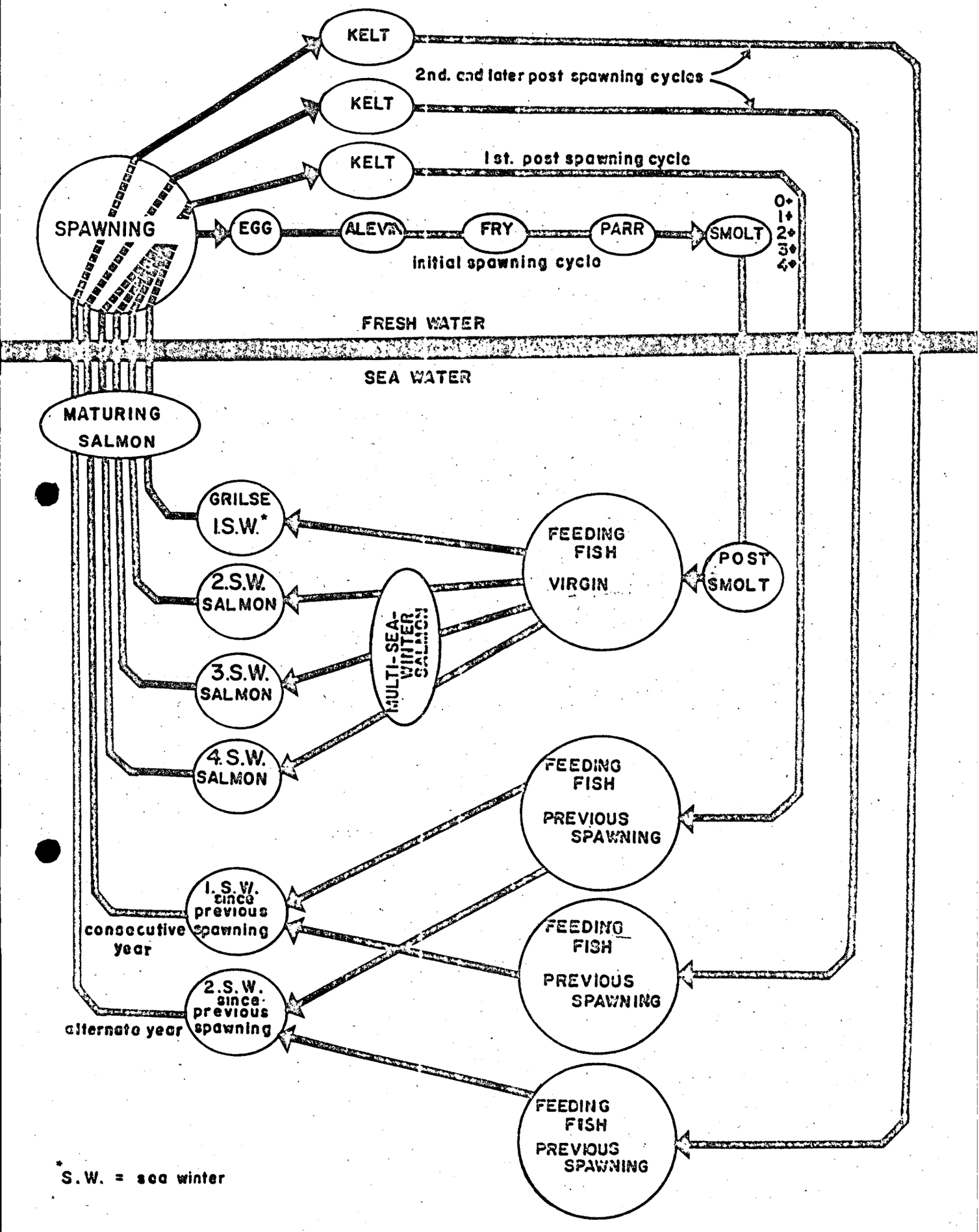
In absence of information regarding age and degree of sexual maturity in adult fish, the following categories result:

Small salmon This term will be used in referring to adult fish which are less than or equal to 5 lbs. (2.3 kg) or, depending on geographical location, 6 lbs. (2.7 kg). This is the weight normally attained by a one-sea-winter fish. Information as to age and state of sexual maturity will not normally be available for members of this group.

Large salmon This term will be used to designate any adult fish in excess of 2.3 kg or 2.7 kg (depending on geographical location), in absence of aging information.

Kelt — A spent or spawned-out adult salmon found in freshwater portion of river system (term synonymous with black salmon or slink).

The following schematic drawing of the life history of the Atlantic salmon will facilitate understanding of the terminology presented within this paper.



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REFERENCE

Allan, I. R. H., 1967. Revised terminology list for Atlantic salmon (*Salmo salar L.*). Submitted to International Council for the Exploration of the Sea. Salmon and Trout Committee, C. M. 1967/M:19.