**Study on distribution and behaviour of brown trout (Salmo trutta L.) in Lake Thingvallavatn Iceland**

**Information on new tagging project given by the project leader Johannes Sturlaugsson**

**The trout and the lake**

A study on brown trout (Salmo trutta L.) behaviour by using data storage tags (DST 200) from Star-Oddi started in Lake Thingvallavatn in Iceland in the winter 1999-2000. The trout in Lake Thingvallavatn is known for its large size (up to >13 kg), but information on their ecology is scarce. Following damming of the outlet of Lake Thingvallavatn trout population(s) has decreased dramatically. In order to improve the status of the stock some projects have now been established. One of them is the DSTs behaviour study.

Lake Thingvallavatn (size 83 km2 ;maximum depth 114 m) received its name from Thingvellir situated beside River Oxara that runs into Lake Thingvallavatn. For those interested in history it was at this Thingvellir where the world's first parliament was established in the year 930, where it was located until 1798 when it was moved to Reykjavik. That area and large surrounding area is now one of the national park of Iceland.

**The project aims and structure**

The DST study has the objective to map the behavioural parts of the trout ecology in the Lake Thingvallavatn (distribution vs. time/conditions), and in River Oxara that are their main spawning ground. The long-term aims are that the new information received from this study will be part of the basic information used to follow up conservation/improvement of the trout stock(s).

The Icelandic Institute of Freshwater Fisheries conducts the research project on behavioural ecology on trout in Lake Thingvallavatn. Other participants in the project are the National Power Company (Landsvirkjun), Armenn Flyfishing Association (Ármenn) and Star-Oddi (the manufacturer of the DST). Large trout spawners up to 7.5 kg in weight and 83 cm in fork length were captured on October 19th in River Oxara. The captured fish consisted of fish fully spawned, partly spawned and mature fish that had not started spawning. Part of the fish were transported to hatchery in relation to stocking program and 11 of those were tagged externally with DSTs. The trout were then transported back on November 1st and released in Oxara at the site where they were captured. Data from DSTs will be recovered the next years (see tagging/recaptures methods here below) and other information will be sampled for comparison during the DSTs sampling period.

**The DSTs measurements**

The DSTs used, record the fish depth (pressure) and corresponding ambient temperature over a 12-month period. Each DST has two sampling intervals, one-hour interval of measurements in the beginning and in the end of the total recording period and then 30-minutes sampling interval over a 5-month period (May - September 2000).

This makes it possible to analyse in more details the depth and the temperature experienced by the trout during the summer-autumn period. During that period their feeding activity is of special interest because of peak in the food abundance e.g. their known main prey type the pelagic small morph of arctic char (Salvelinus alpinus L.). In addition the variance of temperatures are highest during the summer-autumn period, opening more possibilities in locating the trout based on that pattern.

**Use of DSTs data**

The DSTs data will be evaluated to get overall vertical distribution of trout during given condition within periods ranging from days to seasons (i.e. light condition, weather condition, prey vertical distribution). The DSTs information will also been used to locate the trout approximately in the horizontal zone, but such geographical locations are based on the temperature distribution in the lake. Example of such information includes timing of river entry and river departure in connection to the spawning. Altogether the evaluation of the data therefore not only enables mapping of the distribution and corresponding behaviour of trout but also gives possibilities to get detailed knowledge on the relationships/mechanism involved.

**Tagging and recapture methods**

Tagging were based on fastening the DSTs by a modified Carlin method. Conventional T-bar anchor type tag was also inserted for double tagging reasons, giving information on expected tag shedding with respect to long-range in time. The active DST was placed adjacent to the dorsal fin and fastened to a flotation tag of the same size (dummy DST) at the opposite site of the dorsal fin. The dummy DSTs were covered inside with golden film for advertisement reason and a label in the active DST included information on the tag and the contact information (the address & phone of the Institute of Freshwater Fisheries). Here it should be noted that the high visibility of the DSTs was chosen because the trout is "king of the area" at least there are no predators in the lake which threaten the tagged trout fishes. The stainless steel wire used for fastening had 2-point attachment going through the basal of the dorsal fin. That way these two tags are held together as a unit, which is positive buoyant. The purpose of positive buoyant tag unit is to have extra recaptures of DSTs from stranding of such units. Such DSTs recoveries can add considerable to the total tag recoveries. The DSTs recoveries from fish captures are based on traditional net and angling fishery in the lake and from a planned DSTs project seine net fishing at the spawning grounds that has just the aim to release the DSTs from tagged fish. Double Tagging experiments using DSTs on anadromous brown trout and char, has given stranding of DSTs, both DSTs that were slightly negatively buoyant and the more when using the positive DST unit as used on the trout in Lake Thingvallavatn. These strandings are mostly derived from DST shedding from living fish as verified by recaptures of previously DST equipped fish without DSTs that had been tagged months to years earlier. The stranding of DSTs is in addition derived from situation when they float from fish after their natural mortality. The tags shedding periods observed when using this external tagging method are ranging from 4-16 months based on the mentioned experiments of sea trout and char, with exceptional recaptures of char still equipped with the DST 27 months after tagging.

The shedding happens due to the wires being pulled slowly up through basal of the dorsal fin and finally the fin itself as the fish grows. The time this shedding takes is partly depended on the growth rate of the fish. Due to slow retention time the trail of outgoing tags wire are healing in the same rate of time during the shedding period. Using the mentioned external tagging method therefore does avoid injuries that would be involved of fixed fastening of tag as it would then be compressed into the fish flesh as the fish increases its size. In addition it also often serves the research objectives better to have the DSTs measurements done externally (sensors versus external environment) compared to the internal options that also sometimes involves increased risk of tag loss from recaptured fish due to gutting of tagged fish without noticing the DST.

**References:**

Skarphedinsson, Ö. Urridadans, Astir and orlog storurridans i Thingvallavatni. Mal og Menning, Reykjavik: 296 p.

*Pic.1: Trout male spawner from Lake Thingvallavatn in tagging tube during DST tagging (photo/Johannes Sturlaugsson).*

*Pic. 2: DST tagged trout female spawner from Lake Thingvallavatn. The DST and its placement beside the dorsal fin are clearly visible (photo/Johannes Sturlaugsson).*

*Pic. 3: Johannes Sturlaugsson project leader with trout female at River Oxara the most numerous spawning grounds of trout from Lake Thingvallavatn, 1st November 1999. Despite the large size of this fish it was amongst the smaller ones captured at the spawning grounds of River Oxara.*

Additional information is available in Icelandic in the Arodur newsletter (November 1999) of the Armenn Flyfishing Association, see also their website, http://armenn.is/