

THIS NEW RESIDUAL WATER MACHINE IS ALL ABOUT FISH

Revitalisation, residual water utilisation and fish migration, all combined in a compact system: the winning formula behind the all-new hydrodynamic screw by HYDROCONNECT GmbH opens a world of new ecological and economic perspectives for hydropower.

The patented HYDROCONNECT system with Albrecht fishlift INSIDE consists of a hydrodynamic screw solution based on a counter-threaded helical fish conveyor screw. The twin-screw construction forms a compact, tube-encapsulated unit with solidly bonded components. Both the inner and outer screw blades are welded gap-free to the enclosing tube wall. The entire drum is anchored outside the water by means of flat belts. The downward water flow along the external threads drives the rotational movement of the generator, thus transforming the water's gravitational potential energy into electrical power. As a result, the counter-threaded internal helix functions like an Archimedean conveyor screw that gradually moves the water back up from the lower reaches of the river. Dimensioned to the size of the largest local fish species, the conveyor screw can be used by fish as a convenient "lift" to the headwater region. Passing through the conveyor tube poses no risk of injury for the fish, as all components of the twin-screw setup are bonded to each other gap-free. Besides keeping the fish from harm, this also reduces friction loss, thereby increasing overall efficiency. The entire construction rotates as one solid unit at the relatively slow rotational speed of 20 revolutions per minute.

A LIFT FOR FISH

If a fish swims into the intake area of the inner helix, the threaded shaft will gently scoop it



The HYDROCONNECT trial installation on the River Jeßnitz

photo credits: HYDROCONNECT

up, together with some water, transport it upstream and finally release it into the headwater. The water caught in the individual compartments of the moving shaft follows an upward or downward "driving" movement along the individual threads.

Common hydrodynamic screws are generally considered to be "fish-friendly" in the downstream direction. However, their method of using an upright trough requires a certain minimum distance from the rotating screw, which poses a certain risk of injury for the fish. With this new system, however, this risk has been safely eliminated. On their way downstream the fish pass through the tidal barrages by way of the outer thread. The motive water flows out at the lower reaches of the river. This generates the attraction current required to guide the fish entering the fish lift towards the inner helix. The special way the drum is anchored to the outer enclosure a solid connection to the riverbed, which is particularly important for substrate-bound fish species.

SCIENTIFIC RESEARCH

Winter 2012 saw the startup of the first trial installation on the River Jeßnitz in the province of Lower Austria. The location chosen for this purpose was Nebruck near the town of Scheibbs, the site of an old weir gate with a gross head of 3.15 m. The small diversion power plant was in operation but did not have a fish ladder in place. The river is situated in the Hyporhithral region, home to several indigenous fish species, especially brown trout, rainbow trout, grayling and bullhead.

The trial installation had an outer diameter of 1,400 mm, with an 800 mm inner fish conveyor screw. The facility has a 200 l/sec flow rate and rotational speed of 20 rpm, generating more than 4 kW of electrical power. Every second the inner helix transports around 10 litres of water upstream.

Scientific support for the project was provided by a team from the Department of Hydrobiology and Aquatic Ecosystem Management (IHG) of the University of Natural Resources



The attraction current produced by the motive water guides the fish towards the "fish lift".

photo credits: HYDROCONNECT



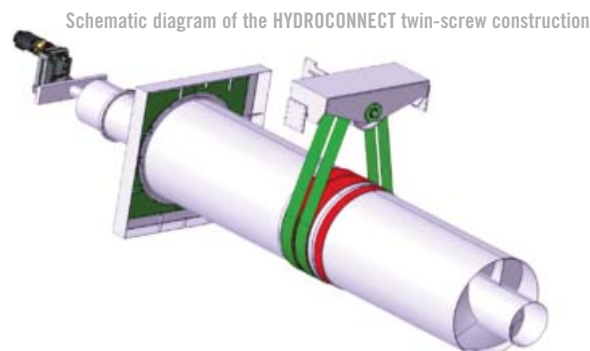
photo credits: HYDROCONNECT

and Life Sciences in Vienna, which was headed by Professor Dr Mathias Jungwirth. Focus-sing on fish ecology, the team set out to determine the species and age range of the fish that preferred to use the “lift”. Their second research goal was to assess the potential risk of injury for the fish passing through or using the lift. In doing so, the team also measured and interpreted the flow conditions at the entry point at the lower end of the construction.

It was only a few days after the installation had completed when the scientists observed numerous fish of the above-mentioned species using the lift voluntarily and without any difficulty. The IHG team conducted several in-depth experiments involving the controlled release of individual species and came up with extremely positive results. Monitoring the behaviour of the fish allowed them to conclude that differently sized fish of four main species were using the fish lift without any difficulty or injuries. The team was particularly impressed with the way the relatively small-sized bullheads were adapting to their new means of upstream transport. A highly substrate-bound variety, bullheads are an important indicator for the functionality of the HYDROCONNECT twin-screw fish lift.

Before they can continue their migration in the headwater, the fish are led into a collecting pool, where members of the scientific team were able to perform a “health check” on them. Examining the fish thoroughly, the scientists found no signs of injury whatsoever on any of them.

In their final report of May 2012, DI Bernhard Zieringer and Professor Jungwirth stated: “The overall result of our initial research can be taken as a clear indication that this new type of fish conveyor screw has excel-



graphics: HYDROCONNECT

lent future potential for solving the problem of upstream and downstream fish migration, especially in small to middle-sized water bodies with trout and grayling populations where space is limited or drop-level constructions and/or weir gates are present.”

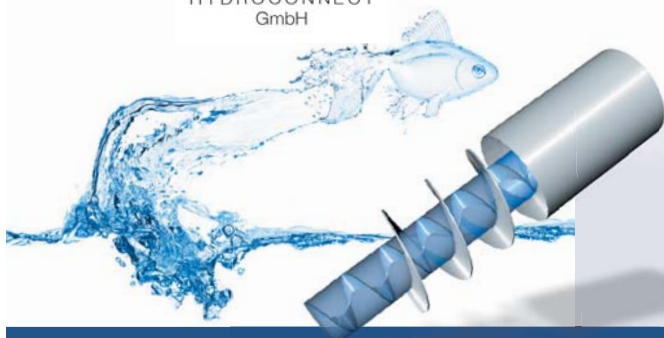
Based on these promising research results, further tests are currently being conducted to study the behaviour of migrating fish as they use or pass through the fish lift. With their Albrecht fish lift INSIDE, HYDROCONNECT offers a wide variety of possible applications when it comes to improving the ecological conditions around ground sills, hydropower plants and lateral structures, as required also by the EU Water Framework Directive. As an economically viable alternative to turbines, the new conveyor screw design offers an ingenious way of combining ecological sensitivity and species conservation with efficient hydropower generation.

KEY BENEFITS:

- ◆ The compact residual water machine is the first one of its kind to offer fish a completely safe, energy-saving way of upstream and downstream migration across tidal barrages and weir facilities.
- ◆ High energetic efficiency
- ◆ The gap-free drum construction of HYDROCONNECT hydro dynamic screws eliminates water loss
- ◆ No risk of injury for migrating fish (as certified by scientific expert reports issued by the Institute of Hydrobiology and Aquatic Ecology Management (IHG) of the Vienna University of Natural Resources and Life Sciences (BOKU).
- ◆ HYDROCONNECT fish lifts are also suitable for areas with highly confined space conditions.



HYDROCONNECT
GmbH



HYDROPOWER SCREW

for river fish migration



- upstream and downstream fish passage
- no harm to fish population
- electric power generation
- minimal space requirements

tested by BOKU Vienna
University of Natural Resources and Life Sciences

www.hydroconnect.at

