

## Fish Protection Systems

Behavioral barriers and guidance

### Key features & benefits

- Deters fish from entering water intakes
- Suitable for most intake types
- Range of site and species specific technology available
- Meets increasing demand for marine life conservation worldwide
- Safeguards the future of fish and other aquatic species

### How we create value

- Helps to meet the requirements of the US EPA regulation 316(b) and the recommendations of the UK's Best Practice Guide
- Significantly reduces trash handling and disposal costs through a decrease in fish kills
- Helps eliminate plant outages due to inundation by large shoals of fish



# Fish Protection Systems

## Providing Innovative Solutions for all Aquatic Environments

### Protection of Aquatic Life

Wherever large volumes of water are abstracted from rivers, lakes, reservoirs, estuaries or oceans, preventing fish and other species from entering water intakes is becoming increasingly important. Ovivo's fish protection systems are designed not only to meet legislative requirements and increasing demands for environmentally friendly practice, but also provides operational benefits to the plant owner by significantly reducing trash handling and disposal costs through a reduction in fish mortality. Ovivo's fish guidance systems can also help eliminate plant outages that can arise from the sudden influx of a large shoals of fish which can result in high headlosses leading to equipment damage.

Ovivo offers some of the world's leading technologies in fish protection, from traditional physical screen barriers to non-physical, behavioral barriers and fish recovery and return systems. We offer a portfolio of different products and techniques that are known to work best for specific species, fish life stages and intake environments.

### Physical Methods

#### Passive screening

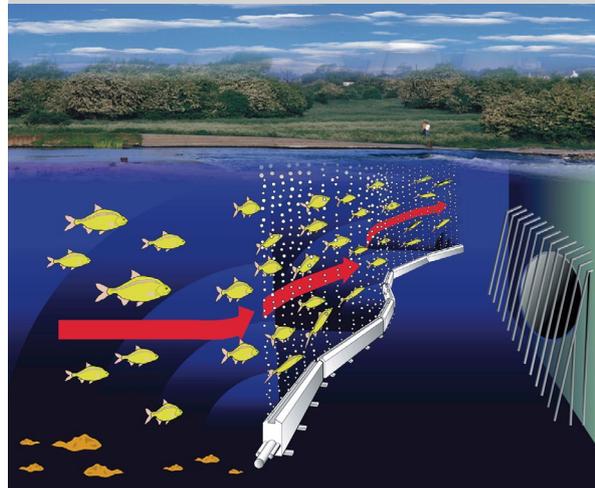
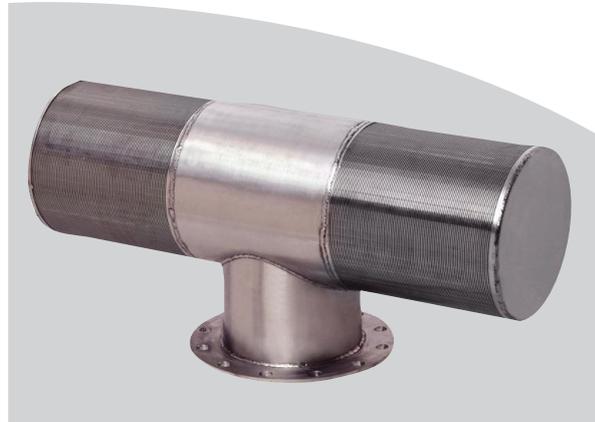
Passive wedge wire screens provide a reliable, robust screen that has no moving parts and are suitable for screening aquatic life and debris from the intake water. Ovivo's passive screens are "fish-friendly" and, with the appropriate choice of slot width and slot velocity, can provide a barrier to eggs or larval/postlarval stages. Passive wedge wire screens are regarded in the UK as the best available technology for juvenile and larval fish protection.

#### S.I.M.P.L.E.<sup>®</sup> Fish Handling Screens

The S.I.M.P.L.E.<sup>®</sup> screen is an adaption to band and drum screens that provides a recovery and return system for fish (FRR). It is often used in conjunction with an acoustic based fish behavioural barrier. The combined system complies with the recommendations for large sea water intakes (>5m<sup>3</sup>/sec) as published in the UK EA document : *Screening for Intake and Outfalls: a best practice guide*.

#### Behavioral Barriers

Behavioral Barriers use non-physical fish deterrent methods that rely on the natural response of fish to certain stimuli to deflect fish away from water intakes. These systems are ideal for use when physical screening is impractical or undesirable due, for instance, to the fish species sensitivity to being physically handled. They are sometimes used in conjunction with a FRR system. Fish have a number



of well developed senses and are able to detect and react to different stimuli (light, sound, vibration, electrical charge, etc). Certain stimuli are best suited to particular species: for example, salmon smolt are more responsive to sound than eels, who respond better to light. Ovivo offer a number of different behavioral barriers which can be used alone or in combination depending on the specific species and the barrier's objectives.

#### Acoustic and Bio-Acoustic Screens

The most widely used behavioral system, acoustic barriers are suitable for deflecting migrating fish, resident coarse fish, estuarine and marine fish.

#### Intense Modulated Light

Used in conjunction with other systems, this is suitable for deflecting fish that are less sensitive to sound, such as eels.

#### Bubble Curtains

Bubble curtains are suitable for guiding fish to a point downstream.

### Acoustic Screens

Acoustic screening may be as much as 95% effective.

Ovivo offers two types of Acoustic Fish Deterrents (AFDs): the SPA Sound Projector Array and BAFF Bio-Acoustic Fish Fence.

#### SPA Sound Projector Array

An array of underwater sound projectors, used to produce a diffused field of sound. Sound Projector Arrays are primarily used for wide area deterrents, for example in front of water intakes or for pumping stations sumps.



#### BAFF Bio-Acoustic Fish Fence

The BAFF<sup>™</sup> is primarily used for more precise fish guidance (into a bywash channel, for example). A distinct wall of sound, in conjunction with a bubble curtain, is used to guide the fish to a target location.

#### Bubble Curtains

Bubble screens are one of the most basic forms of behavioral barrier. A curtain of bubbles are produced by a submerged, perforated tube, through which compressed air is released. The wall of bubbles that is released is used to guide approaching fish into a bywash.

Bubble curtains are most effective when combined with other deterrent systems, such as sound or light screens.

#### Intense Modulated Light

The most effective light screens use intense modulated light rather than continuous illumination. They are particularly effective in repelling eels and salmon, although the success of modulated lighting is dependent on the individual site.



In combination with bubble curtains, modulated light provides an effective barrier for a number of species including alewife, smelt and gizzard shad.

### S.I.M.P.L.E Fish Handling Screens

Ovivo's fish handling band screens, using the S.I.M.P.L.E. marine life recovery process, are available in dual flow, dual flow conversion or thru flow configurations. This advanced process has proven to be both reliable and effective, ensuring significant increases in marine life survival at raw water intakes.

Traveling fish buckets incorporated into the rotating band screen provide a shelter for fish that enter the intake. The captured fish are elevated to deck level in a pool of water retained in the fish buckets, where a series of gentle sprays then sluice them into a return trough, back to their natural habitat and away from the intake flow.

The S.I.M.P.L.E. fish handling screens help meet the requirements of US EPA legislation, 316(b). In combination with acoustic screens from the fish guidance system range, The S.I.M.P.L.E. fish handling screens also meet UK Best Practice requirements. The S.I.M.P.L.E. system is also available for drum screens.

### Applications

- Power stations
- Hydro-electric stations
- Refineries
- Drinking water abstractions
- Flood relief systems
- Inland waterways
- Fish farming
- Irrigation schemes
- Control of invasive species



Traveling band screen with S.I.M.P.L.E.<sup>®</sup> fish recovery and return system

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