App note

Corrosion-resistant measurement technology for fresh and salt water in Europe's largest aquarium

Nausicaá, the National Center for Oceanography in northern France

For more than 33 years, Nausicaá, a national marine center based in northern France, has relied on Xylem to monitor the water quality of its tanks. The marine center is dedicated to raising awareness of the marine environment and is home to approximately 58,000 animals and plants. A technological partnership that has developed over the course of successive expansions and renovations of the marine center.

Opened in 1991, the Nausicaá Marine Center welcomes nearly 900,000 visitors of all ages every year. The center is home to a wide variety of marine animals and plants, and its tanks contain a total of 17,000 m³ of water (saltwater and freshwater), including Europe's largest aquarium with 10,000 m³ of seawater.

> "We have been working with Xylem's WTW products for over 33 years, and they have always been a guarantee of quality, accuracy, robustness, easy installation, easy handling, and easy operation."

Frédéric Cousin, Deputy Director of the Aquariology Department at Nausicaa, responsible for the laboratory and breeding environments

Freshwater and saltwater quality in the aquriums is crucial

Depending on the ecosystem being simulated, the tanks are divided into hydraulic networks, each with its own water treatment system consisting of settling tanks, mechanical filters, UV reactors, and heat exchangers. Fresh water and chemical dosing agents are added as needed. Water treatment is controlled based on continuous measurement data on conductivity, temperature, oxygen content, pH, and redox potential, measured using Xylem's measurement technology.

Customer
Nausicaá – National Center for Oceanography, Northern France

Xylem's task
Installation of corrosion-resistant measurement technology for continuous monitoring of water quality (freshwater and saltwater) in Europe's largest aquarium.

Project results
- Over 20 sensors for conductivity, temperature, O2, pH, and redox
- Stable water quality for 58,000 animals and plants
- Remote monitoring and automatic measurement compensation

Fig. 1 (above): View of the Nausicaá marine center on the northern coast of France.

Measuring and monitoring the quality of fresh and salt water is crucial to ensuring optimal living conditions for the animals and plants in the aquarium. For example, warm water is required for tropical areas and cold water for deep-sea organisms. If temperatures fluctuate too much, this can promote disease in fish and plants, causing stress or even death. Something similar happens when there is a lack of oxygen in the water. The parameters pH and redox provide information about chemical and biological processes, such as decay processes due to organic pollution or nitrite pollution. Salt concentrations or conductivity values that are too high or too low can disrupt the osmotic balance, i.e., the water balance in the organism, and thus also cause stress to the organisms.

Corrosion-resistant measurement technology from Xylem

Due to the corrosive conditions in salt water, the operator decided to install only corrosion-resistant SW (Sea Water) sensors from WTW. These sensors are characterized by the fact that all parts that come into contact with the medium are made of corrosion-resistant titanium, sapphire, and plastic. This makes them suitable for use in high-salinity environments. The recommendation is for a chloride concentration of ≥ 500 mg/L.
The marine center uses the following sensors:

- **FDO 701 IQ SW**
  for measuring oxygen content and temperature
- **SensoLyt 700 IQ SW**
  for measuring pH or redox and temperature
- **TetraCon 700 IQ SW**
  for measuring conductivity and temperature

The sensors are integrated into several IQ SENSOR NET systems, which control the marine center via MIQ/TC 2020 3G and DIQ/S 284 controllers from WTW. In addition to displaying measured values, these enable the setting of alarms and notifications via email or SMS, remote control and maintenance of the system, and logging and archiving of measurement data.

Measured value compensation

The measurement of dissolved oxygen, pH, redox, and conductivity is sometimes highly dependent on temperature. The integrated temperature measurement of WTW sensors ensures automatic temperature compensation and correction of the measured values. In addition, the salinity of a liquid influences the solubility of oxygen, which is why the measured oxygen content should be compensated for salinity. By connecting the oxygen sensors and conductivity sensors to a common IQ SENSOR NET makes this possible at the marine center. The software recognizes both sensors and automatically compensates for the measured values.

Fig. 2, 3 and 4: Corrosion-resistant measurement technology from Xylem at the Nausicaá Marine Center.

The marine center uses the WTW IDS Multi 3630 handheld measuring device to further check the measured values and for 24-hour random sampling measurements. A battery-powered YSI EXO3 probe is also used as a temperature logger at a location that cannot be supplied with power.

> “For an aquarium like ours, it is particularly important to be able to rely on a long-term technological partnership like this one, because it guarantees the preservation of the animals’ living conditions at the center.”

Frédéric Cousin, Deputy Director of the Aquariology Department at Nausicaa, responsible for the laboratory and breeding environments

The right water quality

Figures 5 and 6 show an excerpt from current measurement data on temperature, oxygen concentration, and salinity in the mangrove basin (freshwater) and in the lagoon basin (saltwater). The temperature in both basins is approximately 26.5 °C, which is typical for mangrove and lagoon areas.

The dissolved oxygen concentration (O_2) is given in % saturation (% sat), because this figure illustrates how well the water is saturated with oxygen in relation to the maximum possible amount under the current conditions (temperature, salinity, pressure). In both basins, the value fluctuates around 100% saturation, which confirms a very good oxygen supply.

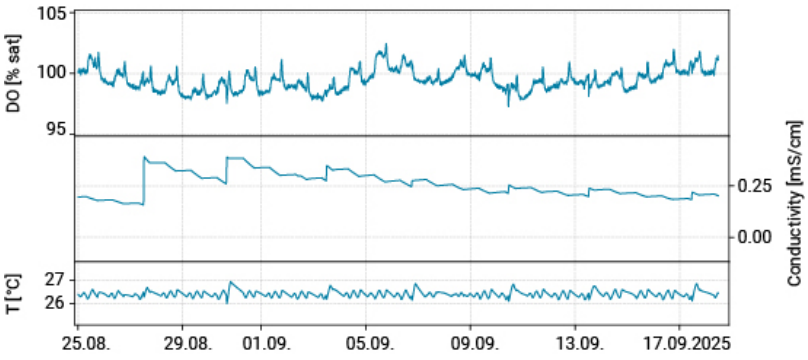

Fig. 5: Excerpt from current measurement data on temperature, oxygen concentration, and salinity in the mangrove basin (freshwater)

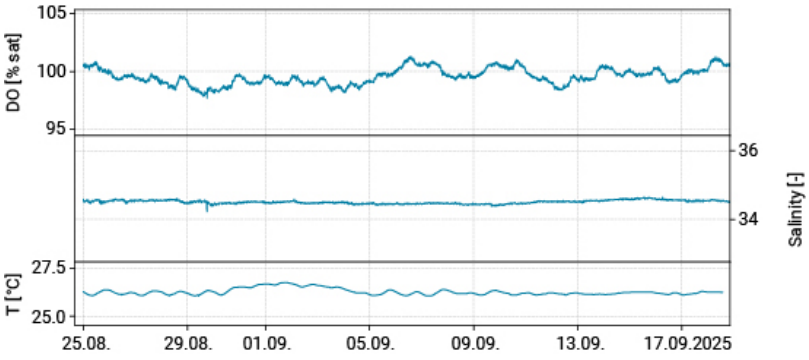

Fig. 6: Excerpt from current measurement data on temperature, oxygen concentration, and salinity in the lagoon basin (saltwater)

> „We chose Xylem measurement technology because it is reliable, robust, user-friendly, and equipped with an intuitive user interface.”
>
> Frédéric Cousin, Deputy Director of the Aquariology Department at Nausicaá, responsible for the laboratory and breeding environments

Significant differences can be seen in salinity. In freshwater, this is measured as conductivity because, with variable ion composition, it provides a simple indication of the salt content. In salt water, salinity is the preferred measurement parameter, as the ion composition is constant, enabling accurate determination. To convert conductivity into salinity, the ion composition in the water must therefore be known.

The conductivity of approx. 0.25 mS/cm in the mangrove basin corresponds to soft, low-mineral tap water. Fluctuations in the measured values in the data can be explained by filter rinsing processes with fresh tap water. The salinity of approx. 34.5 in the lagoon basin corresponds to the typical salt content of approx. 35 g of salt per kilogram of seawater.

Outlook

The next step for Nausicaá is to renovate the historic building, which dates back to 1991, and install four additional IQ SENSOR NET modules. The center also plans to build a new extension in the coming years, which will continue to use Xylem measurement technology to monitor and protect ecosystems, animals, and plants.

Key Takeaways

- Nausicaá relies on corrosion-resistant SW (Sea Water) sensors from Xylem to monitor and create optimal living conditions for its animals and plants in fresh and salt water.
- Over 20 sensors monitor conductivity, temperature, oxygen content, pH, and redox potential.
- For over 33 years, Xylem's measurement technology has convinced operators with its quality, accuracy, robustness, easy installation, and manageability.

Products used in this application:

- IQ SENSOR NET MIQ/TC 2020 3G and DIQ/S 284 controllers
- FDO 701 IQ SW
- SensoLyt 700 IQ SW
- TetraCon 700 IQ SW
- IDS Multi 3630 handheld meter
- YSI EXO3 multiparameter probe

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