

Multi parameters observations for coastal monitoring

About Aanderaa



Aanderaa Data Instruments (Bergen, Norway <http://www.aanderaa.com>) has manufactured reliable, technically advanced, user friendly and robust oceanographic and meteorological sensors, instruments and systems with extremely low power consumption since 1966. Many mechanical current meters (CM) from the early 1970 are still in active use. As of today instruments from Aanderaa are used from the top of mount Elbrus (+5600m) down to the deepest ocean trenches (-11000m). Aanderaa belongs to [Xylem](#), the name Xylem is derived from classical Greek and is the tissue that transports water in plants that is a leading global water

technology provider with business in more than 150 countries.

The goal of this document is to give a wide selection of examples in which our systems, instruments and sensors are used in coastal applications.

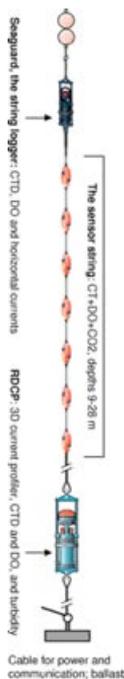
Coastal hypoxia and oxygen monitoring

Most aquatic life depends on oxygen. It is alarming finding that the occurrence of [hypoxic](#) (low oxygen) conditions is increasing worldwide. This is mainly thought to be a consequence of anthropogenic eutrophication (nutrient input) and climate change.

Aanderaa revolutionized oceanographic oxygen measurements with the introduction of oxygen optodes in 2002. The proven long-term stability (years) and reliability of these sensors have opened new possibilities in coastal monitoring and thousands of [Aanderaa optodes](#) are in use. The latest developments of the Aanderaa optodes include the new [Aqua optode](#) and [forty-point calibrations](#) (4 temperatures and 10 oxygen concentrations) of the 4330 and 4831 optodes resulting in an absolute accuracy of $\pm 1.5\%$.



Cabled coastal observatory monitoring water quality in real time



In the Koljöefjord an on-line [observatory](#) was installed in April 2011 to assess and model the dynamics of a system of fjords on the Swedish west coast (you may read more [here](#)). Another function is to serve as a test and development facility for instruments, sensors and antifouling methods. The on-line module consists of two instruments which are a [SeaGuard with a string](#) of maximum 20 sensors and an [RDOP](#) (Recording Doppler Current Profiler). Today about 50 sensors from Aanderaa and [YSI](#) are in operation at this site. Parameters measured at multiple levels include horizontal and vertical currents, conductivity/salinity/density, temperature, oxygen, pCO₂, wave/tide, turbidity, chlorophyll, pH, ORP, FDOM and cyanobacteria. The observatory is deployed close to a sampling site of a monthly high quality survey program run by SMHI (Swedish Meteorological and Hydrological Institute). Efficient methods have been developed to verify the biofouling status of the sensors and to lift and clean the observatory. So far data return rate from individual sensors has been more than 98 %.



Coral reef observatory



At the Conch Reef in Florida (USA) the University of North Carolina is utilizing a SeaGuard with a 170 meter long string for detailed investigations of the respiration of the reef community in general and of giant sponges in particular. Along the string ten 4330 oxygen optodes are distributed in pairs. One mode of operation is to place one optode in the outflow of a giant sponge and the other in the ambient water. The difference in readings give possibilities to track the activity of the sponges with respect to changes in the environment e.g. tides, waves, currents, particle concentration, lunar cycles and seasons. Sensors to measure currents, water level, conductivity/salinity and turbidity are also connected to the SeaGuard. Each of the smart sensors from Aanderaa also measure high quality temperature. Read more about the project at the Conch Reef in Florida [here](#).



Sediment-water exchange



In coastal waters sediments contribute greatly to the water quality by storing or recycling different compounds. The use of in-situ incubation chambers mounted on bottom landers to estimate sediment-water exchange of oxygen, total carbonate, nutrients, metals, toxic compounds etc. has been common practice for over three decades. The Gothenburg University (Sweden) landers have served in several hundred deployments. These are equipped with automatic syringe water sampling systems and sensors and instruments from Aanderaa. [Oxygen, conductivity, turbidity and pCO₂ sensors](#) are measuring inside the incubation chambers. For data logging and for monitoring background conditions outside the incubation chambers SeaGuard and the newly developed coastal current meter [RCM Blue](#) (see picture), are used.

Collection of algae to make biogas for cars

In many Swedish cities domestic organic waste is collected to produce biogas for cars and high quality soil for gardens. In a pilot project stranded algae from the eutrophicated Baltic Sea has been harvested to evaluate if this could be a sustainable method to produce more biogas at the same time as nutrients are removed from the sea. Because algae that has been dead for a long time is likely to produce less biogas than fresh algae, it is important to judge at what stage of breakdown the algae is. For this a SeaGuard instrument was used both to map conditions by walking along the rim of the algae belt and by deploying it during a day/night cycle. You may read more about this topic in our newsletter, [Sensors & Systems # 27](#).



SmartGuard: the “brain” in numerous coastal monitoring projects

[SmartGuard](#) is an ultra-flexible data logger and communication hub for Meteorological and Hydrological sensors. In contrast to the SeaGuard and RDCP-600, which are underwater multisensor platforms, SmartGuard is intended for land and buoy installations. It has low power consumption and the capacity to handle more than 50 Aanderaa and/or third party sensors using different signal standards. Data is stored/backed-up on an SD card. For on-line communication it incorporates USB, LAN/internet and serial capacity supported by Aanderaa real time communication and data presentation software.



SmartGuard: radio wave/tide gauge

For decades Aanderaa water level and wave/tide recorders are used around the world. The latest development is a high resolution long term stable vented, compensated for changes in atmospheric pressure with a tube, [wave/tide or tide sensor](#). Connected to a SmartGuard that is on-line over a direct internet connection or via VHF, UHF, GSM, GOES or Iridium modem will give on-line data to support e.g. navigation and forecast flooding and operations safety.



SmartGuard on buoys

The Mexican National Commission for Use and Protection of Biodiversity (CONABIO) needed a real time system capable of measuring meteorological, oceanographic and water quality parameters in the proximity of a protected ecosystems. The core of the system is based on the SmartGuard integrated in a buoy module which allow collection and on-line presentation through GOES satellite modem of Meteorological (wind speed and direction, solar radiation, net radiation, atmospheric pressure, temperature and humidity) and hydrological parameters (current speed and direction, oxygen, temperature, turbidity, conductivity/salinity and chlorophyll). To view a presentation on this project click [here](#).



SmartGuard + compact flow through system for surface/ballast water monitoring



[SOOGuard](#) is a compact flow through system primarily intended for surface water measurements from e.g. ferries (Ferry box) and research ships. Typically sensors to measure oxygen, conductivity/salinity, temperature, chlorophyll, turbidity, cyanobacteria and position (GPS) have been used. Data is stored by the SmartGuard on an SD card and/or transmitted through GSM/GPRS/Iridium modems or through the on-board satellite based Internet. Sensors are easily accessible making operation and maintenance of the system fast and easy by non-expert operators. This type of flow through system is also suitable to monitor ballast water. Click [here](#) for an example of data from a running system.



SmartGuard in aquaculture applications

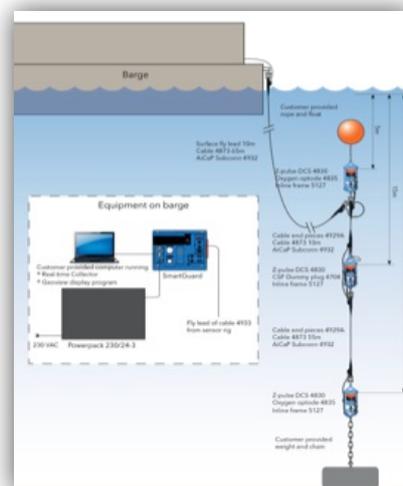
Aanderaa equipment is widely used in aquaculture applications. Before installation of a fish farm a site survey is often carried out to judge if the suggested area is suitable for an installation. For this work typically [RDCP acoustic profilers](#) and [SeaGuard instruments](#) are used. The main parameters studied are circulation, oxygen conditions, salinity and temperature.

During production many fish farms use information from on-line joy-stick controlled underwater video cameras equipped with [Aanderaa oxygen-temperature sensors](#). By moving the camera inside cages the operator can visually inspect the fish and its behavior. If oxygen levels drop below a certain level or if temperature is not suitable the feeding is decreased/stopped because the fish will not grow.

Outside cages systems like the one on the drawing serves the purpose to monitor background conditions that are of special importance if there is risk of contamination, e.g. spreading of viruses, and to select suitable periods for medical treatment of the fish in the cages, e.g. delousing of salmon.

The system on the picture is an example of an operational system where currents are measured at three different levels (5m, 15m and 70m depth) together with oxygen, conductivity and pressure. Data is collected by a [SmartGuard](#) on the barge and transmitted and visualized using our [GeoView](#) real time display.

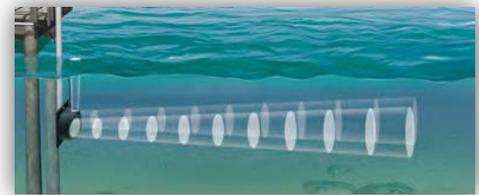
We are just introducing the new Aqua Quality System (AQS) that is developed together with the company Data Quality (<http://www.dq.fo>). AQS is a complete and flexible environmental monitoring system with real time data quality control and a built-in report generator. The AQS is based on using high quality sensors from Aanderaa and gives the fish farmer access to reliable data in a web based display program both with real time and historical data.



Navigational safety and pollution tracking

During the past 30 years Aanderaa has delivered hundreds of systems for port and harbour installations ranging from simple docking, water level and weather monitoring systems to multi-station networks along the coastline. Vessel Traffic Service (VTS) integrators often prefer the [Aanderaa marine transport solutions](#) because we can deliver complete turn-key systems with all hydrological and meteorological sensors needed. [Safeport](#) was a joint EU-research project between Polish and Norwegian partners with the overall goal to improve the safety during approach, entering and berthing of large ships. The end product of Safeport is a ship adapted visualization software, presented on the ferry bridge, that gives recommendations on the safest harbour approach taking into account prevailing hydro-meteorological conditions. Main system components include a dynamic model assimilating real time hydro-meteorological data from Aanderaa systems. In Safeport NIVA (<http://www.niva.no>) also developed a site adaptable model for on-line tracking and breakdown of e.g. oil spill. (Click [here](#) for Aanderaa's oil & gas brochure).

Recently we have expanded our measuring possibilities in several projects by integrating side looking Doppler current meters from our sister company Sontek (<http://www.sontek.com>). These will update the Harbour Master in real time about current conditions with up to 120m horizontal range in addition to water level, by use of a vertical beam.



Sediment transport and dredging

In 2009, Aanderaa was awarded a contract by the German Waterway and Shipping Administration to modernize their on-line network of hydrological monitoring stations (read more [here](#)). The upgrade comprised 7 data buoys, 10 river pile stations along the estuary of the river Elbe as well as the delivery of 180 SeaGuard instruments. Acquisition of hydrological standard parameters along the River Elbe fulfils the waterway authorities duties in terms of administration and provision of safety navigation.

High dredging activities in the area makes it vital to predict the transport of sediments into the shipping channels. In this regard, it is very important to rely on exact measurements. Measured data includes water flow, temperature, pressure, salinity, oxygen and turbidity. In order to get highly accurate and reliable turbidity data, Aanderaa performs 12-point calibrations of these sensors.

