

## Theme Session P

### **An integrated approach to research surveys: monitoring with a combination of sensors**

---

**Conveners: Nils Olav Handegaard, Norway, David Somerton, USA, and Pierre Petitgas, France**

The integration of data from a combination of sensors used simultaneously on research surveys was considered from several perspectives during the session. From the perspective of standard fish assessment surveys, multiple sensors are used to sample species inhabiting such broad range of habitats that no single sampling gear can cover the entire stock. Examples included adding acoustics to bottom trawl surveys to assess the stock component in mid-water or optics to assess the component in rocky areas (P1, P2, P11). In addition, more than one sampling device can be used to assess a species in a single habitat, for example, the simultaneous sampling a stock with acoustics and a continuous egg collection device (P9). Using a combination of sampling methods as part of the survey protocols has increased the understanding of catchability and availability and, thereby, increased data quality by reducing bias. From the perspective of environmental monitoring, multiple sensors can be used to simultaneously measure the species composition and abundance of zooplankton, as well as, the environmental variables associated with their productivity including phytoplankton abundance, nutrients and a variety of physical properties of the water (P13, P10, P8, P5). Towed vehicles with automated sensors have been demonstrated to be especially informative, but the complexity of such automated systems requires technical expert teams to operate and maintain them. Currently, it has been little international coordination of integrated surveys and the issue of data collection prioritization on integrated multiple objective surveys is unclear. Besides traditional ship-based sampling, additional fish sampling devices can be operated independently. Examples include passive acoustic devices to detect species-specific sounds (P14) and buoyed echosounders attached to fish aggregating devices (P4).

Several common issues were considered. Integrated data collection on surveys has outpaced the development of data bases designed to accommodate disparate data structures that could be accessible through a common data repository. In some cases this could be simplified by including data derived products in the data bases rather than the original data itself because it would allow better coupling of biological survey data with environmental conditions. Integrated monitoring programs could include spatial simulation modelling to better understand the most appropriate spatial scales to sample, this is especially important because towed sampling systems now allow continuous sampling which may be oversampling many processes. Surveys could be thought of as part of a global monitoring program where a flux of data would be organised to feed in a variety of models. In Europe, this topic is on the agenda of Horizon 2020 and JPI-Oceans. Users of data from multiple objective integrated surveys have generally not been identified, which would be a first step in developing integrated monitoring. The fishing fleets should also be included as part of such a data collection system.