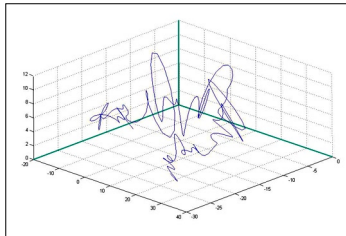


# Acoustic Positioning Software Suite

BioMAP • ALPS • SYNAPS

Lotek offers a suite of technical positioning solutions to deal with the diverse demands of the aquatic environment.

Lotek's **MAP™** acoustic product family uses signal coding to allow transmissions from tagged animals to be precisely timed, and transmitter positions to be estimated by a form of "triangulation", using an array of moored hydrophones at known locations.



3D plot of a fish track over a two minute period

For fixed station monitoring with multiple hydrophones, the precision of the resulting estimates is determined primarily by the spatial distribution of hydrophones, otherwise referred to as the array aperture, relative to the transmitter location.

## BioMAP

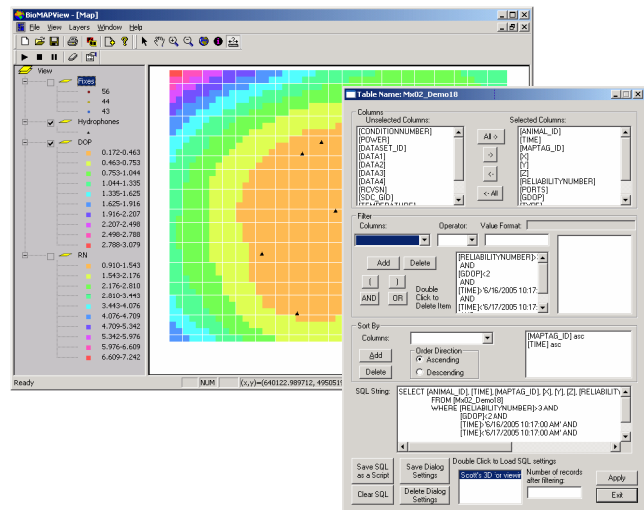
BioMAP is the original 2D and 3D data processing software designed to work in conjunction with hard-wired MAP 600 hydrophones and GPS time synchronized submersible dataloggers.

BioMAP is a Windows software solution for processing and managing fish and wildlife telemetry data.

### Features & benefits

- Importation and processing of data provided by Lotek's telemetry receivers and GPS collars
- Processing of presence/absence, 2D and 3D data for acoustic MAP data
- Export file generation for import by major GIS packages, e.g.
- Reliable and efficient storage of data sets
- Production of raw spatial and temporal data
- Formation of complex data queries using Microsoft Standard Query Language (MSSQL)
- Ability to present animal locations in different coordinate systems (e.g. Projected or Geographical Coordinate Systems)
- Quantification of the precision and accuracy of animal positions
- Optimization of system performance
- Graphical display and animation of processed data, as well as the creation of shape files (BioMAP View)
- Open architecture supports exchange with third party analysis tools
- Password controlled access for security

The database approach that BioMap takes allows access to the full power of Microsoft SQL. The utility most commonly used is Query, which automates the generation of SQL scripts where logical combinations of conditions are selected by the user. Users experienced with MS SQL may also write their own custom scripts, using the SQL Console.



- Receivers
- Acoustic transmitters
- Dataloggers
- Archival tags
- Radio transmitters
- GPS systems

- Hydrophones
- Wireless hydrophones
- Physiological transmitters
- Depth transmitters
- Accessories
- Consulting

## ALPS (Asynchronous Logger Positioning System)

ALPS positioning software is used in conjunction with Lotek WHS 3050/3150 submersible dataloggers (SDL). ALPS is designed to allow data files from independent SDLs to be

processed to estimate 2D source locations of signals detected by a minimum of three SDL units. 3D positioning is supported with the use of depth sensing transmitters.

### Overview

The SDL receivers are initially clock-synchronized by the user on deployment (using the SDL host software). Retrieved data is processed by the ALPS program which takes on the job of tracking differential clock drift between the receivers as a post-processing operation. As with all 2D or 3D acoustic

based positioning systems, uncertainty in the exact locations of hydrophones or within the time base will translate to a reduction in precision of the position estimates. The ALPS system compensates for any drift encountered within the time base and SYNAPS can assist in the hydrophone survey.

### Features & benefits

- No hydrophone cable requirement means lower deployment and maintenance costs and ultimately, higher system reliability.
- No surface buoy requirement translates to lower equipment and deployment costs, higher reliability and reduction in losses from theft, damage from debris or vandalism.
- Precise positioning in areas where cables are impractical means that new research can be conducted in areas of fine scale habitat utilization, species interaction, and behavior around barriers or effluent plumes.

- Survey costs are reduced with the use of SYNAPS.



## SYNAPS (Synthetic Aperture Positioning System)

SYNAPS positioning software is used in conjunction with Lotek MAP 600 RT and LHP hydrophones. SYNAPS (synthetic aperture positioning system) extends hydrophone array positioning to mobile surface vessel based tracking studies by

combining detection records collected from one or two moving hydrophones with GPS-referenced positions of the tow boat. 3D positioning is supported with the use of depth sensing transmitters.

### Overview

SYNAPS is a post-processing Windows-based utility (**SynapsWin™**) that computes estimates of transmitter locations from MAP detection files clock-synchronized to shipboard GPS records. By modeling the physical behavior of the hydrophone tow body, SYNAPS translates GPS boat positions into hydrophone location estimates for each detection record. The assignment of a geographic position to each detection

record creates a virtual or synthetic hydrophone array whose spatial geometry defines its aperture. Through the software, the synthetic aperture array is equivalent to a fixed array of hydrophones stationed at the GPS-referenced positions associated with the individual signal detections. The software is then able to generate a specific location estimate of each detected fish transmitter.

### Features & benefits

- Mobile positioning of tagged animals increases the efficiency of tracking by orders of magnitude over conventional time based acoustic systems that require boat motor shut down to achieve practical detection range.
- Large geographic areas such as marine protected areas can be efficiently surveyed for animal presence and estimated position.
- Tagged animal positions can be computed during post processing rather than tracking down animal positions with boats and potentially disturbing natural behavior.

