BATHYMETRY SURVEY METHODS

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ABOUT US

Infofish Australia has been operating for 30 years in the recreational fishing and natural resource management sectors. We are the country's leading operator of BioSonics Inc. scientific echo sounders. BioSonics is a company in Seattle WA, who, for over 30 years have been developing this technology. The DT-X Extreme echo sounder is able to detect and count fish in real time via their Auto Track software package. Infofish Australia has taken the work of BioSonics even further and brings leading edge habitat, fish stocks and behavior assessment to Australia, incorporating advanced data analysis, modelling and machine learning techniques. Habitat and fish targets can be classified, GPS located and size graded (fish only). Surveys are completed using a combination of side-looking and down-looking techniques, depending on the aims of the survey, and can be completed from distances of up to 200m away. In addition, Infofish incorporates side scan imaging to provide the best possible picture of the underwater environment.

SURVEY DESIGN

Bathymetric modelling is a key part of fish biomass data post processing and analysis. The bathymetry model helps to determine the physical characteristics of a site and where accepted tracks from biomass surveys sit in relation to it. Bathymetry surveys are completed at the same time as habitat and / or fish biomass surveys in estuarine / riverine environments or enclosed waters e.g. dam / impoundments. Survey reaches in a riverine environment (especially tidal affected areas) are typically 1km in length but can be increased as necessary. Once a survey reach (riverine) or zone (impoundment) has been defined, the survey methods for each are as follows:

Riverine (Figure 1):

- A serpentine navigation of the river channel from bank to bank, moving up or downstream
- two longitudinal transects (one upstream and one downstream) with the vessel travelling parallel and as close to the bank as possible, and
- a mid-channel transect that follows the deepest point of the channel along the survey reach.

Enclosed waters / impoundment (Figure 2):

- a shoreline / edge survey of the entire waterbody, and
- a number of transects across the waterbody, spaced 100m apart, and a return track in between as the vessel returns to the start point for the next fish biomass transect. Transect are aligned so that the majority run perpendicular to the dam alignment and / or submerged river channel.

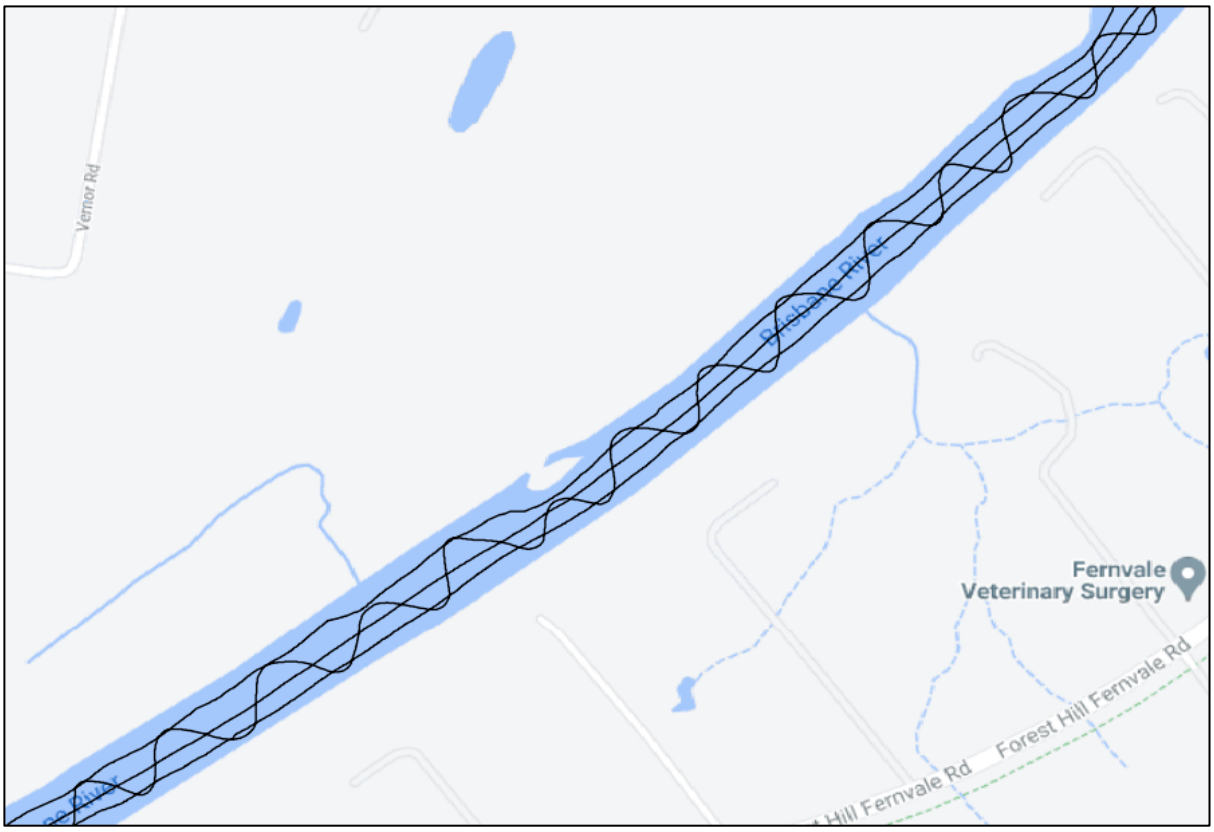


Figure 1. Typical riverine survey method.

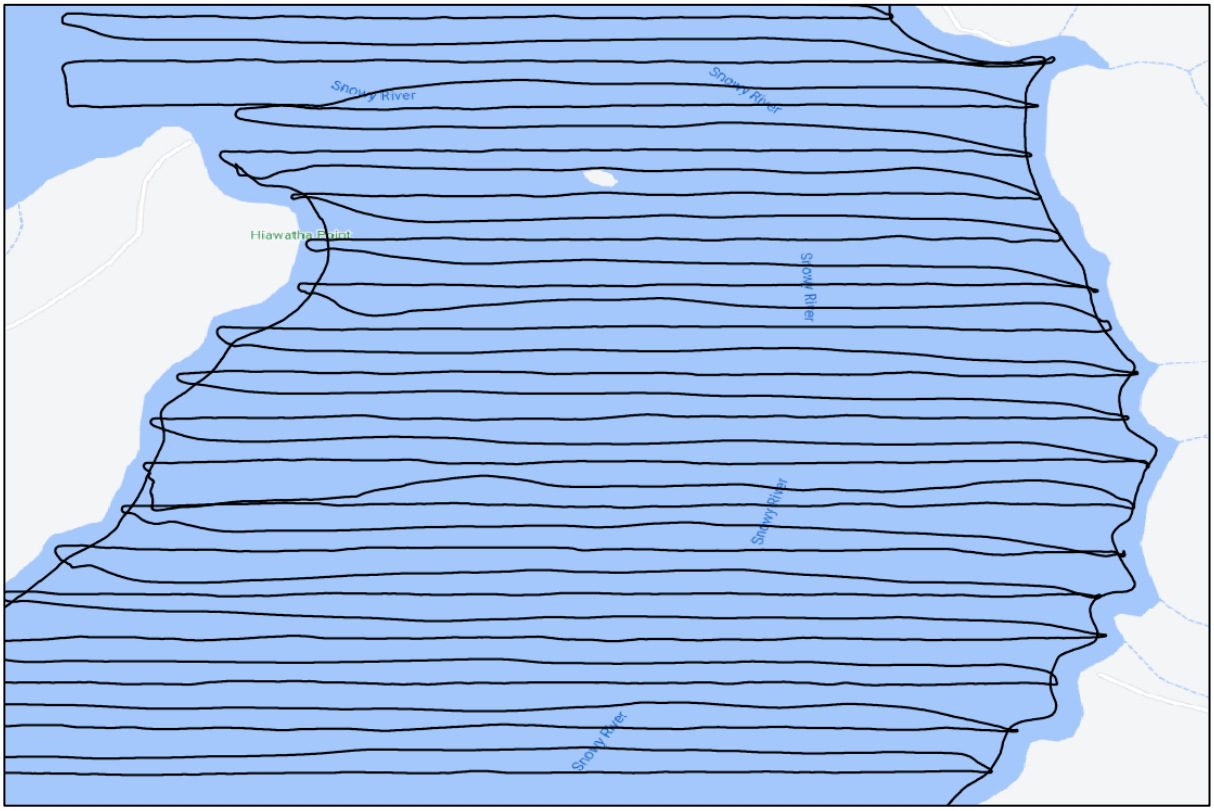


Figure 2. Enclosed waters bathymetry survey transects and edge survey.

DATA COLLECTION

Bathymetry data is collected using Humminbird Helix Mega SI GPS fish finders (Helix) during pre-survey and the fish biomass surveys. Pre-survey bathymetry is typically more detailed to better define channel shape and other form such as aggressive bank slopes, submerged points, point bars and islands.
To avoid accidental data corruption or loss, two helix units are networked with a primary and slave unit both set to record. Data from the surveyed area (shoreline and cross transects) is displayed on the Helix unit during survey using the AutoChart feature and recorded to a Humminbird Zero Lines SD card for Australia and boat track bathymetry data is saved to standard SD cards in the Helix units. All recorded data is backed up and reviewed daily, during surveys.

Where pre-defined impoundment survey transects cut across a submerged river channel acutely, the channel definition can be poor or look stepped when mapped (Figure 3). To improve the data resolution and mapping imagery, additional survey of the channel using a survey pattern similar to that used in a riverine environment is completed (Figure 4). The additional channel shape data assists with improved fish biomass post processing also, as the channel banks can return numerous echoes and signals that can inflate biomass estimates.

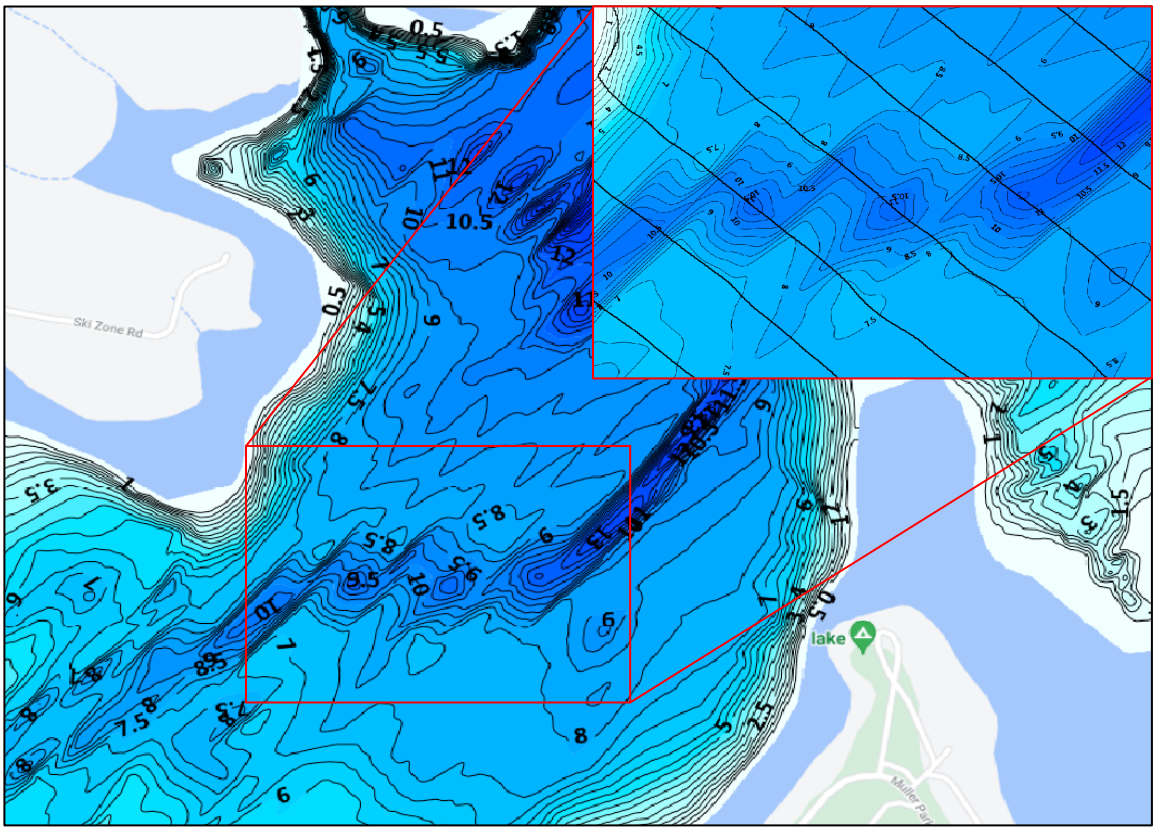


Figure 3. Stepped channel from where cross-transects cut across channel, acutely.

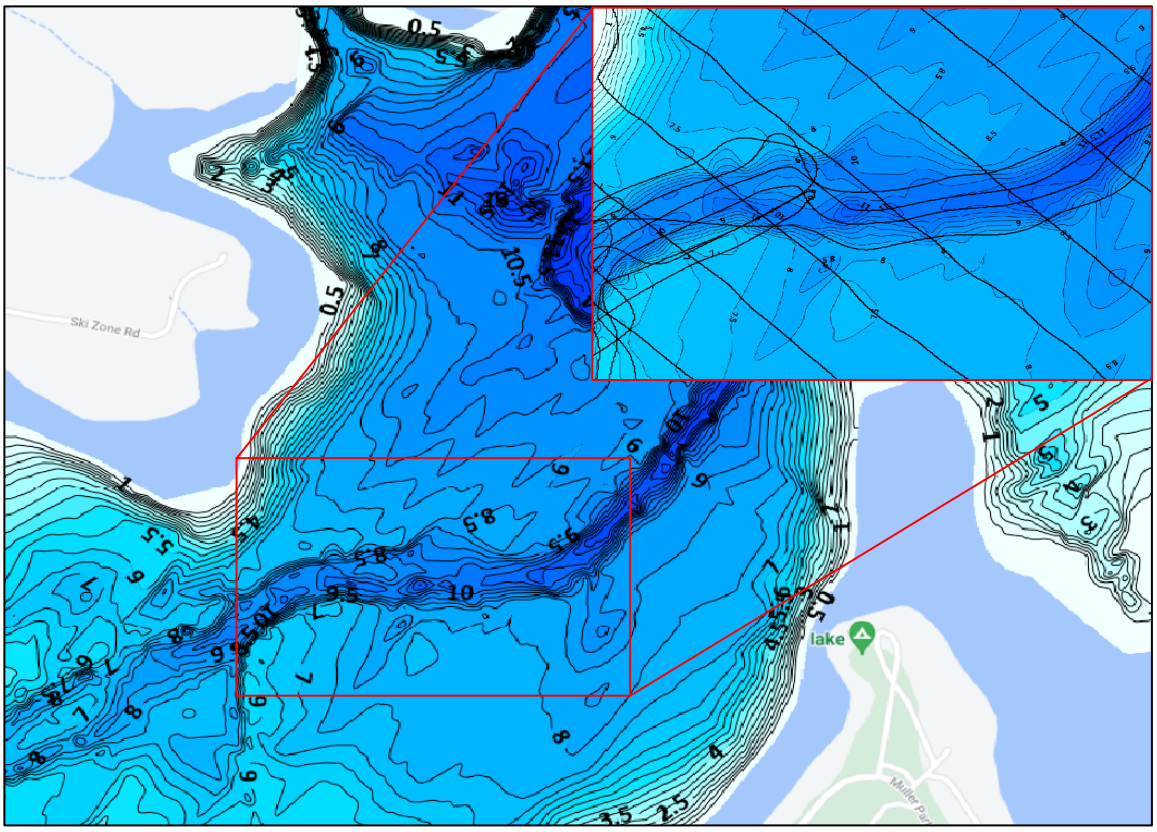
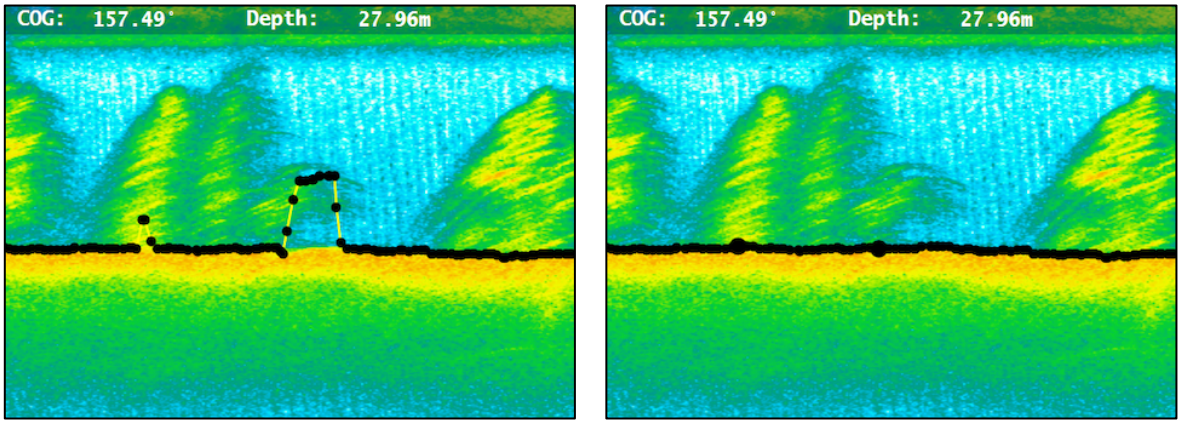


Figure 4. Improved channel definition from additional survey along old river channel.

DATA ANALYSIS

BOTTOM LINE REVIEW AND CORRECTION

All bathymetric data is reviewed using the ReefMaster[1] software and corrected where the bottom readings have been calculated incorrectly. Errors in bathymetric detections bottom are common where the substrate is large rocks or boulder fields, steep drop-offs and river channel banks passed over at speed, where submerged standing timber is extensive or when water surface is wind chopped and the transducer leaves the water temporarily. See Figure 5 a) for where the bottom line (dark line) was calculated incorrectly due to standing submerged timbers and b) after it had been corrected. Once the data has been reviewed and corrected, where necessary, all data files from a survey are compiled in ReefMaster.



a) erroneous bottom detection line

b) corrected bottom-line

Figure 5. Bathymetric bottom-line detection where timber was included in the bottom detection (a) and after correction (b).

ZERO LINE GENERATION

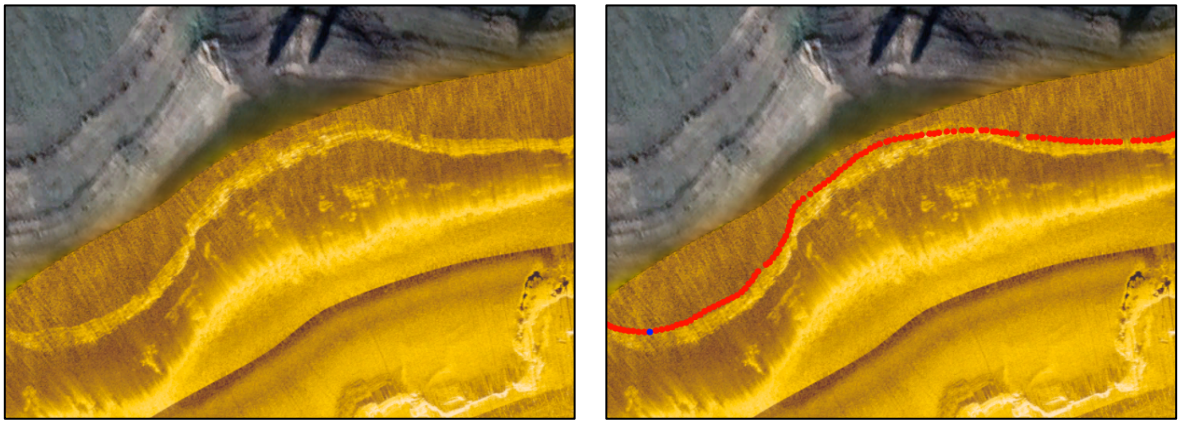
The shoreline / edge sidescan imagery from the habitat survey is used to generate a zero line or the point at which the water meets the land at the time of survey. The imagery is compiled in ReefMaster and exported as a .kmz file then imported to Google Earth Pro[2]. From the sidescan imagery, the zero line is created by tracing the water's edge using the polygon tool in Google Earth (

Figure 6). A separate zero line is generated for any islands present in a survey area also. The polygon(s) is exported as a .kmz and imported to ReefMaster, then added to the complied bathymetry data from the survey. See Figure 7 for raw boat tracks data with zero line (red) included, prior to map image generation.

Where water levels change during a survey from inflows or releases from impoundments or in tidal areas, water level offsets are calculated and applied to the dataset. Water level change information is obtained via water manager websites or Bureau of Meteorology tidal stations. Bathymetry data is exported in .kml, .MBTiles and .csv formats and used in the machine learning and modelling data analyses.

[1] ReefMaster, 2018. ReefMaster Software Limited, V2.0.

[2] Google Earth Pro, 2021. V 7.3.4.8248.



c) edge survey showing waters edge

d) zero line generated in Google Earth Pro

Figure 6. Sidescan imagery used to generate zero lines for each survey location.

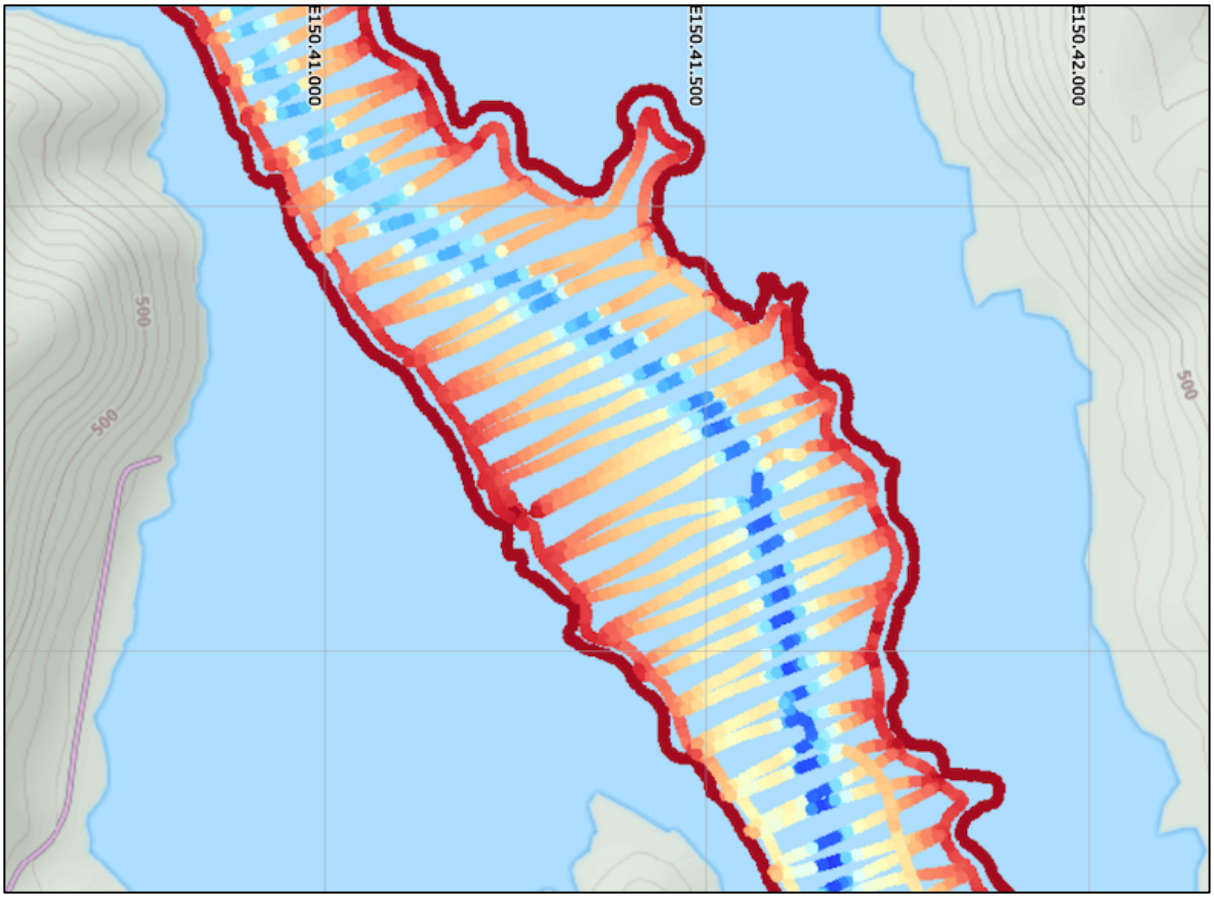


Figure 7. Raw boat track data with zero line included.

DATA OUTPUTS

Bathymetry map images and pointsource models are generated from data collected during pre-survey and biomass survey for each survey reach and / or zone. The bathymetry map is generated and exported in .MBTiles, .kml, .kmz, .png and .csv formats for use in online map presentation tools, during fish biomass data analysis and post processing and data review. See Figure 8 for an example bathymetry map as displayed on Mapbox Studio. The bathymetry model helps to determine the physical characteristics of a site and where accepted tracks from biomass surveys sit in relation to it. See Figure 8 for an example map in .MBTiles format, as displayed in Mapbox Studio. The .kml, .kmz and .png all show the image while the .csv is for processing fish biomass data and not displayed.

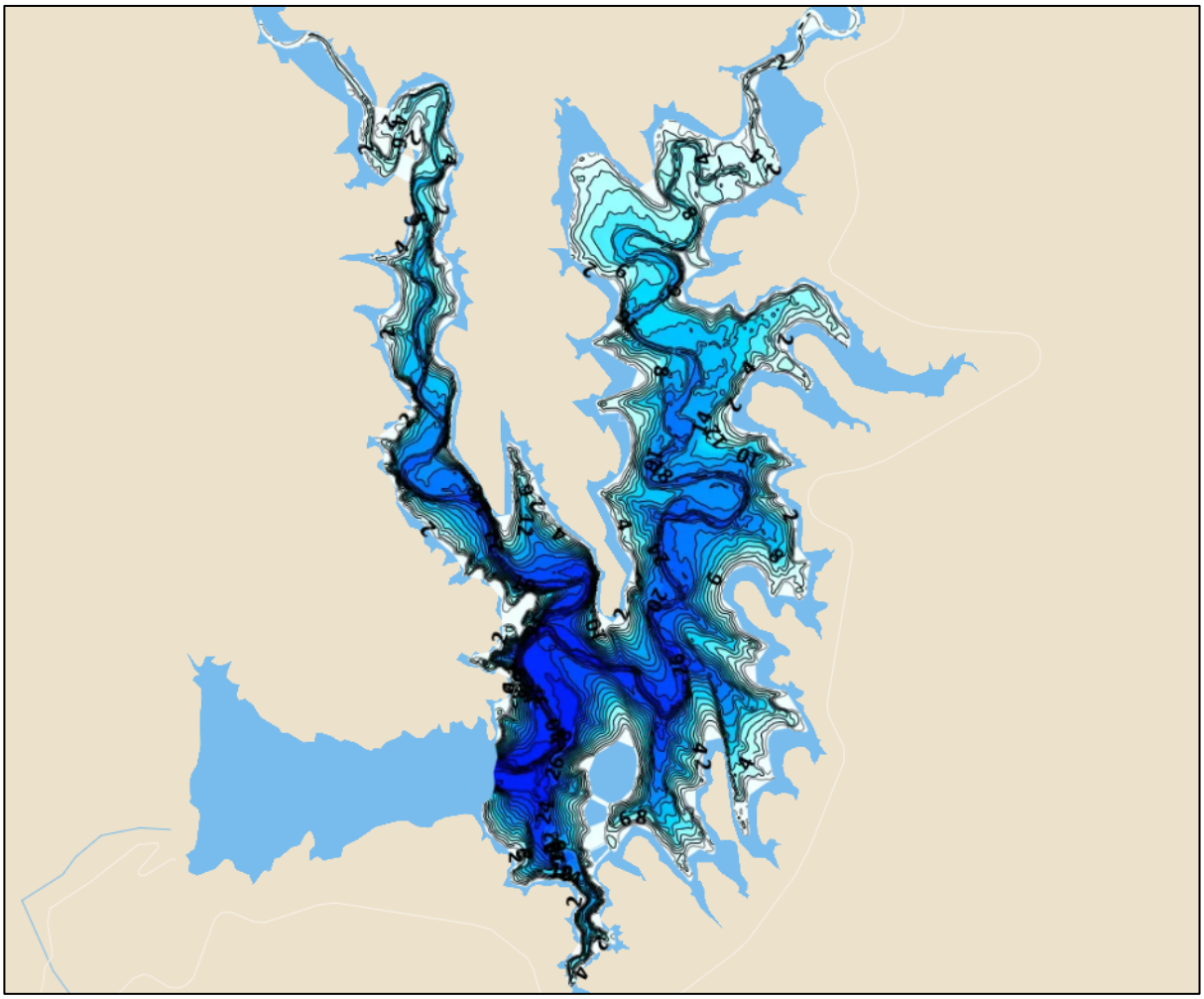


Figure 8. Example bathymetry map of Lake St Clair in .MBTiles format.

QUALITY ASSURANCE AND SAFETY

The survey team holds suitable tertiary qualifications and / or the necessary experience to undertake surveys. Our team is highly experienced in completing scientific studies in field environments. They have the ability to fully assess any potential hazards prior to mobilising into the field and develop appropriate control measures. They also have the experience and authority to alter controls and procedures based on current field conditions, in order to ensure that risks are minimised on the ground. All field team members are required to be inducted into and sign all of Infofish's site safety documentation, per project.

Our survey vessels operate as domestic commercial vessels under the Australian Maritime Safety Authority (AMSA) EX02 – Marine Safety (Certificates of survey) Exemption, 2018, under the Marine Safety (Domestic Commercial Vessel) National Law Act 2012. Our survey teams hold current certification under EX38 - Marine Safety (Low complexity duties) Exemption 2017 (No. 2).

PROJECT EXPERIENCE

Infofish Australia has completed or is currently completing the following relevant projects using the survey methods stated herein:

- Fish Biomass Surveys (including bathymetry mapping) in lakes St Clair, Glenbawn, Copeton, Split Rock, Pindari, Tantangara, Blowering, Burrinjuck and Wyangala, NSW DPIF, 2020-2021.
- Trout Biomass Surveys in Lake Jindabyne, NSW DPI, 2020 and 2021.
- Lake Somerset Fish Biomass Surveys in Lake Somerset, Infofish Australia, 2020
- Golden Perch Biomass Surveys in Lake Windamere, NSW DPI, 2019
- Fish Biomass Surveys in Lake Burrendong, NSW DPI, 2019
- Fish Biomass Surveys in Lake Copeton, NSW DPI, 2019.

For any queries on the above survey methodology and associated data analysis and outputs, don't hesitate to contact us at admin@info-fish.net.