



**Chelonia Limited**  
Wildlife Acoustic Monitoring

## F-POD Specification

Mar 2022

The F-POD has replaced the C-POD which has become the industry standard for monitoring the level of activity of porpoises and dolphins in coastal seas.

The increasing and widespread use of PODs has developed over 20 years and is due to three main features:

- Data volumes are lower than for other methods. This means running times and servicing intervals can be much longer – 4 months or more.
- Automated data analysis has been developed further for PODs and this gives accurate results, with very low false positive rates, without using very large amounts of expensive and subjective expert analyst time.
- The instruments are robust – many are still functioning as new after 10 years of continuous use.

F-PODs log very large numbers of clicks that resemble cetacean clicks. Cetacean detection is performed in post-processing in the FPOD app by the detection and classification of coherent sequences – trains – of clicks found within the raw data. The F-POD stores detailed information, at very high time-resolution, on each click. This provides an optimal input to the train detection and species classification algorithms that run on a PC during post-processing.

<b>Acoustics</b>	The F-POD uses the highest sampling rate of any commercial logger at 1million samples per second. This is upsampled in real time to 4million samples per second and time-domain analysis is performed using parallel processing to enable the key features of clicks to be identified and used as the basis for selecting what is worth storing and what details should be stored.
<b>Software app:</b>	The FPOD app (FPOD.exe) carries out fully automated data analysis to find click trains in the data and identify those produced by all echo-locating cetaceans except sperm whales (Baleen whales do not use echo-location and are not detected). It also provides displays, filtering and export of data. Most users analyse their own data using this software, other use external contractors who provide this service. The FPOD app is free, with free upgrades.
<b>Working depth:</b>	At least 100 metres. A single F-POD has been tested to destruction and failed at 220 m. DeepF-POD: At least 2 km.
<b>Autonomous operation time:</b>	Operation time is affected by battery quality/capacity and deployment noise levels. The F-POD has automated adaptation to noise so that it does not often max out even in severe conditions. Alkaline D-cells: Maximum running times approximately 200 days. With good quality, high capacity D-cells, more than 4 months can be expected. Lithium D-cells: With approximately twice the capacity of alkaline cells, these have the potential to enable longer deployment times. F-PODs can be set to log 1 minute in every 2, 3, 5 or 10 minutes to further extend deployment time. The F-POD has a real-time clock, so you can set the F-POD's start time, making it is feasible to deploy several F-PODs and set them to switch on consecutively in order to obtain a very long continuous data set from one deployment. This is called "daisy chaining".
<b>Housing:</b>	F-POD: Polypropylene. DeepF-POD: Aluminium.
<b>Dimensions</b>	F-POD: Length: 670 mm. Diameter: 90 mm. DeepF-POD: Length: 680 mm. Diameter: 100 mm

<b>Weight:</b>	F-POD: 2.1 kg without batteries, 3.5 kg with batteries. DeepF-POD: 7.15 kg without batteries, 8.6 kg with batteries.
<b>Buoyancy:</b>	F-POD: Approximately 0.7 kg. This makes F-PODs self-orientating and increases the chance of recovery if the mooring fails. A web link engraved on the outside has enabled over 150 PODs to be returned to their owners by people who have found them on sea shores, sometimes more than 2,500 km from home. DeepF-POD: -3.1 kg, not buoyant.
<b>Mooring:</b>	F-POD: 3 x 10 mm holes in the lid. DeepF-POD: 1 x 12 mm hole in the lid.
<b>Hydrophone:</b>	Compared to the C-POD the F-POD has a hydrophone with less Z-plane variation. The frequency range is 20 kHz to 220 kHz. The housing has a large-diameter to reduce surface noise pick-up. The transducer mounting and housing design gives very high resistance to impact damage.
<b>Memory:</b>	Any blank micro SD card up to 32 GB can be used. Data volumes are typically 2GB in 4 months, or less, pro-rata, if alternate minutes or less are logged. Intermittent logging is typically used to get logging periods of over 1year.
<b>Batteries</b>	Battery packs hold 10 D-cells. The battery housing is sprung in both directions to reduce battery damage from end impacts.
<b>Detection range:</b>	Maximum detection range for porpoises is approximately 400 metres. Dolphins may be detected at >1 km.
<b>Standardisation:</b>	The sensitivity of acoustic loggers is a major factor in determining the sea area within which animals are detected. In most studies using them, uniformity of sensitivity is essential and Chelonia has a highly developed standardisation procedure which we believe represents the most precise testing process currently available.
<b>Click selection:</b>	Digital time domain waveform analysis is used to select possible cetacean or boat sonar clicks in the range 20-220 kHz. On-board train detection selects clicks in trains so that greater detail of some clicks can be captured.
<b>Cetacean detection:</b>	Coherent click trains are extracted and classified in post-processing by the KERNO-F classifier. Version 1.0 is now in use and will be retained unchanged to give long term uniformity of performance.
<b>Species classification:</b>	Porpoises and other narrow-band high frequency (NBHF) species can be distinguished from broadband species. Some discrimination of groups of species within the broadband species (dolphins) may become possible when enough data is available. Every species tested has given good detection performance.
<b>Sonars:</b>	Runs two independent sonar detectors that detect and filter out up to two different boat sonars frequencies in each minute if required. A record is kept of sonar detections.
<b>Settings:</b>	The default settings cover all species and environments and very rarely require any changes. The F-POD has a dynamic threshold adaptation process to optimise performance during noisy periods.
<b>Attitude sensing:</b>	The angle-from-vertical is recorded each minute, enabling the user to check after deployment that the F-POD was deployed in a vertical position, and giving information on currents. A range of angles at which the POD will log can be set. This allows the F-PODs to be set up well in advance and transported in a horizontal attitude saving power and memory.
<b>Temperature sensing:</b>	Temperature is recorded each minute.
<b>Maintenance:</b>	The external surfaces of the F-POD are simple and tough allowing robust methods of removing biofouling. The lids use a dual O-ring design with grease-free lubricants and these have proved highly reliable.



#### F-POD, Deep F-POD, C-POD

These versions run for over 4 months on 10 alkaline D cells. With primary lithium cells running times are doubled.

Intermittent logging (1 minute in 2 or in 5) can be used to extend logging durations.

The F-POD and C-POD can be immersed to 100m, Deep PODs can be immersed to 2000m.

The C-POD is now 'end-of-life' as a product. It is still fully supported but is now only supplied to existing C-POD projects.

The acoustic performance of F-PODs is superior to C-PODs. Acoustic performance is not affected by the size of the unit.



The LF-POD is intended for fisheries use where long running times are less important than ease of handling. Can be immersed to 200m.

## Applications

C-PODs, and now F-PODs, are the industry standard for acoustic monitoring of porpoises and dolphins, and have been used in all the large studies worldwide including:

### **SAMBAH**

This was a two year study of the 'Baltic Proper' to determine if the Baltic Sea Harbour Porpoise was extinct or not. 300 instruments were deployed for 3 seasons in each of two years. The results were very clear, with a previously unknown concentration within a small area and with clear seasonal movements. The results have transformed the management of the population of which some 400 animals survive.

### **Wind Farms**

Many studies have been done on marine windfarms in Europe and have in general shown strong but temporary displacement of porpoises during construction with subsequent full normalisation of use of the habitat by porpoises, and later studies have shown evidence of ongoing increases in use of the sites.

## Vaquita

A long term study of the population of this critically endangered porpoise species, that is only found in Mexico, has demonstrated that C-PODs can track a trend more accurately than any other method. Sadly it shows that the population is heading for extinction.

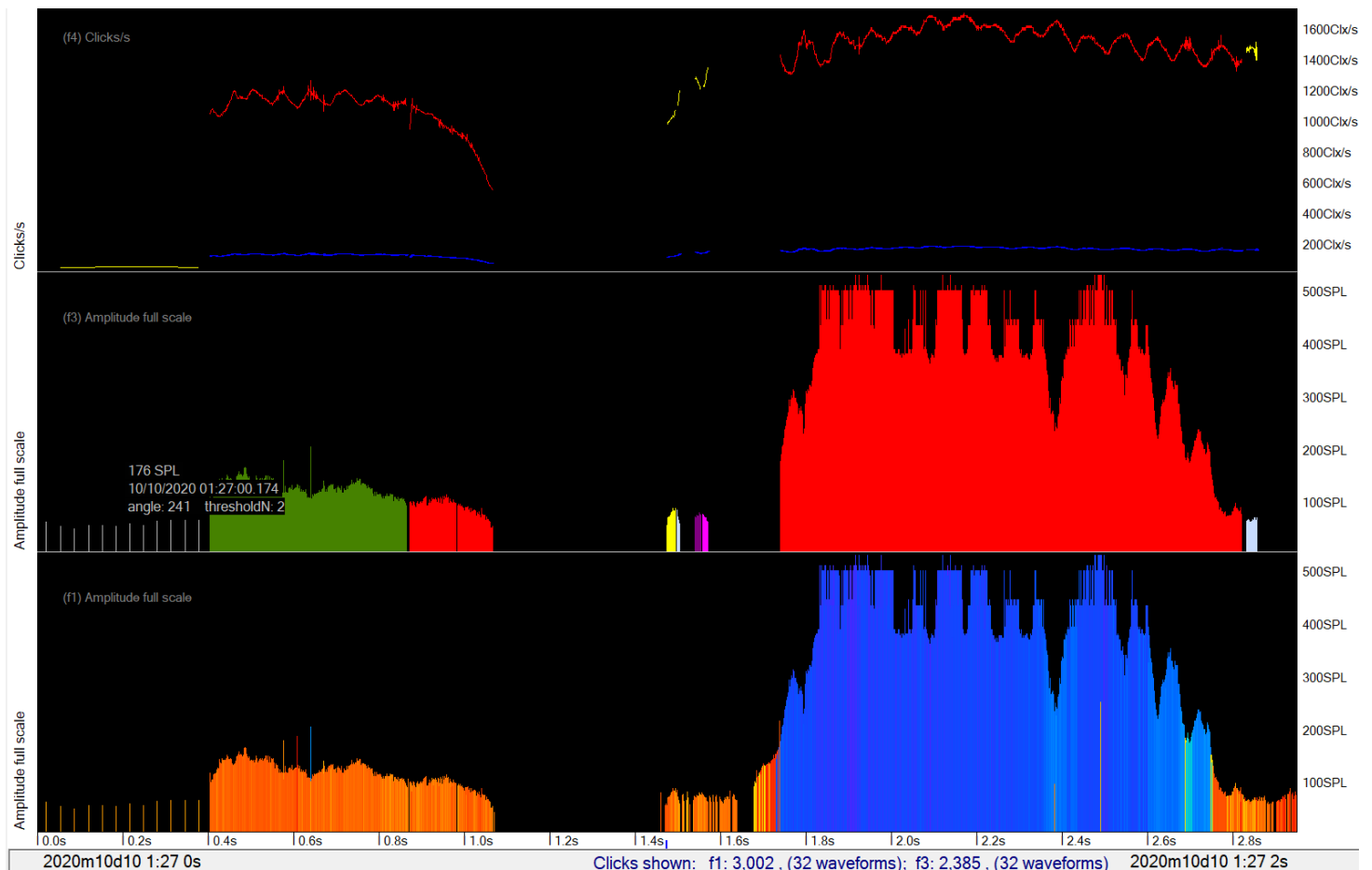
Projects monitoring trends in dolphins and porpoises using PODs are now under way or development in several areas including rivers (Yangtse, Amazon, Mahakam, Indus, Ganges) and around the Black Sea, along the coast of Kenya, and SW England. NOAA in the USA are developing POD monitoring projects.

## Fishery studies

These have included studies of how cetaceans respond to fishery pingers and to fishing gear.

Data display: Amazon River Dolphin *Inia geoffrensis*

This is as high resolution view. In the lowest panel the amplitude of clicks is shown as height, with colour showing the frequency. The middle panel shows extracted click trains and the top panel shows the click rate in the trains.



Contact: [nick.tregenza@chelonias.co.uk](mailto:nick.tregenza@chelonias.co.uk)