The Whales & Dolphins of Cyprus: Summary of 2016 & 2017 Research Surveys

AP MARINE
Environmental Consultancy Ltd

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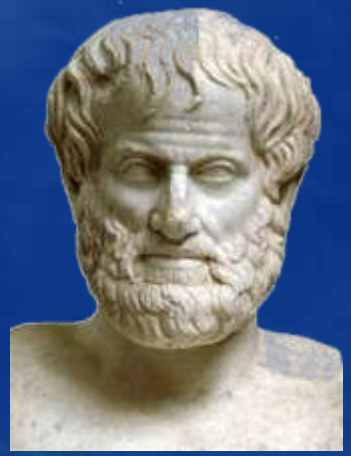
Alexandros Frantzis
Cetacean Expert
PhD Biological Oceanography

Τμήμα Αλιείας και Θαλασσίων Ερευνών
Υπουργείο Γεωργίας, Αγροτικής Ανάπτυξης και Περιβάλλοντος

History of Cetacean Research

- Aristotle ~2300 years ago = the first cetologist?
- Historical gap until medieval texts of 13th century.
- Most early studies = measuring dead animals (whaling).
- Captivity: behaviour, life history, anatomy, acoustics.
- Focus shifted from captive to wild dolphin populations.

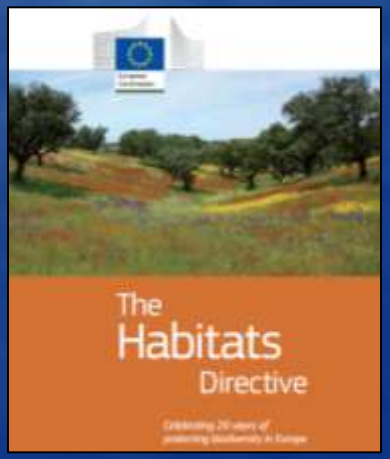


Cetaceans of Cyprus

- Limited information available from strandings, sightings reported by the public & occasional research surveys.
- Known species: sperm whale, Cuvier's beaked whale, false killer whale, bottlenose dolphin, Risso's dolphin, rough-toothed dolphin and striped dolphin.
- Occasional visitors: a fin whale was seen in Larnaka Bay in 2001; a grey whale appeared off Israel in 2010!

Conservation Requirements

- Greater understanding of cetacean presence essential for various international and national regulations.
- European Commission's Habitats Directive: "deliberate capture, killing or disturbance" of all species is forbidden; Member States to consider Special Areas of Conservation.
- EU's Marine Strategy Framework Directive: Member States to achieve Good Environmental Status of waters by 2020.



Aims of 2016 & 2017 Surveys

- Comprehensive assessment of cetacean presence, distribution and, where possible, population size.
- Identify critical habitats & areas where threats arise.
- Surveys conducted by international team of scientists under contract to Dept. of Fisheries & Marine Research.
- Three surveys successfully completed in August 2016, November 2016 and May 2017.

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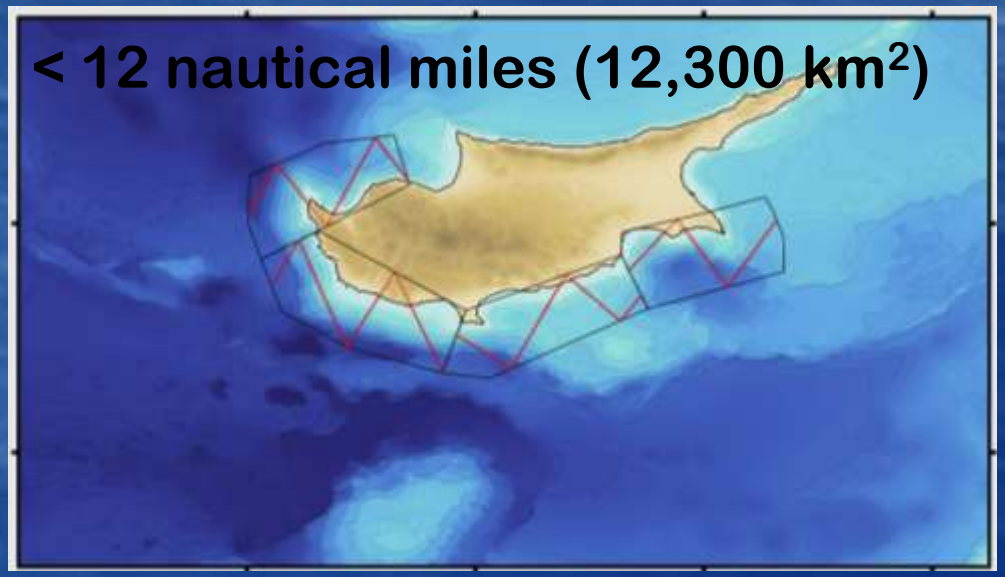
Study Area for 2016 & 2017 Surveys

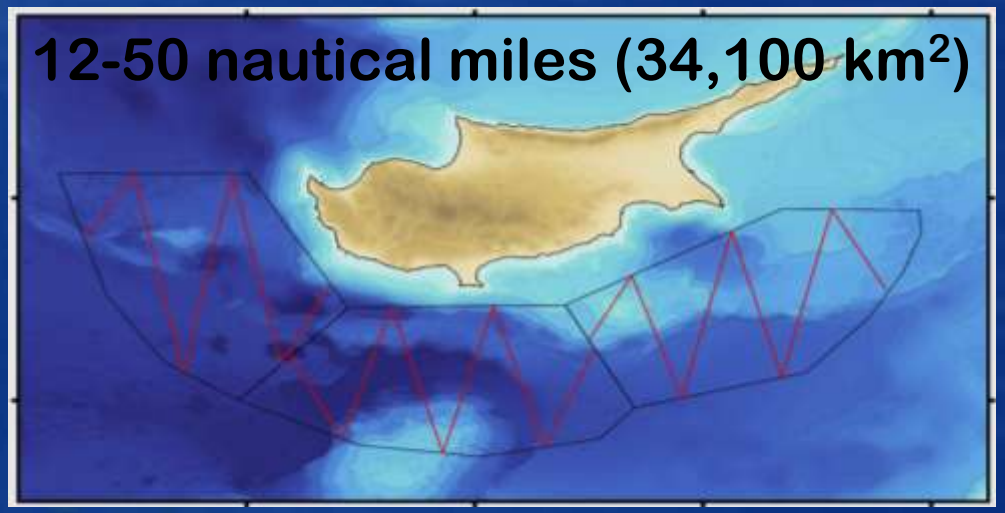
- **Main study area:**

  1) Territorial waters <12 nm offshore (with an emphasis on bottlenose dolphins),

  2) Offshore waters <50 nm offshore (all species).

- **Three surveys with 7 days of effort in each region (Aug 2016, Nov 2016 & May 2017).**





Survey Protocol

- Flash Royal = local 20 m ‘Moody 66’ yacht.
- Sightings, environment & effort data to laptop.
- Position, heading and speed (typically 6-8 knots) logged every 10 s.
- Environmental data logged every 30 mins (sea state, wave & swell height, wind speed & direction, cloud, etc.).

Visual Surveying

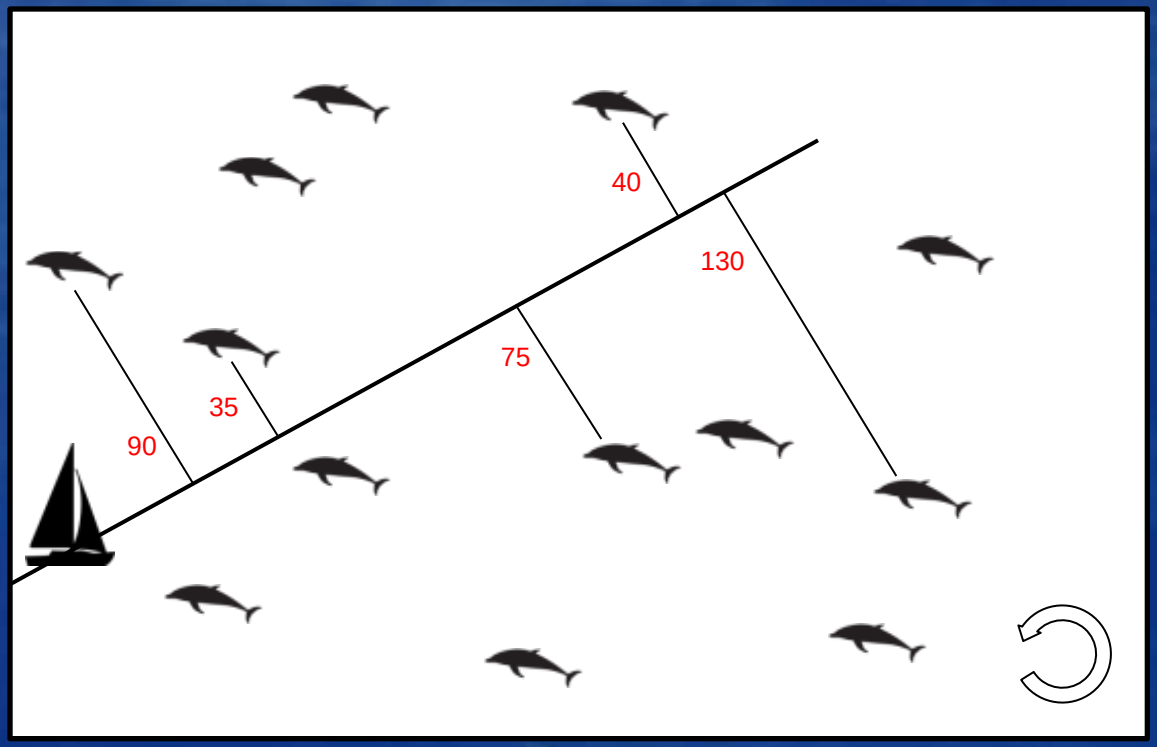
- Visual effort in daylight (~ 7am - 5pm) when sea state <4.
- Two observers (hourly rotation) on a platform on aft deck with eye height of ~ 4.8 m.
- Observers scanned from 0º to 90º either side to 500 m (7x50 binoculars).
- Sightings data collected for marine vertebrates (cetaceans, monk seals, turtles, sharks, sunfish & fish schools) plus marine debris.

Acoustic Surveying

- Towed hydrophone array capable of detecting all cetacean species (10 - 200,000 Hz).
- Acoustic effort was continuous in all weather.
- Towed 400 m behind vessel (200 m for coastal transects).
- Software monitored for clicks, whistles & song in real-time.

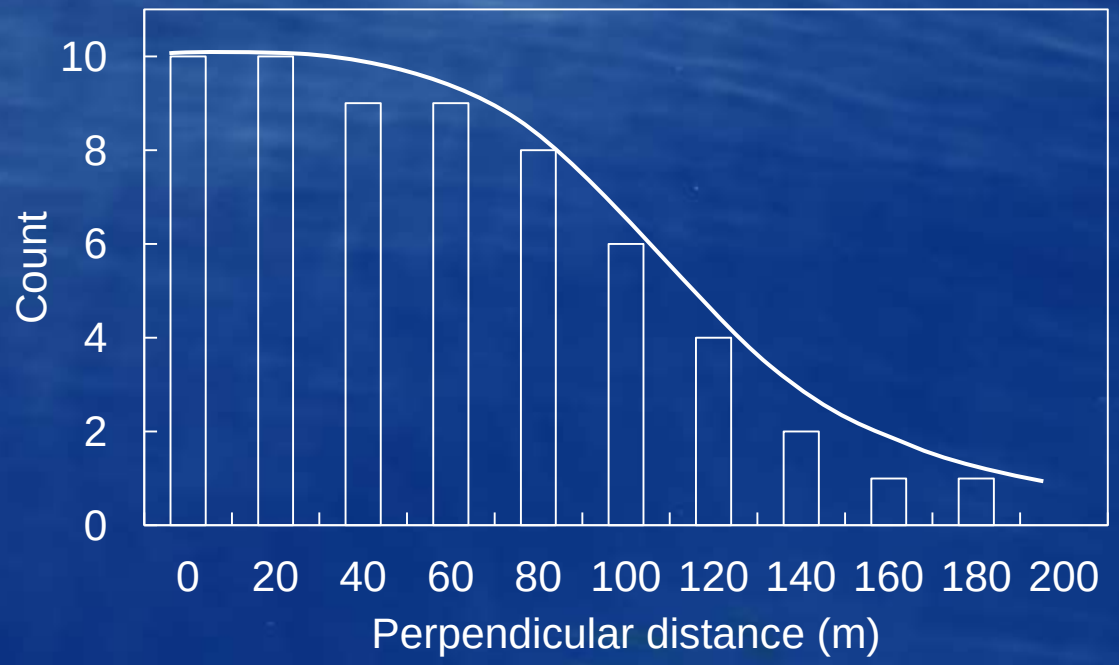
Distance Sampling

- Method for estimating density and/or abundance.
- Observers search for animals along a randomly located set of lines and measure the distance from line to object.



Distance Sampling

- Goal is to fit a detection function to observed distances.
- Function allows estimate of proportion of objects missed.
- We can then obtain estimates for the density/abundance of objects in the survey area.



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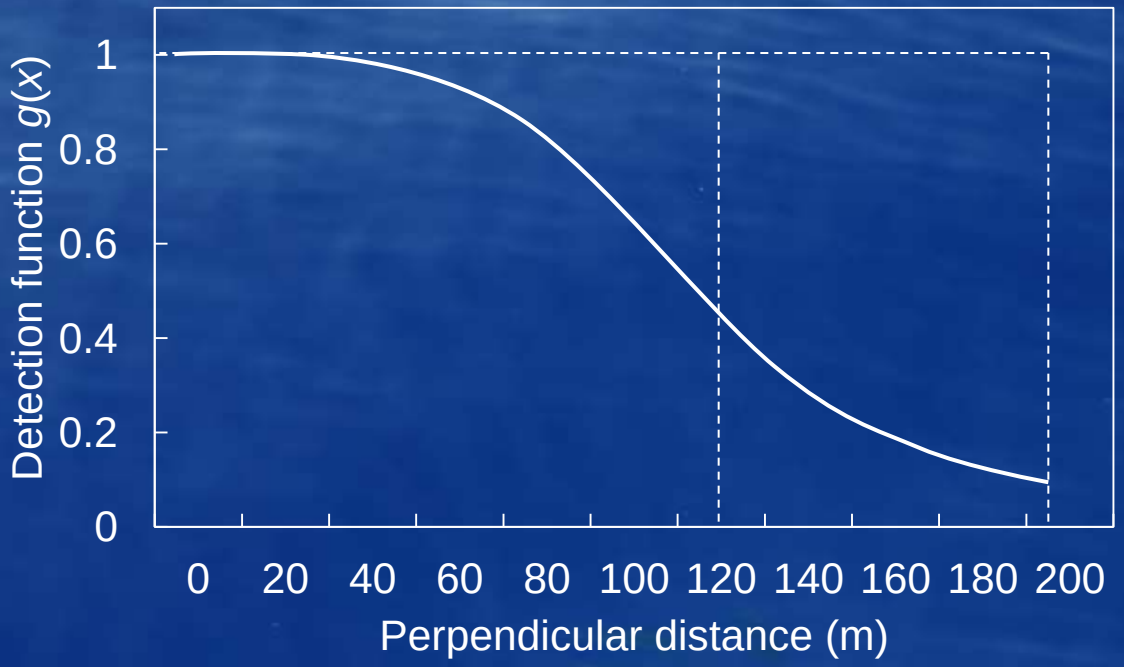


Ambient Noise

- Point samples of ambient noise made using a calibrated hydrophone in a cage deployed to 30 m.
- Twice a day at approximately 07:00 and 19:00.
- Noise levels were estimated for three 1/3 octave bands (centred at 63, 125 and 1000 Hz) to satisfy MSFD.

Vessel Density

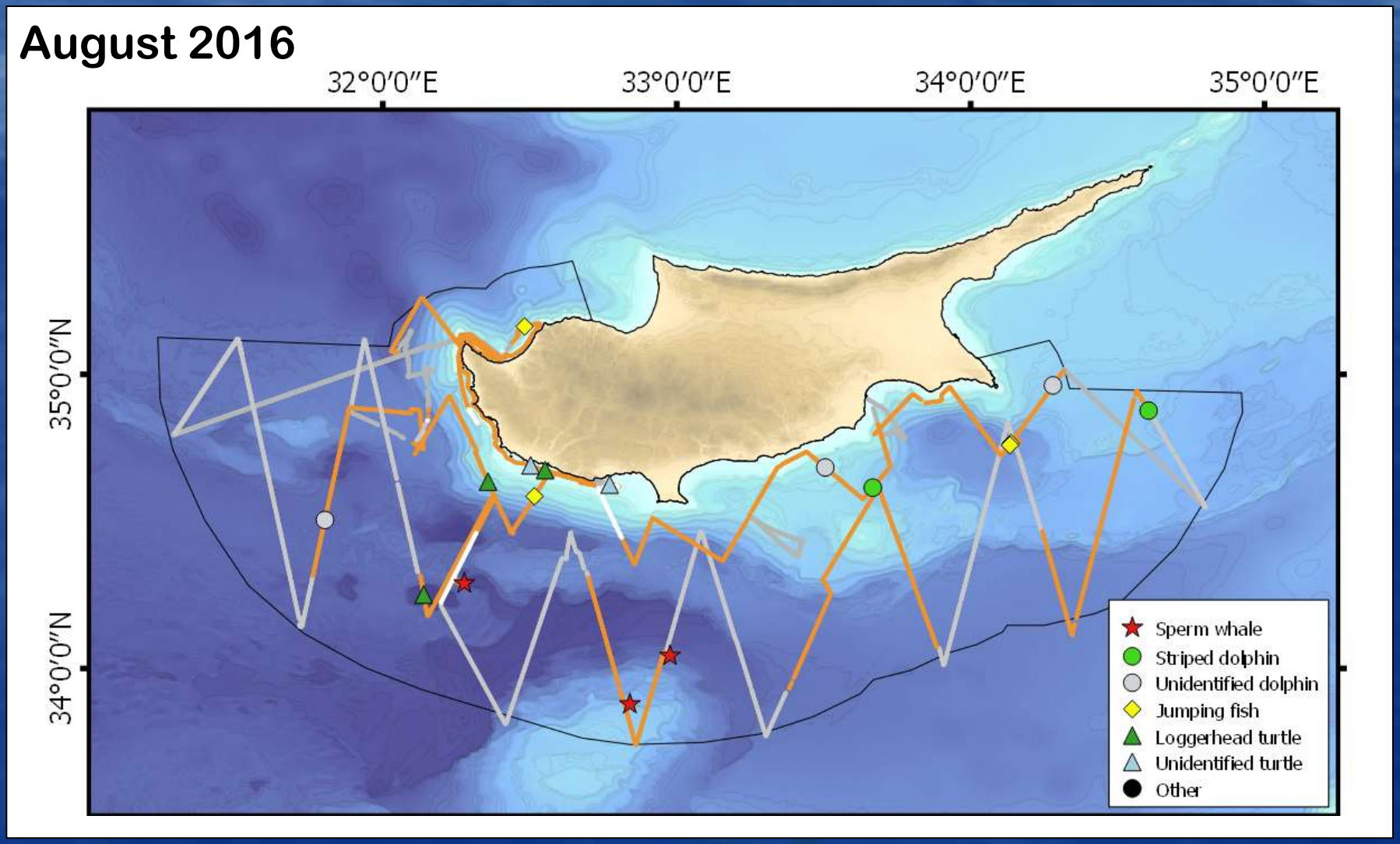
- Commercial vessels over 300t transmit Automatic Identification System (AIS) signals.
- AIS signals were logged to investigate the distribution of shipping traffic and assess ship density levels.
- Such data are critical for identifying high risk zones for cetacean ship-strikes.

Summary of Survey Results

- **Survey effort was equivalent in all three surveys.**

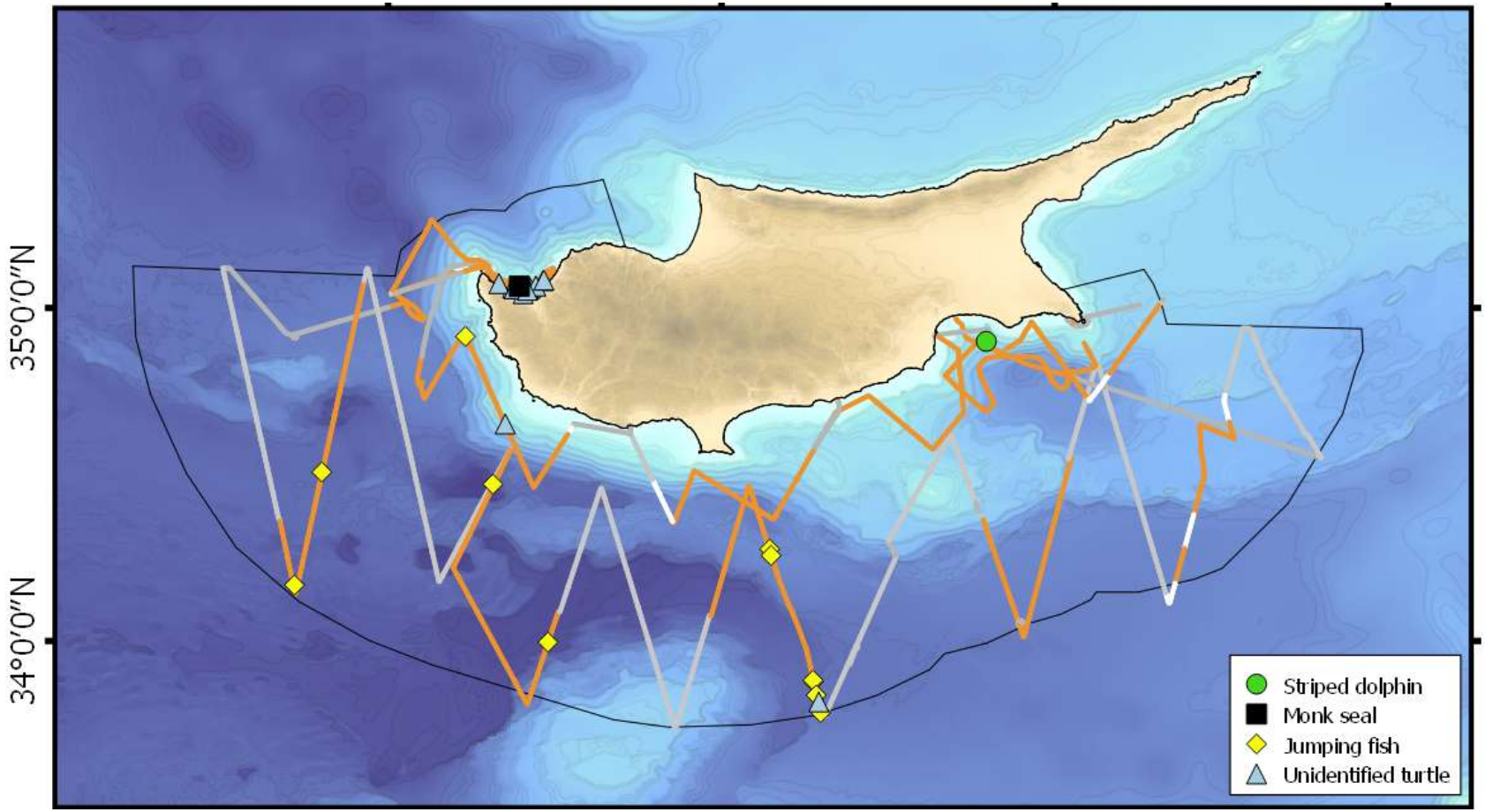
Survey	Coastal	Offshore	Total (< sea state 4)
August	857 km 97 hrs	1620 km 140 hrs	2476 km 236 hrs
November	889 km 72 hrs	1570 km 134 hrs	2459 km 302 hrs
May	1064 km 192 hrs	1430 km 133 hrs	2494 km 289 hrs

Visual Detections by Survey

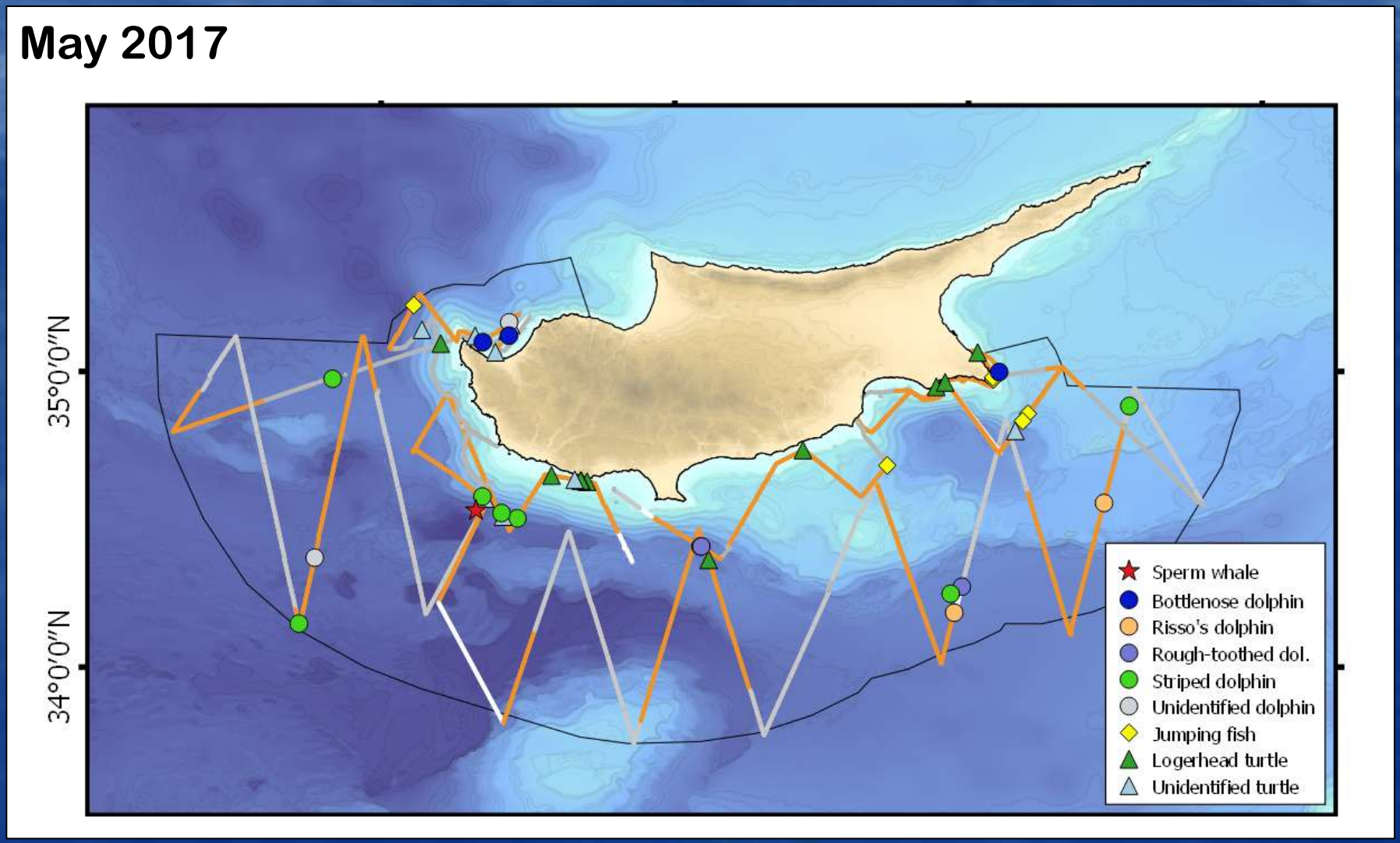


Visual Detections by Survey

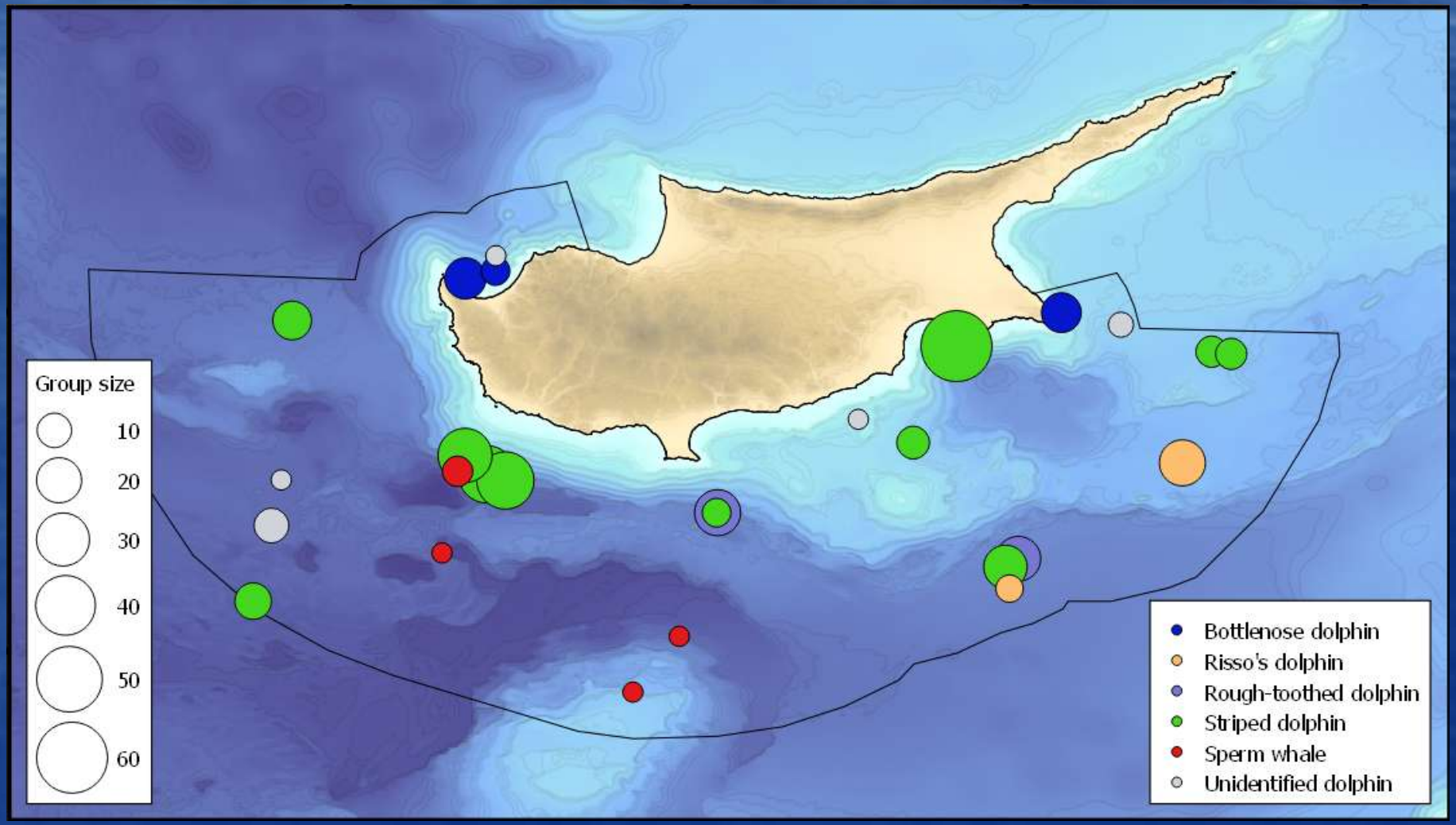
November 2016



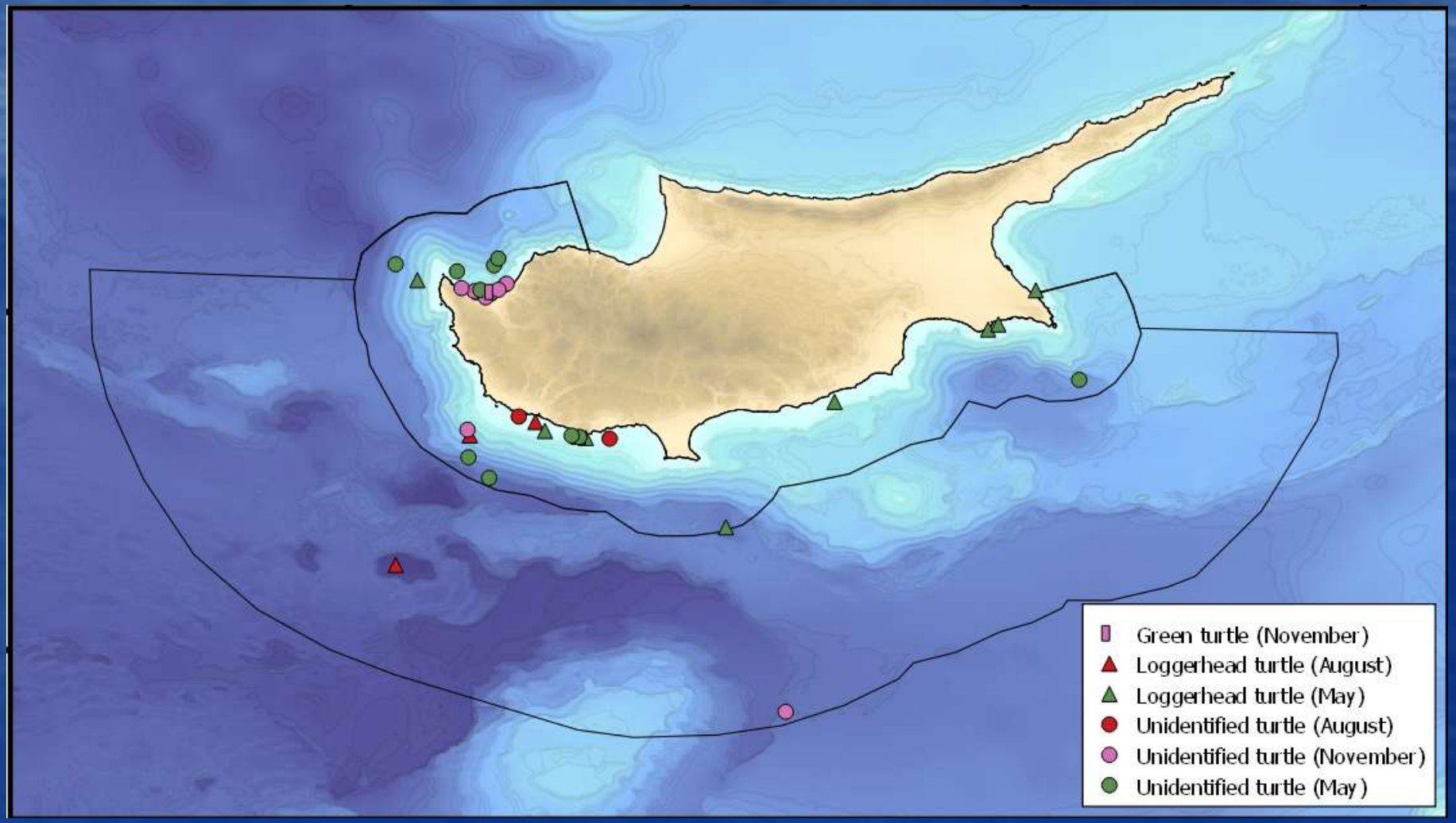
Visual Detections by Survey



Visual Detections Combined



Turtle Sightings Combined



Seabird Sightings Combined

Photo-Identification

- **Photo-ID images were taken for two (of three) sperm whale groups in August; photos showed same individual in both.**

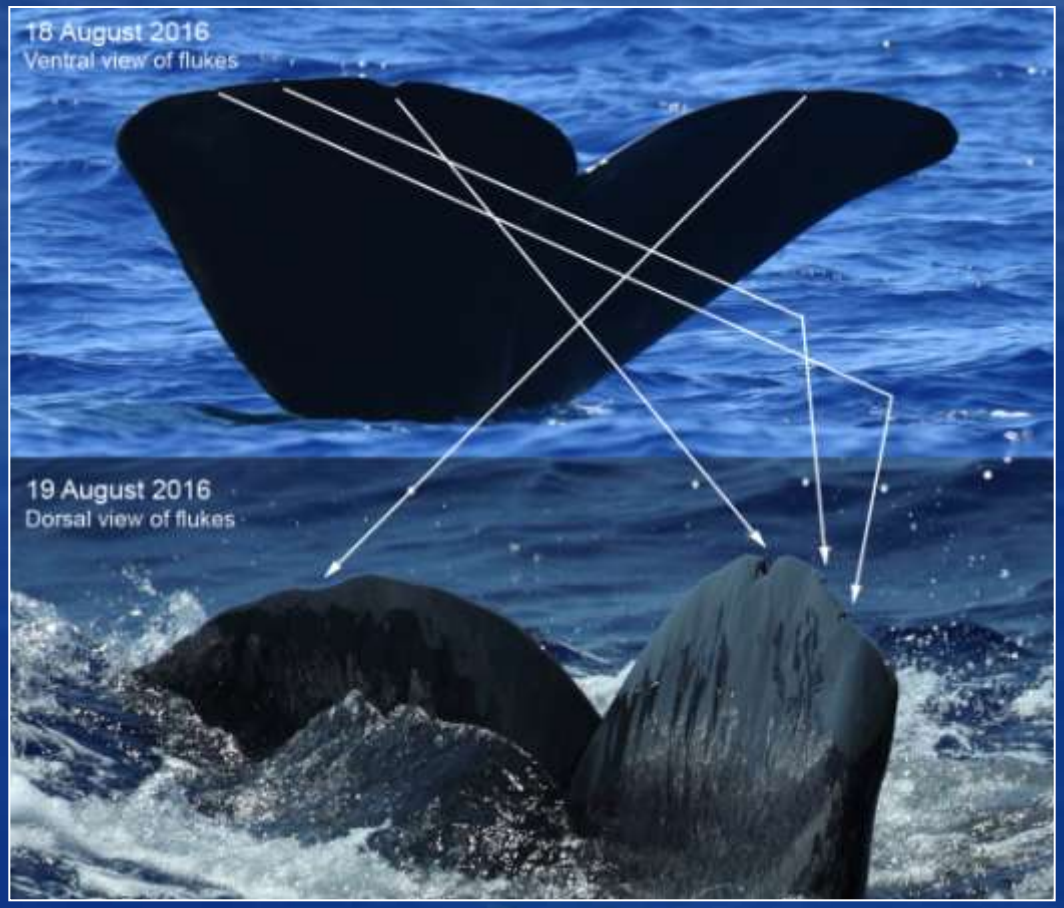
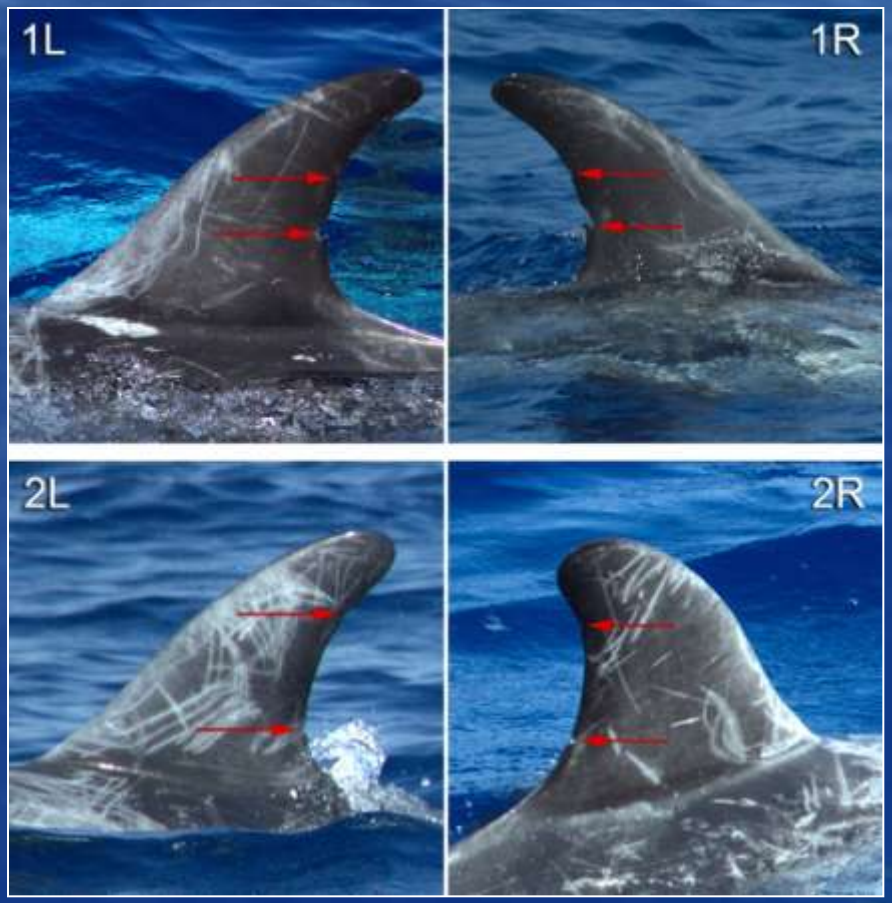


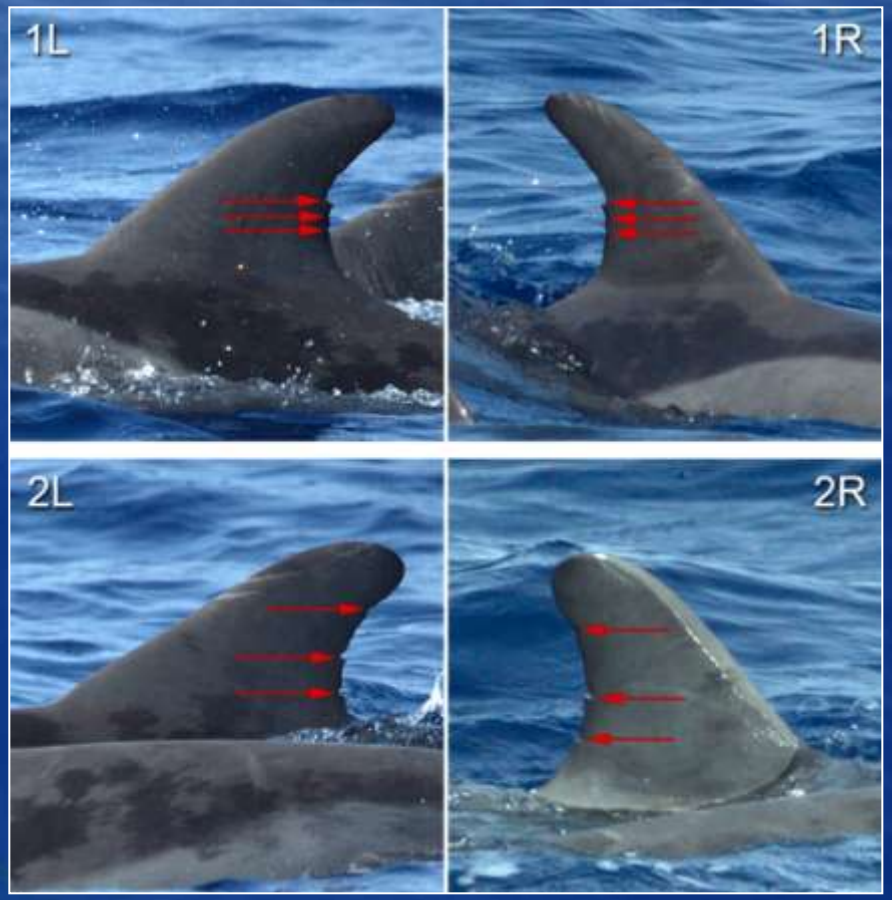
Photo-Identification

- **In May 2017, 3 sperm whales were photo-identified. "Zantok" had been photographed in the Ionian Sea in 2008.**

Photo-Identification

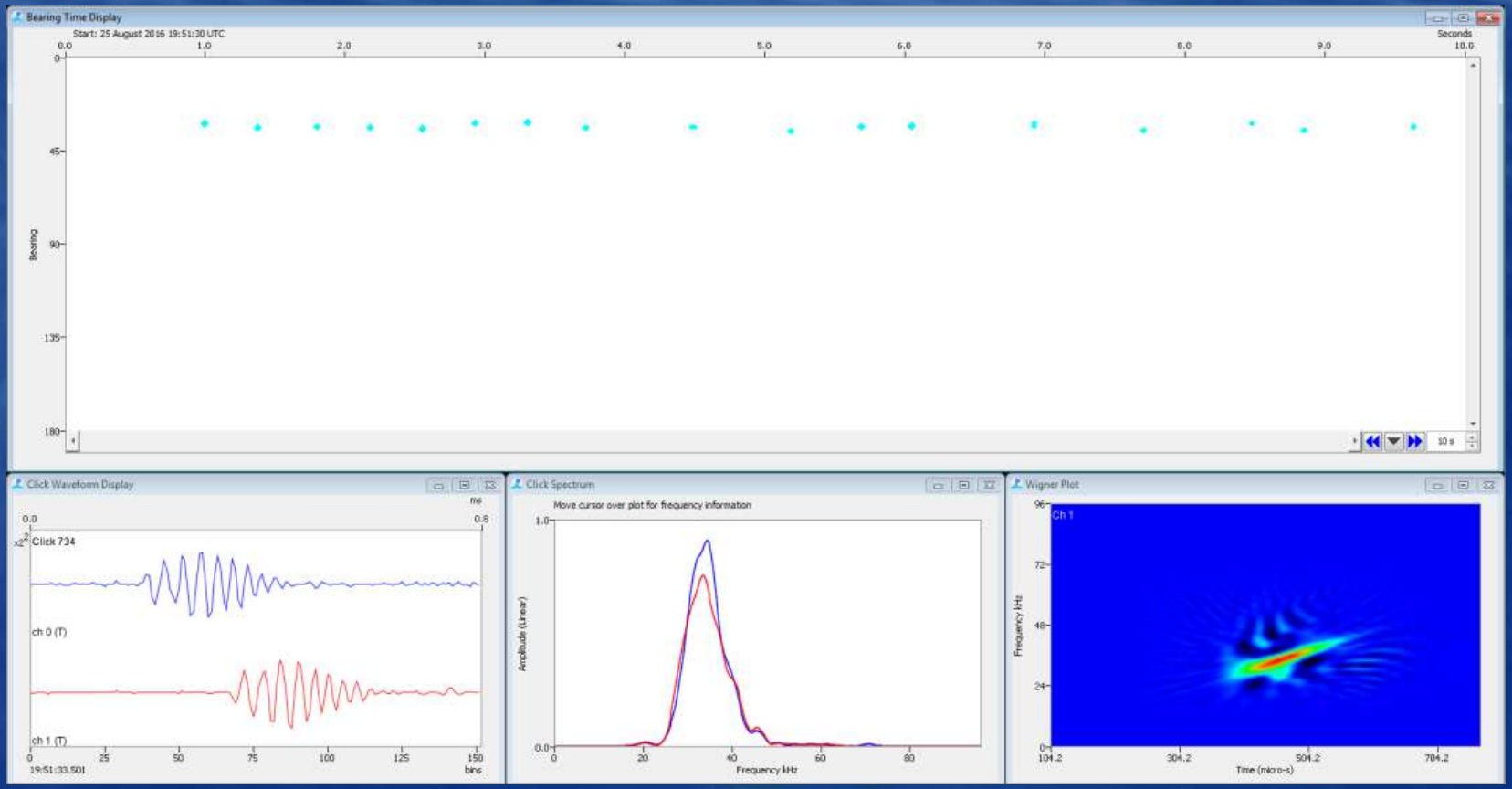
- **Photo-ID possible for several dolphin species (including Risso's dolphin and bottlenose dolphin).**



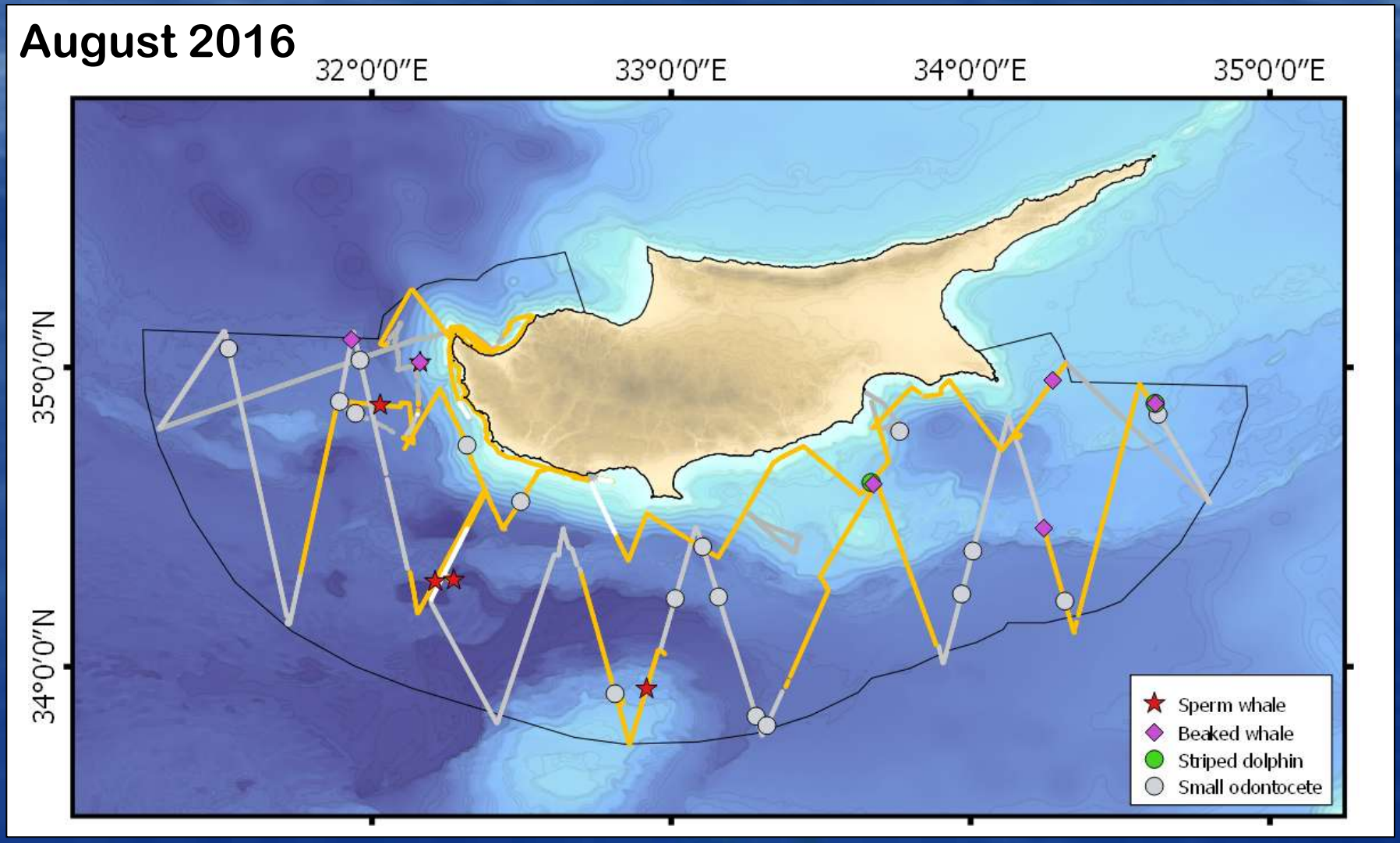


Acoustic Detections by Survey

- Some species (e.g. beaked whale) more readily detected using acoustic techniques.



Acoustic Detections by Survey



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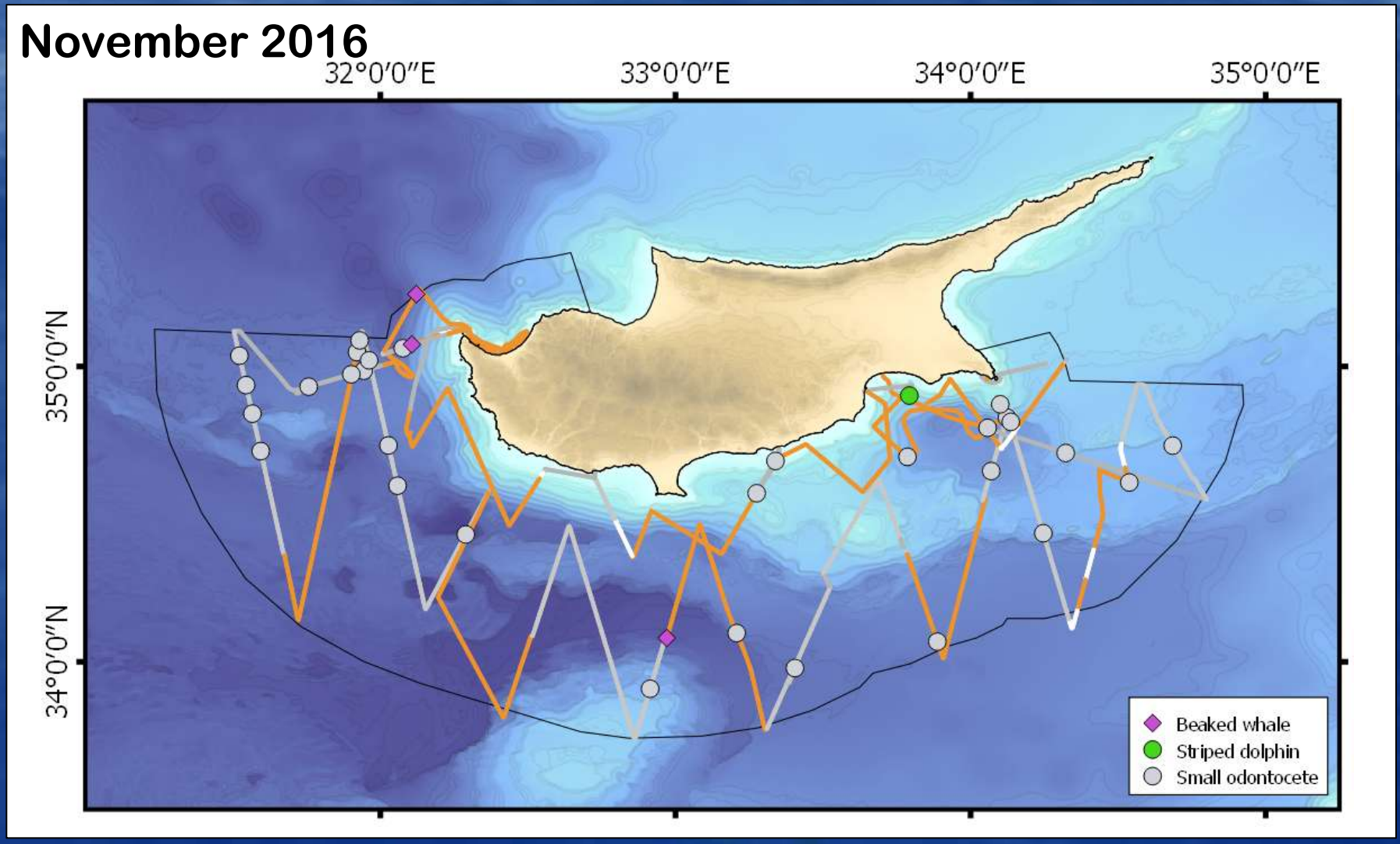
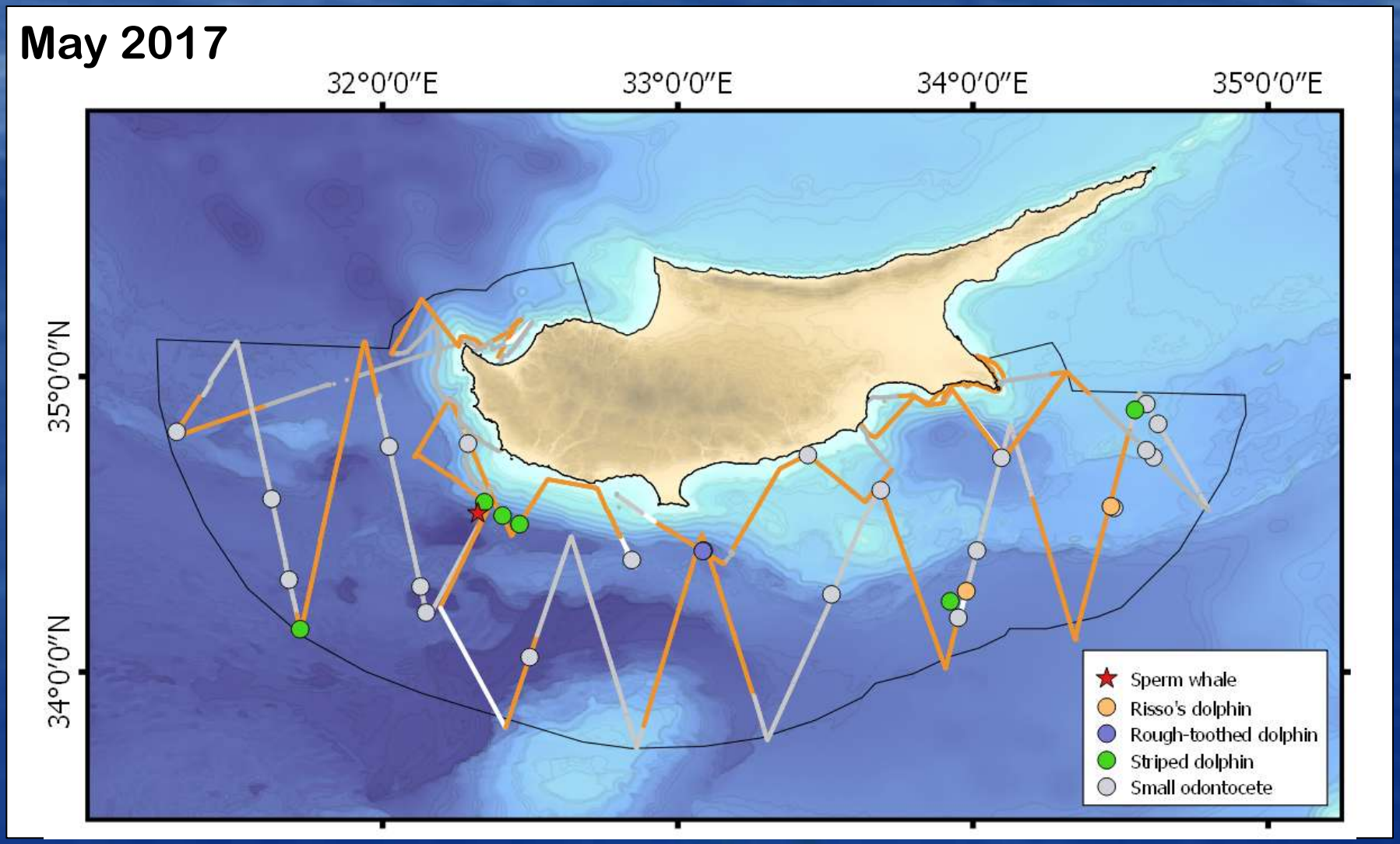
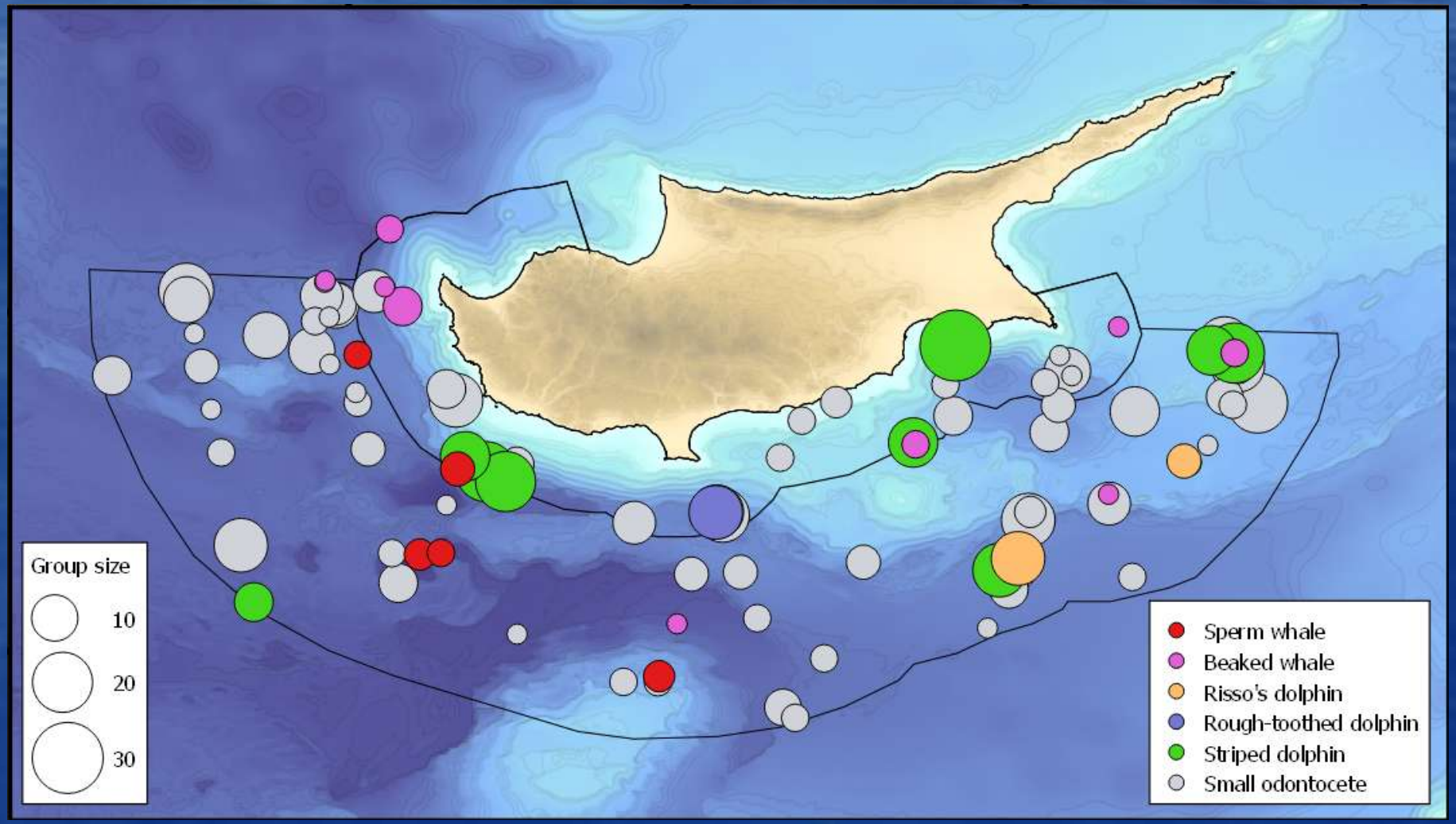


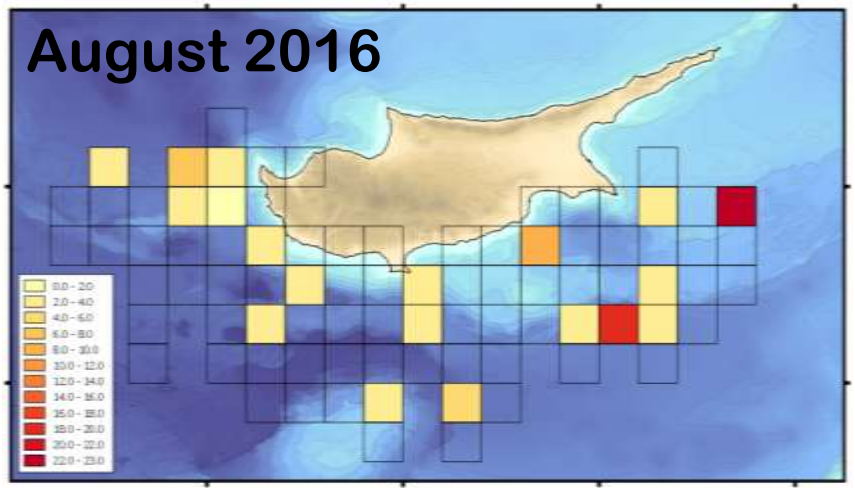
Acoustic Detections by Survey

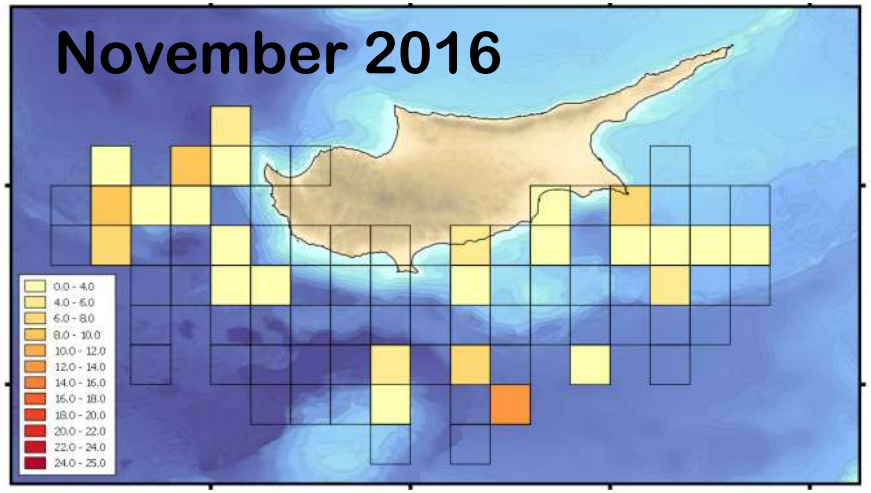


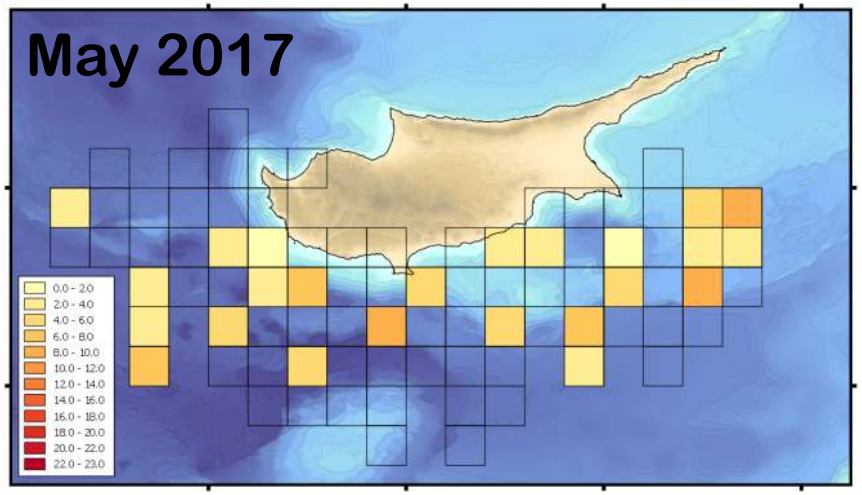
Acoustic Detections Combined



Acoustic Detections Compared







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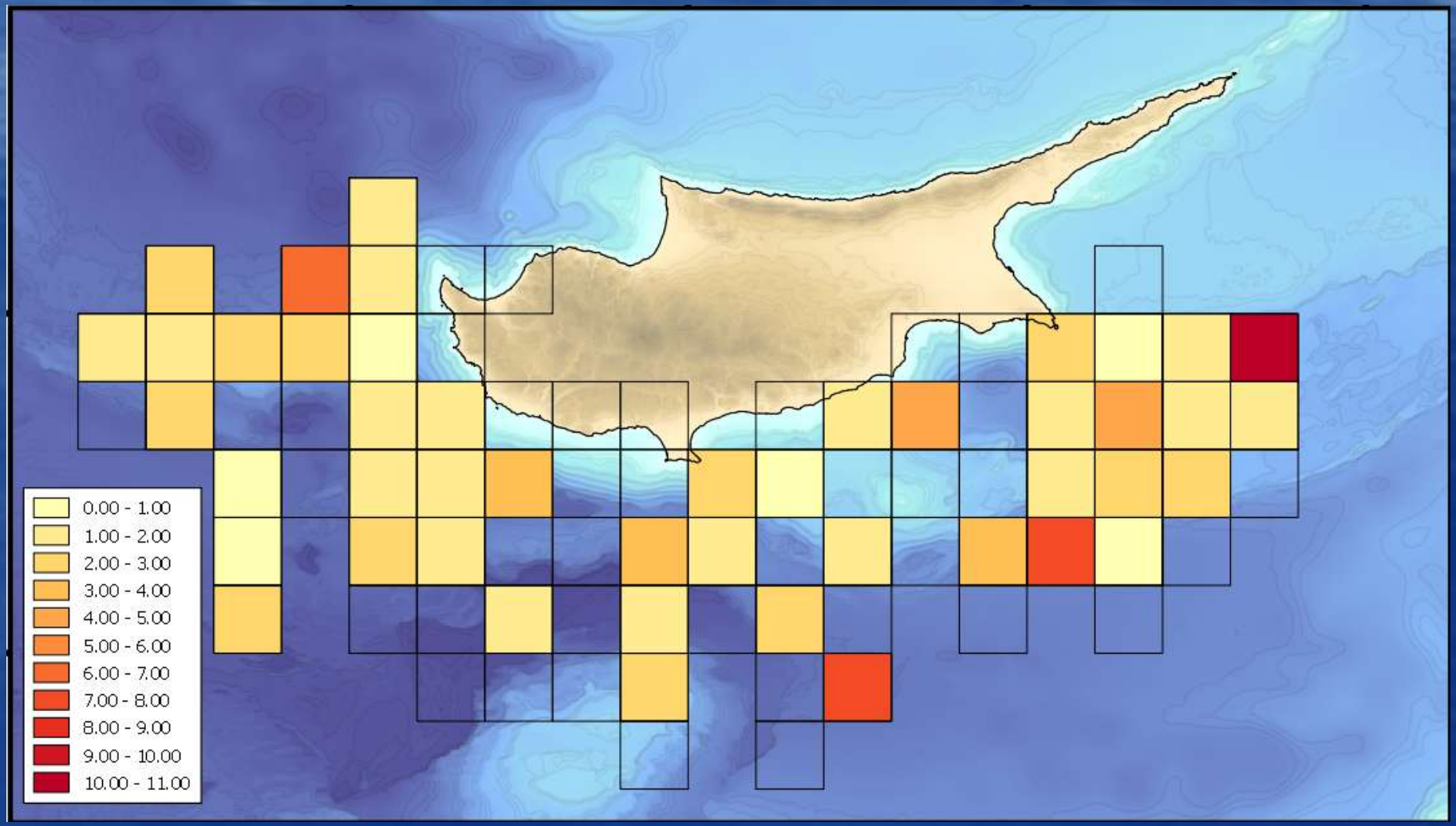
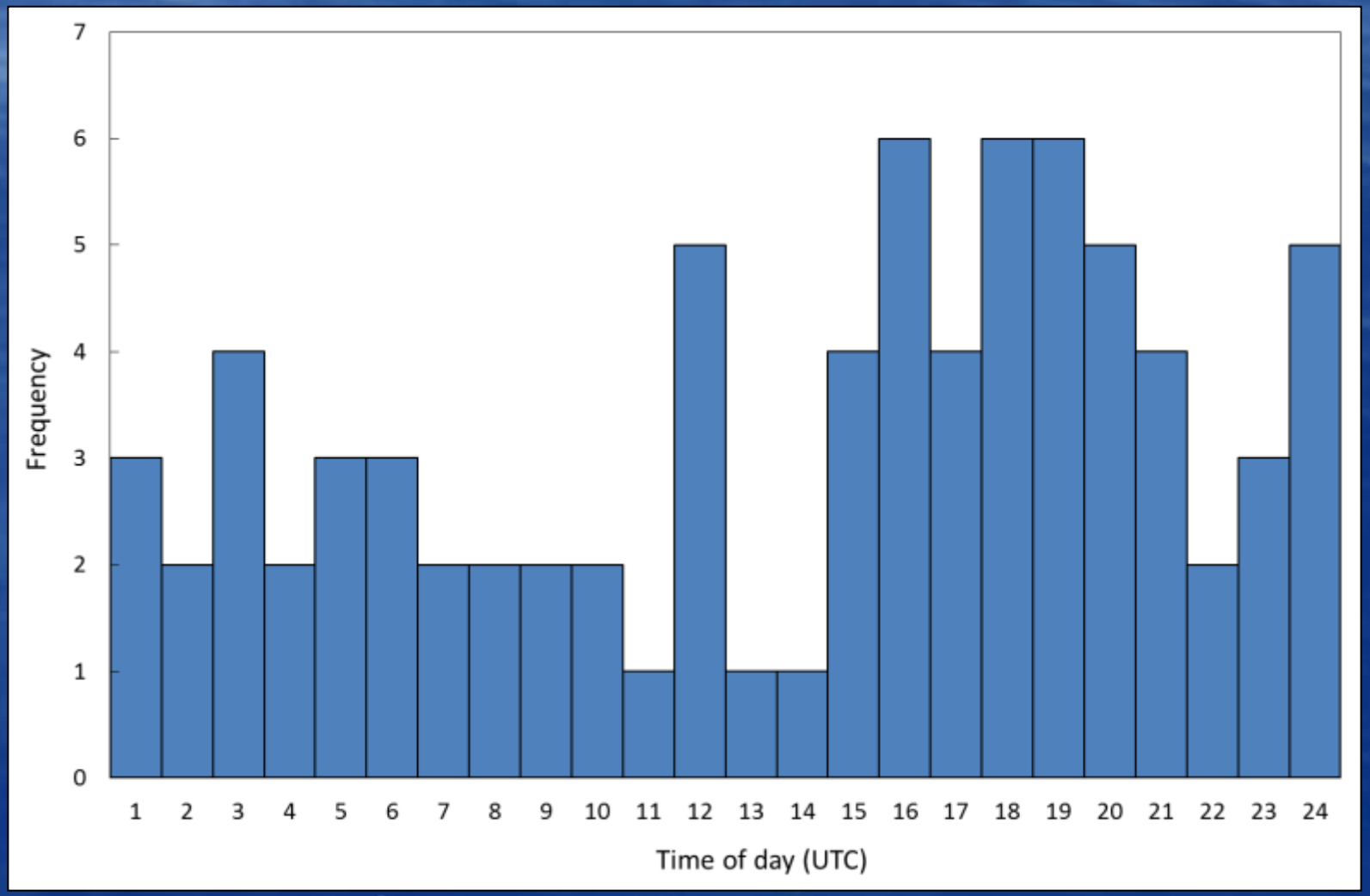
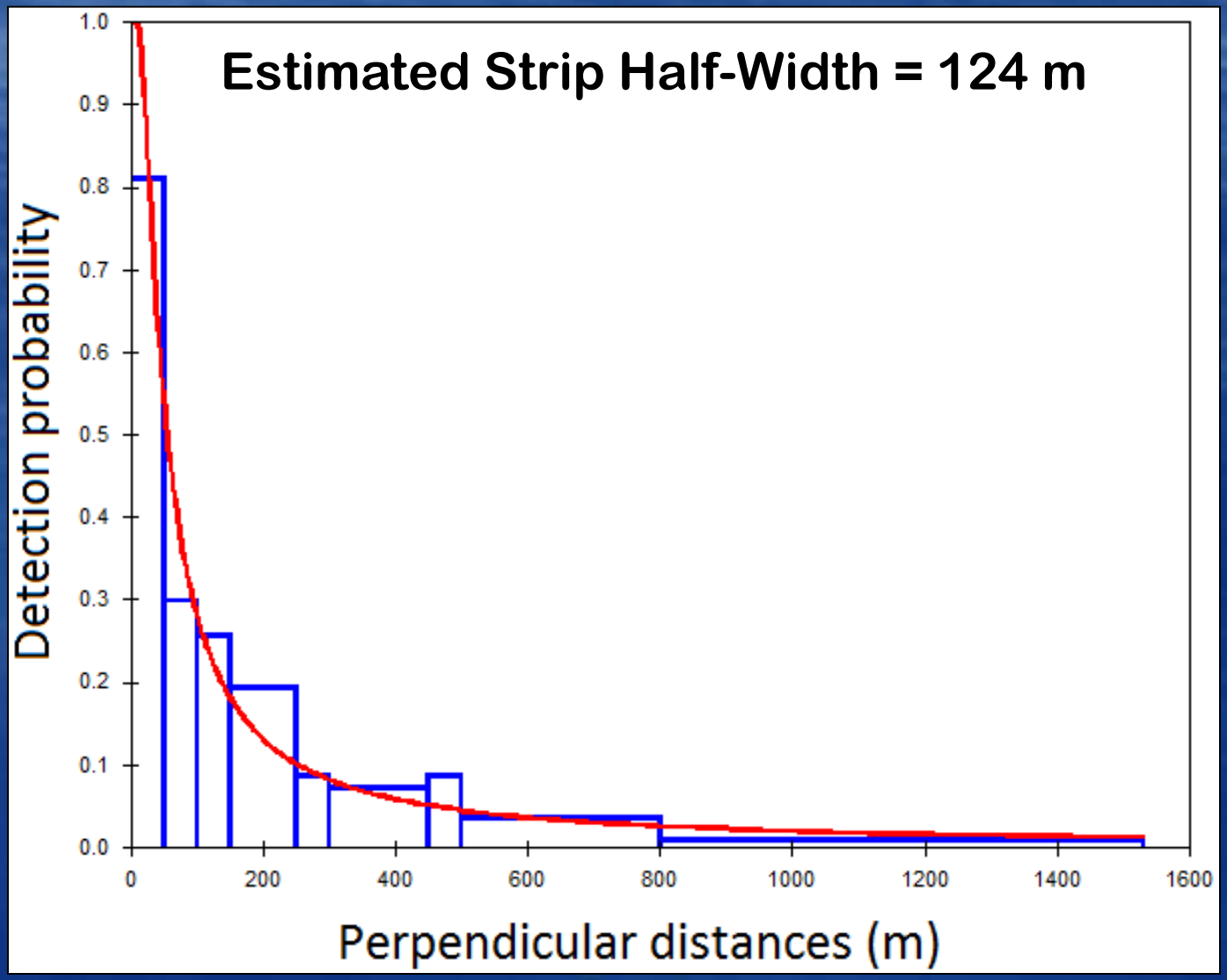


Acoustic Detections of Dolphins



Distance Sampling



Distance Sampling

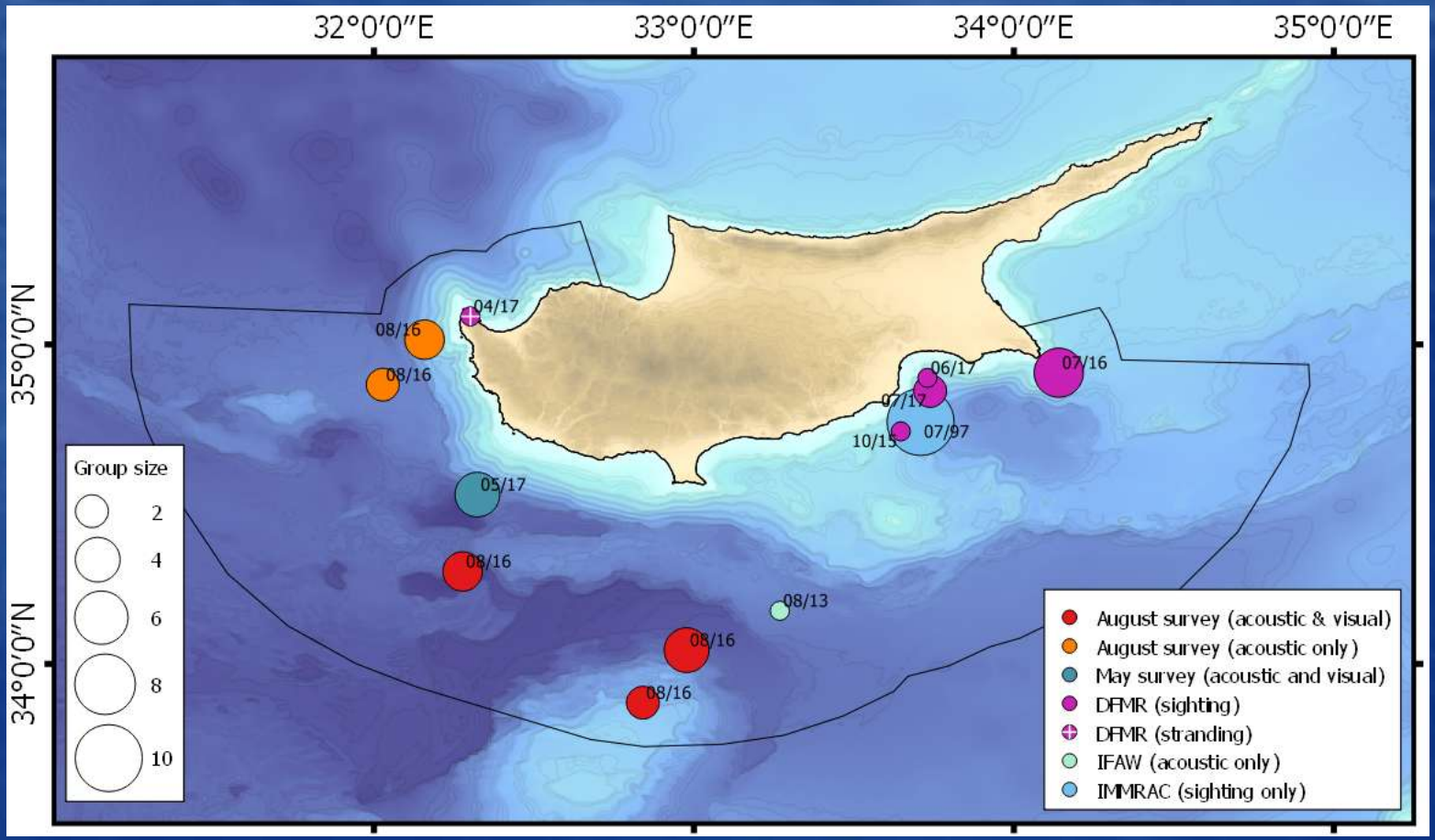
Survey block	Density of groups (km^{-2})	*N*
50a	0.09	6,554
50b	0.03	2,380
50c	0.09	7,400
Total for 50 nm block	0.07	16,251
12a	-	-
12b	0.06	1,682
12c	0.10	2,152
12d	-	-
Total for 12 nm block	0.05	4,515
Survey total	0.06	20,167

Sperm Whales

- Sperm whale groups were seen three times during the August survey and once in May 2017.
- Regular clicks typical of foraging whales heard; all groups ≥ 2 whales (determined acoustically); largest group ≥ 4.

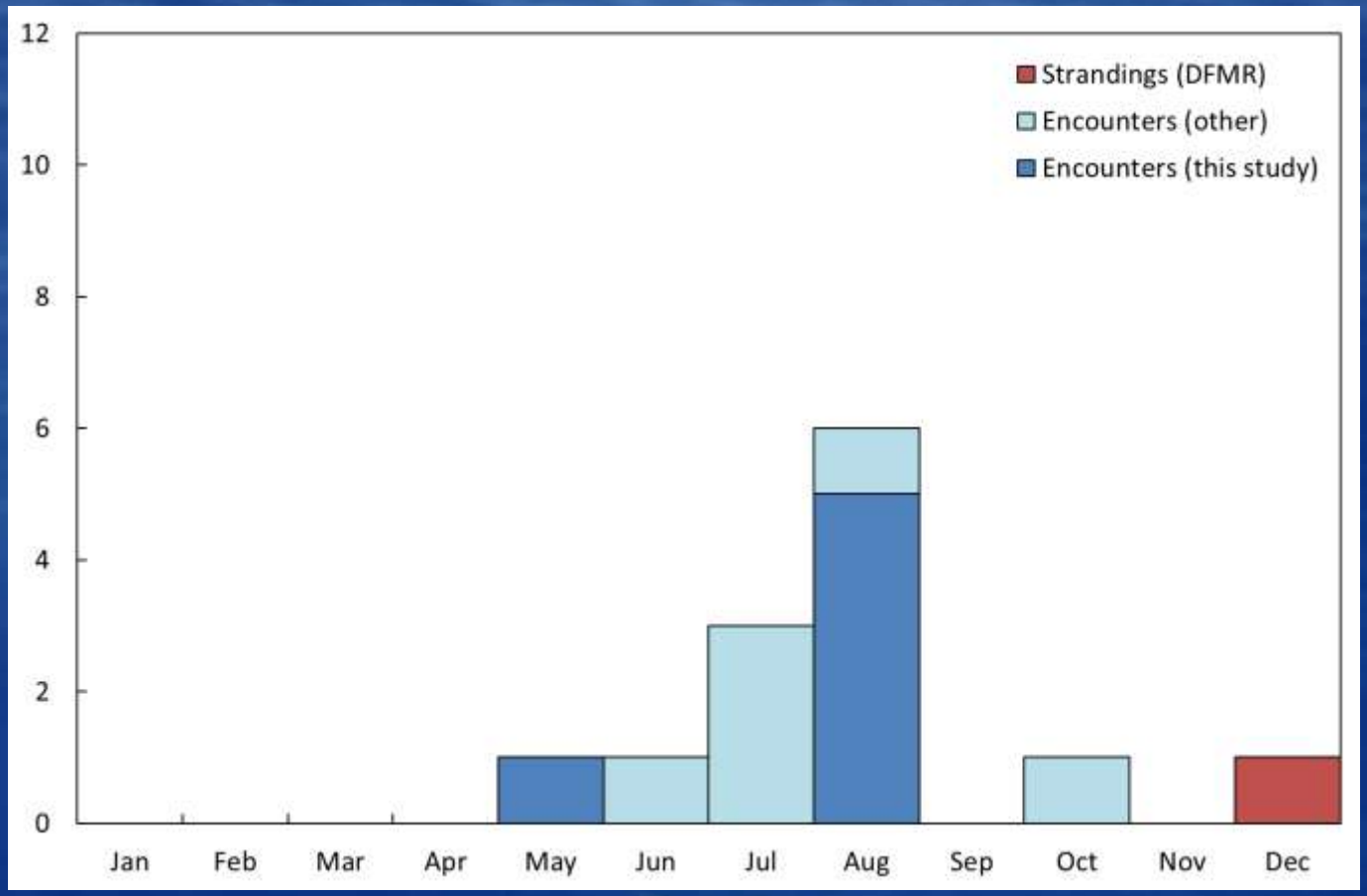
Sperm Whales

- **All encountered in waters deeper than 500 m, with 83% seen in waters over 1000 m deep.**



Sperm Whales

- All sightings to date from May to October; this may reflect higher levels of effort during summer.

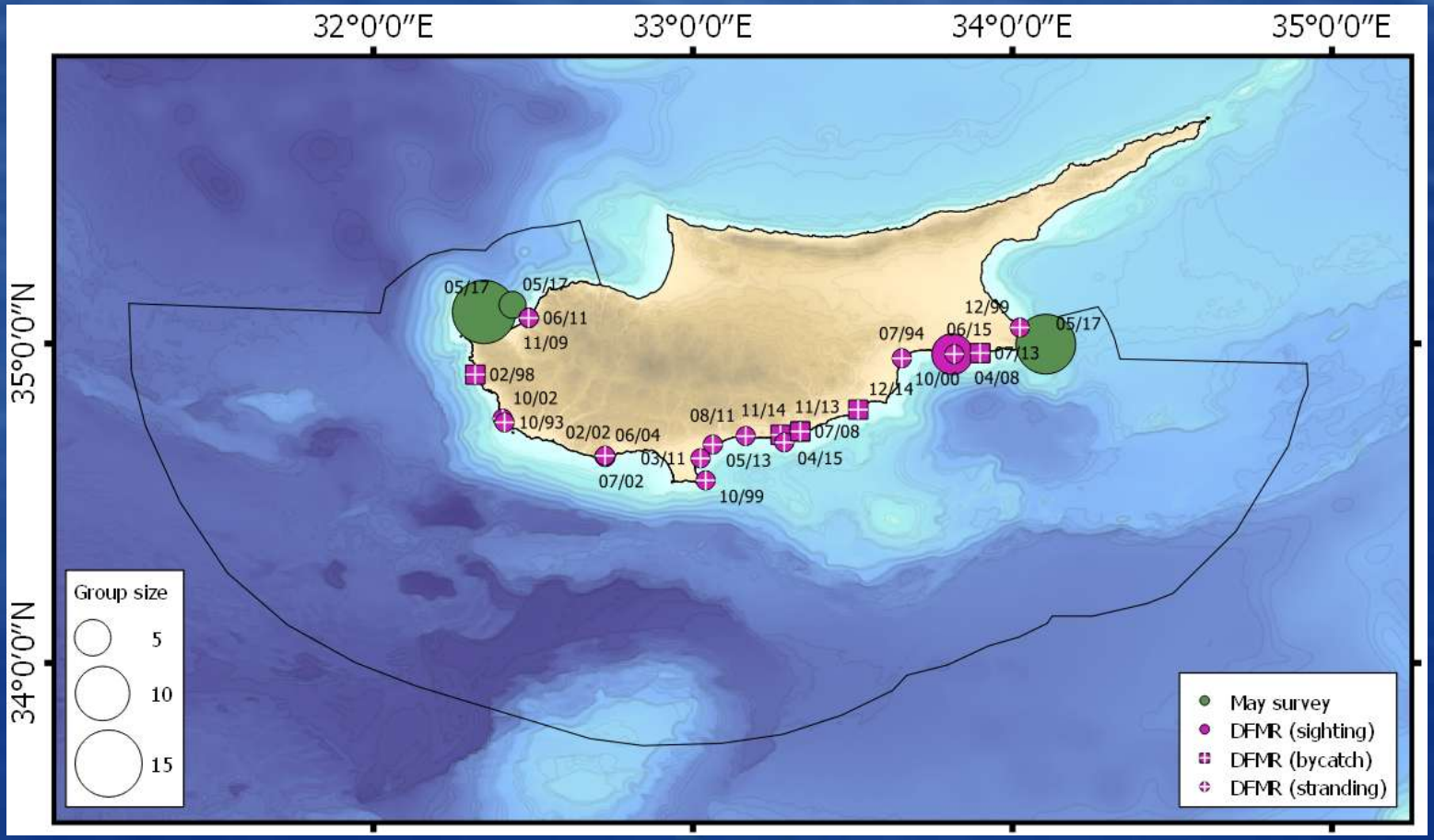


Bottlenose Dolphins

- **Sightings in May support coastal preference of this species (in waters < 500 m deep & as close as 3 km from land).**

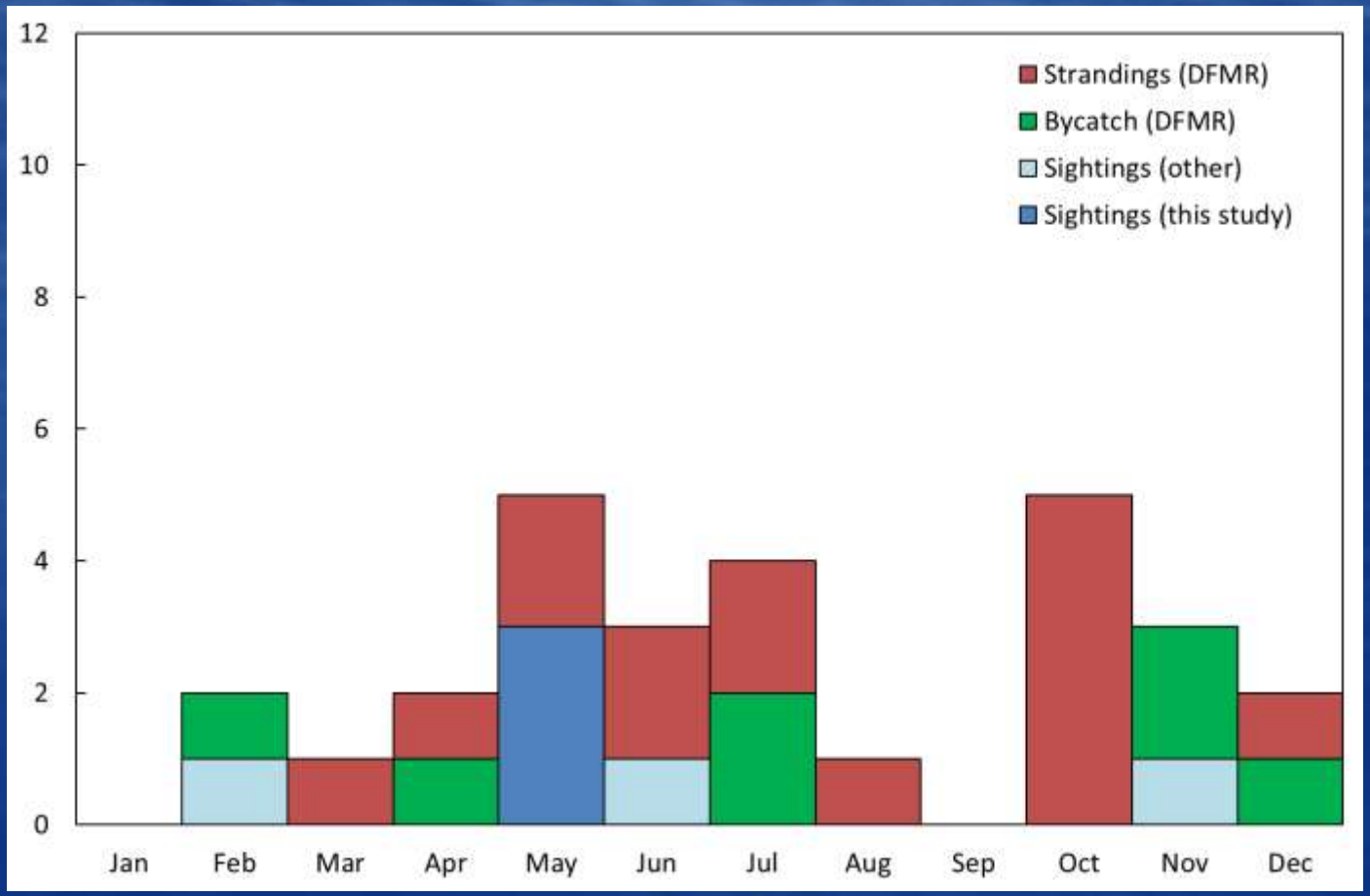
Bottlenose Dolphins

- **15 strandings and 7 instances of bycatch documented (all reported dead at the time of discovery).**



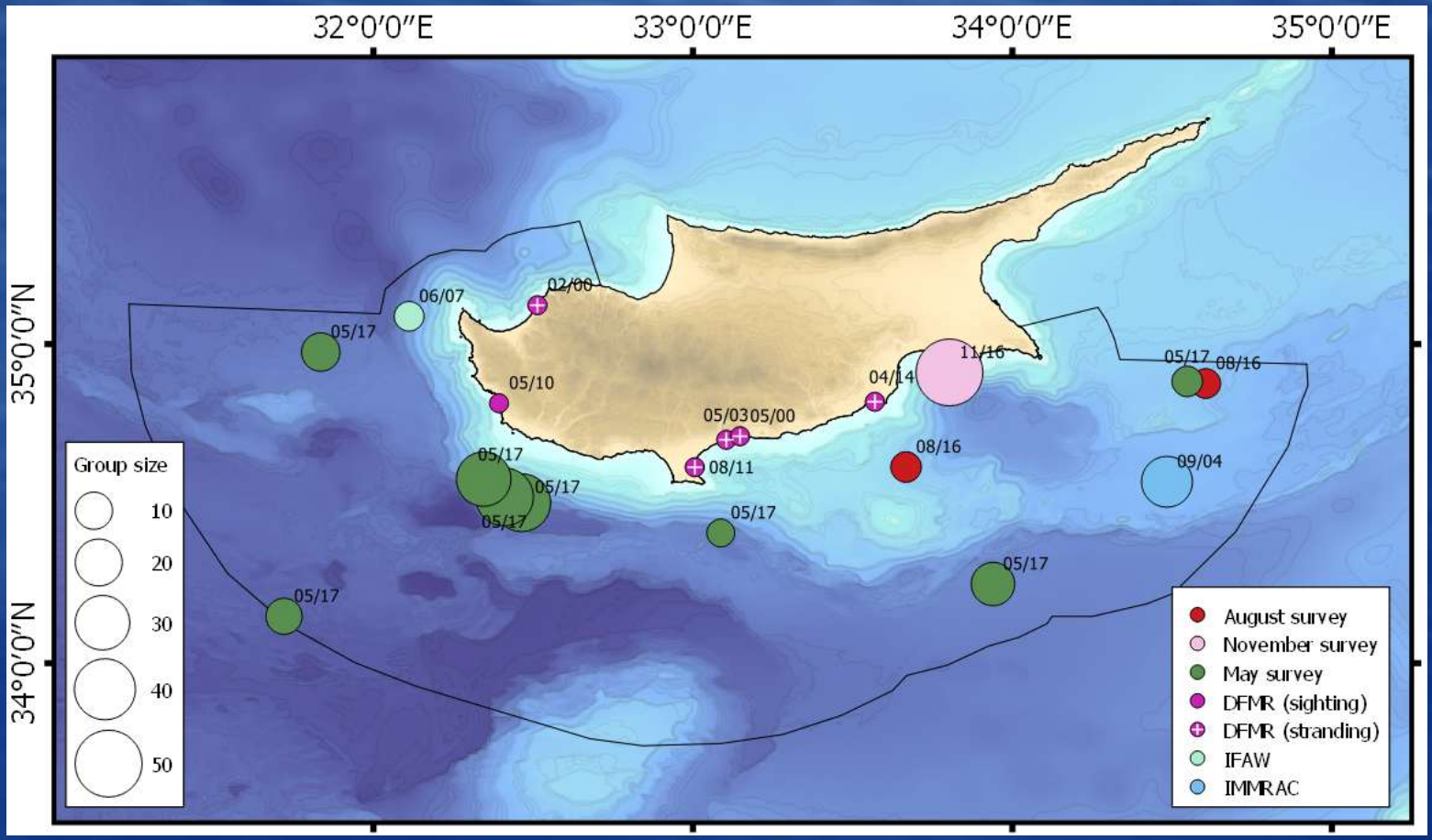
Bottlenose Dolphins

- Strandings (earliest = 1993) and sightings throughout the year; highest numbers for May-July & October-November.



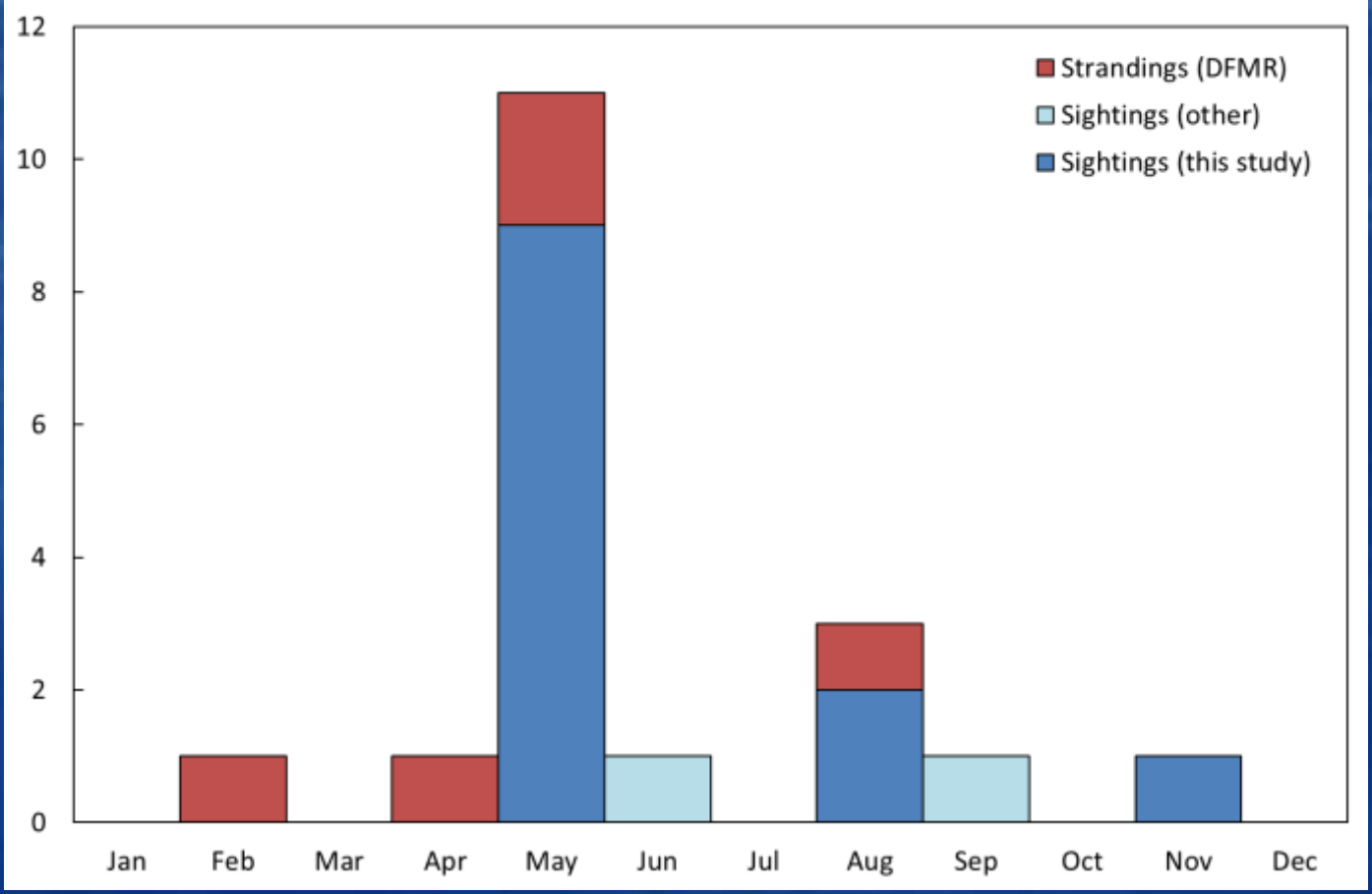
Striped Dolphins

- Seen in all surveys; most routinely encountered marine mammal (11 sightings). 83 % seen in waters > 1000 m.



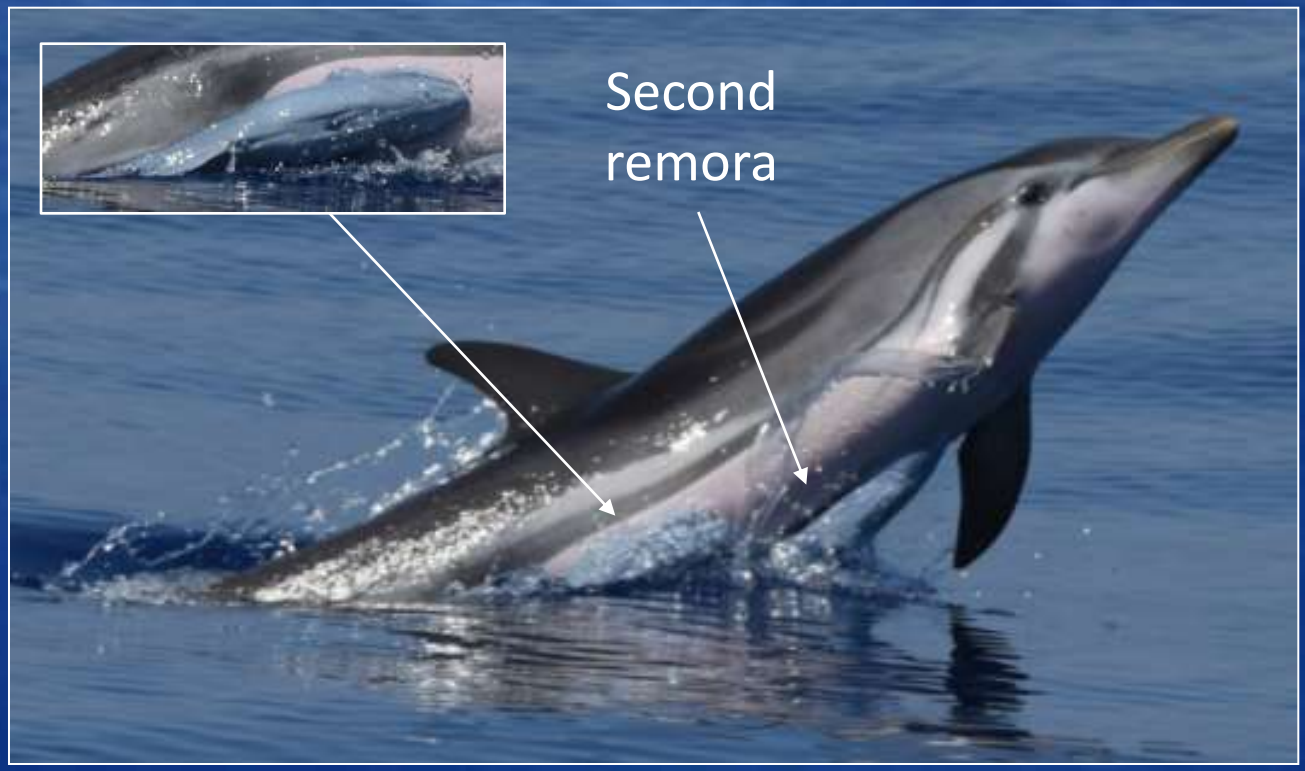
Striped Dolphins

- Sightings and strandings suggest a year-round occurrence, with an increase in summer (pronounced peak in May).



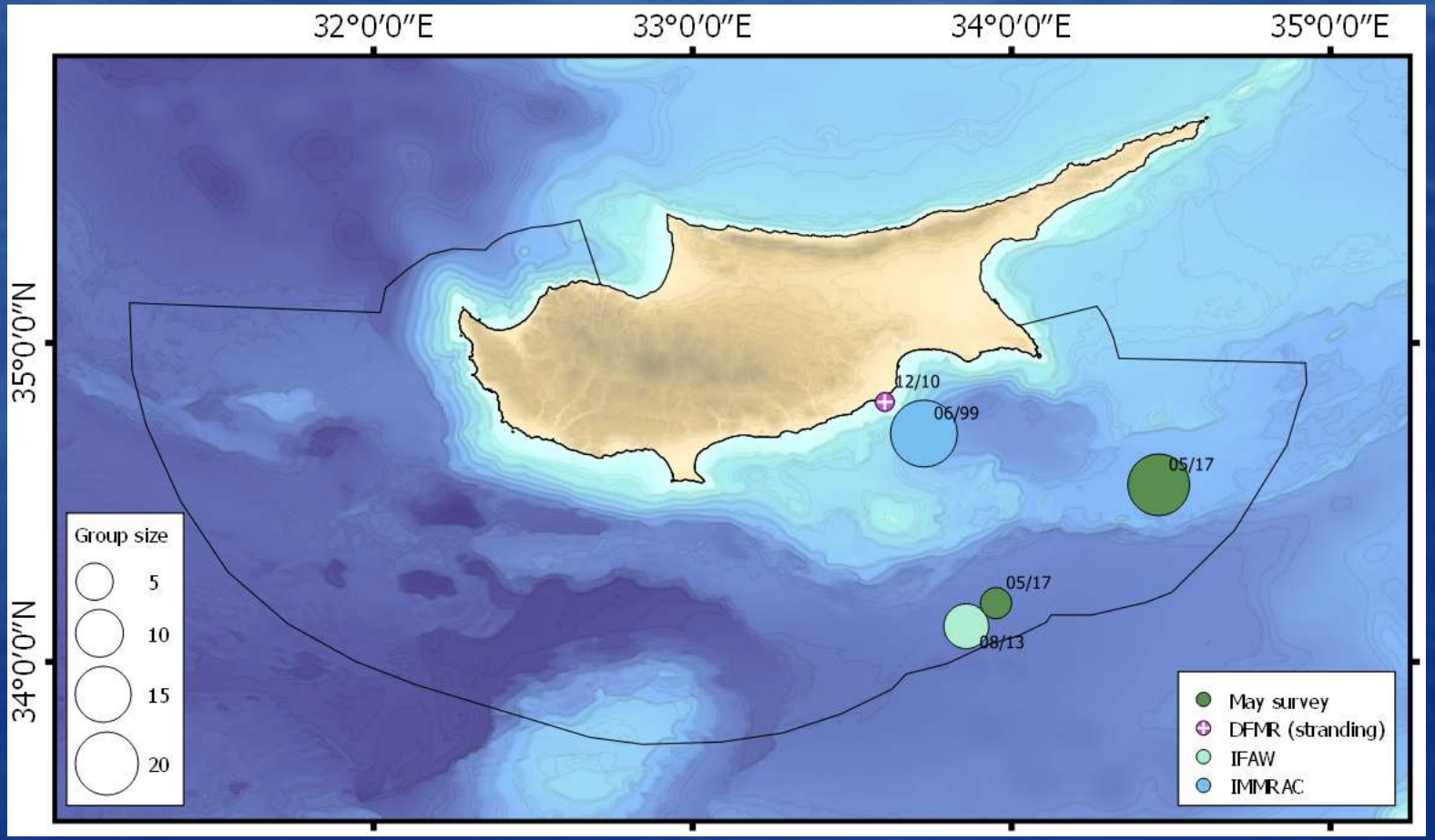
Striped Dolphins

- 6 of 11 sightings included ‘whalesucker’ remoras; in 2007, remoras seen during at least two encounters.
- In contrast, remoras not seen during any other encounters.



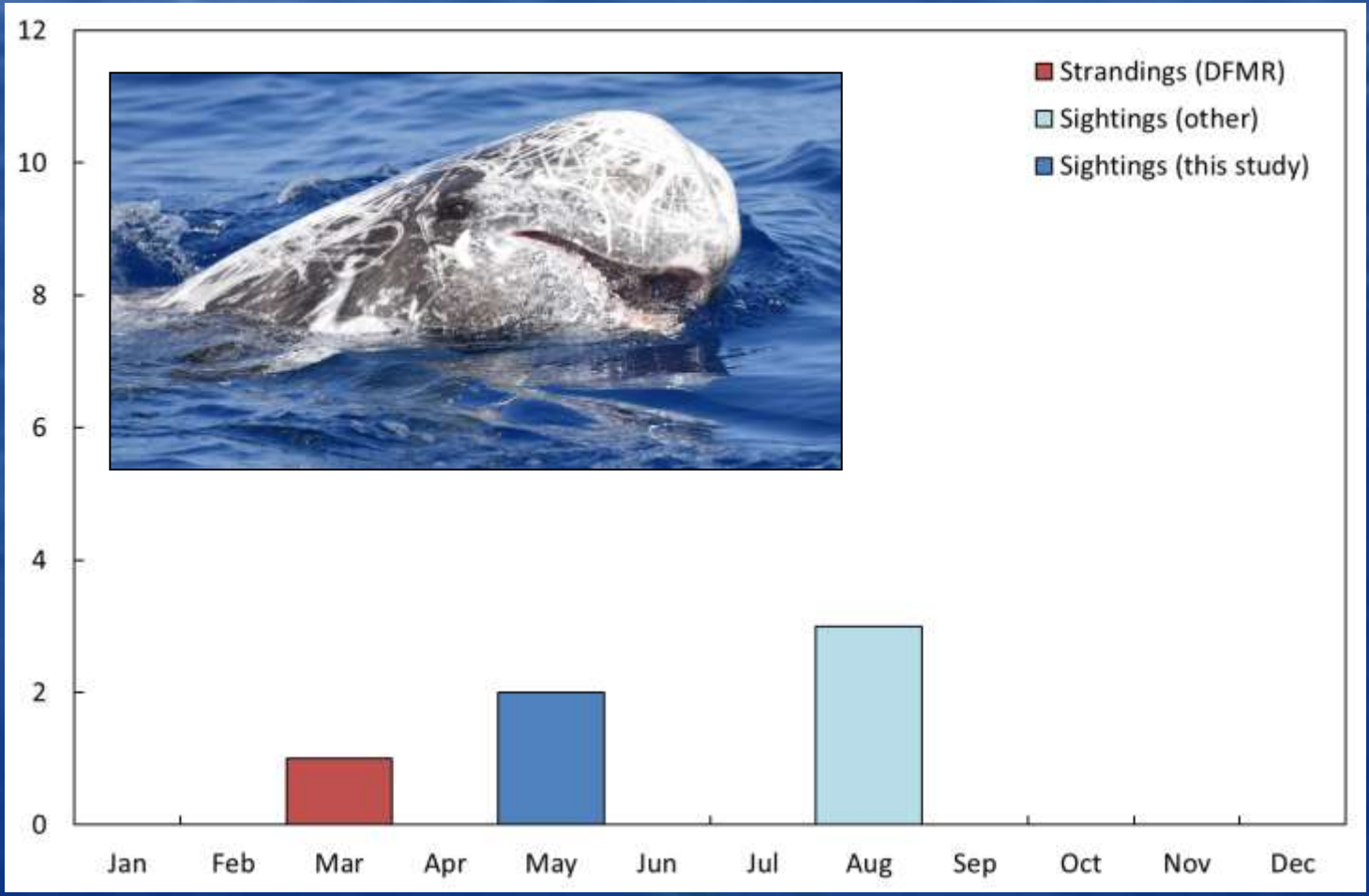
Risso's Dolphin

- **Risso's dolphins seen twice in May 2017; all other sightings to date in south-eastern region (> 1000 m deep).**



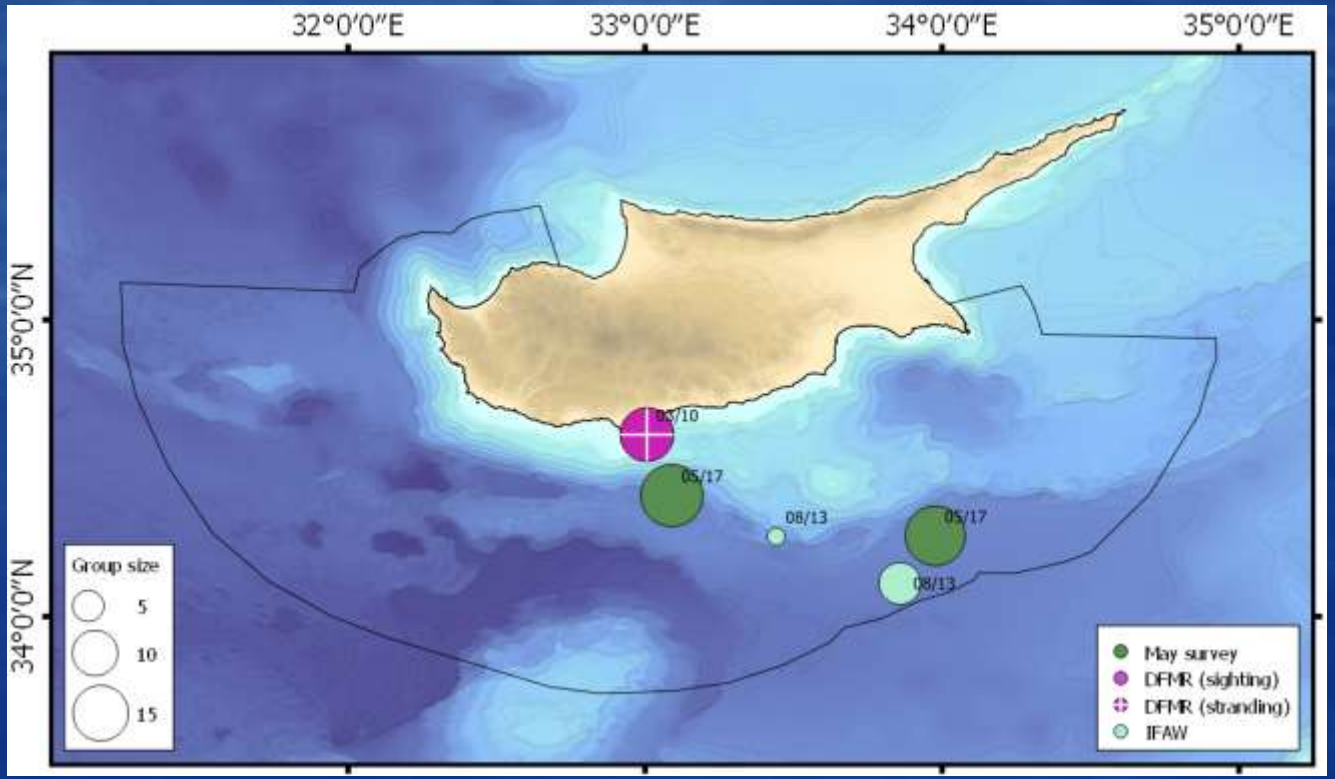
Risso's Dolphin

- **Possible summer peak (but sample size is low).**



Rough-toothed Dolphin

- Seen in May survey; both sightings with striped dolphins.
- 75% of all sightings have involved other species; may often form fission-fusion groups with other species.

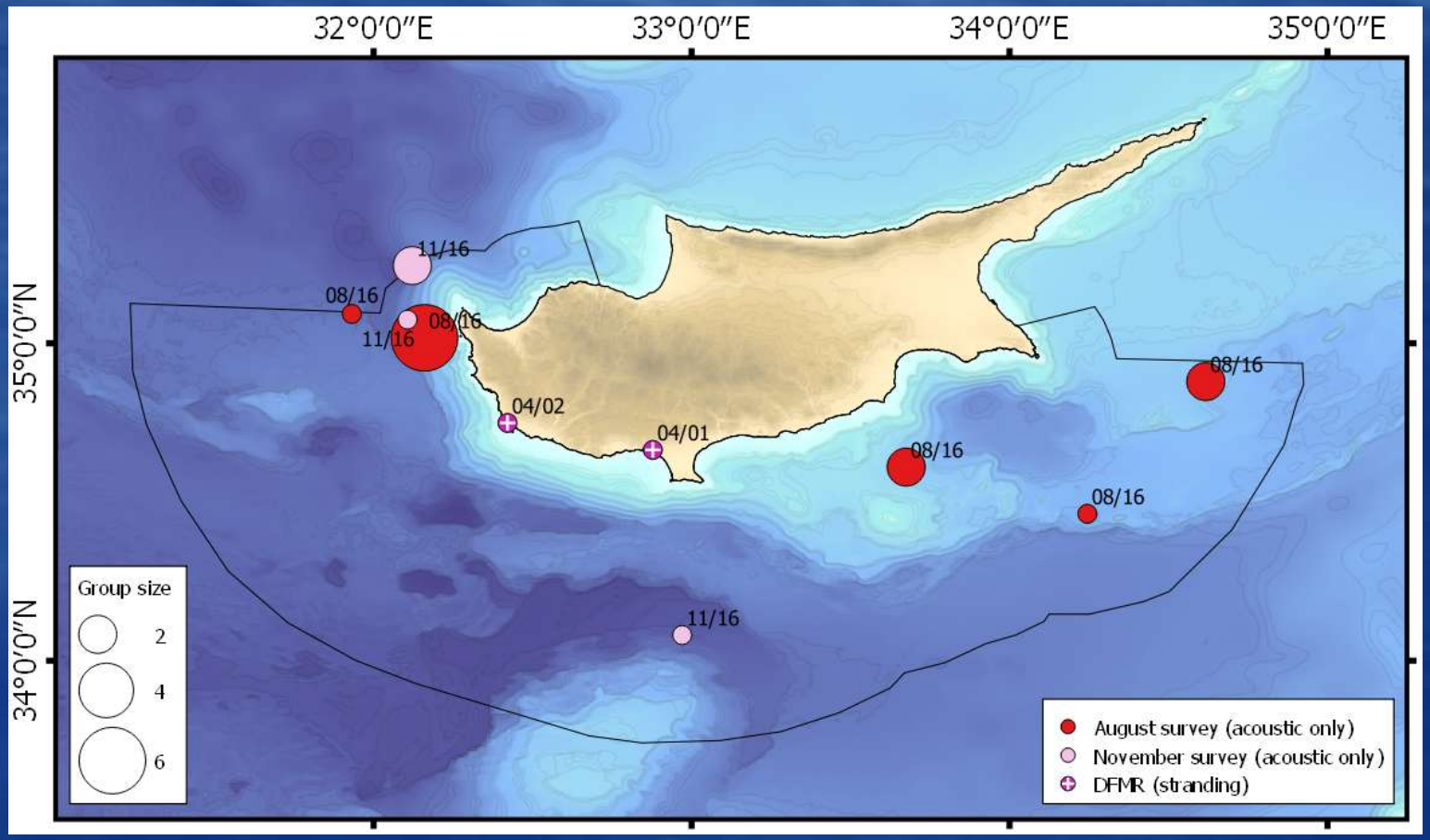


Rough-toothed Dolphin

- **Possible peak in summer (although only in low densities).**

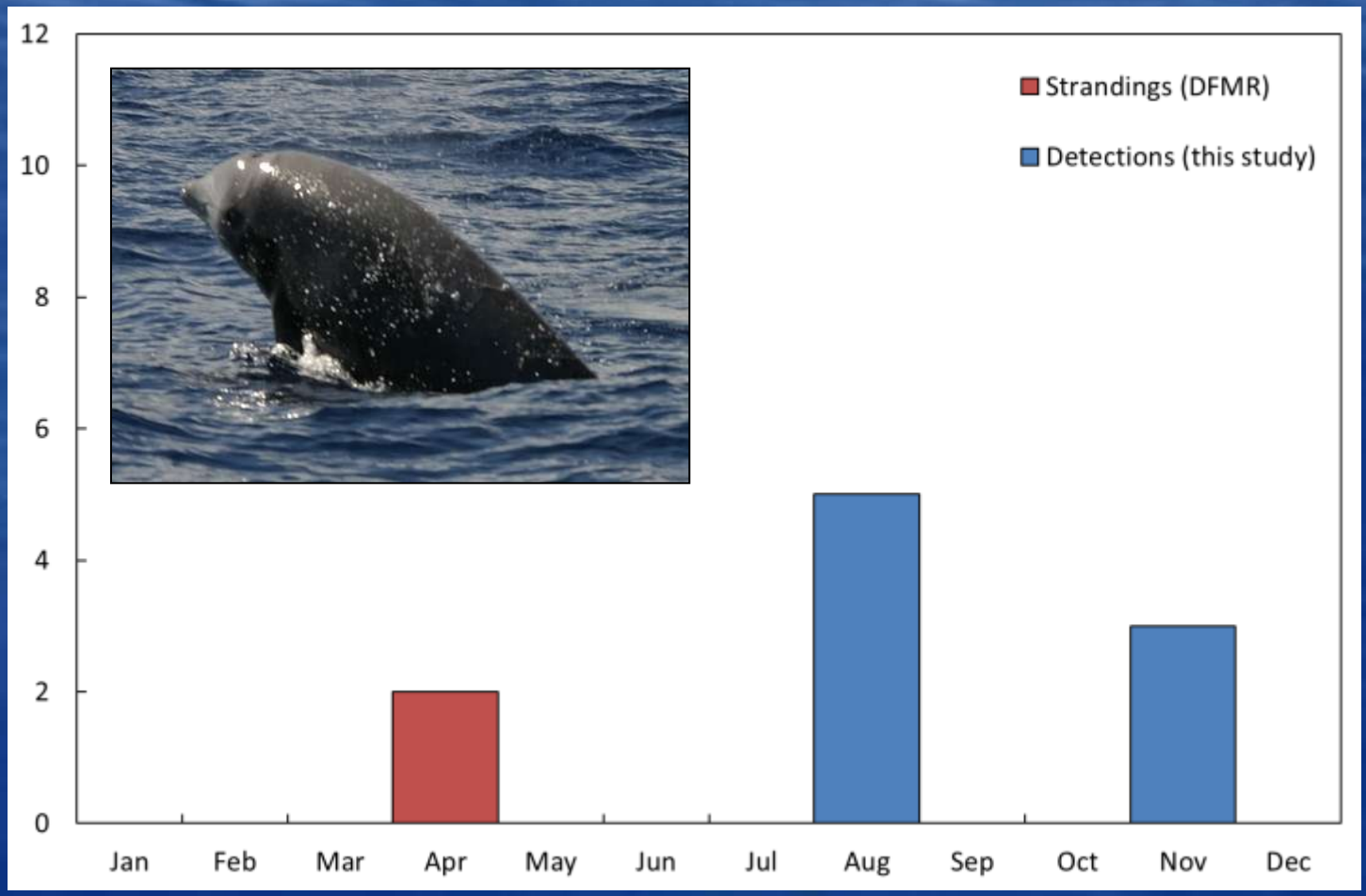
Cuvier's Beaked Whale

- To date, 2 strandings but no confirmed sightings of live individuals. All acoustic detections 1000 - 2300 m deep.



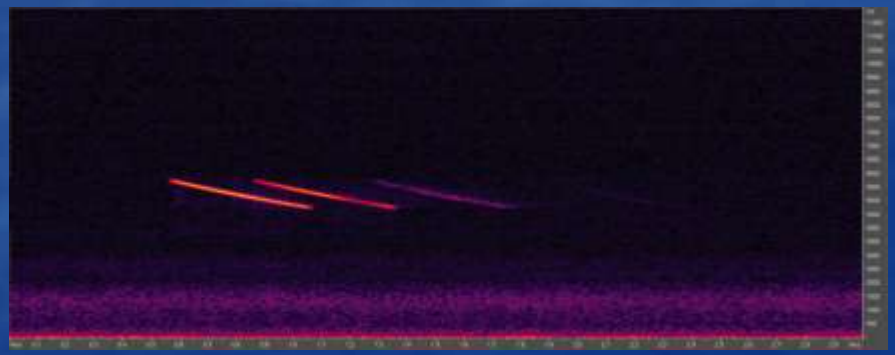
Cuvier's Beaked Whale

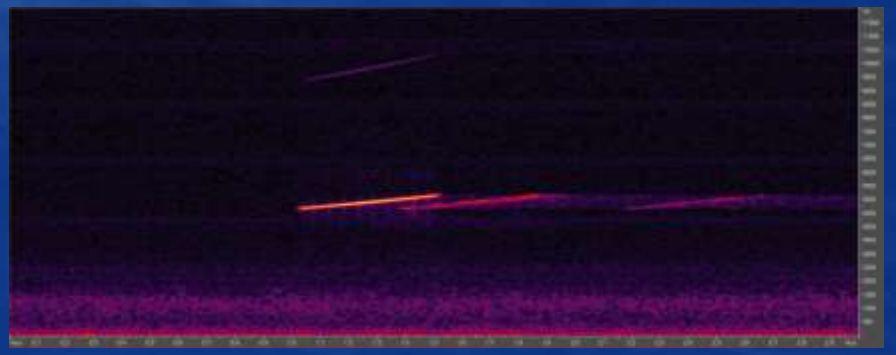
- **Both strandings discovered in April (in consecutive years).**



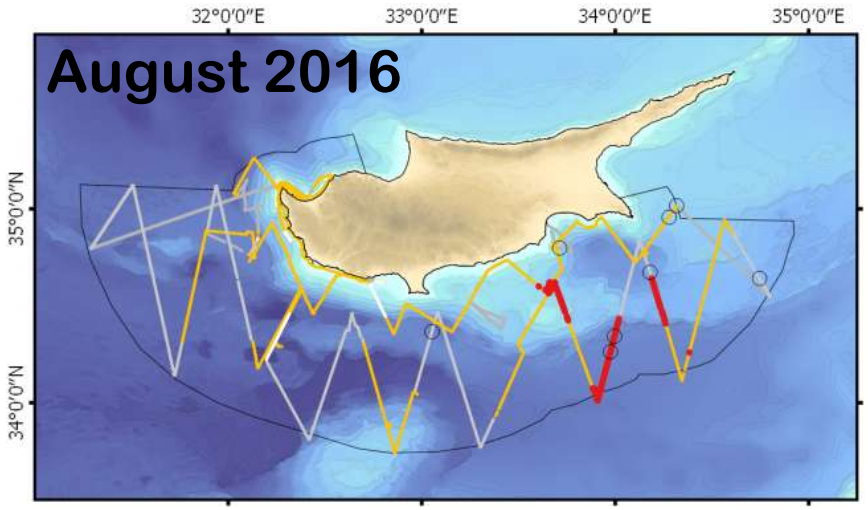
Anthropogenic Signals

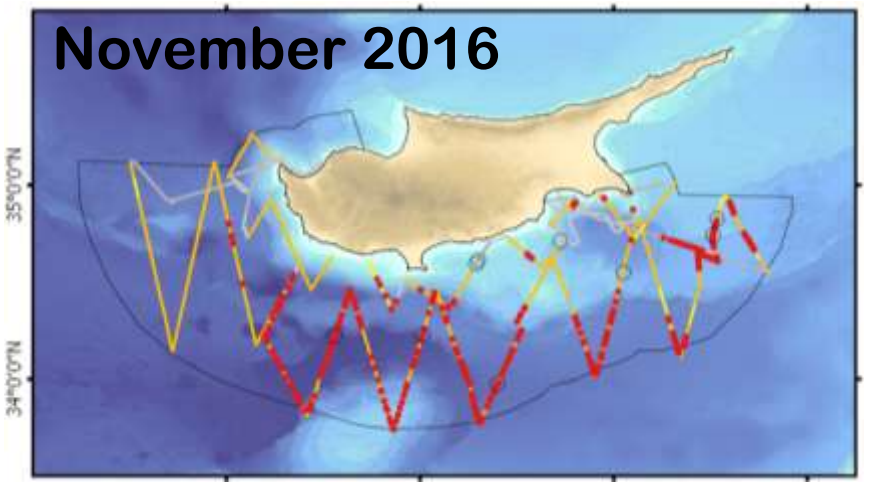
- In all surveys, military sonar was recorded in deeper waters particularly November 2016.
- Signals associated with seismic surveying for oil and gas were detected in all surveys particularly during May 2017.

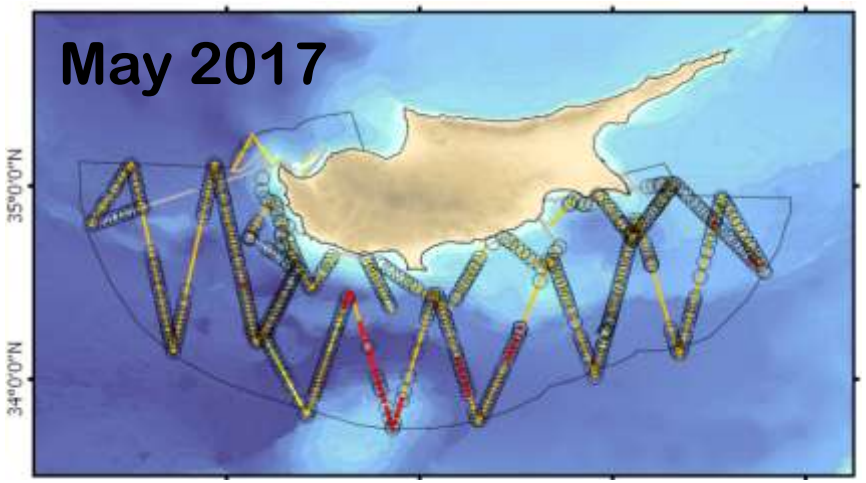




Anthropogenic Signals





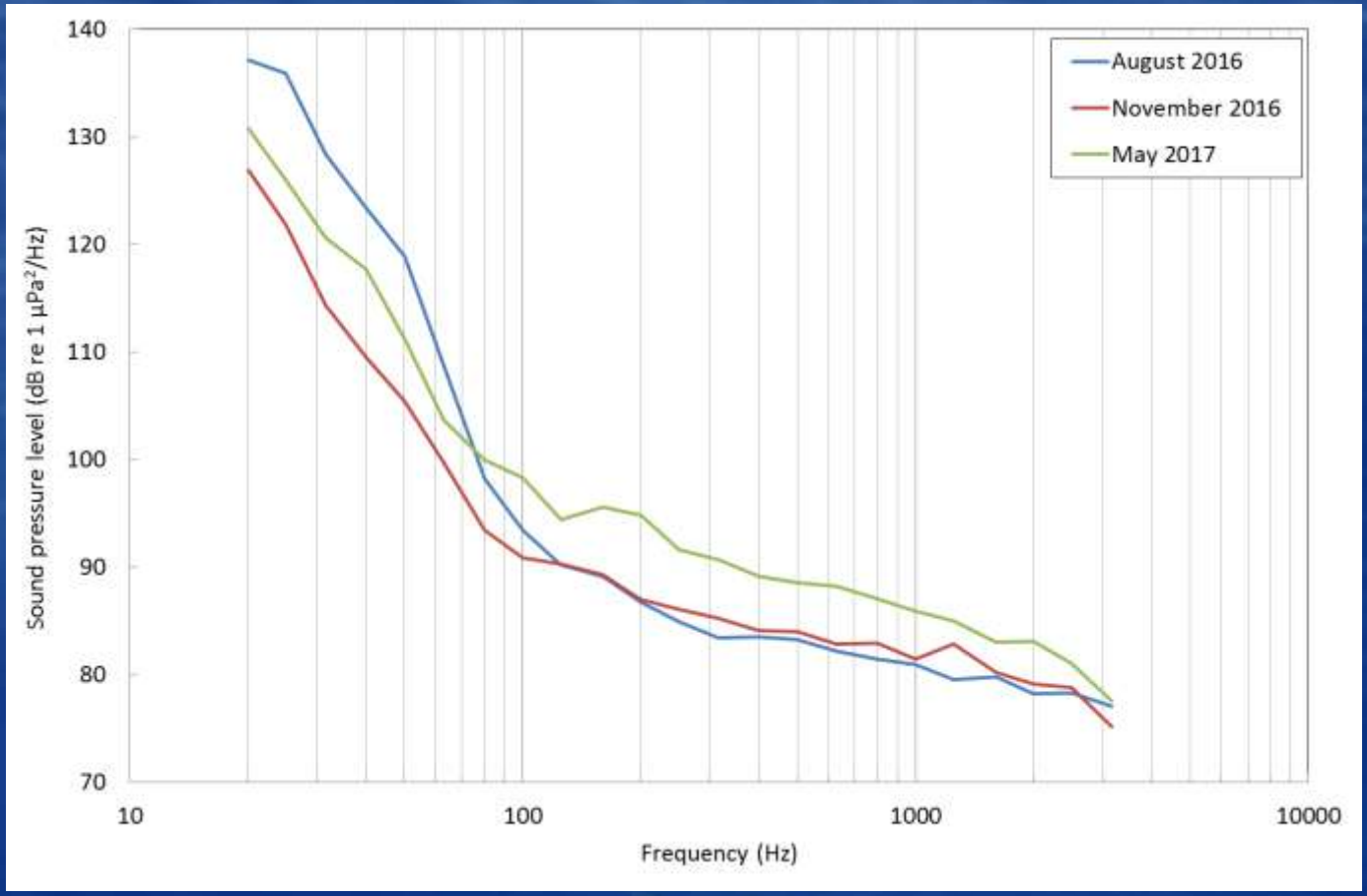


Seismic airgun

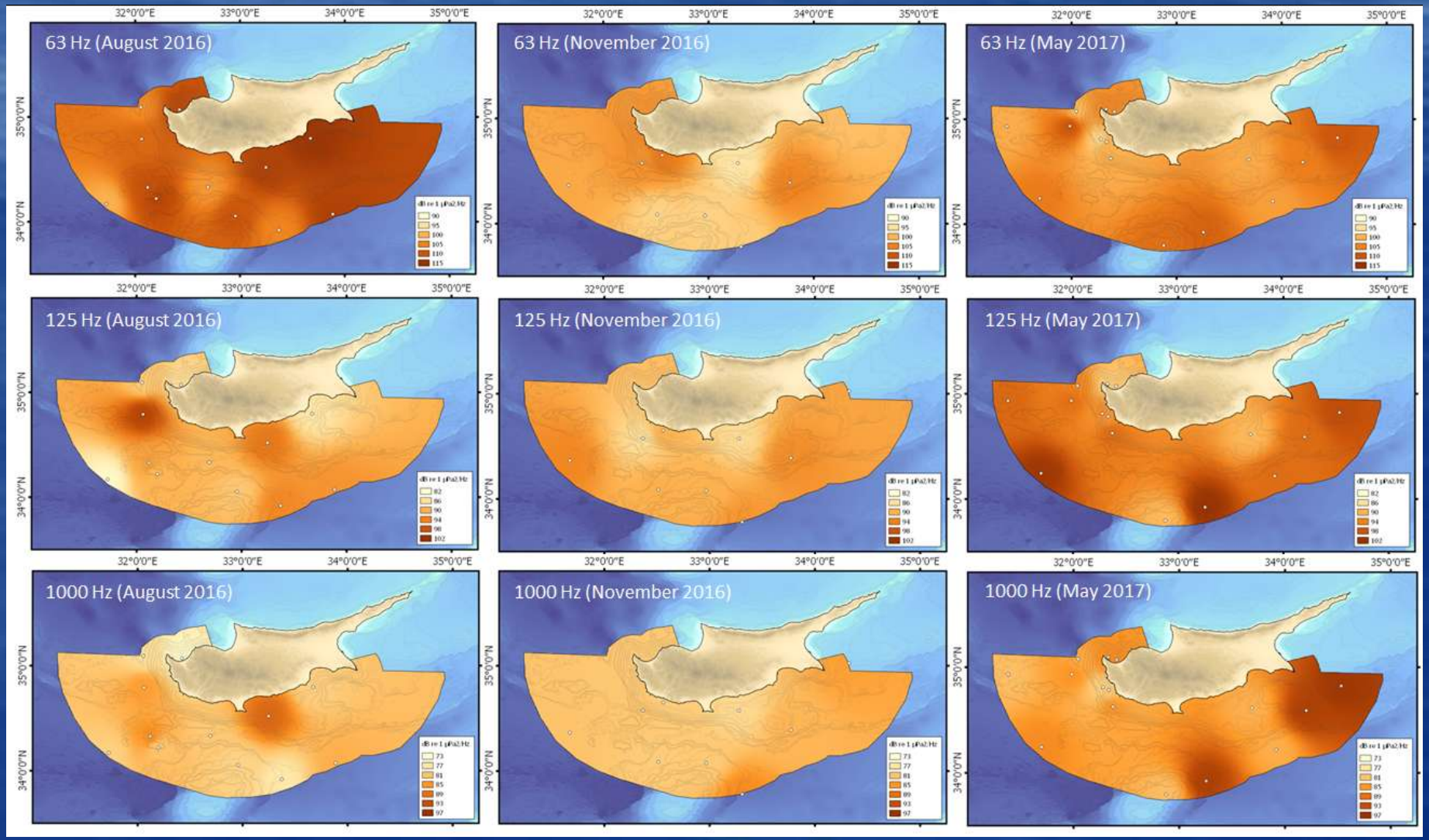
Military sonar

Ambient noise

- **Noise below 100 Hz generally elevated in August 2016; the May 2017 survey defined by elevated noise above 100 Hz.**

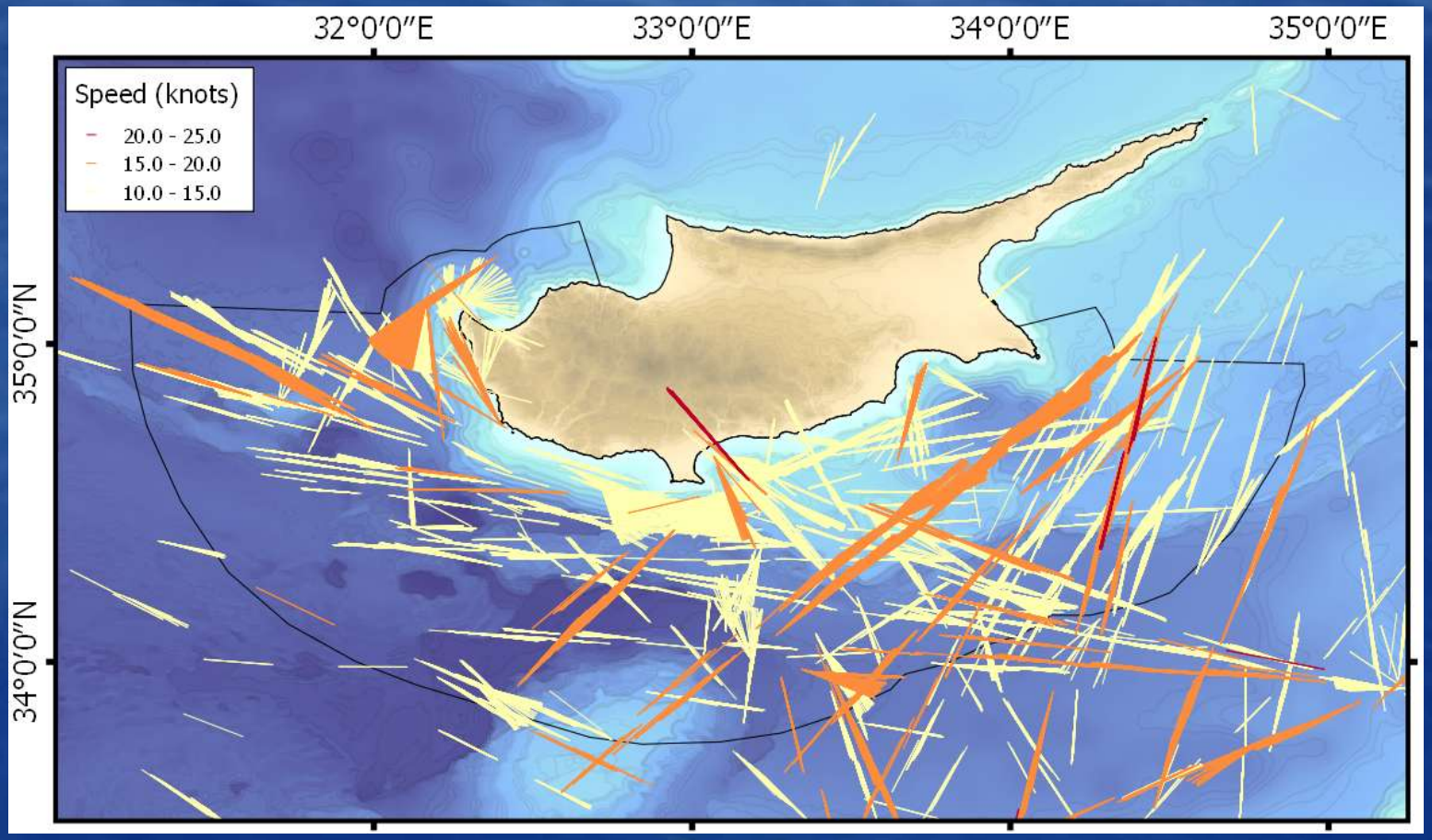


Ambient noise

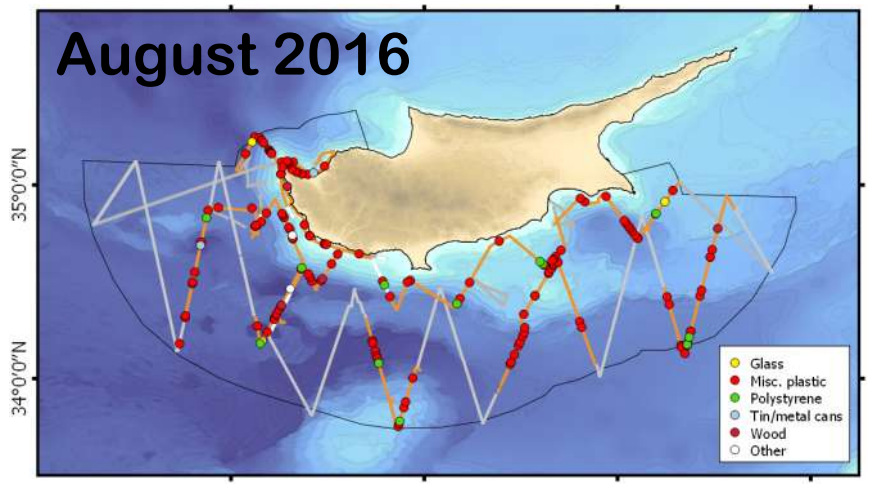


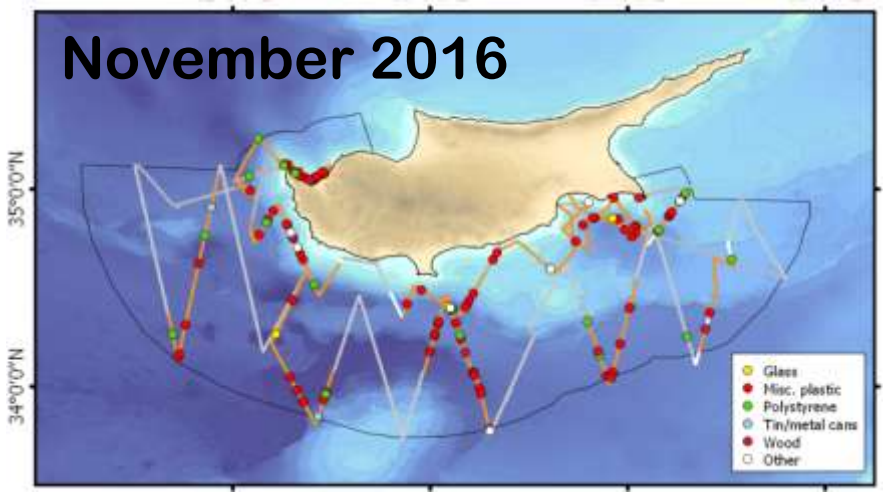
Vessel Density

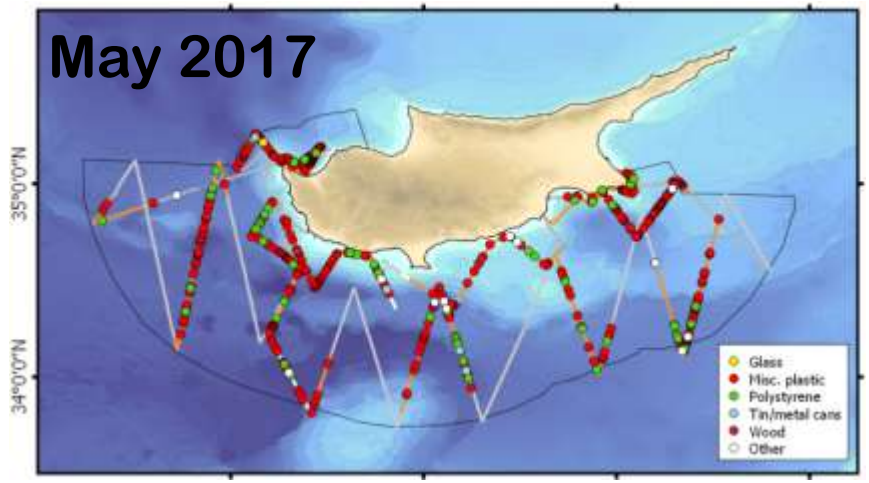
- **Vessel speed and size influence both the frequency & severity of ship-strikes; speeds > 10 knots problematic.**



Marine Debris







Aug = 167 items (142 plastic).

Nov = 137 items (95 plastic).

May = 597 items (443 plastic).

Discussion of Abundance Estimation

- 20,167 small odontocetes estimated in Cypriot waters (80,500 km^2).
- Panigada et al. (2017) estimated 95,013 striped dolphins around Sardinia & Corsica (250,000 km^2) in summer.
- Laran et al. (2017a) estimated 130,000 striped dolphins in a neighbouring region (130,000 km^2) in summer.
- De Segura et al., 2006 estimated 16,900 striped dolphins along central Spanish Mediterranean (32,300 km^2).
- Laran et al. (2017b) estimated 495,000 common and striped dolphins in Bay of Biscay (282,000 km^2).

Threats

- Some regions noisier than others at different times; broad trend for noise to increase in southeast in all surveys.
- Considering AIS data, lower frequency noise becomes elevated due to increased shipping to the southeast.
- Higher frequency noise more influenced by military sonar and seismic airguns.
- Generally the waters to the southeast of the study area presented a ‘perfect storm’ of anthropogenic noise during (military activity to the west of Syria in November 2016 and seismic surveys during May 2017).

Threats

- High densities of shipping introduce noise and increase the risk of ship-strike (particularly for large and fast vessels).
- Stranded animals should be examined for signs of scarring and/or blunt trauma associated with ship-strike.
- Local speed restrictions could be considered if any evidence of mammals being killed or injured.
- Furthermore, monitoring ship speeds via AIS as a proxy for ocean noise could be used in Cypriot waters.
- Of 901 items of debris logged, 680 (75%) were plastic.
- Generally, highest concentrations were close to land, suggesting much of the waste came from Cyprus.

Important Marine Areas

- Waters deeper than 200 m are particularly important for the deep-diving odontocetes; many encounters took place over the abyssal waters between the Eratosthenes Seamount and the mainland.
- Bottlenose dolphins were within four miles of coast and close to the 300 m isobath. If this species is interacting with longline vessels, this suggests use of deeper waters.
- Highest acoustic encounter rates to west of Akamas Peninsula and to southeast of Capo Greco.

Recommendations for Future Work

- Measures to reduce impacts from seismic surveying & other developments (e.g. MMO and/or PAM).
- Establishment of fisheries observer schemes.
- Dedicated inshore bottlenose dolphin surveys between the 300 m contour and the shore.
- Comparison of relevant photo-IDs catalogues.
- Efforts to declare the Cypriot EEZ as a sonar-free zone.
- Inclusion of PAM and/or SAM for cetaceans during future planned surveys off the Eratosthenes Seamount.
- Establishment of citizen science platform (e.g. social media) to solicit & validate sightings, photos & other data.

Summary

- 27 sightings of 5 cetacean species (sperm whale, bottlenose, striped, rough-toothed and Risso's dolphin).
- In addition, Cuvier's beaked whale detected acoustically.
- Photo-identified proved a useful tool.
- Most acoustic detections made at night.
- Abundance estimate of 20,167 small odontocetes.
- Anthropogenic noise both chronic (low frequency ship noise) & acute (higher frequency sonar & seismic airguns).
- Combined with other hazards (e.g. plastic), threats are of significant concern for all species (occur in low densities).

Acknowledgements

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- The realisation of the surveys made possible by the organisation, direction and supervision of the Coordinator, Savvas Michaelides of DFMR, and the Steering Committee.
- Fieldwork was planned and executed by the AP Marine Consortium, drawing on expertise and support from AP Marine Environmental Consultancy, Marine Conservation Research and Pelagos Cetacean Research Institute.
- The research vessel was chartered from Crystal Marine.
- Thanks to the Cypriot authorities for clearance and to Cyprus Radio Coastal Station for support during fieldwork.