Turkish Black Sea Acoustic Surveys: Winter distribution of anchovy along the Turkish coast

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Anchovy Fisheries in Turkey

- In Black Sea the anchovy catch of Turkish commercial fishing fleet is around 300.000 tons per year on average, and fishery carried out mainly in winter and the highest portion of the stock is exploited between November and December.
- Turkish Black Sea anchovy monitoring surveys began in year 2011 and aim to provide data for better management of the stock(s). The primary task in the surveys are hidro-acoustically estimate the size of the over wintering anchovy biomass over the continental shelf of the Turkish Black Sea coast.
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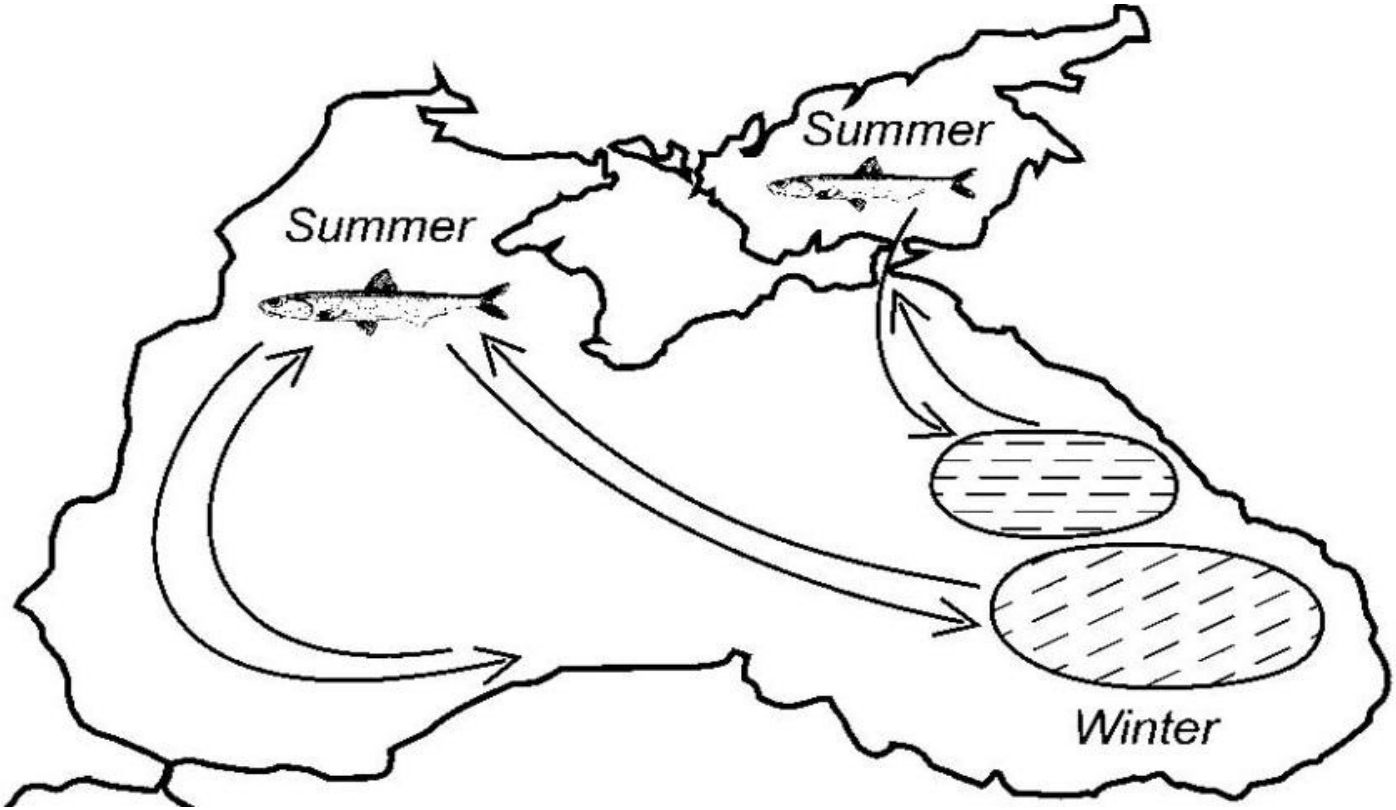
- Acoustic surveys carried out onboard R/V Bilim which is 41m in length equipped with hull mounted SIMRAD EK60 split beam echosounder system with three frequencies (38khz, 120 khz and 200khz), a SeaBird 911 Plus CTD profiling system, oceanographic and trawl winch systems and midwater trawling system rigged with simrad PI net sounder sensors.
- Until now, three surveys have been carried out covering all Turkish Blacksea coast; in December 2011, February 2012 and November – December 2012.

Engraulis encrasicolus ponticus *Engraulis encrasicolus maeoticus*



Shulman G.E., Anchovies of the Azov and the Black Sea: regularities of wintering migrations. Marine Ecology Journal 2002;1:67-77.

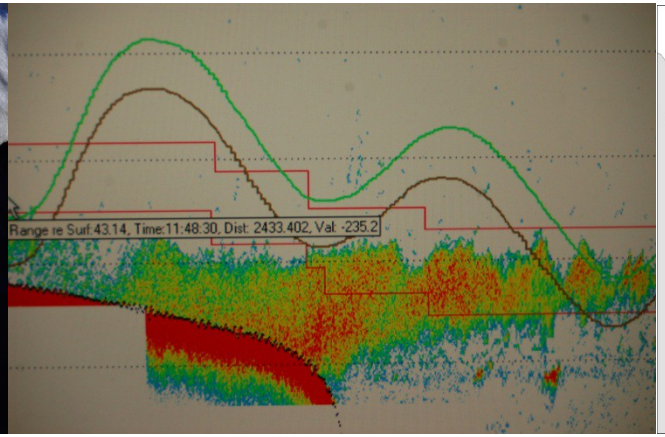
Despite exhibiting basin wide spawning distribution, the Black Sea anchovy is exploited almost exclusively by the Turkish fishing fleet during over-wintering season when they form very dense aggregations along the territorial waters of Turkey.

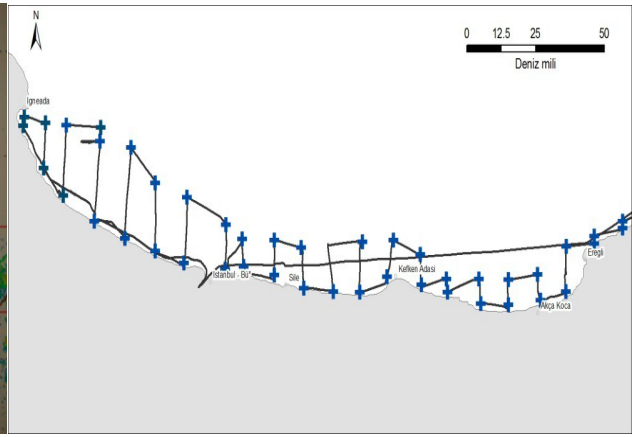
Assessment Of Black Sea Anchovy Using Acoustic Method And Establishing A Monitoring Model For National Fisheries Data Collection Program



The methodology and design of the surveys organized according to Medias protocol in order to be in compliance with other surveys in Black Sea and Mediterranean.

	Medias Echo sounder parameters	METU
Echo sounder	Split beam	✓
Frequency for assessment (kHz)	38	✓
Complementary frequencies (kHz)	120, 200 depending on availability.	✓
Pulse duration (ms)	1 ms	0.512ms
Beam Angle	Should be reported	✓
Ping rate	Maximum depending on depth	✓
Calibration (No per survey)	A calibration report should be given (Annex III) One calibration per survey	✓
Threshold for acquisition (dB)	-80	Non
Threshold for assessment (dB)	-70 to -60 (reported)	-70



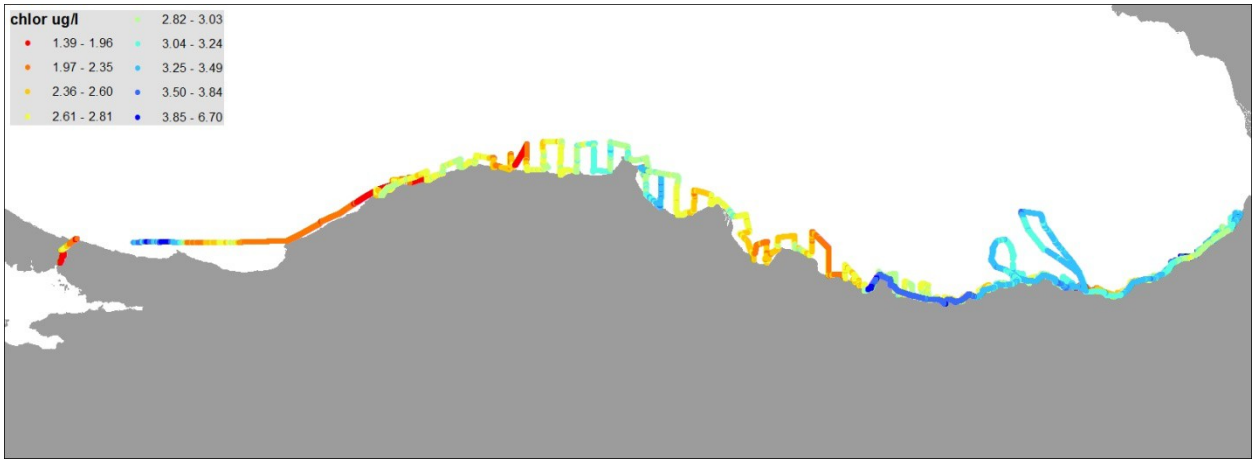


Survey design		
Transects design	Perpendicular to the coastline/bathymetry	✓ Transects adapted regarding the coastline and bathymetry.
Inter-transect distance (NM)	Max <=12 NM.	✓
Time of day for acoustic sampling	Day time.	With Utmost Possibility
EDSU (nm)	1 NM	✓
Distance from the coast according to the Bottom depth (min, m)	At least 20 m bottom depth, minimum 10 m of echo-sampling.	✓
Echo sounding depth (max, m) recording.	200 m	✓
Vessel speed	8-10 knots	✓
Software for analysis	Movies and/or Echoview	Echoview
Inter - transect	Acoustic energy in the inter-transect track will not be taken into account	✓
Applied TS (dB)	Keep historical TS equations.	Under progress
Echo partitioning into species	Echo trace classification based on echogram visual scrutinisation Direct allocation and allocation on account of representative fishing station	Under progress

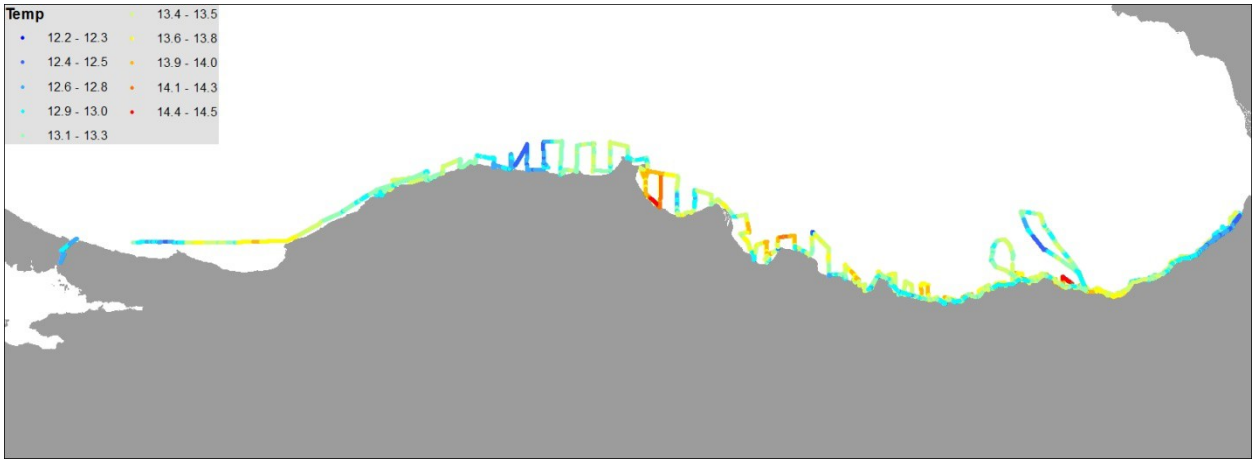
Fish sampling		
Target species	Anchovy, Sardine	Anchovy
Other species	Biological data for all species in the pelagic community: Length-Weight relationships; Length distribution.	Horse mackerel, Sprat, Bluefish, Shad
Fishing gear	Pelagic trawl, Codend and trawl characteristics should be reported. Max Codend mesh size = 24 mm (side of mesh = 12 mm).	✓
Duration of haul	Minimum 30 min for unknown echoes	✓ (less for known pattern)
Vessel speed during fishing	3.5 – 4.5 knots	✓
Sampling intensity, no of hauls	The total number of hauls has to be adequate to ensure identification of echo traces obtain length structure of the population obtain species composition get biological samples	✓

Continuous sampling of surface waters

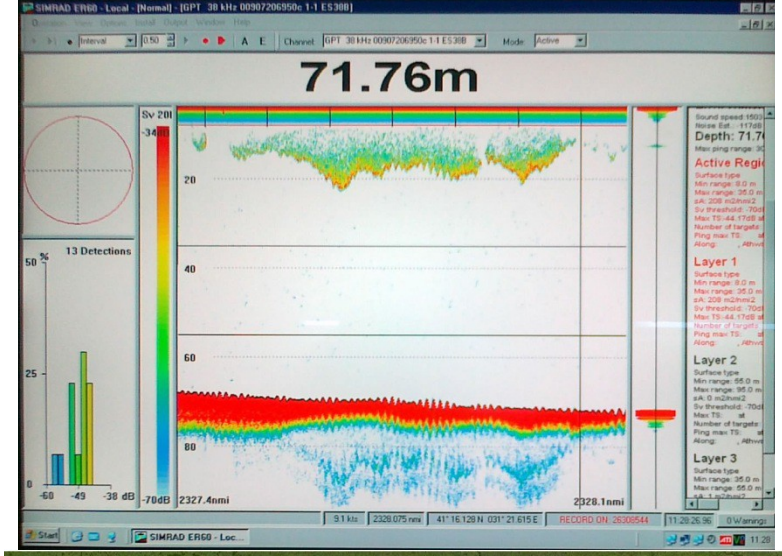
Continuous sea surface chlorophyll and temperature are also measured using Turner fluorometer.

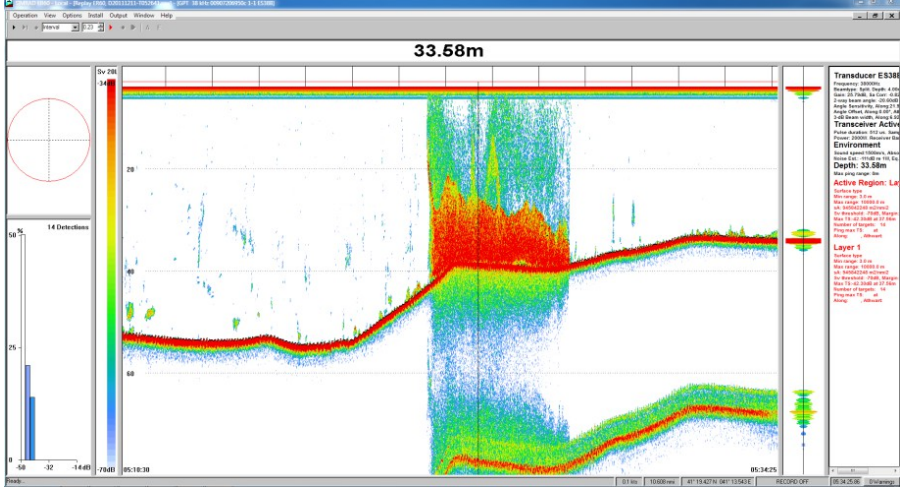


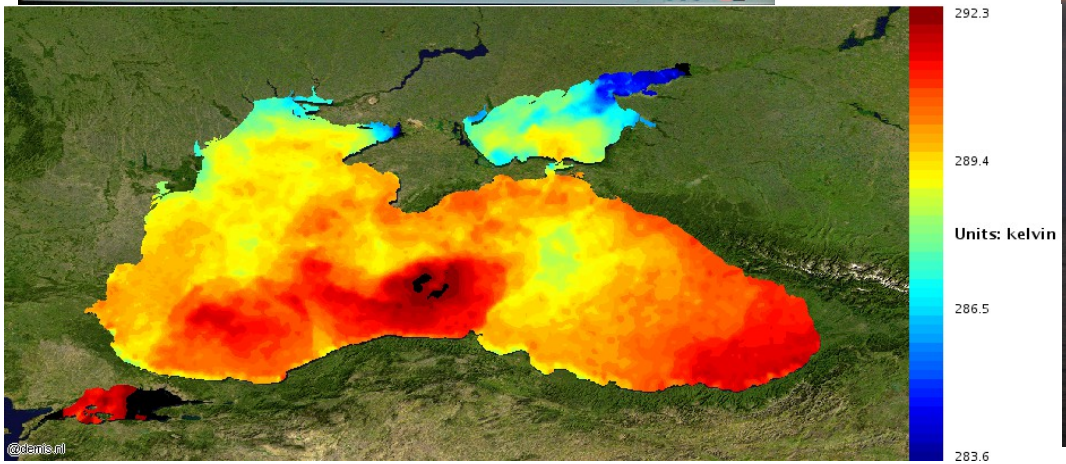
Surface chlorophyll distribution over transects in December 2011



Surface Temperature *in December 2011*

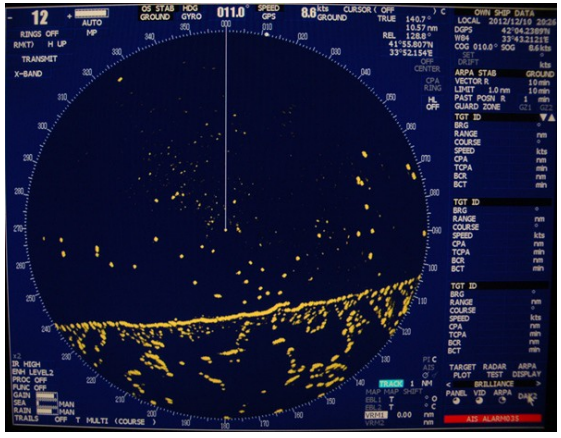




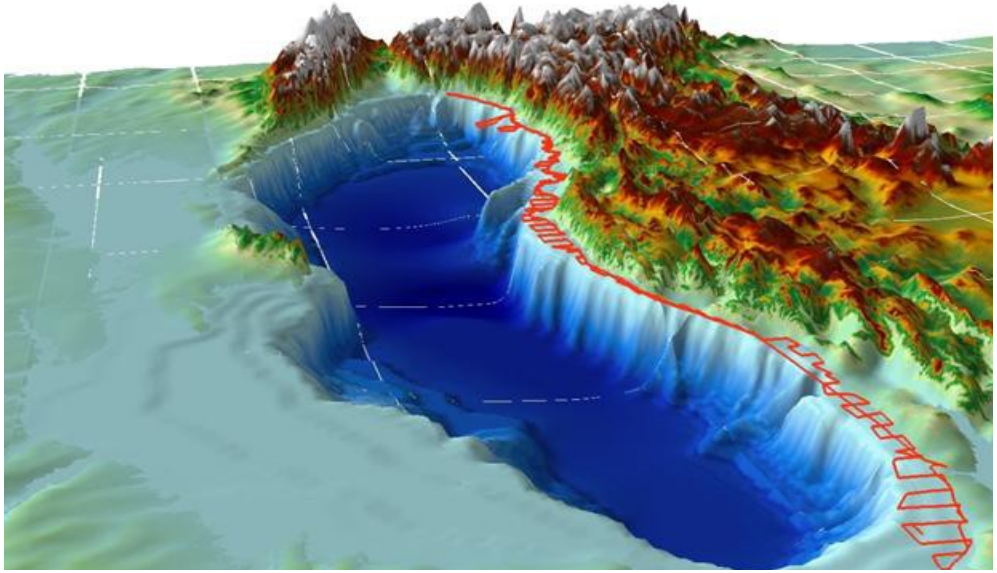


The migration and overwintering behavior of anchovy known to have a strong correlation with seawater temperature, and their migration known to be triggered by temperature drop.

Cruise	Start	End	Duration	CTD	Trawl
December 2011	27 November 2011	23 December 2011	27	303	61
February 2012	19 January 2012	14 February 2012	26	157	28
November 2012	1 November 2012	19 December 2012	37	240	61



Survey in December 2011



Acoustic transects with CTD stations

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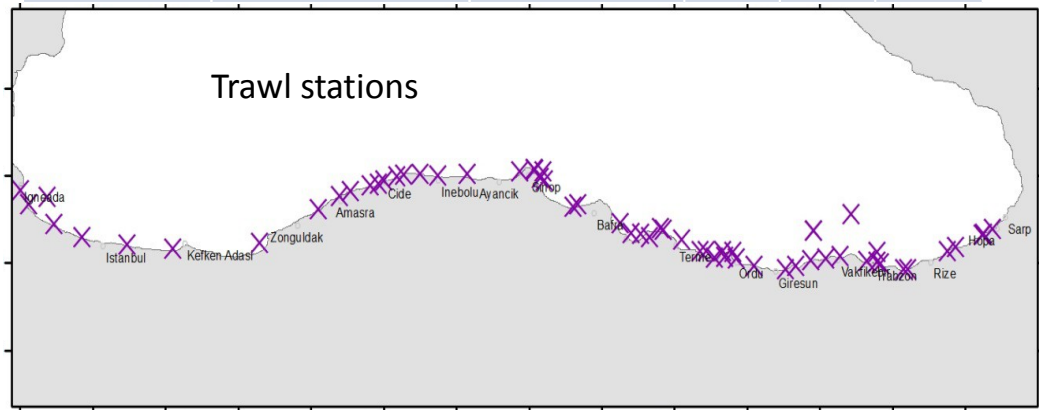
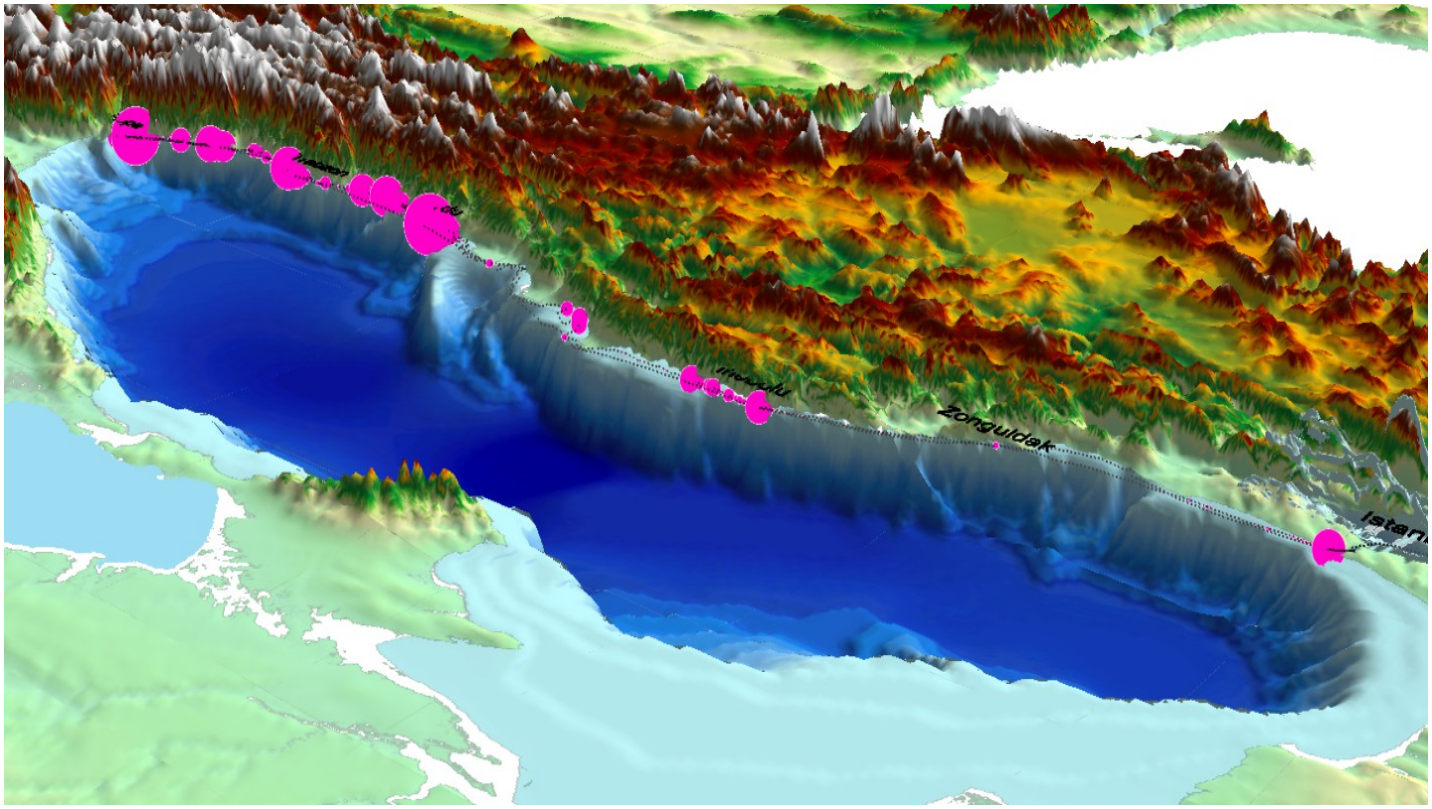
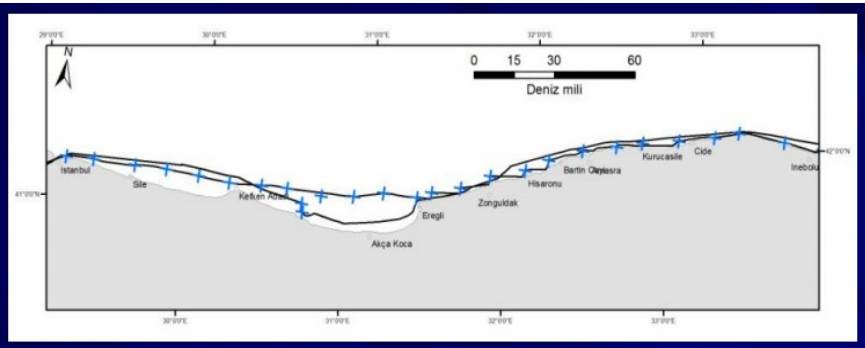
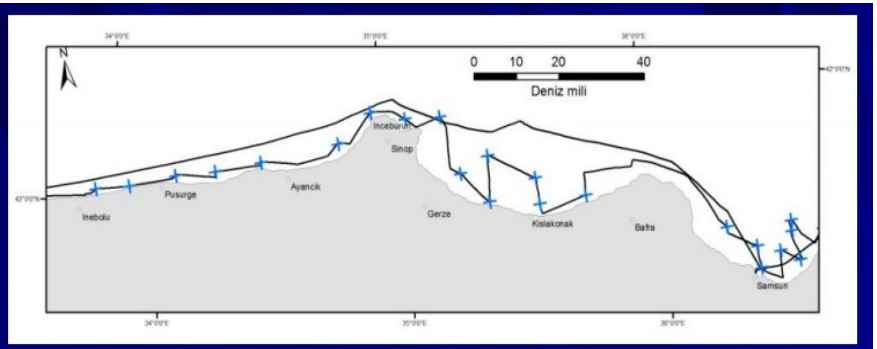


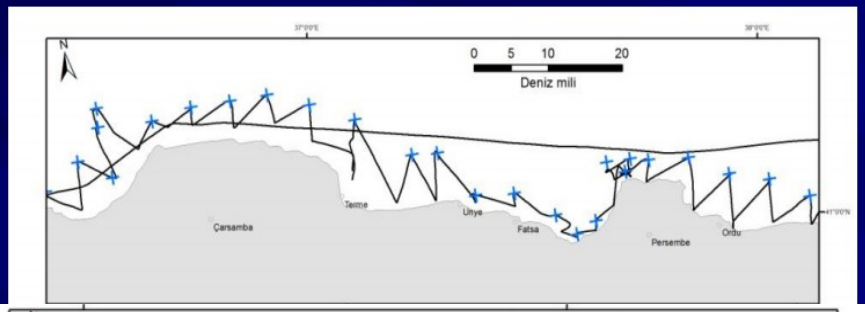
Distribution of anchovy in December 2011

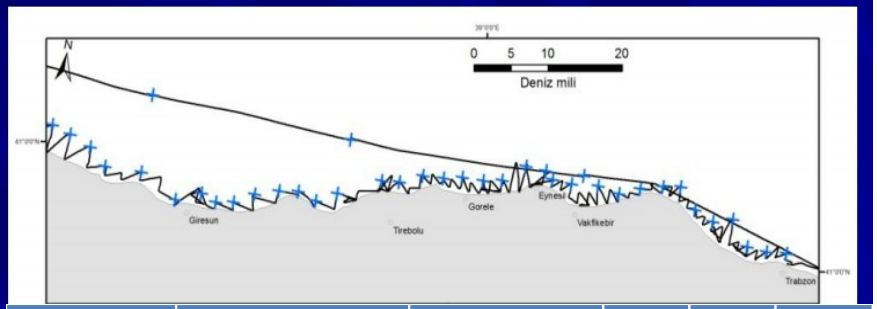


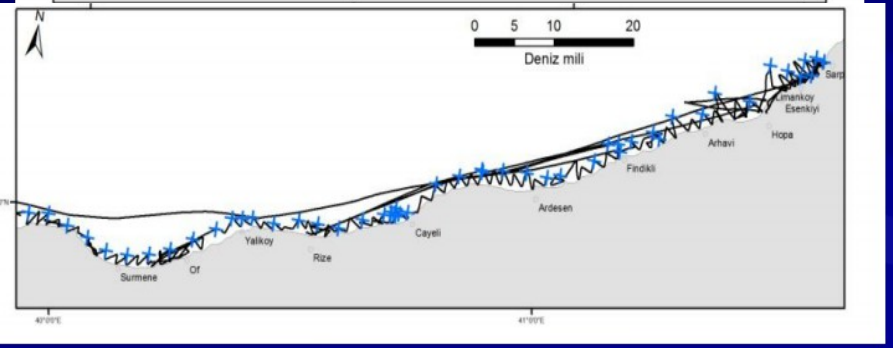
Survey in February 2012











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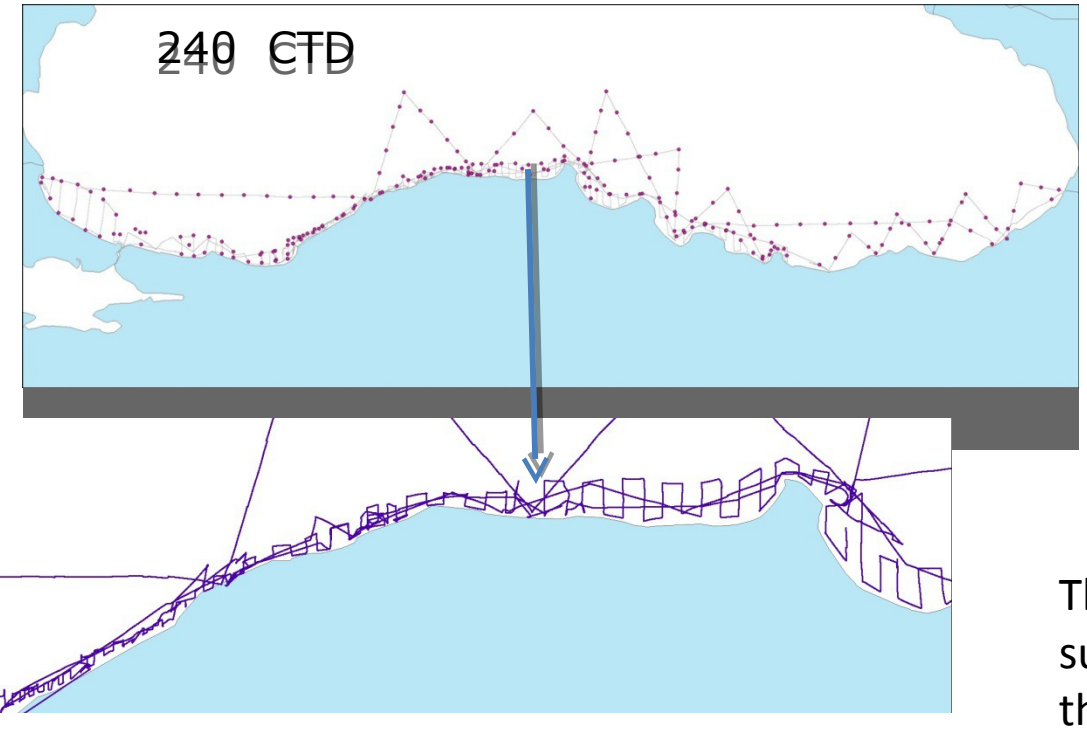
Due to the irregularity of the distribution of the anchovy aggregations because of winter migration, an adaptive strategy in transect deign is being applied to properly account the spatial variability and migration pattern.



The principal strategy is to carry out surveys in daytime due to diel variation in the vertical distribution and schooling. However weather conditions urged to do extra night time surveying.

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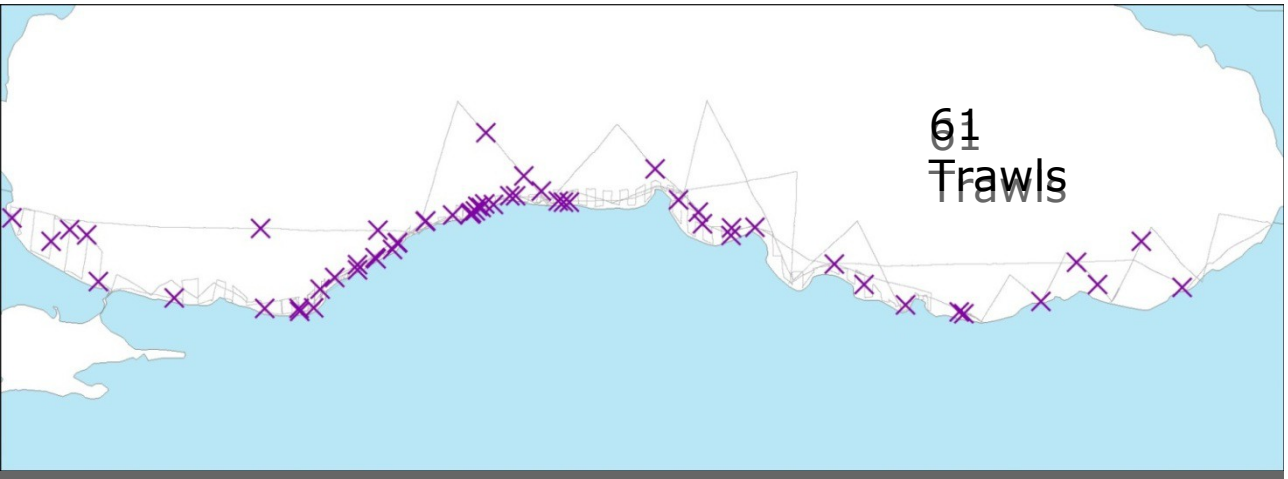
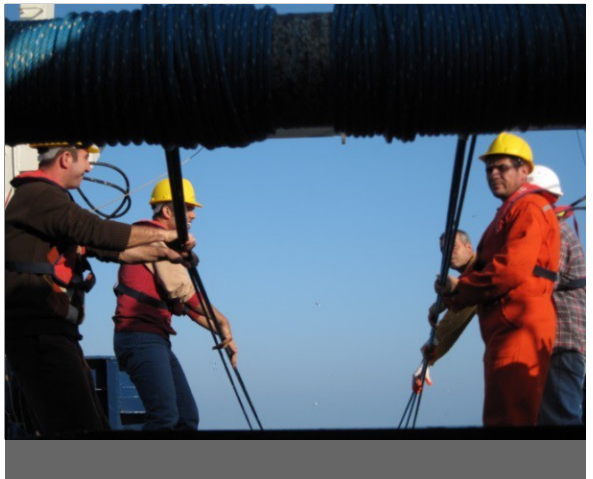
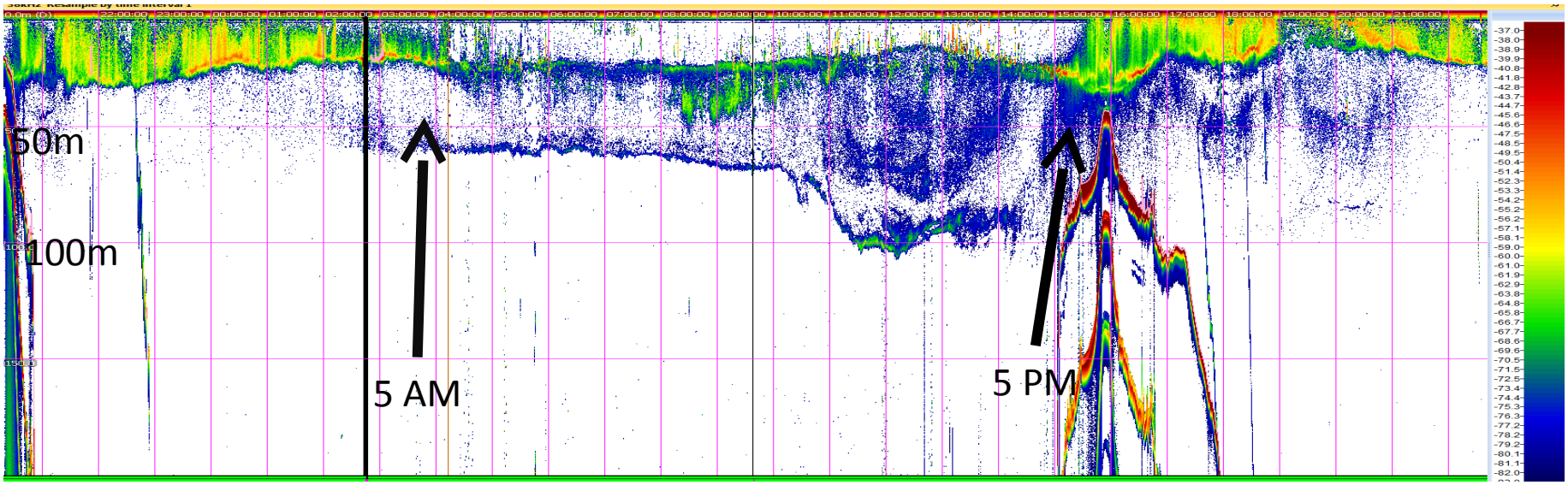
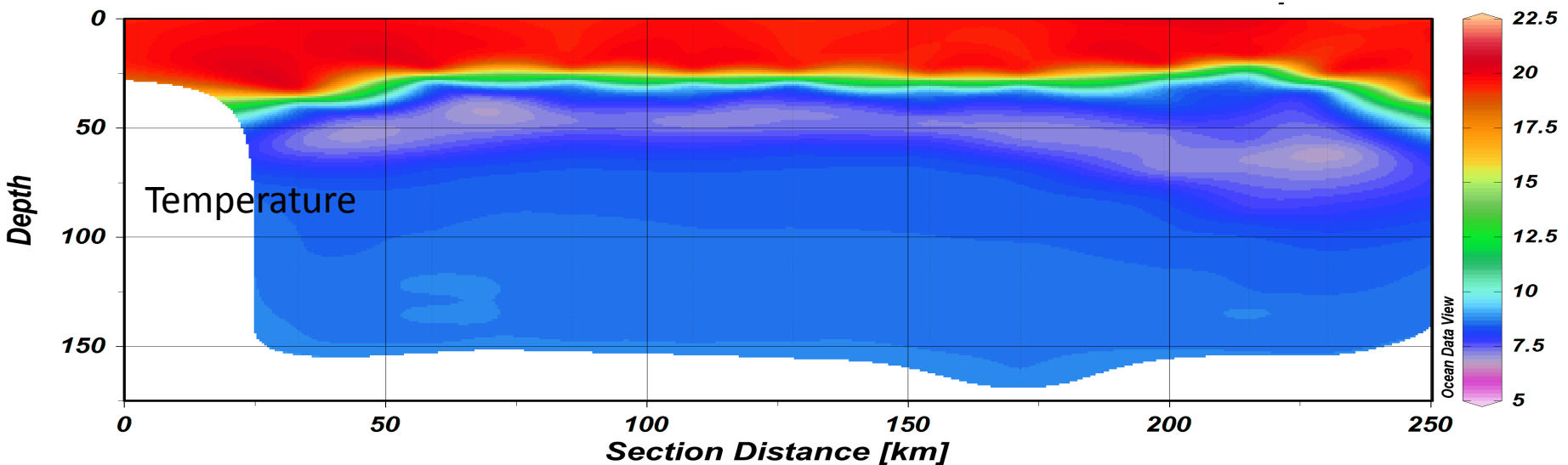
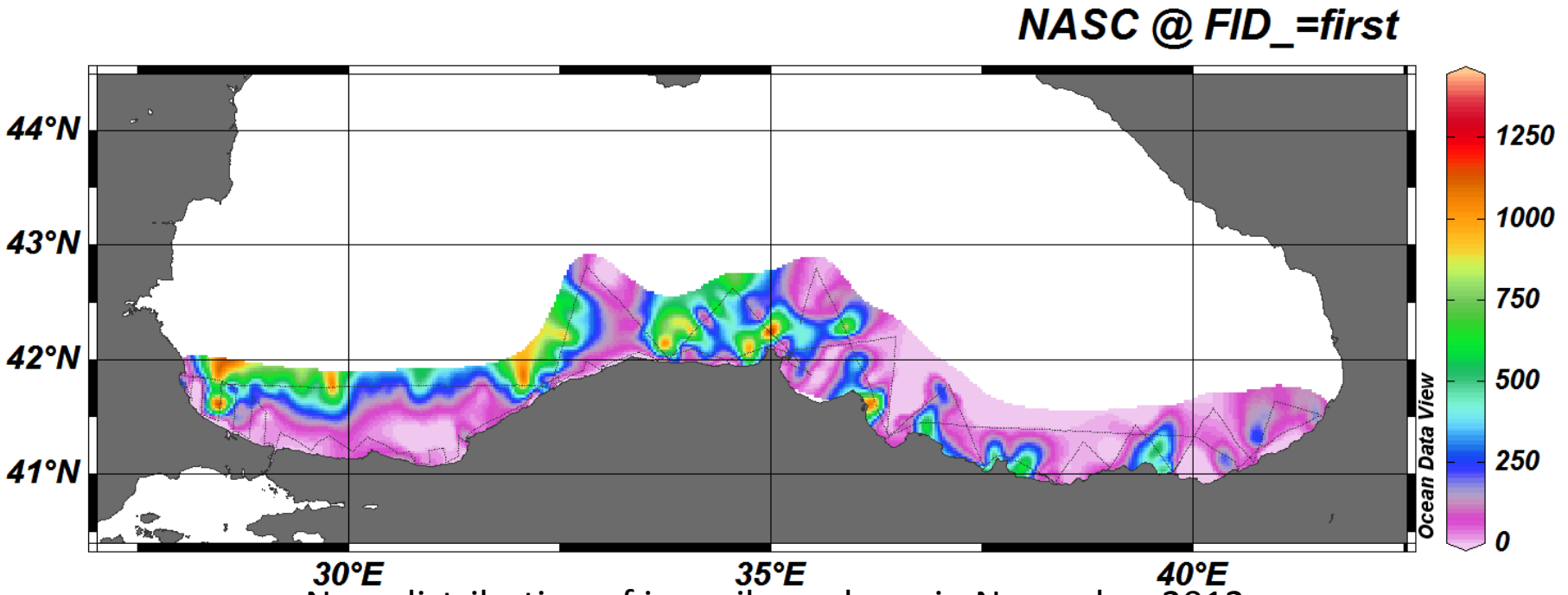




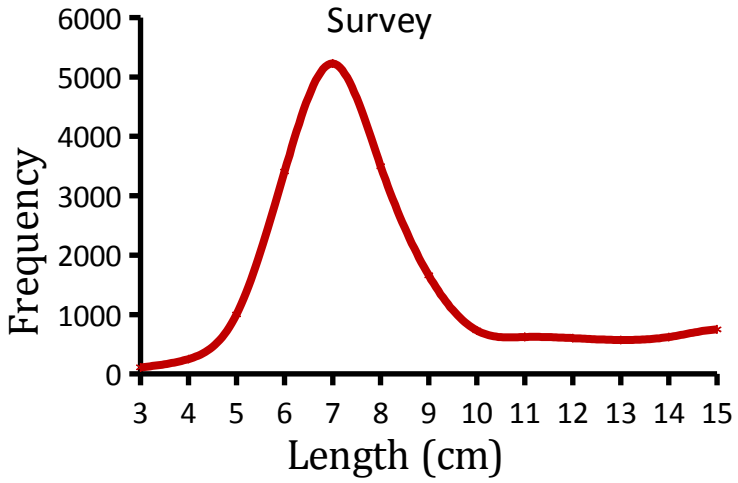


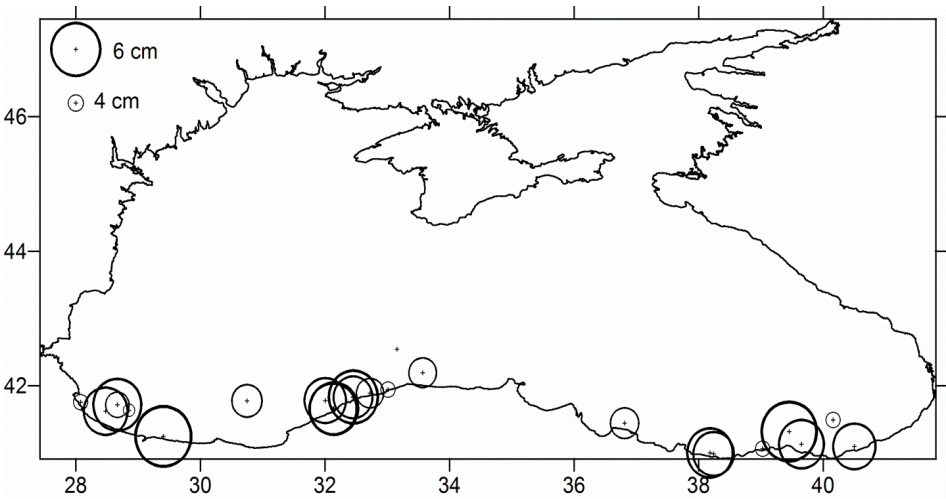
Juvenile anchovy seems to prefer warm waters over strong thermocline.
There is a clear difference in their aggregation pattern during the day and night.



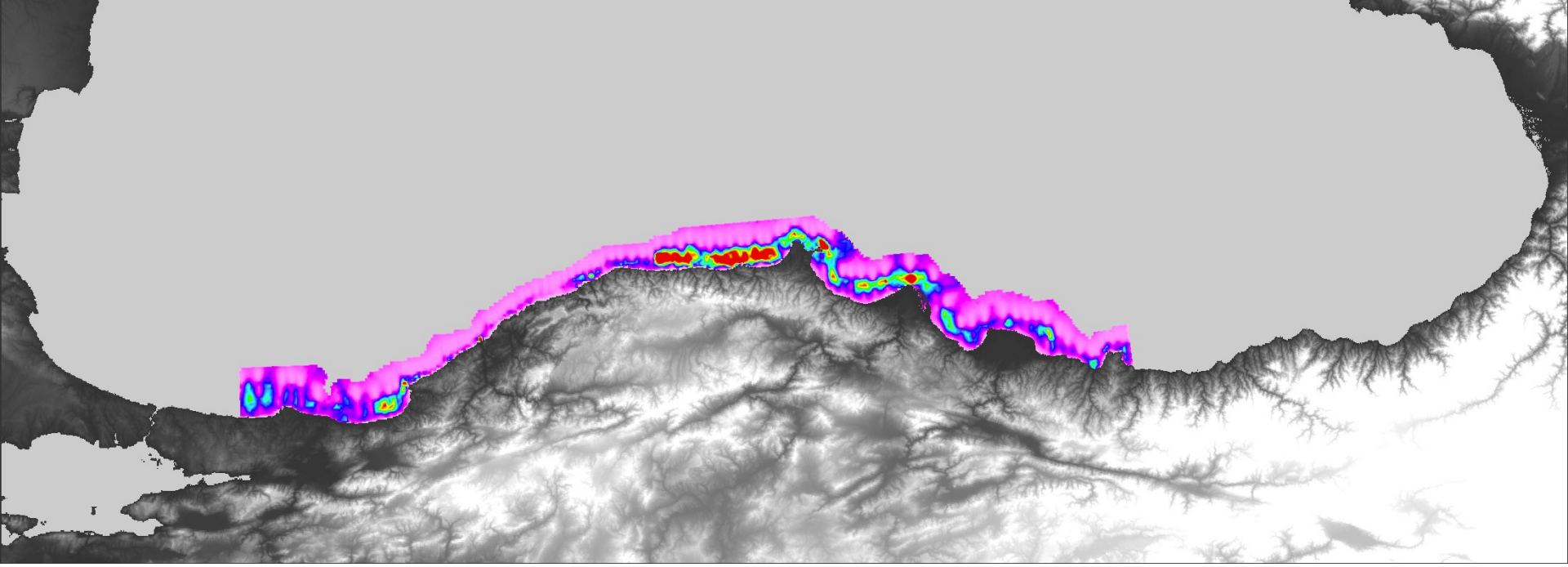


Nasc distribution of juvenile anchovy in November 2012

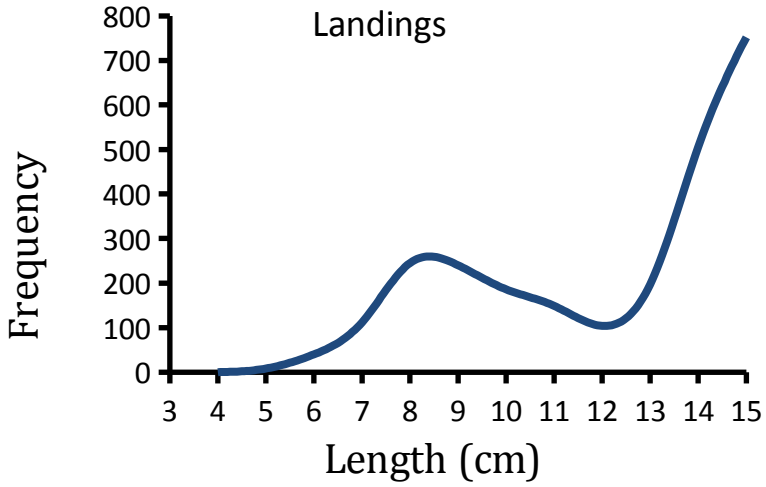




Length frequency distribution in November 2012 – Trawl samplings



Nasc distribution of adult overwintering anchovy in December 2012.
Map based on geostatistical analysis.



Length frequency distribution in November 2012 – Trawl samplings

- Thank you for your attention.