

The Discrimination of Anchovy (*Engraulis encrasicolus*, Linnaeus 1758) Forms Found in the Black Sea

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Anchovy Groups in the Black Sea



Migration Path of Anchovy Races

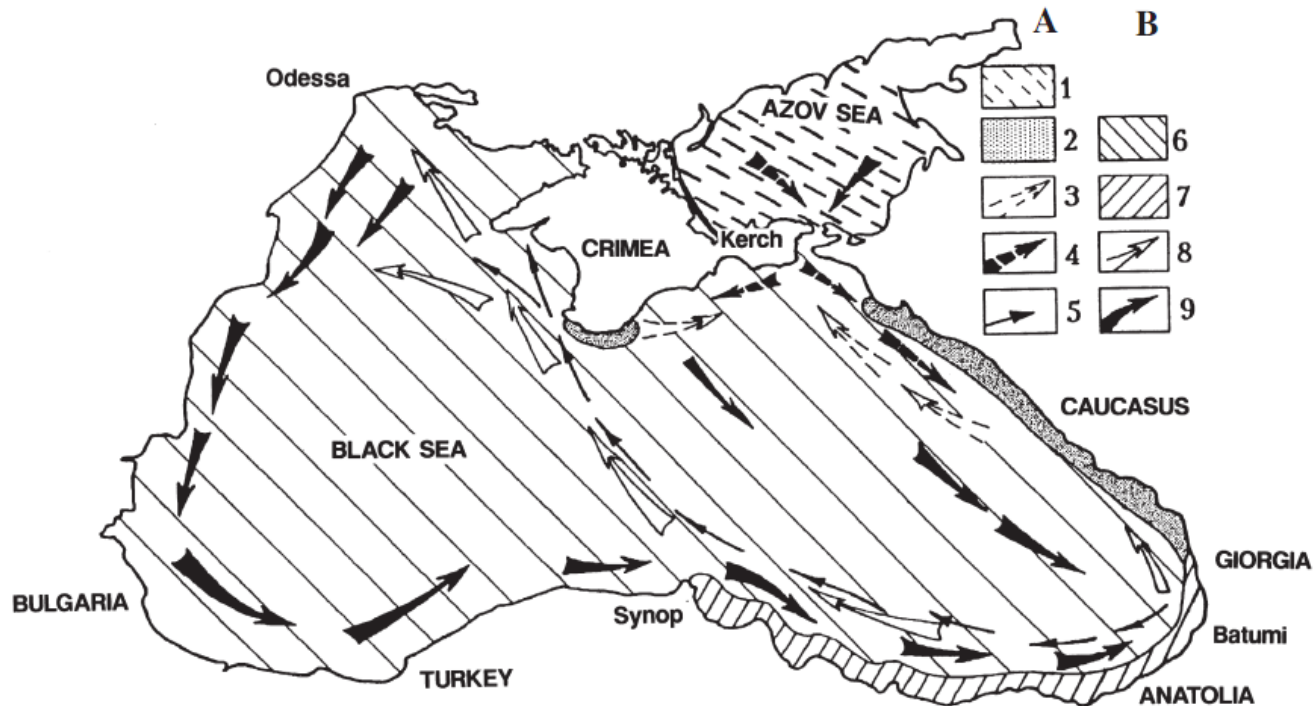
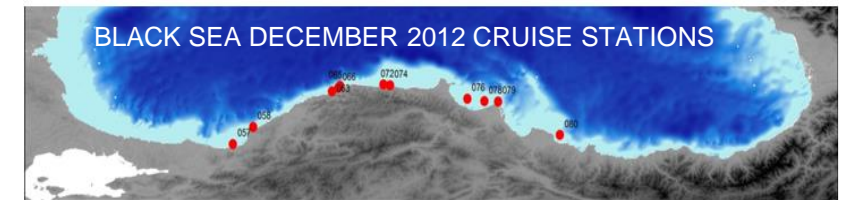
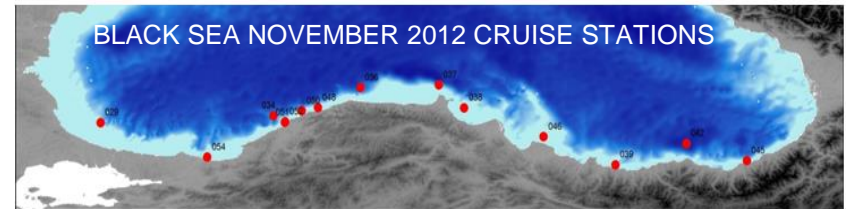
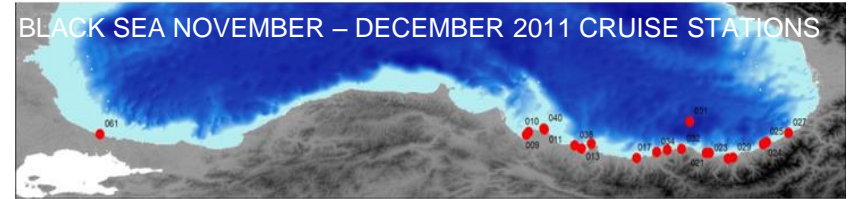


FIG. 2. – The general scheme of anchovy migration. (A) Azov anchovy: 1 – spawning and foraging region; 2 – wintering region; 3 – spring migration; 4 – autumnal migrations; 5 – periodic migrations of a mingled population. (B) Black Sea anchovy: 6 – spawning and foraging region; 8 – spring migration; 9 – autumnal migrations.

Materyal & Metod

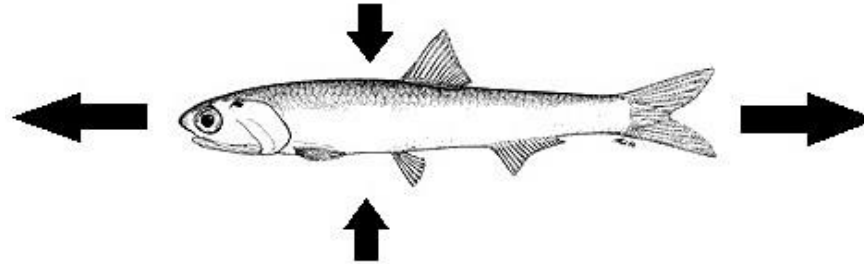


Differences Between The Black Sea & Azov Anchovy

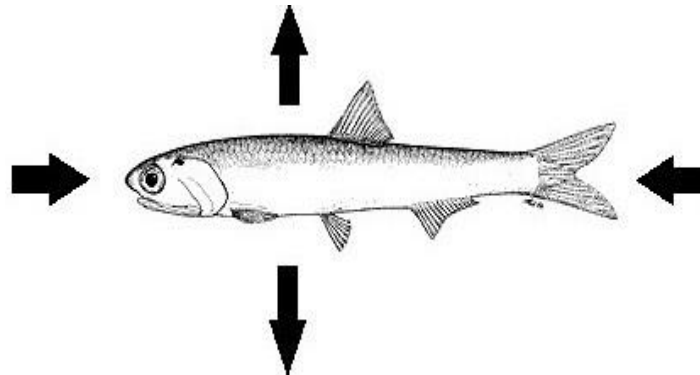
| | Black Sea Anchovy | Azov Anchovy |
|---|--------------------------|----------------------------|
| Growth Rate | Faster | Slower |
| Index of otoliths (Length/Width Ratio) | 2,15 | 1,96 |
| Degree of infestation by <i>Contracaecum aduncum</i> | Higher | Lower |
| Blood Type | A1 (96%) and A2 (4%) | A1 (63%) A2 (16%) A0 (21%) |
| Isocitrate dehydrogenase and esterase | | |
| Racing School Time | Later | Earlier |

FIRST ASSUMPTION

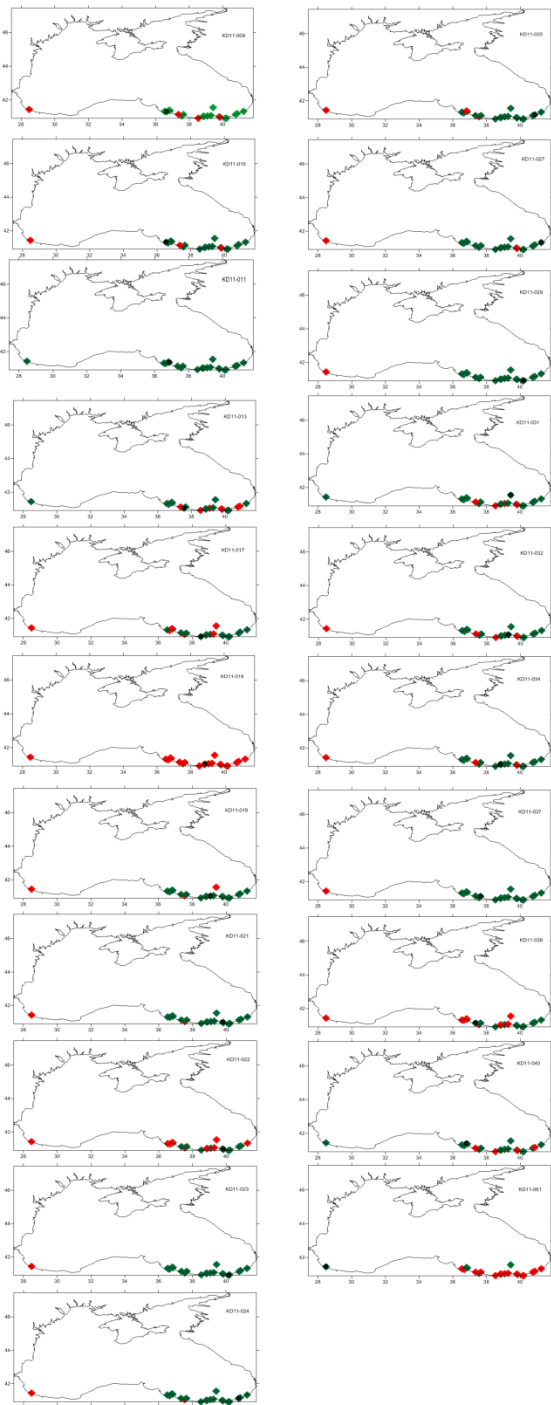
Engraulis encrasicolus ponticus
Longer & Thinner



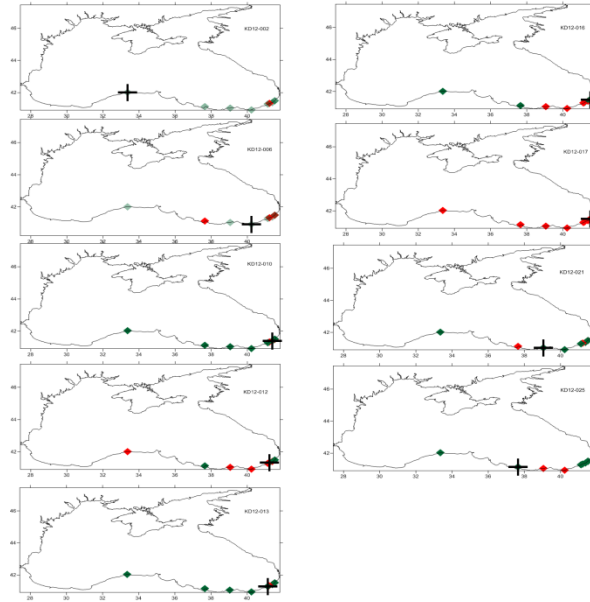
Engraulis encrasicolus maeticus
Slightly Shorter & Thick



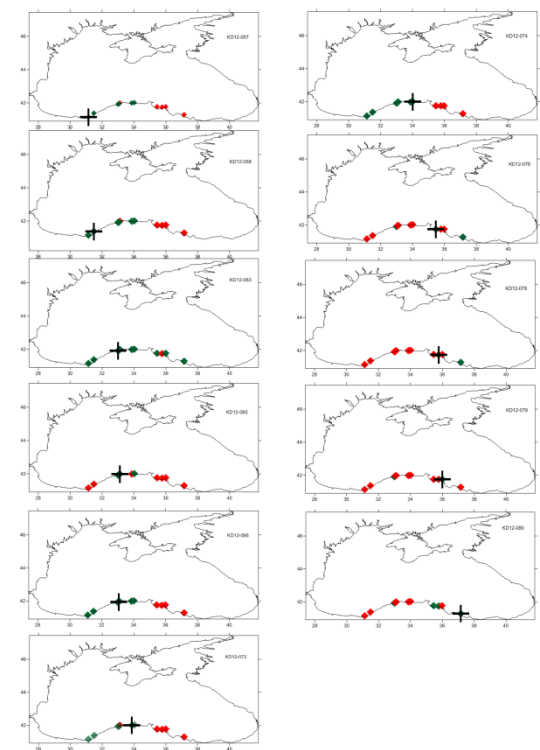
KARADENİZ 2011 ARALIK SEFERİ



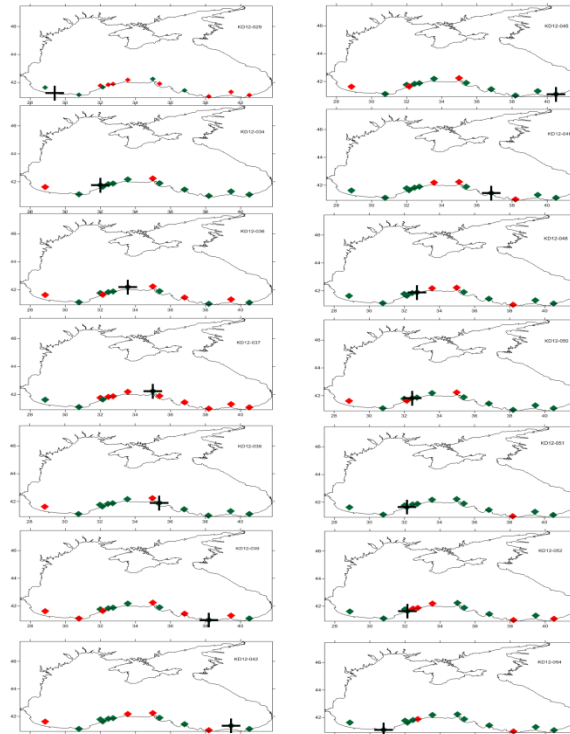
KARADENİZ 2012 OCAK SEFERİ



KARADENİZ 2012 ARALIK SEFERİ



KARADENİZ 2012 KASIM SEFERİ



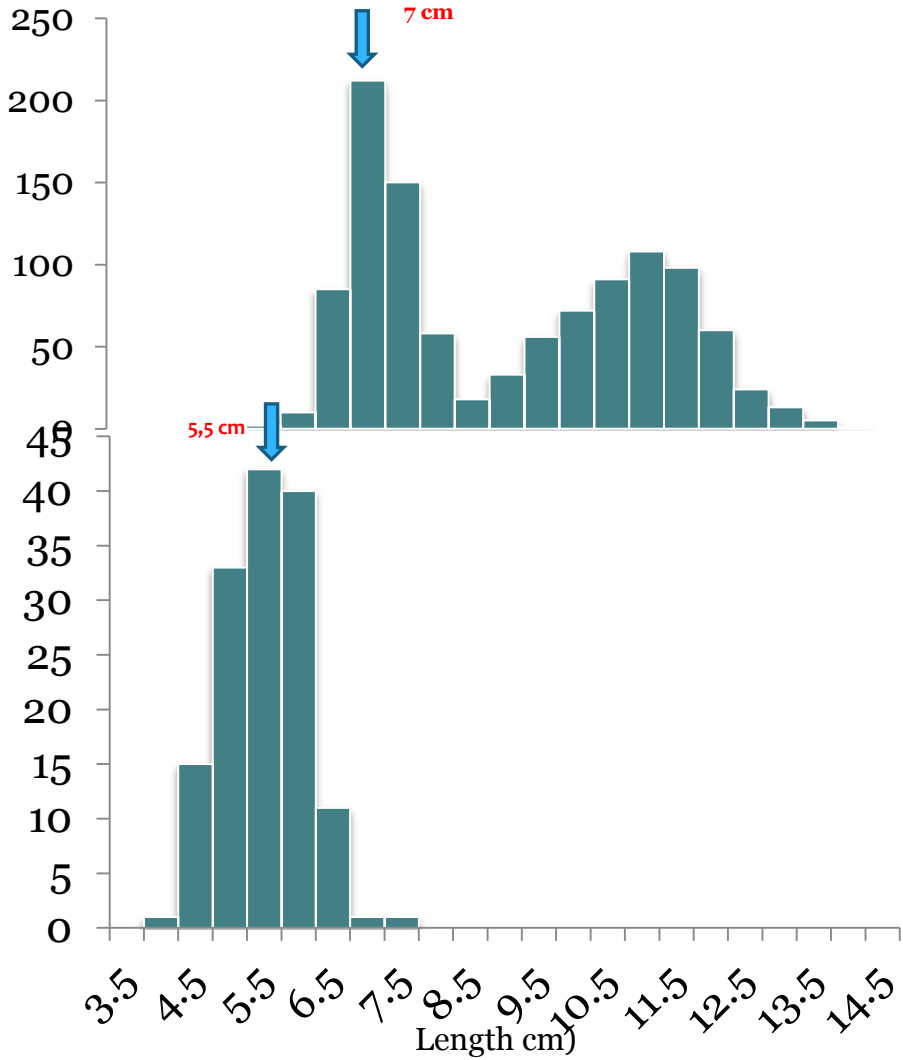
$$W = a \cdot L^b$$

$$t = \frac{b_1 - b_2}{S_{b_1 - b_2}}$$

SECOND ASSUMPTION



Black Sea 2011 November – December Cruise
Comparison between KD11-009 – KD11-031 Stations Length Frequenc



THIRD ASSUMPTION



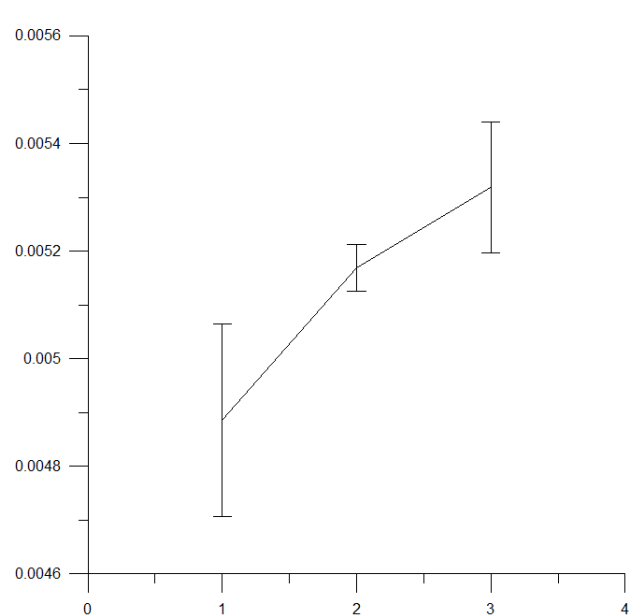
Figures (left to right): 1. GES DISC, Science Focus: Dead Zones. 2. A map of the Black Sea's drainage basin, Liviu Giosan, Woods Hole Oceanographic Institution; Stefan Constantinescu, University of Bucharest. 3. Swirling blue bloom 2012, Nasa Aqua Satellite [Moderate Resolution Imaging Spectroradiometer](#) taken by MODIS

the River Danube after Bondar (1991); Panin (1996).

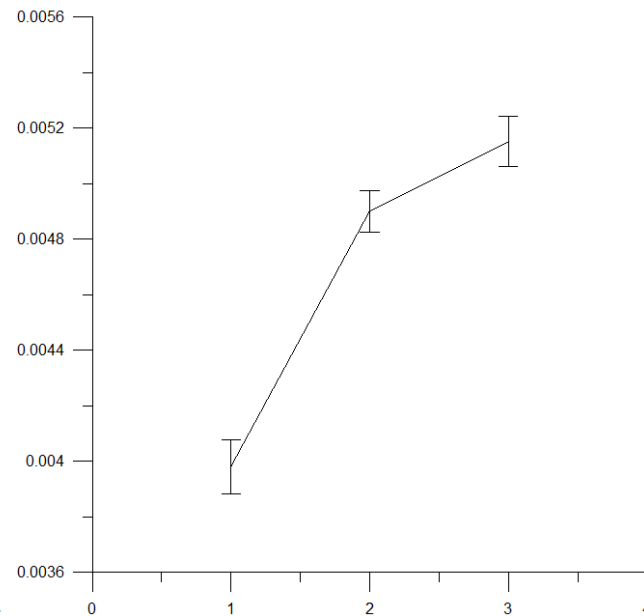
| Rivers | Length (Km) | Drainage basin Area? (Km ²) | Water discharge (Km ³ /yr) |
|------------------------------------|-------------|---|---------------------------------------|
| I. North-Western Black Sea | | | |
| Danube | 2,860 | 817,000 | 190.7 |
| Dniestr | 1,360 | 72,100 | 9.8 |
| Dniepr | 2,285 | 503,000 | 52.6 |
| Southern Bug | 806 | 63,700 | 2.6 |
| Sub-total I: | | 1,455,800 | 255.7 |
| II. Sea of Azov | | | |
| Don | 1,870 | 442,500 | 29.5 |
| Kuban | 870 | 57,900 | 13.4 |
| Sub-total II: | | 500,400 | 42.9 |
| III. Caucasian coast rivers | | | |
| | | | |
| IV. Anatolian coast rivers | | | |
| | | | |
| V. Bulgarian coast rivers | | | |
| | | | |
| TOTAL: | | | 372.3 |



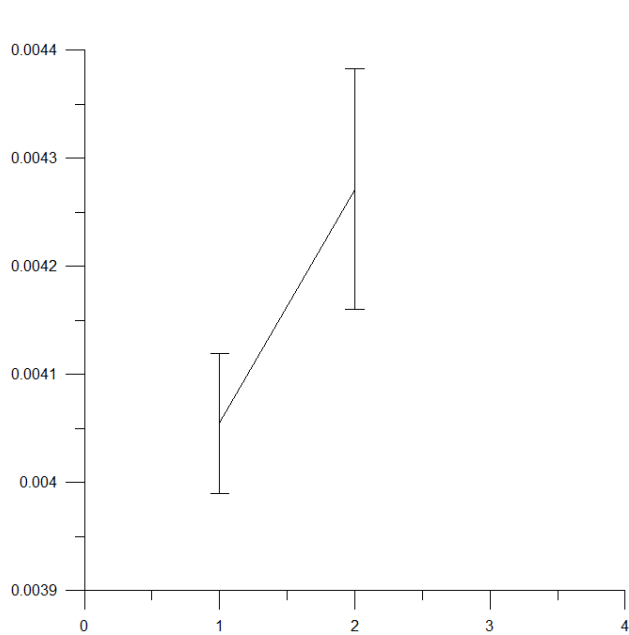
Black Sea 2011 November - December
Condition Factor - Length Group



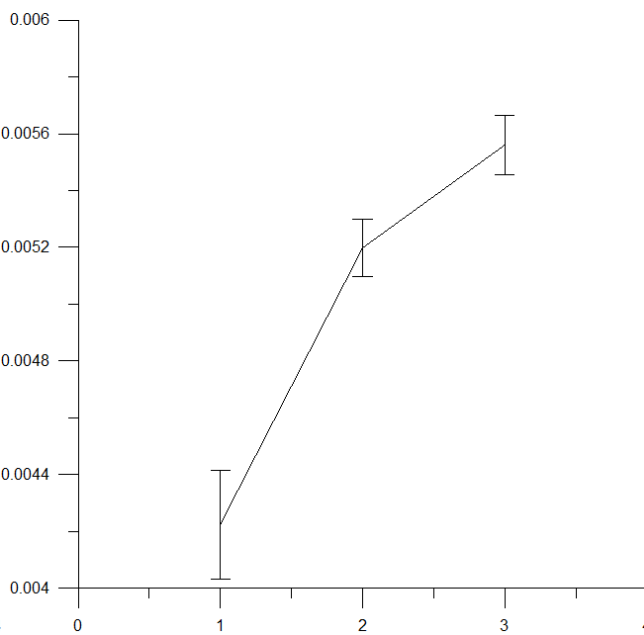
Black Sea 2012 November
Condition Factor - Length Group



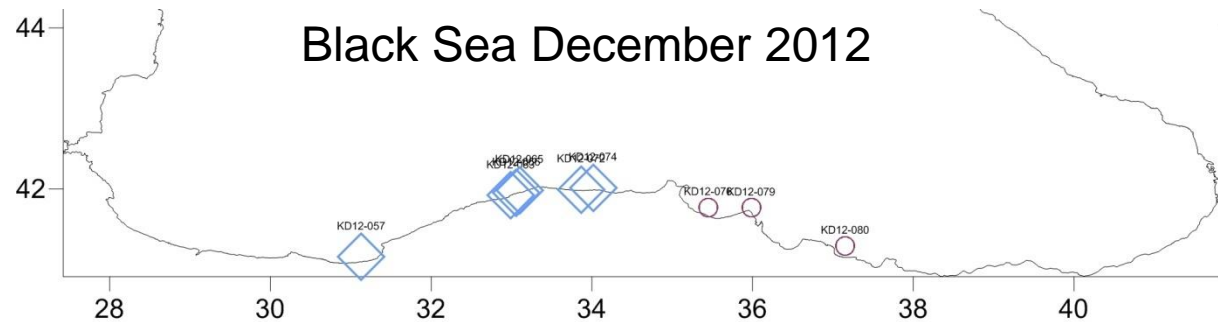
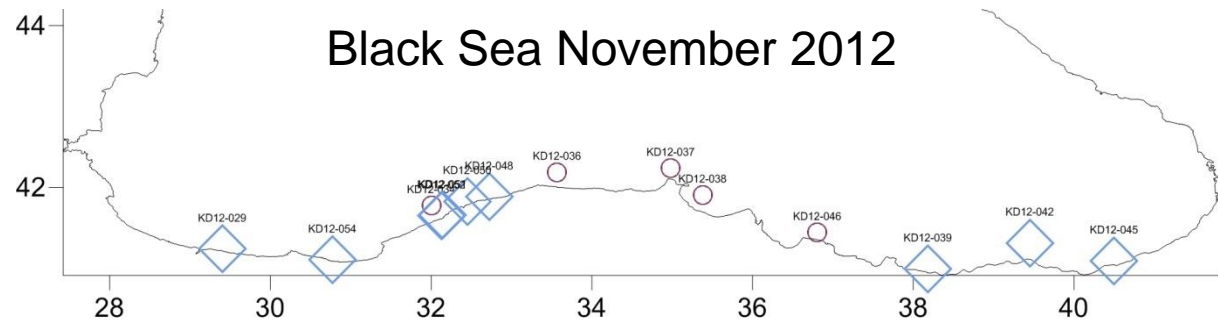
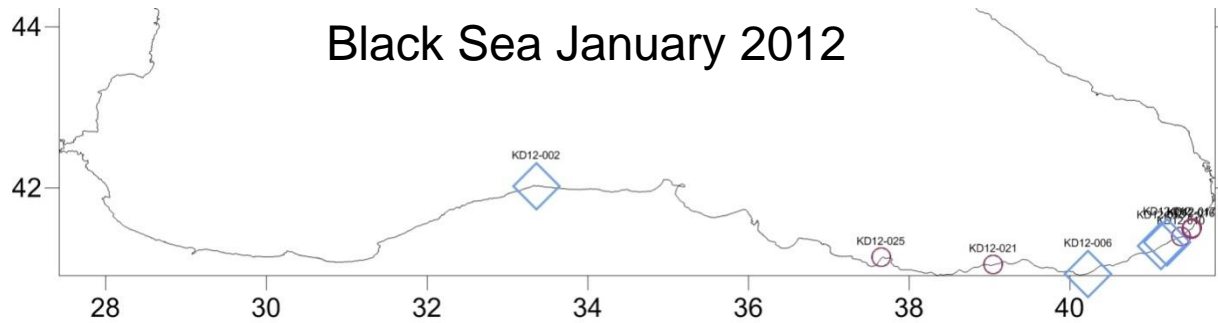
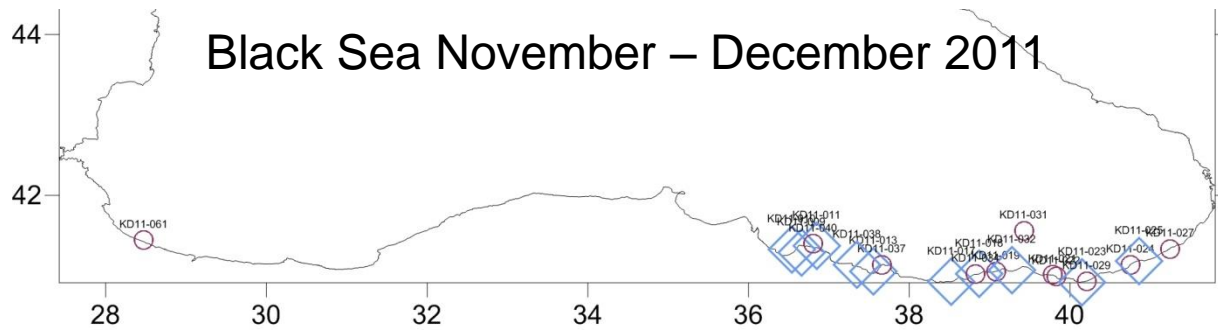
Black Sea 2012 January
Condition Factor - Length Group



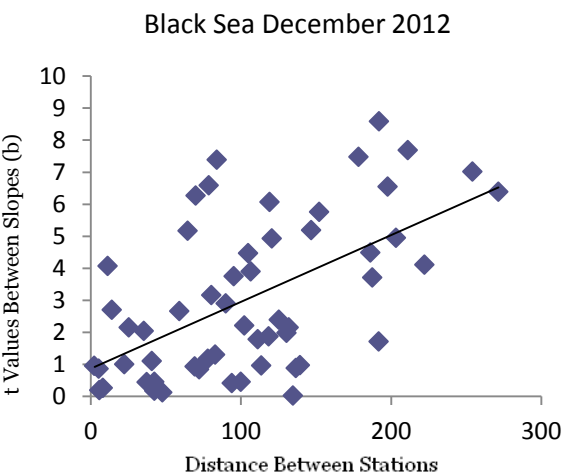
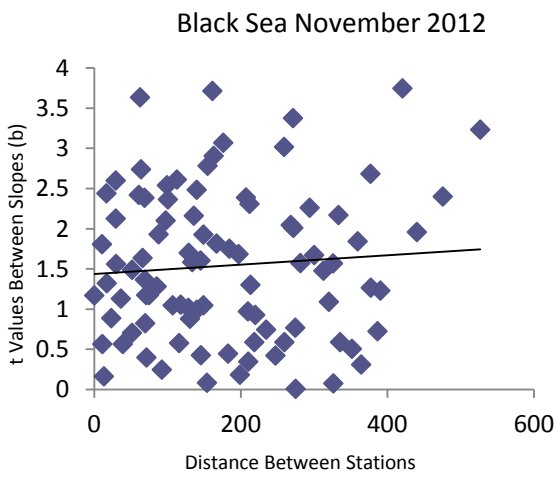
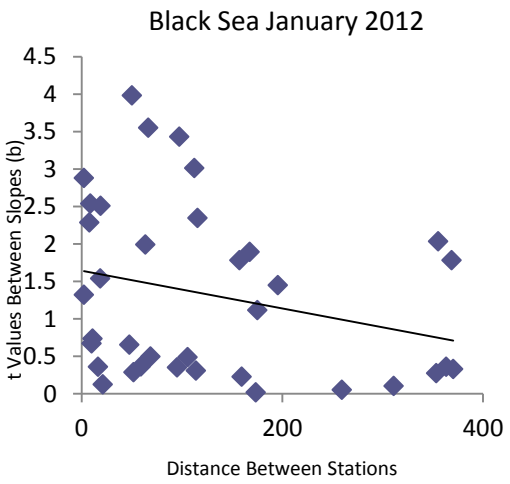
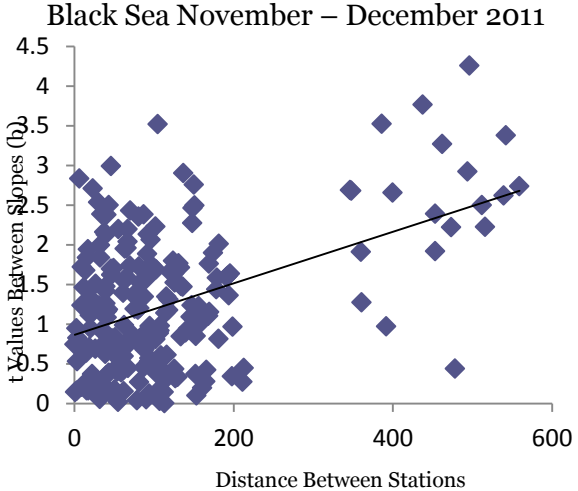
Black Sea 2012 December
Condition Factor - Length Group



$$K = 100 \frac{W}{L^3}$$



LAST ASSUMPTION



| Cruises | R2 | Critical value for $\rho=0.05$ | p |
|------------------------------------|-------|--------------------------------|------|
| Black Sea November - December 2011 | 0.208 | 0.113 | 0.05 |
| Black Sea 2012 January | 0.070 | 0.312 | ns |
| Black Sea 2012 November | 0.006 | 0.197 | ns |
| Black Sea 2012 December | 0.330 | 0.254 | 0.05 |



Thank you for your attention...

REFERENCES

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4. *A map of the Black Sea's drainage basin*, Liviu Giosan, Woods Hole Oceanographic Institution; Stefan Constantinescu, University of Bucharest.
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6. Swirling blue bloom, 2012. [Moderate Resolution Imaging Spectroradiometer](#) (MODIS) on NASA's [Aqua](#) satellite.
<http://earthobservatory.nasa.gov/IOTD/view.php?id=78705>