Climate change effects on fish stocks (Iranian waters of the Caspian Sea)

Mahnaz Rabbaniha,
Fereidoon Owfi, Hassan Fazli, Akbar Pourgholami

Iranian Fisheries Science Research Institute (IFSRI)

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Aims

-Recognize changes in environmental factors (1997-2018) in Iranian waters of the Caspian Sea.

-Recognize changes in fish CPUE (in Iranian waters of Caspian Sea (1997-2018).

-Analyzed the relationship between measured environmental factors with fish CPUE

Method

- Fish stocks were based on the CPUE index obtained from the database of the Iran Fisheries Organization. CPUE data from bony fish were collected monthly (1997-2018).

- Environmental data, including sea surface temperature (SST,°C), surface water chlorophyll-a (CH, mg/l), were downloaded from the MODIS satellite. Wind speed (WS, m/s), air temperature (AT,°C), evaporation (E, mm), and rainfall (R, mm) were also provided from the database of the Iran Meteorological Organization.

- To determine the relationship, We have applied the Generalized Linear Regression Analysis (GLM), Generalized Additive Model(GAM), step by step regression analysis.

Result

Environmental factors (1997-2018)

- **The mean of SST was 14.14 ± 5.64°C,**

the highest amount of SST was recorded from **Golestan> Mazandaran> Gilan**,

- **The mean chlorophyll-a was 1.75 ± 3.82 mg/L**

the highest value was found from **Gilan> Mazandaran> Golestan**

- **The mean rainfall was 121±15mm**

the highest value was found from **Gilan> Mazandaran> Golestan**

- **The mean evaporation was 45.25±26.4**

the highest values was **Golestan> Mazandaran> Gilan**

- **The mean air temperature was 12.38±4.57**

the highest value was in **Golestan> Mazandaran> Gilan,**

- **The wind speed was 9.03±7.1m/s**

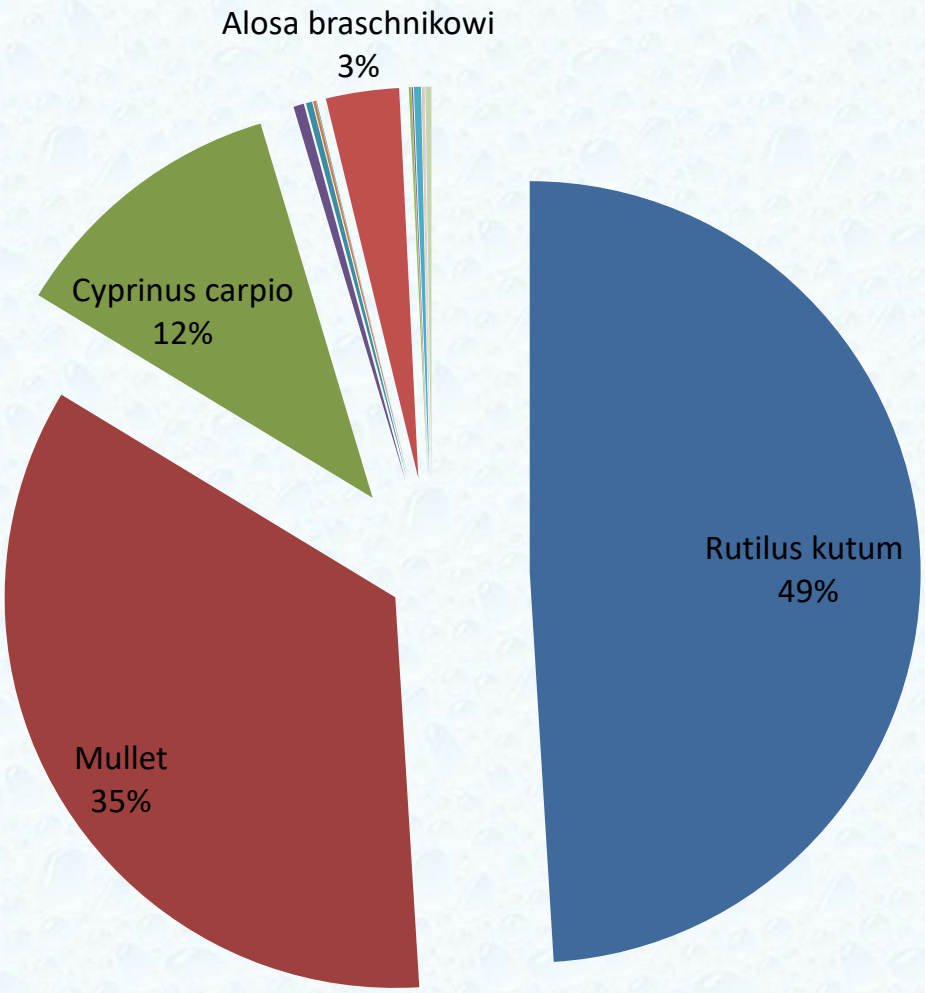
the highest value was in **Mazandaran> Golestan> Gilan**

All factors showed a significant difference (P>0.05) between the three northern provinces (the Caspian Sea).

Result

Fish stock

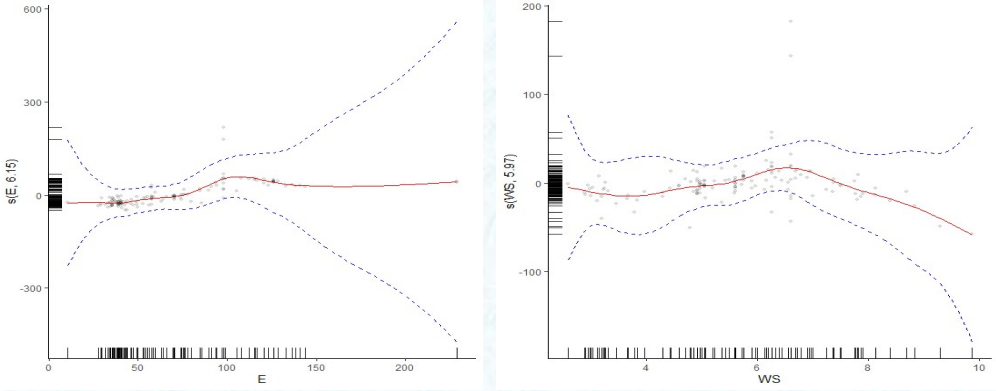
- The number of fish stocks during the period (1997-2018) had a decreasing.
- The relative abundance of fish stock, show some family are dominant.



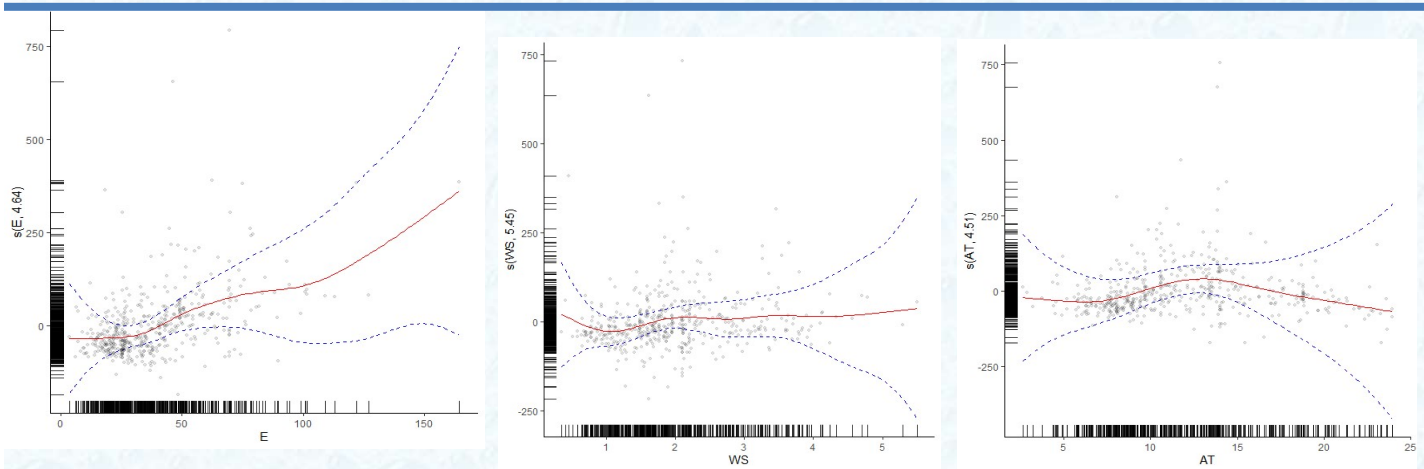
The relation of dominant fish stocks with environmental factors in the northern provinces

Province	Fish	Wind speed	Chlorophyll	Rainy	Evaporation	Sea Surface Temperature	Air temperature
Gilan	*Rutilus kutum*	*			***		**
	Liza	***	*	*	**	*	**
	Alosa	.	***	*		**	
Mazandaran	*Rutilus kutum*		**	***	***	***	***
	Cyprinus carpio	**			***		
	Liza		***	.	***	***	*
	Alosa			*	.	***	***
Golestan	*Rutilus kutum*	**			**		
	Cyprinus carpio		**		**	.	
	Liza				-		

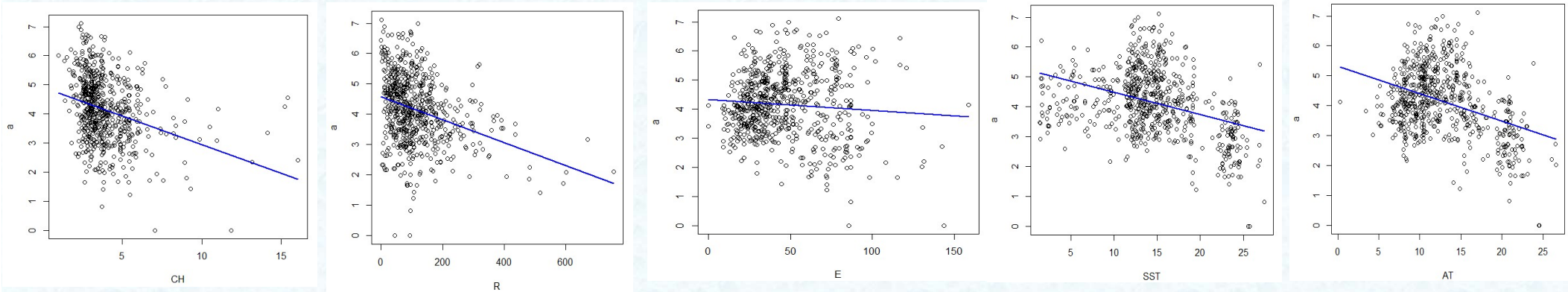
Rutilus kutum



The relation between the CPUE *Rutilus kutum* with E ,WS in Golestan (GAM) (1997-2018)

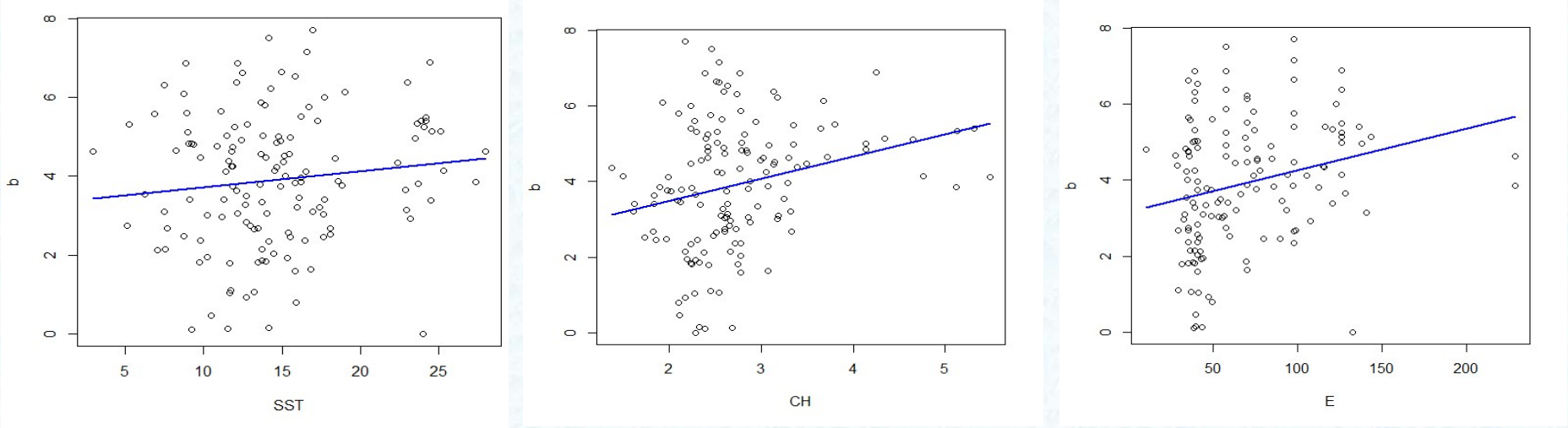


The relation between the CPUE *Rutilus kutum* with E,WS, AT in Gilan (GAM) (1997-2018)

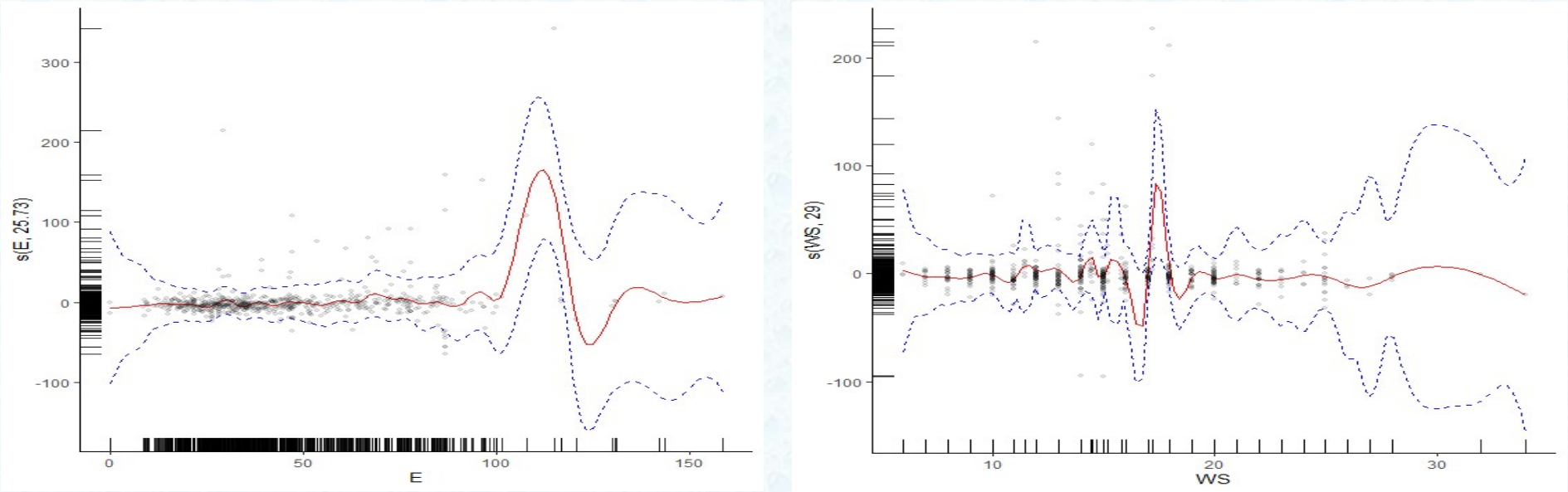


The relation between the log CPUE *Rutilus kutum* with CH, R, E SST, AT in Gilan (GLM) (1997-2018)

Cyprinus carpio

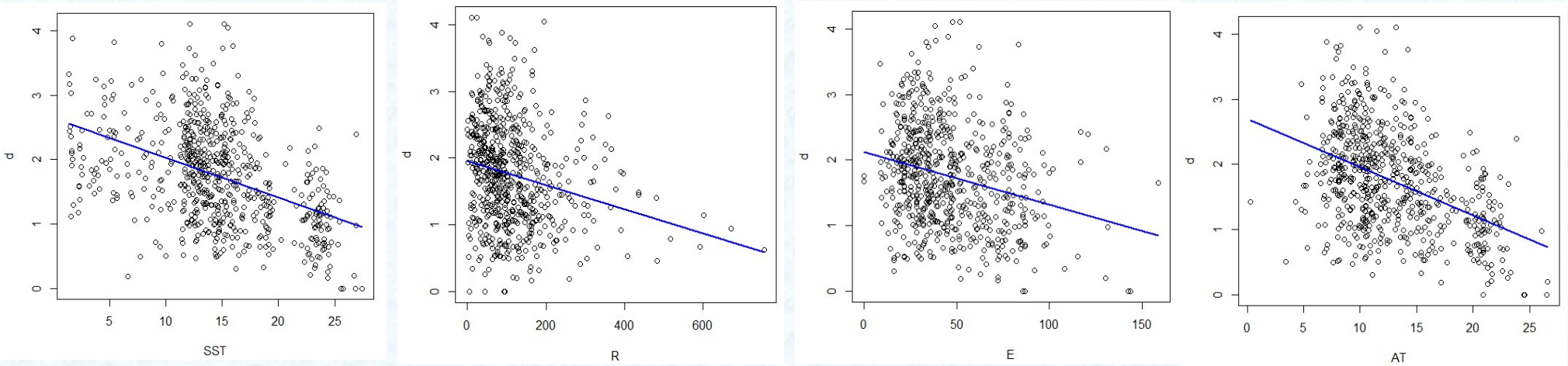


The relation between the log CPUE *Cyprinus carpio* with SST,CH, E in Golestan (GLM) (1997-2018)

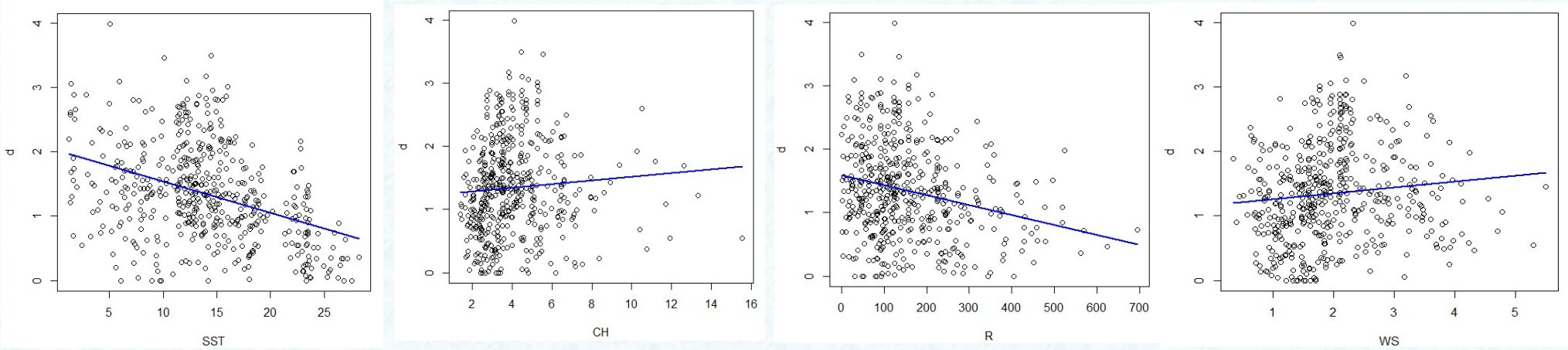


The relation between the log CPUE *Cyprinus carpio* with E ,WS in Mazandaran (GAM) (1997-2018)

Alosa

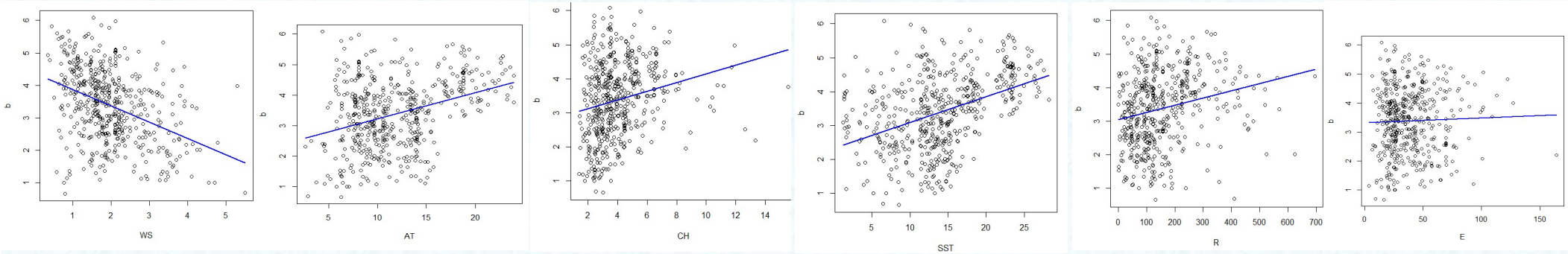


The relation between the log CPUE *Alosa* with SST, R, E, AT in Mazandaran (GLM) (1997-2018)

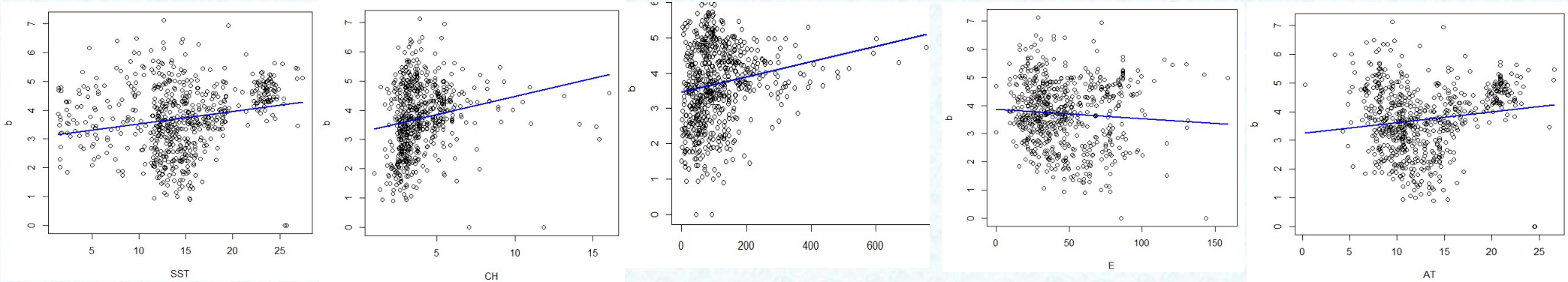


The relation between the log CPUE Alosa with SST, CH, R, WS in Gilan (GLM) (1997-2018)

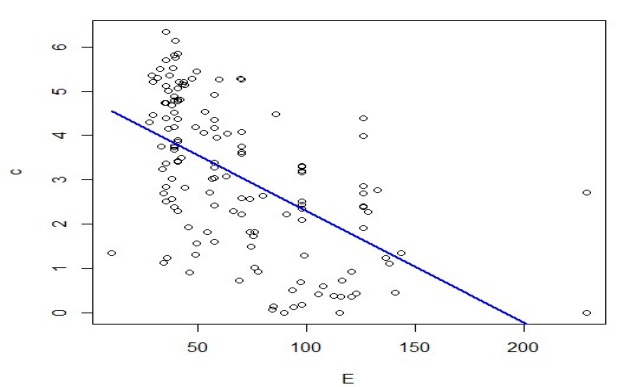
Liza



The relation between the log CPUE Liza with WS,AT,CH,SST in Gilan (GLM) (1997-2018)



The relation between the log CPUE Liza with SST, CH,R,E,AT in Mazandaran (GLM) (1997-2018)



The relation between the log CPUE Liza with E in Golestan (GLM) (1997-2018)

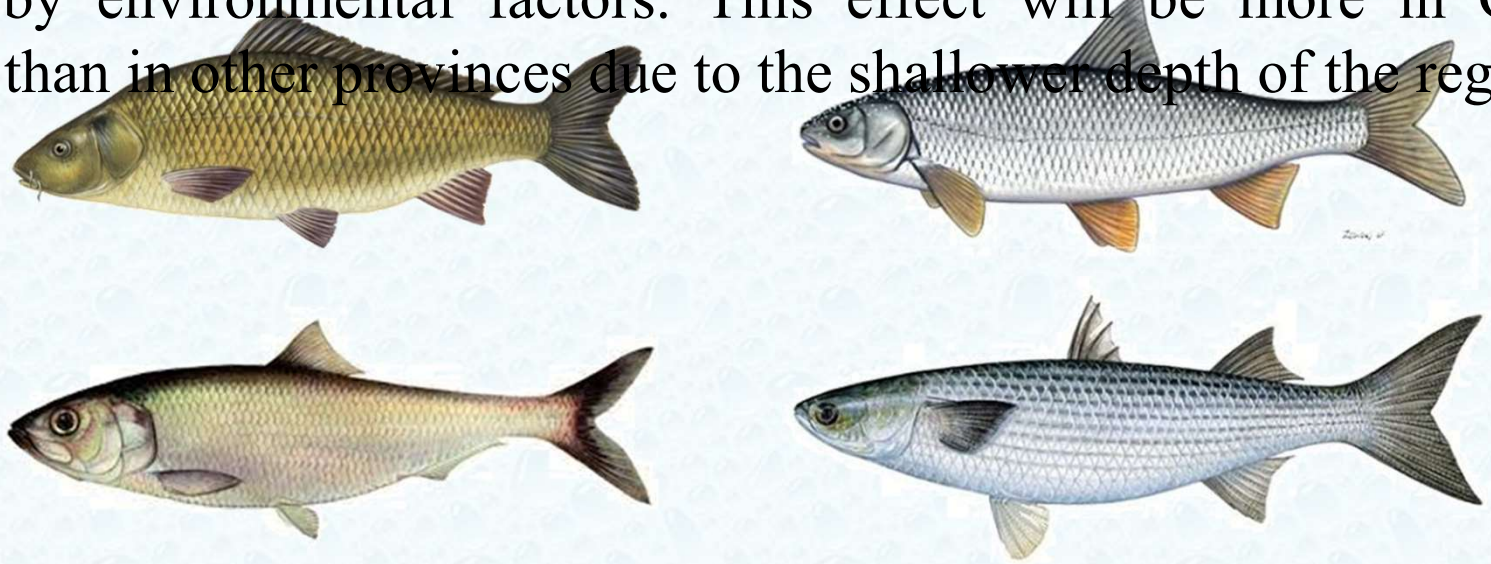
Fish stock (1997-2018)

- The number of fish stocks had a decreasing.

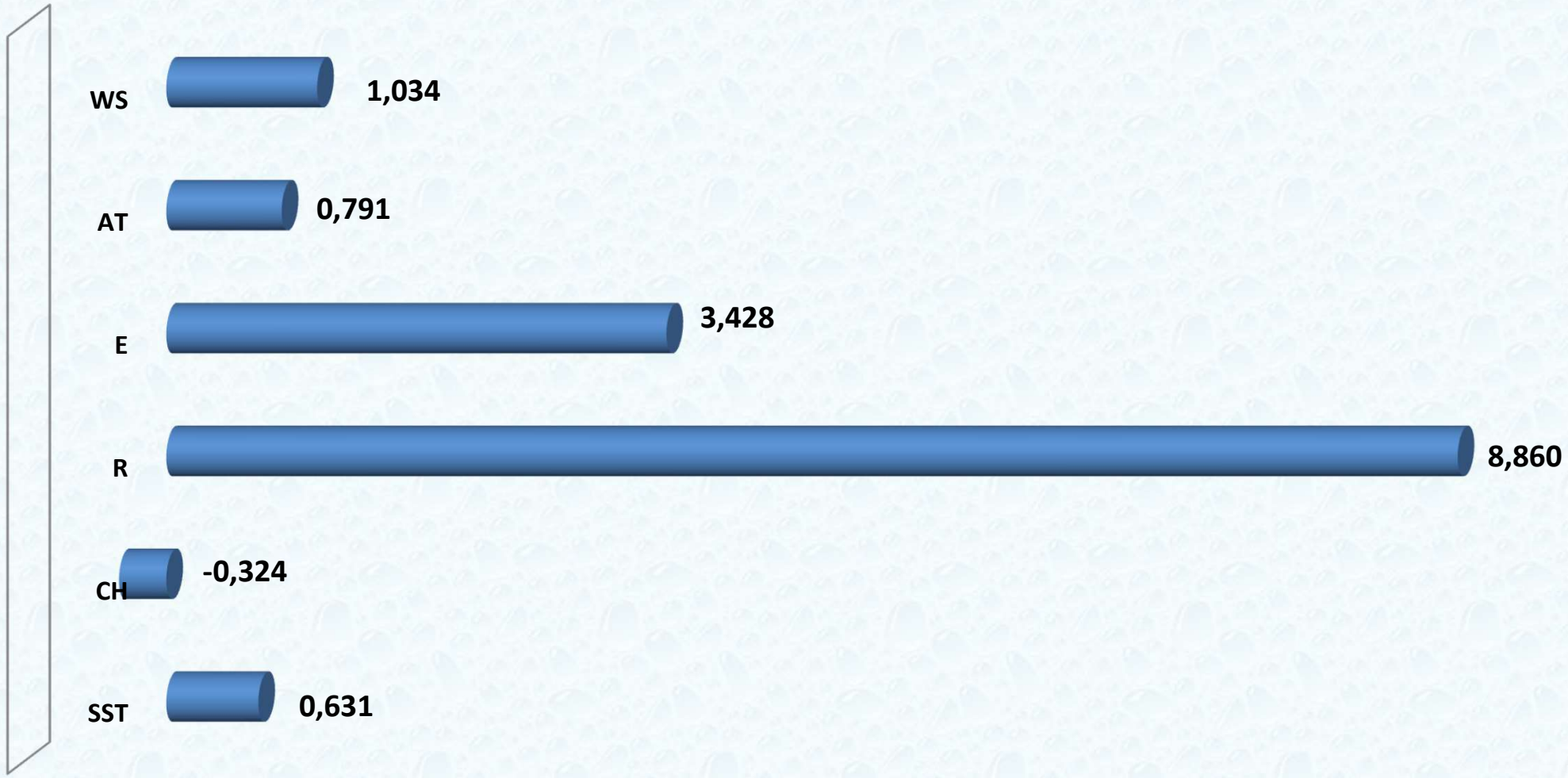
- Environmental factors have increased .

- The trend of provincial ecological changes was not the same, and the studied factors have acted differently on marine reserves. But in the meantime, evaporation with the most effect and then rainfall and water temperature has been the most effective factors.

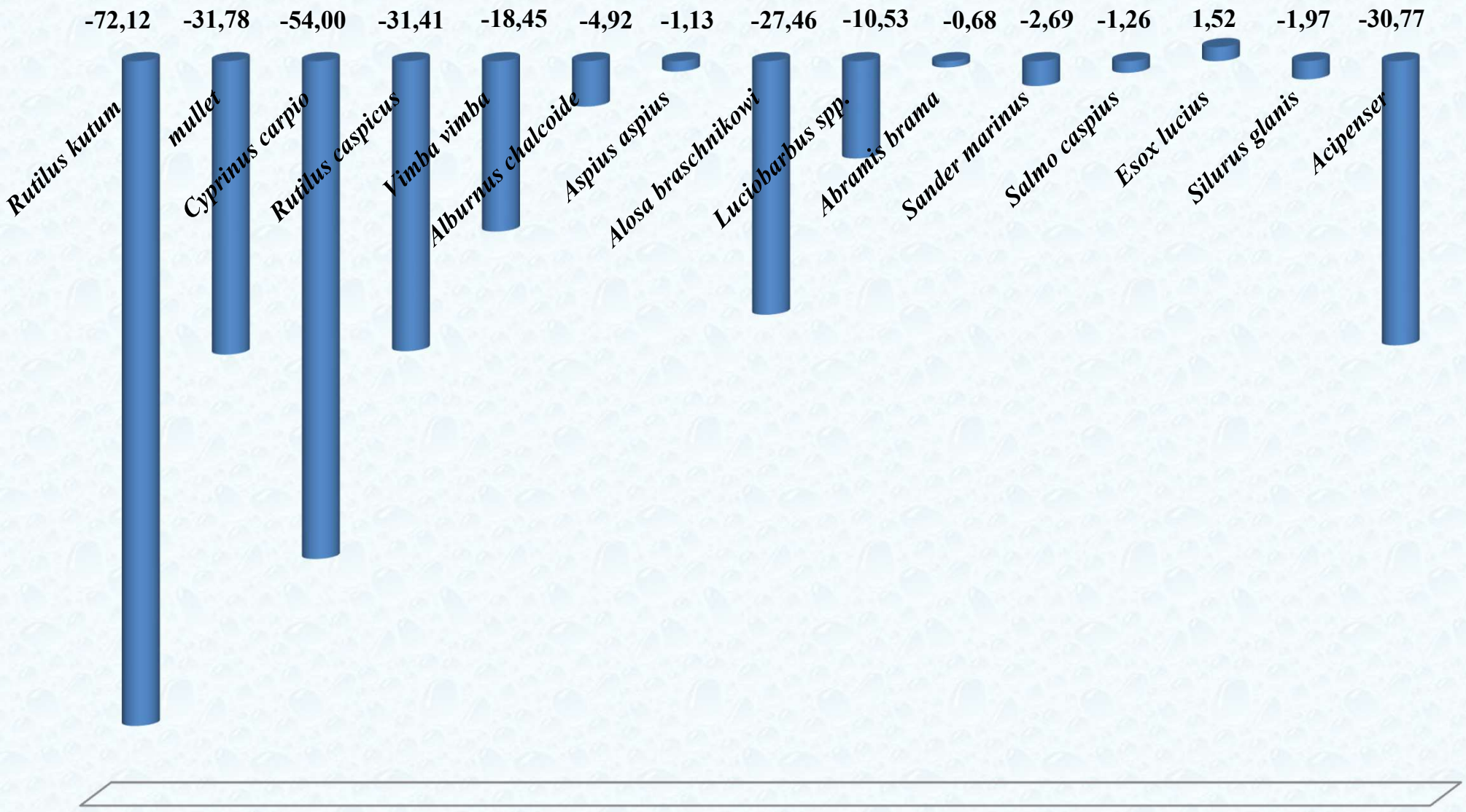
- In addition to the mentioned factors, the level of the Caspian Sea is also related to the decrease of *Kilka*, *mullet* and *Rutilus* stocks.
- Most fishing is in shallow coastal waters, which will naturally be more affected by environmental factors. This effect will be more in Golestan province than in other provinces due to the shallower depth of the region



The difference between the mean of environmental factors in the 3 years period (1996-98) and (2016-2018)



The difference between the mean fish CPUE in the 3 year period (1996-98) and (2016-2018)



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