



Seasonality of Fish Catch and Fish Prices in Natural Egyptian Fisheries

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ABSTRACT

Seasonal index is an important indicator to study seasonal variations in any studied phenomena which can be changed regularly in an interval less than one year. This paper aimed to study the relationship between fish catch & fish prices "Seasonal Index" of Egyptian Natural Fisheries. This relationship determines type of fisheries production, if this relationship is positive, then the fish catch from this fisheries are totally economic. Whereas the negative relationship means the fisheries need to apply new developing programs to be in economic production.

The present work concluded that:

(1) It is important to increase, or at least maintain fish catch in total Egyptian natural fisheries, total fresh water fisheries, total marine fisheries, and individual Red Sea fisheries due to the positive relationship between fish catch seasonal index (%) and fish prices seasonal index.

(2) More and actual effective developing programs must be applied in total lakes fisheries and individual Mediterranean Sea fisheries to overcome the present negative relationship between seasonal index of fish catch and fish prices.

INTRODUCTION

Seasonal index it is an important indicator to study seasonal variations in any studied phenomena which change regularly in an interval less than one year. Seasonal variations are one of components of time series beside secular trend, cyclical or periodical variations, and accidental variations, so to study seasonal variations we must exclude the other variations.

So it is important to find out the relation between fish catch and fish prices "Seasonal Index" to all resources of natural fisheries in Egypt, because these fisheries are affected many variable factors, which reflect the difficult of control the fish catch from Natural Fisheries, to know if the fish catch from this fisheries are totally economic, or need to apply more development programs to be in economic production.

The aim of this paper is study seasonal variation of natural Egyptian fisheries, through two main ways; (1) seasonal index of fish catch, (2) seasonal index of fish prices, to all resources of natural fisheries in Egypt. Because natural fisheries in Egypt have the largest fishing area and the least amount of fish catch compared to the fish production from aquaculture in recent years. To find out the relationship between fish catch & fish prices "Seasonal Index"

MATERIALS AND METHODS

The present study is depending on collecting fisheries official data from General Authority for Fish Resources Development (GAFRD) during the period (2009-2014), and calculated the seasonal index of fish catch and fish prices of the total natural Egyptian fisheries and its sources.

Seasonal index it is an important indicator to study seasonal variations in any studied phenomena which change regularly in an interval less than one year. Seasonal variations are one of components of time series beside secular trend, cyclical or periodical variations, and accidental variations, so to study seasonal variations we must exclude the other variations.

To calculate seasonal index of used data, it has been used a base value of 100 percent (AgriLIFE EXTENSION), which calculated by specific steps as follow, first calculate the monthly average values of fish catch (tons) and fish prices (LE/ kg) during the period of study (2009-2014) to eliminate the random influence, hence this figures represent only monthly seasonality variations, (Carbunaru & Bacescu, 2013), Second calculated the estimated value to every month by using linear time trend equation (Ordinary Least Squares) for the monthly average values data, and finally division the true value on estimated value to every month (%).

Also calculate the correlation coefficient to find out the relation between fish catch & fish prices "Seasonal Index", if this relationship positive then production must be continue from the fisheries because this will increase income from these fisheries, so the fish production from this fishery is totally economic, but if this relationship is negative we should develop these fisheries to be economic production.

RESULTS AND CONCLUSIONS

1. Evaluation and relative importance of fish catch and area in natural Egyptian fisheries.

Natural Egyptian fisheries consist of many sources (marine fisheries, lake fisheries, and fresh water fisheries). These fisheries area are about $13.2 * 10^6$ acre during the period (2009-2014), which represent about 95.0% of Egyptian fisheries area. The aquaculture fish production in Egypt represents 27.3% of Egyptian fisheries production (Table. 1), due to the development program focus on fish aquaculture in fresh water since the

eighteenth of last decade until now, in addition to entry to marine culture in basins recently, (Maiyza, SH.I., 2015).

Table.1. Evaluation and relative importance of fish catch and area in Egyptian fisheries during the period (2009-2014)

Items	Year	Egyptian fisheries		
		Natural fisheries	Aquaculture	Total
Fish catch (tons*10 ³)	2009	387.4	705.5	1092.9
	2010	385.2	919.6	1304.8
	2011	375.4	986.8	1362.2
	2012	354.2	1017.7	1371.9
	2013	356.9	1097.5	1454.4
	2014	344.8	1137.1	1481.9
	Average	367.3	977.4	1344.7
% Egyptian fisheries	27.3	72.7	100.0	
Area (acre*10⁶)		13.205	0.7	13.905
% Egyptian fisheries		95.0	5.0	100.0

Source:

- 1- Collected from; Maiyza, SH.I. (2015), **An Economic Study of Fish Production In Alexandria Mediterranean Sea Fisheries**, Ph.D., Faculty of Agriculture, Alexandria University, Egypt.
- 2- GAFRD, **Yearbook of Fishery statistics**, (2009-2014), Cairo, 2016.

So, it is important to study the Natural Fisheries, which are affected many variable factors such as weathering conditions (storms, humidity, wind...etc.), biological relationships among fish and other living organisms in their ecosystem, economic factors (fish prices, fishing effort, capital...etc.), environmental factors which associate with aquatic pollution from all types (sewages, agriculture, domestic, industry, recreation, oil spill from ports and platforms,... etc.), in addition to the harmful fishing activities by using illegal fishing tools. What mention before reflect the difficult of control the fish catch from Natural Fisheries as opposed to what exists in aquaculture.

Moreover, it is obvious from studying the relative importance of fish production from Egyptian natural fisheries (Table. 2), that lake fisheries are the largest relative importance that contribute about 47.26% of the annual average of total fish production from Egyptian natural fisheries during the period (2009-2014), whereas marine and freshwater fisheries contribute about 31.77% & 20.97% of the annual average of total fish production from Egyptian natural fisheries respectively during the same study period.

Despite the fact that the Marine fisheries area exceed that of lakes and fresh water, which have an area of 11.2×10^6 , 1.818×10^6 , and 0.187×10^6 acre respectively, but lake

fisheries are bigger than marine fisheries in relative importance of fish production due to the potential of applying development programs easily in lake fisheries. Because lakes fisheries are smaller in its area and have small range of climate change effect compared to marine fisheries, (Maiyza, 2015). But when studying each source separately, it is shows that Mediterranean Sea (6.8×10^6 acre) is bigger than Red sea (4.4×10^6 acre) in its relative importance of fish production from Marine fisheries, which contribute about 19.47% & 12.30% of the annual average of total fish production from Egyptian natural fisheries during the period of study (Maiyza, 2015).

In lakes **fisheries**, the northern delta ecosystems are superior to its counterpart (34.89%) in inland lakes (11.23%) and coastal lagoons (1.14%) in its relative importance of fish production - (Table. 2), although the area of inland lakes (1.399×10^6 acre) superior to northern delta lakes (0.252×10^6 acre) and coastal lagoons (0.167×10^6 acre) .

Table.2. Evaluation and relative importance of fish catch in natural Egyptian fisheries during the period (2009-2014). (tons)

Year	Natural Egyptian fisheries																				
	Marine fisheries		Lake fisheries															Fresh water fisheries		Total Natural Egyptian fisheries	
	Mediterranean Sea	Red Sea	Total marine fisheries	Northern delta lakes				Total northern delta lake	Coastal lagoons		Total coastal lagoons	Inland lakes					Total inland lakes	Total lake fisheries	Nile river and its branches		
				Manzala	Burullus	Edku	Mariut		Barduwil	Port Fouad Saltern		Timsah & Bitter lakes and Suez Canal	Qarun	El Ruyain	New valley fishery	Nasser					Toshka spillway
2009	78790	49031	127821	48023	53401	6206	5518	113148	5410	185	5595	4557	3400	2624	452	37657	4809	53499	172242	87335	387398
2010	77388	43974	121362	61075	59517	6493	5919	133004	4731	140	4871	3966	3903	2494	1060	27418	2483	41324	179199	84648	385209
2011	77799	44504	122303	59779	45544	6387	5427	117137	4529	123	4652	3474	4364	3053	1653	26270	2736	41550	163339	89712	375354
2012	69332	44866	114198	62272	52076	6576	7427	128351	3844	95	3939	26290	4410	3451	1780	2894	2301	41126	173416	66623	354237
2013	63027	43634	106661	81365	49704	6169	7636	144874	3237	104	3341	4015	4420	3416	1832	18716	1911	34310	182525	67671	356857
2014	62746	45053	107799	55022	63980	5855	7463	132320	2758	53	2811	3685	4518	3782	1887	21736	193	35801	170932	66060	344791
Average	71513.7	45177	116690.7	61256	54037	6281	6565	128139	4084.8	116.7	4201.5	7664.5	4169.2	3136.6	1444	22448.5	2405.5	41268.3	173608.8	77008.2	367307.7
% Marine fisheries	61.3	38.7	100.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
%Northern delta lake	—	—	—	47.8	42.2	4.9	5.1	100.0	—	—	—	—	—	—	—	—	—	—	—	—	—
%Coastal lagoons	—	—	—	—	—	—	—	—	97.2	2.8	100.0	—	—	—	—	—	—	—	—	—	—
%Inland lakes	—	—	—	—	—	—	—	—	—	—	—	18.6	10.1	7.6	3.5	54.4	5.8	100.0	—	—	—
% Lake fisheries	—	—	—	35.3	31.1	3.6	3.8	73.8	2.3	0.1	2.4	4.4	2.4	1.8	0.8	13.0	1.4	23.8	100.0	—	—
%Egyptian natural fisheries	19.47	12.30	31.77	16.68	14.71	1.71	1.79	34.89	1.11	0.03	1.14	2.09	1.14	0.85	0.39	6.11	0.65	11.23	47.26	20.97	100.00

Source: collected from: GAFRD, *Yearbook of Fishery statistics*, (2009-2014), Cairo, 2016.

So, although the inland lakes area is bigger than northern delta lakes, but its relative importance of fish production is smaller because of two main reasons: (1) the renewed water of northern delta lakes, due to their communication of Mediterranean Sea by small holes, (Water Quality Assessment, 1996), (2) application law of stop fishing in inland lakes from May to September (5 months) such as, Qarun (May: June), El Ruyain (July) and New valley fishery (August- September), Whereas stop fishing applied in coastal lagoons in (January: June & December) such as, **Barduwil** (January: April & December) and **Port Fouad Saltern** (January: June), (GAFRD, 2014).

2. Seasonal Index of fish catch in natural Egyptian fisheries.

To study the seasonal index of fish catch, we applied the steps mentioned before to the data on table.3. Seasonality Index of fish catch in natural Egyptian fisheries come from variability of seasonality of marine, lakes and freshwater fisheries, which increasing in months (January, March, April, July, September, October, November), and decrease in other months- (Table. 4).

Table.3. Monthly average of fish catch in natural Egyptian fisheries during the period (2009-2014) (Tons)

Statement Months	Marine fisheries		Total Marine fisheries	Lakes fisheries			Total Lakes fisheries	Fresh water fisheries	Natural Egyptian fisheries
	Mediterranean Sea	Red Sea		Northern delta lakes	Coastal lagoons	Inland lakes			
January	5041.0	4851.3	9892.3	8923.5	21.3	3224.7	12169.5	6614.2	28676.0
February	5264.8	3802.2	9067.0	9311.8	0.0	3104.5	12416.3	6251.2	27734.5
March	5551.3	4370.7	9922.0	9588.5	0.0	4116.8	13705.3	6298.5	29925.8
April	5899.8	3808.2	9708.0	10168.8	501.0	3003.7	13673.5	6531.5	29913.0
May	3927.8	3750.5	7678.3	10456.8	948.0	1908.0	13312.8	6539.7	27530.8
June	5743.3	1560.0	7303.3	11077.7	517.2	3791.3	15386.2	6493.5	29183.0
July	6903.0	1016.5	7919.5	12376.7	384.0	3796.6	16557.3	6577.5	31054.3
August	7323.7	299.3	7623.0	11513.8	318.7	3628.7	15461.2	6533.3	29617.5
September	7477.7	3884.3	11362.0	11342.0	378.3	3561.1	15281.4	6547.8	33191.2
October	6783.8	7133.6	13917.4	11420.1	484.7	3791.0	15695.8	6241.2	35854.4
November	6072.0	5299.7	11371.7	11094.5	404.5	4509.3	16008.3	6130.5	33510.5
December	5525.5	5400.7	10926.2	10864.8	243.8	2832.6	13941.2	6249.3	31116.7
Total	71513.7	45177.0	116690.7	128139.0	4201.5	41268.3	173608.8	77008.2	367307.7
Average	5959.4	3764.8	9724.2	10678.3	350.1	3439.0	14467.4	6417.4	30609.0

Source: Collected from: GAFRD, Yearbook of Fishery statistics, (2009-2014), Cairo, 2016.

Table.4. Seasonal index offish catch in natural Egyptian fisheries during the period (2009-2014) (%)

Statement Months	Marine fisheries		Total Marine fisheries (M)	Lakes fisheries			Total Lakes fisheries (L)	Fresh water fisheries (F)	Natural Egyptian fisheries
	Mediterranean Sea	Red Sea		Northern delta lakes	Coastal lagoons	Inland lakes			
January	97.2	151	118	93.81	10.0	101.7	94.32	101.4	103
February	99.3	114	105	95.71	0.0	96.5	94.22	96.1	98
March	101.3	128	112	96.52	0.0	126.0	101.73	97.2	104
April	105.3	108	106	100.22	177.3	90.6	99.42	101.0	102
May	68.2	103	82	100.92	309.9	56.7	94.82	101.5	92
June	97.2	42	76	104.82	157.0	111.0	107.43	101.0	96
July	114.2	27	80	114.82	108.9	109.6	113.33	102.6	101
August	119.3	8	76	104.82	84.7	103.3	103.83	102.3	94
September	118.3	96	110	101.22	94.8	100.0	100.73	102.8	104
October	105.3	173	132	100.02	114.7	105.0	101.53	98.3	111
November	92.2	125	105	95.41	90.7	123.2	101.62	96.8	102
December	82.2	125	98	91.71	52.0	76.4	87.02	99.0	93

Source: Calculated from table 3.

2.1. Seasonal index of fish catch in marine fisheries.

Egyptian marine fisheries consist of two seas are Mediterranean Sea and Red sea Fisheries, the seasonal index of fish catch in marine fisheries is decreased in May, June, July and August. (Table. 4), because these months are stop fishing period for some fishing crafts in these fisheries, (1/5: 15/6) for the Mediterranean Sea and (1/5: 30/8) for Red sea, (GAFRD,2014). Also decreases in December due especially to unsuitable weathering condition at this time in the Mediterranean Sea.

Mediterranean Sea has an especial seasonal index of fish production, which decreases in winter months (November, December, January, and February) when decrease fishing trips, also in the months of stop fishing period, but the seasonality of **Red Sea** decrease only in the months of stop fishing period (May :June) (GAFRD,2014).

2.2. Seasonal index of fish catch in lakes fisheries

Seasonal index of fish catch in **lakes fisheries** decreases in winter months (December, January, and February) also in the months April and May. So we have to study in details seasonal index of fish catch in the Northern delta lakes, Coastal lagoons, and Inland lakes to find out who is the most influence on Lakes Fisheries Seasonal Index (Table. 4).

Seasonal index of fish catch in **Northern delta lakes** (Manzala, Burullus, Edku and Mariut) decrease in its value in five months from November to March. Fish catch seasonal index in **Coastal lagoons** (Barduwil and Port Fouad Saltern) has special nature, because it increases in months from April to July and October. Whereas in **Inland lakes** (Timsah &

Bitter lakes and Suez Canal, Qarun, El Ruyain, New valley fishery, Nasser and Toshka spillway), Its seasonal index of fish catch decrease in the months February, April, May and December (Table 4).

So, seasonal index of fish catch in lakes fisheries decreases because of two reasons:(1) decreasing the temperature in winter months which is unsuitable circumstances for fishing trips, (2) application of stop fishing laws in inland lakes and coastal lagoons (GAFRD, 2014). Hence, climate and fisheries management are the most influential factors in seasonal catch variation in marine and lake natural Egyptian fisheries.

2.3. Seasonal index of fish catch in fresh water fisheries.

Fresh water fisheries are the Nile River and its branches, the seasonal index of fish catch in these fisheries decrease in months February, March and from October to December, which are autumn and winter months where they are unsuitable circumstances for fishing trips (Table 4).

It is clear from studying the Seasonal Index of fish catch in natural Egyptian fisheries during the period (2009-2014) that, It outcomes of the seasonality effect of their sources (Table 5), for instance:

- (1) In *September* and *December* the effect of Seasonal index of fish catch in natural Egyptian fisheries comes from the Seasonality of fish catch in marine, lakes, and freshwater fisheries.
- (2) In March, May, October, and November the seasonality of fish catch in *marine and lakes* fisheries are the responsible of the seasonal index of fish catch in natural Egyptian fisheries.

Table.5. The effect of seasonal index of fish catch in natural Egyptian fisheries during the period (2009-2014)

Months	Seasonal index of fish catch (%)		
	Bigger value in (>100)	Smaller value in (<100)	Natural Egyptian fisheries
January	M (118) , F (101.4)	L (94.32)	103
February	M (105)	L(94.22), F (96.1)	98
March	M (112) , L (101.73)	F (97.2)	104
April	M (106) , F (101.0)	L (99.42)	102
May	F (101.5)	M (82), L (94.82)	92
June	L(107.43), F (101.0)	M (76)	96
July	L (113.33) , F (102.6)	M (80)	101
August	L(103.83), F (102.3)	M (76)	94
September	M (110) , L (100.73) ,F (102.8)	—	104
October	M (132) , L (101.53)	F (98.3)	111
November	M (105) , L (101.62)	F (96.8)	102
December	—	M (98), L (87.02),F (99.0)	93

M: Marine Fisheries. L: Lakes Fisheries. F: Freshwater Fisheries.

Source: Collected from Table 4.

- (3) Seasonal index of fish catch in lakes and freshwater fisheries is the effective resources on seasonal index of fish catch in natural Egyptian fisheries in *February and July*.
- (4) In *January and April* the seasonal index of fish catch in marine and fresh water fisheries affected on Seasonal index of fish catch in natural Egyptian fisheries.
- (5) Finally seasonal index of fish catch in marine fisheries in *June and August* is the only resources affected on Egyptian natural fisheries Fish catch seasonality.

3. Seasonal Index of fish prices in natural Egyptian fisheries.

The study of seasonal index of fish prices, it depends on the data from table 6. Seasonal index of fish prices in natural Egyptian Fisheries come from variability of seasonality of marine, lakes and freshwater fisheries, which decrease in 4 months (June to September) during the period (2009-2014) - (Table. 7).

Table.6.Monthly average of fish prices in natural Egyptian fisheries during the period (2009-2014) (LE/ kg)

Statement Months	Marine fisheries		Total Marine fisheries	Lakes fisheries			Total Lakes fisheries	Fresh water fisheries	Natural Egyptian fisheries
	Mediterranean Sea	Red Sea		Northern delta lakes	Coastal lagoons	Inland lakes			
January	19.31	14.69	16.07	25.44	29.12	22.59	22.59	19.15	16.93
February	19.16	14.87	16.06	25.11	28.25	22.42	22.42	19.42	16.99
March	19.56	14.95	16.31	26.16	29.23	23.23	23.23	20.37	17.39
April	19.65	15.15	16.47	26.45	29.26	23.51	23.51	20.90	17.63
May	18.72	14.23	15.56	25.30	28.32	22.50	22.50	19.81	16.63
June	15.43	12.09	12.73	21.37	21.94	19.32	19.32	19.68	14.25
July	13.04	11.15	11.02	19.65	18.00	18.03	18.03	20.41	13.06
August	12.85	10.87	10.78	20.05	18.26	18.28	18.28	21.21	12.94
September	17.66	14.54	14.65	23.87	24.79	21.66	21.66	21.31	16.18
October	19.20	14.92	16.03	25.34	28.07	22.55	22.55	20.07	17.10
November	20.70	15.62	17.17	27.19	30.78	24.10	24.10	20.59	18.12
December	20.81	15.83	17.27	27.27	30.86	24.25	24.25	20.66	18.23
Total	216.07	168.91	180.12	293.21	316.88	262.44	262.44	243.58	195.44
Average	18.01	14.07	15.01	24.43	26.41	21.87	21.87	20.30	16.29

Source: Collected from: GAFRD, Yearbook of Fishery Statistics, (2009-2014), Cairo, 2016.

Table.7. Seasonal index of fish prices in natural Egyptian fisheries during the period (2009-2014) (%)

Statement Months	Marine fisheries		Total Marine fisheries (M)	Lakes fisheries			Total Lakes fisheries (L)	Fresh water fisheries (F)	Natural Egyptian fisheries
	Mediterranean Sea	Red Sea		Northern delta lakes	Coastal lagoons	Inland lakes			
January	107.00	105.09	106	104.34	108	104	104	97	104
February	106.21	106.24	107	102.96	106	103	103	98	105
March	108.46	106.65	108	107.22	110	107	107	102	107
April	109.04	107.98	109	108.36	110	108	108	104	108
May	103.89	101.26	104	103.59	107	103	103	98	102
June	85.65	85.96	85	87.48	83	88	88	97	88
July	72.41	79.16	73	80.42	68	82	82	100	80
August	71.40	77.05	72	82.01	69	83	83	104	79
September	98.19	103.01	98	97.58	95	99	99	103	99
October	106.77	105.56	107	103.58	107	103	103	97	105
November	115.16	110.34	115	111.10	118	110	110	99	111
December	115.82	111.69	116	111.36	119	110	110	99	112

Source: Calculated from table 6.

3.1. Seasonal index of fish prices in marine fisheries.

The seasonal Index of fish prices in Marine fisheries during the period (2009-2014) is similar to its counterpart in Egyptian national fisheries, where it decreases in June to September (Table 7).

In Mediterranean Sea, Seasonal Index of fish prices is also decreases in June to September. Whereas, seasonal Index of fish prices in Red Sea decreases only in months from June to August.

Hence the seasonal Index of fish prices in Mediterranean Sea fisheries is similar to seasonal Index of fish prices in marine fisheries.

3.2. Seasonal index of fish prices in lakes fisheries.

Seasonal Index of fish prices in lakes fisheries – like the seasonal Index of fish prices in Marine and Mediterranean Sea fisheries- also decrease in June to September (Table 7).

Moreover, in studying of seasonal Index of fish prices in lakes fisheries resources, it found that the seasonal Index of fish prices in Northern delta lakes, Coastal lagoons and Inland lakes decrease in months from June to September too.

3.3. Seasonal index of fish prices in fresh water fisheries.

The Nile River and its branches has especial seasonal Index of fish prices, which increase only in March, April, July, August and September (Table 7).

Then, the effect of seasonal index of the fish prices in natural Egyptian fisheries during the period (2009-2014) is the outcome of the seasonal effect of their resources (Table 8).

- (1) In *March, April and June* the effect of seasonal index of fish prices in natural Egyptian comes from seasonal index of the fish prices in *marine, lake, and fresh water* fisheries.
- (2) In other months *Marine and Lake* seasonal index are the responsible of the seasonal index of the fish prices in natural Egyptian fisheries.

Table.8.The effect of seasonal index of the fish prices in natural Egyptian fisheries of during the period (2009-2014)

Months	Seasonal index of fish prices (%)		
	Bigger value in (>100)	Smaller value in (<100)	Natural Egyptian fisheries
January	M (106) , L (104)	F (97)	104
February	M (107) , L (103)	F (98)	105
March	M (108) , L (107) ,F (102)	—	107
April	M (109) , L (108) ,F (104)	—	108
May	M (104) , L (103)	F (98)	102
June	—	M (85) , L (88) ,F (97)	88
July	F (100)	M(73), L (82)	80
August	F (104)	M(72), L (83)	79
September	F (103)	M(98), L (99)	99
October	M (107) , L (103)	F (97)	105
November	M (115) , L (110)	F (99)	111
December	M (116) , L (110)	F (99)	112

M: Marine Fisheries.

L: Lakes Fisheries.

F: Freshwater Fisheries.

Source: collected from table 7.

4. Relationship between seasonal index of fish catch and fish prices in natural Egyptian fisheries.

By the estimation of correlation coefficient (r) between seasonal index of fish catch (%) and seasonal index of fish prices (%) in natural Egyptian fisheries and its resources, it found **positive relationship** in Egyptian natural fisheries (+0.25), Marine fisheries (+0.68), and Fresh water fisheries (+0.32). but find **negative relationship** in Lake fisheries (-0.73) (Table 9).

In Egyptian marine fisheries, it was negative relationship in Mediterranean Sea (-0.56), and positive relationship in Red Sea (+0.90). But in Egyptian lakes fisheries, it was negative relationship in Northern delta lakes (-0.87), Coastal lagoons (-0.11), and Inland lakes (-0.18) (Table 10).

Table 9. Relationship between fish catch and fish prices in Egyptian natural fisheries during the period (2009-2014)

Statement Months	Marine fisheries		Lakes fisheries		Fresh water fisheries		Natural Egyptian fisheries	
	Seasonal index of fish catch (%)	Seasonal index of fish prices (%)	Seasonal index of fish catch (%)	Seasonal index of fish prices (%)	Seasonal index of fish catch (%)	Seasonal index of fish prices (%)	Seasonal index of fish catch (%)	Seasonal index of fish prices (%)
January	118	106	94.32	104	101.4	97	103	104
February	105	107	94.22	103	96.1	98	98	105
March	112	108	101.73	107	97.2	102	104	107
April	106	109	99.42	108	101.0	104	102	108
May	82	104	94.82	103	101.5	98	92	102
June	76	85	107.43	88	101.0	97	96	88
July	80	73	113.33	82	102.6	100	101	80
August	76	72	103.83	83	102.3	104	94	79
September	110	98	100.73	99	102.8	103	104	99
October	132	107	101.53	103	98.3	97	111	105
November	105	115	101.62	110	96.8	99	102	111
December	98	116	87.02	110	99.0	99	93	112
Geometric Average	98.49	98.82	99.78	99.53	99.97	99.92	99.86	99.36
Correlation coefficient(r)	+ 0.68		- 0.73		+ 0.32		+ 0.25	

$$r = \frac{n(\sum x y) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Source: Collected from Tables 4 & 7.

Hence, it is concluded that: (1) it is important to increase, or at least maintain fish catch in total Egyptian natural fisheries, total fresh water fisheries, total marine fisheries, and individual Red Sea fisheries due to the positive relationship between fish catch seasonal index (%) and fish prices seasonal index. (2) More and actual effective developing programs must be applied in total lakes fisheries and individual Mediterranean Sea fisheries to overcome the present negative relationship between seasonal index of fish catch and fish prices.

Table 10. Relationship between fish catch and fish prices in Egyptian marine and lakes fisheries during the period (2009-2014)

Statement Months	Seasonality index in Egyptian marine fisheries				Seasonality index in Egyptian lakes fisheries					
	Mediterranean Sea		Red Sea		Northern delta lakes		Coastal lagoons		Inland lakes	
	Seasonal index of fish catch (%)	Seasonal index of fish prices (%)	Seasonal index of fish catch (%)	Seasonal index of fish prices (%)	Seasonal index of fish catch (%)	Seasonal index of fish prices (%)	Seasonal index of fish catch (%)	Seasonal index of fish prices (%)	Seasonal index of fish catch (%)	Seasonal index of fish prices (%)
January	97.2	107.00	151	105.09	93.81	104.34	10.0	108	101.7	104
February	99.3	106.21	114	106.24	95.71	102.96	0.0	106	96.5	103
March	101.3	108.46	128	106.65	96.52	107.22	0.0	110	126.0	107
April	105.3	109.04	108	107.98	100.22	108.36	177.3	110	90.6	108
May	68.2	103.89	103	101.26	100.92	103.59	309.9	107	56.7	103
June	97.2	85.65	42	85.96	104.82	87.48	157.0	83	111.0	88
July	114.2	72.41	27	79.16	114.82	80.42	108.9	68	109.6	82
August	119.3	71.40	8	77.05	104.82	82.01	84.7	69	103.3	83
September	118.3	98.19	96	103.01	101.22	97.58	94.8	95	100.0	99
October	105.3	106.77	173	105.56	100.02	103.58	114.7	107	105.0	103
November	92.2	115.16	125	110.34	95.41	111.10	90.7	118	123.2	110
December	82.2	115.82	125	111.69	91.71	111.36	52.0	119	76.4	110
Geometric Average	98.92	98.79	78.84	99.26	99.83	99.42	—	98.42	98.04	99.53
Correlation coefficient (r)	- 0.56		+ 0.90		- 0.87		- 0.11		- 0.18	

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Source: Collected from Tables 4 & 7.

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