

# Effects of dietary fats on egg quality and lipid parameters in serum and yolks of Shan Partridge Duck

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## ABSTRACT

585 0.5%, 1%, 2% f ( )/f ( )/ 28- ( ), (P < 0.001), ( ),  $\omega$ -6 ( ),  $\omega$ -3 ( )

Key words:

2017 96:1184 1190 :// /10.3382/ / 348

## INTRODUCTION

(PU- (FAs) f (LÄ) (ARA) -6 (ALA), (EPA

(1934), (2007).  
 (2001; 2006; 2007).  
 (2011; 2012).  
 (OA),  
 Duck, Shan Partridge

**MATERIALS AND METHODS**

**Animals**

4  
 (1)

**Experiment Design**

585 Shan Partridge Ducks  
 (C); (F);  
 (FL); (R);  
 (T).  
 0.5%,  
 1%, 2%)  
 15  
 (1),  
 (1994).  
 2%

**Table 1.**

	C	(%)
	400	11.2
	290	16.5
	120	0.70
	90	3.35
	12	0.79
	80	0.40
	3	29.0
	5	

1,500, 1,200,  
 10, 3.5,  
 1,000, 0.15, 30, 10 μ,  
 3.0, 80, 40, 0.5, 60, 0.18, 8,  
 0.3; J/

**Table 2.**

	C	2%	2%	2%	2%
	32.61	30.36	25.50	26.22	41.94
14:0	5.32	5.80	3.88	3.44	5.52
15:0	0.29	0.19	0.18	0.19	0.47
16:0	21.23	18.57	15.81	16.07	24.11
18:0	5.12	4.87	5.16	4.91	11.19
20:0	0.65	0.94	0.46	1.13	0.48
22:0	0	0	0	0.35	0.06
24:0	0	0	0	0.12	0.10
	37.75	34.65	33.03	48.50	36.90
16:1	5.23	6.06	3.50	3.53	4.01
18:1	31.2	25.42	28.53	42.39	32.04
20:1	1.32	1.23	0.96	2.50	0.84
22:1	0	1.57	0.05	0.07	0
24:1	0	0.37	0	0	0
	29.84	35.12	41.59	25.40	20.25
18:2( = 6)	18.77	12.73	18.67	17.42	12.93
20:2	0.11	0.78	0.07	0.12	0.07
20:3	2.32	1.48	1.51	1.49	1.48
22:3( = 6)	0	1.08	0	0	0
20:4	0.46	0.69	0.38	0.29	0.25
22:4	0	1.08	0	0	0
18:4	0	0.84	0	0	0
18:3( = 3)	6.22	4.42	19.69	4.83	4.21
20:5( = 3)	0.98	6.14	0.64	0.63	0.60
22:5	0.65	0.86	0.42	0.44	0.35
22:6( = 3)	0.33	5.01	0.21	0.20	0.18

28 f  
 (TC), (TG),  
 (C), 2% f (2%), 2% f  
 (2%), 2% (2%), 2% (2%)  
 3,000 × g f 10  
 -20 C

### Egg Quality Measurement

0.01-  
-0503 ( , J. ).  
-1061 ( , 1969),  
( , 1936),  
100 (  $1.7 \times 0.37 + 7.6$  ) ( , 1937)  
-5200 ( , J. ).

### Oil and Yolk Lipid Analysis

20140520, / ( , 20141120/  
(1957), (FAMES).  
500 #, (C) C-61626-  
(1964), (6890,  
(30  $\times 0.25 \times 0.2 \mu$ , C)  
C, C).  
( 1015 f , 1016 f  
( 1003 f , 1013-105 f  
( , C ),

### Serum Lipid Parameter Analysis

023074, ( 022447, 133309,  
( , 1997).

### Statistical Analysis

f 3  
( 17.0) f  
(f )  
ff  
ff  
ff  
ff  
(  $P < 0.05$  ). 5%

## RESULTS AND DISCUSSION

### Egg Quality Measurement

( 3).  
tridge Ducks.  
(2011).  
(1968). (1990),  
(2009), 2%  
( , 2008;  
( , 2014).

### Yolk TC, TG, and Crude Fat Analysis

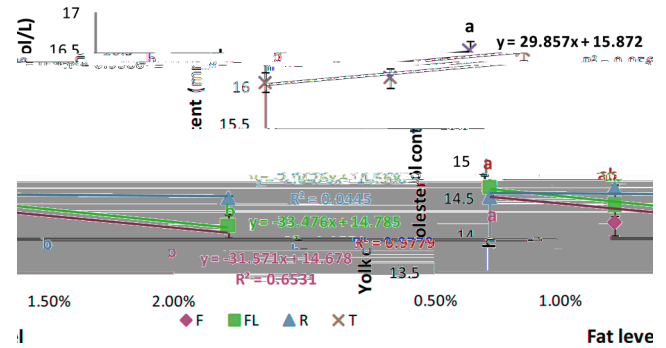
(  $P \leq 0.001$  )  
(  $P = 0.040$  ).  
(J , 2016).  
(  $P < 0.001$  ) C ( 0.7 )-

**Table 3.** Effect of dietary fat level and fat source on the performance of growing-finishing gilts

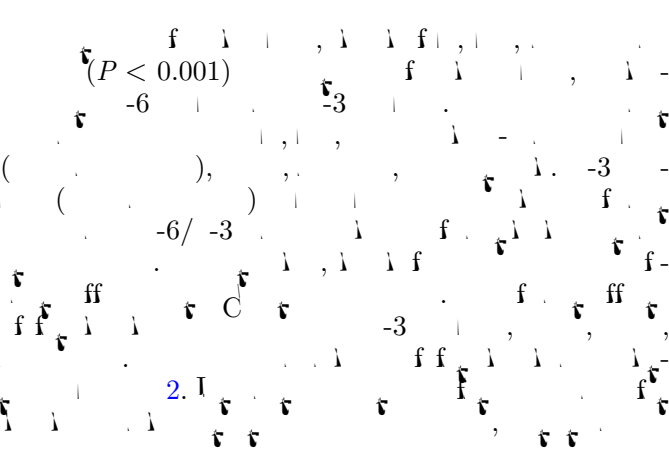
Dietary fat level (%)	Fat source	Initial BW (kg)		Final BW (kg)		ADG (kg/d)		DMI (kg/d)		FCR	
		Start	End	Start	End	Start	End	Start	End	Start	End
0.5	C	0	74.03	1.33	4.34	0.43	6.60	12.38	73.64	24.56	0.34
		0.5	71.65	1.35	3.97	0.40	5.88	12.46	73.06	22.95	0.32
		1	73.16	1.35	3.39	0.41	5.83	12.13	70.52	24.78	0.33
		2	72.24	1.35	4.11	0.43	6.18	11.39	73.48	23.43	0.33
	F	0.5	71.58	1.35	3.88	0.41	4.74	12.70	61.16	23.16	0.32
		1	71.70	1.37	4.46	0.43	5.23	12.51	64.83	22.54	0.32
		2	74.97	1.32	4.12	0.44	6.83	12.16	73.12	23.16	0.31
		0.5	74.59	1.35	3.98	0.40	6.74	12.39	75.91	24.11	0.32
	T	1	72.20	1.34	3.98	0.40	6.37	12.61	73.03	22.73	0.32
		2	70.58	1.31	3.77	0.41	6.16	12.66	72.89	22.79	0.33
		0.5	71.09	1.35	3.72	0.41	5.67	12.38	67.23	22.88	0.32
		1	71.70	1.38	4.22	0.41	5.20	12.29	63.37	23.87	0.33
C × F	2	72.32	1.38	3.62	0.39	6.36	12.71	74.68	22.91	0.32	
	0.411	0.005	0.075	0.004	0.143	0.577	1.090	0.181	0.002		
	C	74.03	1.33	4.34	0.43	6.60	12.38	73.64	24.56	0.34	
	F	72.35	1.35	3.83	0.41	5.96	13.11	72.35	23.72	0.020	
F × T	1	72.75	1.35	4.16	0.43	5.60	14.68	66.37	22.95	0.016	
	2	72.46	1.33	3.91	0.40	6.42	12.55	73.94	22.21	0.016	
	0.5	71.70	1.37	3.85	0.40	5.74	12.46	68.43	23.22	0.016	
	0	74.03	1.33	4.34	0.43	6.60	12.38	73.64	24.56	0.34	
F × C	0.5	72.23	1.35	3.89	0.41	5.66	14.98	69.34	23.28	0.32	
	1	72.19	1.36	4.01	0.41	6.38	12.39	67.94	23.48	0.33	
	2	72.53	1.34	3.90	0.42	6.60	12.23	76.54	23.07	0.32	
	0.12	0.053	0.64	0.075	0.35	0.51	0.81	0.43	0.22		
F × T × C	0.77	0.61	0.94	0.17	0.079	0.060	0.12	0.66	0.49		
	0.089	0.29	0.84	0.28	0.061	0.19	0.20	0.54	0.62		

**Table 4.** Effect of dietary fat level and fat source on the performance of growing-finishing gilts (n = 3)

Dietary fat level (%)	Fat source	Initial BW (kg)		Final BW (kg)	
		Start	End	Start	End
C <sup>1</sup>	0	16.16	753.7	30.52	
	0.5	14.65	746.7	31.39	
	1	14.16	753.4	31.68	
F <sup>1</sup>	2	14.11	751.4	31.90	
	0.5	14.64	747.5	31.49	
	1	14.41	751.3	31.54	
T <sup>1</sup>	2	14.13	753.1	31.91	
	0.5	14.50	754.6	31.43	
	1	14.63	757.3	31.68	
C <sup>2</sup>	2	14.50	760.7	31.90	
	0.5	16.05	764.3	31.31	
	1	16.11	769.7	32.00	
F <sup>2</sup>	2	16.40	772.7	32.28	
	0.14	1.8	0.21		
	16.16 <sup>1</sup>	753.7	30.52		
T <sup>2</sup>	14.31 <sup>2</sup>	750.5	31.66		
	14.39 <sup>2</sup>	750.6	31.65		
	14.54 <sup>2</sup>	757.5	31.67		
C <sup>3</sup>	16.22 <sup>1</sup>	768.9	31.86		
	0 <sup>1</sup>	16.16	753.7	30.52	
	0.5 <sup>3</sup>	14.96	753.3	31.41	
F <sup>3</sup>	1 <sup>3</sup>	14.83	757.9	31.73	
	2 <sup>3</sup>	14.80	759.5	32.00	
	P < 0.001		0.19	0.97	
0.11		0.10	0.30		
0.040		0.99	0.98		



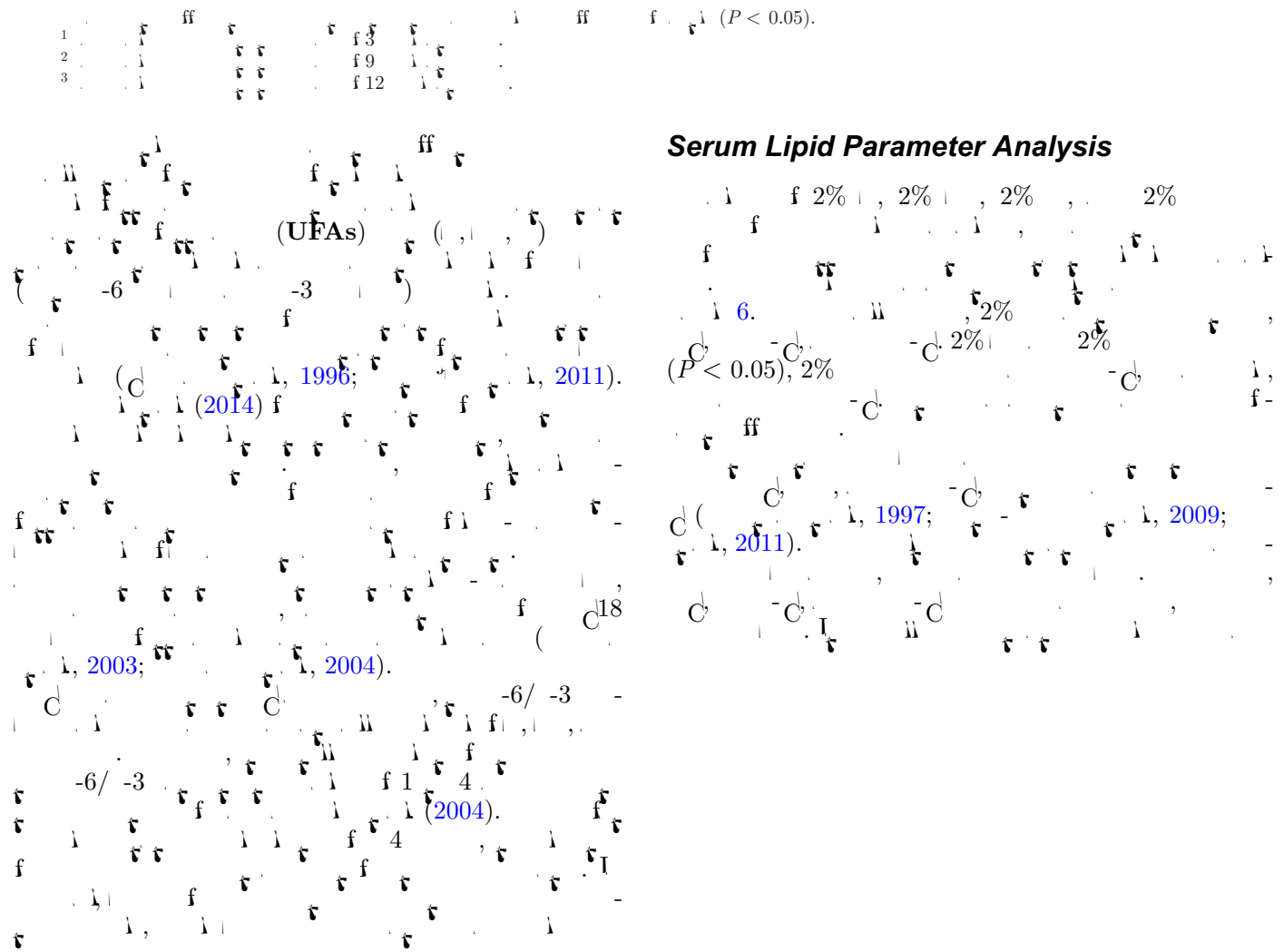
**Figure 1.** Effect of dietary fat level on the performance of growing-finishing gilts (P < 0.05).



**Table 5.**  $\chi^2$  test for differences in the distribution of serum lipid parameters between the two groups (P < 0.05).

		-6	(C <sub>18:2</sub> =6)	(C <sub>20:4</sub> =6)	-3	(C <sub>18:3</sub> =3)	(C <sub>20:5</sub> =3)	(C <sub>22:6</sub> =3)	-6/-3			
C <sub>1</sub> <sup>1</sup>	0	36.28	47.18	16.54	15.89	13.17	2.32	0.65	0.32	0.05	0.27	23.96
	0.5	34.28	38.97	21.04	17.70	15.39	2.31	2.81	0.79	0.63	1.39	6.30
	1	34.33	38.62	21.19	17.69	15.03	2.66	2.96	0.81	0.67	1.48	5.97
	2	32.79	39.44	21.73	18.11	15.26	2.85	3.04	0.76	0.72	1.56	5.98
C <sub>1</sub> <sup>1</sup>	0.5	31.60	40.85	24.47	20.95	18.40	2.55	2.99	1.27	0.49	1.23	7.02
	1	30.87	41.50	24.37	20.89	18.34	2.58	3.14	1.41	0.45	1.28	6.64
	2	30.03	44.80	24.99	21.30	18.66	2.64	3.32	1.44	0.52	1.36	6.45
C <sub>1</sub> <sup>1</sup>	0.5	30.38	45.44	23.62	21.14	19.07	2.07	1.88	0.90	0.17	0.81	11.23
	1	30.03	45.36	23.93	21.48	19.31	2.17	2.14	0.99	0.21	0.94	10.05
	2	29.90	44.38	25.12	22.49	20.23	2.34	2.23	1.04	0.24	0.94	10.12
C <sub>1</sub> <sup>1</sup>	0.5	33.90	49.90	15.93	14.74	12.98	1.76	0.73	0.31	0.02	0.39	20.72
	1	34.42	49.18	16.10	14.95	12.93	2.03	0.71	0.34	0.03	0.35	20.98
	2	35.24	47.68	16.73	15.54	13.08	2.46	0.72	0.32	0.02	0.38	22.55
		0.373	0.629	0.573	0.448	0.436	0.054	0.165	0.065	0.041	0.075	1.137
C <sub>2</sub> <sup>1</sup>	0	36.28	46.94	16.54	15.49	13.17	2.32	0.65	0.32	0.05	0.27	23.96
	0.5	33.80	39.01	21.32	17.83	15.23	2.61	2.94	0.79	0.67	1.48	6.08
	1	30.83	42.38	24.61	21.05	18.47	2.59	3.15	1.37	0.48	1.18	6.70
	2	30.16	45.06	24.22	21.70	19.54	2.19	2.08	0.99	0.21	0.89	10.47
C <sub>2</sub> <sup>1</sup>	0.5	34.52	48.92	16.26	15.08	13.00	2.08	0.72	0.32	0.02	0.37	21.42
	1	36.28	46.94	16.54	15.49	13.17	2.32	0.65	0.32	0.05	0.27	23.96
	0.5 <sup>3</sup>	33.52	48.05	18.40	16.59	14.52	2.08	1.01	0.47	0.06	0.48	18.87
C <sub>2</sub> <sup>1</sup>	1 <sup>3</sup>	30.59	43.02	24.47	21.45	19.07	2.41	2.62	1.18	0.35	1.01	8.46
	2 <sup>3</sup>	32.86	40.46	22.24	18.70	16.08	2.62	3.03	0.95	0.63	1.45	6.17
P-value												
		<0.001	<0.001	<0.001	<0.001	<0.001	0.042	<0.001	<0.001	<0.001	<0.001	<0.001
		0.14	0.60	<0.001	0.001	0.037	<0.001	<0.001	0.040	<0.001	0.004	0.95
×		0.047	0.022	0.44	0.30	0.037	0.033	0.042	0.093	0.016	0.059	0.50

### Serum Lipid Parameter Analysis



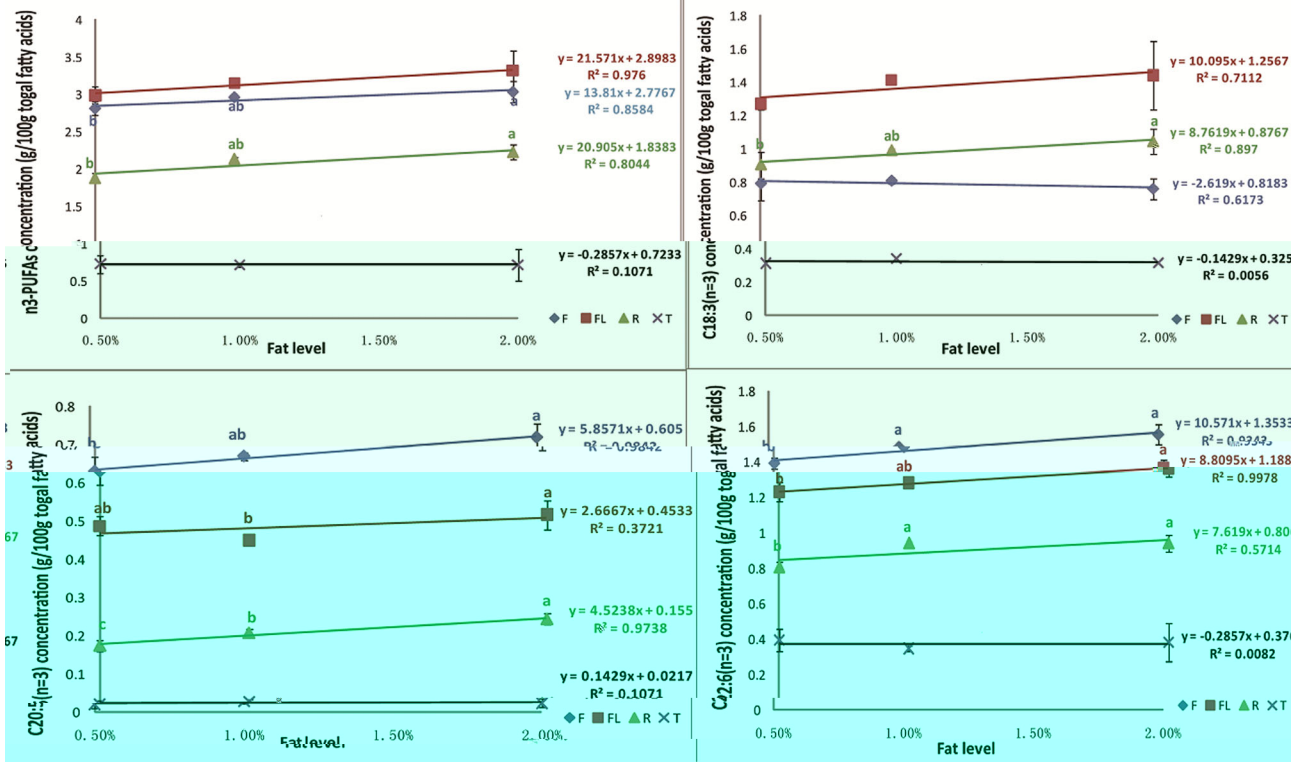


Figure 2. Concentration of n3-PUFAs, C18:3 (n-3), C20:5 (n-3), C22:6 (n-3) (P < 0.05).

Table 6. Concentration of n3-PUFAs, C18:3 (n-3), C20:5 (n-3), C22:6 (n-3) (n = 3).

	0.5%	1%	2%	2%	2%	2%	P-value
C18:3 (n-3)	1.51 ± 0.04	1.48 ± 0.08	1.31 ± 0.07	1.35 ± 0.05	1.66 ± 0.16	0.15	<0.001
C20:5 (n-3)	5.74 ± 0.31	5.59 ± 0.06	5.61 ± 0.13	5.52 ± 0.20	5.92 ± 0.16	0.04	0.011
C22:6 (n-3)	1.06 ± 0.11	1.11 ± 0.08	0.99 ± 0.07	1.11 ± 0.04	1.09 ± 0.07	0.02	0.058
n3-PUFAs	2.12 ± 0.05	2.11 ± 0.04	2.07 ± 0.03	1.85 ± 0.06	2.24 ± 0.07	0.03	<0.001
FL	1.05 ± 0.03	1.11 ± 0.06	1.17 ± 0.05	1.42 ± 0.07	1.11 ± 0.05	0.03	<0.001

Table 6. Concentration of n3-PUFAs, C18:3 (n-3), C20:5 (n-3), C22:6 (n-3) (n = 3) (P < 0.05).

(2013 31880) (12906-14).

**CONCLUSIONS**

Shan Partridge Duck

**ACKNOWLEDGMENTS**

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**REFERENCES**

J. 2011.  
 52:750-760.  
 1997.  
 48. J. 108:269-274.  
 2004. J.  
 J. 33:266-273.  
 2007.

17:280 287.  
 1994.  
 J. 13:5165 5175.  
 1996.  
 75:423 431.  
 1989.  
 24:45 50.  
 1934.  
 28:965 977.  
 1994.  
 3:101.  
 2012.  
 96:85 94.  
 2013.  
 12:152.  
 1999.  
 1010 1019.  
 1957.  
 226:497 509.  
 2007.  
 76:19 28.  
 1937.  
 43:552 555, 572 573.  
 1936.  
 15:141 148.  
 2008.  
 11:1 7.  
 2015.  
 94:2763 2771.  
 2014.  
 53:1 17.  
 2016.  
 95:41 52.  
 2011.  
 90:147 156.  
 2014.  
 564 573.

2005.  
 195 213.  
 2009.  
 81:99 104.  
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 43:36 54.  
 2011.  
 12:736 743.  
 2001.  
 80:753 761.  
 2009.  
 1086 1090.  
 1990.  
 4:634 639.  
 1968.  
 95:578 582.  
 1964.  
 5:600 608.  
 2010.  
 2009.  
 J. 23:3129 3139.  
 2006.  
 85:1584 1593.  
 2003.  
 97 106.  
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 31:507 513.  
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 200:511 516.  
 2011.  
 52:310 317.  
 2009.  
 55:219 228.  
 1997.  
 51:219 230.  
 1969.  
 48:767 776.  
 1999.  
 129:467 472.  
 2008.  
 86: 140 148.