Growth rates of bluegill (*Lepomis macrochirus)* in Northwoods lakes

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Abstract

Bluegill are popular sport fish throughout much of the upper midwest, with the DNR of many states expending time and resources into managing bluegill populations. Many studies have looked at how different biotic and abiotic conditions impact bluegill growth, but few have a holistic view of how the whole lake ecosystem can impact Bluegill growth. Two lakes at the University of Notre Dame Environmental Research Center (UNDERC), which is on the border of Wisconsin and Michigan, were chosen based on these differences in order to see how different factors impact growth. The von Bertalanffy growth function was used to model the growth of bluegill from the two lakes, using the variables L_∞, k, and t_0. A 95% confidence interval was calculated for each variable for each lake, and no significant difference was found, possibly due to the asymptote not being reached for Tenderfoot Lake which skewed the values. . However, there was a nonsignificant trend of bluegill being larger on Bay Lake (a less productive system with less competition and predation) compared to Tenderfoot Lake, with interesting implications when this data is compared to previous literature on bluegill growth.

Key Words: *Annuli, von Bertalanffy Growth Function, Brody Growth Constant, L_∞, Bay Lake, Tenderfoot Lake*

Introduction

Bluegill (Lepomis macrochirus) are a species of sunfish popular in sport fishing throughout the upper-midwest of the United States. These fish can exhibit different growth rates due to a variety of factors, but generally finish growing after five years of age (Mecozzi, 2008). Factors that have been found to influence this pattern includes lake size (Mecozzi, 2008) and submerged aquatic vegetation at intermediate densities (Tomcko and Pereira, 2006). However, there has been contradictory evidence with regards to how nutrients such as nitrogen and phosphorus affect growth (Matthias et al, 2018 and Schindler et al. 2000), and it has been found that no one aspect of lakes impacts bluegill growth (Shoup et al, 2007). Due to the importance this fish has on the economy and ecology of the areas it lives, further investigation into how different factors between lakes affect bluegill growth could help with management in the future.

Bay and Tenderfoot Lakes are two lakes at the University of Notre Dame Environmental Research Center (UNDERC), which is on the border of Wisconsin and the Upper Peninsula of Michigan, with very different biotic and abiotic conditions. Tenderfoot is a larger lake with an area of 194.2 hectares, but is shallower with a maximum depth of 9.14 meters and has a smaller shoreline development of 1.91 when compared to Bay (Tenderfoot, 1962). Tenderfoot is also home to more species of fish, including several species of piscivorous fish such as muskellunge and largemouth bass, and is a much more productive system (UNDERC, unpublished). In comparison, Bay Lake is smaller with an area of 67.3 hectares, but a greater depth of 13.7 meters as well as a much larger shoreline development index of 2.64 (Bay Lake). Bay has fewer species of fish and is a less productive system (UNDERC, unpublished). Bay Lake also has a larger secchi disk depth of 4.3 meters when compared to Tenderfoot's 1.3 meters, and Bay is much more acidic with a pH of 6 compared to Tenderfoot's much more basic value of 7.8 (UNDERC, unpublished). Finally, both Tenderfoot and Bay are used by the public, however, Tenderfoot is the more popular location for recreational fishers due to its much easier access.

These lakes were sampled with fyke nets, minnow traps, and angling. Nets were moved to avoid recatching fish as bluegills are thought to have a home range of 0.15-0.75 hectares (Fish and Savitz, 1983), although there is conflicting evidence over whether or not bluegills have home ranges or not (Paukert et al. 2004). The length of the captured bluegill was measured, and five scales were removed for scale aging. The bluegill captured were used to measure length, as well as to obtain a few scales for scale aging, as it has been found to be an accurate measure of age in bluegill (Reiger, 1962).

Scale aging involves counting the annuli of fish, which are rings that form on the scale as the fish ages, similar to rings on a tree (Reiger, 1962). Fish grow faster in the summer than in the winter due to resource availability, which subsequently causes paired summer and winter growth areas on the scale. When distinguished between, these growths can be used to determine the age of a fish (Reiger, 1962). It is also these summer/winter growth pairings that form a singular annulus for a fish.

The von Bertalanffy growth model is a pattern of growth exhibited by many species, including bluegill (Hogue and Kilambi, 1975), and is found with the equation: $lt=L\infty(1-e-k(t-t0))$. In the equation, lt is the expected length at time or age "t", $L\infty$ is the asymptotic average growth length, k is the Brody growth coefficient, and t0 is the time or age when the average length as zero (Francis, 1988). The scale data and length will be used with the von Bertalanffy growth function to graph this data, from which the values $L\infty$, k, and t0 can be found. $L\infty$ can be used to determine if there is a difference in the average length at which fish finish growing between the two lakes, however, this value will only be useful should mortality be low enough in the two lakes for length to no longer increase (Francis, 1988). K can be used determine the rate at which bluegill growth reaches $L\infty$, which is similar to a growth rate but a more functional definition would be the fraction that the actual growth rate is multiplied by as the fish ages (Shnute and Fournir, 1980). Finally, t0 is less important compared to the other two parameters as it is less of a coefficient for a measured parameter and more of a correction factor to the von Bertalanffy growth function (Shnute and Fournir, 1980).

From these variables, I would expect that Tenderfoot would have a larger $L\infty$ and k. This is because Tenderfoot is a more productive system, allowing for fish to grow larger due to the higher resource availability, similar to what is seen in previous studies (Tomcko and Pereira, 2006). However, this assertion could prove to be false if the increase in productivity on Tenderfoot results in an increase in the bluegill density, in which case $L\infty$ would be less on Tenderfoot due to intraspecific competition (Wiener and Hanneman, 1982). I would also expect that, given the much larger presence of piscivorous fishes on Tenderfoot Lake, the k value would be larger as the fish would allocate more resources into growth in order to avoid predation (Oplinger et al, 2011). This could also be exacerbated by interspecific competition as bluegills grow faster in systems where they compete with other species for resources (Aday et al. 2003).

Methods

Tenderfoot and Bay Lakes were used for the purposes of this study due to their differences in biotic and abiotic conditions. Minnow traps and angling were used the first week in order to sample for fish, however, there was little success due to the atypically cool weather which continued into the next two weeks. The minnow traps and angling focused on the littoral of each of the lakes. In the second week of research, fyke nets were used, garnering much better results. Fyke nets were placed in shallow areas near the littoral of the lakes where, should any vertebrates get caught, they would have space for air until they could be released. Fyke nets were set up in the early evening and then pulled in the early morning so that the nets would not be tampered with by any fishermen. I moved the fyke netsI moved the fyke nets to different locations in order to avoid recatching any fish.

When fish were caught, five scales were taken from the tip of the pectoral fin, which has been found to be the best location for accurate age measurements (Regier, 1962), and then carefully labeled for later processing. The length of the fish was also taken to the nearest millimeter.

The scales were later cleaned of debris using a bleach solution and placed on labeled microscope slides in order to be aged. Using a microscope, the annuli of the scales were counted, with care taken to make sure that the scales were not regrowth from a previously lost scale. This would be denoted by irregularities in the scale and significant differences in the annulus count between the other scale samples (Reiger, 1962). Scales were re-aged by both myself and others in order to check the accuracy of the initial age given to the fish.

This data was then compiled and the von Bertalanffy growth function was fitted to the data. This was used to find the L_{∞}, k, and the intercept using the R packages FSA, FSAdata, and nlstools developed by Dr. Derek Ogle.

Results

Overall, I caught and obtained scales from 99 fish in Tenderfoot and 75 in Bay Lake in May through July. Due to the difficulty in catching fish, more effort was necessary to catch fish on Bay compared to Tenderfoot Lake. All the fish used in analysis were caught in fyke nets although alternate methods were used.

I found that fish in Bay Lake were non-significantly larger based on age and size data than fish in Tenderfoot lake (figure 2), however, the calculated 95% confidence interval for L_∞ for Bay Lake was 222-287mm, where it was 161-392mm for Tenderfoot Lake (table 1) (table 1). Given that these values overlap completely, there is not a significant difference in the asymptotic growth length between these two lakes.

The confidence interval for k had a slight overlap between the two lakes, with Bay lake having slightly higher values than Tenderfoot Lake (table 1). The t_0 values also overlap slightly with Bay Lake's confidence interval being slightly larger than Tenderfoot's interval.

Discussion

A more holistic look at bluegill populations could greatly help with future management, as the literature on the topic currently focuses on how single aspects of a lake effect bluegill growth. No one factor solely exerts control over bluegill growth, but it can be hard to understand how different aspects interact together. A whole lake perspective can help government agencies with understanding which tactics would be most effectively when managing bluegill populations on different lake systems.

While I found no significant difference between the two populations, the data for Tenderfoot Lake was skewed by the fact that I never reached the asymptote of the von Bertalanffy growth function (figure 1), which causes a large amount of error in the calculations for the coefficients (table 1). Because of this, there is a large confidence interval of values for L_∞ which would have been much smaller had I had reached the asymptote. The reasons for not reaching this point could potentially be due to error when aging the scales, however, I did double-check the ages that I assigned to the fish. Should this still be the case, it could be that there is a consistent error with aging the scales throughout both of the lakes. Considering that Bay Lake has a more complete size and age distribution compared to Tenderfoot Lake, I feel confident that the results are not due to reader error. Instead, I think that maybe more effort should have been put on angling on Tenderfoot Lake in order to catch older and larger bluegill that would most likely help with rounding out the population enough in order to garner better results. It could also be the case that Tenderfoot Lake is not a system that has a low enough mortality for L_∞ to be reached. This could be a sign that Tenderfoot has higher mortality than Bay Lake. This is most likely the case given that Tenderfoot had a much larger sample size that Bay, and the predation and fishing pressure on bluegill in Tenderfoot Lake. In addition, the values for k and t_0 would most likely be different should the graph be more similar to a typical von Bertalanffy growth curve. How this would impact the data would be speculation, but most likely the values would have less overlap given that k and t_0 are highly correlated with L_∞ (Ratkowski, 1986) and both were less than Bay.

That said, there was a nonsignificant trend of larger bluegill on Bay than on Tenderfoot Lake (figure 2). This could imply that, had the asymptotically larger bluegill been captured in Tenderfoot, the confidence interval for L_∞ on Tenderfoot would shrink, leading to significantly different values in L_∞ between lakes. This is most likely due to the reduced competition from both other bluegills. While the population was not officially estimated, the lower catch per unit effort for Bay is a probable sign that the population is smaller on Bay Lake compared to Tenderfoot Lake. In addition, bluegill on Tenderfoot Lake compete with other panfish such as pumpkinseed. In contrast, bluegill in Bay Lake have less competition as most of the other fish are piscivorous and only compete with bluegill when they are younger.

This observation could also conflict with studies that found that length is positively related with percent macrophyte cover and negatively related to secchi disk depth. This could be that these don't exert as much selective pressure on bluegill as compared to other pressures (such as predation), or it could be that these variables are not significantly different enough between these two lakes for them to actually have any influence over bluegill growth. While this study only looked at two lakes, it would be interesting to see if this pattern continued across other, similar lakes.

This could also be why fish on Bay Lake have k values that are non significantly larger. While Tenderfoot has more piscivorous fishes compared to Bay Lake, Bay Lake only has bluegills as a consumer of lower trophic levels throughout the entirety of its life. As previously stated, fish grow faster when they are under more predation pressure (Oplinger et al. 2011). In the case of Bay Lake, the smaller prey population could shift predator's focus solely on bluegill as a source of food which then puts selective pressure on bluegill to grow faster. This could potentially be a larger source of pressure than competition too. Given that bluegill have been found to grow faster when competing with others (Aday et al. 2003), Tenderfoot should have a larger k value. This trend could mean that, in these lakes, predation exerts more selective pressure on bluegill compared to competition.

Another possibility is that the density of submerged vegetation on Tenderfoot is negatively impacting bluegill growth. Tomcko and Periera (2006) found that bluegill grow best at intermediate densities of submerged vegetation, although they struggled with defining exactly what "intermediate density" would look like. It could be possible that, given the level of submerged macrophytes on Tenderfoot, the vegetation has reached a point that it's surpassed the percent coverage of the lake most beneficial for bluegill growth. While percent cover was not calculated for either lake, it could be interesting to see how much it differs between the two lakes.

Finally, the calculated t_0 values are not particularly applicable for this study given that they are just correction coefficients and they are not significantly different between the two lakes.

Overall, this study is limited by only looking at two lakes that, while vastly different, are not a large enough sample size to make any definitive conclusions about what factors have the greatest effect on bluegill populations. A larger-scale study would most likely look at several lakes that are some mix of all of the factors seen in this study: different nutrient compositions, fish populations, percent macrophyte cover, and others would be helpful in establishing a gradient of these variables and then seeing how and to what extent the fish populations change. While I can speculate over why there are differences, and I can say that all of these most likely have some impact on the bluegill populations on each lake, I can't say which have the greatest influence.

Tables

Table 1. Confidence intervals of the parameters L_∞, k, and t_0 for bluegill caught during the summer of 2019 on Bay Lake in Wisconsin and Tenderfoot Lake in Wisconsin and Michigan.

Lake	L_∞ Confidence Interval	k Confidence Interval	t_0 Confidence Interval
Bay Lake	222 - 287 mm	0.227 - 0.533	-0.685 - 0.240
Tenderfoot Lake	161-392 mm	0.019 - 0.300	-2.865 - -0.506

Figures

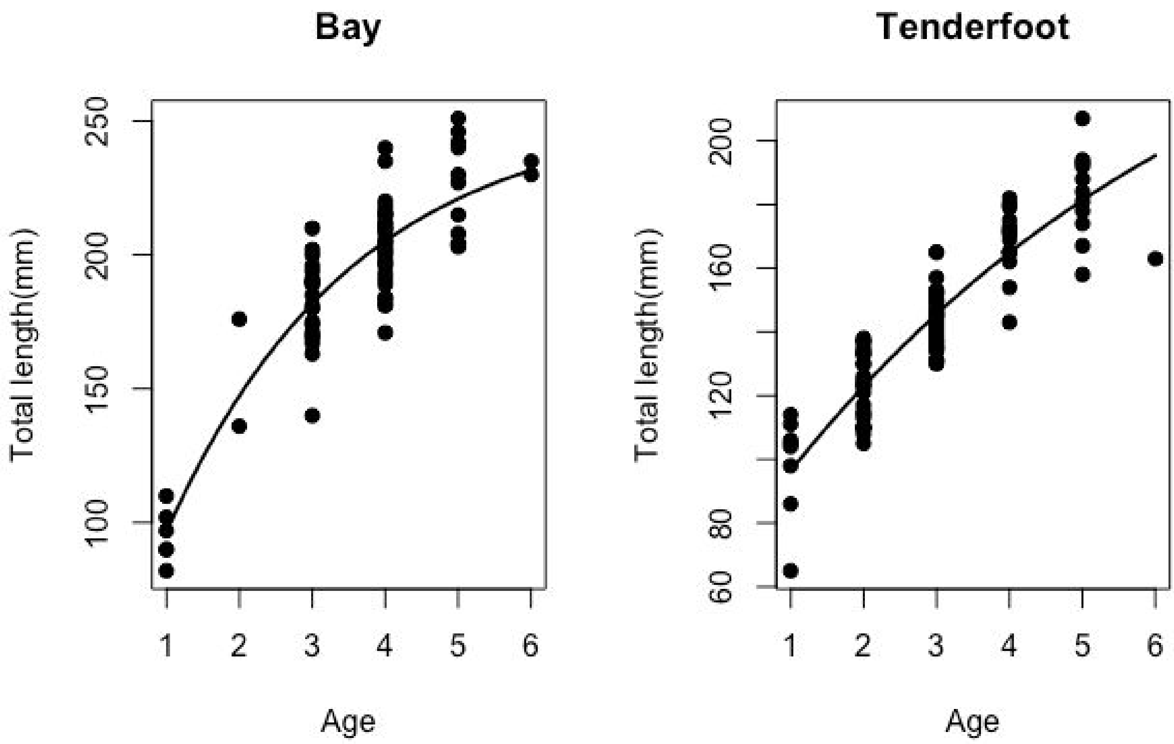

Figure 1. Von Bertalanffy growth functions relating age (years) and length (mm) for bluegill caught on Bay Lake in Wisconsin and Tenderfoot Lake in Wisconsin and Michigan.

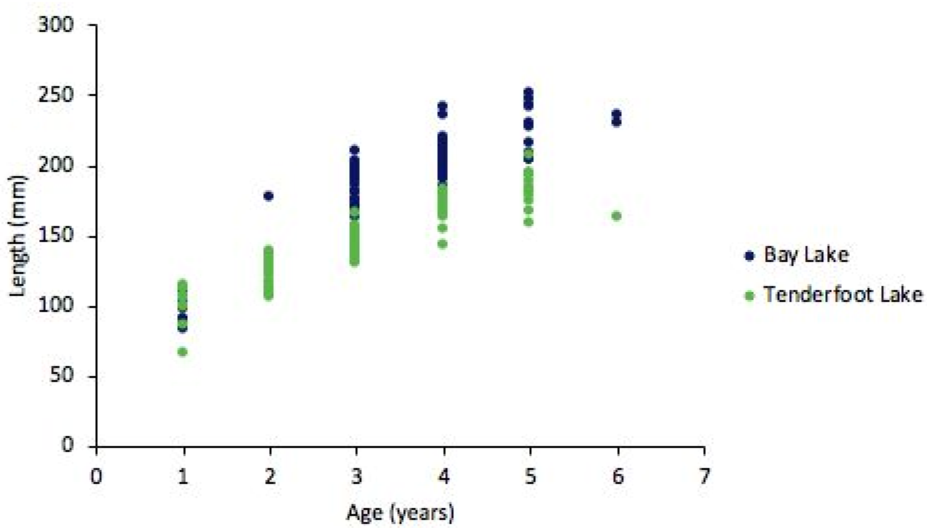

Figure 2. Length (mm) and age (years) of bluegill caught in Bay Lake in Michigan and Tenderfoot on the border of Wisconsin and Michigan in the summer of 2019.

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Literature Cited

Bay Lake. University of Notre Dame Environmental Research Center. Source: US Forest Service. <URL: https://underc.nd.edu/assets/201305/bay_lake_bathymetric_map.pdf>. Accessed 15 July 2019.

Carlson, R. E. 1977. A trophic state index for lakes. *Limnology and Oceanography* 22 (2): 361-369.

Corman, J. R., B. L. Bertolet, N. J. Casson, S. D. Sebestyen, R. K. Kolka and E. H. Stanley. 2018. Nitrogen and phosphorus loads to temperate seepage lakes associated with allochthonous dissolved organic carbon loads. *Geophysical Research Letters* 45. https://doi.org/10.1029/2018GL077219

Fish, P. A. and J. Savitz. 1983. Variations in home ranges of largemouth bass, yellow perch, bluegills, and pumpkinseeds in an Illinois lake. *Transactions of the American Fisheries Society* 112 (2): 147-153.

Francis, R. I. C. C. 1988. Are growth parameters estimated from tagging and age-length data comparable? *Canadian Journal of Fisheries and Aquatic Sciences* 45:936–942.

Hogue, J. J. and R. V. Kilambi. 1975. Age and growth of bluegill, *Lepomis macrochirus* Rafinesque*,* from Lake Fort Smith, Arkansas. *Journal of Arkansas Academy of Science* 29 (15).

Hoxmeier, R. J. H., D. D. Aday, and D. H. Wahl. 2009. Examining interpopulation variation in bluegill growth rates and size structure: Effects of harvest, maturation, and environmental variables. *Transactions of the American Fisheries Society* 138:423-432.

Matthias, B. G., R. M. N. Ahrens, M. S. Allen, T. Tuten, Z. A. Siders and K. L. Wilson. 2018. Understanding the effects of density and environmental variability on the process of fish growth. *Fisheries Research* 198: 209-219.

Mecozzi, M. 2008. Bluegill (*Lepomis macrochirus*). Wisconsin Department of Natural Resources PUBL-FM-711 08.

Paukert, C. P., D. W. Willis and M. A. Bouchard. 2004. Movement, home range, and site fidelity of bluegills in a great plains lake. *North American Journal of Fisheries Management* 24 (1): 154-161.

Oplinger, R. W., D. H. Wahl and M. A. Nannini. 2011. Effect of predators on growth and reproductive investment in bluegills: Comparison of populations with differing size and age of maturation. *Transactions of the American Fisheries Society* 140:1532-1539.

Ratkowsky, D. A. 1986. Statistical properties of alternative parameterizations of the von Bertalanffy growth curve. *Canadian Journal of Fisheries and Aquatic Sciences* 43:742–747.

Regier, H. A. (1962). Validation of the scale method for estimating age and growth of bluegills. *Transactions of the American Fisheries Society* 91(4): 362-374.

Schindler, D. E., S. I. Geib and M. R. Williams. 2000. Patterns of Fish Growth along a Residential Development Gradient in North Temperate Lakes. *Ecosystems* 3: 229-237.

Schnute, J., and D. Fournier. 1980. A new approach to length-frequency analysis: Growth structure. *Canadian Journal of Fisheries and Aquatic Sciences* 37:1337–1351.

Shoup, D. E., S. P. Callahan, D. H. Wahl and C. L. Pierce. 2007. Size-specific growth of bluegill, largemouth bass and channel catfish in relation to prey availability and limnological variables. *Journal of Fish Biology* 70: 21-34.

Tenderfoot Lake. University of Notre Dame Environmental Research Center. Source: US Geological Survey. 1961. <URL: https://underc.nd.edu/assets/201331/tenderfoot_lake_bathymetric_map.pdf>. Accessed 15 July, 2019.

Tomcko, C. M., and R. B. Pierce. 2001. The relationship of bluegill growth, lake morphometry, and water quality in Minnesota. *Transactions of the American Fisheries Society* 130:317–321.

Tomcko, C. M. and Pereira, D. L. 2006. The relationship of bluegill population dynamics and submerged aquatic vegetation in Minnesota lakes. Minnesota Department of Natural Resources Investigational Report 538.

UNDERC. Unpublished. Aquatic Habitat Descriptions.

Wiener, J. G. and W. R. Hanneman. 1982. Growth and condition of bluegills in Wisconsin Lakes: Effects of population density and lake pH. *Transactions of the American Fisheries Society* 111:761-767.

Appendix

Fish	tl	age	date	method	lake
13	167	5	12-Jun	FN	TF
14	158	5	12-Jun	FN	TF
15	163	6	12-Jun	FN	TF
40	143	4	13-Jun	FN	TF
41	110	2	13-Jun	FN	TF
42	137	3	13-Jun	FN	TF
43	135	3	13-Jun	FN	TF
44	174	5	13-Jun	FN	TF
45	207	5	13-Jun	FN	TF
46	133	2	13-Jun	FN	TF
47	149	3	13-Jun	FN	TF
48	173	4	13-Jun	FN	TF
49	136	3	13-Jun	FN	TF
50	117	2	13-Jun	FN	TF
51	138	2	13-Jun	FN	TF
52	157	3	13-Jun	FN	TF
53	105	1	13-Jun	FN	TF
54	125	2	13-Jun	FN	TF
55	180	4	13-Jun	FN	TF
56	123	2	13-Jun	FN	TF
57	111	1	13-Jun	FN	TF
58	153	3	13-Jun	FN	TF

59	143	3	13-Jun	FN	TF
60	134	2	13-Jun	FN	TF
61	144	3	13-Jun	FN	TF
62	130	2	13-Jun	FN	TF
63	130	3	13-Jun	FN	TF
64	115	2	13-Jun	FN	TF
65	146	3	13-Jun	FN	TF
66	137	2	13-Jun	FN	TF
67	175	4	13-Jun	FN	TF
68	165	3	13-Jun	FN	TF
69	146	3	13-Jun	FN	TF
70	171	4	13-Jun	FN	TF
72	124	2	13-Jun	FN	TF
73	114	2	13-Jun	FN	TF
75	98	1	13-Jun	FN	TF
76	141	3	13-Jun	FN	TF
77	142	3	13-Jun	FN	TF
79	121	2	13-Jun	FN	TF
80	146	3	13-Jun	FN	TF
81	165	4	13-Jun	FN	TF
82	126	2	13-Jun	FN	TF
83	147	3	13-Jun	FN	TF
84	137	2	13-Jun	FN	TF
85	114	1	13-Jun	FN	TF
86	138	3	13-Jun	FN	TF
87	194	5	13-Jun	FN	TF

88	181	5	13-Jun	FN	TF
89	86	1	13-Jun	FN	TF
90	171	4	13-Jun	FN	TF
91	182	4	13-Jun	FN	TF
92	134	3	13-Jun	FN	TF
93	153	3	13-Jun	FN	TF
94	165	4	13-Jun	FN	TF
95	184	5	13-Jun	FN	TF
96	178	5	13-Jun	FN	TF
97	108	2	13-Jun	FN	TF
98	131	3	13-Jun	FN	TF
99	105	2	13-Jun	FN	TF
100	131	3	13-Jun	FN	TF
101	162	4	13-Jun	FN	TF
102	135	3	13-Jun	FN	TF
103	130	2	13-Jun	FN	TF
104	110	2	13-Jun	FN	TF
105	145	3	13-Jun	FN	TF
106	179	4	13-Jun	FN	TF
107	152	3	13-Jun	FN	TF
108	192	5	13-Jun	FN	TF
109	172	4	13-Jun	FN	TF
110	150	3	13-Jun	FN	TF
111	188	5	13-Jun	FN	TF
112	140	3	13-Jun	FN	TF
113	145	3	13-Jun	FN	TF

114	139	3	13-Jun	FN	TF
115	169	4	13-Jun	FN	TF
116	135	3	13-Jun	FN	TF
117	131	3	13-Jun	FN	TF
118	154	4	13-Jun	FN	TF
119	193	5	13-Jun	FN	TF
120	150	3	13-Jun	FN	TF
121	110	2	13-Jun	FN	TF
122	145	3	13-Jun	FN	TF
123	137	3	13-Jun	FN	TF
124	165	4	13-Jun	FN	TF
125	106	1	13-Jun	FN	TF
126	110	2	13-Jun	FN	TF
127	133	2	13-Jun	FN	TF
128	104	1	13-Jun	FN	TF
129	165	3	13-Jun	FN	TF
130	165	4	13-Jun	FN	TF
131	172	4	13-Jun	FN	TF
132	113	2	13-Jun	FN	TF
133	152	3	13-Jun	FN	TF
134	165	4	13-Jun	FN	TF
135	135	2	13-Jun	FN	TF
136	180	4	13-Jun	FN	TF
137	123	2	13-Jun	FN	TF
139	65	1	13-Jun	FN	TF
2	210	4	13-Jun	FN	BA

3	182	4	14-Jun	FN	BA
4	181	3	14-Jun	FN	BA
5	251	5	14-Jun	FN	BA
8	240	4	9-Jul	FN	BA
9	180	3	9-Jul	FN	BA
10	175	3	9-Jul	FN	BA
11	191	4	9-Jul	FN	BA
12	205	4	9-Jul	FN	BA
13	202	3	9-Jul	FN	BA
14	181	4	9-Jul	FN	BA
15	191	3	9-Jul	FN	BA
16	204	5	9-Jul	FN	BA
17	205	4	9-Jul	FN	BA
18	230	6	9-Jul	FN	BA
19	205	4	9-Jul	FN	BA
20	215	4	9-Jul	FN	BA
21	203	4	9-Jul	FN	BA
22	171	3	9-Jul	FN	BA
23	184	4	9-Jul	FN	BA
24	185	3	9-Jul	FN	BA
25	140	3	9-Jul	FN	BA
26	184	4	9-Jul	FN	BA
32	220	4	11-Jul	FN	BA
33	212	4	11-Jul	FN	BA
34	204	5	11-Jul	FN	BA
35	189	3	11-Jul	FN	BA
36	193	4	11-Jul	FN	BA
37	210	3	11-Jul	FN	BA
38	210	4	12-Jul	FN	BA
39	200	4	12-Jul	FN	BA
40	82	1	12-Jul	FN	BA
41	102	1	12-Jul	FN	BA
42	97	1	12-Jul	FN	BA
43	110	1	12-Jul	FN	BA
44	136	2	12-Jul	FN	BA
45	163	3	12-Jul	FN	BA

46	197	4	12-Jul	FN	BA
47	216	4	12-Jul	FN	BA
48	176	2	12-Jul	FN	BA
49	200	3	12-Jul	FN	BA
50	90	1	12-Jul	FN	BA
51	201	4	12-Jul	FN	BA
52	167	3	12-Jul	FN	BA
53	194	3	12-Jul	FN	BA
54	196	4	12-Jul	FN	BA
55	208	5	12-Jul	FN	BA
56	198	4	12-Jul	FN	BA
57	170	3	12-Jul	FN	BA
58	203	5	12-Jul	FN	BA
59	169	3	12-Jul	FN	BA
60	171	4	12-Jul	FN	BA
61	240	5	12-Jul	FN	BA
62	218	4	12-Jul	FN	BA
63	190	3	12-Jul	FN	BA
64	246	5	12-Jul	FN	BA
65	242	5	12-Jul	FN	BA
66	235	6	12-Jul	FN	BA
67	208	4	12-Jul	FN	BA
68	190	3	12-Jul	FN	BA
69	215	5	12-Jul	FN	BA
70	235	4	12-Jul	FN	BA
71	174	3	12-Jul	FN	BA
72	190	3	12-Jul	FN	BA
73	230	5	12-Jul	FN	BA
74	210	4	12-Jul	FN	BA
75	189	4	12-Jul	FN	BA
76	215	4	12-Jul	FN	BA
77	227	5	13-Jul	FN	BA
78	212	4	13-Jul	FN	BA
79	202	4	13-Jul	FN	BA
80	204	5	13-Jul	FN	BA
81	90	1	13-Jul	FN	BA
82	196	3	13-Jul	FN	BA

83	215	4	13-Jul	FN	BA