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Original Article

Estimates of Sire Breeding Value for Milk production and Reproductive Traits in Crossbred Dairy Cattle

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ABSTRACT

The breeding values of 98 pure Holstein Friesian and crossbred sires were estimated from the lactation and reproductive performance of dairy cattle by using WOMBAT software fitted to mixed animal model evaluation method. The performance records of 851 crossbred dairy cows, daughters of 98 sires (AI semen or bulls) were collected from the pedigree sheets at the research farm. Sires with two and more daughters were included in the data. The source of Sires (semen) were worldwide sire (WWS), Western Asia imported and domestic semen source. The traits studied were lactation milk yield (LMY), daily milk yield (DMY), lactation length (LL), age at first service (AFS), age at first calving (AFC), calving interval (CI), days open (DO) and number of service per conception (NSC). From the analysis, the estimated average sire-breeding value for LMY was 7.51 kg, which varied from 663.82 kg below the average to 1055.19 kg above the average. Average estimated sire-breeding value for DMY was 0.06 in the range of 1.22 kg below the average to 2.27 kg above the average breeding value. For LL, the estimated difference of sire breeding value was 97 days ranges from 49.8 days below the average to 47 days above the average. The sire breeding value of AFS trait was -0.71 days ranges from 179 days below the average to 161 days above the average. Sire-breeding value of AFC trait was -0.66 days estimated from 257 days below the average to 366 days above the average. Average sire breeding value for CI was -1.87 days ranges from 50 days below the average to 39 days above

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the average. For DO, it was -1.81 days ranged from 56 days below the average to 44 days above the average. Sire breeding value for NSC was varied from 0.02 below the average to 0.02 above the average.
Keywords: crossbred; Milk production traits; Reproductive traits; Sire breeding value

INTRODUCTION

With the advent of artificial insemination (AI), which accompanied with progeny testing scheme, worldwide improvement of dairy cattle and milk yield is increasing from time to time. Now days, few elite sires are contributed their genetic potential for genetic improvement through artificial insemination to the world cattle population. This is because of the sire path contributes more than the dam path in the overall genetic improvement of a trait due to higher intensity of selection on male side and shortening the generation interval (Schaeffer, 2006; Banik and Gandhi, 2010; Lodhi *et al*., 2016; Vani *et al*. 2018,). Earlier studies revealed that sire selection contributes about two-thirds of the potential genetic progress for milk production in an optimal dairy cattle breeding structure (Robertson and Rendel, 1950; Skjervold, 1963). However, selection of cows for dam of future sire is the most important potential. In the biological fact, sire and dam contribute equally to the inheritance of productive and functional characters of the progeny, milk production and reproductive performance like milk yield, age at first calving, calving interval, service per conception and service period cannot be measured directly on males rather on female's side (Lodhi *et al*., 2016). Therefore, genetic evaluation of dairy cattle can be applied based either on records of female ancestors or on records of female progenies. However, in most cases intense selection are applied on male animals from progeny records for the purpose that males are produce more progenies at one time for genetic evaluation (Schaeffer, 2006). On the other hand, selection on females has limited scope due to insufficient number of replacement stocks (Lodhi *et al*., 2016).

Cattle breeding program in Ethiopia has been directed towards involving the exotic breeds through cross breeding by bringing superior sire semen of progeny tested/proven bulls from different countries like Western Asia (located on the southeastern shore of the Mediterranean Sea) and USA. The use of such progeny tested bulls are the major cause of milk improvement of dairy cattle in the country. Apart from this, domestic semen has been produced from selected bulls, which is found in some government and research farms in the country. Bull selection in the country has traditionally been done on their phenotypic appearances. Selection on the performances of extra ordinary records on their dam (selection based on dam breeding values) for national artificial insemination service is recent work in the research farm. Moreover, cow selection for dam of future sire is not undergoing rather cows are selected for dam of future dam in the research farm. In the last 42 years, more than 98 sires/semen (imported and domestic) were used for genetic improvement of dairy cattle at Holetta Dairy Research Farm. Information on estimated breeding value and genetic performance of both domestic and imported sires have not been well known in the research center. Therefore, this study was aimed to generate an information on individual sire estimated breeding value and rank the sires based on their genetic contribution to the farm. Moreover, knowing the estimated breeding values of those sires are crucial for future herd improvement, essential for maximum genetic gain by utilizing top sires, to commence progeny testing scheme for best bull selection at the research farm and or to made a decision from which country we import best sire semen.

MATERIALS AND METHODS

Study location: Data were collected from crossbred dairy cattle recorded spread over 42 years (1974-2017) maintained at Holetta dairy cattle research farm, located 29 km away from the capital, Addis Ababa in the western direction. The detail geographical location and environmental condition of the study area is described by (Getahun *et al.* 2019).

Data management: The traits included in the study were LMY, DMY, LL, AFS, AFC, CI, DO and NSC. Data was needed to be censored before analysis for accurate estimation. The minimum truncation point for LL in this study was 100 days, which regarded as incomplete lactation for analysis of LMY, DMY and LL. AFS below 10 and above 80 months, and AFC below 20 and above 90 months were truncated. The animals that had abnormal calving, (i.e., abortions and stillbirths) were not included in the analys Western Asia Sires with less than two daughters were not included in the analys Western Asia

Statistical analysis: Variance components and breeding values of each trait were estimated by using WOMBAT genetic analysis software version 01-11-2011. Three productive traits (LMY, DMY, and LL) and five reproductive traits (AFS, AFC, CI, DO and NSC) were analysed consecutively by applying linear mixed animal model procedure. The breeding values of sires were estimated and evaluated based on breeding values of their progenies. Sires are imported (sire semen) from different country and bulls semen selected on the base of phenotypic and dam genetic performance from this farm. Overall 97 Sires (15 Western Asia imported, 63 NAIC Kality/domestic and 19 worldwide sires) were used for trait analys Western Asia. The service span of all the three semen sources at the research farm were different. Western Asia imported semen served over 36 years (1976-2012) which produced 76 progenies, domestic sires/semen used over 40 years (from 1977- recent years) which produced 546 progenies and WWS semen served for 2010-recent years and produced 229 progenies.

Western Asia imported and worldwide sires are pure Friesian used to produce 50% F1 and backcrossed progenies while NAIC Kality sires were either pure Friesian or progenies of 50% F1, F2 and 75% F1 crosses mainly used for inter se mating to produce F2 and F3 generations in the research station. Therefore, this study was not intentionally compare the breeding values of three sire sources each other rather to generate information about individual sire breeding value in each trait. The result of this study was also estimates group average breeding values of sires from their sources.

Effects in the linear mixed animal model were fitted as random and fixed. Animal additive (genetic) effect was fitted as random while year, season, genetic group and parities were fitted as fixed effects. The model is presented as a matrix form as follows;

$Y = Xb + Za + e$. where;

Y, is a vector of phenotype, b, is a vector of fixed effects, a, is a vector of random additive genetic effects and e, vector of the residuals for trait or environment. X and Z are incidence matrices.

RESULT AND DISCUSSION

Lactation Milk Yield (LMY): Sire-breeding value for LMY was varied from 663.82 (sire 150) kg below the average to 1055.19 (sire 133) kg above the average. There were 48 sires whose breeding values observed below the average and 42 sires with breeding values above the average. The difference between lowest and highest breeding value was 1719.01 kg. The highest and lowest breeding value was found from NAIC kality sires (1055 and -663 kg). 56% NAIC Kality, 50% Western Asia imported and 47% worldwide sires had below (undesirable) average breeding value for the trait lactation milk yield. Therefore, there were differences observed between the three sire (semen) sources. The different values observed among the sires might be associated with the number of daughters per sire and their sources to perform at local condition.

Daily Milk Yield (DMY): Average sire breeding value of DMY was 0.06 in the range of 1.22 kg (sire 165) below the average to 2.27 kg (sire 133) above the average breeding value. The difference between highest and lowest breeding value was found to be 3.49 kg. From the whole sires, 47 sires whose breeding values exhibited below the average and 41 sires with breeding values above the average. 51% NAIC kality, 57% Western Asia imported and 52% worldwide sires showed unfavorable (negative) average breeding values for the trait daily milk yield. The maximum and minimum average sire breeding value was from NAIC kality source. However, more than half sires showed negative breeding values.

Lactation Length (LL): The estimated difference of sire breeding value for LL was 97 days ranges from 49.8 days (sire 125) below the average to 47 days (sire 291) above the average. From the whole, 48 sires exhibited below the average breeding values and 40 sires with breeding values above the average. 40% Western Asia imported and

NAIC Kality and, 65% worldwide sires were exhibited favorable (positive) average breeding values. Majority of worldwide sires showed positive values for this trait. However, maximum and minimum average breeding values were observed from NAIC Kality and Western Asia imported sires, respectively.

Age at First Service (AFS): The sire breeding value of AFS trait varies from 179 days (sire 21001) below the average to 161 days (sire 2025) above the average. The highest and lowest breeding values were from NAIC Kality. From the total, 46 sires were desirable (negative) and 44 sires were undesirable (positive) breeding value for the trait AFS. More than half (60%) of Western Asia imported and NAIC Kality (54%) and less than half (32%) of worldwide sires showed negative breeding values.

Age at First Calving (AFC): Sire-breeding value of AFC trait was estimated from 257 days (sire 21001) below the average to 366 days (sire 2025) above the average breeding value. Both extremes were observed from NAIC Kality sire source. From the whole sire sources, 52 sires showed negative (desirable) breeding value whereas, 39 sires were positive (undesirable) breeding value for the trait AFC. Majority of sires (69%, 56% and 53%) from Western Asia imported, NAIC Kality and worldwide sires showed favorable (negative) breeding values.

Calving Interval (CI): Sire breeding value for CI was varied from 50 (sire 180) days below the average to 39 (sire 98131) days above the average. There were 40 sires whose breeding values observed below the average and 38 sires with breeding values above the average. The difference between lowest and highest breeding value was 89 days. Majority of sires (60% Western Asia imported and 52% of NAIC Kality) were exhibited undesirable (positive) breeding values whereas 73% of worldwide sires showed the reversed value.

Days Open (DO): Sire-breeding value of DO was ranged from 56 days (sire 180 of worldwide sire) below the average to 44 days (sire 98131 of NAIC Kality) above the average. The difference between maximum and minimum breeding value was 100 days. There were 40 sires whose breeding value exhibited below the average and 37 sires with positive breeding values. 40%, 47% and 80% of Western Asia imported, NAIC Kality and worldwide sires were negative (desirable) breeding values for the trait DO. Therefore, differences were observed among the three sire sources.

Number of Service per Conception (NSC): Sire breeding value for NSC was varied from 0.02 (sire 3521 and 21001) below the average to 0.02 (sire 132 and 31007) above the average. The minimum and maximum sire breeding values were found from NAIC/Kality source. The difference between the two extremes was 0.04. Based on this result, sires would have 0.02 times reduced or added its breeding values of the repetition of service per conception for its progeny in the herd. From all sire sources, majority of them are zero breeding values means that there is no any systematic genetic trend of service per conception.

Table 1**: Average sire breeding value estimate for milk production and reproductive traits**

Traits	Sire type	Minimum (below average) BV	Maximum (above average) BV	Number of sire above average BV	Number of sire below average BV
LMY	Western Asia imported	-436.56	383.46	7	7
	NAIC Kality	-663.83	1055.19	25	32
	Worldwide sire	-340.36	655.06	10	9
DMY	Western Asia imported	-0.99	1.6	6	8
	NAIC Kality	-1.22	2.27	28	30
	Worldwide sire	-0.77	1.31	8	9
LL	Western Asia imported	-49.8	21.71	6	9
	NAIC Kality	-35.46	47.06	23	34
	Worldwide sire	-10.25	20.74	11	6
AFS	Western Asia imported	-135.38	77.36	4	8
	NAIC Kality	-179.25	160.74	27	32
	Worldwide sire	-20.95	81.2	13	6
AFC	Western Asia imported	-124.27	60.23	4	9
	NAIC Kality	-257.1	365.58	26	33
	Worldwide sire	-38.45	100.58	9	10
CI	Western Asia imported	-46.35	36.28	9	6
	NAIC Kality	-28.94	39.47	25	23
	Worldwide sire	-49.7	32.23	4	11
DO	Western Asia imported	-44.27	36.03	9	6
	NAIC Kality	-41.42	44.49	25	22
	Worldwide sire	-56.03	36.2	3	12
NSC	Western Asia imported	-0.01	0.01	3	3
	NAIC Kality	-0.02	0.02	8	9
	Worldwide sire	-0.01	0.01	3	4

Sires that showed positive breeding value on one trait would showed positive or negative breeding values on the other traits. The sires gene interaction and environmental condition might not be allowed all economical traits to express equally on their daughters. The selection of sires' emphasis on single trait would also limit the expression of other traits. Keep this in view that globally, majority of sires have been selected based on performance of single trait i.e., selection has been undertaken only for improvement of milk yield (Shakiti *et al.*, 2016). For this reason, other traits have limited opportunities for selection unless they are correlated to milk trait.

Table 2: Average sire breeding values of all and group (three-sire semen sources) sires.

traits	Average BV of all sires	Average sire BV of the three sire semen sources		
		Western Asia imported	NAIC Kality	WWS
LMY	7.51	-12.50	-9.17	72.29
DMY	0.06	-0.01	0.10	-0.004
LL	-1.29	-4.67	-2.18	4.50
AFS	-0.71	-22.18	-2.01	16.88
AFC	-0.66	-27.38	-1.86	23.54
CI	-1.87	0.29	0.77	-12.47
DO	-1.81	0.60	1.31	-13.96
NSC	0.00	0.00	0.00	0.00

CONCLUSION

On average, the worldwide sires are ideal for milk production, CI and DO traits but showed less performance on AFS and AFC traits, which was extended their productive days in this study. The reason behind is that Selection of worldwide sires has been undertaken only for improvement of milk yield. As a general, the breeding values of the three source of bull semen used at the research station had not gave promised result. In case more than half sires with their breeding values were not the right direction, which might be the following reasons. First, in crossbreeding experiments where exotic sires are imported through frozen semen and there is no direct information on the performance of the exotic parental breed under our local conditions. This will be reduced the performance of exotic sire because of environmental changes. Second, sires of NAIC Kality for domestic semen production has not been selected based on genetic performance rather selected on the bases of visual appraisal, third, different management and environmental problems might affect dam and daughters performance and fourth, the number of daughter per sire for this study would be limit for the accurate estimate of each sire. Selection of cows for future dam at the research center could not bring the required genetic progress. Therefore, for bringing the overall genetic improvement in the research farm, emphasis should be given for the selection and utilization of best sires as a bull can be bred more number of cows. Selection of cows for future dam of sires and progeny testing scheme of the selected bulls should be done at the research farm. Moreover, as we used to import worldwide proven sires semen, follow up should be underway on the imported semen as the WWS semen is very expensive.

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CONFLICT OF INTEREST

The author declared that no potential conflict of interest is reported regarding the subject matter of this manuscript.

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Appendix

Table 1: Breeding values (BV) and ranks (in bracket) of the whole sires at the research farm

Traits																daughter/sire	sire (semen) source
AFC		AFS		CI		DMY		DO		LL		LMY		NSC			
Sire ID	BV (Rank)	Sire ID	BV (Rank)	Sire ID	BV (Rank)	Sire ID	BV (Rank)	Sire ID	BV (Rank)	Sire ID	BV (Rank)	Sire ID	BV (Rank)	Sire ID	BV (Rank)		
1	2.41 (54)			1	16.24 (68)	1	-1.00 (85)	1	12.34 (62)	1	-2.60 (51)	1	-281.14 (78)	1	0.01 (4)	3	Western Asia imported
3	-64.54 (14)	3	-135.38 (2)	3	36.28 (77)	3	-0.46 (66)	3	39.03 (76)	3	16.52 (12)	3	-73.70 (52)	3	0.01 (4)	7	Western Asia imported
4	-8.66 (45)	4	23.09 (66)	4	4.11 (51)	4	-0.94 (83)	4	3.51 (48)	4	-20.39 (76)	4	-436.56 (87)	4	0.00 (3)	4	Western Asia imported
5	-74.02 (12)	5	-99.79 (4)	5	28.79 (74)	5	-0.80 (81)	5	21.65 (69)	5	-3.48 (53)	5	-252.50 75	5	0.00 3	9	Western Asia imported
7		7		7	3.02 (48)	7	-0.19 (54)	7	3.32 (46)	7	2.37 (35)	7	119.02 (28)	7	0.00 (3)	2	Western Asia imported
36	-41.87 (21)	36	-17.70 (28)	36	1.15 (44)	36	-0.47 (67)	36	1.70 (44)	36	21.71 8	36	25.74 (39)	36	-0.01 (2)	9	Western Asia imported
37	38.88 (70)	37	-15.04 (32)	37	-21.84 (9)	37	-0.04 (43)	37	-24.10 (10)	37	-22.19 (81)	37	-159.65 (64)	37	-0.01 (2)	3	Western Asia imported
39		39		39	-9.97 (22)	39	-0.70 (74)	39	-11.25 (21)	39	-8.78 (63)	39	-237.04 (73)	39	0.00 (3)	2	Western Asia imported
42	-15.82 (42)	42	4.75 (52)	42	10.61 (62)	42	0.50 (22)	42	15.33 (63)	42	11.43 (17)	42	243.75 (18)	42	-0.01 (2)	11	Western Asia imported
43	-46.39 (18)	43	-22.43 (25)	43	-17.31 (15)	43	0.00 (41)	43	-20.03 (14)	43	-28.72 (85)	43	-157.85 (62)	43	0.00 (3)	7	Western Asia imported
44	11.11 (59)	44	71.36 (85)	44	18.88 (70)	44	0.47 (23)	44	22.03 (70)	44	12.64 (16)	44	186.94 (22)	44	0.01 (4)	3	Western Asia imported
124	-124.27 (3)	124	-76.62 (5)	124	-18.44 (13)	124		124	-11.98 (20)	124		124		124	0.00 (3)	3	Western Asia imported
125	60.23 (77)	125	60.26 (82)	125	-29.75 (5)	125	1.62 (4)	125	-30.27 (6)	125	-49.80 (88)	125	265.12 (17)	125	0.00 (3)	7	Western Asia imported
129	-75.99 (9)	129	-45.22 (13)	129	29.01 (75)	129	0.91 (13)	129	31.95 (73)	129	-1.05 (44)	129	199.52 (20)	129	0.00 (3)	2	Western Asia imported

130	-17.05 (41)	130	-13.39 (34)	130	-46.35 (2)	130	0.97 (9)	130	-44.27 (3)	130	7.00 (27)	130	383.46 (11)	130	0.00 (3)	4	Western Asia imported
132	36.88 (69)	132	61.72 (84)	132	0.38 (41)	132	1.72 (3)	132	3.83 (49)	132	10.05 (20)	132	518.72 (6)	132	0.01 (4)	30	NAIC/Kality
133	57.45 (75)	133	40.29 (73)	133	8.37 (59)	133	2.27 (1)	133	7.59 (54)	133	39.82 (2)	133	1055.19 (1)	133	0.02 (5)	19	NAIC/Kality
134	-0.51 (52)	134	25.17 (67)	134	13.13 (65)	134	0.60 (18)	134	15.50 (64)	134	21.90 (7)	134	309.22 (14)	134	-0.01 (2)	26	NAIC/Kality
135	30.38 (66)	135	36.15 (71)	135	19.42 (72)	135	0.58 (19)	135	22.12 (71)	135	-10.90 (66)	135	5.21 (42)	135	0.01 (4)	38	NAIC/Kality
136	-24.00 (31)	136	-10.47 (37)	136		136	0.19 (34)	136		136	-3.95 (54)	136	8.67 (41)	136		2	NAIC/Kality
137	-49.08 (17)	137	-55.68 (10)	137	9.78 (60)	137	1.80 (2)	137	12.29 (60)	137	15.97 (13)	137	672.05 (2)	137	0.01 (4)	10	NAIC/Kality
138	52.36 (72)	138	-5.14 (42)	138	-4.29 (33)	138	1.04 (8)	138	-4.92 31	138	8.04 (25)	138	346.41 (12)	138	0.00 (3)	3	NAIC/Kality
140	-17.07 (40)	140	4.14 (50)	140	-6.10 (29)	140	0.64 (17)	140	-8.01 (25)	140	2.84 (34)	140	183.46 (23)	140	0.00 (3)	7	NAIC/Kality
141	21.86 (64)	141	-7.02 (40)	141	14.79 (66)	141	0.83 (16)	141	16.54 (65)	141	15.59 (14)	141	343.49 (13)	141	0.00 (3)	7	NAIC/Kality
142	-105.48 (4)	142	-75.71 (6)	142	-2.64 (36)	142	0.58 (20)	142	-3.53 (34)	142	-7.13 (60)	142	60.55 (35)	142	0.00 (3)	12	NAIC/Kality
146	7.33 (56)	146	10.91 (60)	146	10.65 (63)	146	-0.74 (75)	146	12.32 (61)	146	-25.47 (82)	146	-498.32 (89)	146	0.00 (3)	7	NAIC/Kality
147	-34.70 (24)	147	-7.02 (39)	147	-1.00 (38)	147	0.30 (30)	147	-0.89 (39)	147	-15.61 (71)	147	-155.22 (6)1	147	0.00 (3)	6	NAIC/Kality
148	66.43 (78)	148	29.99 (69)	148	15.49 (67)	148	0.39 (27)	148	16.99 (66)	148	-21.81 (79)	148	-115.13 (55)	148	-0.01 (2)	18	NAIC/Kality
149	-75.01 (10)	149	-39.35 (15)	149	4.12 (52)	149	0.24 (31)	149	3.44 (47)	149	-8.87 (64)	149	-43.33 (48)	149		2	NAIC/Kality
150	-25.04 (30)	150	-70.26 (7)	150	18.41 (69)	150	-0.95 (84)	150	19.44 68	150	-30.43 (86)	150	-663.83 (90)	150	0.00 (3)	11	NAIC/Kality
151	68.87 (79)	151	41.61 (74)	151	6.04 (55)	151	0.36 (28)	151	7.62 (55)	151	-2.02 (50)	151	-79.43 (53)	151	0.00 (3)	11	NAIC/Kality
152	33.22 (67)	152	42.08 (75)	152		152	-0.53 (70)	152		152	-27.10 (83)	152	-455.99 (88)	152		4	NAIC/Kality
153	112.37 (85)	153	46.83 (78)	153	-4.52 (31)	153	1.37 (5)	153	-2.62 (35)	153	13.78 (15)	153	387.34 (10)	153	0.00 (3)	10	NAIC/Kality
154	-23.22	154	-4.53	154	-15.22	154	-1.05	154	-18.60	154	-11.73	154	-406.02	154	-0.01	22	NAIC/Kality

	(33)		(43)		(18)		(86)		(15)		(67)		(85)		(2)		
155	-12.72 (43)	155	6.42 (54)	155	19.05 (71)	155	0.94 (10)	155	19.36 (67)	155	-15.62 (72)	155	48.27 (37)	155	0.00 (3)	11	NAIC/Kality
156	16.87 (62)	156	16.51 (65)	156	2.80 (47)	156	0.90 (14)	156	4.15 (51)	156	10.45 (19)	156	298.52 (15)	156	0.00 (3)	3	NAIC/Kality
157	10.24 (58)	157	86.14 (87)	157	12.82 (64)	157	0.14 (38)	157	22.86 (72)	157	-17.86 (73)	157	-17.59 (45)	157	0.00 (3)	4	NAIC/Kality
158	124.29 (86)	158	47.61 (79)	158	-19.40 (11)	158	-0.29 (60)	158	-17.74 (16)	158	-27.46 (84)	158	-392.58 (83)	158	-0.01 (2)	20	NAIC/Kality
160	-23.40 (32)	160	-28.96 (20)	160	6.43 (56)	160		160		160		160		160	0.01 (4)	5	NAIC/Kality
163	-80.92 (8)	163	-68.24 (8)	163	1.94 (45)	163	-1.19 (87)	163	1.27 (43)	163	-0.13 (41)	163	-287.01 (79)	163	0.00 (3)	5	NAIC/Kality
164	27.39 (65)	164	-17.62 (29)	164	-0.61 40	164	-0.04 (44)	164	-1.46 (38)	164	7.05 (26)	164	172.05 (24)	164	0.00 (3)	3	NAIC/Kality
165	-58.96 (15)	165	-51.45 (12)	165	-18.57 (12)	165	-1.22 (88)	165	-20.85 (13)	165	4.66 (30)	165	-338.73 (81)	165	0.00 (3)	10	NAIC/Kality
166	-32.35 (25)	166	-12.64 (35)	166	-8.54 (24)	166	-0.44 (65)	166	-8.59 (23)	166	-3.16 (52)	166	-151.95 (59)	166	0.00 (3)	3	NAIC/Kality
167	-42.30 (19)	167	-24.64 (22)	167	-6.26 (28)	167	-0.53 (71)	167	-7.36 (27)	167	0.81 (38)	167	-158.31 (63)	167	0.00 (3)	2	NAIC/Kality
168	-3.91 (48)	168	-25.57 (21)	168	-3.94 (34)	168	-0.76 (78)	168	-3.77 (33)	168	-1.88 (49)	168	-169.08 (66)	168	0.00 (3)	4	NAIC/Kality
169	83.08 (81)	169	45.70 (77)	169	-1.93 (37)	169	0.45 (25)	169	-0.77 (40)	169	16.97 (10)	169	439.47 (8)	169	0.01 (4)	14	wws
170	-18.33 (39)	170	5.50 (53)	170	5.24 (54)	170	1.25 (7)	170	7.92 (56)	170	16.60 (11)	170	655.06 (3)	170	0.00 (3)	12	wws
171	55.25 (74)	171	50.39 (80)	171	32.23 (76)	171	0.88 (15)	171	36.20 (75)	171	20.74 (9)	171	589.26 (5)	171	-0.01 (2)	10	wws
172	88.29 (82)	172	54.61 (81)	172	-17.39 (14)	172	1.31 (6)	172	-24.54 (9)	172	9.48 (22)	172	441.53 (7)	172	-0.01 (2)	19	wws
175	36.30 (68)	175	39.14 (72)	175	10.17 (61)	175	0.20 (32)	175	11.80 (59)	175	-10.25 (65)	175	-12.07 (44)	175	0.00 (3)	5	wws
176	98.96 (83)	176	81.21 (86)	176	0.77 (43)	176	-0.42 (64)	176	-2.26 (37)	176	9.18 (23)	176	272.67 (16)	176	0.00 (3)	12	wws
177	-6.78 (46)	177	-14.81 (33)	177	-17.01 (17)	177	0.16 (35)	177	-21.22 (12)	177	-0.15 (42)	177	192.69 (21)	177	0.01 (4)	14	wws
178	-21.17 (34)	178	-17.11 (30)	178	-42.12 (3)	178	-0.53 (69)	178	-48.21 (2)	178	5.63 (29)	178	53.85 (36)	178	0.01 (4)	18	wws

179	-6.01 (47)	179	4.01 (49)	179	-17.23 (16)	179	-0.61 (73)	179	-13.42 (19)	179	1.25 (37)	179	-167.96 (65)	179	-0.01 (2)	8	wws
180	100.58 (84)	180	30.20 (70)	180	-49.71 (1)	180		180	-56.03 (1)	180	8.25 (24)	180	86.07 (33)	180	0.00 (3)	27	wws
181	59.66 (76)	181	42.62 (76)	181	-31.90 (4)	181	-0.16 (50)	181	-36.07 (5)	181	11.38 (18)	181	104.39 (31)	181	-0.01 (2)	19	wws
184	-96.87 (6)	184	-23.20 (24)	184	-14.51 (19)	184	0.16 (36)	184	-15.47 (17)	184	0.16 (40)	184	112.98 (29)	184	-0.01 (2)	17	NAIC/Kality
185	-19.79 (37)	185	6.87 (55)	185	-24.45 (8)	185	-0.75 (77)	185	-25.24 (8)	185	-1.31 (46)	185	-340.36 (82)	185	0.00 (3)	4	wws
186	-32.23 (26)	186	-4.26 (44)	186	-5.32 (30)	186	-0.77 (79)	186	-6.53 (30)	186	-1.72 (48)	186	-71.59 (51)	186		3	wws
187	-38.45 (23)	187	-20.95 (26)	187	-6.79 (26)	187	-0.41 (62)	187	-7.55 (26)	187	1.78 (36)	187	-58.12 (50)	187	0.00 (3)	4	wws
189	54.46 (73)	189	12.53 (61)	189	-21.68 (10)	189	0.19 (33)	189	-23.42 (11)	189	-8.50 (61)	189	-240.29 (74)	189	0.00 (3)	27	wws
190	49.36 (71)	190	13.19 (62)	190		190	-0.26 (58)	190		190	5.64 (28)	190	67.19 (34)	190	0.00 (3)	17	wws
193	-3.22 (49)	193	3.06 (48)	193		193		193		193		193	-153.77 (60)	193	0.00 (3)	3	wws
194	-20.13 (36)	194	-2.22 (46)	194		194	-0.75 (76)	194		194	-8.53 (62)	194	-206.57 (70)	194	0.00 (3)	7	wws
195	-12.51 (44)	195	-9.02 (38)	195		195		195		195		195	-278.00 (77)	195	0.00 (3)	6	wws
1600		1600		1600		1600		1600	6.97 (53)	1600		1600		1600		5	NAIC/Kality
1800		1800		1800		1800	-0.25 (56)	1800		1800		1800		1800		27	NAIC/Kality
2025	365.59 (90)	2025	160.74 (90)	2025	-27.71 (7)	2025	0.39 (26)	2025	-41.42 (4)	2025	-12.58 (70)	2025	-54.58 (49)	2025	0.00 (3)	4	NAIC/Kality
3109	-88.23 (7)	3109	-65.32 (9)	310(9)	-9.60 (23)	3109	-0.05 (45)	3109	-8.53 (24)	3109	-1.31 (45)	3109	31.09 (38)	3109	-0.01 (2)	3	NAIC/Kality
3159	-103.77 (5)	3159	-23.60 (23)	3159		3159		3159		3159		3159		3159	0.00 (3)	2	NAIC/Kality
3209	179.78 (89)	3209	143.87 (89)	3209	22.23 (73)	3209	0.94 (11)	3209	32.58 (74)	3209	47.06 (1)	3209	609.84 (4)	3209	0.00 (3)	9	NAIC/Kality
3379	8.91 (57)	3379	-11.77 (36)	3379	-4.34 (32)	3379	-0.03 (42)	3379	-4.59 (32)	3379	-0.98 (43)	3379	88.15 (32)	3379	0.00 (3)	8	NAIC/Kality
3469	1.74	3469	4.15	3469	-7.92	3469	-0.41	3469	-7.12	3469	9.59	3469	-6.36	3469	0.00	2	NAIC/Kality

	(53)		(51)		(25)		(63)		(28)		(21)		(43)		(3)		
3521		3521	7.19 (56)	3521	-10.32 (21)	3521	-0.23 (55)	3521	-10.82 (22)	3521	23.57 (5)	3521	169.53 (25)	3521	-0.02 (1)	12	NAIC/Kality
3705	-18.76 (38)	3705	-32.90 (16)	3705	-0.87 (39)	3705	0.14 (37)	3705	-2.32 (36)	3705	-6.58 (56)	3705	-118.81 (56)	3705	0.00 (3)	2	NAIC/Kality
3799	77.09 (80)	3799	26.68 (68)	3799		3799	-0.19 (52)	3799		3799	-6.86 (58)	3799	-171.02 (67)	3799		2	NAIC/Kality
8217	-201.71 (2)	8217	-124.12 (3)	8217	-2.86 (35)	8217	-0.91 (82)	8217		8217	-6.79 (57)	8217	-289.90 (80)	8217		2	NAIC/Kality
8227		8227		8227	-14.37 (20)	8227	0.46 (24)	8227	-14.19 (18)	8227	27.89 (3)	8227	399.64 (9)	8227	0.01 (4)	12	NAIC/Kality
8235		8235		8235	3.87 (50)	8235	-0.11 (47)	8235	5.57 (52)	8235	25.10 (4)	8235	148.71 (26)	8235	0.00 (3)	2	NAIC/Kality
8569	-1.98 (51)	8569	-3.78 (45)	8569	3.35 (49)	8569	0.36 (29)	8569	2.62 (45)	8569	4.32 (31)	8569	133.86 (27)	8569	-0.01 (2)	6	NAIC/Kality
8643	15.65 (61)	8643	15.70 (64)	8643	8.24 (58)	8643	-0.55 (72)	8643	8.62 (57)	8643	-12.45 (69)	8643	-189.97 (68)	8643	0.00 (3)	9	NAIC/Kality
21001	-257.10 (1)	21001	-179.25 (1)	21001	-28.94 (6)	21001		21001	-28.93 (7)	21001		21001		21001	-0.02 (1)	21	NAIC/Kality
21149	3.12 (55)	21149	7.64 (57)	21149		21149	0.12 (39)	21149		21149	-6.24 (55)	21149	-28.43 (46)	21149		3	NAIC/Kality
22139	-26.01 (29)	22139	-30.07 (18)	22139		22139	0.53 (21)	22139		22139	-21.80 (78)	22139	-142.16 (57)	22139		6	NAIC/Kality
22143	21.81 (63)	22143	10.31 (59)	22143		22143	0.92 (12)	22143		22143	-21.83 (80)	22143	-148.35 (58)	22143		4	NAIC/Kality
27005	-74.02 (11)	27005	-29.37 (19)	27005		27005		27005		27005		27005		27005	0.00 (3)	2	NAIC/Kality
29707	12.43 (60)	29707	9.47 (58)	29707		29707	-0.14 (48)	29707		29707	2.89 (33)	29707	105.64 (30)	29707		4	NAIC/Kality
31007	-69.14 (13)	31007	-41.37 (14)	31007	5.05 (53)	31007	0.05 (40)	31007	0.28 (41)	31007	22.81 (6)	31007	201.88 (19)	31007	0.02 (5)	11	NAIC/Kality
31011	-40.74 (22)	31011	-19.98 (27)	31011		31011	-0.17 (51)	31011		31011	0.73 (39)	31011	-29.27 (47)	31011		2	NAIC/Kality
33189	-42.00 (20)	33189	-52.35 (11)	33189		33189	-0.32 (61)	33189		33189	-11.90 (68)	33189	-204.81 (69)	33189	0.00 (3)	5	NAIC/Kality
97111	135.25 (88)	97111	60.73 (83)	97111	0.50 (42)	97111	-0.27 (59)	97111	0.47 (42)	97111	-1.66 (47)	97111	-84.33 (54)	97111	0.00 (3)	12	NAIC/Kality
97117	125.74 (87)	97117	117.49 (88)	97117	2.22 (46)	97117	-0.19 (53)	97117	3.84 (50)	97117	-35.46 (87)	97117	-400.84 (84)	97117	0.00 (3)	17	NAIC/Kality

98131	-20.44 (35)	98131	14.51 (63)	98131	39.47 (78)	98131	-0.78 (80)	98131	44.49 (77)	98131	-20.88 (77)	98131	-432.54 (86)	98131	0.01 (4)	6	NAIC/Kality
98137	-50.95 (16)	98137	-31.10 (17)	98137	7.33 (57)	98137	-0.16 (49)	98137	9.23 (58)	98137	-18.03 (74)	98137	-274.44 (76)	98137	0.00 (3)	4	NAIC/Kality
98169	-31.05 (27)	98169	-16.48 (31)	99161		98169	-0.25 (57)	98169		98169	-19.94 (75)	98169	-233.68 (72)	98169	0.00 (3)	4	NAIC/Kality
99161	-2.40 (50)	99161	2.25 (47)	99169	-6.38 (27)	99161	-0.05 (46)	99161		99161	4.16 (32)	99161	23.02 (40)	99161		3	NAIC/Kality
99169	-30.00 (28)	99169	-5.65 (41)	99169		99169	-0.52 (68)	99169	-6.85 (29)	99169	-7.04 (59)	99169	-214.45 (71)	99169	0.00 (3)	3	NAIC/Kality