Data collection

Assessment was performed visually only at a distance of 0.50 m. When the evaluation of a parameter was not possible (manure on the body of the animal, sow not standing up), "NA" (not assessable) was recorded for the respective body region.

Examinations were carried out up to four times per farrowing period:

- day (D)1: on the day of moving the sows into the pens: 5 days before expected farrowing date (on group level); carried out on all batches of all farms
- D 2: during the first week after birth of piglets (on group level 4-7 days after farrowing); carried out on all batches of all farms
- D 3: during the third week after birth of piglets (on group level 17-20 days after farrowing); carried out on all batches of farms A and B and during long trial runs on farm C (13 out of 23 batches)
- D 4: during the fourth week after birth of piglets (on group level 25-28 days after farrowing); carried out during long trail runs on farm C (13 out of 23 batches)

Assessments were performed by a total of 11 trained observers who were assigned to one or two farms each. Observers were trained by one experienced observer (using photos, videos and direct observation) who also served as silver standard across three rounds of inter-observer reliability testing (before, during and after on-farm assessments). Minimum Prevalence and Bias Adjusted Kappa (PABAK) values ranged from 0.5 to 1.00 (according to Viera & Garrett (2005) moderate to perfect agreement) for all but one parameter ('alterations of dew claws', minimum PABAK 0.35), which was therefore excluded from further analysis. Appendix 1, Table 1 shows definitions for all assessed parameters.

Appendix 1, Table 1 Definitions of parameters of lesions (for all severity scores) in sows

Parameter	Score 0	Score 1	Score 2
Shoulder sore	None	Clearly visible reddening; >= ø 3cm	Broken skin/bleeding/ scab Bleeding/scab; >= ø3cm
Injuries body	Clearly visible injuries (blood/scab) on head, ear, neck, shoulder, side, back, hindquarters, longitudinal >= 5 cm, round >= ø 3cm		
	None	<= 3 injuries/region	> 3 injuries/region
Injuries legs	Clearly visible injuries (blood/scab), 5 cm and above, longitudinal >= 5 cm, round >= ø 2cm		
	None	<= 3 injuries/region	> 3 injuries/region
Injuries front/rear udder region	Clearly visible injuries (blood/scab), longitudinal >= 5 cm, round >= ø 3 cm, separated in front/rear udder region		
	None	<= 3 injuries/region	> 3 injuries per region or > 5 injuries >= 1cm
Number of injured front/rear teats	Number of clearly visible erythema and/or scabs; separated in front/hind teats		
Number of partial/missing front/rear teats	Number of entirely missing and/or partially torn-off teats, blood/scab, separated in front/rear udder		
Swelling in region of front/rear udder	None	Lump with minimal size of an egg visible	
Injuries vulva	None	Injury (blood/scab) of arbitrary size visible	
Vulval scarring/missing parts	None	Clearly deformed vulva (scarring, parts torn off or missing)	
Swellings hind legs	None	Swellings >= 5 cm & with at least half-round shape („ball“, “size of a small mandarin”)	
Claw length (hind legs)	Normal	Claws too long (one claw clearly longer, claws crossed over, abnormal angle)	
Infection of claws/“panaritium“ (hind legs)	None	Swollen coronary band, swollen claw, pus	
Changes claw horn (hind legs)	None	Very clearly visible changes like cracks, bleedings, abrasions of the wall etc., longitudinal >= 2 cm, round >= Ø 2 cm)	
Alterations dew claws (hind legs)	None	Every clearly visible alteration (injuries/avulsions/bleedings/swellings) on lateral skin of dew claws, longitudinal >= 2 cm, round >= Ø2cm	
Lameness	Normal gait/steps shortened steps and/or curved back	Moderate lameness – reduced weight bearing on one limb	Severe lameness: no load on at least one limb and/or the animal can’t stand up/walk

Observations were recorded on paper and afterwards transferred to an Excel-sheet (Microsoft Corporation, Redmond, Washington, USA). Altogether 2,532 assessments of 449 sows were conducted. From these, 355 assessments were excluded from the analysis according to predefined criteria (farrowing date initially unknown, so that sows were confined or released too early/too late: 302 assessments; crate opened earlier due to severe skin lesions of the sows: 8 assessments; other reasons for exclusion, e.g. sow deceased or excluded due to severe disease before D 2, exact number of piglets unknown, piglets weaned earlier due to health reasons: 45 assessments). All sows were identified using individual ear tags and further information (age, genetic background, etc.) were available from the herd management program “Online Sauenplaner“ (Intelicon Software Development GmbH, Heiligenkreuz am Waasen, Austria).

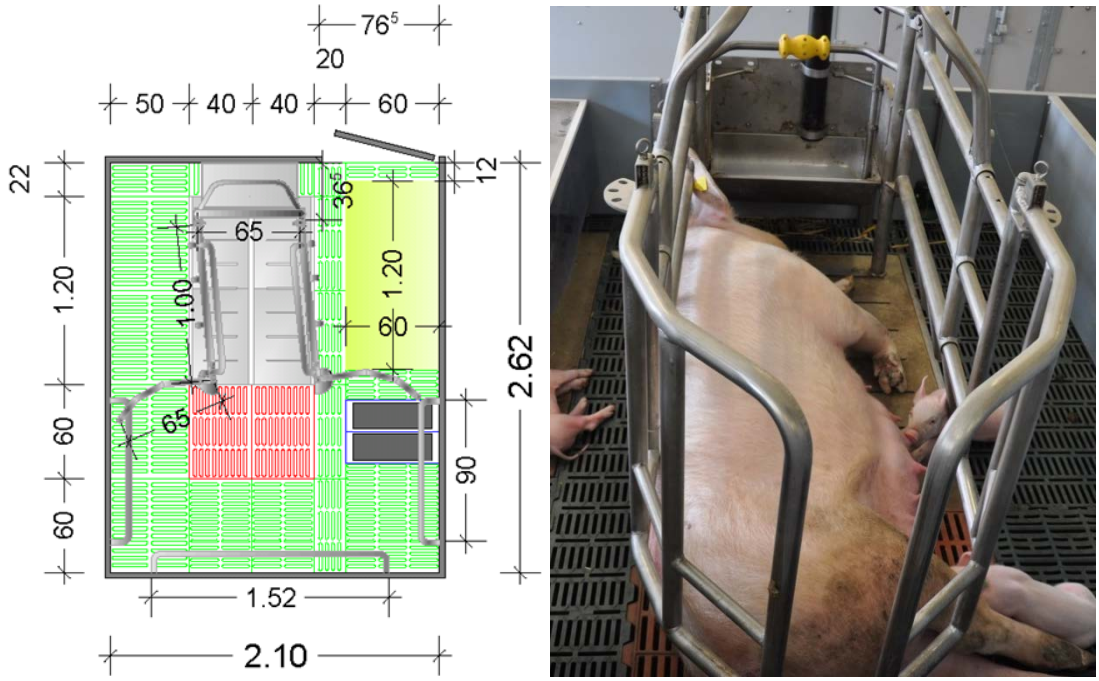

Figure 1: Flügel pen (STEWA Steinhuber GmbH, Sattledt, Austria): plan of pen with open crate and photograph of sow in closed crate. Farrowing crate with rear end cantilevered and equipped with flexible wings for crating the sow, side elements modifiable in width and length (telescopic design). Lowest bars (distance to floor: 0.35 m) of side elements equipped with diagonally arranged pins directed towards the sides. Flooring: solid concrete floor in the creep area (light green), minimally slatted (max. 5% perforation) concrete floor in front of the trough (light grey), cast iron slatted floor (red), plastic slatted floor (dark green) and solid plastic floor (dark grey). Farrowing rails in the back area of the pen.

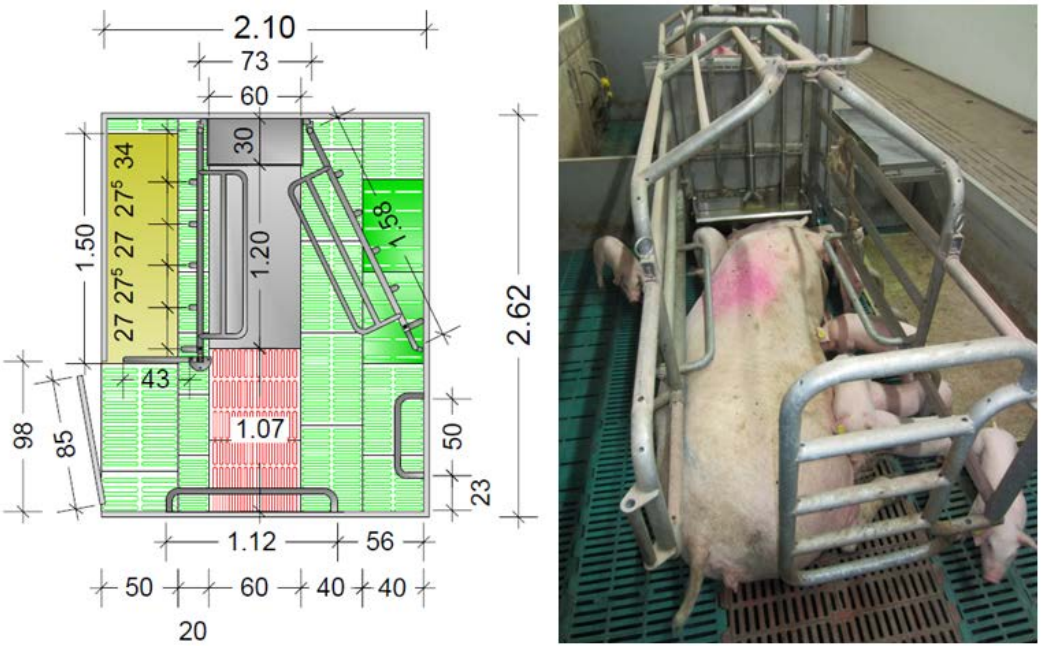

Figure 2: Knick pen (BRÄUER Stalltechnik, Behamberg, Austria): plan of pen with open crate and photograph of sow in closed crate. Both side elements of the crate adjustable in length (telescopic design), one in width. Flexibly pivoted door in the back for closing the crate. Lowest bars (distance to floor: 0.35 m) equipped with vertical pins of half-round, convex shape with tips directing towards the floor. Flooring: solid concrete floor (creep area in beige and area in front of the trough in light grey), cast iron slatted floor (red), plastic slatted floor (light green) and plastic partially slatted floor (dark green). Farrowing rails attached to the rear and one side wall of the pen.

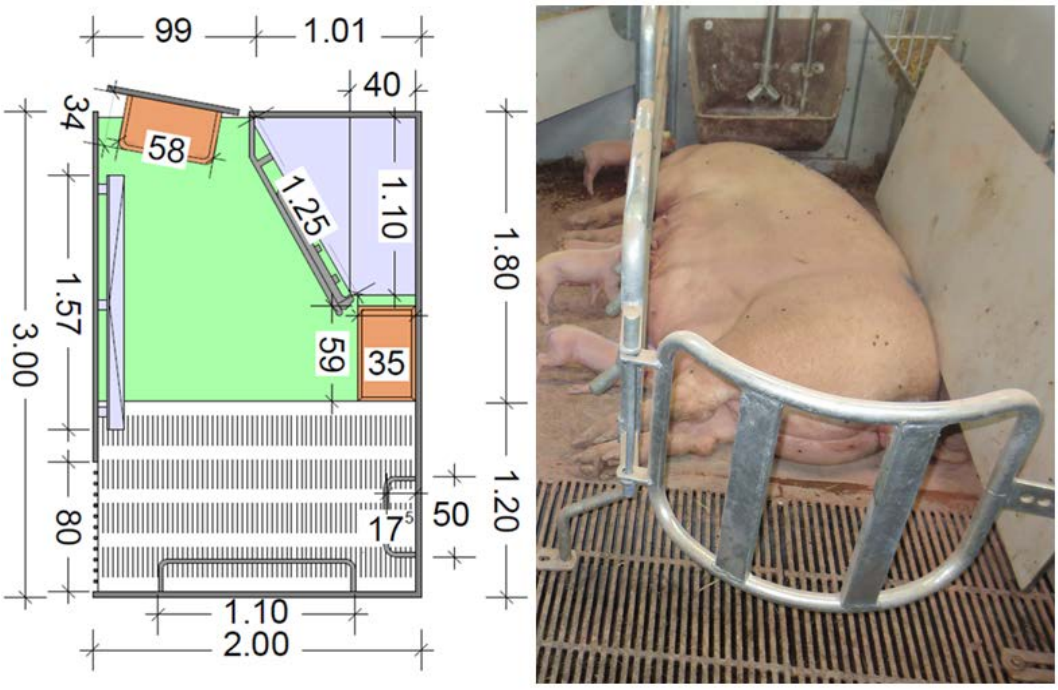

Figure 3: SWAP pen (Jyden Bur A/S, Vemb, Denmark): plan of pen with open crate and photograph of sow in closed crate. Crate formed by hinged swing fixed to front wall of the pen, closure to the back provided by a flexible element. Only width of the crate (length: 2.20 m with trough) adjustable. Lowest bar of swing (distance to floor: 0.36 m) featured with concavely shaped pins with tips directing to the inside of the pen. Flooring: 60% solid concrete floor (green and blue, blue represents the creep area) with a gradient of 2% located in the front area of the pen, 40% slatted iron cast (white) in the back. Sloping wall installed at the crate-site, back and side walls equipped with farrowing rails. Two feeding troughs (red) available: one in the front to feed the sow during crating, one in the back for the time after crating.

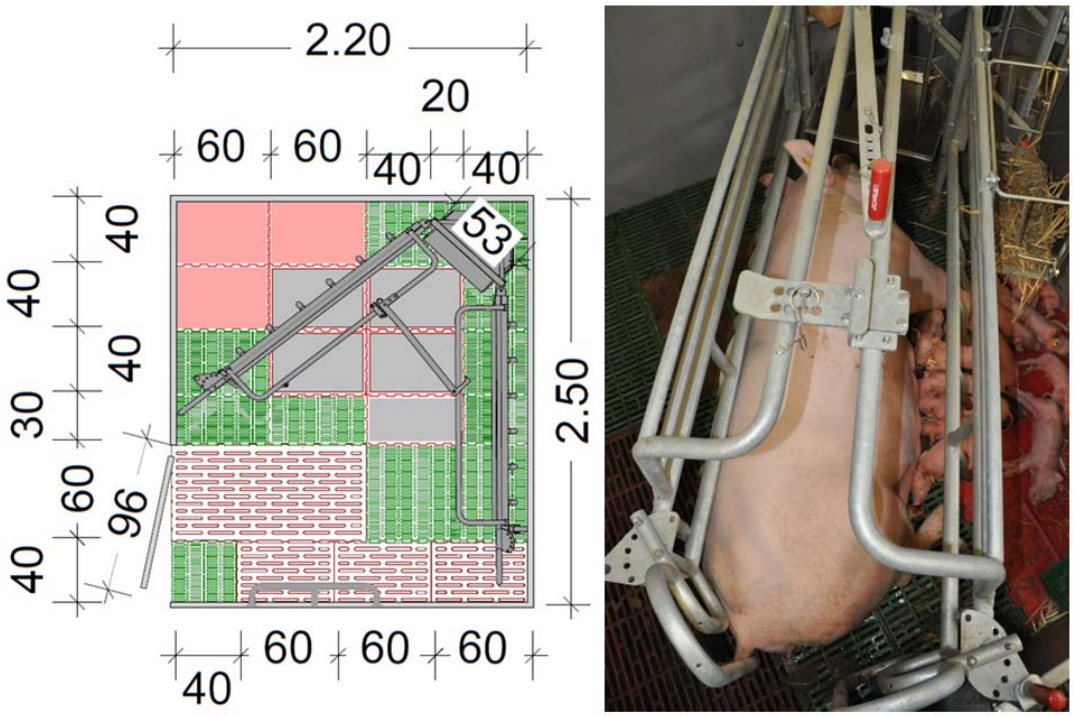

Figure 4: Trapez pen (Schauer Agrotronic GmbH, Prambachkirchen, Austria): plan of pen with open crate and photograph of sow in closed crate. Crate equipped with a wheel and a lever mechanism for adjustment in width and opening of the crate, flexible wings attached to the rear end for length adjustment. Lowest bars (distance to floor: 0.40 m) equipped with wave-shaped, diagonal pins directing towards the outside of the crate. Flooring: solid plastic floor (red, creep area), plastic slatted floor (green), cast iron slatted floor (white with red slats) and solid concrete floor (grey). Farrowing rail mounted to side wall of the pen.

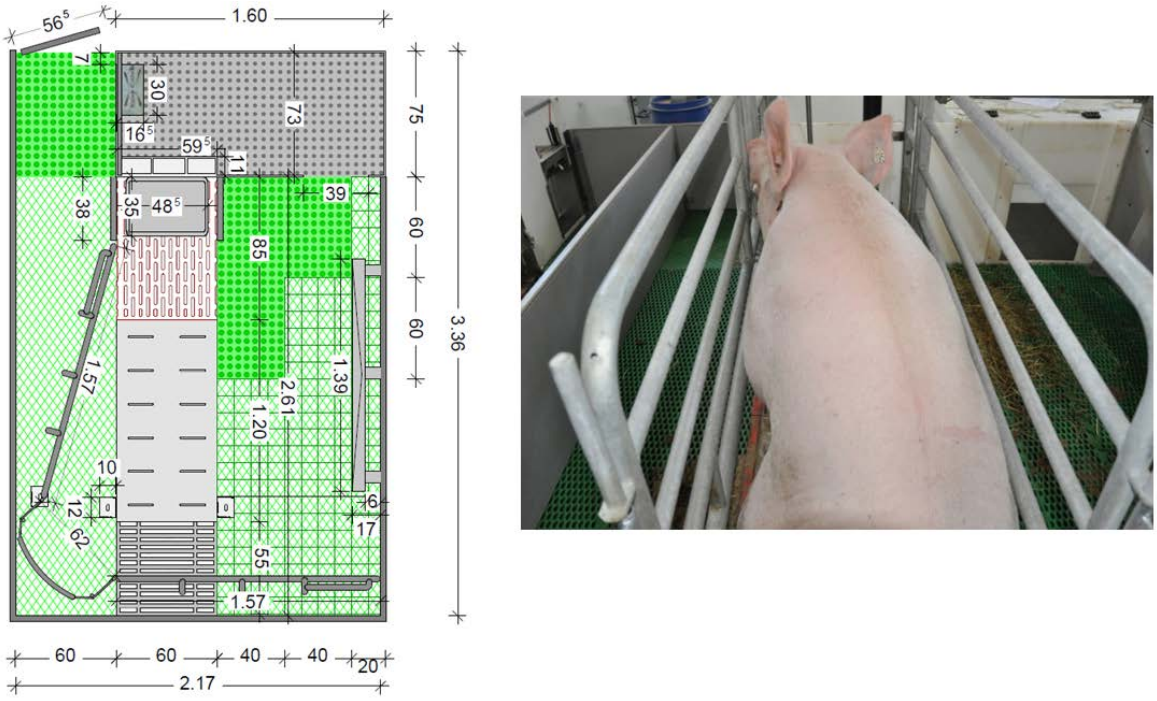

Figure 5: Pro Dromi pen (Vereijken Products B.V., Beek En Donk, Netherlands): plan of modified pen with open crate and photograph of sow in closed crate. Bars of open crate attached on one side to the construction of the trough, on the other to the side wall; both side elements of closed crate fixed to the trough construction (width: 0.62 m, not adjustable). Flexible element to close the crate rearwards. Lowest horizontal bars of the crate mounted at a height of 0.30 m with crate-outwardly directed diagonal pins and two brackets located close to the trough. Flooring: The original pen was equipped with solid metal flooring in the area in front of the trough that was determined as slippery and therefore exchanged at first to a chequer plate and then to minimally slatted solid concrete floor. Also parts of the original slatted floor were removed and replaced by a further developed version with surface profiling (Pro Grip ®) and solid plastic floor. Final floor version consisted of minimally slatted solid concrete floor (light grey), original plastic slatted floor (chequered green on the left), Pro Grip ® plastic slatted floor (chequered green with rectangles on the right), metal slatted floor with vertical slats (white with red slats), slatted iron cast (dark grey with slats), solid plastic floor (full green and dark grey in the creep area). Sloping wall mounted on one side wall.

Table 1 Prevalences and frequencies of all (modelled) parameters on Day 3 with total numbers of observations within aggregated scores or count measures (*) for all combinations of confinement period (CP) and pen-type (PT). Pen-types (PT): F: Flügel, K: Knick, P: Pro Dromi, S: SWAP, T: Trapez. CP 0-sows were not confined; CP 3-sows were crated postpartum for 3 days; sows in CP 4 and CP 6 were crated from a day prior to expected farrowing until day 4 and 6 postpartum, respectively. Total percentage of observations with score 1 indicated for each parameter and respective PT and CP.

		PT F		PT K		PT P		PT S		PT T		Total % score 1
		Score/count measure										
	CP	0	1	0	1	0	1	0	1	0	1	
Injuries head region	0	37	1	35	0	12	0	22	2	36	2	3.40
	3	39	4	28	3	13	3	25	0	35	2	7.90
	4	38	3	29	2	8	2	32	0	32	3	6.71
	6	41	5	33	0	8	0	25	1	43	2	5.06
	Total %		7.74		3.85		10.9		2.80		5.81	
Injuries neck	0	36	2	34	1	12	1	24	0	38	0	2.70
	3	43	0	27	4	10	3	24	1	36	1	6.04
	4	39	2	28	3	9	3	32	0	35	0	5.30
	6	45	2	32	1	9	0	27	0	44	1	2.48
	Total %		3.55		6.923		14.9		0.93		1.29	
Injuries back	0	34	4	31	4	7	6	23	1	37	1	10.8
	3	40	3	24	7	8	5	25	0	33	4	12.8
	4	38	3	24	6	9	3	27	5	34	1	12.0
	6	40	7	22	11	8	1	22	5	40	5	18.0
	Total %		10.1		21.7		31.9		10.2		7.09	
Shoulder sore	0	35	3	29	6	9	4	22	2	32	6	14.2
	3	37	6	28	3	11	2	23	2	31	5	12.2
	4	38	3	22	4	8	3	29	2	32	3	10.4
	6	44	1	28	1	7	2	25	1	35	8	8.55
	Total %		7.78		11.6		23.9		6.60		14.5	
Injuries body side	0	36	2	31	4	10	3	21	3	37	1	8.78
	3	38	5	28	3	5	8	22	2	34	3	14.2
	4	38	3	27	3	7	4	26	6	31	4	13.4
	6	42	4	29	4	6	2	18	7	42	3	12.7
	Total %		8.33		10.9		37.8		17.1		7.10	
Injuries udder region	0	25	13	23	11	11	2	16	8	30	8	28.6
	3	28	15	16	15	9	4	19	6	17	19	39.9
	4	19	22	17	13	6	6	20	11	23	12	43.0
	6	21	25	17	16	5	3	19	7	32	13	40.5
	Total %		44.6		43.0		32.6		30.2		33.8	
Number of injured teats*	0	14	24	22	13	7	6	17	7	24	14	43.2
	3	21	22	13	18	8	5	18	7	22	15	45.0
	4	7	34	12	18	5	7	17	14	15	20	62.4
	6	23	23	18	15	4	4	18	8	23	22	45.6
	Total %		61.3		49.6		47.8		34.0		45.8	
Number of partial/ missing teats*	0	37	1	32	2	12	1	24	0	36	2	4.08
	3	40	3	29	2	12	1	25	0	35	2	5.37
	4	40	1	29	1	10	2	30	1	34	1	4.03
	6	45	1	32	1	8	0	24	2	44	1	3.17
	Total %		3.6		4.69		8.70		2.8		3.9	

		PT F		PT K		PT P		PT S		PT T		Total % score 1
		Score/count measure										
	CP	0	1	0	1	0	1	0	1	0	1	
Injuries vulva	0	38	0	35	0	9	0	23	1	37	1	1.39
	3	41	2	31	0	11	0	25	0	37	0	1.36
	4	40	1	30	1	11	0	31	1	33	2	3.33
	6	47	0	32	1	8	0	27	0	45	0	0.63
	Total %		1.78		1.54		0.00		1.85		1.94	
Injuries legs	0	37	1	33	2	12	0	24	0	37	1	2.72
	3	38	5	28	3	11	2	22	2	36	1	8.78
	4	40	1	29	2	9	2	31	1	33	2	5.33
	6	42	3	31	2	8	0	26	0	43	2	4.46
	Total %		5.99		6.92		9.09		2.83		3.87	
Swell-ings hind legs	0	37	1	34	1	12	1	24	0	37	1	2.70
	3	41	2	31	0	11	1	25	0	35	2	3.38
	4	40	1	31	0	9	3	31	1	35	0	3.31
	6	46	1	33	0	8	0	26	1	45	0	1.25
	Total %		2.96		0.77		11.1		1.85		1.94	
Changes claw horn	0	37	1	31	4	8	3	22	2	35	2	8.28
	3	35	3	28	3	6	5	23	2	30	5	12.9
	4	38	2	26	5	7	3	28	3	32	1	9.66
	6	42	3	28	5	7	1	23	3	44	1	8.28
	Total %		5.59		13.1		30.0		9.43		6.00	
Lame-ness	0	37	1	34	1	11	2	24	0	38	0	2.70
	3	41	2	30	1	11	1	24	1	34	3	5.41
	4	39	2	31	0	7	3	29	3	35	0	5.37
	6	42	4	32	1	8	1	26	0	43	2	5.03
	Total %		5.36		2.31		15.9		3.74		3.23	