

# China's Pork and Poultry Production: Long-term Potential and Prospects

By  
**James R. Simpson**

Professor of International Agriculture, Ryukoku University, Japan and Professor Emeritus, University of Florida. [simpson@world.ryukoku.ac.jp](mailto:simpson@world.ryukoku.ac.jp) or <http://www.jamesrsimpson.com>

## Abstract

Total pork production in China is projected to increase from 42 million MT in 2000 to 57 million MT in 2030 during which time pig inventory is calculated to decline from 440 million head to 392 million head. The nation's production of poultry meat is projected to more than double, from 13 million tons in 2000 to 31 million tons in 2030. Inventory of all birds is calculated to decline from 4.4 billion birds to 4.3 billion over this 30 year period. The rationale for substantial pork and poultry meat production increases, yet declining inventories, is technology adoption and structural changes in the industry, and is the principal topic of this article.

**Key words: China, pig, pork, poultry, chickens, feedstuffs, trade, projections,**

The purpose of this article is to explain why—**technically**—China can potentially meet its long-term pork, poultry meat and hen egg requirements through domestic production. The term **technically** is crucial as the model used is not a trade or economics based one. Rather, the results are based on a computer program especially developed for long-term projections of animal inventories, feedstuffs requirements and feedstuffs availabilities. Explanation of the model, and projections for the beef sector are provided in Simpson, 2003. (Available at <http://www.china.wsu.edu/pubs/pub2003.htm>).

## Pig and Pork Projections

### Consumption and Production of Porcine Products

Pork is a relatively mature meat commodity in China, with per capita consumption expected to grow relatively little during the three decades spanning 2000-2030, from 33 kg to 38 kg, a 15 percent total increase over that 30 year period (Table 1). As a comparison, per capita consumption of pork in the EU15 averaged 45 kg in 2000 (averages of 1999-2001 are used in this paper), 54 kg in Germany, 18 kg in Japan, and 30 kg in the USA (Table 2).

Total meat consumption in China of 49 kg in 2002 is projected to reach 69 kg in 2030, a 41 percent increase. In contrast, per capita consumption of meat in 2002 was 88 kg in the EU15, 81 kg in Germany, 43 kg in Japan, and 122 kg in the United States.

Meat is only one part of the story, for freshwater fish and seafood consumption is also very important in some countries. Chinese consumed 25 kg of freshwater fish and seafood in 2000 bringing their total meat, fish and seafood consumption to 74 kg, while Japanese consumed a whopping 63 kg of fish and seafood for a total of 106 kg. Adding fish and seafood to meat brings the total to 114 kg in the EU15, 95 kg in Germany and 106 kg in the U.S. China's total meat, fish and seafood consumption is projected to increase from 74 kg in 2000 to 86 kg in 2010, 95 kg in 2020 and 103 kg in 2030.

The per capita projections indicate that by the time China reaches an economic level comparable to the EU15, Germany, Japan and the U.S., its total per capita consumption of meat, fish and seafood will be in line with them, although there will be differences in their diets. For example, in 2000 pork accounted for 44 percent of China's total meat, freshwater fish and seafood consumption, while it was 57 percent in Germany, 17 percent in Japan, and 21 percent in the U.S. (Table 2).

Total production of meat and eggs in China from 1985 to 2000, and projections to 2030, is provided in Table 3. Imports and exports (quite small) were held constant at 2000 levels in projections to make domestic feedstuffs requirements and availabilities comparable with that base year. Total meat production is calculated to grow 63 percent from 2000 to 2030 and, during that 30-year projection period, pork production to increase 36 percent, from 42 million tons to 57 million tons.

### Livestock Productivity

Remarkable growth has been recorded in China's livestock product production, and it is projected to continue for the foreseeable future, primarily because there is still great latitude for further progress in production efficiency and productivity. A multitude of technical variables such as dressing percent, live weight, offtake rates, and ration composition are taken into account in the model for livestock to explain and project animal numbers and feedstuffs requirements. Pigs are particularly complicated to the extent that 65 variables such as whether they are backyard or commercially raised, number born per litter, number of litters per year, weaning weights, time on feed by stage of feeding, death loss, etc., are included in the modeling.

Technological adoption has had, and will continue to have, a great impact on production of pork in China. In 1985 only 54 kg of pork was produced per pig in inventory (Table 4). By 2000 it had reached 95 kg, and it is projected to reach 145 kg by 2030. In comparison, the average in 2000 was 156 kg in Germany, 140 kg in the United Kingdom and 144 kg in the U.S. (Table 5). The projections in this paper are quite conservative given the significant technological advances being made worldwide and ones that will be made over the next quarter century. The historical relationship in productivity growth between China and the U.S. is striking (Figure 1). China's current level is where the U.S. was in 1970, and both countries follow parallel trend lines. Equally striking is that Japan's productivity grew very rapidly from the early 1960's to the late 1970's (when it was higher than the U.S.) but then declined and has remained at a lower level than the U.S. since 1990, largely due to low carcass weights and feeding practices.

Carcass weights of pigs in China have increased steadily, growing from 68 kg in 1985 to 77 in 2000 (Table 5). They are projected to continue increasing with most change taking place by 2020 when they reach 84 kg, somewhat lower than in the Germany and the U.S. currently, but considerably more than in Japan.

Offtake rates (the percent of pigs going to slaughter compared to inventory) in China are projected to increase from 124 percent in 2000, to 170 percent in 2030. As a point of reference, the rates for Germany and Japan were 169 percent in 2000, while they were 193 percent in the UK and 165 percent in the U.S. The rates are heavily influenced by carcass weights and age at slaughter.

Pig inventory in China grew from 319 million head in 1985 to 440 million head in 2000, a 38 percent increase in that 15 year period (Table 6). It is projected to increase to 455 million head in 2010 and then begin to decline as an increasing proportion is raised in commercial operations. By 2020 there should be a dramatic decline—to 403 million head—and then by 2030 down to 392 million head, about the same as in the early 1990s.

Shifts in agricultural structure, improved genetics, higher quality inputs and improved management are the main reasons that pork production per head of inventory is projected to increase from 95 kg in 2000, to 103 in 2010, 130 in 2020 and 145 in 2030 (Table 5). Modeling and review of a study by Simpson et al (1999) lead to an estimate that 36 percent of pork was produced by commercial farms in 2000. It is projected that proportion will increase to 47 percent in 2010, 77 percent in 2020 and 92 percent in 2030. The term "commercial" refers to operations other than "backyard" (those with 2-3 mature pigs). Included are "specialized" (typically 20-50 or 100 pigs) a term that came into being in the 1980s as private enterprise was encouraged. Currently,

the most appropriate classifications are very small (“backyard”), medium (“specialized”), and both large and very large. There are no regular surveys made on farms by inventory size.

### Feed Requirement Projections

There is a strong relationship between body condition and feed consumption. Animals on a maintenance diet consume relatively small amounts of energy and protein, but production per head of inventory is also low. Most pigs in China have traditionally been poorly fed. As time has passed a variety of management practices commensurate with improved diets and intake have been adopted that have increased production efficiency. Pigs and poultry particularly have benefited by improved quality and quantity in their diet due to their being raised in confinement.

Energy requirements for pigs will increase for the next 10 to 15 years as inventory increases, genetic level increases, a larger proportion are raised on commercial operations, body size increases, and they are fed at a higher plane of nutrition. Once an adequate level of nutrition is reached commensurate with the feeding strategy, the amount of energy and protein per kg of pork produced will decline.

Metabolizable energy (ME) requirements of China’s pigs are calculated to have been 660 billion Mcal in 2000, accounting for 42 percent of all animal and freshwater aquaculture raised fish requirements (Table 7). The ME requirements are projected to increase 38 percent over the 30 year period to 2030. Crude protein (CP) requirements of pigs are projected to grow slightly more, 44 percent between 2000 and 2030.

Total ME requirements of livestock and freshwater fish are calculated to grow 44 percent by 2030. Growth in CP protein requirements is larger than energy needs, increasing 55 percent by 2030.

### **Poultry Projections**

Chinese consume a relatively large amount of hen eggs so that per capita consumption is projected to only increase from 15.1 kg in 2000 to 16.5 in 2030, a 9 percent increase (Table 1). In contrast, per capita consumption of poultry meat is projected to double during that period, from 10 kg in 2000 to 21 kg in 2030. In comparison, poultry meat consumption in the EU15 was 21 kg in 2000 at which time it was 13 kg in Germany, 15 kg in Japan and an astounding 48 kg in the U.S. (Table 2).

China produced 2 million tons of poultry meat in 1985. By 2000 it had grown to 13 million tons, and is projected to reach 31 million tons in 2030 (Table 3). The nation produced 4 million tons of hen eggs in 1985, 20 million by 2000 and the projection is for 25 million tons in 2030.

Technology adoptions including shifts from backyard production to commercial operations and tie-ups with foreign companies are reasons why China has been so successful in rapid expansion of poultry production. An estimated 26 percent of layers and 30 percent of broilers were in commercial operations by 2000, and 32 percent of poultry meat was produced by those birds (Table 8). The evidence of success is that meat production per head of inventory increased from 1 kg in 1985 to 3 kg in 2000, and the projection is for 7 kg per bird (for meat and eggs) in inventory in 2030 (Table 4). At that time at least three quarters of inventory and meat production will be associated with commercial farms.

Energy requirements for poultry amounted to 154 billion Mcal in 2000, equivalent to 10 percent of all livestock and fresh water fish. Poultry ME requirements are projected to grow slightly, to 14 percent in 2030 (Table 7). Protein requirements will likely grow faster, from 12 percent of all requirements in 2000 to 19 percent in 2030.

### **Concluding Remarks**

It is important to realize that productivity will continue to increase in countries other than China, thus providing external sources of new technology in addition to current known technology and research. China is also carrying out its own rather ambitious biotechnology oriented program (Huang, et al, nd) leading to the conclusion that **technically** the country can very likely meet, and probably exceed, the projections in this article. Naturally serious concerns exist, such as whether China's economy will continue on a high growth rate (affecting both the demand and supply sides), success in reorganization of its rural economy, the extent to which it will be able to increase its livestock feed production, the influence WTO membership will have on trade, etc.

A key point is that accuracy in projections about China's agriculture depends on a good understanding of its agricultural structure (including policy, research, education, etc.), knowledge about international agriculture and technology, recognition that agriculture is a dynamic industry and not a static one, and that in many respects China is more like European agriculture than its East Asian neighbors to which it is often, and misleadingly, compared (Simpson, Cheng and Miyazaki, 1994). Indeed, proper structural specification has been a chronic problem in trade modeling leading to underestimation of China's ability to feed itself (McCalla and Revoredo, 2001).

It can be concluded that **technically** China will be able to meet its demand for pork and poultry products, and that inventories of pigs and poultry will even decline after 2010. Tuan, Cheng and Peng (2001) conclude that China also has production cost advantages in these commodities over potential competitors, or at least not severe cost disadvantages. In all likelihood, as explained in Simpson's 2003 WCC-101 paper, although protein based feedstuffs imports will continue to grow to meet the varied requirements of the entire food chain, China should not have to increase imports of energy feedstuffs. There will be imports and exports of pork and poultry meat for specialized needs such as certain parts of the hotel trade and some cuts for home use, but relative to China's size they will be small provided government adopts appropriate policy measures.

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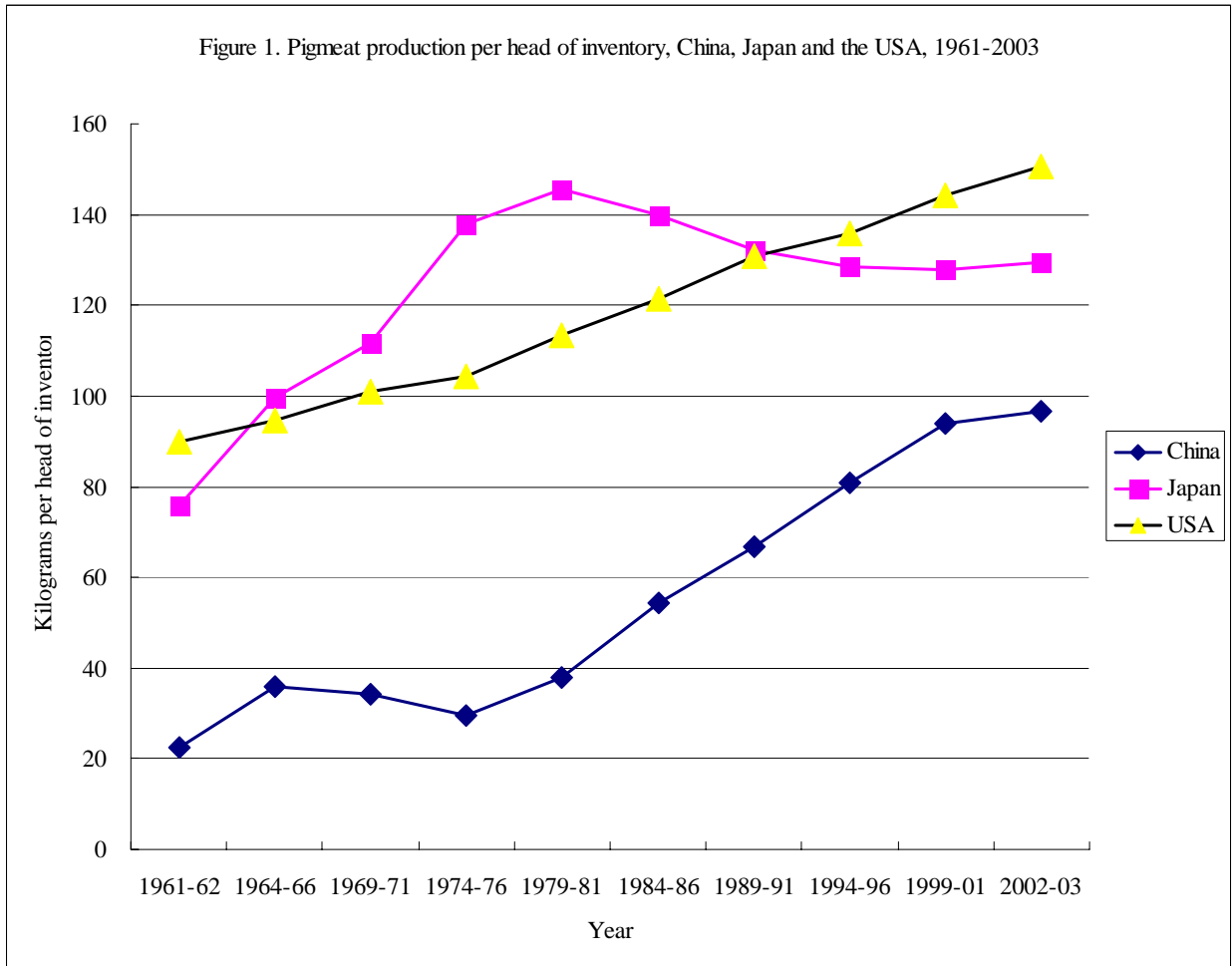


TABLE 1. PROJECTIONS OF PER CAPITA MEAT AND FISH SUPPLY, CHINA, ECONOMY ROBUST, 1999-2000 TO 2030

	COMPOUND ANNUAL GROWTH RATE			PER CAPITA MEAT, FISH AND SEAFOOD SUPPLY			
	2000-2010	2010-2020	2020-2030	1999-2001	2010	2020	2030
	-----PCT-----			-----KG-----			
BEEF AND VEAL	3.6	1.7	1.4	3.9	5.5	6.5	7.5
PORK	0.4	0.6	0.5	32.6	34.0	36.0	38.0
MUTTON AND GOAT	0.8	0.2	0.0	2.1	2.3	2.4	2.4
MUTTON AND LAMB	0.7	0.4	0.0	1.1	1.2	1.3	1.3
GOAT	0.9	0.0	0.0	1.0	1.1	1.1	1.1
BUFFALO MEAT	-2.2	-2.7	-6.7	0.3	0.2	0.2	0.1
TOTAL, RED MEAT	0.8	0.7	0.6	38.9	42.0	45.0	47.9
POULTRY	3.5	2.5	1.6	9.9	14.0	18.0	21.0
TOTAL MEAT	1.4	1.2	0.9	48.8	56.0	63.0	68.9
FRESH FISH & SEAFOOD (2)	1.8	0.6	0.6	25.0	30.0	32.0	34.0
TOTAL MEAT, FISH,SEAFOOD	1.5	1.0	0.8	73.8	86.0	95.0	102.9
MILK							
COW	1.4	4.1	5.2	7.0	8.0	12.0	20.0
GOAT	-0.1	0.0	0.0	0.2	0.2	0.2	0.2
BUFFALO	-1.7	-3.4	-7.3	2.1	1.7	1.2	0.6
EGGS, HEN	0.8	0.1	0.0	15.1	16.3	16.5	16.5

SOURCE: SIMPSON, MODELING RESULTS.

TABLE 2. PER CAPITA MEAT, FISH AND SEAFOOD CONSUMPTION IN CHINA AND SELECTED COUNTRIES AND REGIONS, AVERAGE, 1999-2001

COUNTRY	COMMODITY	KILOGRAMS	MEAT ONLY	MEAT, FISH
		PER CAPITA PER YEAR	PERCENT	& SEAFOOD PERCENT
CHINA	BOVINE MEAT	4.2	8.6	5.7
CHINA	MUTTON AND GOAT MEAT	2.1	4.3	2.8
CHINA	PIGMEAT	32.6	66.8	44.2
CHINA	POULTRY MEAT	9.9	20.3	13.4
CHINA	TOTAL MEAT	48.8	100.0	
CHINA	FISH, SEAFOOD	25.0		33.9
CHINA	TOTAL	73.8		100.0
EUROPEAN UNION (15)	BOVINE MEAT	18.9	21.6	16.6
EUROPEAN UNION (15)	MUTTON AND GOAT MEAT	3.3	3.8	2.9
EUROPEAN UNION (15)	PIGMEAT	44.5	50.7	39.1
EUROPEAN UNION (15)	POULTRY MEAT	20.9	23.8	18.4
EUROPEAN UNION (15)	TOTAL MEAT	87.6	100.0	
EUROPEAN UNION (15)	FISH, SEAFOOD	26.2		23.0
EUROPEAN UNION (15)	TOTAL	113.9		100.0
GERMANY	BOVINE MEAT	12.3	15.2	12.9
GERMANY	MUTTON AND GOAT MEAT	1.0	1.2	1.1
GERMANY	PIGMEAT	53.9	66.9	56.7
GERMANY	POULTRY MEAT	13.4	16.7	14.1
GERMANY	TOTAL MEAT	80.6	100.0	
GERMANY	FISH, SEAFOOD	14.5		15.2
GERMANY	TOTAL	95.1		100.0
JAPAN	BOVINE MEAT	9.5	22.3	9.0
JAPAN	MUTTON AND GOAT MEAT	0.2	0.5	0.2
JAPAN	PIGMEAT	17.7	41.5	16.7
JAPAN	POULTRY MEAT	15.2	35.7	14.4
JAPAN	TOTAL MEAT	42.6	100.0	
JAPAN	FISH, SEAFOOD	63.3		59.8
JAPAN	TOTAL	106.0		100.0
USA	BOVINE MEAT	43.6	35.7	30.4
USA	MUTTON AND GOAT MEAT	0.6	0.5	0.4
USA	PIGMEAT	30.1	24.6	21.0
USA	POULTRY MEAT	47.8	39.2	33.3
USA	TOTAL MEAT	122.0	100.0	
USA	FISH, SEAFOOD	21.4		14.9
USA	TOTAL	143.4		100.0

SOURCE: FAOSTATS, FOOD SUPPLY, LIVESTOCK AND FISH PRIMARY EQUIVALENT.

TABLE 3. TOTAL PRODUCTION OF MEAT AND FISH, CHINA, ECONOMY ROBUST, 1984-86 TO 2030

SPECIES	1984-1986	1989-1991	1994-1996	AVG 99-2001	2010	2020	2030
	-----1,000 MT-----						
BEEF AND VEAL	406	1,168	3,054	4,944	7,559	9,458	11,206
PORK	17,322	24,062	33,010	41,811	46,730	52,380	56,776
MUTTON AND GOAT	601	1,071	1,682	2,731	3,161	3,419	3,511
MUTTON AND LAMB	307	551	893	1,438	1,649	1,819	1,868
GOAT	294	520	789	1,292	1,512	1,601	1,644
BUFFALO MEAT	127	165	275	369	317	256	131
TOTAL, RED MEAT	18,456	26,465	38,021	49,855	57,767	65,513	71,624
POULTRY	2,092	3,855	8,279	12,671	19,242	26,190	31,376
TOTAL MEAT	20,548	30,321	46,300	62,526	77,009	91,703	103,000
EGGS, HEN	4,225	6,701	13,912	19,390	22,403	23,935	24,653

SOURCE: HISTORICAL DATA FROM FAOSTATS. PROJECTIONS FROM SIMPSON, MODELING RESULTS.

TABLE 4. PRODUCTION PER HEAD OF INVENTORY, CHINA, ECONOMY ROBUST, 1984-86 TO 2030

SPECIES	YEAR						
	1984-1986	1989-1991	1994-1996	AVG 99-2001	2010	2020	2030
	-----KG OF MEAT PER HEAD OF INVENTORY-----						
SHEEP	3	5	8	11	11	12	13
GOATS	5	5	6	9	9	9	10
CATTLE	6	15	31	47	61	77	87
BUFFALO	6	8	12	16	16	18	19
PIGS	54	67	81	95	103	130	145
POULTRY	1	2	2	3	4	6	7

SOURCE: HISTORICAL DATA FROM FAOSTATS. PROJECTIONS FROM SIMPSON, MODELING.

TABLE 5. INTERNATIONAL COMPARISON OF PIG DATA

	CHINA	ARGENTINA	GERMANY	JAPAN	UK	USA
-----KG-----						
PRODUCTION PER HEAD OF INVENTORY						
1984-1986	54	53	125	140	130	122
1989-1991	67	60	127	132	127	131
1994-1996	81	65	146	128	133	136
1999-2001	95	51	156	128	140	144
2010	103					
2020	130					
2030	145					
CARCASS WEIGHTS						
1984-1986	68	90	87	74	63	79
1989-1991	74	83	90	75	68	81
1994-1996	77	88	91	75	69	84
1999-2001	77	79	92	76	73	87
2010	79					
2020	84					
2030	85					
-----PERCENT-----						
OFFTAKE RATES						
1984-1986	79	59	144	189	195	154
1989-1991	90	72	142	177	188	161
1994-1996	106	74	160	171	192	162
1999-2001	124	65	169	169	193	165
2010	130					
2020	155					
2030	170					

SOURCE: HISTORICAL DATA FROM FAOSTATS. PROJECTIONS FROM SIMPSON, MODELING RESULTS.

TABLE 6. PIG INVENTORY AND PRODUCTION BY TYPE SYSTEM, CHINA, 1984-86 TO 2030

SPECIES	YEAR						
	1984-1986	1989-1991	1994-1996	AVG 99-2001	2010	2020	2030
-----PIG INVENTORY-----							
-----1,000 HEAD-----							
COMMERCIAL				154,134	204,594	302,370	356,833
BACKYARD				286,248	250,060	100,790	35,291
TOTAL	319,078	360,543	408,782	440,382	454,654	403,160	392,124
-----PERCENT-----							
COMMERCIAL				35	45	75	91
BACKYARD				65	55	25	9
TOTAL				100	100	100	100
-----PORK PRODUCTION-----							
-----PERCENT-----							
COMMERCIAL				36	47	77	92
BACKYARD				64	53	23	8
TOTAL				100	100	100	100

SOURCE: HISTORICAL DATA FROM FAOSTATS. PROJECTIONS FROM SIMPSON, MODELING RESULTS.

TABLE 7. METABOLIZABLE ENERGY AND CRUDE PROTEIN REQUIREMENTS BY SPECIES GROUPS, CHINA, ECONOMY ROBUST, 1999-2001 AND 2030

SPECIES	TOTAL REQUIREMENTS		PERCENT INCREASE FROM AVG 99-2001		SPECIES PROPORTION	
	ME	CP	ME	CP	ME	CP
	-MILLION MCAL-	-1000 MT-	-----PERCENT-----		-----PERCENT-----	
-----AVG 99-2001-----						
DRAFT/BEEF CATTLE	352,933	14,074			22.4	20.6
OTHER LARGE ANIMALS	134,344	5,407			8.5	7.9
TOTAL LARGE ANIMALS	487,277	19,481			30.9	28.5
SMALL RUMINANTS	124,315	5,678			7.9	8.3
PIGS	660,159	23,534			41.9	34.4
POULTRY	154,003	8,182			9.8	12.0
FISH, FRESH WATER	151,631	11,463			9.6	16.8
TOTAL	1,577,385	68,337			100.0	100.0
-----2030-----						
DRAFT/BEEF CATTLE	627,249	23,837	78	69	27.6	22.5
OTHER LARGE ANIMALS	90,029	4,262	-33	-21	4.0	4.0
TOTAL LARGE ANIMALS	717,278	28,100	47	44	31.6	26.5
SMALL RUMINANTS	154,837	7,103	25	25	6.8	6.7
PIGS	909,159	33,781	38	44	40.0	31.8
POULTRY	311,544	20,576	102	151	13.7	19.4
FISH, FRESH WATER	179,516	16,585	18	45	7.9	15.6
TOTAL	2,272,334	106,145	44	55	100.0	100.0

SOURCE: SIMPSON MODELING RESULTS.

TABLE 8. POULTRY INVENTORY AND PRODUCTION BY TYPE SYSTEM, CHINA, 1984-86 TO 2030

	YEAR						
	1984-1986	1989-1991	1994-1996	1999-2001	2010	2020	2030
<b>POULTRY INVENTORY</b>							
-----MILLION BIRDS-----							
EGG PRODUCTION (LAYERS)				2,966	2,817	2,300	2,008
MEAT ONLY (BROILERS)				1,443	1,958	2,298	2,289
CHICKENS	1,296	2,127	3,203	3,607	4,187	4,115	3,918
OTHER	290	431	711	802	588	483	380
TOTAL POULTRY	1,586	2,558	3,914	4,409	4,775	4,598	4,298
<b>POULTRY MEAT PRODUCTION</b>							
-----1,000 MT-----							
POULTRY MEAT PRODUCTION				1,744	2,025	1,887	1,879
LAYERS				626	4,775	4,599	4,298
BROILERS				10,928	17,216	24,303	29,497
TOTAL PRODUCTION	2,092	3,855	8,279	12,671	19,242	26,190	31,376
<b>POULTRY MEAT PRODUCTION BY SYSTEM</b>							
-----PERCENT-----							
POULTRY INVENTORY							
LAYERS, (MATURE HENS ONLY, ALL KINDS) (1)							
MATURE AND IMMATURE FOR EGG PRODUCTION							
COMMERCIAL				26	36	60	77
BACKYARD				51	50	28	12
OTHER (2)				22	15	13	11
TOTAL, ALL LAYERS AND PULLETS				100	100	100	100
BROILERS							
COMMERCIAL				30	38	58	75
BACKYARD				60	53	34	18
OTHER (2)				10	9	8	7
TOTAL, BROILERS				100	100	100	100
POULTRY MEAT PRODUCTION (LAYERS, BROILERS, OTHER)							
COMMERCIAL				32	42	61	76
BACKYARD				47	42	26	13
OTHER				20	16	13	10
TOTAL PRODUCTION				100	100	100	100

(1)MATURE LAYERS IN PRODUCTION. (2) OTHER IS DUCKS, GEESE AND TURKEYS. SOURCE: SIMPSON MODELING RESULTS.