Instituto Agronómico Mediterráneo de Zaragoza
Mediterranean Agronomic Institute of Zaragoza

'Precision Livestock Farming'
(1st edition)

1. Livestock production today:
1.3. The Mediterranean scenario

Gerardo CAJA
gerardo.caja@uab.es
G2R, Departament de Ciència Animal i dels Aliments, Universitat Autònoma de Barcelona (Bellaterra, Spain)

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CIHEAM

Mediterranean and CIHEAM's countries scenario

Human population: 430 × 10^6 head

Animal populations[1]:

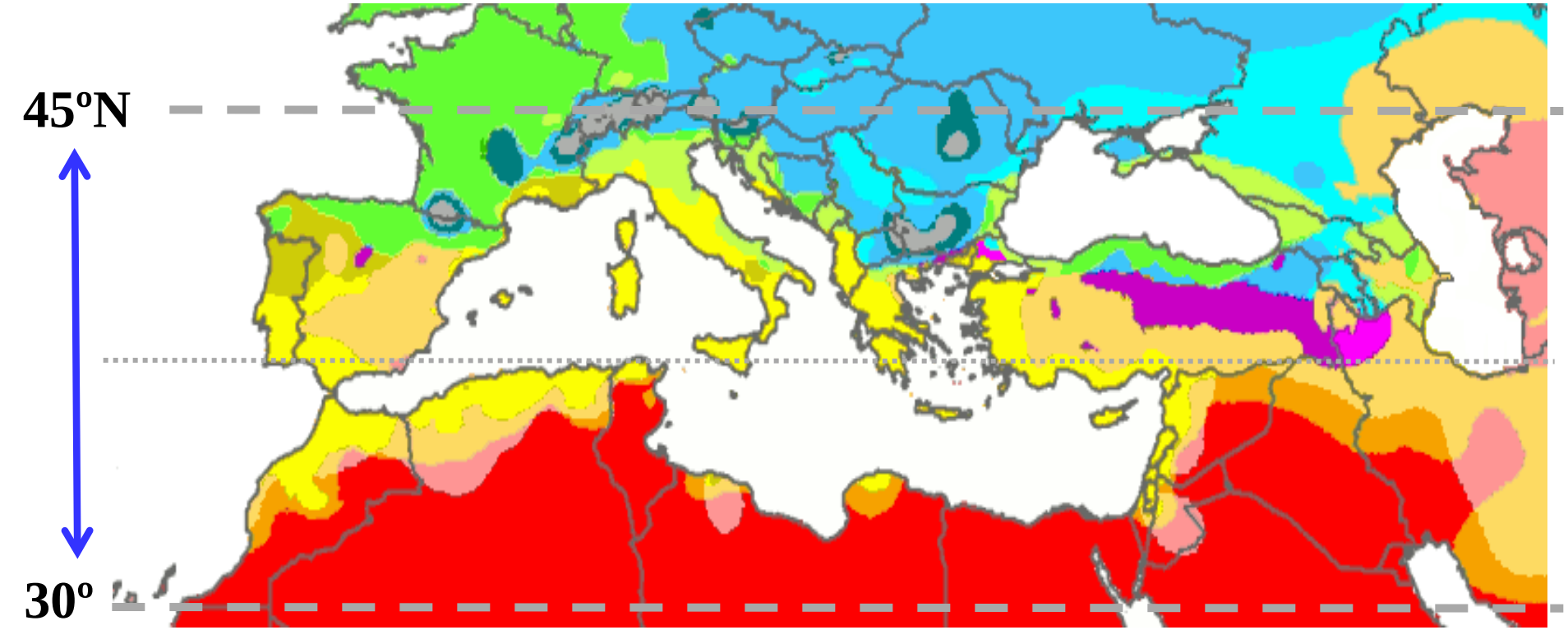
Species	× 10^6	LSU[2]	LSU×10^6
Cattle	57.6	0.8	46.1
Pigs	51.0	0.3	15.3
Sheep	122.6	0.1	12.3
Buffaloes	4.6	0.7[3]	3.2
Goats	26.0	0.1	2.6
Camels	0.6	0.5[3]	0.3
Chicken	1,031.7	0.007	7.2

Total = 87 × 10^6 head

[1]FAOstat (2015); [2]Livestock units: 1 LSU = 1 dairy cow (Eurostat, 2014); [3]Personal estimations.

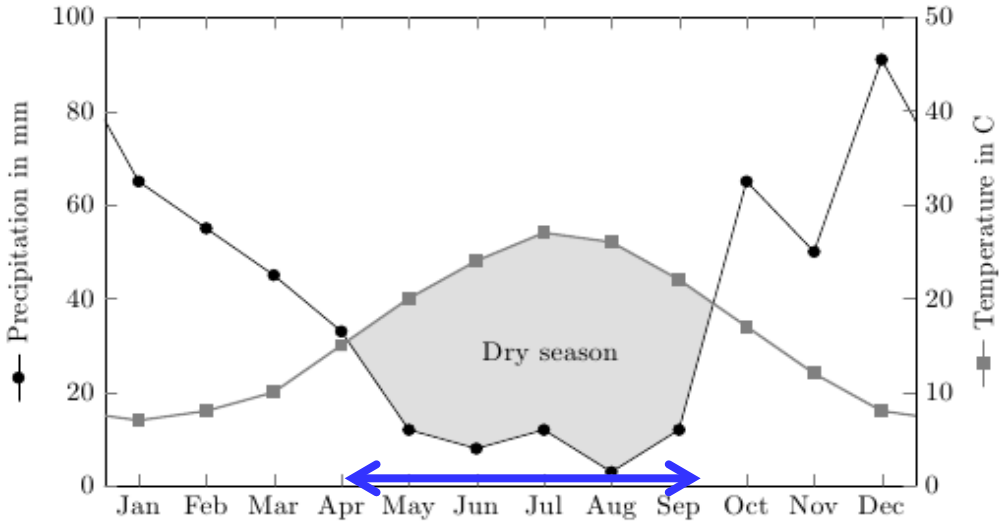
Mediterranean scenario: 1. Latitude and climate

- **Mediterranean** climate = **"Dry-summer subtropical"** climate (Köppen-Geiger)
  Codes: **Csa** and **Csb**
  Mean monthly temperature (T_m):
  C, T_m>10ºC in the warmest/20 to -0ºC in the coldest
  a, warm (warmest T_m >22ºC, at least 4 mo T_m>10ºC)
  b, fresh (warmest T<22 ºC, at least 2 mo T_m>10ºC)
  s, dry summer (< 40 mm/mo)
- **Photoperiod** (longitudinal axis) 30-45ºN



Mediterranean scenario: 2. Water, temp. and light

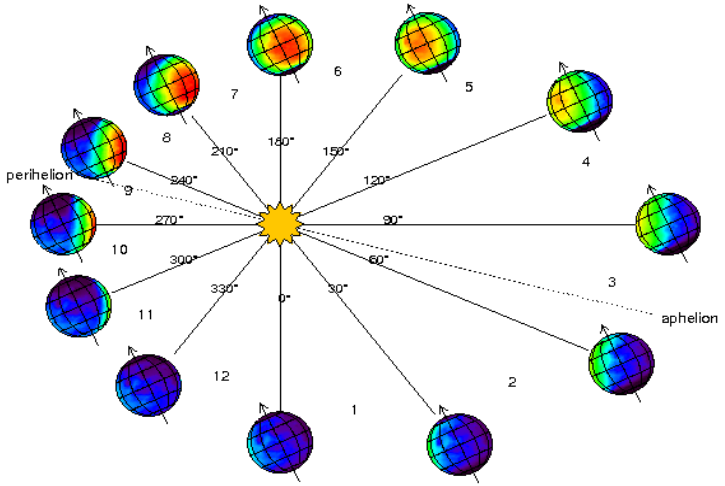
- **Ombrothermic diagram:** dry summer period (P, mm = 2T, ºC)

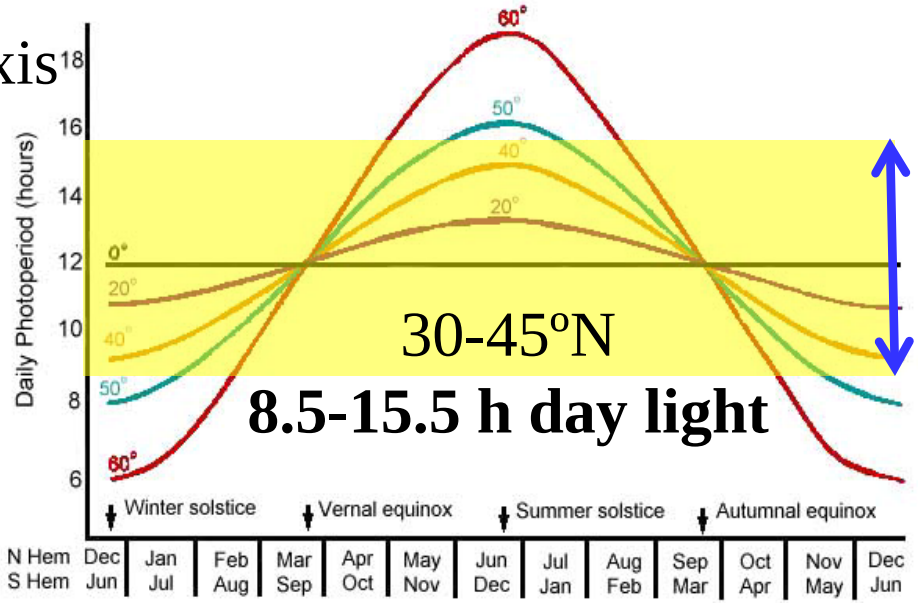


Liodakis et al. (2011)
National Park of Parnitha (38ºN, 23.5ºE)
(Thrakomacedones, Greece)

Water scarcity the main limitation.

- **Photoperiod:** 15º longitudinal axis





Mediterranean scenario: 3. Natural resources

- **Land:**
  - **Eroded (overgrazed) and poor in organic mater**
  - **Steep and mountainous areas (isolating factor)**
  - **Highly fragmented ownership**
  - **Competing with construction (cities and residential areas)**
- **Water:**
  - **The first production factor**
  - **Salinization of water resources**
  - **High cost of irrigation (deep wells, high evaporation…)**
  - **Compromised by climate change**
- **Live resources:**
  - **High biodiversity in livestock and wild species**
  - **High risk of summer fires**
  - **Conflict with wild carnivores (vulture, wolf, bear)**
  - **Wild animal borne diseases**

Mediterranean scenario: 4. Socio-cultural

- **Diversity:**
  - **Demography**
  - **Economical development and investment**
  - **Infrastructures and industrialization**
  - **Access to modern technologies**
  - **Traditional practices**
  - **Education**
  - **Religion**
  - **Politics**
- **Tourism:**
  - **Main national industry in many countries**
  - **Tourism localization in dense areas**
  - **Increasing price factor (salaries, land, foods…)**
  - **Development factor**
  - **Disappearance of traditions**

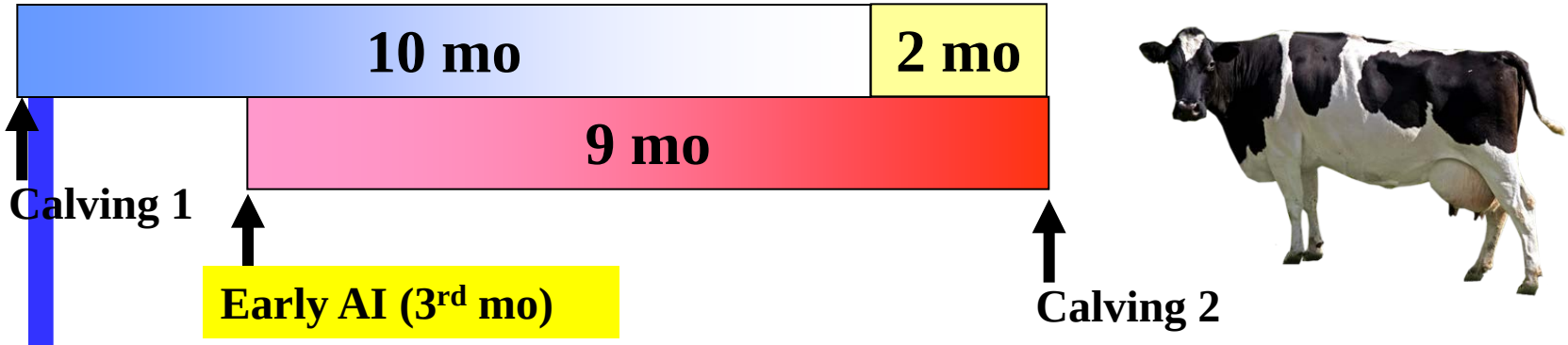
Mediterranean scenario: livestock production systems

- **Consequence of previously indicated diversity**
  - **Livestock species and breeds**
  - **Market practices (Slaughtering weights)**
- **Production systems:**
  - **Traditional:**
    - **Extensive or semi-extensive**
    - **Low inputs and outputs**
    - **High resilience**
    - **Supported by EU labels (PDO)**
    - **Oriented to “organic and functional foods”**
  - **Modern:**
    - **Intensive or semi-intensive**
    - **High inputs and outputs**
    - **Oriented to “high yield and standardized quality”**
    - **Sensitive to LPF**

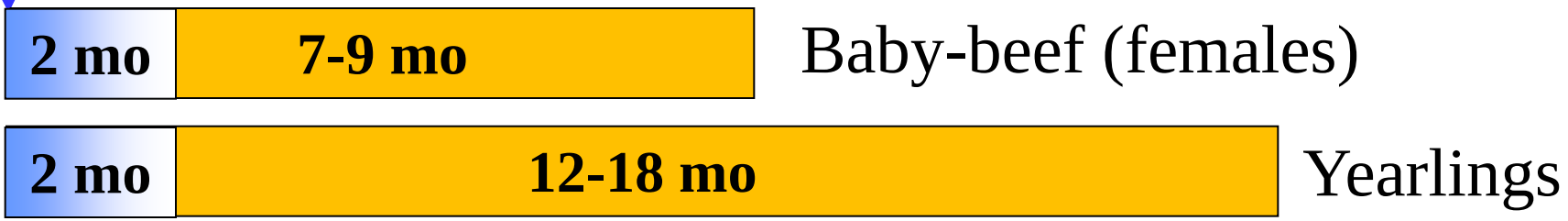
Production cycles: 1. Dairy cows and calves

Pregnancy (9 mo)	Lactation (8-24 mo)	Dry

A) Standard (CI = 12 mo): 1 calving/yr

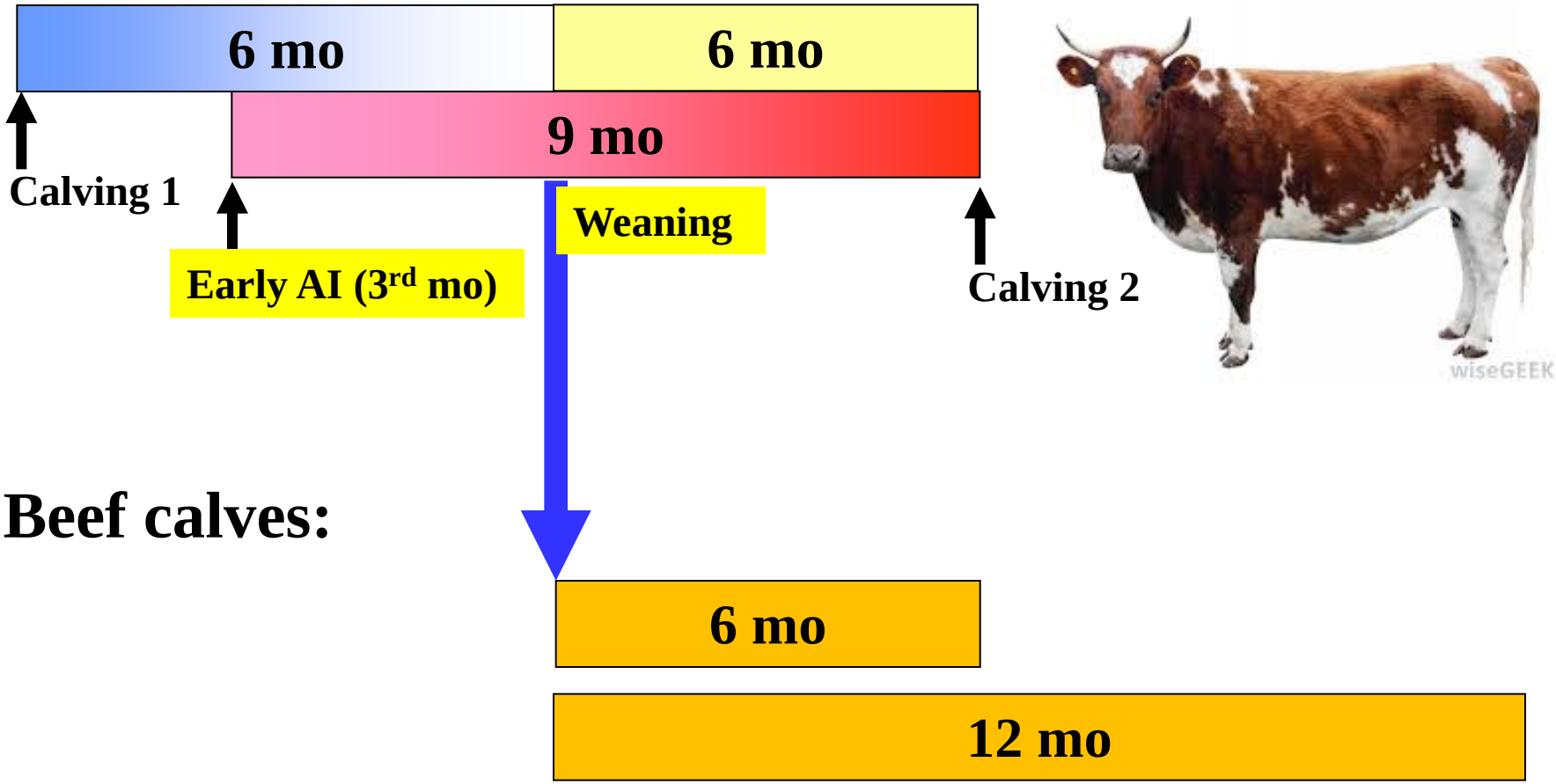


Dairy calves: Artificial rearing



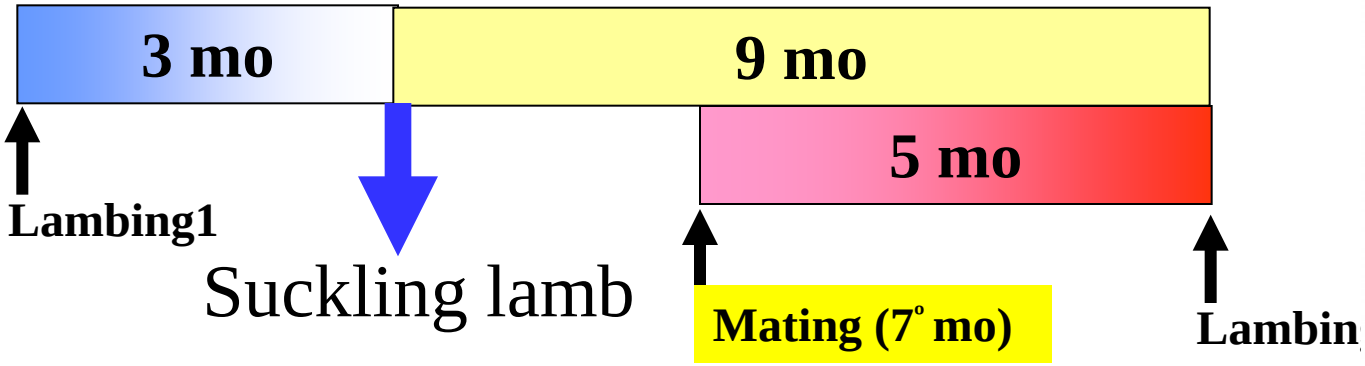
Production cycles: 2. Beef cows and calves

A) Standard (CI = 12 mo): 1 calving/yr

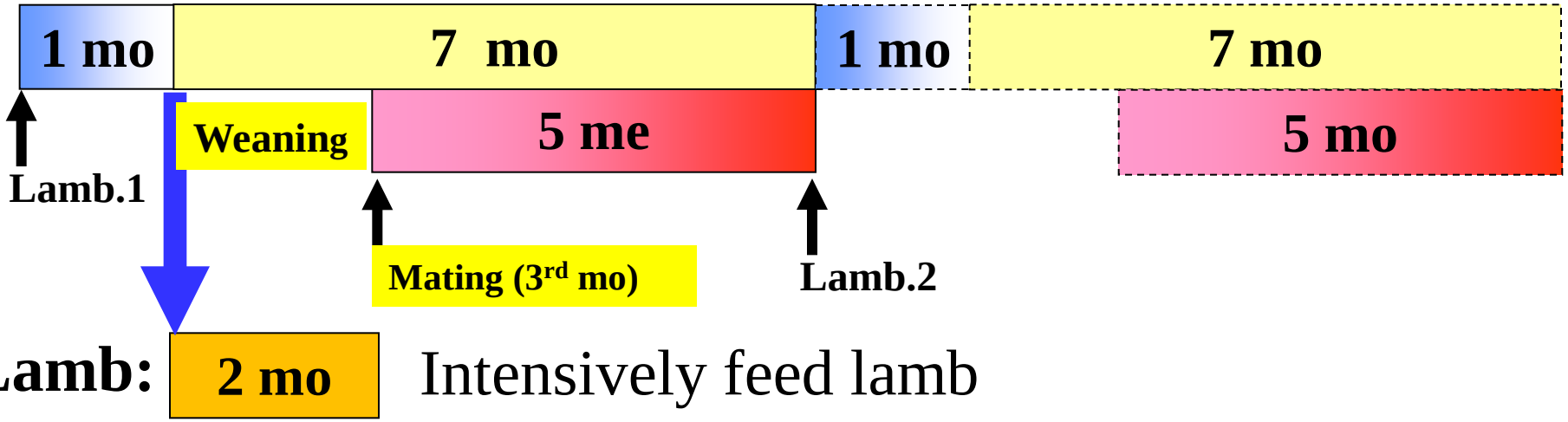


Production cycles: 3. Meat & wool sheep

A) Standard (LI = 12 mo): 1 lambing/yr

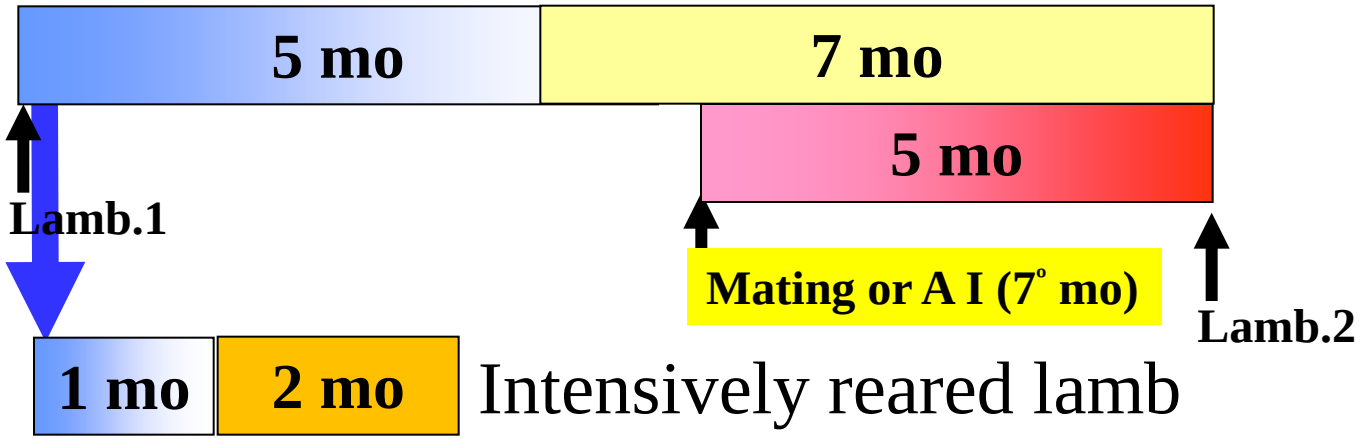


B) Accelerated (LI = 8 mo): 1.5 Lambing/yr



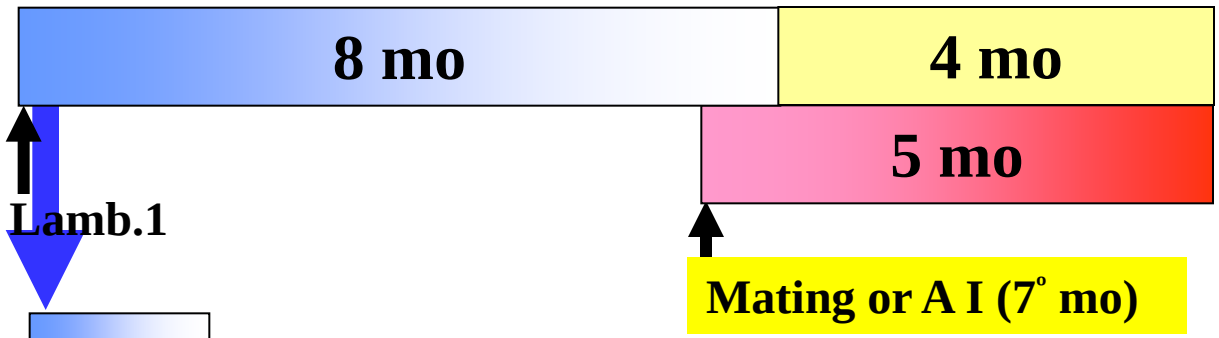
Production cycles: 4. Dairy sheep

A) Standard (LI = 12 mo): 1 lambing/yr



Intensively reared lamb

B) Extended lactation (LI = 12 mo): 1 lambing/yr

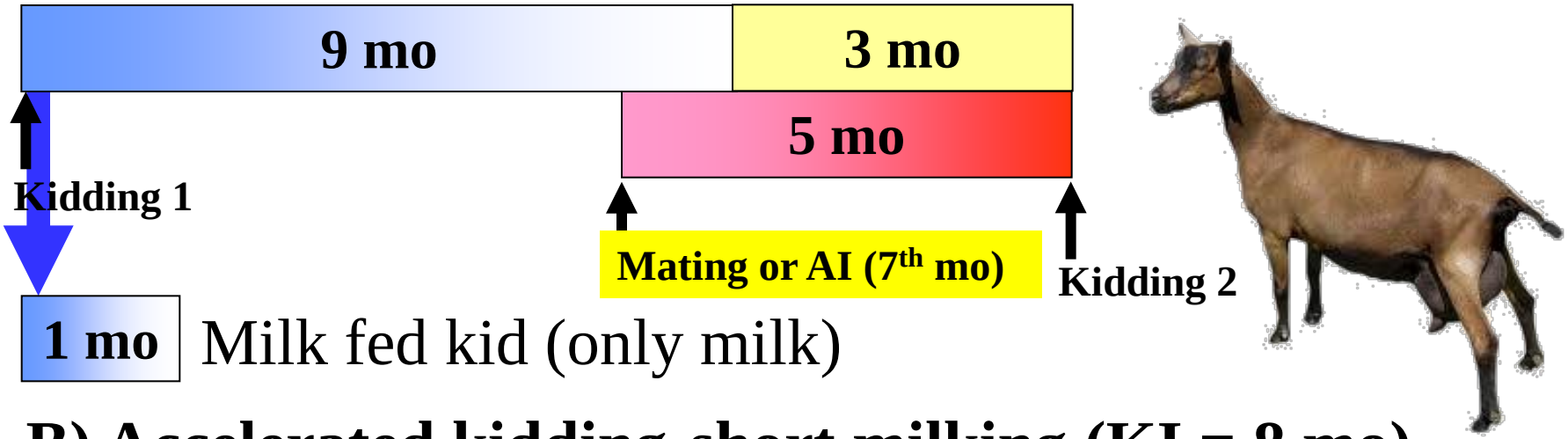


Milk fed lamb (milk only)

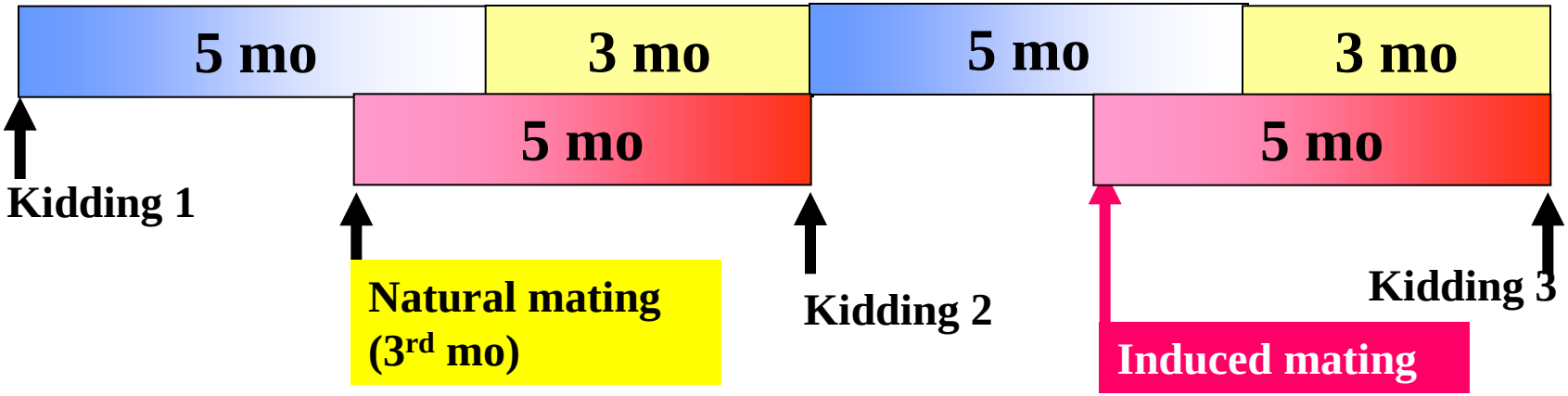
Production cycles: 6. Dairy goats

Pregnancy (5 mo)	Lactation (7-10 mo)	Dry (2-5 mo)

A) Standard (KI = 12 mo): 1 kidding/yr



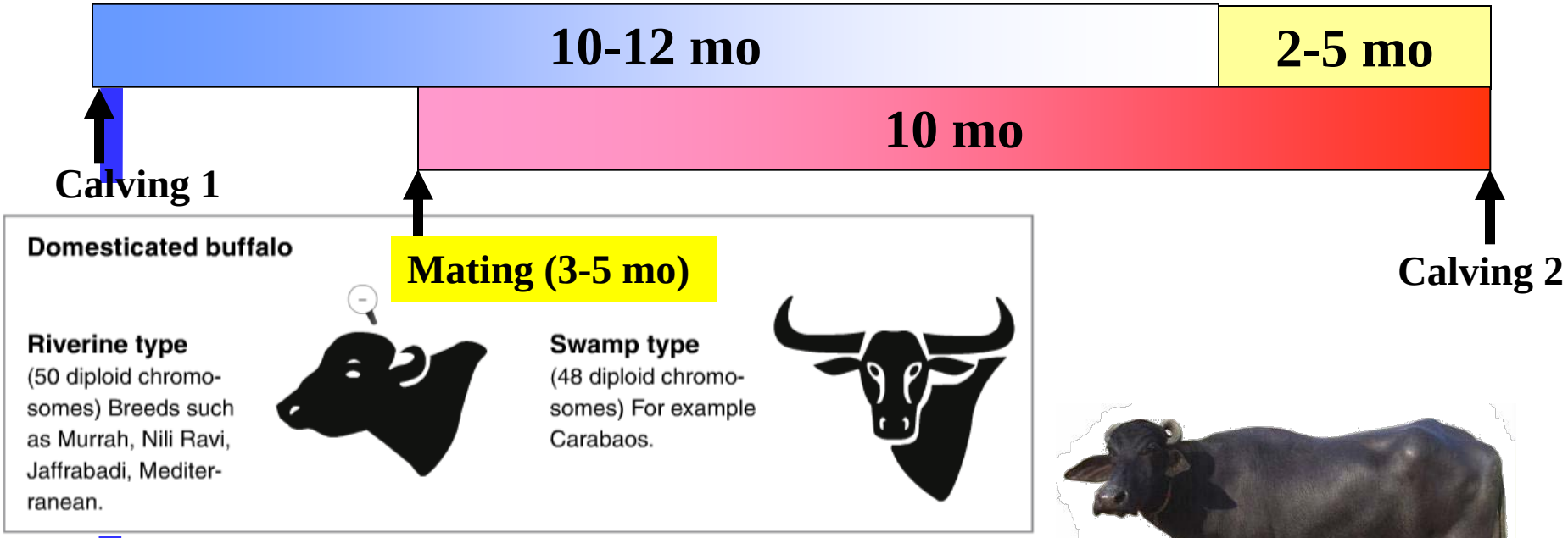
B) Accelerated kidding-short milking (KI = 8 mo)



Production cycles: 7. Dairy water buffalo (*Bubalus arnee*)

Pregnancy (10 mo)	Lactation (7-10 mo)	Dry (2-5 mo)

A) Standard (CI = 13-15 mo): ~ 0.8 calving/yr



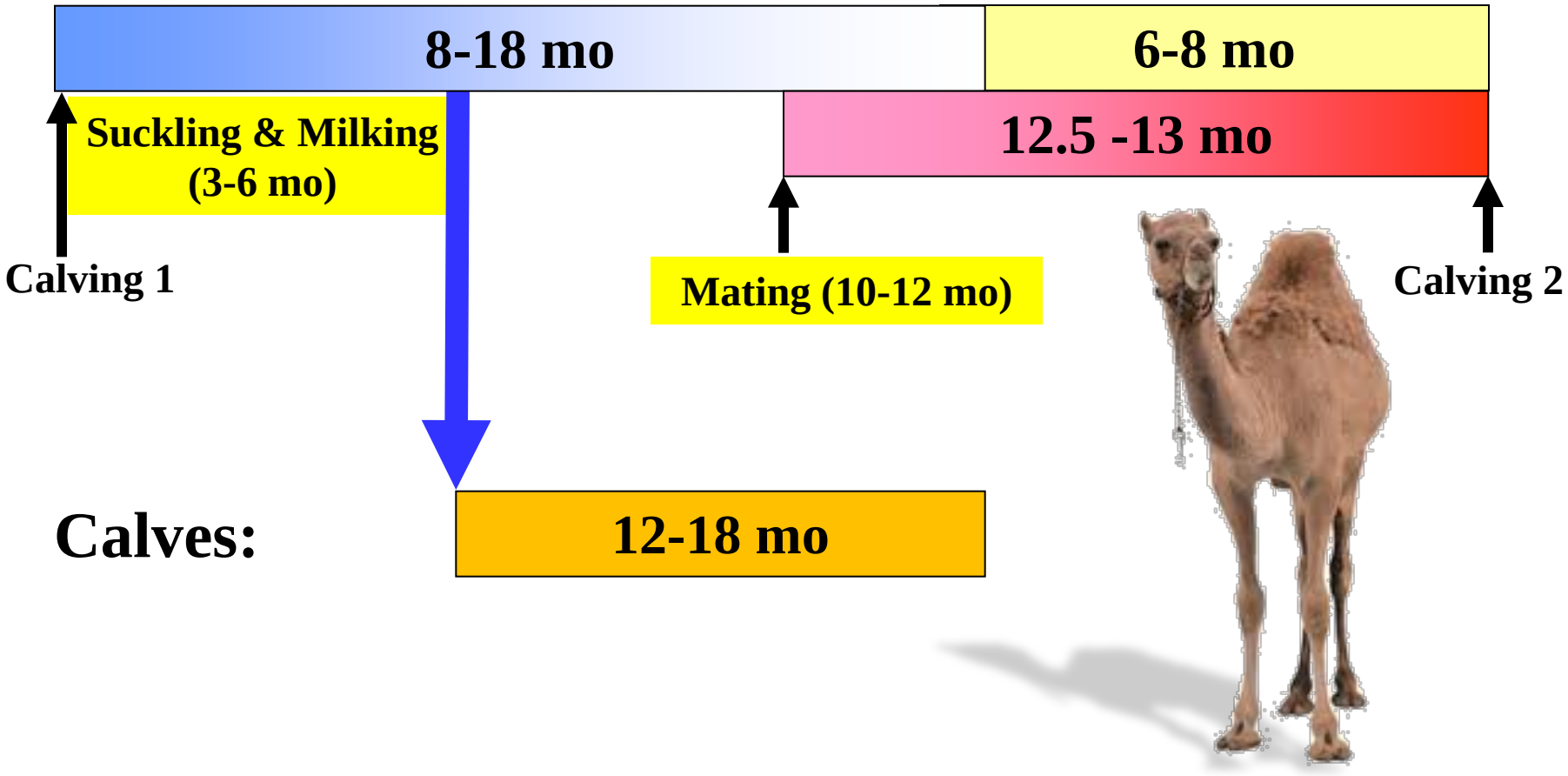
Calves:

2 mo	8-10 mo

Production cycles: 8. Dairy camel (*Camelus dromedarius*)

Pregnancy (12-13 mo)	Lactation (8-18 mo)	Dry (6-8 mo)

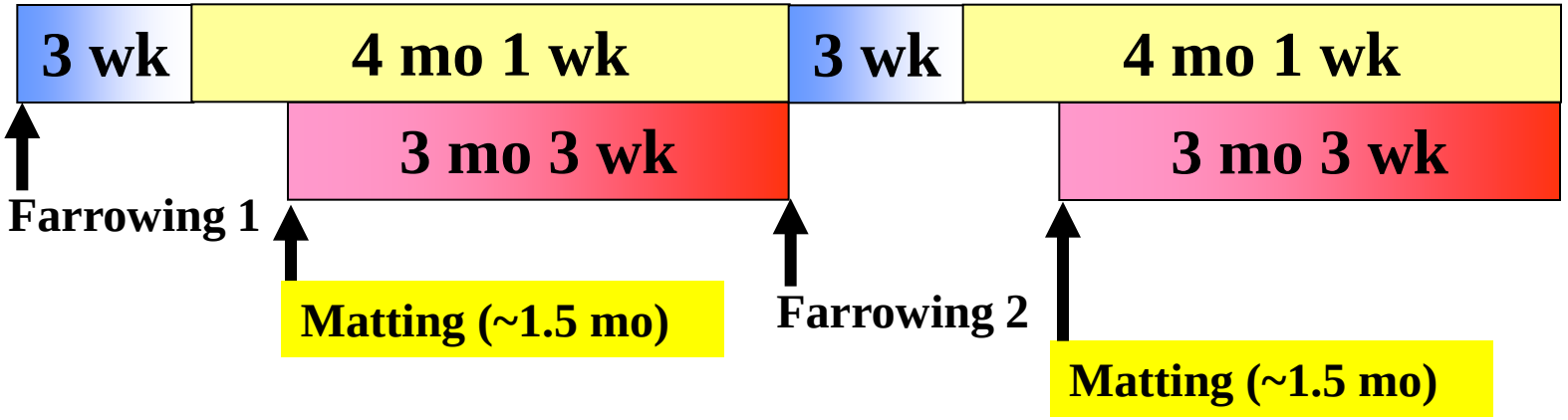
A) Standard (CI = 24 mo): ~ 0.5 calving/yr



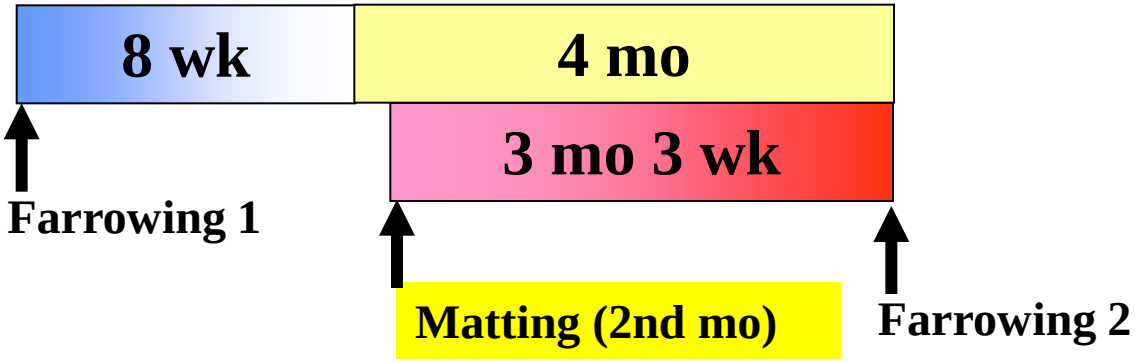
Pigs: Mediterranean intensive *vs*. extensive

Production cycles: 9.1 Pigs intensive *vs.* extensive

A) Intensive (FI = 5 mo): 2.4 farrowings/yr



B) Extensive (FI = 6 mo): 2 farrowings/yr



Production cycles: 9.2 Pigs intensive *vs.* extensive

Fattening period:

A) Intensive (6-7 mo): 70-90 kg BW

3 wk	6 mo

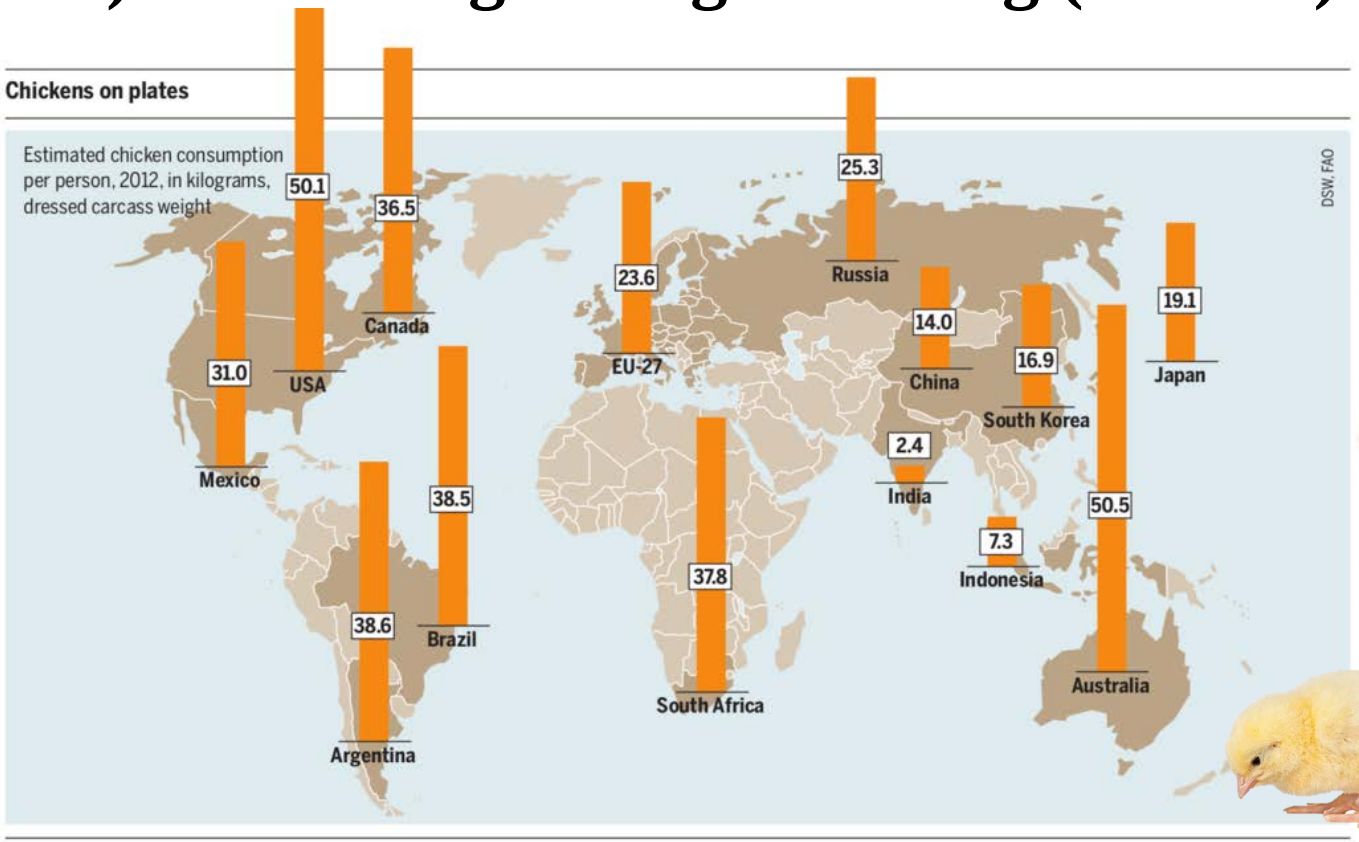
B) Extensive (12-24 mo): 180 kg BW

8 wk	12-24 mo	"Montanera"

Finishing in "Dehesa"
(*Quercus ilex* sweet acorns)

Production cycles: 10. Intensive chicken

A) Standard growing-fattening (1.5 mo): 2.0 kg BW

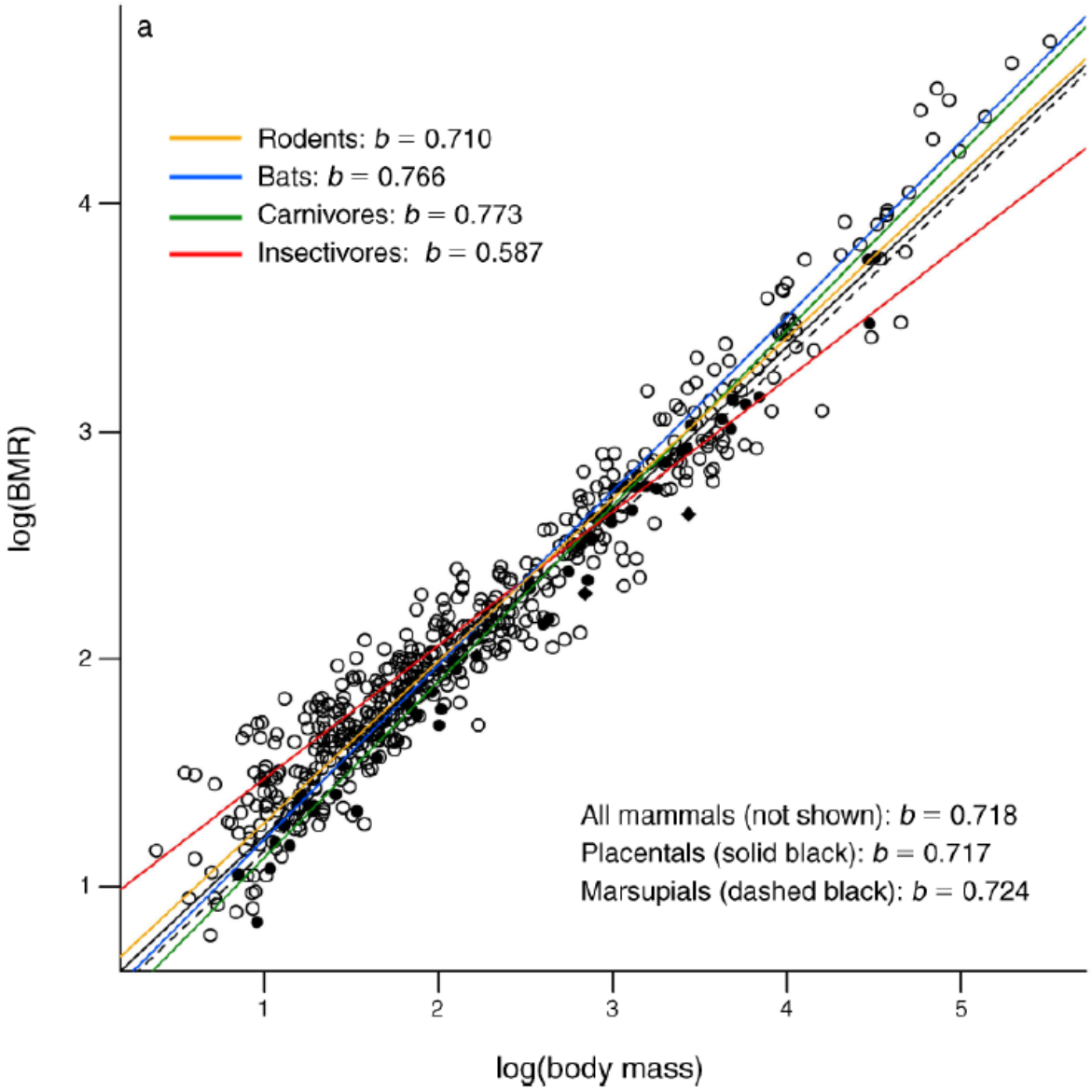


Physiological traits

Trait	Cattle	Pig	Sheep	Buffalo	Camel	Chicken
Temp., ºC	38.5	39.0	39.5	38.2	34-40	40-43
Resp., bpm	10-30	8-18	12-20	10	11	15-30
Heart, bpm	60-70	60-80	70-80	50-60	30-50	220-360
Longevity, yr	22	25	19	45	40	15
Pregnancy, d	278	114	148	300	390	21[1]
Estrus, d	21	21	16	21	19	-
Blood cells:						
Red, $\times 10^6$	5-8	5-8	9-13	5-8	5-9	2-3
White, $\times 10^3$	9				6-13	12-25
Glucose, mg	50	90	40	60	120	180

[1]Incubation; [2]mg/100 mL.

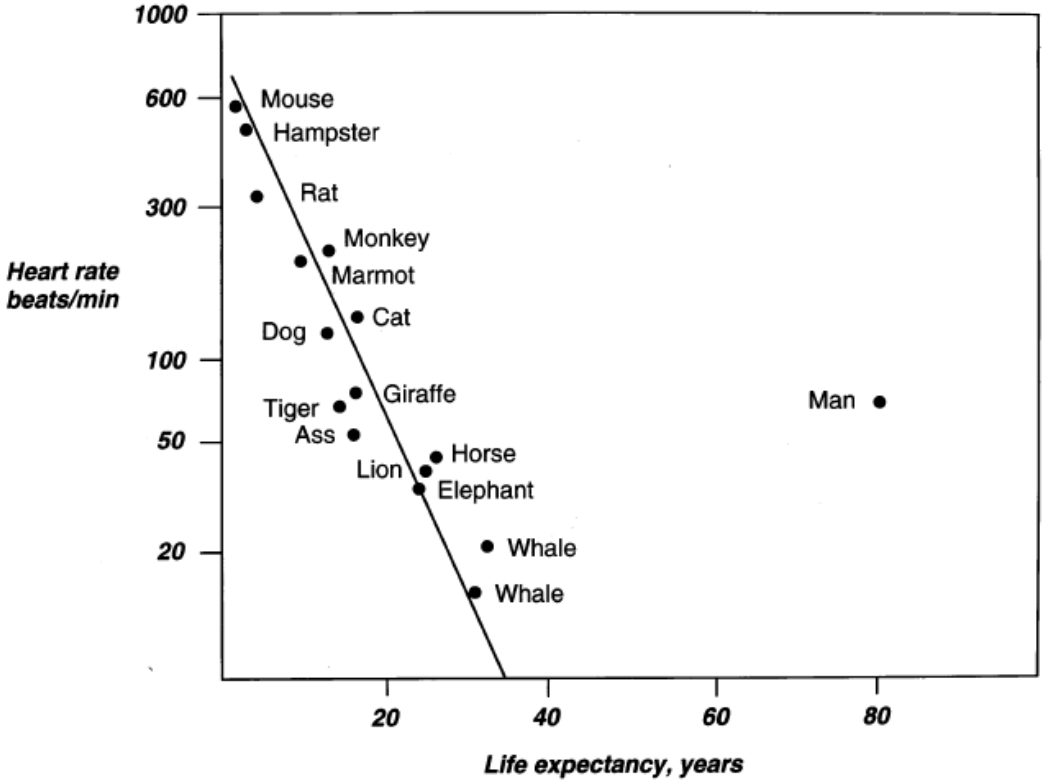
Physiol. relationship: Basal metabolic rate

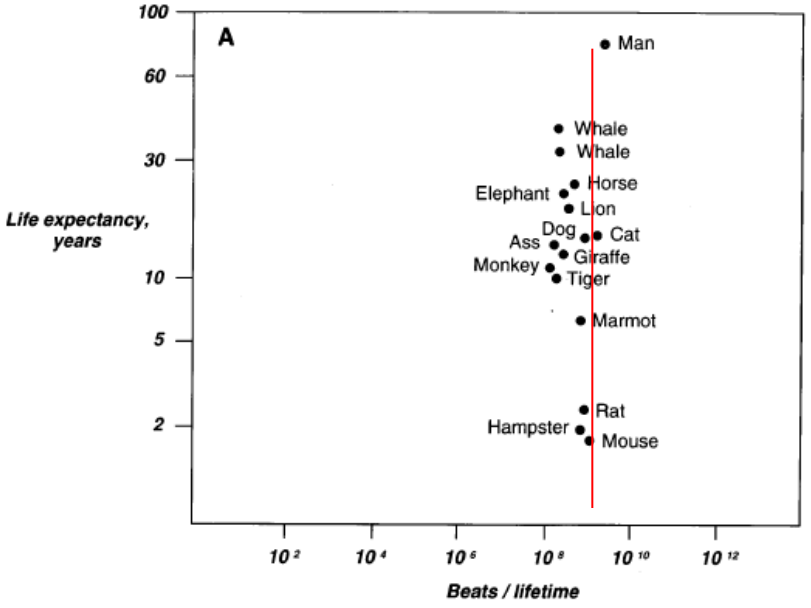


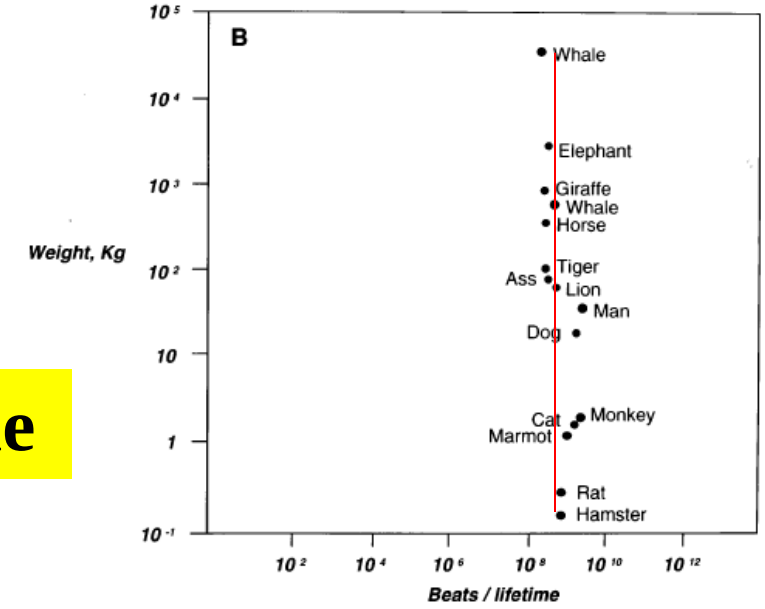
Capellini et al. (2010)

Physiol. relationship: Longevity vs. heart rate

Levine (1997)







Average = 10×10^8 beats/lifetime

(10^{-8} O_2 molecules/heart beat)