The Preparation of Farm and Production Plans for Aquaculture

Definition

- Aquaculture: The Production of Aquatic Organisms in controlled environments
- Aquaculture manager: A person capable of preparing and implementing optimal production plans for aquaculture

Aquaculture management

- Aquaculture management differs according to:
  - Species
  - Environment
  - Intensity of culture
  - Means of production

Preparation of aquaculture projects

- Requires the collaboration among:
  - Marketing experts
  - Econimists
  - Aquaculturist

Business environment

- Trends (Global, Local)
- Trade barriers and customs
- Supply
  - Quality of products
  - Quality control
  - Customers preference
- Periodicity (continuous, seasonal)

- **COMPETITORS**

They are always there, right behind your shoulder!

Find out what they are and be one step ahead of them!

Information gathering

- Evaluate local potential of production
- Identify: business opportunities
  - localities for development
  - required means of production
  - constraints on means of production
  - potential production strategies

Defining aims

- Define:
  - Quantitative parameters
  - Qualitative parameters
  - Timing
  - Organizational

what, when, where, how, who

Essential means of production

- Land
- Water
- Manpower
- Equipment and materials
- Budget

Land

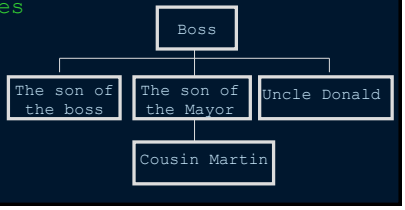
Information	Uses
Locality	Construction of:
Ownership	– ponds
Quality of soil	– Roads
Municipal regulation	– Building
Environmental regulation	– Drainage

Water

Quality	Salinity
	Pollution
	Chemical composition
Quantity	Limited
	Unlimited
Availability	Continuous
	Seasonal

Manpower

- Availability
- Professional qalifications
- Training
- Salaries

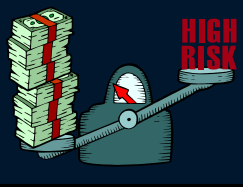


Equipment and materials

- Nets
- Vehicles
- Aereted transportation tanks
- Grading equipment
- Refrigerated storage facilities
- Chemicals
- Feeds…

Budget

- Big or small enterprise
- Maximum profit strategy
- Risks



Production strategies

- What for?
- To enable the optimal use of all means of production required to realize the aims of a project
- Allow optimal and continuous availability of products

Time period

- Relation between the Growth Period (GP) and Marketing Period (MP)
- Options:
  - GP = MP= 52 weeks (1 year)
  - GP < MP < 52 weeks
  - GP > MP < 52 weeks

Culture phases - definition

- **Reproduction:** proliferation of fish in culture. Reproduction is either done naturally in pond condition or induced in controlled facilities
- **Nursuring:** A growth period at the end of which fish in culture are not of a marketable weight.
- **Growout:** A growth period at the end of fish in culture are of marketable weight.

Compilation of data

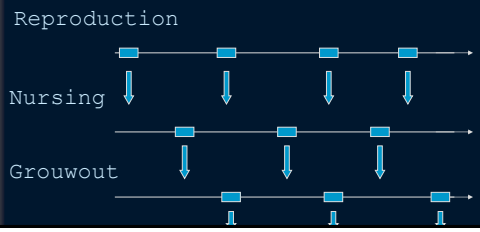
- **Establish:**
  - Total production target(s): TP
  - Expected survival rates: (s%)
  - Total no. of fish: (x)
  - Culture cycles annum (seasons) c = 0,-1,-2..
  - Expected annual yields (AY)
  - Average daily increment (i)
  - Optimal stocking density (OSD)
  - Optimal biomass in storage (OSB)

Evaluation of pond area

- **Factors affecting individual pond area**
- Marketing strategy
  - Seasonal
  - Continuous
- Indoor or outdoor production systems
- Acquisitions,(catching) or local production of seeds
- Monoculture or polyculture

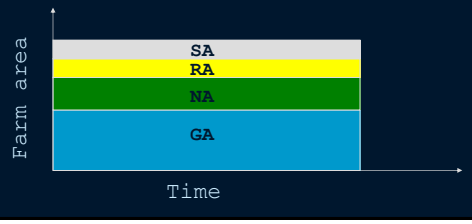
GP= MP = 52 weeks = 1 year

- Main characteristic: WO = WS
- Weekly output = Weekly sales



Allocation of farm area

- When: MP = GP = 52 weeks
- TA = RA + NA + GA + SA
- **Total Area = Repro.+ Nur.+ Grwt.+ Storage**



Evaluation of pond area (a)

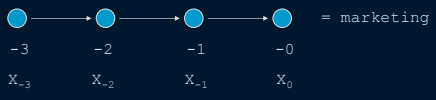
Growthout pond area: (GA)

- Since: TP = GA x AY
- Total production = Growout area x annual yield (total growout per year)
- GA = TP/AY

Example: TP = 100000 kg
AY = 3000 kg/ha/yr
GA = 100000/3000 = **33,3** ha

Evaluation of pond area (b)

Nursing: (NA) for n stages



- $X_0=TP/w_m$
- $X_0=100000/0,5=200000$
- $X_{-1}=X_0/s\%$
- $X_{-1}=200000/0,7=285714$
- $X_n=X_{n-1}/s\%_{n-1}$
- NA= X_{-n}/OSD

w_m - marketable weigth of fish; x - no. of fish
s% - survival rate; OSD = optimal stocking density

Evaluation of pond area (c)

Reproduction: (RA)

- RA =$(X_n/(♀*F))/OSD$
- RA =(1,000,000/1500)/1000 =**0,66** ha
- X_n = no. fish
- *F* = fecundity per female
  - (eggs/kg od body weight)
- OSD = optimal stocking density/ha
  - *Broodstock (1000/ha, 1/10 m^2)*

Evaluation of pond area (d)

Storage area (SA)

- In theory, if WO = WS, no storage is required (SA = 0).
- Nevertheless an operetional storage area will be required.
- How big should it be?

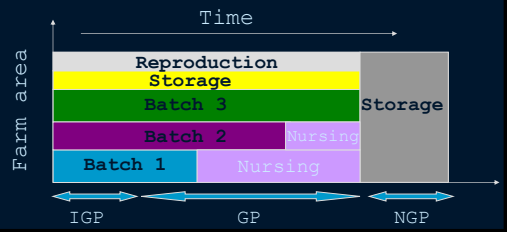
WO - weekly output, WS - weekly sale

GP < MP ≤ 52 weeks

- Main characteristic: WO > WS
- weekly output > weekly sales
- reproduction + nursing ⟶ storage

Allocation of farm area

- When GP < MP < 52 weeks



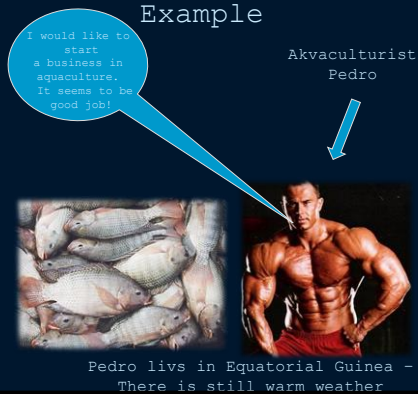
Evaluation of pond area

- SA max- Maximum storage area
- **SA max = WOPr x GP-IGP/OSD**
- WOPr – weekly over production
- GP - growth period
- IGP - initial growth period
- OSD - optimal stock density

Conclusion

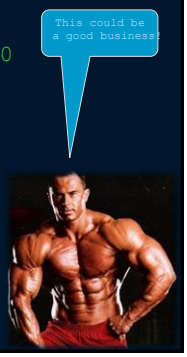
- **For optimal rsults to be obtained, commercial aquaculture project must be properly planned!**
- **Production plans in aquaculture follow certain rules that depend on the:**
  - **Characteristics and availability of essential means of production**
  - **Environment**
  - **Species in culture**
  - **Market characteristics**
  - **Relation between growth period and the marketing period**

Example



Pedro undertook market research

- The market demanded 100 tons of fish
- The market weight of 500g
- The processing factory will take the fish from Pedro quarterly at a bargain price.



Pedro suggested the following system

100t = 100.000kg
1 fish weight 500g
Pedro needs to produce 200.000 fish yearly

50.000 fish	50.000 fish	50.000 fish	50.000 fish
January	April	July	October

Pedro collects information

- Raising is divided into 4 phases
- Fish reached 500g in 10 month
- The annual yield is ≈3000kg/ha/yr
- Losses in each phase are:
- X_0=3%; X_{-1}=5%; X_{-2}=10%
- Fish are easy to reproduce in a pond

Basic design

200.000 fish

phase 0	Jan	Apr	Jun	Oct
phase -1	Oct	Jan	Apr	Jul
phase -2	Jul	Oct	?	Jan	Apr
phase -3	Apr	Jul	Oct	Jan

Pedro collects more information

- **OSD_0 = 12.000 fish/ha**
- **OSD_{-1} = 25.000 fish/ha**
- **OSD_{-2} = 50.000 fish/ha**
- **OSD_{-3} = 100.000 fish/ha**

Now it is necessary to calculate

$GA = TP/AY$

$X_0=TP/w_m$
$X_{-1}=X_0+(X_0/100*s\%_0)$
$X_n=X_{n-1}+(X_{n-1}/100*s\%_n)$

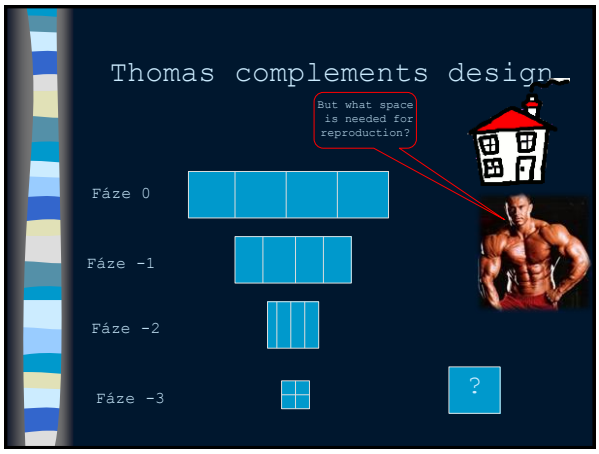
$NA= X_n/OSD_n$

W_m - marketable weight of fish; X - number of fish
s% - survival rate[%]; OSD = opt.stock.densit.; n=pahse

Pedro complements design

Pahse 0	200.000 fish; 16,66 ha
Pahse -1	206.000 fish; 8,24 ha
Pahse -2	216.300 fish; 4,326
Phase -3	237.300 fish; 2,373 ha

Thomas complements design



Balance the use of area (c)

Area for reproduction : (RA)

$$RA = \frac{(Xn/O)+((Xn/O)/f)*m}{OSD}$$

Xn = **237.300**
O = **300**
OSD = **2 fish/m²**
m/f = **1:4**

Area for reproduction : (RA)

$$RA = \frac{(237.300/300)+((237.300/300)/4))*1}{5000}$$

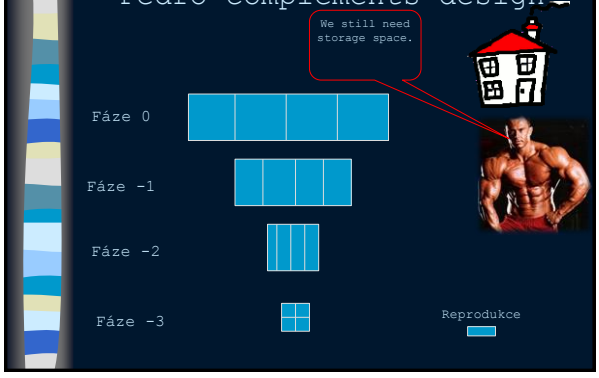
Xn = **237.300**
O = **300**
OSD = **2 fish/m² (1ha=10000m2 5000 fish/ha)**
m/f = **1:4**

Area for reproduction : (RA)

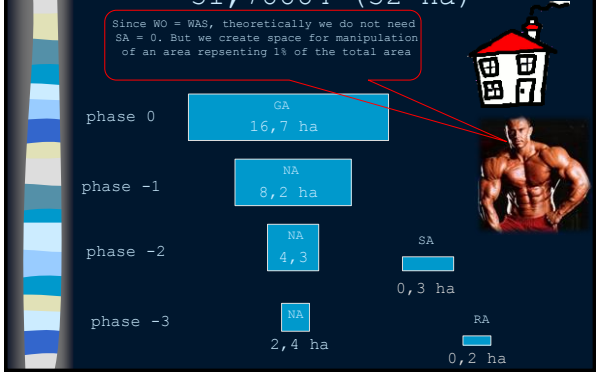
$$RA = \frac{(791)+((791/4)*1)}{5000}$$

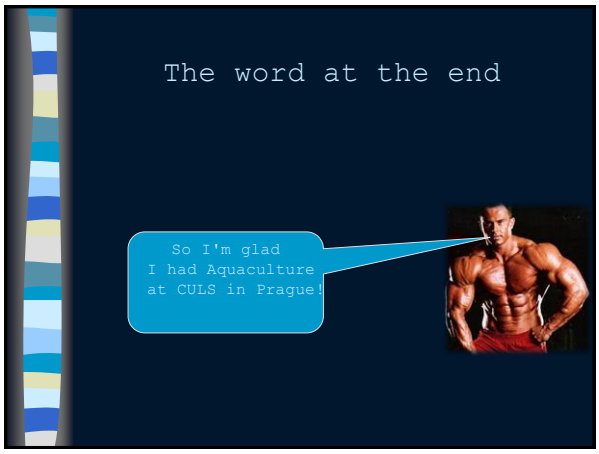
Number of females **791**
Number of males (791/4)*1 = **197.75** (**198**)
Total number of fish **989**
Needed area 0,1978 ha (**0,20 ha**)

Pedro complements design



31,78884 (32 ha)




The word at the end
So I'm glad
I had Aquaculture
at CULS in Prague!