

SCOTIAN HALIBUT LTD.

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**Scotian Halibut Ltd.
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**Fiskeldi Eyjafjarðar hf.
Glerárgata 34
IS-600
Akureyri,
Iceland**

(354) 461-2494

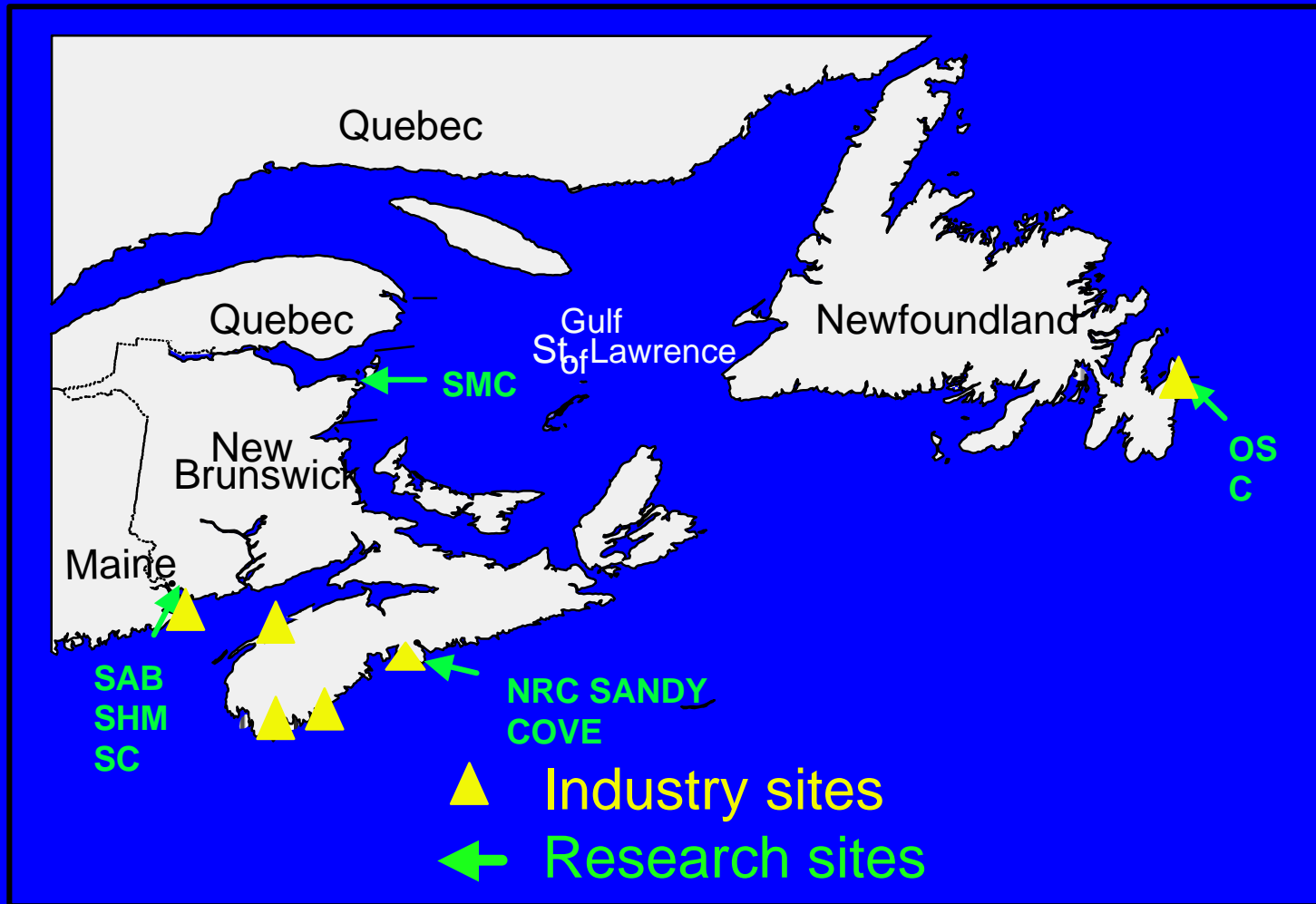
Cool water Aquaculture

- $1^{\circ} - 8^{\circ} \text{ C}$ *Cold water* Atlantic Wolf Fish
Arctic Char
- $8^{\circ} - 16^{\circ} \text{ C}$ *Cool Water* Atlantic Halibut
Atlantic Cod
Atlantic Salmon
Haddock
- $16^{\circ} \text{ C} +$ *Warm water*

Atlantic Halibut

- **Largest flatfish**
- **Strong Markets**
- **High value**
- **Declining catch levels**
- **Easy to grow**

Atlantic Halibut Production

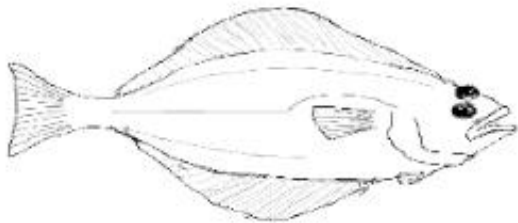


Broodstock & Hatchery Operations Clark's Harbour

Halibut Life Cycle



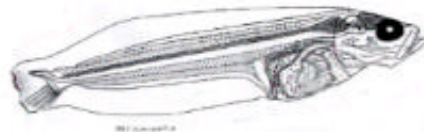
EGG
14 days



METAMORPHOSED JUVENILE



YOLK SAC LARVA
50 days



FIRST FEEDING LARVA

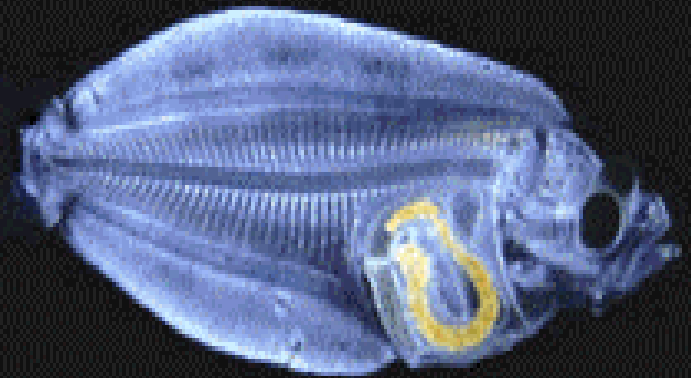
Early Life History



Fertilized Egg



Yolk-sac Stage Larva



Early Feeding Stage Larva

Halibut Spawning



Tagged Broodstock



Egg Collection



Mitt Collection



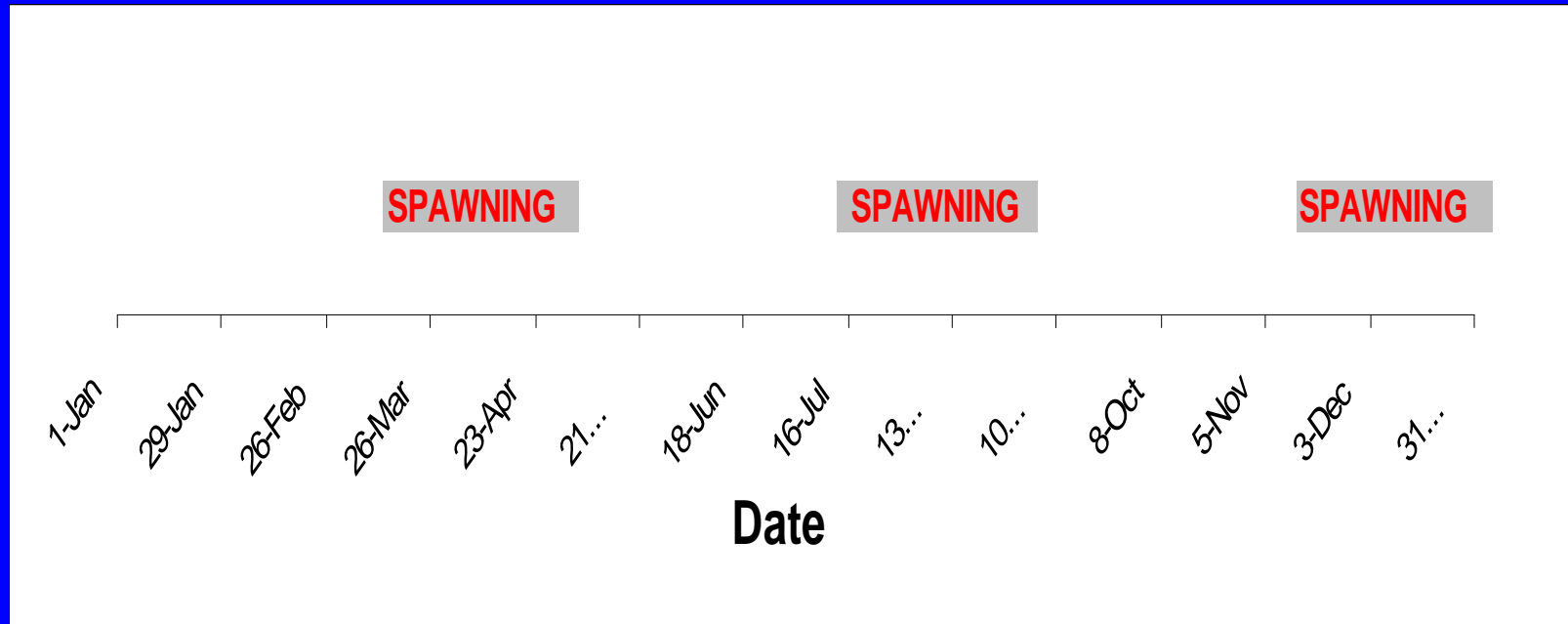
Fertilizing Eggs

Milt

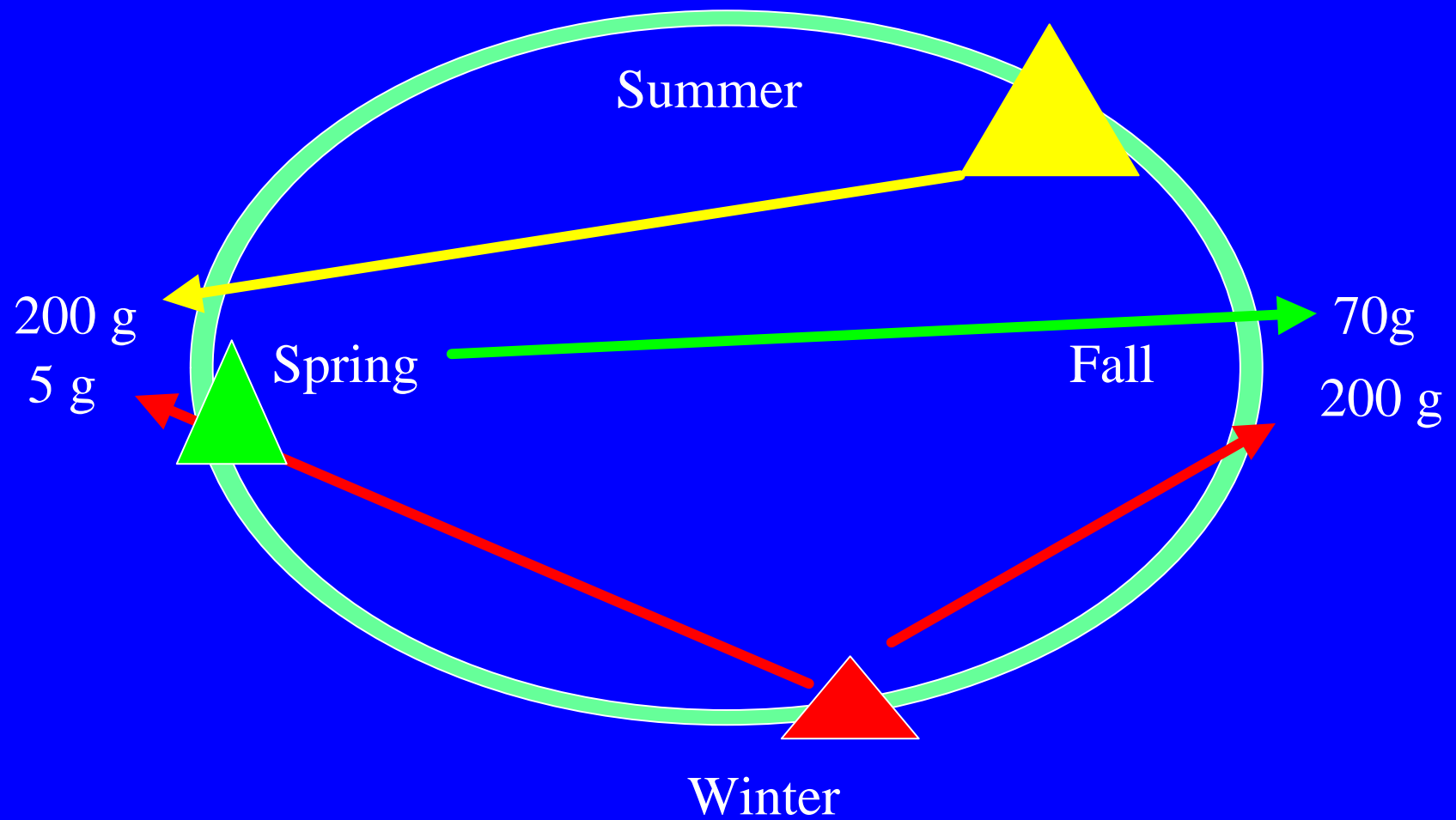
Eggs



Spawning



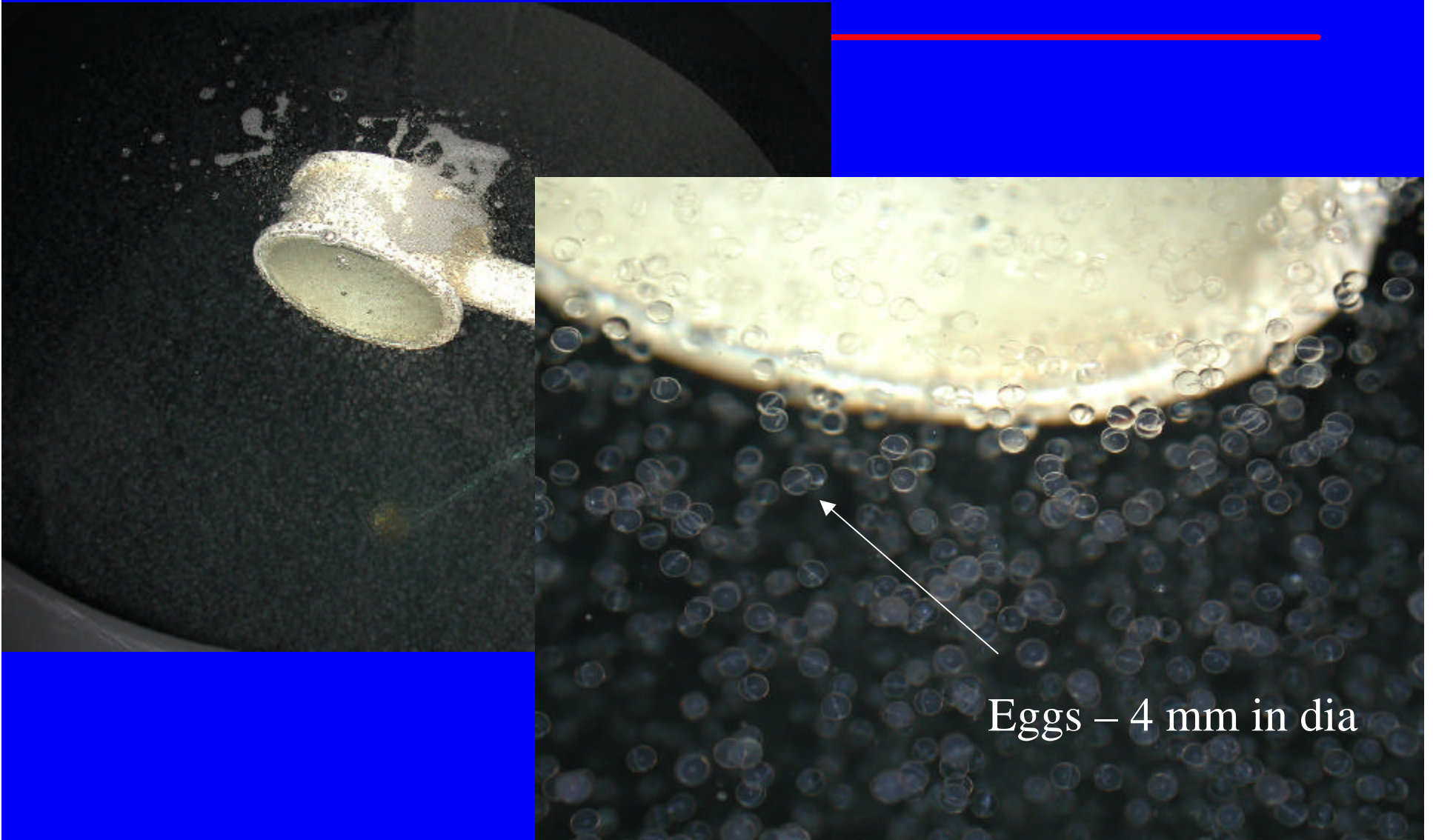
Juvenile Production cycles



Eggs Incubation Room



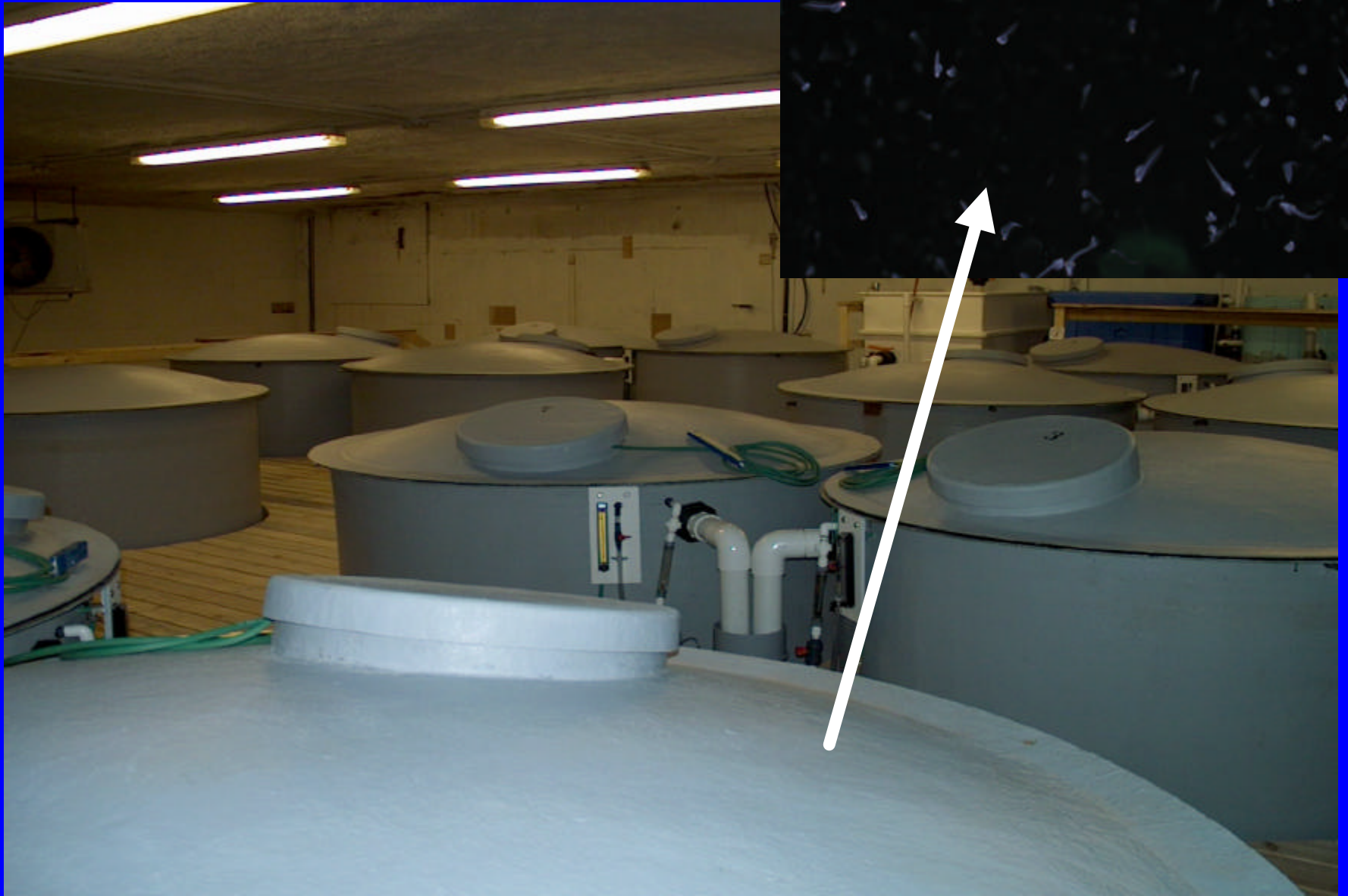
Eggs in Incubator



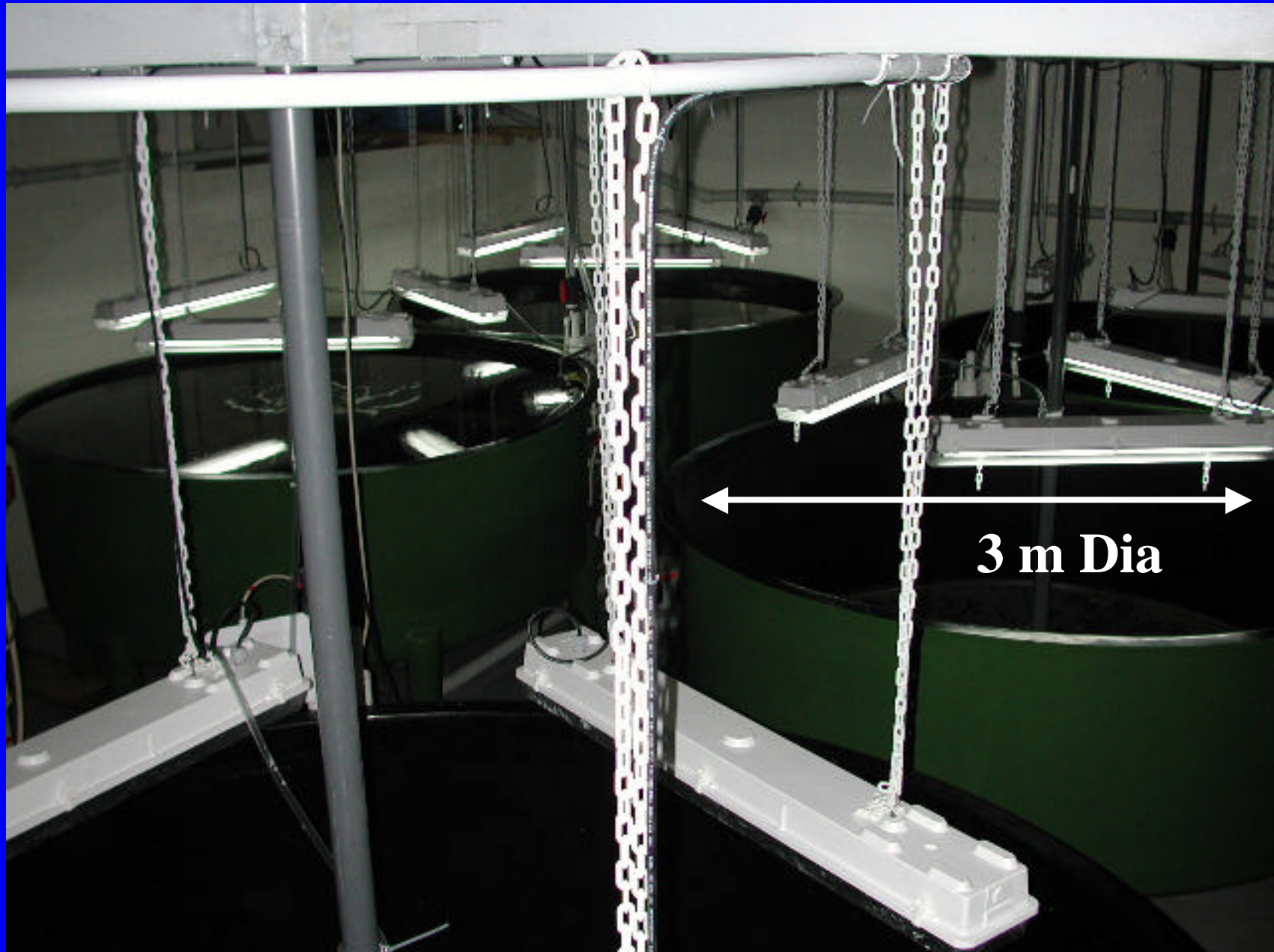
Eggs - 4 mm in dia

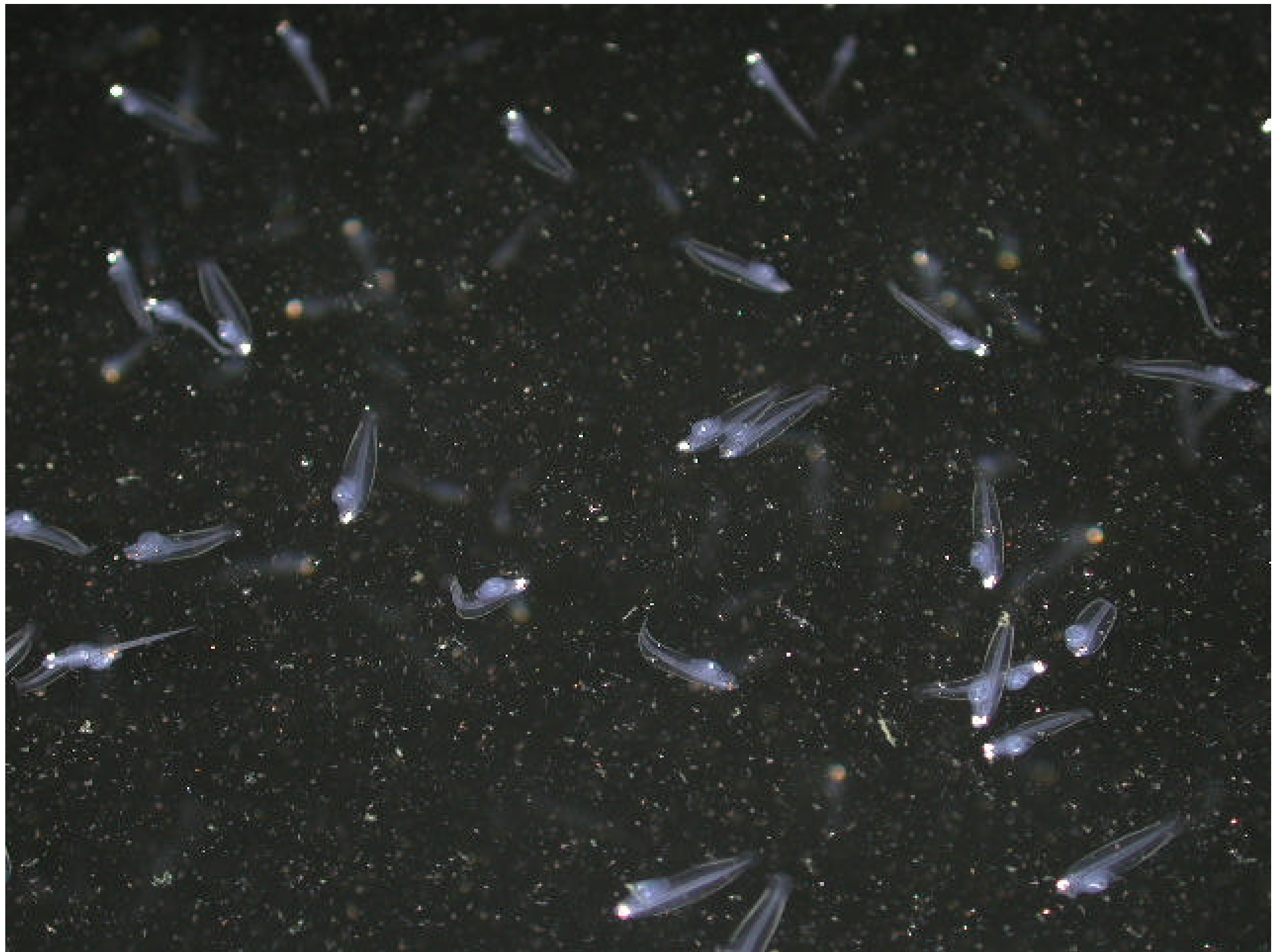
Yolk Sac Silos

Yolk Sac Larvae



Larval Rearing Tanks

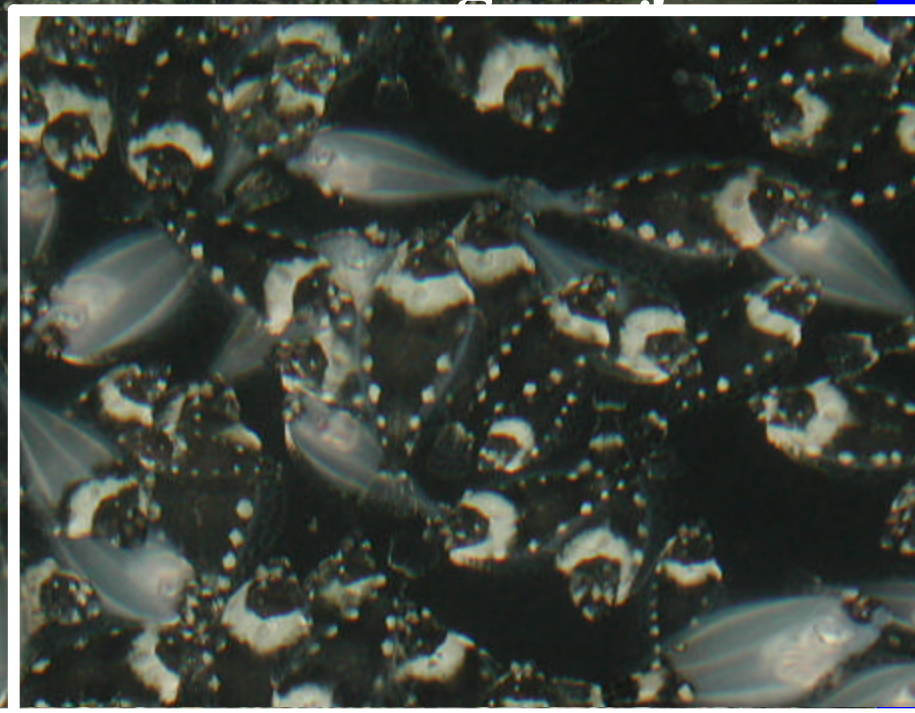




Halibut Juveniles

← Broadcast feeder

3 gram juveniles

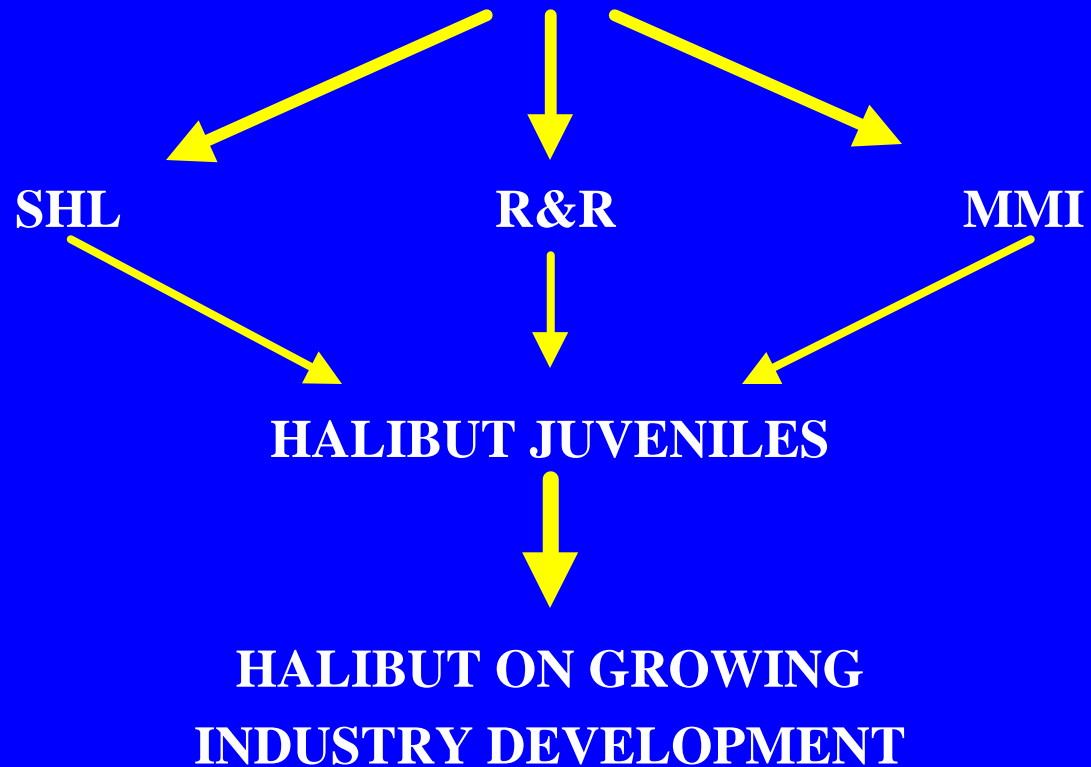




**10 g Halibut Juveniles
In 3 m tank**

PARTNERSHIP

FEDERAL AND PROVINCIAL SUPPORT



PRODUCTION NUMBERS

COMPANY	2002	2003	2004
MMI	20,000	50,000	100,000
R &R	45,000	80,000	100,000
SCOTIAN	100,000	250,000	300,000
TOTAL	165,000	350,000	460,000

SCOTIAN HALIBUT Ltd.

Incorporated 1998

8 staff

Hatchery = 20,000 sq ft

Capacity = 600,000 5 gm juveniles

Icelandic partner

R & R FINFISH

Incorporated 1995

7 staff

Hatchery = 8,000 sq ft

Capacity = 100,000 5 gm juveniles

Maritime Mariculture Inc.

Incorporated 1996

7 staff

Hatchery = 8,000 sq ft

Capacity = 100,000 5 gm juveniles

Norwegian partner

Estimated Production of Non-salmonids in Atlantic Canada

Species	1997	1998	1999	2000	2001	2002
Haddock	2,000	18,000	75,000	95,000	170,000	140,000
Cod	12,000	10,000	45,000	10,000	56,000	10,000
Halibut	5,000	30,000	55,000	60,000	120,000	165,000
Flounder	8,000	17,000	50,000	50,000	Unknown	Unknown

Haddock - Over 300,000 fish in grow out at two Heritage Salmon sites

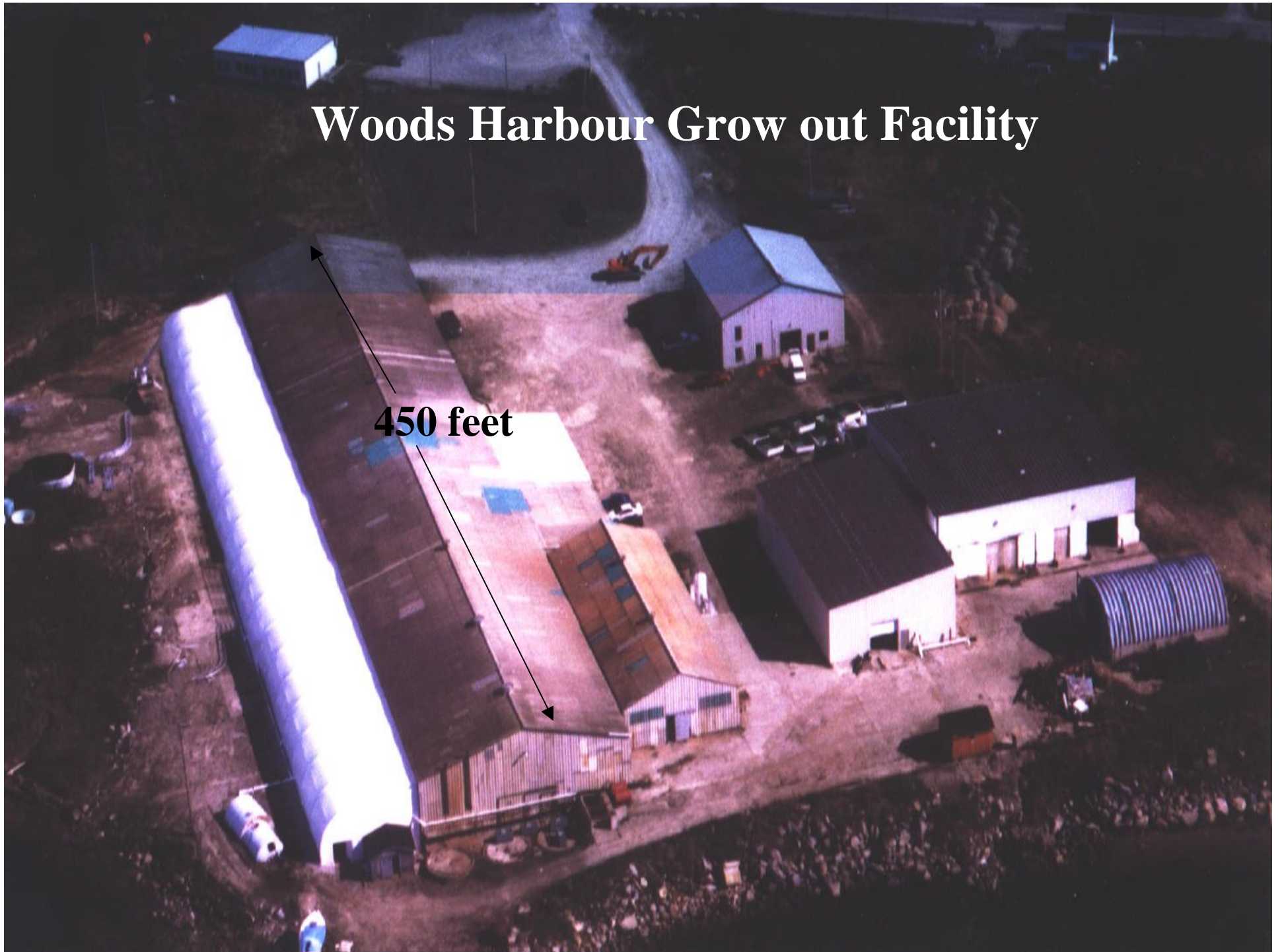
Research Contributions

NRC – NS, NB	\$ 500,000
CCFI – NFLD	\$ 350,000
DFO – NB (10 yr)	\$ 2,000,000
ACRDP – NS, NB	\$ 200,000
NB/ACOA	\$ 1,750,000
CBT – NB	\$ 50,000
	Total 4,850,000

**Halibut
Grow-out Operation
Woods Harbour**

Woods Harbour Grow out Facility

450 feet



Halibut Juvenile Grow-out

- **Juveniles imported from Iceland for first 3 years of operation**
- **50 000 juveniles imported from 1998 to 2000**
- **Input from local hatchery in 2000/2001.**

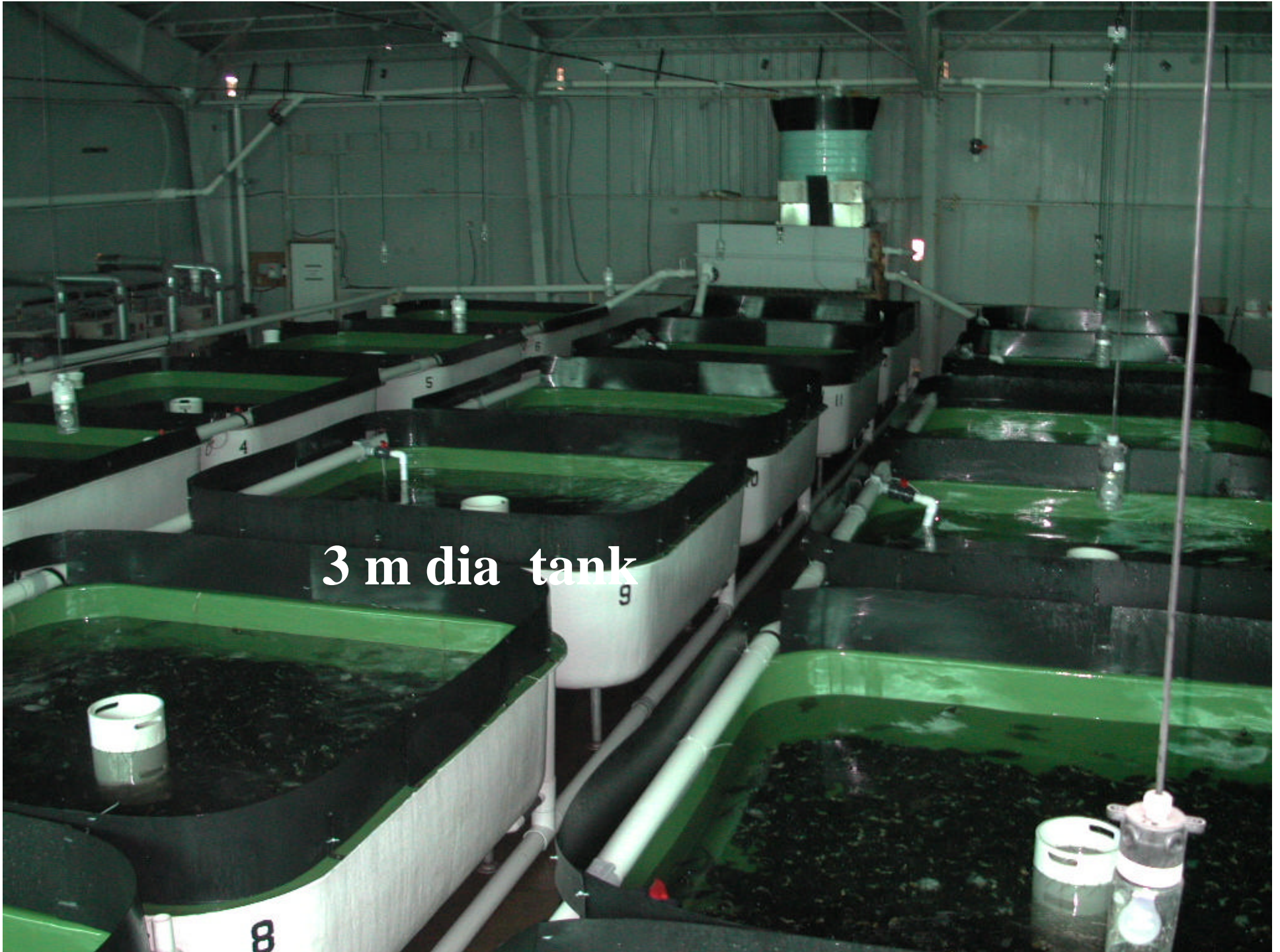
Water Supply

- **Sea water wells**
 - Thermally stable ~ 7^o C
 - Low filtration requirements
 - Low pathogen risk
- **Deep water abstraction**
 - Relative thermal stability below thermal cline
 - Low to moderate filtration depends upon water depth
 - low to moderate pathogen risk
- **Shallow water abstraction**
 - Thermally unstable Tidal influence
 - High filtration requirement
 - high pathogen risk

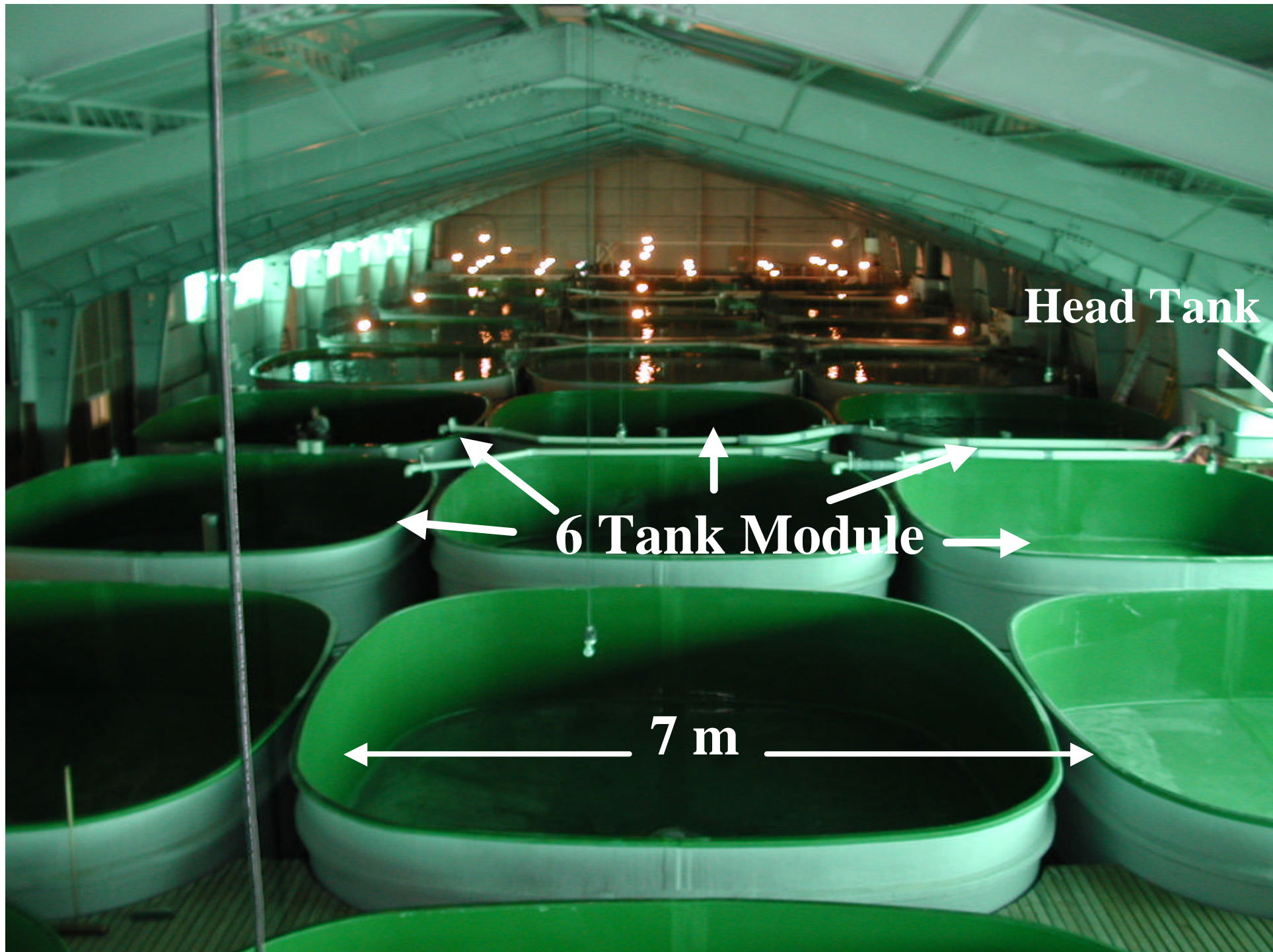
Temperature Requirements for Atlantic Halibut

Fish weight in grams	Temperature °C
2 - 25	11 – 14
25 - 100	11 – 13
100 – 500	10 – 12
500 - 1,000	9 – 11
Above 1,000	7 – 11

Thermal Limits - 1.0 to 18° C



3 m dia tank



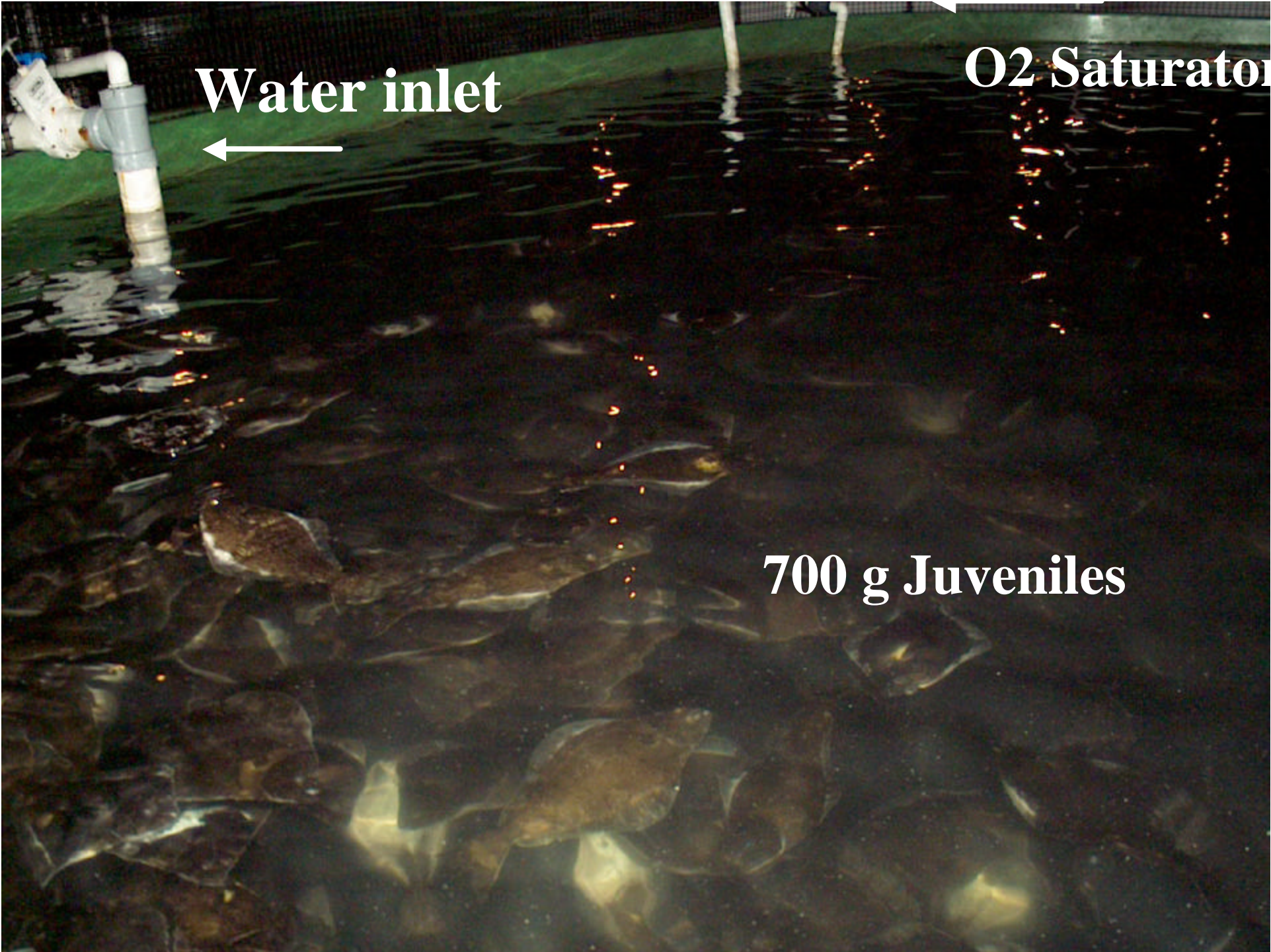
Head Tank

6 Tank Module

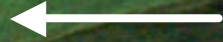
7 m

Mortality Rates

- **Transport** **< 1%**
- **Monthly** **= 0.1 %**
- **Grading (hand)** **= 0.0 %**



Water inlet



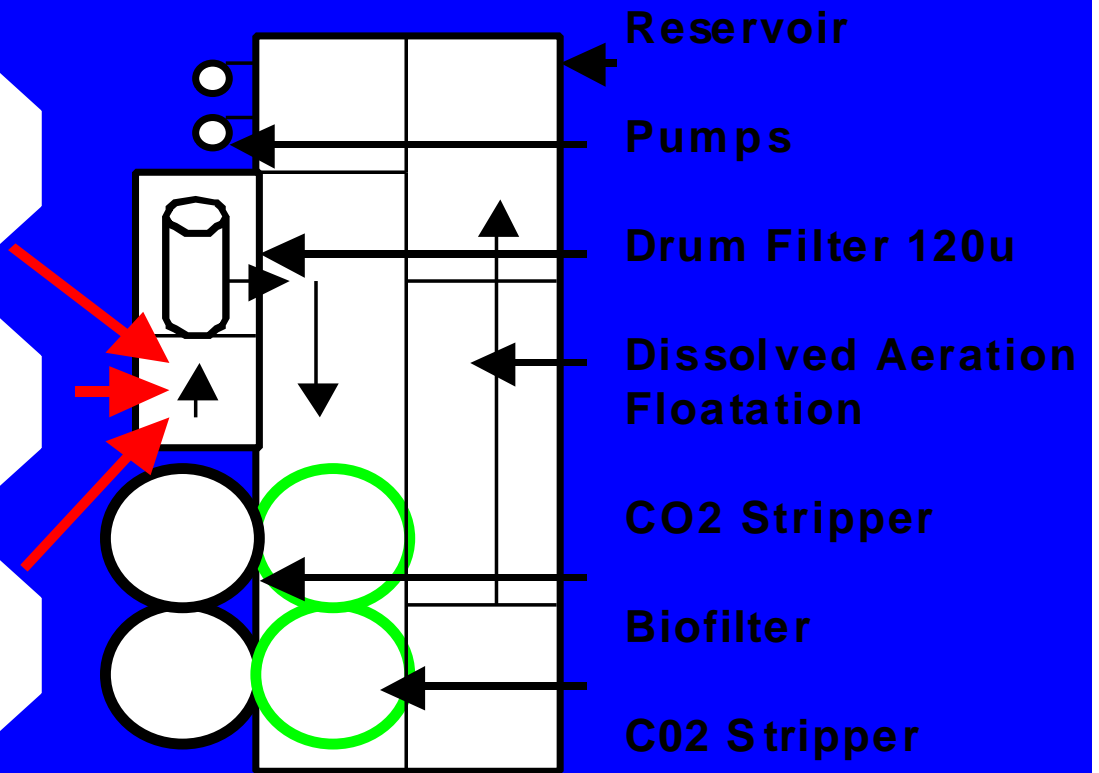
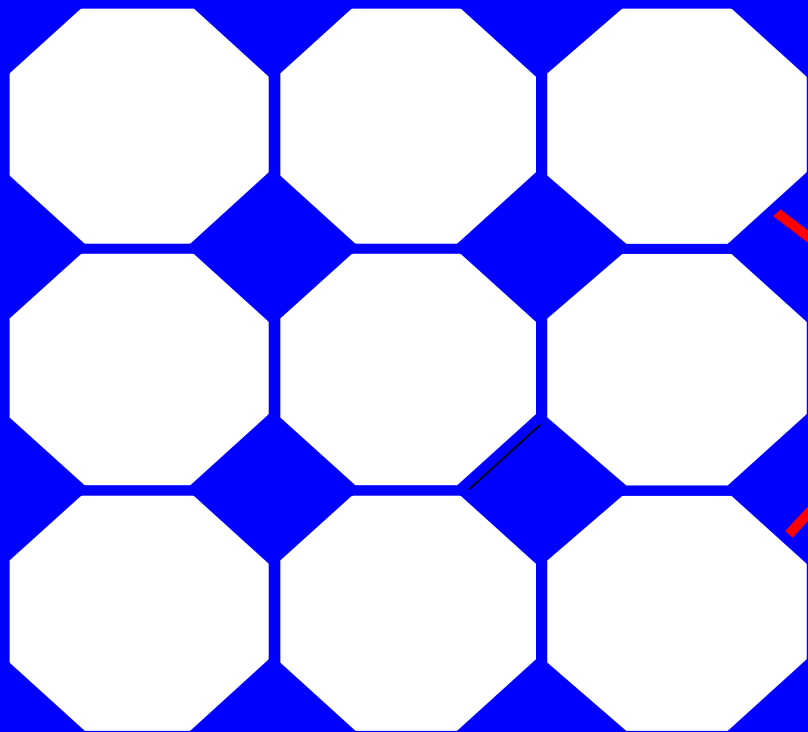
O2 Saturator

700 g Juveniles



Module Layout

Tank field



Shelves for Fish





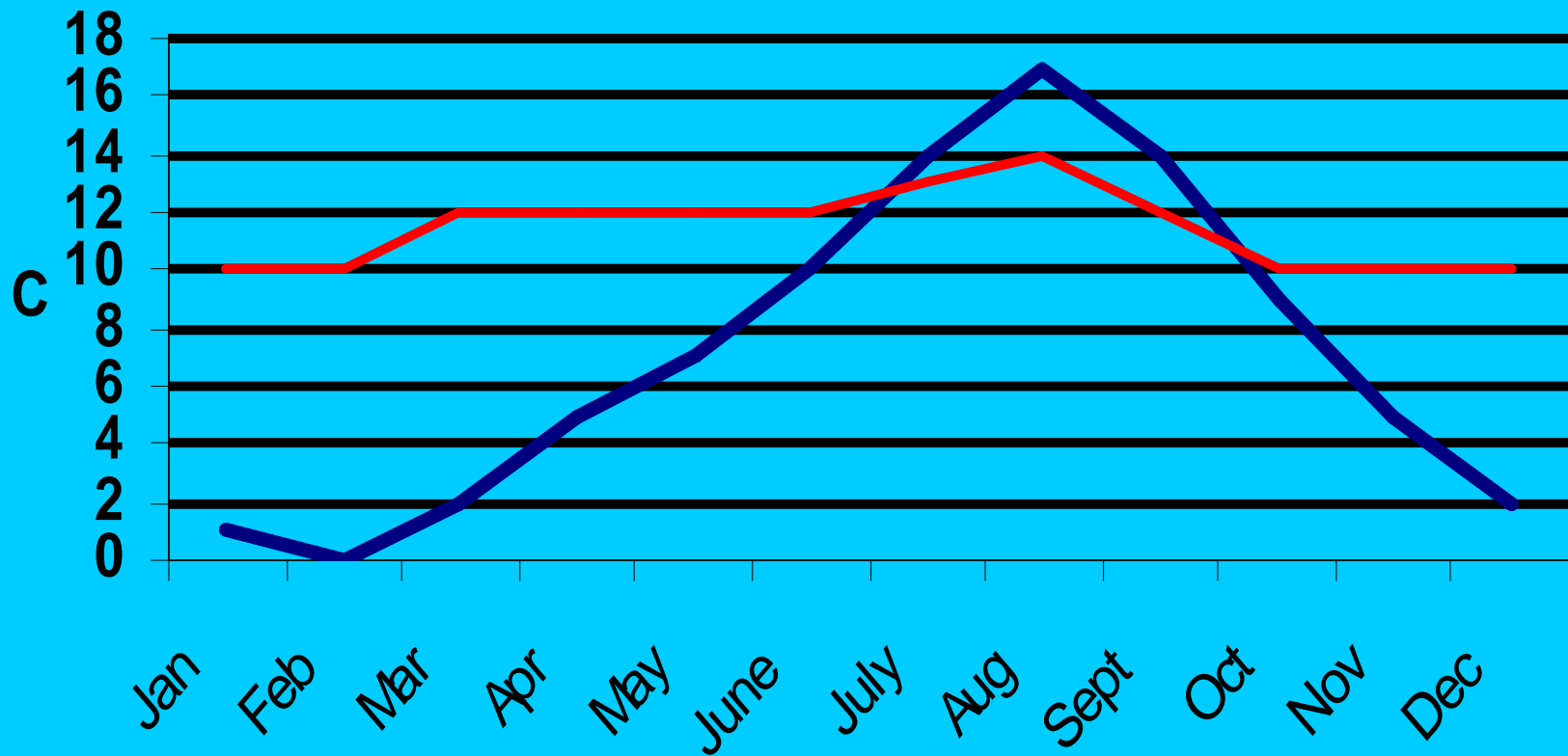
Biofilter

Swirl Separator

**CO2
Stripper**

Drum Filter
D
r
u

Ambient Average Temperature Atlantic Canada



Production Strategies for Atlantic Canada

- 1. Nursery to Cage Growout**
- 2. Nursery to large Land 2+ Kilo to Cage
Grow out**
- 3. All Land Based**

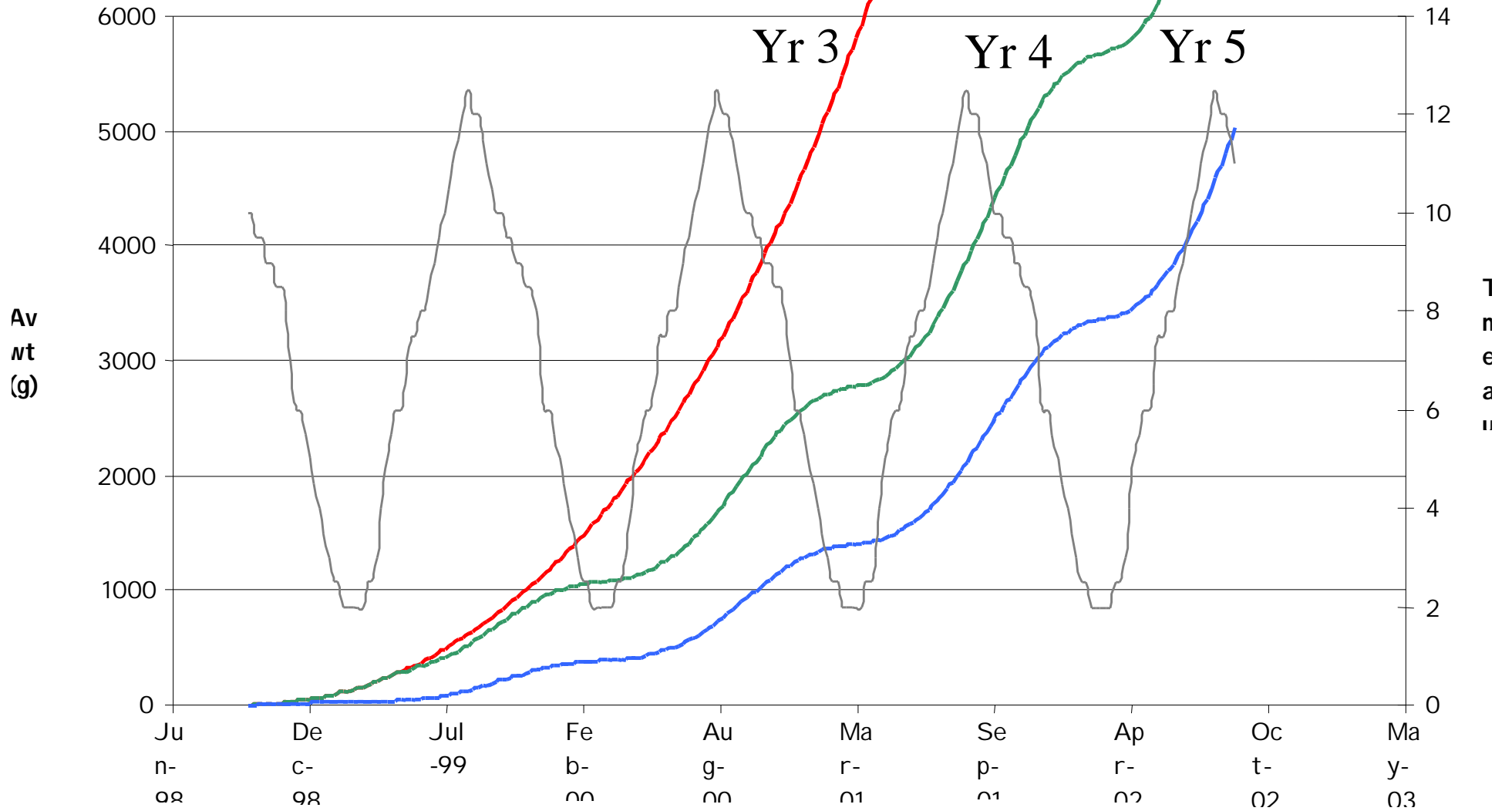
Cage Site Requirements

- **Current < 1.5 knots ?**
- **Depth No minimum**
- **Uses Existing infra Structure**
 - **With minor Retrofits**
- **Expertise is available**
- **Shading Required - UV protection**

Cage Site Husbandry

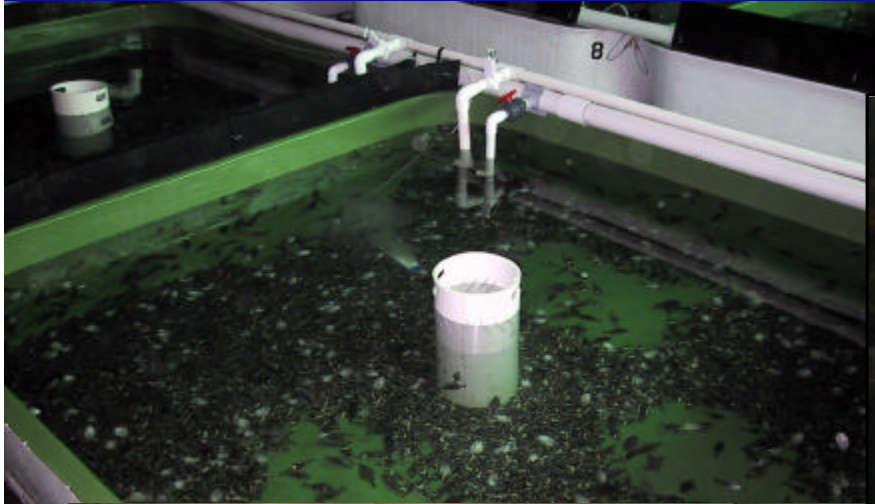
- Feeding Practices different in Marine Fish
- No Seasonal windows for entry to cage
- Flatfish graders required
- Fish pumps can be used
- Feed Conversion Rates 1.2
- Stocking Densities with Shelves = 25kg/ M3

R&R Halibut Growth Models: Ambient run, start 5g Oct 98



- Optimum temp land-based
- Heated nursery to 1st spring
- Ambient temperatures
- Temperature

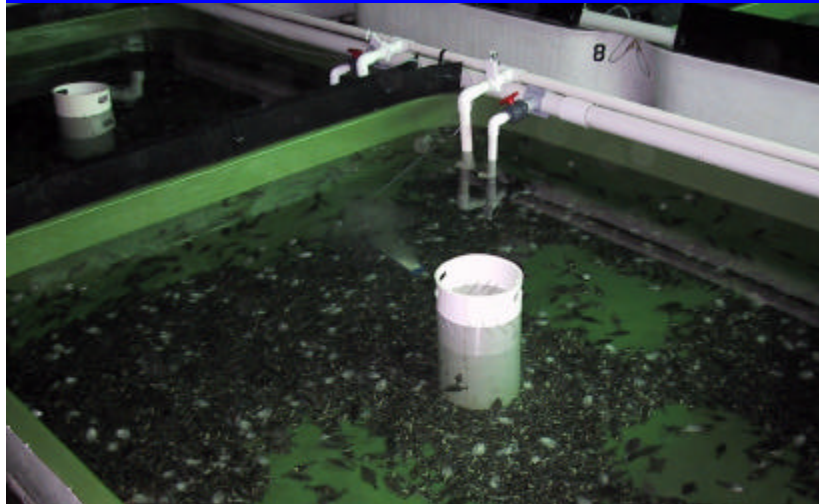
Halibut Grow-out Cycle



Sea cage



Halibut Grow-out Cycle

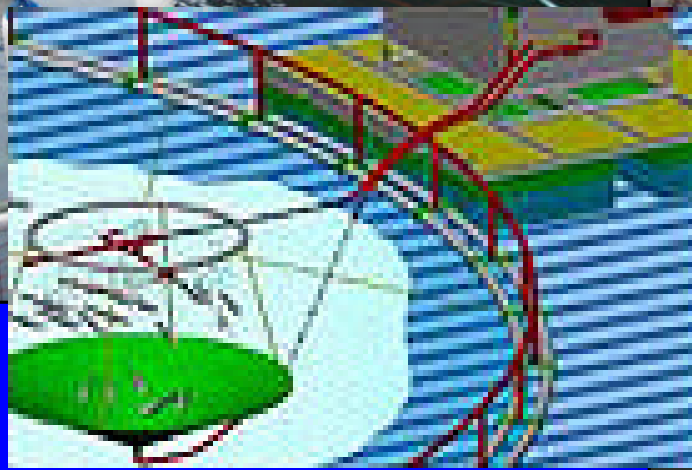
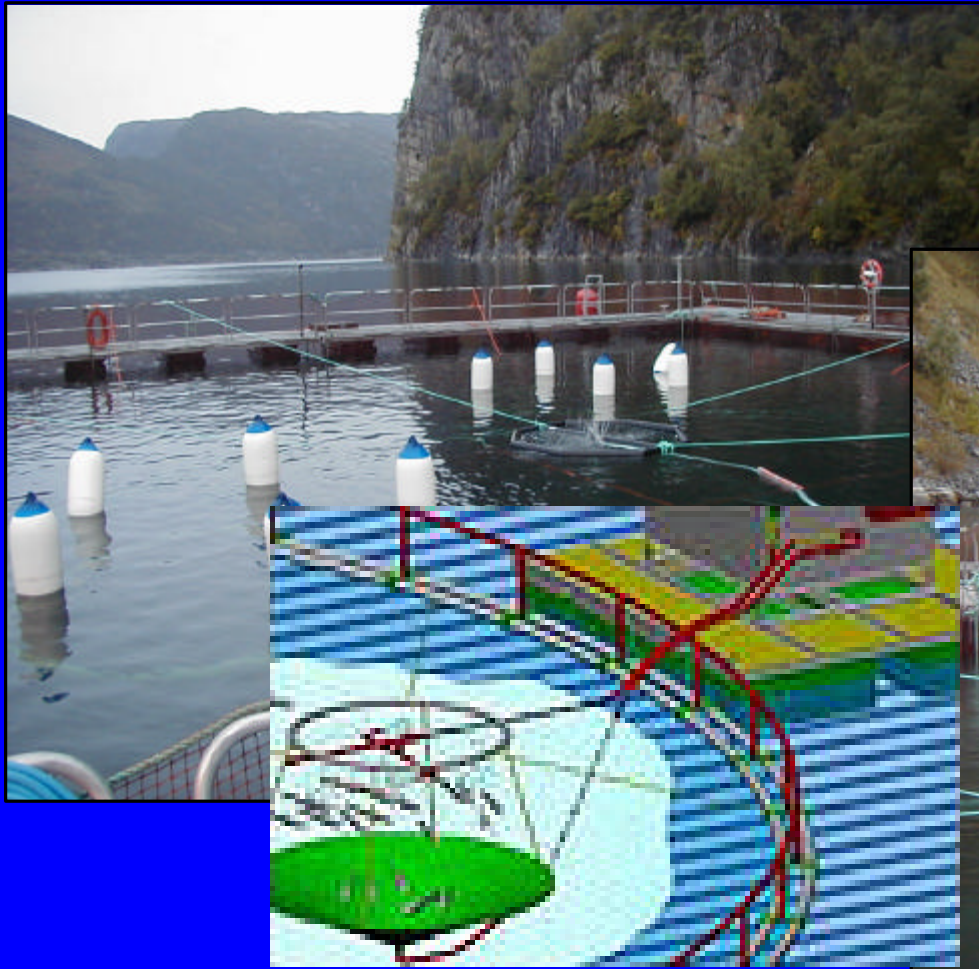


Land Based

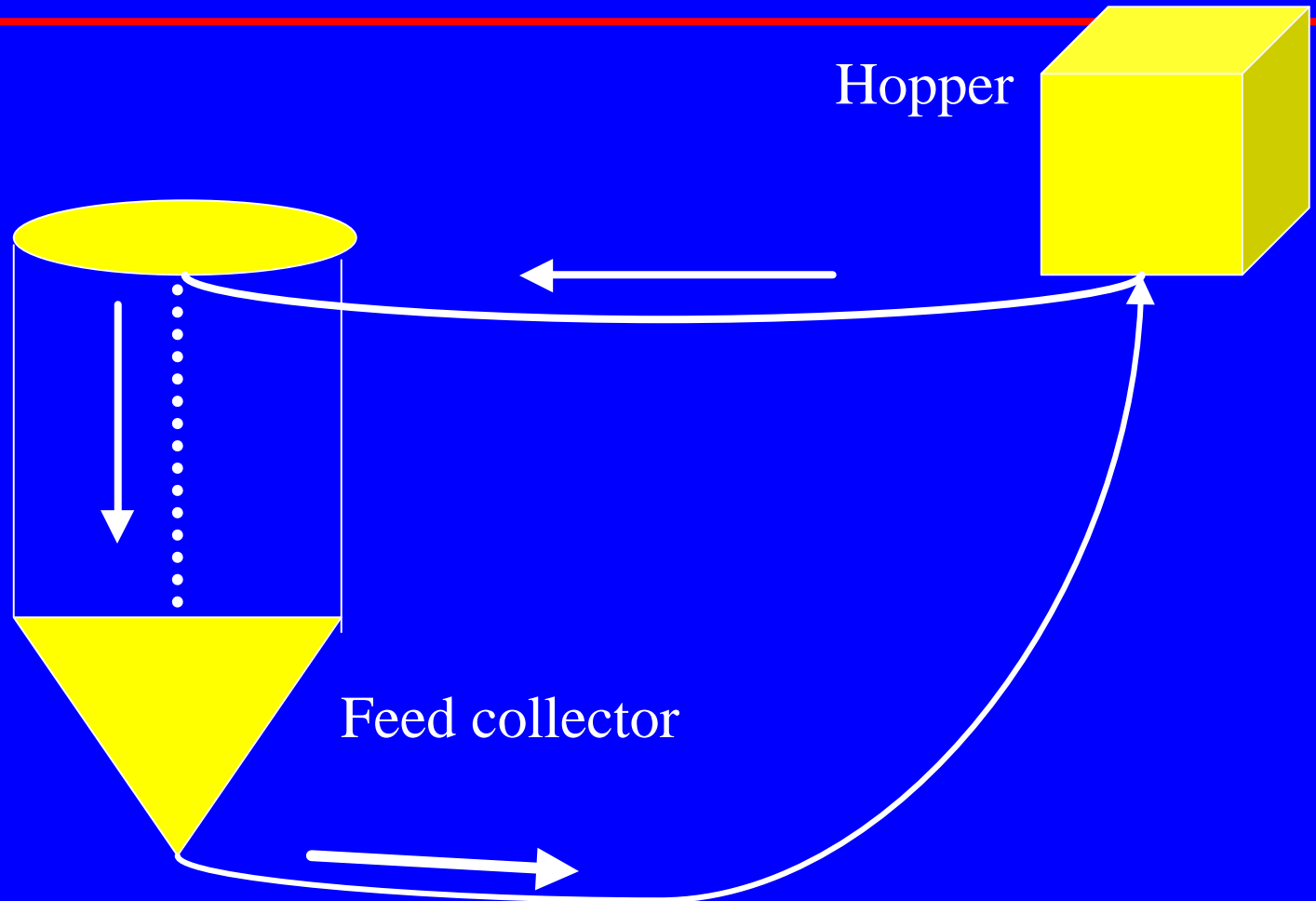


Kjeurda

Feeding system

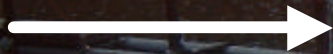


Storvik Feeding System

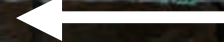


Storvik Feed System

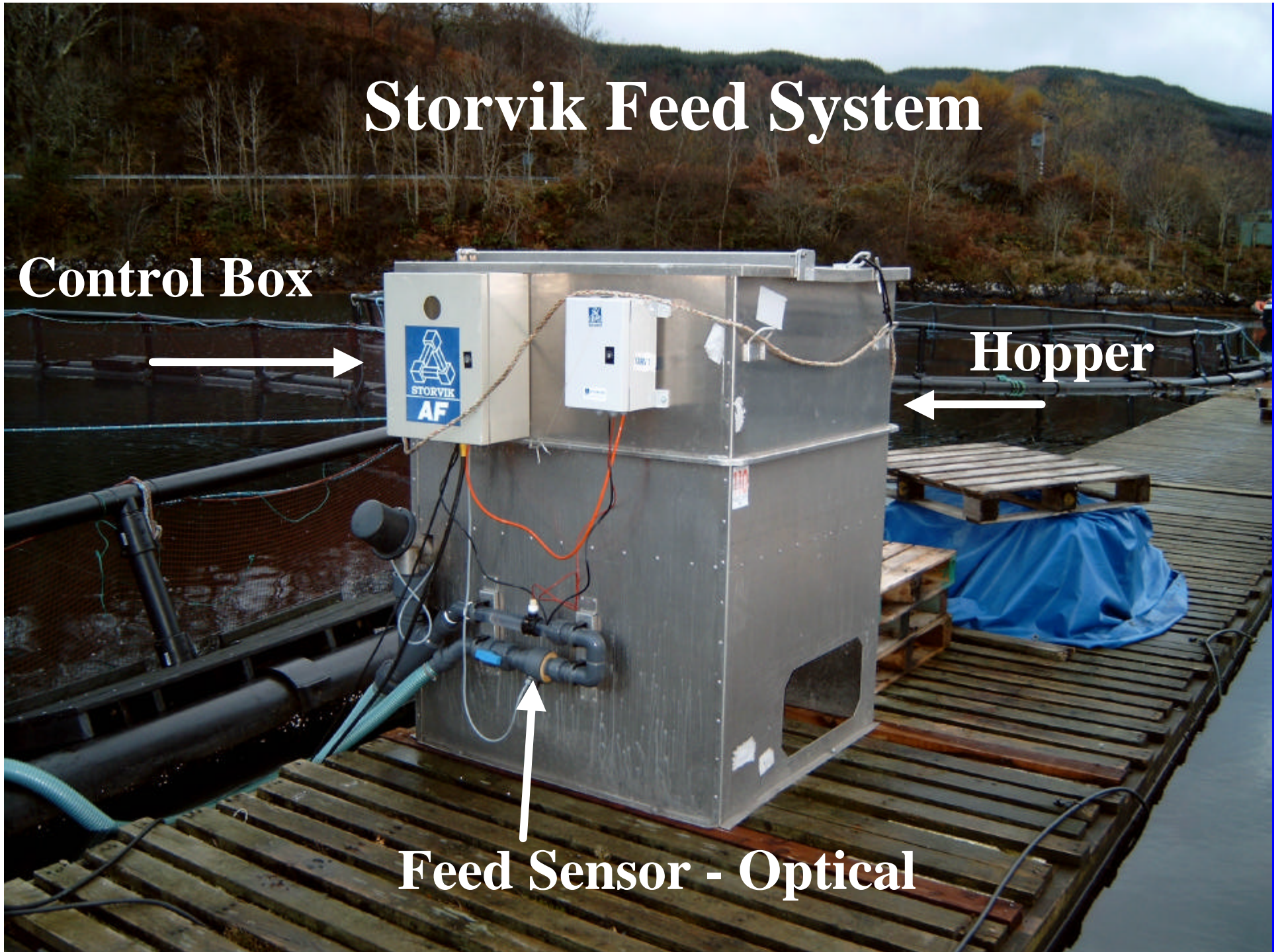
Control Box



Hopper



Feed Sensor - Optical



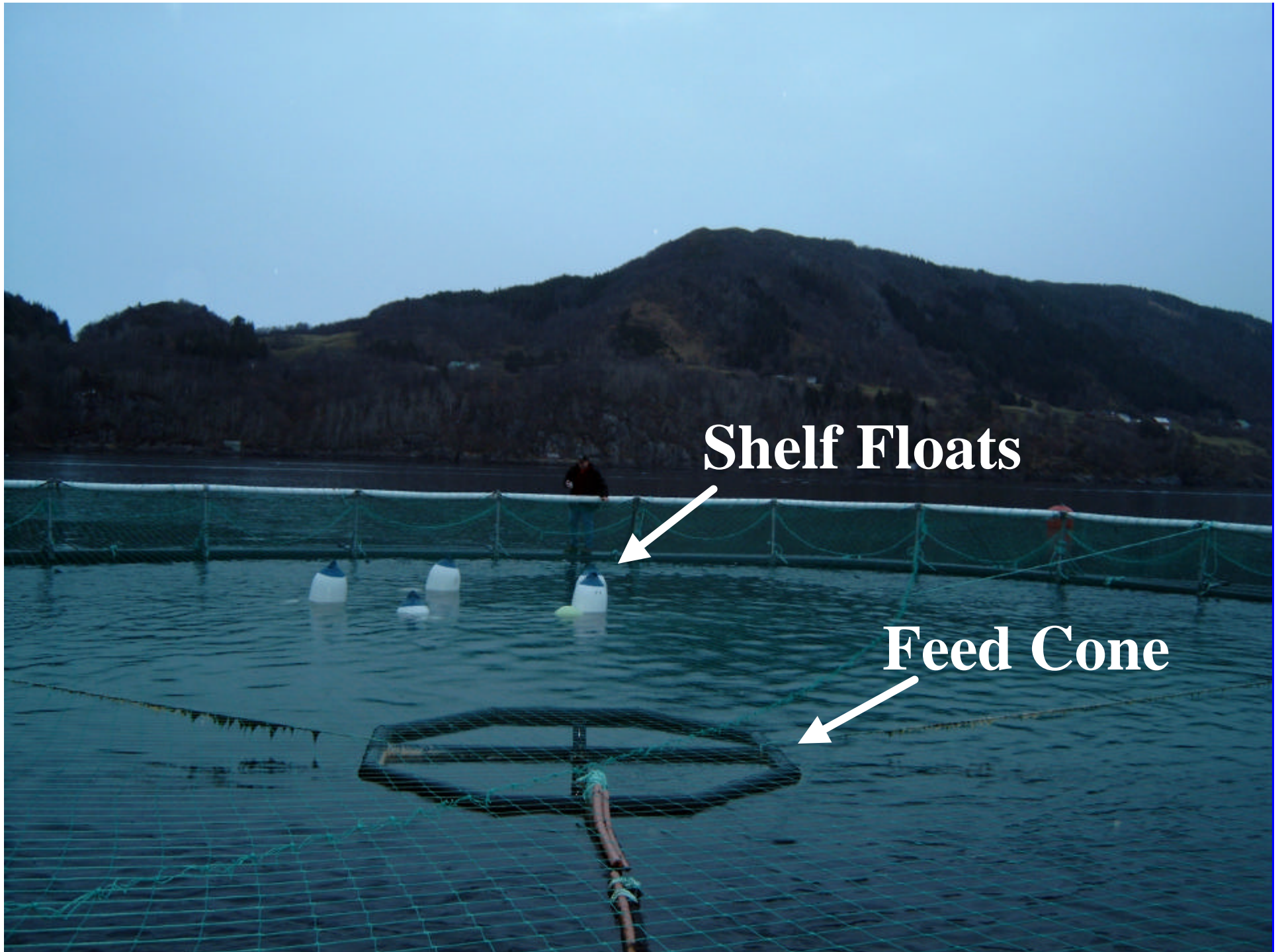
Feed Cone



Nordic Seafarms

Storvik Feeding System





Shelf Floats

Feed Cone

Storvik Feeding System

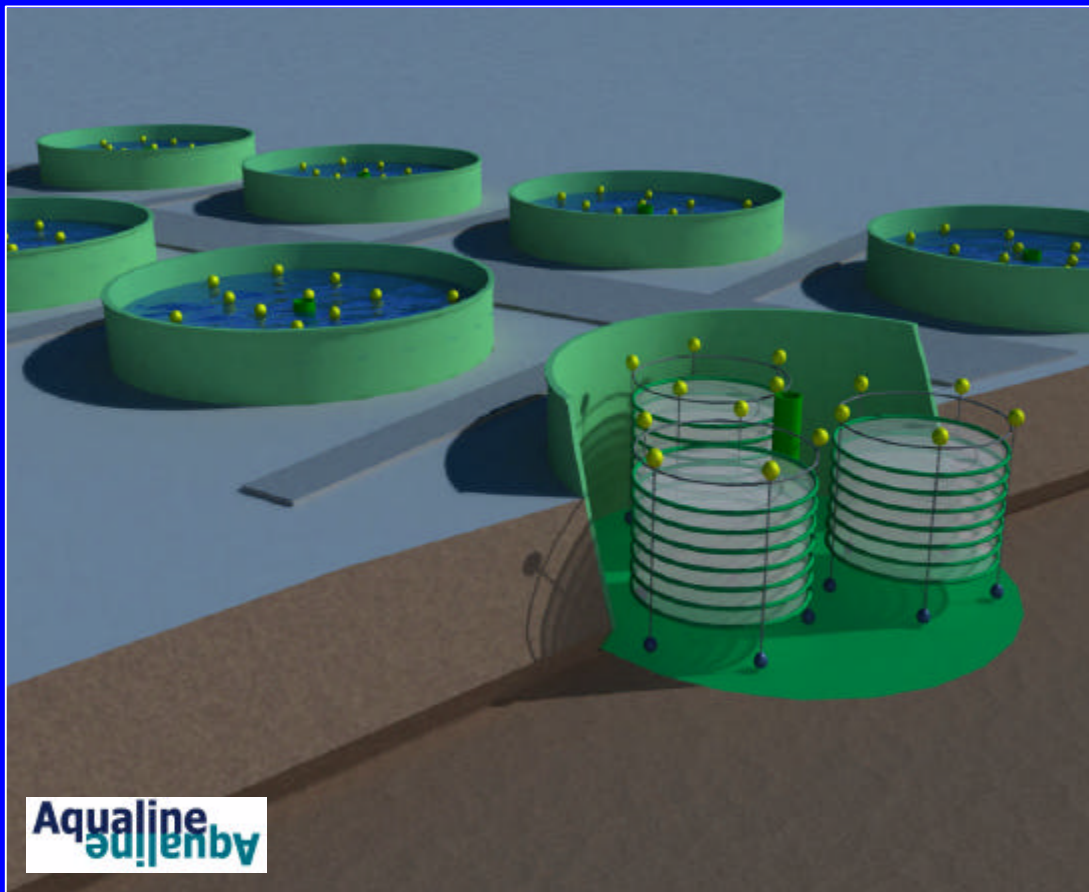
AF1000 - NOK 99,500 Can \$ 21170

AF2000 - NOK 122,500 Can \$ 26063

AF4000 - NOK 133,500 Can \$ 28404

**This price includes the silo and all
necessary working parts.**

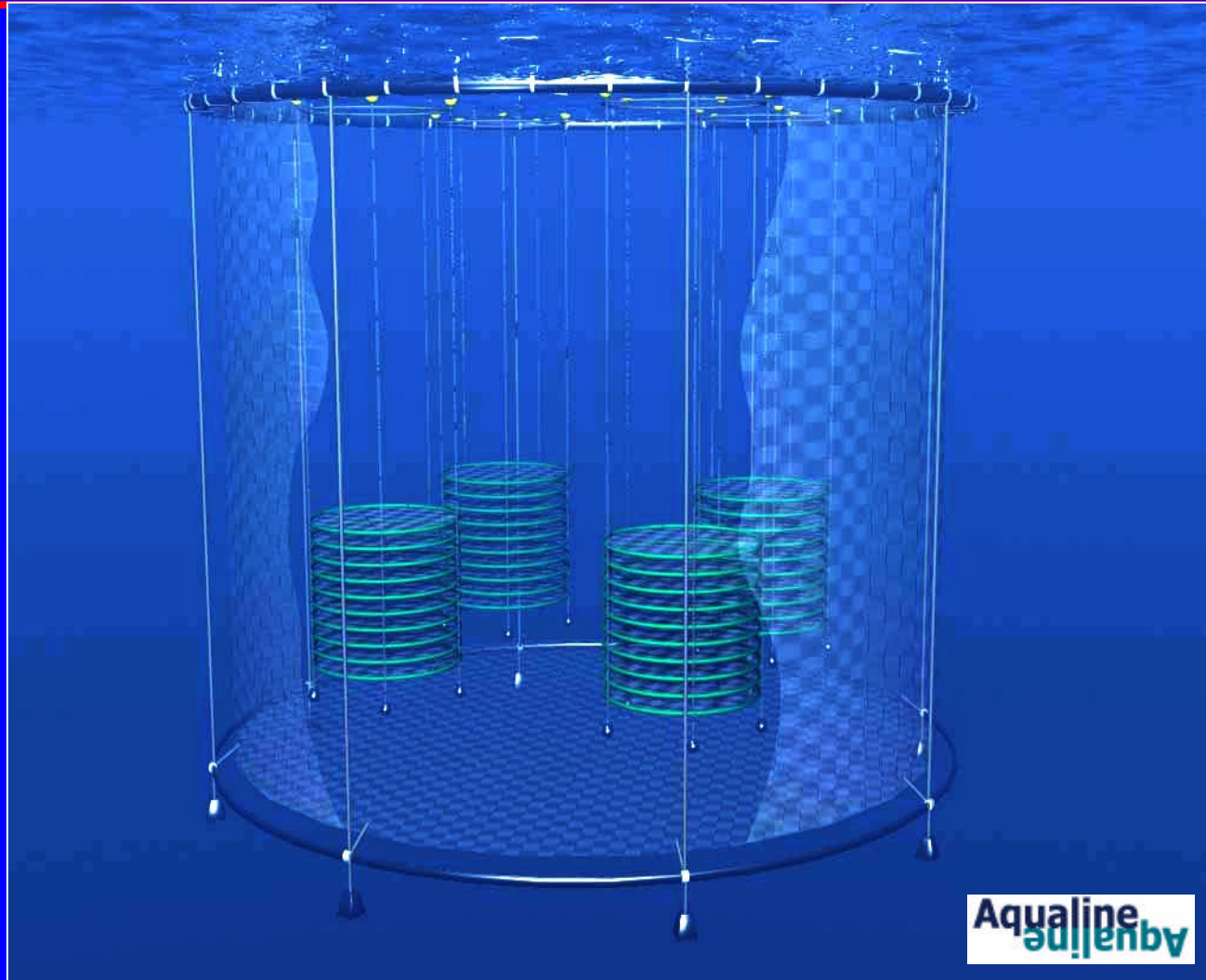
Halibut is an area-demanding fish

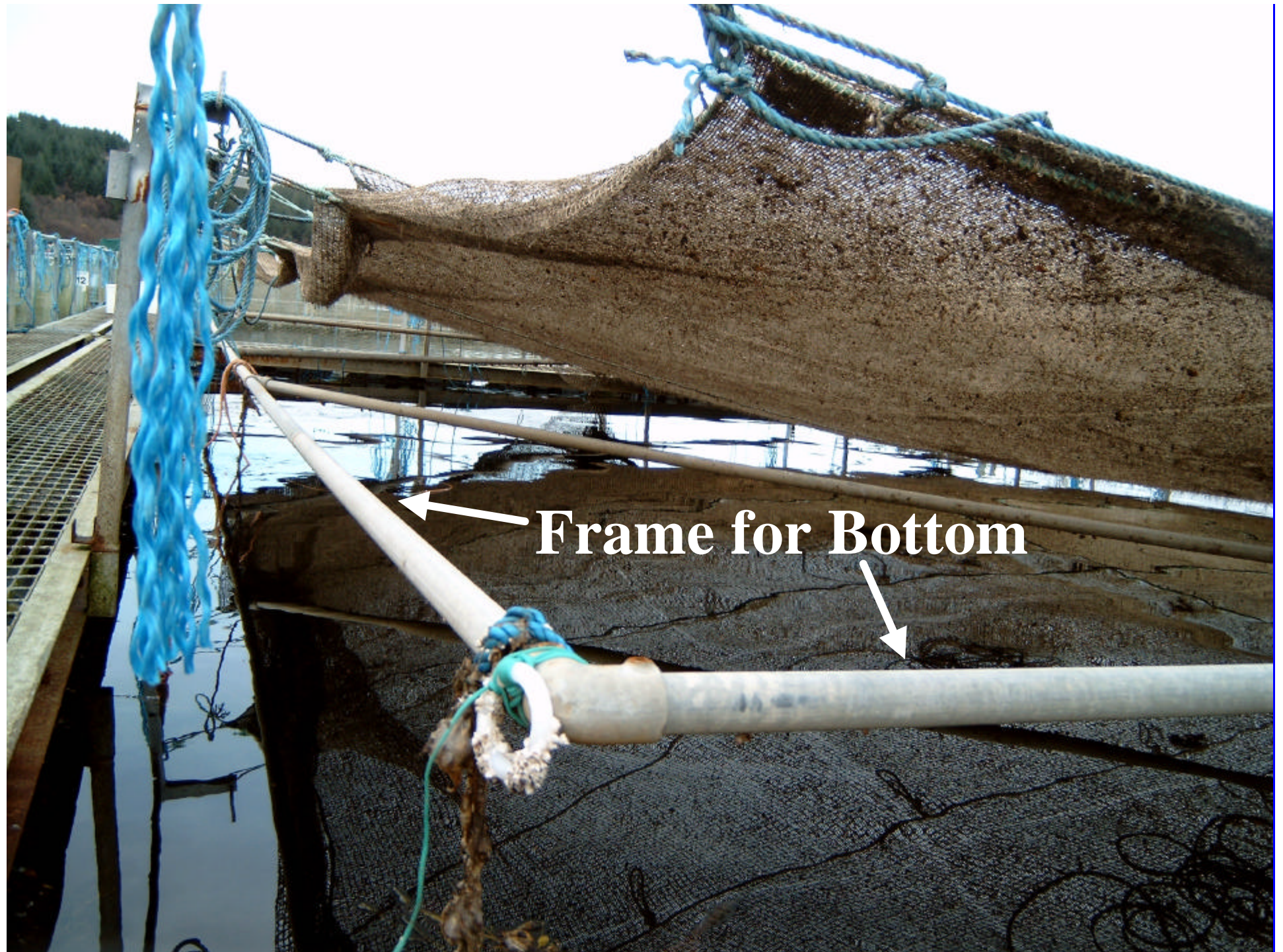


Ø-18m tank:

- Area (ground): 250 m²
 - 4 rows
 - à 6 shelves: 750 m²
-
- Total area: 1.000 m²

Halibut sea cage





Frame for Bottom

Marine Harvest Scotland

Single Shelf



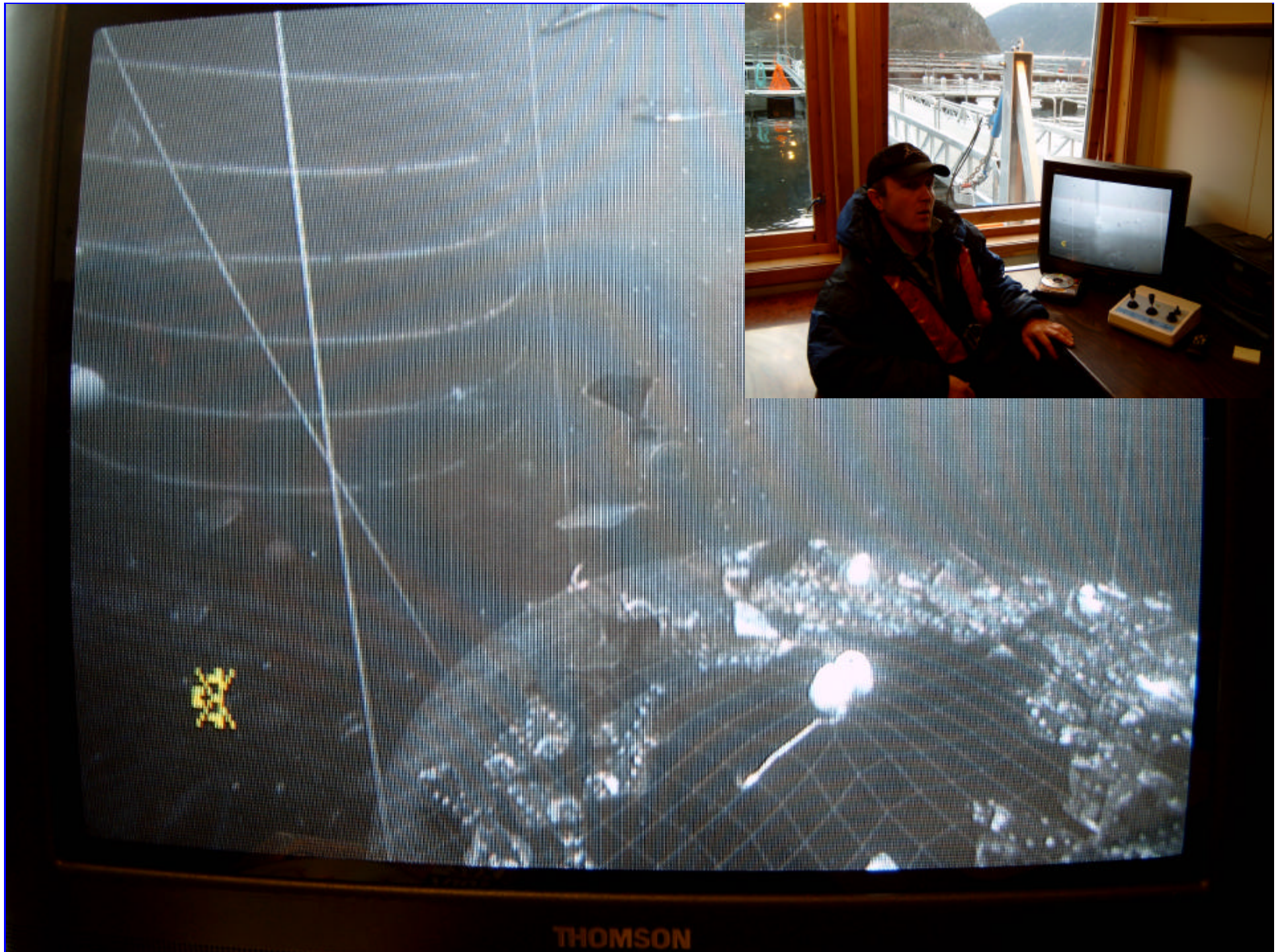
Bottom Frame For 20m x 20m At MHSN



Kjeurda

Shelf system



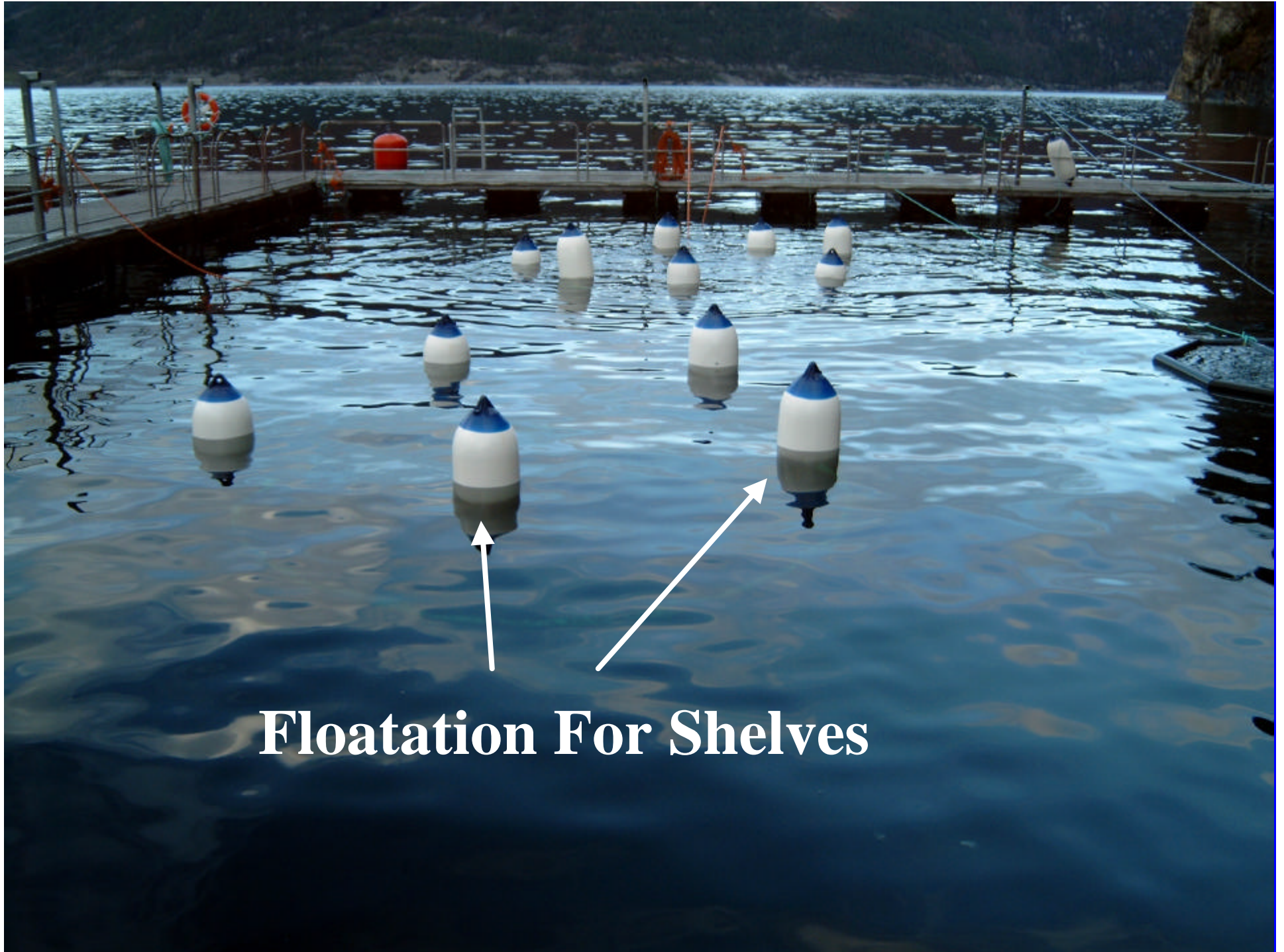


Shelving cost / Unit

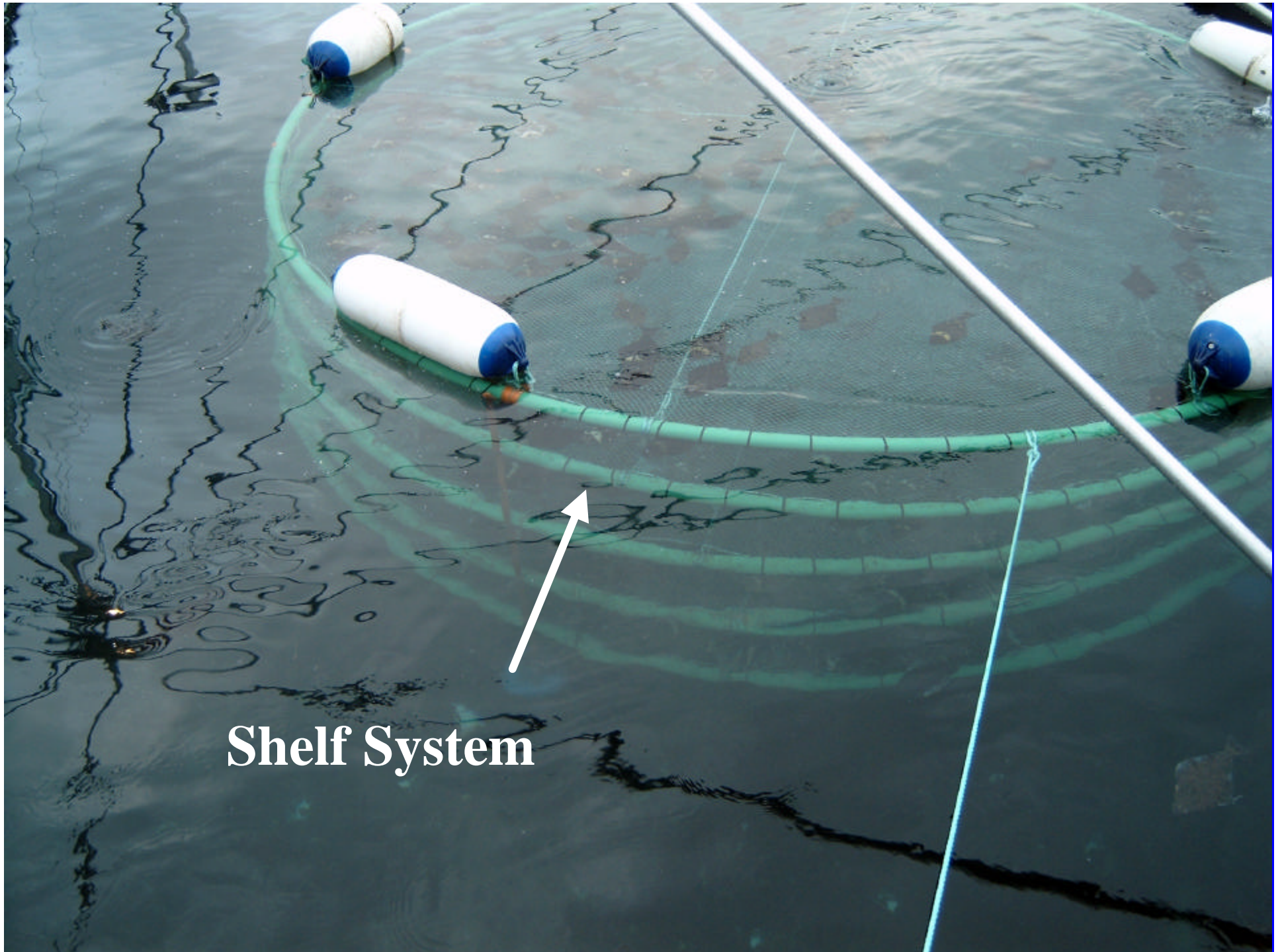
Shelf Dia in M	S A m2	shelf cost
3	7.065	94.2
4	12.56	150.72
5	19.625	219.8
6	28.26	301.44
7	38.465	395.64
8	50.24	502.4
9	63.585	621.72
10	78.5	753.6
12	113.04	1055.04
14	153.86	1406.72
15	176.625	1601.4

Shelving cost

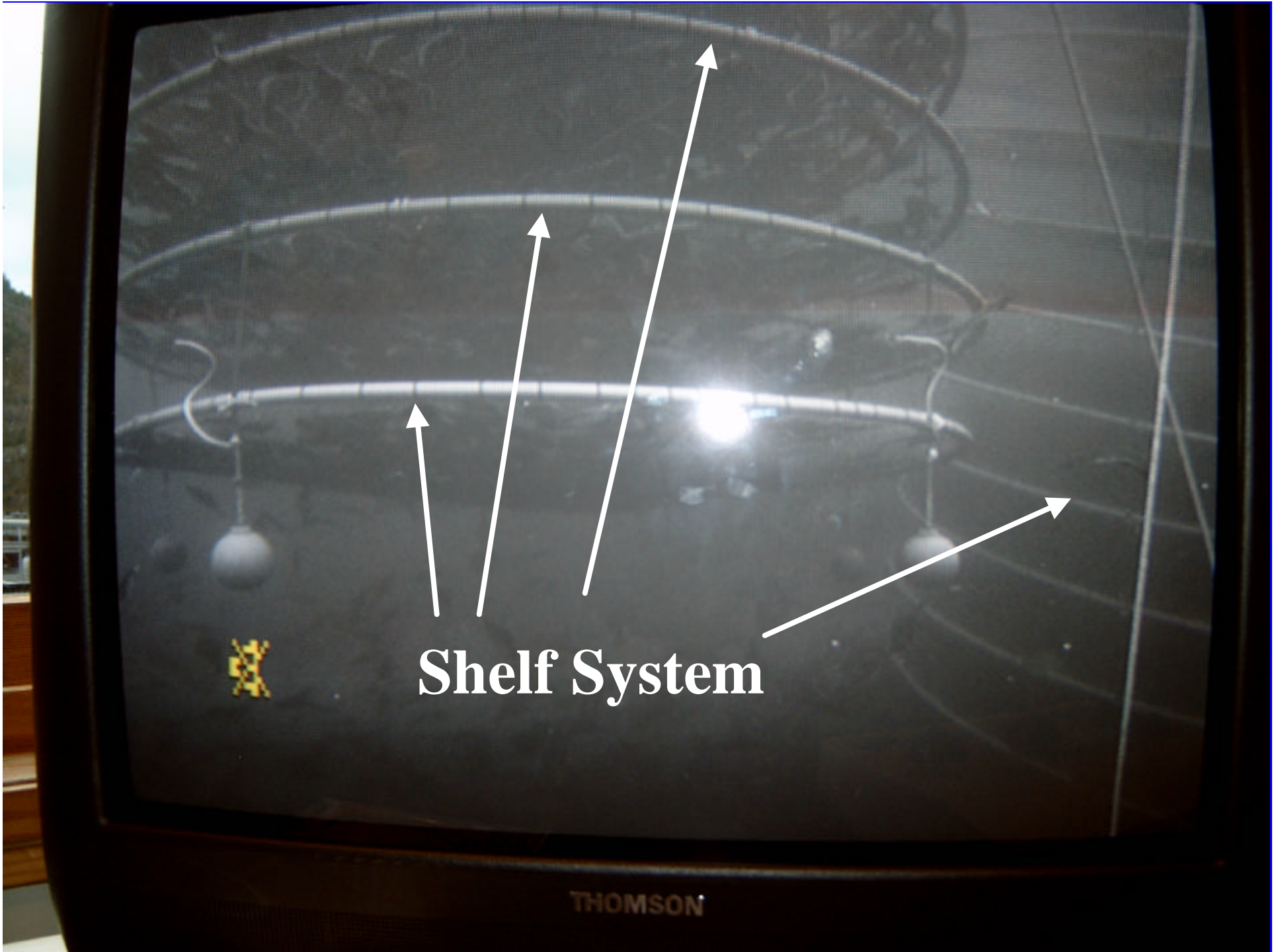
Cage system	Shelf Dia	Total SA	Shelving Cost
12	5	706.5	\$7,913
15	6	1695.6	\$18,086
20	8	4019.2	\$40,192
Circular			
50 m (16 m dia)	5	1962.5	\$21,980
70 m (22 m dia)	7	3846.5	\$39,564
90 m (28 m)	12	11304	\$105,504



Floatation For Shelves



Shelf System



Shelf System

THOMSON