

## Production of red tilapia (*Oreochromis* spp.) in floating cages in the Mekong Delta, Vietnam: mortality and health management

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*Diseases of Aquatic Organisms* 124: 131–144 (2017)

Table S1: Farmers' answers to the questionnaires for the subject mortality. Categorical answers: % of farmers who answered a category and average "overall perceived mortality (PM)" per category. Continuous answers: median (min.–max.). n = no. of responses

Variable	n	Categorical answers: % of farmers	PM between stocking and harvest
		Continuous answers: median (min.–max.)	
PM in the first 2 weeks post stocking*	201		
0%		2%	33
1–5%		46%	27
6–10 %		16%	32
>10%		34%	33
Other		1%	35
Reason for mortality in the first 2 weeks post stocking (RIM)*	198		
Disease		33%	27
Temperature fluctuation		8%	32
Stress		32%	28
Pollution		17%	33
Other		19%	37
PM between stocking and harvest	201		
0–10%		3%	
11–20%		17%	
21–30%		30%	
31–40%		28%	
41–50%		17%	
51–60%		3%	
61–70%		1%	
Reason for mortality between stocking and harvest (ROM)*	201		
Disease		43%	30
Temperature fluctuation		3%	42

Stress		6%	27
Pollution		41%	32
Other		7%	23
Frequency of removal dead fish	201		
At least once per day		87%	30
Nearly every day		11%	34
Once per week		1%	35
Discarding method of dead fish	201		
Sell as food for catfish or other fish farms		82%	31
Serve as food for animals other than fish		6%	27
Use as food for humans		1%	20
Use as compost for the garden		2%	18
Other		10%	30
Send fish to laboratory for pathology	201		
Always		2%	30
>5 times per year		2%	20
≤5 times per year		3%	26
Only when suspect an unknown problem or cause		7%	31
Never		85%	30
Other		1%	25
Type of laboratory	12		
University		0%	
Government		0%	
Private laboratory		17%	30
Feed company		33%	20
Pharmacy		50%	27
If send to laboratory, store the results	76		
Always		3%	40
80–99 % of time		0%	
20–80% of time		5%	23
1–20% of time		4%	28
Never		75%	35
Never, but I remember		13%	28
If stored lab results, level of record keeping	11		
Cage level		82%	24
Species level		18%	35
Site level		0%	
Other		0%	
Methods of record keeping for lab results	11		
Written, record book		55%	30
Written, loose paper		45%	21
Computer, spreadsheet own design		0%	
Computer, specialized program		0%	
Other		0%	
Records of dead fish numbers	199		
Yes		6%	28
No		82%	31
No, but in memory		12%	27

If dead fish no. are recorded, on what level are records kept	13		
Cage level		62%	23
Species level		23%	35
Site level		15%	30
Other		0%	
Frequency of updating mortality records	10		
>5 times per week		100%	26
1–5 times per week		0%	
< once per week, at least once per month		0%	
Very irregularly		0%	
Other		0%	
Method of storing mortality records	10		
Written, record book		90%	26
Written, loose paper		10%	25
Computer, spreadsheet own design		0%	
Computer, specialized program		0%	
Other		0%	
Records of suspected reason of death	9		
Always		11%	45
80–99 % of time		11%	25
20–80% of time		11%	15
1–20% of time		0%	
Never		67%	27

\*: Question included (in original or adjusted form) in the multivariable analysis.

Table S2: Farmers' answers to the questionnaires. Categorical answers: % of farmers who answered a category and average "overall PM" per category. Continuous answers: median (min.–max.) for farmers who responded to the question. n = no. of responses. (A) General and farmer, (B) human consumption of fish, (C) site and employment, (D) fallow and stocking, (E) between stocking and harvest, (F) harvest, (G) record keeping.

Table S2A: General and farmer

<b>Variable</b>	<b>n</b>	<b>Categorical answers: % of responders</b>	<b>PM between stocking and harvest</b>
		<b>Continuous answers: median (min.–max.)</b>	
Province*	201		
An Giang		25%	35
Vinh Long		25%	29
Dong Thap		25%	32
Ben Tre		25%	23
Year of birth of farmer*	186	1972 (1927–1991)	
Sex	201		
Male		90%	30
Female		10%	32
Source of income in last year: agriculture	201		
Yes		8%	28
No		92%	30
Source of income in last year: tilapia aquaculture*	201		
Yes		92%	29
No		8%	32
Source of income in last year: striped catfish aquaculture	201		
Yes		0%	
No		100%	50
Main source of income last year	201		
Tilapia aquaculture		97%	30
Striped catfish aquaculture		1%	25
Agriculture		2%	35
Other		2%	38
Farmer owns site	201		
Yes		97%	30
No		3%	27
Number of sites owned by farmer	194		
1		91%	30
2		8%	28
>2		1%	15
If >1 site, farmer shares equipment between sites	69		
Yes		59%	34
No		41%	32
Farmer sleeps overnight on site	201		

Always (except occasional night away)	92%	31
Other	8%	22

\*: Question included (in original or adjusted form) in the multivariable analysis.

Table S2B: Human consumption of fish

Variable	n	Categorical answers: % of responders	PM between stocking and harvest
		Continuous answers: median (min.–max.)	
Consume fish from site*	201		
Daily		10%	26
Few times per week		36%	30
Few times per month		34%	31
Few times per year		5%	38
Never		12%	28
Consume fish caught within 500 m from site*	201		
Daily		4%	23
Few times per week		41%	29
Few times per month		22%	33
Few times per year		3%	26
Never		29%	31
Consume fish bought at local market	201		
Daily		3%	27
Few times per week		46%	30
Few times per month		31%	34
Few times per year		2%	18
Never		18%	26
Discard unconsumed fish as food for dogs*	201		
Yes		18%	28
No		82%	31
Discard unconsumed fish as food for other animals on the farm	201		
Yes		13%	36
No		87%	29
Discard unconsumed fish as food for fish in cages	201		
Yes		6%	27
No		94%	30
Discard unconsumed fish as food for fish in ponds	201		
Yes		5%	36
No		96%	30
Discard unconsumed fish in river*	201		

Yes	54%	29
No	46%	31

\*: Question included (in original or adjusted form) in the multivariable analysis.

Table S2C: Site and employment

Variable	n	Categorical answers: % of responders	PM between stocking and harvest
		Continuous answers: median (min.–max.)	
Years site operational*	200	4 (1–20)	
Type of water	200		
Fresh		98%	30
Half of the year fluctuating salinity		1%	25
Other		1%	30
Maximum length site (m)	149	12 (6–500)	
Maximum width site (m)	149	6 (3–700)	
Number of striped catfish ponds belonging to the site		0 (0–3)	
Closest pangasius pond (m)	101	200 (20–5000)	
Closest tilapia cage upstream (m)*	193	20 (1–4000)	
Closest tilapia cage downstream (m)	191	10 (1–3000)	
Distance to closest upstream city (km)*	193	4 (0.3–80)	
Number of full time employees*	201	0 (0–5)	
Number part time employees*	201	0 (0–20)	
Animals on the farm other than fish	201		
None		59%	30
Dogs		30%	29
Wild birds		0%	
Mice and rats		3%	25
Cats or other pets		1%	55
Poultry kept for food		0%	
Pigs kept for food		0%	
Other		7%	37
Agriculture is part of the farm	199		
Yes		18%	30
No		82%	30
If agriculture, what type	35		
Orchard		20%	27
Rice		51%	26
Vegetable garden		9%	35
Other		20%	38
Cage information			
Number of cages per farm used	200	3 (0–19)	
Number of cages per farm total*	200	4 (1–28)	

Number of fish in cage *	192	16000 (1000–2000000)
Avg weight of fish in cage	194	300 (0.3–1200)
Length *	200	10 (6–20)
Width *	200	5 (3–10)
Depth *	200	3.5 (2.5–5.5)

\*: Question included (in original or adjusted form) in the multivariable analysis.

Table S2D: Fallow and stocking

<b>Variable</b>	<b>n</b>	<b>Categorical answers: % of responders</b>	<b>PM between stocking and harvest</b>
		<b>Continuous answers: median (min.–max.)</b>	
Restock with same species (red tilapia)	200		
Always		87%	30
80–99 % of time		9%	34
20–80% of time		3%	30
1–20% of time		0%	
Never		1%	20
Other		1%	15
Treat fish before stocking	200		
Yes		82%	31
No		18%	27
Type of treatment before stocking	163		
Bath		98%	31
Oral		1%	15
Injection		0%	
Other		1%	35
Vaccination before stocking	201		
Yes		0%	
No		100%	
Clean nets before stocking	200		
Always		64%	31
80–99 % of time		23%	28
20–80% of time		6%	32
1–20% of time		5%	32
Never		3%	31
Other		1%	25
Origin of stock *	201		
1 hatchery in the same province		65%	31
1 hatchery in another province in the Mekong Delta		26%	28
1 hatchery outside the Mekong Delta		1%	30
> 1 hatchery in the Mekong Delta		5%	38

> 1 hatchery outside the Mekong Delta		0%	
Wild		0%	
Don't know		0%	
Other		3%	17
Stocking size (g)*	187	4 (1–10)	
Fallow period	200		
1–7 days		75%	30
1–2 weeks		18%	29
2–10 weeks		4%	36
>10 weeks		1%	25
Other		4%	36
Stocking season	194		
Dry		41%	30
Wet		59%	31

\*: Question included (in original or adjusted form) in the multivariable analysis.

Table S2E: Between stocking and harvest

Variable	n	Categorical answers: % of responders	PM between stocking and harvest
		Continuous answers: median (min.–max.)	
Min months stocking to harvest	200	5 (2–8)	
Max months stocking to harvest	201	6 (3–10)	
Number of red tilapia cycles per year	201	2 (0–4)	
Mix fish stocked at different times or different cages	200		
Yes		21%	29
No		79%	30
Don't remember		1%	45
Frequency of mixing fish	52		
Never		19%	31
Once		44%	29
Twice		10%	37
2–10 times		15%	26
>10 times		10%	31
Other		2%	35
Mixing is always part of a partial harvest	52		
Yes		35%	29
No		50%	33
Don't remember		15%	26
Move fish to or from another site	195		
Always		6%	32
80–99% of time		3%	29
20–80% of time		5%	24



1–20% of time		6%	36
Never		79%	30
Other		1%	35
Type of feed	201		
Pellet		99%	30
Fish bought from fisherman		1%	32
Dead fish bought from other farms		0%	
Type of feed last 2 months before harvest	201		
Pellet		99%	30
Fish bought from fisherman		1%	30
Dead fish bought from other farms		1%	35
Feeding frequency when fingerlings	201	2 (1–7.5)	
Feeding frequency last 2 months before harvest	196	3 (1–6.5)	

\*: Question included (in original or adjusted form) in the multivariable analysis.

Table S2F: Harvest

<b>Variable</b>	<b>n</b>	<b>Categorical answers: % of responders</b>	<b>PM between stocking and harvest</b>
		<b>Continuous answers: median (min.–max.)</b>	
Person performing the harvests	201		
Middle man		95%	29
Farmer		5%	30
Perceived harvest weight of fish	192	700 (250–1500)	
Reason for harvesting	67		
Price of fish		82%	32
Cash flow		0%	
Need to stock with the next group of fish		15%	35
Other		3%	30
Duration of harvest (days)		2 (1–35)	
Market last 5 years was local commune*	201		
Yes		17%	30
No		83%	30
Market last 5 years was elsewhere in Mekong Delta*	201		
Yes		47%	29
No		53%	30
Market last 5 years was elsewhere in Vietnam*	201		
Yes		54%	32
No		46%	27
Market last 5 years was elsewhere in Southeast Asia	201		
Yes		1%	25
No		99%	30

Market last 5 years was elsewhere in world	201		
Yes		0%	65
No		100%	30
Most common market	201		
Local commune		16%	30
Elsewhere in Mekong Delta		34%	27
Elsewhere in Vietnam		48%	32
Elsewhere in Southeast Asia		0	
Elsewhere in world		1%	35
Don't know		1%	20
After partial harvest of a cage, remaining fish are mixed with other fish	114		
Always		8%	32
80–99 % of time		16%	28
20–80% of time		4%	28
1–20% of time		6%	28
Never		67%	29
Other		0%	
Harvested tilapia leave the farm alive	201	%	
Always		87%	30
80–99 % of time		12%	30
20–80% of time		0%	
1–20% of time		1%	25
Never		1%	25
Other		1%	30
Origin harvesting nets *	200		
Nets that always stay on the site		49%	31
Nets that travel with the harvester		42%	29
Other		9%	31
Cage(s) harvested in 1 day	200		
Part of one cage		63%	30
One cage		19%	31
Part of several cages		11%	32
More than 1 cage on the same farm		3%	33
Other		5%	26
Harvester visits other farms on same day *	199		
Always		19%	30
80–99 % of time		17%	27
20–80% of time		24%	29
1–20% of time		14%	30
Never		12%	38
Other		10%	30
Don't know		4%	25
Harvesters use disinfectants before arrival	200		
Always		17%	32
80–99 % of time		4%	26
20–80% of time		3%	29
1–20% of time		1%	20

Never	74%	30
N.A.	1%	40
Other	1%	35

\*: Question included (in original or adjusted form) in the multivariable analysis.

Table S2G: Record keeping

<b>Variable</b>	<b>n</b>	<b>Categorical answers: % of responders</b>	<b>PM between stocking and harvest</b>
		<b>Continuous answers: median (min.–max.)</b>	
Records of no. fish stocked*	201		
Yes		24%	25
No		34%	30
No, but in memory		42%	33
If stocking no. are recorded, on what level are records kept	47		
Cage level		74%	24
Species level		13%	23
Site level		9%	33
Other		4%	20
Frequency of updating stocking records	41		
> 5 times per week		27%	25
1–5 times per week		22%	24
< once per week, at least once per month		17%	28
Very irregularly		22%	26
Other		13%	19
Method of storing stocking records	36		
Written, record book		78%	24
Written, loose paper		19%	28
Computer, spreadsheet own design		0%	
Computer, specialized program		0%	
Other		3%	35
Records of no. fish harvested*	200		
Yes		13%	25
No		44%	31
No, but in memory		43%	30
If harvested no. are recorded, on what level are records kept	26		
Cage level		69%	21
Species level		15%	38
Site level		15%	28
Other		0%	
Method of storing harvesting records	22		

Written, record book	95%	24
Written, loose paper	5%	25
Computer, spreadsheet own design	0%	
Computer, specialized program	0%	
Other	0%	
Record environmental parameters (e.g. water temperature, pH, dissolved oxygen)	201	
At least once per week	0%	
> 5 times per year	0%	
≤ 5 times per year	0%	
Never	100%	
Never, but I remember	0%	

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\*: Question included (in original or adjusted form) in the multivariable analysis.