

ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
ສັນຕິພາບ ເອກກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ

ກະຊວງກະສິກໍາ ແລະ ປ່າໄມ້  
ສະຖາບັນຄົ້ນຄ້ວາກະສິກໍາ ແລະ ປ່າໄມ້  
ສູນຄົ້ນຄ້ວາການປະມົງ

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## ບົດລາຍງານກ່ຽວກັບການລ້ຽງປາກະຊັງ



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## ບົດລາຍງານກ່ຽວກັບການລ້ຽງປາກະຊ້ງ

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I **ສະພາບທົ່ວໄປຂອງການລ້ຽງປາໃນກະຊັງ.**

ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວມີແຫຼ່ງນ້ຳທີ່ອຸດົມສົມບູນແລະເໝາະສົມໃຫ້ແກ່ການລ້ຽງປາແລະຂະຫຍາຍພັນ, ເຊິ່ງມີເນື້ອທີ່ບໍລິເວນນ້ຳເຊັ່ນ: ແມ່ນ້ຳຂອງແລະສາຂາມີຫຼາຍກ່ວາ 336,656 ເຮັກຕາ ( ກົມລ້ຽງສັດແລະການປະມົງ , 1999 ). ໃນອະນາຄົດຂ້າງໜ້າຄາດວ່າຈະມີເນື້ອທີ່ນ້ຳເພີ່ມຫຼາຍຂຶ້ນຍ້ອນມີການພັດທະນາແລະກໍ່ສ້າງອ່າງເກັບນ້ຳຊົນລະປະທານ, ອ່າງເກັບນ້ຳເພື່ອປ້ອງກັນນ້ຳຖ້ວມແລະອ່າງເກັບນ້ຳເພື່ອຜະລິດໄຟຟ້ານ້ຳຕົກ. ນອກຈາກນັ້ນຍັງມີໜອງບຶງຢູ່ຫຼາຍທ້ອງຖິ່ນລ້ວນແຕ່ມີເງື່ອນໄຂໃຫ້ແກ່ການລ້ຽງປາກະຊັງ.

ການລ້ຽງປາກະຊັງໄດ້ເລີ່ມຕົ້ນໃນປີ 1980 ທີ່ອ່າງນ້ຳຈື່ມ ຕໍ່ມາໄດ້ມີການລ້ຽງປາໃນກະຊັງ ທີ່ອ່າງນ້ຳຫຸມແລະນ້ຳຂອງແລະຂະຫຍາຍໄປເລື້ອຍໆຕາມແມ່ນ້ຳຂອງແລະສາຂາກໍ່ຄືອ່າງເກັບນ້ຳແລະແຫຼ່ງນ້ຳອື່ນໆ. ການລ້ຽງປາກະຊັງມີສອງລັກສະນະຄື:ອະນຸບານລູກປາແລະລ້ຽງເປັນປາຊື່ນ. ມາຮອດປະຈຸບັນນີ້ການລ້ຽງປາກະຊັງມີໃນ 6 ແຂວງແລ້ວເຊັ່ນ: ( ຫຼວງພະບາງ, ແຂວງວຽງຈັນ, ແຂວງກຳແພງນະຄອນ, ຄຳມ່ວນ, ສະຫວັນນະເຂດແລະແຂວງຈຳປາສັກ ) ແຕ່ຢູ່ ແຂວງວຽງຈັນແຂວງກຳແພງນະຄອນມີການລ້ຽງ ຫຼາຍ ກ່ວາແຂວງອື່ນໆ .

ບົດຮຽນການລ້ຽງປາໃນກະຊັງທີ່ອ່າງເກັບນ້ຳດັ່ງຢູ່ອ່າງນ້ຳຫຸມໄດ້ລ້ຽງປາຫົວໄຫຍ່ແລະປາເກັດແລບ ໂດຍບໍ່ໄດ້ເກືອອາຫານອາໄສອາຫານທຳມະຊາດຈາກນ້ຳ ເຊັ່ນ: ພວກໄຮນ້ຳພືດແລະໄຮນ້ຳສັດໄຊ້ເວລາລ້ຽງປະມານ 8 ຫາ 10 ເດືອນໄດ້ນ້ຳໜັກ 0.7 ຫາ 1.0 ກິໂລ / ໂຕ.ປະຈຸບັນນີ້ການລ້ຽງປາກະຊັງໄດ້ຮັບຄວາມສົນໃຈຢ່າງກ້ວາງຂວາງຈາກຊາວກະສິກອນຍ້ອນວ່າ: ການລ້ຽງປາໃນກະຊັງບໍ່ໄດ້ລົງທຶນຄ່າສະຖານທີ່ແລະມີແຫຼ່ງນ້ຳທີ່ເໝາະສົມໃນການວາງກະຊັງລ້ຽງປາ, ການດູແລຮັກສາກໍ່ສະດວກເພາະບໍ່ໄດ້ໃຊ້ເນື້ອທີ່ກ້ວາງແລະການເກັບກູ້ກໍ່ສະດວກ.

ໃນໄລຍະຜ່ານມາຈົນເຖິງປະຈຸບັນມີຊາວກະສິກອນຜູ້ລ້ຽງປາໃນກະຊັງຈຳນວນໜຶ່ງກໍ່ໄດ້ຮັບຜົນສຳເລັດໃນການລ້ຽງແຕ່ຈຳນວນໜຶ່ງກໍ່ບໍ່ທັນໄດ້ຮັບຜົນເທົ່າທີ່ຄວນຍ້ອນວ່າມີຫຼາຍປັດໄຈເຊັ່ນ: ຕົ້ນທຶນການຜະລິດຂ້ອນຂ້າງສູງໂດຍສະເພາະຄ່າອາຫານສຳເລັດຮູບ, ແນວພັນປາບໍ່ຮັບປະກັນແລະຂາດຄວາມຮູ້ຂັ້ນພື້ນຖານໃນການລ້ຽງແລະອື່ນໆ.

**II ວິທີການເກັບກຳຂໍ້ມູນ.**

- ໄດ້ຈັດຕັ້ງເປັນໜຶ່ງທົມປະກອບມີ 3 ຄົນ ( ສູນຄົ້ນຄວ້າການປະມົງຮ່ວມກັບກອງລ້ຽງສັດແລະການປະມົງ ).
- ລົງເກັບກຳຂໍ້ມູນຕົວຈິງ,ສອບຖາມກັບຜູ້ລ້ຽງໂດຍກົງແລະສັງເກດເບິ່ງຕົວຈິງ.
- ເກັບກຳຂໍ້ມູນຈາກເອກະສານແລະບົດລາຍງານຕ່າງໆ.
- ລວບລວມຂໍ້ມູນແລະວິເຄາະ.
- ລາຍງານ.

**III ຜົນຂອງການເກັບກຳຂໍ້ມູນການລ້ຽງປາກະຊັງ.**

**3.1 ການລ້ຽງປາກະຊັງຢູ່ໃນແມ່ນ້ຳຂອງເຂດກຳແພງນະຄອນວຽງຈັນ.**

ຕາມແມ່ນ້ຳຂອງໃນເຂດກຳແພງນະຄອນວຽງຈັນກໍເປັນເຂດໜຶ່ງທີ່ເຫັນວ່າມີເງື່ອນໄຂໃຫ້ແກ່ການລ້ຽງປາກະຊັງ.ມາຮອດປັດຈຸບັນນີ້ການລ້ຽງປາກະຊັງໃນເຂດດັ່ງກ່າວໄດ້ມີການລ້ຽງຫຼາຍກ່ວາ 10 ປ່ອນຊຶ່ງນຳໄຊ້ເຕັກນິກວິທີການລ້ຽງແລະຂະໜາດຂອງກະຊັງທີ່ແຕກຕ່າງກັນເຊັ່ນຕົວຢ່າງ:

**3.1.1 ການລ້ຽງປາກະຊັງຂອງລູກພຸດທາ ປະຖຳມະວົງ.**

ລູກ ພຸດທາ ປະຖຳມະວົງ ບ້ານຫາດດອກແກ້ວ ເມືອງຫາດຊາຍຟອງ ແຂວງກຳແພງນະຄອນ. ອາຊີບຊາວນາ ແຕ່ກ່ອນເຮັດນາແລະປູກໄມ້ໄທ້ໜາກລົງຂາຍຕະຫຼາດຕໍ່ມາໄດ້ຫັນມາທຳການລ້ຽງປາໃສ່ກະຊັງໂດຍອາໄສກາງກະຊັງໃສ່ໃນນ້ຳຂອງ,ໃນຂັ້ນເບິ່ງຕົ້ນມີ 3 ກະຊັງ, ກະຊັງດັ່ງກ່າວແມ່ນໄດ້ຊື້ ສຳເລັດຮູບຈາກໄທແລະເລີ່ມລ້ຽງມາແຕ່ເດືອນ 12 ປີ 2000, ລ້ຽງ 4 ເດືອນ.ຜົນຜະລິດ 1,100 ກິໂລ / ກະຊັງ.

**3.1.2 ກະຊັງ.**

- ກະຊັງຂະໜາດ 4 X 6 X 2 ແມັດ.
- ທຸ່ນສຳລັບລອຍກະຊັງ ປະກອບມີ 6 ໜ່ວຍ / ກະຊັງ.
- ຮ່າງເຫຼັກສຳລັບປະກອບເປັນແພລອຍກະຊັງ.
- ກະຊັງເຮັດດ້ວຍ ດາງດຳ,ດາງຂຽວຕາທ່າງ,ດາງຕາຖິ່ສີຟ້າແລະເຊືອກສຳລັບຫຍິບແລະເຮັດຂ້າວກະຊັງສຳລັບດຶງກະຊັງໄວ້ບໍ່ໃຫ້ນ້ຳພັດໄປ.

**3.1.3 ສະພາບເງື່ອນໄຂປ່ອນກາງຫຼືລອຍກະຊັງ.**

- ຈຸດຫຼືປ່ອນດັ່ງກ່າວມີນ້ຳໄຫຼບໍ່ແຮງ,ໄດ້ປ່ອນຢູ່ອາໄສແລະເປັນປ່ອນທີ່ງຽບດີ.

### 3.1.4 ຂັ້ນຕອນຂອງການລ້ຽງປາກະຊັງ

- ນຳພັນປານິນແປງເພດຂະໜາດຄວາມຍາວ 10 ຊັງຕີແມັດ, ປ່ອຍລົງລ້ຽງໃນອັດຕາ 2,500 ໂຕ / ກະຊັງ.
- ໃຫ້ອາຫານຍີ່ຫໍ້ແມັກ ( MAX ) ເບີ 32 ໂປຼເຣເຕອິນ 32 % ໃຫ້ 5 % ຂອງນ້ຳໜັກປາຕໍ່ມື້ ( 3 - 5 ຄັ້ງ / ມື້ ), ໄຊ້ເວລາໃຫ້ອາຫານດັ່ງກ່າວຢູ່ 1 ເດືອນ, ຈາກນັ້ນໃຫ້ອາຫານທີ່ມີໂປຼເຣເຕອິນ 30 % ໃຫ້ຕະຫຼອດຈົນຮອດເວລາຂາຍ ( 3 ເດືອນ ) ຈຳນວນ 60 ຖົງ / ກະຊັງ.
- ໄລຍະການລ້ຽງ 4 ເດືອນ.
- ອັດຕາການຕາຍແມ່ນ 10 % .
- ຜົນເກັບກູ້ 1,100 ກິໂລ / ກະຊັງ.

ການລ້ຽງປາໃນກະຊັງຕາມແຄມແມ່ນ້ຳຂອງ ( ຮູບ 1 )



3.1.5 ການໄລ່ລຽງເສດຖະກິດ: (1 ກະຊັງ/ ຄັ້ງ )

3.1.6 ການຫຼຸດຮຸນທຶນຄົງທີ່

ລ/ດ	ລາຍການ	ຈຳນວນ (ກະຊັງ)	ລາຄາຫົວ ໜ່ວຍ/ ກີບ	ອາຍຸ ນຳໄຊ້ (ປີ)	ຫຼຸດຮຸນປະ ຈຳປີ (ກີບ)	ສາມາດ ລ້ຽງ (ຄັ້ງ/ ປີ)	ມູນຄ່າຫຼຸດຮຸນ / ຮອບ (ກີບ)
1	ກະຊັງ	1	3,200,000	3	1,066,666	2	533,333
ລວມ:							533,333

ຫມາຍເຫດ: ໃນ 1 ປີສາມາດລ້ຽງໄດ້ ເຖິງ 3 ຮອບ/ປີ.

3.1.7 ທຶນໝູນວຽນ( 1 ກະຊັງ ).

ລ/ດ	ລາຍການ	ຈຳນວນ	ລາຄາຫົວໜ່ວຍ (ກີບ)	ມູນຄ່າ (ກີບ)
1	ລູກປາ	2,500 ໂຕ	600	1,500,000
2	ອາຫານ	60 ຖົງ(1ຖົງບັນຈຸ 20 ກິໂລ)	66,000	3,960,000
3	ຄົນຍາມ	4 ເດືອນ	100,000	400,000
ລວມ:				5,860,000

3.1.8 ລາຍຮັບຂອງການຂາຍປາໃນ 1 ກະຊັງ

ລ/ດ	ລາຍການ	ຈຳນວນ (ກິໂລ)	ລາຄາຂາຍ (ກີບ/ ກິໂລ)	ມູນຄ່າ (ກີບ)
1	ປາຊີ້ນ	1,100	11,000	12,100,000
ລວມ:				12,100,000

3.1.9 ການດຸ່ນດ່ຽງລາຍຮັບ - ລາຍຈ່າຍ

ລ/ດ	ລາຍຮັບ (ກີບ)	ຕົ້ນທຶນ		ມູນຄ່າຜິດດ່ຽງ (ກີບ)
		ຄ່າຫຼ້ຍຫຼັງເງິນຄົງທີ່ (ກີບ)	ທຶນໝູນວຽນ (ກີບ)	
1	12,100,000	533,333	5,860,000	5,706,667

3.2.1 ການລ້ຽງປາກະຊ້າຂອງທ້າວ ຄຳປູ່.

ທ້າວ ຄຳປູ່ ຢູ່ບ້ານສີໂຄທ່າ ເມືອງສີໂຄດຕະບອງ ແຂວງກຳແພງນະຄອນ, ຍ້ອນມີຄວາມສົນໃຈໃນການລ້ຽງປາໃນກະຊ້າຈຶ່ງໄດ້ໄປເບິ່ງຂັ້ນຕອນວິທີການຕ່າງໆຂອງການລ້ຽງປາກະຊ້າຢູ່ເຂດທາບໍ່, ຫມອງຄາຍປະເທດໄທ ຈາກນັ້ນຈຶ່ງມາອອກແບບເຮືອນແພກະຊ້າແລະຈັດທຳດ້ວຍຕົວເອງ. ເຮືອນແພແລະຮ່າງເຫຼັກສຳລັບກາງກະຊ້າປະກອບດ້ວຍລູກບອງ 6 ໜ່ວຍແລະຟຸ່ຍ 2 ໜ່ວຍ (ໃຊ້ສຳລັບລອຍເຮືອນແພແລະຮ່າງເຫຼັກສຳລັບກາງກະຊ້າ). ຂະໜາດຂອງກະຊ້າ 3 X 4 X 1.8 ແມັດ ມີ ( 5 ກະຊ້າ ), ຂະໜາດ 6 X 2 X 1.5 ແມັດ ມີ ( 2 ກະຊ້າ ) ແລະຂະໜາດ 3 X 2 X 1.5 ແມັດ ມີ ( 1 ກະຊ້າ ).

3.2.2 ກະຊ້າ.

- ອຸປະກອນທີ່ໃຊ້ເຮັດກະຊ້າມີ: ດາງດຳ , ດາງຂຽວຕາທ່າງແລະດາງສີຟ້າຕາຖີ່ ( ດາງສີຟ້າຕາຖີ່ໃຊ້ກາງເພື່ອບໍ່ໃຫ້ອາຫານໄຫຼອອກຈາກກະຊ້າ ) , ເຊືອກຂະໜາດໃຫຍ່ແລະເຊືອກຂະໜາດນ້ອຍໄຊ້ສຳລັບມັດກະຊ້າ.

3.2.3 ເຕັກນິກໃນການລ້ຽງປາກະຊ້າ.

- ກະຊ້າຂະໜາດ 6 x 2 x 1.5 ແມັດ ມີ 2 ກະຊ້າ ປ່ອຍ 2,000 ໂຕ / ກະຊ້າ.
- ກະຊ້າຂະໜາດ 3 x 4 x 1.8 ແມັດ ມີ 5 ກະຊ້າ ປ່ອຍ 1,500 ໂຕ / ກະຊ້າ.
- ກະຊ້າຂະໜາດ 3 x 2 x 1.5 ແມັດ ມີ 1 ກະຊ້າ ປ່ອຍ 500 ໂຕ / ກະຊ້າ.
- ຂະໜາດລູກປາ 10 - 15 ຊ້າຕີແມັດ.
- ແນວພັນປາ ( ປານິນພັນ ) ຈາກ ບໍລິສັດ ຊີພີ ໄທ.
- ອາຫານທີ່ໃຊ້ເກືອປາແມ່ນອາຫານສຳເລັດຮູບປານິນ ໄຮເຖດ ເບີ 9952 ໂປຼໂຣເຕອີນ 30% ຊື້ ຈາກບໍລິ ສັດ ຊີພີ ຂອງປະເທດໄທເຊິ່ງມີສາຂາຕັ້ງຢູ່ບ້ານຫມອງແຕ່ງ. ການເກືອແມ່ນເກືອ 3 ຄາບ ( ເຂົ້າ, ສວຍແລະແລງ ), ອັດຕາການຕາຍ 10 %.

ການລ້ຽງປາໃນກະຊັງຢູ່ແຄມແມ່ນ້ຳຂອງ ( ຮູບ 2 )



3.2.4 ການໄລ່ລຽງເສດຖະກິດ

3.2.5 ຫຼິ້ນສຳລັບສ້າງກະຊັງ(1 ກະຊັງ).

ລ/ດ	ລາຍການ	ຈຳນວນ	ລາຄາຫົວໜ່ວຍ (ກີບ)	ອາຍໄຊ້ ງານ (ປີ)	ຫຼັຍຫ້ຽນປະຈຳ ປີ (ກີບ)	ສາມາດ ເຮັດໄດ້ (ຄັ້ງ / ປີ)	ມູນຄ່າຫຼັຍຫ້ຽນ / ຮອບ (ກີບ)
1	ກະຊັງ	1	2,000,000	3	666,000	2	333,000
ລວມ:							333,000

3.2.6 ຫຼິ້ນໝູນວຽນຕໍ່1ກະຊັງ.

ລ/ດ	ລາຍການ	ຈຳນວນ	ລາຄາຫົວໜ່ວຍ / (ກີບ)	ມູນຄ່າ (ກີບ)
1	ລູກປາ	2,000 ໂຕ	600	1,200,000
2	ອາຫານ	56 ຖົງ / 1ຖົງ 20 ກິໂລ	76,000	4,256,000
3	ຢາ/ ວິຕາມິນ		100,000	100,000
4	ແຮງງານແລະຍາມ		200,000	200,000
ລວມ:				5,756,000

3.2.7 ລາຍຮັບຈາກການຂາຍປາ

ລ/ດ	ລາຍການ	ຈຳນວນ (ກິໂລ)	ລາຄາຂາຍ (ກີບ/ ກິໂລ)	ມູນຄ່າ (ກີບ)
1	ປາຊີ້ນ	720	12,000	8,640,000
ລວມ:				8,640,000

3.2.8 ການດຸ່ນດ່ຽງລາຍຮັບລາຍຈ່າຍ.

ລ/ດ	ມູນຄ່າລາຍຮັບ ( ກີບ )	ຕົ້ນທຶນ		ມູນຄ່າຜິດດ່ຽງ ( ກີບ )
		ຄ່າຫຼັຍຫຼ່ຽນທຶນຄົງທີ່ ( ກີບ )	ທຶນໝູນວຽນ( ກີບ )	
1	8,640,000	333,000	5,756,000	2,551,000

4.1 ການລ້ຽງປາກະຊ້ຽງສາຂາແມ່ນໍ້າຂອງ ( ແມ່ນໍ້າງົ່ມ ).

ແມ່ນໍ້າງົ່ມຕອນລຸ່ມຂອງເຄື່ອນໄພພື້ນທີ່ແມ່ນມີເງື່ອນໄຂເໝາະສົມສໍາລັບການລ້ຽງປາກະຊ້ຽງ, ເພາະເປັນເຂດທີ່ມີນໍ້າໄຫຼບໍ່ແຮງ, ຄຸນນະພາບຂອງນໍ້າກໍດີ ໃນປັດຈຸບັນນີ້ໃນເຂດດັ່ງກ່າວແມ່ນໄດ້ເລີ່ມມີການລ້ຽງປາກະຊ້ຽງເຊັ່ນ: ການລ້ຽງປາກະຊ້ຽງຂອງທ້າວ ອະຈ່າງ ບ້ານນາສາລາ ເຂດບ້ານດົງບັງ ເມືອງໄຊທານີ ແຂວງກໍາແພງນະຄອນ. ໄດ້ລ້ຽງປາໃນກະຊ້ຽງແມ່ນໍ້າງົ່ມມີທັງໝົດ 4 ກະຊ້ຽງ . ຮ່າງແພສໍາລັບຄົງກະຊ້ຽງແມ່ນເຮັດດ້ວຍເຫຼັກກໍ່ແປ້ນນໍ້າປະປາ, ໂດຍອອກແບບແລະເຮັດເອົາເອງ . ກະຊ້ຽງມີ 2 ຂະໜາດ, ຂະໜາດ 4 X 4 X 2 ແມັດ ມີ ( 2 ກະຊ້ຽງ ) ແລະຂະໜາດ 4 X 3 X 2 ແມັດ ມີ ( 2 ກະຊ້ຽງ ).

4.1.1 ກະຊ້ຽງ.

- ອຸປະກອນທີ່ໄດ້ເຮັດກະຊ້ຽງມີ 3 ຊະນິດຄື: ດາງດໍາ, ດາງຂຽວຕາທ່າງແລະ ດາງສີຟ້າຕາຖີ່ ( ກາງປ້ອງກັນເພື່ອບໍ່ໃຫ້ອາຫານໄຫຼອອກຈາກກະຊ້ຽງ ) ໄດ້ຊື້ຟຸ້ຍ 4 ໜ່ວຍ / ກະຊ້ຽງ ເພື່ອເປັນທຸ່ນລອຍ, ເຊື່ອກສໍາລັບຫຍິບແລະມັດຕາໜ່າງກັບກະຊ້ຽງ.

4.1.2 ຊະນິດພັນທີ່ນໍາມາລ້ຽງແລະອັດຕາການປ່ອຍ.

- ພັນປານິນສາຍພັນຈາກໃຕ້ຫວັນ ( ບໍ່ໄດ້ແປງເພດ ).
- ຂະໜາດ 4 x 4 x 2 ແມັດ ມີ 4 ກະຊ້ຽງ, ປ່ອຍ 2,000 ໂຕ / ກະຊ້ຽງ.
- ຂະໜາດ 4 x 3 x 2 ແມັດ ມີ 2 ກະຊ້ຽງ, ປ່ອຍ 1,300 ໂຕ / ກະຊ້ຽງ.
- ຂະໜາດລູກປາເວລາປ່ອນລົງກະຊ້ຽງ 10 - 15 ຊ້ຽງຕີແມັດ.
- ອາຫານທີ່ໄດ້ເກືອແມ່ນອາຫານສໍາເລັດຮູບປານິນ ຊີພີ ເບີ 9041 ເມັດນ້ອຍ ໂປຣເຕອິນ 40% ແລະ ຊີພີ ເບີ 9551 ເມັດໄຫຍ່ ໂປຣເຕອິນ 30%
- ການເກືອແມ່ນເກືອ 2 ຄາບ ( ເຊົ້າແລະແລງ ).
- ໄລຍະການລ້ຽງ 4 ເດືອນ, ອັດຕາການຕາຍ 10 %.

ການລ້ຽງປາກະຊ້ງຢູ່ແມ່ນ້ຳງື່ມ ( ຮູບ 3 )



4.1.3 ການໄລ່ລຽງເສດຖະກິດ

4.1.4 ຫິນຄົງທີ່ ( 2 ກະຊັງ ທີ່ມີຂະໜາດຕ່າງກັນ ).

ລ/ດ	ລາຍການ	ຈ/ນ	ລາຄາຫົວໜ່ວຍ ( ກີບ )	ອາຍຸໄຊ້ ງານ (ປີ)	ຫຼ້ຍຫ້ຽນປະຈຳ ປີ ( ກີບ )	ສາມາດລ້ຽງ ( ຄັ້ງ / ປີ )	ມູນຄ່າຫຼ້ຍ ຫ້ຽນ/ ຮອບ ( ກີບ )
1	ກະຊັງ (4x4x2 ມ)	1	1,300,000	3	433,000	2	216,500
2	ກະຊັງ (4x3x2 ມ)	1	1,200,000	3	400,000	2	200,000
ລວມ:							416,500

4.1.5 ທຶນໝູນວຽນ( 2 ກະຊັງທີ່ມີຂະໜາດແຕກຕ່າງກັນ ).

ລ/ດ	ລາຍການ	ຈຳນວນ	ລາຄາຫົວໜ່ວຍ ( ກີບ )	ມູນຄ່າ ( ກີບ )
I	ກະຊັງກຂະໜາດ (4x4x2 ມ)			
1	ລູກປາ	2,000	400	800,000
2	ອາຫານ	61 ຖົງ	44,000	2,684,000
3	ຄົນຍາມ	4 ເດືອນ	75,000	300,000
4	ອື່ນໆ		100,000	100,000
ລວມ:				3,884,000
II	ກະຊັງຂະໜາດ ( 4 X 3 X 2 ມ )			
1	ລູກປາ	1,300	400	520,000
2	ອາຫານ	39 ຖົງ	44,000	1,716,000
3	ຄົນຍາມ	4 ເດືອນ	75,000	300,000
4	ອື່ນໆ		100,000	100,000
ລວມ:				2,636,000

4.1.6 ລາຍຮັບຈາກການຂາຍປາ 2 ກະຊັງ

ລ/ດ	ລາຍການ	ຈຳນວນ (ກິໂລ)	ລາຄາຂາຍ (ກີບ / ກິໂລ)	ມູນຄ່າ (ກີບ)
1	ກະຊັງຂະໜາດ (4 X 4 X 2 ມ)	702	12,000	8,424,000
2	ກະຊັງຂະໜາດ (4 X 3 X 2)	495	12,000	5,940,000
3	ລວມ:	1,197	12,000	14,364,000

4.1.7 ກຳໄລທີ່ໄດ້ຈາກການຂາຍປາຂອງແຕ່ລະກະຊັງ.

ລ/ດ	ລາຍຮັບ (ກີບ)	ຕົ້ນທຶນ (ກີບ)		ມູນຄ່າຜິດດ່ຽງ (ກີບ)
		ຫຼັຍຫຼ່ຽມທຶນຄົງທີ່	ທຶນໝູນວຽນ	
1	8,424,000	216,500	3,884,000	4,323,500
2	5,940,000	200,000	2,636,000	3,104,000

ຫມາຍເຫດ: ມີລາຍຮັບສູງຕົ້ນທຶນອາຫານຖືກ ຖົງລະ 44,000 ກີບ (2,200 ກີບ/ກິໂລ), ຕົ້ນທຶນຊື້ລູກປາຖືກກ່ວາບ່ອນອື່ນໆເຖິງໂຕລະ 200 ກີບໂຕ, ສ້າງກະຊັງເອງ.

5.1 ການລ້ຽງປາກະຊັງຢູ່ໃນໜອງ:

5.1.1 ການລ້ຽງປາກະຊັງຂອງໂຮງຮຽນກະເສດນາບົງ.

ການທົດລອງລ້ຽງປາກະຊັງຢູ່ໃນໜອງຂອງໂຮງຮຽນມະຫາໄລແຫ່ງຊາດຄະນະກະເສດສາດແລະປ່າໄມ້ວິທະຍາເຂດນາບົງ. ໃນປີ 1998 ເພື່ອສຶກສາການນຳໃຊ້ສູດອາຫານທີ່ແຕກຕ່າງກັນແລະນຳໃຊ້ຕົ້ນທຶນແຕກຕ່າງກັນໂດຍນຳໃຊ້ໜອງທີ່ມີ ເນື້ອທີ່ 2,000 ຕາແມັດ, ຄວາມເລິກຂອງໜອງ 1 ຫາ 1.8 ແມັດ, ສະເລ່ຍອຸນນະພູມຂອງນ້ຳ 25 ຫາ 35 ອົງສາ, ລະດັບຂອງ pH ຂອງນ້ຳ 5.8 ຫາ 7.5 ແລະມີອາຫານທຳມະຊາດມີຄວາມອຸດົມສົມບູນພໍສົມຄວນ. ອາຫານທີ່ໃຊ້ເກືອປາ ມີ 4 ຊະນິດ: ຮຳ ໂປຣເຕອີນ 8 - 12 %, ອາຫານປານິນສຳເລັດຮູບ ຊີພີ ເບີ 9932 ໂປຣເຕອີນ 15.5 %, ຮຳ + ອາຫານປານິນສຳເລັດຮູບ ( 1: 1 ) ແລະ ອາຫານໄກ່ພັນຊິ້ນ ຊີພີ ເບີ 911 ໂປຣເຕອີນ 19 %.

5.1.2 ກະຊັງ.

- ກະຊັງເຮັດດ້ວຍຕາງຂຽວແລະໄຊ້ໄມ້ເພື່ອເປັນຮ່າງຄືງກະຊັງ.
- ກະຊັງທີ່ທົດລອງມີ 12 ກະຊັງແຕ່ລະກະຊັງມີຂະໜາດກ້ວາງ 1.5 ມ X ຍາວ 2 ມ X ເລິກ 80 ຊັງຕີແມັດ ແລະເຮັດຂົວໂຕ່ໄປເກືອບາຍາວ 11 ມ.

5.1.3 ຂັ້ນຕອນວິມິການລ້ຽງ.

- ນຳໄຊ້ພັນປານິນທຳມະດາ( *Tilapia niloticus*) ທີ່ຜະລິດໃນປະເທດເຮົານຳໜັກເວລາປ່ອຍລ້ຽງໃນກະຊັງໂດຍສະເລ່ຍ 25 ກຮາມ, ອັດຕ່າຮັປ່ອຍ 200 ໂຕ / ກະຊັງ ( ປະມານ 83 ໂຕ/ມ<sup>3</sup> ).
- ວາງກະຊັງທ່າງລະຫວ່າງຄອກ 1 ແມັດ ໄລຍະທ່າງລະຫວ່າງແຖວ 1.5 ແມັດ.
- ວາງກະຊັງເລິກລົງໄປໃນນ້ຳ 60 ຫາ 70 ຊັງຕີແມັດ.
- ກວດກາເບິ່ງສະພາບອາຫານທຳມະຊາດໃນນ້ຳ, pH ແລະອຸນນະພູມຂອງນ້ຳກ່ອນການປ່ອຍປາລົງກະຊັງ.
- ຂະໜາດຂອງປາທີ່ປ່ອຍລົງລ້ຽງມີຂະໜາດສະເລ່ຍນ້ຳໜັກ 25 ກຮາມ / ໂຕ.ອັດຕາການປ່ອຍ 200 ໂຕ ຫຼືເທົ່າກັບ 5 ກິໂລ / ກະຊັງ ຫຼືເທົ່າກັບ 83 ໂຕ/ແມັດກ້ອນ.
- ຫຼັງຈາກນັ້ນໃຫ້ປາພັກຜ່ອນ 6 ຫາ 12 ຊົ່ວໂມງ ຈົ່ງໃຫ້ອາຫານ.
- ການໃຫ້ອາຫານທັງ 4 ຊະນິດແມ່ນເທົ່າກັນຄື: 3 ກະຊັງໃຫ້ອາຫານປາ, 3 ກະຊັງຈະໃຫ້ອາຫານໄກ່ ພັນຊິນ, 3 ກະຊັງໃຫ້ອາຫານປານິນ + ຮຳ ແລະອີກ 3 ກະຊັງໄຊ້ຮຳເປັນອາຫານພ້ອມທັງຈະໄຊ້ຮຳເປັນຕົວຢືນ.
- ອັດຕາສ່ວນປະສົມອາຫານລະຫວ່າງອາຫານປານິນແລະຮຳແມ່ນ (1:1)
- ອັດຕາໃຫ້ອາຫານແມ່ນ 3 ເດືອນ ທຳອິດແມ່ນໃຫ້ 4 % ຂອງນ້ຳໜັກປາ/ມື້ ແລະເດືອນທີ 4 ແມ່ນໃຫ້ 3 % ຂອງນ້ຳໜັກໂຕຕໍ່ມື້.
- ການເກືອ 2 ຄາບ / ມື້ ( ເຂົ້າ ແລະແລງ ) .
- ໄລຍະການລ້ຽງແມ່ນ 4 ເດືອນ, ອັດຕາການຕາຍ 20%

ການລ້ຽງປາກະຊ້ງຢູ່ໃນໜອງ ( ຮູບ 4 )



5.1.4 ການໄລ່ລຽງເສດຖະກິດ

5.1.5 ທຶນຄົງທີ່

ກະຊັງສາມາດນຳໃຊ້ໄດ້ 3 ປີ

ຄ່າຫຼັຍຫຼຽນ ຕໍ່ 1 ຄັ້ງ 102,133 ກີບ

ກະຊັງ ທີ 1 = 25,533 ກີບ

ກະຊັງ ທີ 2 = 25,533 ກີບ

ກະຊັງ ທີ 3 = 25,533 ກີບ

ກະຊັງ ທີ 4 = 25,533 ກີບ

5.1.6 ທຶນໝູນວຽນ

ກະຊັງ ທີ 1	= 58,385 ກີບ
ກະຊັງ ທີ 2	= 269,885 ກີບ
ກະຊັງ ທີ 3	= 278,345 ກີບ
ກະຊັງ ທີ 4	= 164,135 ກີບ

5.1.7 ການໄຊ້ຈ່າຍເຂົ້າໃນການລ້ຽງແຕ່ລະກະຊັງ

ກະຊັງ ທີ 1	= 83, 918 ກີບ
ກະຊັງ ທີ 2	= 295,418 ກີບ
ກະຊັງ ທີ 3	= 278,345 ກີບ
ກະຊັງ ທີ 4	= 189,668 ກີບ

5.1.8 ລາຍຮັບຈາກການຂາຍປາ

ລາຍການ	ນ້ຳໜັກປາທັງໝົດ (ກິໂລ)	ຂາຍປາທັງໝົດ (ກິໂລ)	ມູນຄ່າ (ກີບ)	ຫມາຍເຫດ
ກະຊັງ 1	59,04	3,635	214,610	
ກະຊັງ 2	84	3,635	305,340	
ກະຊັງ 3	104,64	3,635	380,366	
ກະຊັງ 4	69,12	3,635	251,251	

5.1.9 ສະແດງຄ່າຜິດດ່ຽງ

ລາຍການ	ມູນຄ່າລາຍຮັບ ( ກີບ )	ລາຍຈ່າຍ ( ກີບ )	ຄ່າຜິດດ່ຽງ ( ກີບ )
ກະຊັງ ທີ 1	214,610	83,918	130,692
ກະຊັງ ທີ 2	305,340	295,418	9,922
ກະຊັງ ທີ 3	380,366	303,878	76,488
ກະຊັງ ທີ 4	251,251	189,668	61,583
ໄວມ:	1,151,567	872,882	278,685

ຫມາຍເຫດ: ການທົດລອງລ້ຽງໃນ ເດືອນ 10 ປີ 1998 ທີ່ ໂຮງຮຽນກະເສດນາບົງ.

6.1 ສະພາບການລ້ຽງປາກະຊັງຢູ່ໃນປະເທດໄທ.

ປະເທດໄທເປັນປະເທດໜຶ່ງທີ່ມີການພັດທະນາໃນດ້ານການລ້ຽງປາຢູ່ໃນຂົງເຂດອາຊີ, ໂດຍສະເພາະຮູບແບບການລ້ຽງປາຢູ່ໃນກະຊັງຂຶ້ນມີຫຼາຍລະດັບແລະຫຼາຍວິທີການລ້ຽງທີ່ແຕກຕ່າງກັນດັ່ງໃນປັດຈຸບັນ, ໃນປະເທດດັ່ງກ່າວນີ້ແມ່ນນິຍົມກັນລ້ຽງປານິນແປງເພດຊຶ່ງລ້ຽງຢູ່ຕາມອ່າງເກັບນ້ຳ, ຫ້ວຍ, ໜອງ, ຄອງ, ບຶງ ແລະຫຼາຍກ່ວາບ່ອນອື່ນໆແມ່ນຢູ່ຕາມລຳແມ່ນ້ຳຂອງ, ການລ້ຽງປານິນແປງເພດໃນກະຊັງແມ່ນຮູບແບບເຕັກນິກວິທີການໜຶ່ງທີ່ໃຫ້ຜົນຜະລິດສູງແລະມີຮອບໝູນການຜະລິດໄດ້ໄວເຊັ່ນ: ຢູ່ໃນເຂດຕາເວັນອອກຂຽງເໜືອຂອງປະເທດໄທເປັນຕົ້ນເຂດຈັງຫວັດ ອຸດອນທານີ, ໜອງຄາຍແມ່ນນິຍົມກັນລ້ຽງປານິນແປງເພດຫຼາຍກ່ອນບ່ອນອື່ນໆ. ການລ້ຽງປານິນແປງເພດໃນກະຊັງຢູ່ເຂດດັ່ງກ່າວມີ 2 ຂັ້ນຕອນຄື:

ຂັ້ນຕອນທີ 1. ແມ່ນລ້ຽງປານິນແປງເພດໃນກະຊັງຈາກຂະໜາດນ້ອຍຈົນເຖິງຂະໜາດປານາມເອີ້ນວ່າ: ການອະນຸບານລູກປານິນໃນກະຊັງ ກຳນົດ 2 ເດືອນ.

ຂັ້ນຕອນທີ 2. ລ້ຽງປາດັ່ງກ່າວໃນກະຊັງຈາກຂະໜາດປານາມຈົນຮອດໄດ້ຂະໜາດປາຊັ້ນຫຼືຂະໜາດທີ່ຕະຫຼາດຕ້ອງການ ( 300 - 1000 ກຮາມ ). ໂດຍນຳໄຊ້ຂະໜາດກະຊັງທີ່ແຕກຕ່າງກັນອີງຕາມສະຖານທີ່ແລະເງື່ອນໄຂຈຸດພິເສດຂອງແຕ່ລະບ່ອນດັ່ງ:

6.1.1 ການລ້ຽງປານິນແປງເພດຢູ່ອ່າງເກັບນ້ຳຂອງກຸ່ມກະເສດຕະກອນ: ບ້ານກາງໃຫຍ່ ( ອຸດອນທານີ ).

6.1.2 ການອະນຸບານລູກປານິນຢູ່ໃນກະຊັງ.

ການອະນຸບານລູກປານິນທີ່ມີຂະໜາດ 1,5 - 2 ຊັງຕີແມັດ ໃຫ້ໄດ້ຂະໜາດ 7 - 10 ຊັງຕີແມັດ ໃນກະຊັງທີ່ເຮັດດ້ວຍດາງສີຟ້າຕາຖີ່.

6.1.3 ກະຊັງ.

- ກະຊັງມີ 2 ຂະໜາດຄື: ຂະໜາດ 1,80 X 3 X 0,9 ແມັດແລະຂະໜາດ 4,5 X 5 X 0,9 ແມັດ.

- ກະຊັງຂະໜາດ 1,80 X 3 X 0,9 ແມັດ, ບ່ອຍລູກປານິນລົງລ້ຽງຈຳນວນ 1,000 ໂຕ / ກະຊັງ.

- ການໃຫ້ອາຫານແມ່ນໃຫ້ອາຫານສຳເລັດຮູບທີ່ມີໂປຼເຕິນບໍ່ຕ່ຳກ່ວາ 35 % ຫຼືອາຫານປະສົມເອົາເອງ ໂດຍໄຊ້ຮຳອ່ອນໆ 1 ສ່ວນ ປະສົມກັບອາຫານໝູນ້ອຍ 2 ສ່ວນ ( 1 : 2 ). ການເກືອແມ່ນເກືອ 2 - 3 ຄັ້ງ / ມື້ , ກຳນົດເວລາລ້ຽງ 6 - 8 ອາທິດ , ອັດຕາການຕາຍ 20 % - 30 % .

- ຕົ້ນທຶນການອະນຸບານ ( ຄ່າອາຫານ, ຄ່າລູກປາແລະຄ່າກະຊັງ = 120,000 ກີບ ).

- ຄ່າຂາຍລູກປາ = 280,000 ກີບ ແລະ ມູນຄ່າຜົດວ່າງ = 160,000 ກີບ.

- ກະຊັງຂະໜາດ 4,5 X 5 X 0,9 ແມັດ.
- ປ່ອຍລູກປານິນລົງລ້ຽງຈຳນວນ 3,000 ໂຕ / ກະຊັງ.ການ ໃຫ້ອາຫານແມ່ນໃຫ້ອາຫານສຳເລັດ ຮູບທີ່ມີໂປຼເຕອິນບໍ່ຕໍ່າກ່ວາ 35 % ຫຼືອາຫານທີ່ປະ ສົມເອົາ ເອງໂດຍໄຊ້ຮຳອ່ອນໆ 1 ສ່ວນ ປະ ສົມກັບອາຫານໝູນ້ອຍ 2 ສ່ວນ ( 1 : 2 ).ໃຫ້ ອາຫານ 2 - 3 ຄັ້ງ / ມື້,ກຳນົດລ້ຽງ6-8 ອາທິດ,ອັດ ຕາການຕາຍ 20 % - 30 %.
- ຕົ້ນທຶນການອະນຸບານ ( ຄ່າອາຫານ,ຄ່າລູກປາແລະຄ່າກະຊັງ = 320,000 ກີບ ).
- ຄ່າຂາຍລູກປາ = 680,000 ກີບ.
- ມູນຄ່າຜົດດ່ຽງ = 360,000 ກີບ.

ການອະນຸບານລູກປານິນແປງເພດຢູ່ໃນກະຊັງທີ່ບ້ານກາງໃຫຍ່,ອຸດອນທານີ ( ຮູບ 5 )



**7.1 ການລ້ຽງປານິນແປງເພດໃນກະຊັງຢູ່ອ່າງເກັບນ້ຳ.**

ການລ້ຽງປານິນໃນກະຊັງທີ່ບ້ານກາງໃຫຍ່ (ອຸດອນທານີ). ລ້ຽງຢູ່ບໍລິເວນອ່າງເກັບນ້ຳ ມີເນື້ອທີ່ປະມານ 200 ໄລ່. ການລ້ຽງປານິນແປງເພດແມ່ນເລີ່ມລ້ຽງແຕ່ຂະໜາດປານິນຈົນເຖິງຂະໜາດທີ່ຕະຫຼາດຕ້ອງການ. ມີທັງໝົດ 88 ກະຊັງ . ກະຊັງມີຂະໜາດ 4 X 5 X 2,5 ແມັດ.

**7.1.1 ກະຊັງ.**

ອຸປະກອນທີ່ໃຊ້ເຮັດກະຊັງມີຕ່າງໆຂຽວຕາໃຫຍ່, ຮ່າງສຳລັບຄຶງກະຊັງເຮັດດ້ວຍໄມ້ໄຜ່ແລະໃຊ້ພຸຍເປັນທຸນລອຍກະຊັງ.

**7.1.2 ຂະນິດພັນປານິນຳມາລ້ຽງແລະອັດຕາການປ່ອຍ.**

- ພັນປານິນແມ່ນປານິນແປງເພດ.
- ຂະໜາດ 4 X 5 X 2,5 ແມັດ, ປ່ອຍ 1,000 ໂຕ / ກະຊັງ.
- ຂະໜາດລູກປາປ່ອຍລົງກະຊັງ 30 ກຮາມ.
- ອາຫານທີ່ໃຊ້ເກືອແມ່ນອາຫານສຳເລັດຮູບປານິນ ໄຮເກຼດ ໂປຼຕິນ 40 % ເມັດນ້ອຍ.
- ການເກືອແມ່ນເກືອ 3 ຄາບ ( ເຊົ້າ, ສວຍແລະແລງ ).
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ກະຊັງທີ່ລ້ຽງມີຂະໜາດ 3 x 3 x 2.5 ແມັດ. ໂດຍນຳໃຊ້ຕາຫນ່າງຫ່າງສືດຳເພື່ອໃຫ້ມີການລະບາຍນ້ຳແລະເອົາດາງຂຽວໃສ່ເບື້ອງເທິງທາງຂ້າງກະຊັງເພື່ອປ້ອງກັນບໍ່ໃຫ້ອາຫານພູທີ່ເກືອໄຫຼອອກໄປເວລາເກືອ. ມູນຄ່າຂອງກະຊັງ ຂະໜາດ 3 x 3 x 2.5 ແມັດ. ລາຄາປະມານ 2,000,000 ກີບ / ກະຊັງ ອາຍຸໄຊຊ້ງານ 3 ປີ. ປານິນຳມາລ້ຽງແມ່ນປານິນໝັນ ປາດັ່ງກ່າວນຳໄປລ້ຽງໃນໜອງດິນປະມານ 3 ເດືອນຈົນຮອດ 45 ກຮາມ ເຊິ່ງມີລາຄາອີງຕາມຂະໜາດປະມານ 400 - 600 ກີບ. ອັດຕາການປ່ອຍ 1,000 ໂຕ / ກະຊັງ. ວິທີການເກືອແລະດູແລຮັກສາປາໃນກະຊັງມີດັ່ງນີ້:

**ອາທິດທີ 1 ແລະທີ 2.**

- ການເກືອອາຫານ ຊີພີ ເບີ 9041 ເມັດນ້ອຍ ໂປຣເຕອິນ 40 % ລາຄາ 74,000 ກີບ / ຖົງ 20 ກິໂລ.

**ອາທິດທີ 3 ແລະທີ 4.**

- ການເກືອອາຫານ ຊີພີ ເບີ 9961 ໂປຣເຕອິນ 30 % ລາຄາ 72,000 ກີບ / ຖົງ 20 ກິໂລ.

**ຫຼັງຈາກນັ້ນໃນການເກືອປາໃນເດືອນທີ 2.**

- ການເກືອອາຫານ ຊີພີ ເບີ 9950 ໂປຣເຕອິນ 30 % ລາຄາ 72,000 ກີບ / ຖົງ 20 ກິໂລ.

**ການເກືອປາໃນເດືອນທີ 3 ແລະເດືອນທີ 4.**

- ການເກືອອາຫານ ຊີພີ ເບີ 9951 ໂປຣເຕອິນ 30% ລາຄາ 72,000 ກີບ / ຖົງ 20 ກິໂລ. ວິທີ

- ການເກືອປາແມ່ນເກືອ 4 - 5 ຄັ້ງ / ມື້, ເພື່ອບໍ່ໃຫ້ອາຫານເສຍຫຼືຈົມແລະໄຫຼອອກ. ຊາວກະສິກອນຈຳນວນໜຶ່ງກໍມີການແຊ່ອາຫານໄວ້ເກືອປາເພື່ອເຮັດໃຫ້ອາຫານອ່ອນນຸ້ມເລັກໜ້ອຍກ່ອນຈະເກືອ ປາ, ຖ້າເກືອອາຫານແທ້ໆ ເມື່ອປາກິນດ້ວຍຄວາມຫິວປາຈະກິນຫຼາຍໂພດອາດຈະເຮັດໃຫ້ປາທ້ອງເບັງແລະຕາຍກໍໄດ້. ຕອນເຊົ້າເລີ່ມແຕ່ 7 ໂມງ - 9 ໂມງ 30 ນາທີ. ຕອນສວາຍ 12 ໂມງ 30 ນາທີ ແລະຕອນແລງແມ່ນ 5 ໂມງ .ອາຫານເສີມທີ່ໃຫ້ແມ່ນວິຕາມິນເຊເປັນສ່ວນໄຫຍ່.
- ການຈຳໜ່າຍປາແມ່ນເຮັດໂດຍບໍລິສັດ ຊີພີ ປາ ຂະໜາດ 700 - 750 ກວາມ ສິ່ງຕໍ່ໃນຕະຫຼາດໜອງຄາຍ. ປາທີ່ມີຊີວິດ ( ປາສົດ ) ຂັງໃສ່ອ່າງປະມານ 2 - 3 ມື້ ໂດຍບໍ່ເກືອອາຫານໄດ້ຂາຍໃນລາຄາ 10,000 ກີບ / ກິໂລ. ມີລາຍຮັບປະມານ 1,200,000 – 1,800,000 ກີບ / ກະຊັງ.

ການລ້ຽງປານົນແດງ ( ປາທັບທົມ ) ຢູ່ໃນກະຊັງທີ່ ໜອງຄາຍ ( ຮູບ 6 )



IV. ສະຫຼຸບ

- ການລ້ຽງປາຂອງທ້າວ ພຸດທາ ຢູ່ແຄມຂອງ ເມືອງຫາດຊາຍຟອງ ແມ່ນລ້ຽງດ້ວຍອາຫານ ( ແມັກ) ສາມາດກຳໄລຈາກການລ້ຽງ 5,706,667 ກີບ / ກະຊັງ.
- ການລ້ຽງປາຂອງທ້າວ ຄຳບູ່ ຢູ່ແຄມຂອງ ເມືອງສີໂຄດຕະບອງ, ແມ່ນນຳໄຊ້ອາຫານ (ໄຮເກຣດ ) ແມ່ນສາມາດກຳໄລ 2,251,000 ກີບ / ກະຊັງ.
- ການລ້ຽງປາຂອງທ້າວ ອະຈ່າງ ທີ່ນ້ຳຊື່ມ ເມືອງໄຊທານີ, ໄຊ້ອາຫານ ( ໄຮລັກ ),ກະຊັງທີ 1 ຂະ ໜາດ 4 X 4 X 2 ມ,ກຳໄລ 4,323,500 ກີບ / ກະຊັງ ແລະກະຊັງທີ 2 ຂະ ໜາດ 4 X 3 X 2 ມ ກຳໄລ 3,104,000 ກີບ / ກະຊັງ.
- ການທົດລອງລ້ຽງປາກະຊັງທີ່ໂຮງຮຽນກະເສດນາບົງ ເມືອງໄຊທານີ, ໄຊ້ອາຫານ 4 ປະເພດ,ລ້ຽງ 4 ເດືອນ ,ເຮົາສາມາດຮູ້ຄ່າຜິດດ່ຽງແຕ່ລະກະຊັງໄດ້ດັ່ງນີ້:  
ກະຊັງທີ 1 ໄຊ້ອາຫານ ຮຳ = 130,692 ກີບ.  
ກະຊັງທີ 2 ໄຊ້ອາຫານປານິນ = 9,922 ກີບ.  
ກະຊັງທີ 3 ໄຊ້ອາຫານໄກ່ພັນຊັ້ນ = 76,488 ກີບ.  
ກະຊັງທີ 4 ໄຊ້ອາຫານປານິນ + ຮຳ ( 1: 1 ) = 61,583 ກີບ.
- ການນຳໄຊ້ຮຳລ້ຽງປານິນກໍໄດ້ຮັບຜົນດີເຊັ່ນດຽວກັນເຖິງວ່າຜົນຜະລິດຈະບໍ່ໄດ້ຫຼາຍເທົ່າກັບການນຳໄຊ້ອາຫານແຕ່ການໄລ່ລຽງເສດຖະກິດແມ່ນດີກ່ວາ.
- ຜົນຈາກການລ້ຽງປາມໃນກະຊັງມີຄວາມແຕກຕ່າງກັນຍ້ອນລາຄາວັດຖຸດິບມີຄວາມແຕກຕ່າງກັນເຊັ່ນ: ລາຄາຂອງອາຫານ ( ເຊິ່ງແມ່ນປັດໃຈສຳຄັນກ່ວາໝູ່ ), ວັດຖຸອຸປະກອນທີ່ນຳມາສ້າງກະຊັງມີລາຄາແຕກຕ່າງກັນ,ເຕັກນິກແລະວິທີການລ້ຽງ,ຄຸນນະພາບຂອງອາຫານແລະແນວພັນມີ ຄວາມແຕກຕ່າງກັນຈຶ່ງເຮັດໃຫ້ການດຸ່ນດ່ຽງຈາກການລ້ຽງປາກະຊັງແຕກຕ່າງກັນໄປດ້ວຍ.
- ຜ່ານການລົງສຳຫຼວດກ່ຽວກັບການລ້ຽງປາກະຊັງໃນເຂດກຳແພງນະຄອນວຽງຈັນ,ສາມາດສະຫຼຸບສັງ ລວມໄດ້ດັ່ງລຸ່ມນີ້:

#### 4.1 ຈຸດດີ

- ສາມາດສ້າງລາຍຮັບເພີ່ມແລະມີວຽກເຮັດງານທຳໃຫ້ແກ່ຊາວກະສິກອນໂດຍສະເພາະໃນເຂດຊານເມືອງແລະຊົນນະບົດ, ເໝາະສຳລັບຊາວກະສິກອນທີ່ຢູ່ອາໄສຢູ່ແຄມແມ່ນ້ຳແລະບໍ່ມີເນື້ອທີ່ການ ຜະລິດ.
- ຕະຫຼາດມີຄວາມຕ້ອງການຍ້ອນປາມີກິນແລະລົດຊາດແຊບດີ, ປາສົດ, ສະອາດແລະການບໍລິການສະດວກດີ, ສາມາດເກັບກູ້ໄດ້ງ່າຍແລະສະດວກໃນການດູແລໃນບໍລິເວນທີ່ຈຳກັດເຊິ່ງສາມາດຄຸ້ມຄອງໄດ້.
- ປະຢັດແຮງງານແລະຕົ້ນທຶນເມື່ອປຽບທຽບກັບການສ້າງໜອງປາ.
- ການປົກປັກຮັກສາແມ່ນສະດວກແລະມີເວລາຫຼາຍໃນການເຮັດວຽກອັນອື່ນໆນຳອີກ.
- ແຫຼ່ງນ້ຳທຳມະຊາດແມ່ນມີຫຼາຍໂດຍສະເພາະແມ່ນຜູ້ທີ່ຢູ່ໄກ່ແຄມຂອງແມ່ນເໝາະສົມໃນການລ້ຽງປາກະຊ້ງ.

#### 4.2 ຈຸດອ່ອນ

- ການລົງທຶນຄ່ອນຂ້າງສູງສຳລັບຊາວກະສິກອນຜູ້ທີ່ມີລາຍໄດ້ຕ່ຳເພື່ອຊື້ກະຊ້ງ, ແນວພັນປາແລະອາຫານສຳເລັດຮູບ.
- ຍັງມີການນຳໄຊ້ອາຫານສຳເລັດຮູບແລະແນວພັນປາຈາກຕ່າງປະເທດຢູ່.
- ສ່ຽງຕໍ່ການລົງທຶນໃນກໍລະນີກະຊ້ງຂາດປາອອກ, ປາເບົ້າກັດ, ນາກກັດ, ໝູກັດ, ນ້ຳໄຫຼແຮງ, ລົມ ພະຍຸແລະຄື້ນຟອງນ້ຳໄຫຼແຮງ.
- ຕ້ອງໄດ້ມີຄວາມຮັບຜິດຊອບແລະເອົາໃຈໃສ່ສູງກ່ວາການລ້ຽງປາໃນໜອງດິນ, ໂດຍສະເພາະລະດູຝົນຈະມີຝົນຕົກແຮງນ້ຳໄຫຼນອງ, ມີຂອນໄມ້ໄຫຼມາທັບໃສ່ກະຊ້ງ, ນ້ຳມີຄວາມຊຸ່ນສູງອາດຈະເຮັດໃຫ້ປາຕາຍແລະເກີດຄວາມເສຍຫາຍໄດ້.
- ແນວພັນໃນແຫຼ່ງຕ່າງໆຍັງບໍ່ທັນຮັບປະກັນ, ປາບາງບ່ອນທີ່ນຳມາລ້ຽງໃຫຍ່ໄວແລະບາງບ່ອນໃຫຍ່ຊ້າ.
- ຕົ້ນທຶນທີ່ຈ່າຍເຂົ້າໃນການຊື້ອາຫານສູງເຖິງ 50 - 70 % , ຊາວກະສິກອນຍັງບໍ່ທັນໄດ້ເອົາໃຈໃສ່ໃນການນຳໄຊ້ອາຫານທີ່ມີໃນທ້ອງຖິ່ນປະສົມກັບອາຫານສຳເລັດຮູບ.

V. ຂໍ້ແນະນຳ

- ສະຖານທີ່ເປັນອີກປັດໃຈໜຶ່ງທີ່ມີຄວາມສຳຄັນຊຶ່ງເຮົາຄວນເລືອກບ່ອນທີ່ມີນ້ຳໄຫຼແລະຖ່າຍເທສະດວກດີ, ນ້ຳໃຫ້ມີຕະຫຼອດປີແລະມີປະລິມານອີກຊີແຊນຢ່າງພຽງພໍ.
- ຢູ່ໄກ້ແຫຼ່ງອາຫານ, ບ່ອນຈຳໜ່າຍແລະບ່ອນພັກພາອາໃສສະດວກໃນການດູແລຮັກສາ.
- ກະຊັງທີ່ໄຊ້ລ້ຽງປາຄວນໃຫ້ນ້ຳໄຫຼຜ່ານສະດວກດີແຕ່ເຮົາຄວນເອົາຕາງຂຽວກາງເຄິ່ງໜຶ່ງເພື່ອບໍ່ໃຫ້ອາຫານໄຫຼອອກໃນເວລາເຮົາເກືອ.
- ອາຫານທີ່ໄຊ້ລ້ຽງປາຄວນເກັບຮັກສາໄວ້ໃຫ້ຢູ່ໃນສະພາບດີເປັນປົກກະຕິ, ຖ້າອາຫານເສຍຄຸນກໍບໍ່ຄວນໄຊ້ແລະຄຳນຶງເຖິງຂະໜາດຂອງເມັດອາຫານທີ່ເໝາະສົມກັບປາຂະໜາດປາທີ່ເຮົາລ້ຽງ.
- ເວລາໃຫ້ອາຫານບໍ່ຄວນໃຫ້ມີສິ່ງລົບກວນເພາະປາຈະກິນອາຫານໄດ້ໜ້ອຍແລະເຮັດໃຫ້ອາຫານສູນເສຍໄປ.
- ການຄັດເລືອກລູກປາມາລ້ຽງຄວນຄັດເອົາປາທີ່ມີສຸຂະພາບແຂງແຮງສົມບູນດີແລະໃຫ້ມີຂະໜາດໄກ້ຄຽງກັນທີ່ສຸດທັງເປັນປາລຸ້ນດຽວກັນ, ຄວນໃສ່ຄູຫຼືຊາມຄັດກ່ອນຈະປ່ອຍລົງກະຊັງ.
- ແນວພັນປາຊາວກະສິອນຄວນຈະ ສົ່ງເສີມການຜະລິດເອງພາຍໃນປະເທດບໍ່ຄວນຈະໄປຊື້ປາຈາກຕ່າງປະເທດໄກ້ຄຽງຫຼາຍເກີນໄປເພື່ອປະຢັດຕົ້ນທຶນ.
- ອາຫານທີ່ນຳມາລ້ຽງປາຄວນຈະໝູນໄຊ້ສິ່ງທີ່ມີຢູ່ໃນປະເທດເຮົາບໍ່ຄວນຈະໄປຊື້ຈາກປະເທດອື່ນຫຼາຍເພື່ອປະຢັດລາຍຈ່າຍແລະຫຼຸດຜ່ອນຕົ້ນທຶນການຜະລິດ.

LARReC Data and Information Unit

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ສະຫງວນລິກະສິດ

## A Report on Cage Culture in Lao PDR



# **A Report on Cage Culture in Lao PDR**

**Prepared by the Living Aquatic Resources Research Centre (LARReC)  
and the Network of Aquaculture Centres in Asia-Pacific (NACA)**

This report gives the results of a survey of cage fish culture carried out during 2001 coordinated by the Living Aquatic Resources Research Centre (LARReC) and the Network of Aquaculture Centres in Asia-Pacific (NACA).

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## Background

Lao PDR has abundant aquatic resources. The water surface covers large areas in reservoirs, backswamps, the Mekong river and its tributaries. Fisheries are a critically important source of food and income to the Laotian people, and aquaculture is making an increasingly important contribution to fisheries production in the country.

Fish cage culture is one technique for producing fish, that was first introduced to the Lao PDR around 1985. The first ever fish cages were introduced in Nam Ngum, Nam Hum and Nam Suang reservoirs. Thereafter the farming practice has expanded to some small rivers, and recently to the Mekong and its tributaries. Cage culture activities include fish culture for grow out, holding of fish for markets, and nursing of fingerlings. There are two main types of feeding practice - one depends on inputs of supplementary feed supply and another one relies on the natural productivity of the water (zooplankton and algae).

Several fish species are reported to be cultured in cages in Lao PDR. These include *Pangasius larnaudiei*, *Channa striata*, *Pangasius sutchi* and tilapia and carp species namely: silver barb, common carp, big head and silver carp. The latter carp species are cultured in cages without supplementary feed where the water is sufficiently fertile. The most popular fish being produced in cages at the present time appear to be tilapia, and the number of cage farms producing tilapia seems to be increasing. The price of 1 kg tilapia fish is reported to be around the same price as livestock meat in the northern part of the country (15,000 Kip/kg), however in the southern part of the country and Vientiane municipality the price ranges from 8,000 to 10,000 Kip/kg. There are also seasonal fluctuations in prices depending on demand and availability of fish.

The culture of fish in cages has several advantages, such as a means of diversifying production, income generation, lower cost compared to constructing a pond, and easier harvest and feeding of fish stock. The disadvantages of cage culture are its dependence on feed supply, its sensitivity to environmental change and that supplementary feed is relatively expensive. The cost for feed in intensive cage culture is estimated as about 50 to 70% of total operational costs. Feeds and some fingerlings supply are still imported into Laos. There is some concern that intensive and large-scale production in cages may also lead to an affect on the environment through water pollution.

Recognising the need for more information on cage culture, LARReC initiated a research project (with support from the DANIDA funded NARI project) in cooperation with the Department of Livestock and Fisheries and the National University of Laos. This report gives the findings from that research project<sup>1</sup> and outcome of a workshop that discussed the findings and future development of cage culture in the country.

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<sup>1</sup> A preliminary report of the study has also been published in *Aquaculture Asia*. Somboon, B.Sapphakdy, Sola, S. Ingthamjitr and M.Phillips. 2001. Lao PDR looks into potential for freshwater cage culture. *Aquaculture Asia*. July-September 2001 (Vol.VI:3): 16.

## **Objectives and workplan**

### ***Objectives***

The goal of the research was defined as “Fish cage culture activities that contribute to fishery development goals of the Lao PDR”.

The purposes of the project were:

- 1) To gain understanding of the present status, opportunities and constraints to development of fish cage culture in the Lao PDR, considering technical, economic/markets, social and environmental factors.
- 2) To identify researchable issues and prepare a research strategy for cage culture that addresses these issues according to different local conditions.
- 3) To make recommendations to government on a future development strategy for cage culture in the Lao PDR based on better understanding of the role of cage culture in meeting government fishery development goals.

The research project was initiated in March 2001 with a study tour of Lao officials to Thailand. The research was continued with a survey of fish cage farms in Laos PDR conducted during July and August 2001. The preliminary findings from the survey were presented to a workshop in August 2001, and this report completed based on the workshop comments.

The logframe for the research project is attached as Annex A.

### ***Materials and methods***

The project was initiated by a study tour to Thailand in March 2001. The study tour allowed key participants in the research to better understand the cage culture activities in Thailand. This information was used in the design and analysis of the subsequent research in Laos.

The research was conducted through a survey of existing cage culture operations and resources in different regions. A questionnaire was prepared in cooperation between the Aquaculture Research Unit of LARReC, the Department of Livestock and Fisheries and National University of Laos drafted these. Dr. Suchart Inthamjitr (Department of Fisheries, Thailand) assisted in the design and field testing of the questionnaires in Vientiane Municipality.

After finalisation of the questionnaire, the survey was carried out in seven provinces. The survey covered attempted to cover all known cage farms in 7 provinces (14 districts, about 38 households and 3 farmers’s groups (1 in Nam Ngum and 2 in Nam Houm reservoirs).

The data collected by questionnaire was checked and then entered into the SPSS program for subsequent analysis. The questionnaire is attached as Annex C.

The following persons were involved in the project.

<i>Name</i>	<i>Position</i>	<i>Responsibility</i>
Mr. Lieng Khamsivilay	Deputy of LARReC	Team leader (Technical advise)
Mr. Tienne Vannasouk	Director of LFDD	Planning and reporting
Mr. Bounthong Saphakdy	Deputy Director of LFDD	Interview form Data revise
Mr. Somboun	Head of ARU	Data compilation
Mr. Sola	Technician	Data collection
Dr. Suchart Inthamjitr	Department of Fisheries, Thailand	Technical support

### **Workshop**

Following preliminary analysis of the survey data, a workshop was held from 29<sup>th</sup>-30<sup>th</sup> August 2001. The objectives of the LARReC cage culture workshop were as follows:

- 1) To present and discuss the results of a study of cage culture in Laos.
- 2) To gain understanding of the present status, opportunities and constraints to development of fish cage culture in the Lao PDR, considering technical, economic/markets, social and environmental factors.
- 3) To identify researchable issues and prepare a research strategy for cage culture that addresses these issues according to different local conditions.
- 4) To make recommendations to government on a future development strategy for cage culture in the Lao PDR based on better understanding of the role of cage culture in meeting government fishery development goals.
- 5) To identify opportunities for further cooperation on cage culture development between Laos and other Mekong countries.

The workshop, that included farmers, provincial staff, staff of LARReC, LFDD and National University, and resource persons from Thailand, provided a good opportunity to discuss the research findings among a range of stakeholders.

The following report details the survey results and conclusions, based on the analysis of the project team, and also suggestions and recommendations from the workshop.

## Survey findings

### *Technical information*

#### **Baseline information**

The survey covered 38 farms and a total of 1642 cages in seven provinces/municipality. The largest number of cages is found in Vientiane municipality, followed by Khammouan province as noted in Table 1 below.

*Table 1: Number of farms and cages surveyed.*

<b>Provinces</b>	<b>Number of informants</b>	<b>Number of cages</b>	<b>Remarks</b>
Luang phrabang	2	18	
Vientiane	1	3	Pens
Vientiane Municipality	30	1193	10 cage for retailing
Borikhamxay	1	2	
Kham mouane	3	324	
Savannakhet	1	7	107 cages for holding fish prior to retailing
Champassak	2	39	
<i>Total</i>	<i>40</i>	<i>1,586</i>	

Some farms were not included in the survey. It was not possible to interview staff at the Savang fish farm (150 cage of tilapia and *Pangasius hypophthalmus*). Some farms were also not possible to access as they are scattered in the provinces. However, based on the survey findings, there is an estimated 2,000 cages and pens involved in cage culture in the country.

In addition, there are estimated to be 117 cages found in Savannakhet and Vientiane Municipality that are mainly used for holding fish for trading or retailing (ie not culture).

Province located along Mekong River have high potential for fish cage culture. Vientiane Municipality has largest number of fish cage culture farmers and the practice has expanded to the south particularly in Borilhamxay, Kham mouane, Savannakhet and Champasak provinces. The reason behind this expansion may due to the abundant water resources of Mekong River and the input materials supply from Thailand. Of the total number of key informants of 40, 32 practiced cage culture with monosex tilapia in running water, the rest practiced the other species in stagnant water (reservoirs).

#### **Types of cage culture system**

The following table shows some basic technical information from the survey, based on the farming systems for different culture species. The survey found there are three major

cage farming systems: monosex tilapia; bighead and silver carp system (without feed) and snakehead cage culture, that is practiced only in Ngam Ngum reservoir.

In the past, aquaculture, particularly cage culture in Lao PDR has been rarely practiced due primarily to the dual constraints of seed and feed availability. It was found only 5 key informants in Vientiane Municipality practicing big head and silver carp cage culture. These two species are the traditional cage culture species since they can survive by feeding on natural feed. One snake head farmer in Vientiane was interviewed. The very small number of informants merely reflects the unpopularity of this fish species for cage culture. Snakehead is a carnivorous and normally feeds on an high protein diet. Unpopularity for cage culture of this fish species may relate to its feeding habit that requires substantial investment in feed. Recently, monosex tipalia has become the most popular fish for cage culture. However, farmers have to import all inputs from abroad but the margin is large enough to attract more and more farmers to invest.

Table 2: Summary of major types of cage culture in Lao PDR

	Fish species		
	Monosex Tilapia	Big Head + Silver Carp	Snake Head
Number of farms	32	5	1
Number of cages	542	804	3
Type of cage	Nylon net	Nylon, bamboo	bamboo
Size of cage (m <sup>3</sup> )	36.6±13.6	37.5±18.1	18
Stocking rate (seed/ m <sup>3</sup> )	112±163	7±8	56
Source of seed	Abroad hatchery	Local hatchery	natural
Size of seed (total length in cm)	5-10	7-10	10
Type of feed	pellet	Natural feed	Small dry fish
Source of feed	imported	natural	Locally produce
Feeding regime (time/day)	3	-	1
Culture period (month)	3	12	7
Harvest size (gram)	500	1000	500
Production (kg/ m <sup>3</sup> )	29.7±10.7	36.4±7.6	26.9
FCR	1.4	-	3.5
Survival rate (%)	80.7	27.1	97

### Cultured species and cropping patterns

The main cultured species is tilapia, and several strains/types are used, including normal, sex reversed and red tilapia. Red tilapia is reported to be less popular than other tilapia types. The other species cultured include common carp, silver barb, big head carp, silver carp, *Cirrhinus molitoretella*, grass carp, *Clarias micocephalus*, *Clarias gariepinus*, *Pangasius hypophthalmus* and *Pungasius bacourti*.

Big head and silver carp are raised without feeding. During 1-year raising period fish obtained about 1 kg in Nam Houm reservoir. The farmers report a problem of fish mortality (40%) especially in the cool period. The other species is *Pangasius hypophthalmus* raised in Savang fish farm, but in very limited quantities, some farmers caught wild fish seed and bought from the hatcheries. Tilapia is more than 80% of the fish produced.

The cropping pattern is influenced by the seasonal changes. Normally, fish farmers did not raise fish for 1 year (only 9-8months) due to a drop in water level in the dry season in rivers and limited natural feed in the reservoir. The stocking density of big head and silver carp is about 5fish/m<sup>3</sup>. The average cage size or cage volume is about 56 m<sup>3</sup>. Final weight is 0.7kg, fish mortality is about 40%.

Tilapia is raised for around 4 months, FCR was about 1.5, average mortality is about 10%, average final weight 0.5 kg. In fact there were only 2-3 crop cycles/year, because some fish farmers did not raise in the rainy season (high turbidity and strong current of water), and sometimes the seed supply is limited.

### Cage design and construction

There are several cage sizes used in the raising fish in Laos. The most common one is a 2x4x6m cage. Others are 3x3x1.8m; 4x6x1.5m; 5x5x2.8m. All of these cages are placed above the bottom (at least 0.5m) and the top of the cages is higher than the water surface (about 0.3 m).

Four scales of operation can be categorized based on the number of cage. Table 3 shows that the majority of monosex tilapia cage culture have less than 5 cages. This may relate to the experience of farmers, who are mostly new operators. The number of cage can increase rapidly when farmers have more experience and practice cage culture successfully.

Table 3: Categories of cage farms

Number of cage	Monosex Tilapia		Big Head+ Silver Carp		Snake Head	
	Number	%	Number	%	Number	%
<5	15	46.9	-	-	1	100
5-10	11	34.4	1	20	-	-
11-20	1	3.1	-	-	-	-
>20	5	15.6	4	80	-	-
<i>Total</i>	<i>32</i>	<i>100</i>	<i>5</i>	<i>100</i>	<i>1</i>	<i>100</i>

There are several sizes of cage being used for culturing fish. Classification of cage by using volume (m<sup>3</sup>) is more suitable than its three dimensions (W x L x D in meter) since the stocking rate or fish production actually depends on the volume of cage rather than size or area. Up to 56.3% of monosex tilapia operator has volume of cage more than 40 m<sup>3</sup> (Table 4). Classification of scale operation by the volume of cage is obviously contrast to the previous classification by the number of cage (Table 3). The majority of

monosex tilapia operator is large scale operator when taking volume of cage into consideration.

Table 4: Classification of farms based on volume of cage

Size of cage (m <sup>3</sup> )	Monosex Tilapia		Big Head+ Silver Carp		Snake Head	
	Number	%	Number	%	Number	%
10-20	7	21.9	-	-	1	100
21-30	3	9.4	4	80	-	-
31-40	4	12.5	-	-	-	-
>40	18	56.3	1	20	-	-
<i>Total</i>	<i>32</i>	<i>100</i>	<i>5</i>	<i>100</i>	<i>1</i>	<i>100</i>

Nylon net is seems to be the most popular construction material of cage at the moment. Almost 100% of cage using at the moment are constructed by using nylon net. Very few bamboo cages were found (Table 5).

Table 5: Construction materials

Type of cage	Monosex Tilapia		Big Head+ Silver Carp		Snake Head	
	Number	%	Number	%	Number	%
Bamboo	1	3.1	1	20	1	100
Nylon net	31	96.9	4	80	-	-
Total	32	100	5	100	1	100

In rivers, cages are placed in areas with slow water current, with suitable site out of strong wind and near the house, some of farmers made their house along the cages. Some cages are fixed together with a floating house especially in the Mekong river, some are fixed by the bamboo and wood poles. All materials used for making cages are imported.

There are some four coves in Ban xay oudom in Nam Ngum reservoir and 60 pens that are used to grow out of snakeheads (*Channa striata*) by use of dry and sometimes live or iced *Pa keo* fish. These fish are captured from the reservoir.

### Fish seed and stocking practices

The main source of fish seed is from imports. Only Savang fish farm (private) sector can produce 200,000 tilapia/week. Other sources are very limited. Lao PDR could produce enough tilapia to be self-sufficient but the quality of fish seed in both private and government hatcheries is not yet reliable as reported by farmers. Therefore the quality needs to be developed.

Most of the monosex tilapia and big head and silver carp used by cage culture operators is from hatchery. Only snake-head farmers on Nam Ngum reservoir use seed collected from the wild (Table 14).

Table 6: Source of fish seed for stocking of cages

Source of seed	Monosex Tilapia		Big Head+ Silver Carp		Snake Head	
	Number	%	Number	%	Number	%
Natural	-	-	-	-	1	100
Hatchery	32	100	5	100	-	-
<i>Total</i>	<i>32</i>	<i>100</i>	<i>5</i>	<i>100</i>	<i>1</i>	<i>100</i>

Almost 100% of monosex tilapia seed is imported from abroad while seed of big head and silver carp are locally produced (Table 15).

Table 7: Location of hatchery

Location of Hatchery	Monosex Tilapia		Big Head+ Silver Carp		Snake Head	
	Number	%	Number	%	Number	%
Local	2	6.3	5	100	-	-
Abroad	30	93.8	-	-	-	-
<i>Total</i>	<i>32</i>	<i>100</i>	<i>5</i>	<i>100</i>	<i>1</i>	<i>100</i>

The stocking densities varied by the options and the experiences of fish farmers and fish available in the local context (see Table 2). Number of fish stocked about 40-50 fish (10 gram-fish)/m<sup>2</sup>. During 4 month-growing period fish obtained nearly 500g each. In Tha Ngone fish farm stocked 100g-fish of normal (both male and female) and raised about 2-3 months. Reports are that such strong water current and high stocking density (4,000 fish/cage) both male and female showed almost similar growth performances.

Stocking densities of silver and bighead carp are lower as these fish rely on natural productivity.

Normally sex reversed fish are nursed for about 1 month, restocked in secondary nursing ponds about 3 months before releasing to the cages sometimes at 100g size.

## Feeds and feeding

The cage farms in the country use a range of feeds, mostly imported commercial diets and local diets. Tilapia farms use a range of commercial feeds, with a protein content estimated as 30-32%. The following feeds were in use: Hi lux (CP); High grade(CP); Lee (CP); Win (CP); Max (CP); CP(Catfish feed); Centaco (Catfish feed); and Thailux (catfish feed)

Some farmers use catfish feed (32% protein content) but the cost of feed and quality is reported to be little different. Some farmers have the opinion that catfish feed is not good for tilapia, which is not surprising as the diet is developed for a different fish.

Local feeds are also used on some farms, depending on species. These include the following: water hyacinth, rice bran; broken rice, and duckweed and grass for grass carps, boiled corn meal, cherry mollusk, and earthworm as supplementary feed/ animal feed.

All this local feed is rarely used on farms. Most farms, particularly monosex tilapia used mainly commercial feed, snakehead used pa keo and bighead+silver carp feed on natural food.

In Nam Ngum reservoir *Channa striata* is cultured using of dry and sometimes live or iced Pa keo fish. The price of dry Pa keo is around 1,500 Kips/kg.

Farmers report that the disadvantage of using dry commercial diets feed is that they are poor in vitamin content. Therefore, feed mixes are used (Vitamin C) and additional antibiotics are added (1 table spoon antibiotic added 5 kg of feed in the morning and the other 1 spoon of vitamin C added 5 kg of feed in the evening for feeding). The trademarks called (Turbo tetra and turbo C or Turbo F) within the first week. After that vitamin C will be added with feed once/week. Feed is soaked thoroughly with water with antibiotic and vitamin before giving fish. Some farmers report that they never use any antibiotics or vitamins; the use of antibiotic is a significant concern for food safety and should be urgently addressed.

### **Socio-economics**

According to the culture species, monosex Tilapia are practiced in many provinces but intensively in Vientiane Municipality while bighead and silver carp, and snakehead are found only in Borikhamxay and Vientiane, respectively (Table 8)

*Table 8: Information on number of cage culture farms surveyed*

Province	Monosex Tilapia		Big Head+ Silver Carp		Snake Head	
	Number	%	Number	%	Number	%
Luang Phra Bang	2	-	-	-	-	-
Vientiane	-	-	-	-	1	100
Vientiane Municipality	23	-	-	-	-	-
Borikhamxay	1	-	5	100	-	-
Khammouan	3	-	-	-	-	-
Savannakhet	1	-	-	-	-	-
Champasak	2	-	-	-	-	-
<i>Total</i>	<i>32</i>	<i>100</i>	<i>5</i>	<i>100</i>	<i>1</i>	<i>100</i>

The key informants during the survey are mostly male. There are only four females interviewed (who were involved in monosex tilapia (Table 9).

*Table 9: Cage farm key informants*

Sex	Monosex Tilapia		Big Head+ Silver Carp		Snake Head	
	Number	%	Number	%	Number	%
Male	28	87.5	5	100	1	100
Female	4	12.5	-	-	-	-
<i>Total</i>	<i>32</i>	<i>100</i>	<i>5</i>	<i>100</i>	<i>1</i>	<i>100</i>

The age of cage fish culture operators are distributed in the four categories (Table 10). Monosex tilapia has widest range of age, start from very young to very old while the other two species start from older. This just reflects the popularity of cage culture of monosex tilapia and also its initial state of development.

Table 10: Age of farmers involved in cage culture

Age (year)	Monosex Tilapia		Big Head+ Silver Carp		Snake Head	
	Number	%	Number	%	Number	%
21-30	7	21.9	-	-	-	-
31-40	9	28.1	2	40	-	-
41-50	10	31.3	1	10	1	100
>50	6	18.8	2	40	-	-
<i>Total</i>	<i>32</i>	<i>100</i>	<i>5</i>	<i>100</i>	<i>1</i>	<i>100</i>

Similar to the age of the operator, the education of monosex tilapia cage culture operators is wide ranging, either uneducated or educated. The educational level starts from primary school up to university (Table 11). Bighead and silvercarp even started at the higher level but involved no university graduates.

Table 11: Educational level of farmers

Education	Monosex Tilapia		Big Head+ Silver Carp		Snake Head	
	Number	%	Number	%	Number	%
Uneducated	2	6.3	-	-	-	-
Primary school	3	9.4	2	40	-	-
Secondary school	8	25.0	1	20	-	-
High school	3	9.4	1	20	1	100
College	10	31.3	1	20	-	-
University	6	18.8	-	-	-	-
<i>Total</i>	<i>32</i>	<i>100</i>	<i>5</i>	<i>100</i>	<i>1</i>	<i>100</i>

The majority of monosex tilapia cage culture operators have limited experience, with 93.8% of respondents 8% having experience less than or equal to 12 months. Only 6.3% has experience more than 12 months. In contrast to monosex tilapia, farmers involved in bighead+silver carp and snakehead cage culture have much more experience (Table 12).

Table 12: Experience in cage culture

Experience (month)	Monosex Tilapia		Big Head+ Silver Carp		Snake Head	
	Number	%	Number	%	Number	%
≤12	30	93.8	-	-	-	-
>12	2	6.3	5	100	1	100
<i>Total</i>	<i>32</i>	<i>100</i>	<i>5</i>	<i>100</i>	<i>1</i>	<i>100</i>

Most of cage fish culture operators report that they operate cage culture mainly for commercial purposes. The majority of cage fish culture operators have other activities, only four farmers involved in monosex tilapia report no other occupation (Table 13). The diversification of other activities and previous occupation (Table 14) of those practices cage culture reflects some aspects. Firstly, cage culture does not take time for operating, therefore most operators can practice other activity simultaneously. Secondly, cage fish culture particularly monosex tilapia has high potential for business, therefore people from diverse activities are starting to get involved. Lastly, in sufficient technical support should be provided to facilitate the activity since those practicing monosex tilapia cage culture have very limited experience.

*Table 13: Other activities of cage culture farmers*

Other activity	Monosex Tilapia		Big Head+ Silver Carp		Snake Head	
	Number	%	Number	%	Number	%
Gassoline	1	3.1	-	-	-	-
Nothing	4	12.5	-	-	-	-
Government service	5	15.6	-	-	-	-
Farmer	9	28.1	3	60	1	100
Life fish seller	1	3.1	-	-	-	-
Employee	3	9.4	-	-	-	-
Vendor	2	6.3	-	-	-	-
Handcraft	1	3.1	-	-	-	-
Mechanic	1	3.1	-	-	-	-
Fish breeder	1	3.1	-	-	-	-
Medical doctor	2	6.3	-	-	-	-
Teacher	1	3.1	-	-	-	-
Gold shop	1	3.1	-	-	-	-
Soldier	-	-	2	40	-	-
<i>Total</i>	<i>32</i>	<i>100</i>	<i>5</i>	<i>100</i>	<i>1</i>	<i>100</i>

*Table 14: Previous occupations of cage farmers*

Previous occupations	Monosex Tilapia		Big Head+ Silver Carp		Snake Head	
	Number	%	Number	%	Number	%
Gasoline	1	3.1	-	-	-	-
Nothing	3	9.4	-	-	-	-
Government service	7	21.9	-	-	-	-
Farmer	9	28.1	3	60	1	100
Employee	3	9.4	-	-	-	-
Vendor	2	6.3	-	-	-	-
Handcraft	1	3.1	-	-	-	-
Mechanic	1	3.1	-	-	-	-
Medical doctor	2	6.3	-	-	-	-
Teacher	1	3.1	-	-	-	-

Gold shop	1	3.1	-	-	-	-
Restaurant owner	1	3.1	-	-	-	-
Soldier	-	-	2	40	-	-
<i>Total</i>	<i>32</i>	<i>100</i>	<i>5</i>	<i>100</i>	<i>1</i>	<i>100</i>

The majority of cage culture operator started their business with their own savings (Table 15). This means they have to have sufficient money to start the business or they do not want to borrow money, probably due to the very high interest rate. This also means that poorer farmers may find it difficult to start cage culture.

*Table 15: Sources of investment*

Initial investment	Monosex Tilapia		Big Head+ Silver Carp		Snake Head	
	Number	%	Number	%	Number	%
Own saving	29	90.6	5	100	-	-
Borrowing	2	6.3	-	100	1	100
Both	1	3.1	-	100	-	-
<i>Total</i>	<i>32</i>	<i>100</i>	<i>5</i>	<i>100</i>	<i>1</i>	<i>100</i>

## Cost structure

The cost structure of three types of cage culture (Monosex tilapia, Snakehead and Bighead+Silver carp) was categorized into 2 major components; fixed and variable cost. The following shows the costs for the average costs and returns for the different cage culture systems in the Lao PDR.

### Cost structure (Kip/kg fish production)

	Monosex tilapia	Snakehead	Bighead+Silver carp
<b>Fixed cost</b>	<b>238.80 (2.61%)</b>	<b>1,122.57 (15.80%)</b>	<b>3,452.00 (51.99%)</b>
Cage	208.00	206.19	2,747.00
Boat	17.00	916.38	394.00
House	13.00	-	-
Scoop net	0.60	-	9
Pump	0.20	-	302
<b>Variable cost</b>	<b>8920.00 (97.39%)</b>	<b>5,982.83 (84.20%)</b>	<b>3,188 (48.01%)</b>
Seed	3411.30	618.56	1,813.00
Feed	5399.90	5195.88	-
Labor	45.70	-	132
Gassoline	18.80	144.33	1,200
Lubricant	0.50	24.06	43
Antibiotic	12.90	-	-
Vitamin	30.8	-	-
Electricity	0.10	-	-
<b>Total</b>	<b>9,158.80 (100%)</b>	<b>7,105.40 (100%)</b>	<b>6,640 (100%)</b>

The fixed cost comprises 5 main items. Different type of cage has different combination of items and also investment. Small investment for cage of monosex tilapia is due to its longer durability (economic life is 4 years for nylon net cage and 2 years for bamboo or wooden cage) and much higher production.

Variable cost comprises 9 items, but this is true for monosex tilapia only while the other species have smaller number of items. Cost of seed is the most significant item for bighead+silver carp while cost of feed is the most significant major cost for monosex tilapia and snakehead

The production cost was calculated in kips per kilogram fish since there are many size of cage with different volume. Therefore cost structure in a standardized form is necessary. Depreciation cost of items in fixed cost was taken into account with the information from key informants.

The major costs for tilapia and snakehead farms are clearly feed and seed. The fixed cost of monosex Tilapia is only 2.61% of the total cost because the culture period of monosex tilapia is 3 month compare to 12 and 7 months for snake head and bighead+silver carp, respectively. Therefore 1 m<sup>3</sup> of cage can produce monosex tilapia up to 118 kg/m<sup>3</sup>/year which was much higher than the other species. The economic life of cage made of nylon that was widely used for monosex tilapia is 4 years while cage used with the other species last only 2 years.

Investment for boat is the other major fixed cost for snakehead and big head+silver carp. This finding just reflects different location of cage while monosex tilapia mostly are located close to river bank and less dependent on boat.

It was found that cost of seed and feed contribute significantly to the extremely high variable cost. However, feed cost was the major one. A small portion of variable cost of monosex tilapia also comes from vitamin and antibiotic while no use of these items for the other species.

Production cost of monosex tilapia in kips/kg was considerable higher than the other species. But when take selling price (farm gate price) into consideration, it was found that the farm gate price of monosex tilapia, snakehead and bighead+silver carp are 11687.50, 9,000 and 7,000 kips/kg, respectively. Therefore the margin for these fish species was 2528.70, 1894.60, 360.00 kips/kg, respectively. No doubt an attractive margin of monosex tilapia is the main factor encourage expansion of cage culture of this fish species recently.

## **Marketing**

The cost of fingerling of sex-reversed tilapia is about 300-600 Kip/fish. The market price fluctuates by season. It varies from about 10-12,000 Kip/kg. However in Luang Prabang Province the price of table size tilapia is about 15,000 kip/kg. The consumers can buy

live one directly from the cage, or from the local market. Feed, antibiotic, vitamins are available in animal feed shops. The price of feed is about 4,500 kips/kg. The price of snakehead, *Channa striata*, big head and silver carp is about 500 kip/fish. The price of these market fish depends on the sizes and fish species varied from 7-10,000 Kips/kg.

### ***Environmental aspects***

Impact on cage culture due to uncontrollable development and other environmental factors such as water supply both in quantity and quality were investigated by questionnaires from key informants. It was found that almost key informants insisted there is no problem of water supply either in term of quantity or quality. There is no industrial plant locates around cage culture areas, therefore there was no water pollution to cause mass fish kill. The only problem the farmers faced was cage damage due to poaching of log or wood during rainy season.

Some additional information on environmental concerns, that may be considered in the medium to long-term with expansion of cage culture, is provided in Annex D.

### ***Problems and constraints***

The main problems and constraints raised by farmers include:

- High production cost due to expensive inputs that are mostly imported from abroad.
- Lack of appropriate technology for cage culture management.
- Variation in seed quality.

### **Workshop discussions**

The above results were presented and discussed during a workshop hosted by LARReC on the 29<sup>th</sup>-30<sup>th</sup> August 2001. The workshop provided a good opportunity for discussions and evaluation of the findings involving a number of different stakeholder groups.

### **General discussion points**

The following summarises some of the major points arising during the workshop:

- The importance of economic evaluation, and the need for checking of the economic data, as some participants felt that feed inputs may be underestimated.
- The need to include information on the cage culture in different resource systems throughout the country (Mekong river, reservoirs etc).
- Farmers considered that feed is an important issue. Commercial feed is imported and the price varies. Farmers requested support and cooperation from LARReC and government institutes to develop feeds and cage culture.
- There is a need for more details on the cage culture organisation in Laos – small household, medium, large-scale cage culture.
- One participant raised the issue of health concerns and the effect of monosex tilapia on humans (due to use of testosterone). Information from Thailand indicated no adverse health affects so far.
- In Luang Prabang, workshop participants noted that cage farms were culturing different species due to the local conditions.

- Farmers have imported new tilapia strains (from the Philippines, Taiwan and Thailand). It was reported that Lao people do not accept the hybrid and prefer “indigenous” tilapia species. Some checking of the quality of hybrids was necessary. Care over imports was also necessary.
- The importance of brining in exotic species in an official way. The importance of developing a policy on exotic species. In discussions it was stated that the government policy is to use local species (see also FAO/NACA 2001).
- The importance of broodstock development, and avoiding hybridisation and breeding issues (quality deteriorates with time in many hatcheries).
- The need for more research on marketing of fish.
- The need for research to replace Thai formulated feed and reduce reliance on imports of commercial feeds. Farmers noted that rice bran and other local ingredients had been tried, but considered as not practical.
- Need to ensure good information gets to farmers – farmers should have come on the study tour!
- Farmers are looking for technical advice, issues such as feeds, how to deal with flooding, and other technical problems. Some basic extension material would be useful.
- Private farmers want lower feed costs. Food from Thailand is a major issue that farmers want addressed. Use of hormones and other ingredients is a concern, as they increase the cost and may not provide any benefit.
- In Nam Huon reservoir, silver and bighead carp can be grown, but with low market price. Seed availability is also a problem.
- Research should be conducted to reduce the cost of the cages – look into lower cost cage options. It may also be useful to look into the mix between pond and cage culture (stock small fish in ponds, then larger fish in cages). Stocking, harvest and marketing strategies also need to be explored.
- Farmer comments August - December – fish die in river; March/April up to August – no problem.
- Transportation of seed faces problems with skin damage. Some farmers after 3-4 days after stocking face 20-30% mortality of tilapia (size 5cm). Some farmers use medicines to treat before stocking fish. Maybe also some parasite problems, but there has been limited work on fish health in Laos PDR?
- Transportation guidelines are needed to advise farmers on the best time to transport (the morning) and to promote better collection and transport of fry.
- The role of LARReC’s in the *Pangasius* project in southern Laos – monitoring or site selection?. Some work may be needed on what are the best sites for cage culture (eg deep pools, running water?). Some consideration should be given to possible environmental impacts of putting cages over deep pools.
- Follow up research should focus on pilot studies on other species (such as *Barbodes*, other species), low investment cages and close monitoring of inputs/outputs, economics, water quality.
- LARReC should build some capacity for aquatic animal health management.

The workshop also divided into groups and discussed the major opportunities, weaknesses and research needs. The following summarises the main agreements from the working groups.

*Opportunities:*

The workshop considered that there were opportunities to expand cage culture in Laos, that would further provided opportunities for food and income in urban and some rural areas. The government was further supportive in promotion of cage culture.

*Weakness:*

The workshop also identified a number of weaknesses to address. These include:

- lack of sufficient seed supply and broodstock
- lack of local fish feed, and capacity for feed production.
- need to reduce costs of fish production
- promote use of natural resources, indigenous species.

*Research:*

The participants also identified a number of research activities that could follow from the workshop. These include:

- participation of poor people
- development of low investment cage culture systems
- development of fish feeds, using locally available ingredients
- testing of indigenous species
- research on fish disease, and reducing mortality in transportation
- how to make groups of fish farmers for cage culture management
- market analysis to determine long-term demand.

The workshop also noted the need to share information among institutions within the country, LARReC, DLF, RDC, as well as MRC and NACA outside the country. This should be pursued.

## **Summary of findings**

The culture of fish in cages culture in Lao PDR is spreading throughout the country, with an estimated number of nearly 2,000 cages in 7 provinces. The demand on fish seed, feed, and other materials for cages making is growing. The evidence available, albeit limited, suggests that consumers prefer to eat fish from cage culture due to having good taste, sweet flesh and no off flavours. There appear to be good natural resources for further development of cage culture in the country.

There are some constraints. Lao PDR is not yet self-sufficient in tilapia or other fish seed, and local fish farmers are not satisfied with the quality of fish that can be produces. Some fish seed are imported with a high cost and some are not very good quality. There is a need therefore to continue to promote local, quality, seed supply.

Another constraint is the lack of local feeds. The Lao feed mill (producing feeds for livestock) has shown an interest in producing fish feed, but they do not know exactly the requirement for feed in the whole country. This mill does not have yet the machine for producing floating pelleted feed as required for cage culture. The import of this kind of machines is possible but the data on the demand is needed. The possibility of using locally made “on-farm” feeds also needs much more attention.

The survey and workshop has identified some future researchable issues for cage culture, such as developing appropriate techniques in fish seed feed production locally, gradually reduced the importation, development of cages using locally made materials and farm made feed by using the cheap raw materials available. Further extension activities are also necessary to disseminate information on good farming practice to cage operators. There are also opportunities to share experiences on cage culture with other Mekong countries. The role of cage culture, using simple techniques and cheap inputs, to help small-scale fish farmers in cage culture development also needs to be explored. The next section outlines pilot projects that to follow up from the present survey and workshop.

## **Follow up research and extension activities**

The findings from this study and the workshop recommendations provide a basis for further pilot trials and research activities to support the sustainable development of cage culture in Laos. The following outlines the main options prepared by the project team:

### **Pilot trials**

The next stage of the work should focus on pilot trials of small-scale cage culture in selected ecological regions. The objectives of the pilot trials should be to identify species and culture practices for small-scale cage culture appropriate for the three regions. Each pilot study should explore the use of cages made from as much readily available and affordable local material as possible, the use of different species and locally available feeds. Each trial should be carefully monitored (economics, participation of farmers, basic environmental parameters, growth, survival, inputs and outputs) to determine the economic, social and environmental suitability of the different techniques. Target groups, and particularly the participation of poorer groups, should be given careful attention to ensure that developed technologies are relevant to poorer farmers or fishers.

### *Cage construction*

The cage farms surveyed during the study reported using materials imported from Thailand. However, there are opportunities for use of local materials that should be investigated. The following issues and opportunities should be explored:

- **Cage types** – Floating or fixed cages? Floating cages are likely to be most suitable in rivers with fluctuating water levels and in reservoirs. Fixed cages may be suitable in ponds or other water bodies without seasonal variations in water levels. Size can vary. However, experience in some countries suggests small scale cage culture with 1m<sup>3</sup> cages is suitable for small-scale farmers. Trials should

examine different sizes of cages. Larger cages may be tried, but are also less likely to be affordable to farmers.

- **Cage frame materials** – Experience with small cage culture in other countries suggests that several materials can be used for frames (see CARE cage culture manual, developed for Bangladesh). Bamboo is commonly used. Alternatives include iron bars and PVC pipes, but more expensive less suitable.
- **Nets** – Nets can be made with polyethylene, nylon or other materials. Further research on netting availability should be undertaken, with reference to cost, availability for farmers and durability. The aim should be to make an enclosed net. Mesh size should be carefully considered to ensure good water flow, but sufficient size to retain fingerlings.
- **Floats** – For floating cages, cheap floats should be found to provide buoyancy. Options include empty oil cartons/drums, plastic bottles, and even thick bamboo or banana trunks (however, likely to rot fairly quickly, and need replacement).

#### *Fish species and farming systems*

Most cage culture is presently focused on tilapia. However, there is an opportunity to explore the use of other species in trials.

- **Grass carp** – although exotic, grass carp may provide opportunities in more upland areas of Laos, including Luang Prabang. Grass carp cage culture is practiced in mountain areas of Vietnam. It is suitable for feeding using waste vegetables and vegetation, although fingerlings require higher protein feed. Fingerling availability may also be a constraint. Care must be taken in any import from Vietnam, as red spot disease is a serious problem of grass carp in mountain areas. Careful monitoring of disease status is required.
- **Barbodes** – this species has been shown to grow successfully in other countries (eg Bangladesh) and has a good local market. Trials should therefore explore its potential for growth in cage culture. Above 15 cm in size, it should be possible to feed on vegetation and other locally available feeds.
- **Tilapia** – further trials of this species can be conducted in small-scale cages.
- **Gourami** – gouramis have been cultured successfully (although growth is slow) in Thailand. Gouramis can be fed on vegetation and other materials from low in the food chain.
- **Pangasius** – *Pangasius* cage culture is developing in Vietnam and Thailand. However, some *Pangasius* species needs a higher protein feed. Attention will be needed to looking for fingerlings sources and suitable local feed. The suitability for small-scale cage culture is uncertain.

Trials may also be conducted on the use of cages for nursing. Before designing nursing trials, it would be useful to review of experience of RDC in Savannaketh on nursing of fingerlings (mainly tilapia and *Barbodes*) in hapas. In some cases, a combination of nursing in small hapas and grow out in cages may be appropriate.

In development of the trials, there should be a close cooperation with AIMS project. AIMS is supporting the development of indigenous fish aquaculture. Some of the target species for AIMS would also be suitable for trials in cage culture (*Barbodes gonionotus*, *Cirrhinus microlepis*, *Cirrhinus molitorella*, *Clarias macrocephalus*, *Morulus chrysophekadion*, *Osphronemus exodon*, *Puntiplites falcifer*).

The following options can be explored in the trials:

- Stocking densities
- Stocking and harvesting schedules
- Feed types and feeding schedules
- Marketing (live sales, if possible, may be better)

#### *Feeds*

The emphasis in trials should be on locally available feed. If small-scale cage culture is tried using the above species there should be several options. Large scale culture is likely to require more investment and perhaps import of materials. The key will be to base feeds on resources available with minimal costs.

Some of the locally available diets used in cage culture in Bangladesh and elsewhere can be used for further development of locally available options include rice bran and oil cakes, kitchen waste, elephant grasses, banana leaves, duck weed, snails, and others. A survey of available diets should be carried out before designing the trials.

Close cooperation with the ongoing ACIAR fish nutrition review will be provide additional ideas on suitable diets for the trials.

#### *Location for trials*

The suggestion of the workshop was to focus on three areas: Vientiane, Luang Prabang and Savannaket for small-scale cage culture trials. Trials in each area should be designed based on locally suitable species and available resources.

#### *Monitoring and evaluation*

Simple monitoring and evaluation guidelines should be prepared for the small-scale pilot trials. The following should be considered:

- Inputs - feed amounts and type, stocking density, species
- Production and outputs - fish survival, growth, cage yields.
- Economics - costs of inputs and market value.
- Environmental conditions - DO and temperature, within and outside cages, surface and bottom values (ideally weekly); Secchi disc and water colour (ideally daily, and as part of the farmers routine work).
- Mortalities, and particularly for any disease symptoms/unusual fish behaviour (should be monitored daily as part of the farmers routine). Fish showing disease symptoms should be properly preserved as mentioned above.
- Farmer opinions and social and economic benefits to participating households.

Further attention should be given to environmental assessments and development of environmental management strategies for cage culture. This will require more background information on water quality, depths and ecological conditions in each pilot location.

#### *Suitability of sites for cage culture*

In evaluating sites for trials and extension of cage culture, the suitability of sites in relation to the following factors should be considered:

- **Suitable water body** – How long does the site have sufficient water?. Fish grow best in green water, as they feed on algae in the water. Sites with green water are likely to be more productive and require less supplementary feeding than other more turbid sites. In running water, pay attention to seasonal fluctuations in flow and water quality. Supplementary feeding will also be important.
- **Access to water body** – Is access to the water possible? Who has access?
- **Interested farmers** – Are there private farmers close to the water body who have an interest to do cage culture? Who are the likely beneficiaries? How can poorer groups be involved?
- **Risk assessment** – What risks are there at the site? Are there risks from floods, water pollution, high water current? Is the site prone to poaching, vandalism? Experience elsewhere suggests that poaching may be a problem, and daily management is difficult if farmers live far from the water body. Make sure there are plans to address poaching concerns.
- **Inputs required** – Where will the cage material be obtained? Where will fish fingerlings and feed come from? Can farmers obtain these inputs themselves? What are the costs. Think carefully about all input supplies before starting. Trials should emphasise locally available materials.
- **Marketing** – Are markets available for fish?

#### *Institutional arrangements for pilot trials*

The research should be carried out in close cooperation with relevant provincial departments and farmers. Given the serious lack of trained researchers in LARReC, close cooperation should be extended to other projects involved in aquaculture in Laos, and to work with NGO's where possible. The role of LARReC staff should be more in providing technical support in establishing the trials, and in monitoring and evaluation of trials, rather than direct involvement in cage culture research.

A detailed plan should be prepared in the early part of 2002 to implementation when seed becomes available in 2002.

### **Feed and nutrition research**

The study has again emphasized the importance of development of local feeds. The development of a strategy for fish nutrition research, as highlighted in the LARReC research plan, should be pursued during 2002. Close cooperation with the ongoing ACIAR-supported review of fish nutrition research needs in the Mekong basin should be pursued in developing a fish nutrition research plan for LARReC.

### **Simple siting and development guidelines for cage culture**

Based on the pilot trials, some simple siting, cage management and development guidelines/ extension materials should be prepared for future development of cage culture in Laos. The guidelines should include technical, economic, environmental information that can help to guide development of cage farming in an environmentally friendly manner.

### **Develop capacity in LARReC for monitoring**

There are some larger scale developments of cage culture in the southern part of Lao PDR. LARReC should aim to participate in the projects, particularly to develop some capacity for environmental monitoring and assessment of the projects.

Simple monitoring and evaluation guidelines should be prepared for the small-scale pilot trials to enable assessment of the social, economic and environmental aspects of developments to be carefully considered.

Environmental assessment of cage culture in particular should be given careful attention.

### **Extension activities**

The farmers participating in the workshop emphasized the importance of training in good husbandry techniques. Such a course could be organized for farmers using experienced practical teachers from neighbouring countries. A simple course targeted at farmers would be useful to avoid some of the losses that are occurring (eg due to poor transport/nursing techniques) and promote better practice (eg less use of antibiotics should be given serious attention). This could easily be organized in cooperation between LARReC and the DLF.

### **Aquatic animal health**

Finally, aquatic animal health remains an important issue. There is a need to develop a more comprehensive strategy for LARReC and other institutions to address existing fish health problems and build future capacity. This should be pursued during 2002.

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## Annexes

### *Annex A: Logframe for the cage culture survey project*

<b>Hierarchy of objectives</b>	<b>Objectively verifiable indicators</b>	<b>Means of verification</b>	<b>Important assumptions</b>
<b>Goal</b>			
Fish cage culture activities that contribute to fishery development goals of the Lao PDR	Fish cage farms that produce fish in a profitable way without negative environmental impacts  Fish cage farms that contribute social and economic benefits to fish farm households	Field surveys of cage farmers Market surveys	Environmentally sound farming systems can be adopted by farmers, markets exist for products.
<b>Purpose</b>			
To gain understanding of the present status, opportunities and constraints to development of fish cage culture in the Lao PDR, considering technical, economic/markets, social and environmental factors.	Survey report, covering all relevant issues	Review of reports	Trained staff are available with skills to undertake and analyse results of survey
To identify researchable issues and prepare a research strategy for cage culture that addresses these issues according to different local conditions.	Project identifies development constraints that can be addressed through research.	Review of reports	Trained staff are available with skills to undertake and analyse results of survey
To make recommendations to government on a future development strategy for cage culture in the Lao PDR based on better understanding of the role of cage culture in meeting government fishery development goals.	Recommendations identified in workshop and project report	Review of reports	Trained staff are available with skills to undertake and analyse results of survey  Sufficient expertise available to analyse findings.
<b>Outputs</b>			
Survey results that provide understanding of the present status and development trends for fish cage culture in the Lao PDR.	Surveys implemented and report prepared	Survey data and project report presented at workshop and disseminated.	Farmers cooperate with survey and survey team are sufficiently skilled to obtain reliable information.
Identified opportunities and constraints for future development of fish cage culture, considering technical, economic/markets, social and	Surveys implemented and report prepared	As above	As above, and surveyors are able to analyse the results.

environmental factors.			
Researchable issues identified and a research project prepared to address key issues.	Project document prepared and agreed by DLF/LARReC based on survey findings and stakeholder workshop.	Workshop proceedings and project report.	Constraints requiring research exist.
Development recommendations for cage culture in the Lao PDR prepared.	Report prepared	As above	Issues can be properly identified based on survey results
<b>Activities</b>			
Study tour to Thailand to familiarise key project personnel with cage culture activities in NE Thailand and to assist in elaborating project plan	LARReC and LFDD officers. Finances available from NARI project for study tour.		Study tour can be organised and suitable sites available.
Prepare statistically valid survey plan based on representative sample of current activities	Information on existing cage culture operations – location and number, type of cages Small meeting to design survey Input from resource person (one day)		Information exists Resource person available
Training of survey personnel, including field testing of survey techniques	Two day meeting to train personnel, and test survey approach. Input from resource person (two days).		Surveyors able and willing to adopt participatory approach to survey Resource person available
Implement field survey with cage farmers and other stakeholders (e.g. local fishermen)	Funds to implement survey (travel, accomodation) Input from external adviser		Farmers cooperate Survey team sufficiently trained
Analysis of results and drafting of survey report.	LARReC and LFDD scientists Input from external adviser		Data is of sufficient quality for analysis
Hold small workshop in LARReC to present and discuss findings.	Presentations by LARReC and LFDD survey team of draft report Resource persons (2 each) from Vietnam and Thailand Input from external adviser Funds for workshop and resource persons		Resource persons available
Prepare report and follow up research plan	Preparation of final report based on workshop discussions Input from external adviser		Research possible and suitable results obtained.

## **Project milestone events, materials, equipment, human resources and costs**

<b>Milestone events and timing</b>	<b>Activities necessary to achieve milestones</b>	<b>Materials (a), equipment (b) and human resources (c) to achieve milestones</b>	<b>Costs involved in achieving milestones (US\$)</b>
1. Study tour to Thailand (March 2001)	1. Organise study tour to view cage farms in central and NE Thailand. NACA offers assistance to organise the study tour.	1a. None 1b. None 1c. DSA for three LARReC/LDFF researchers for 5 days; -air fare Vientiane - Bangkok –Udon Thani for three researchers car hire - minor expenses associated with study tour	1a. 0 1b. 0 1c. DSA at \$50/day for 5 days= \$750 -air fare Vientiane – Bangkok –Udon Thani for three researchers \$600 internal travel by car - \$300 minor expenses - \$400 study tour bonus - \$105 <b>Total = \$2055</b>
2. Three day meeting to finalise survey plan, train survey team, including one day field testing of survey techniques (April <sup>2</sup> )	2. LARReC to organise meeting to develop survey plan. One day field testing.	2a. Paper, misc. meeting materials, expenses for local field trip (Nam Ngum?) 2b. None 2c. survey team to attend meeting external adviser (4 days)	2a. None 2b. None 2c. Research bonus for 5 persons for 3 days x 7.5 = \$112.5 to attend meeting external adviser (4 days estimated at \$250/day = \$1,000 + air fare (\$150) <b>Total = 1,262.5</b>
3. Implement field survey (May-June)	3. Implement surveys at Luang Prabang, Vientiane province, Vientiane municipality, Khammouane, Savannakhet and Champassak	3a. Film, minor expenses for survey Fuel oil 3b. None 3c. Per diem for survey staff researcher bonus	3a Film etc \$100 Fuel and car maintenance - \$500  3c. Per diem for LARReC/LFDD staff: Luang Prabang – 3 days for 3 participants, at \$15/day = \$135 Vientiane province and municipality –4 days for 3

<sup>2</sup> The survey should be coordinated with the planned visit of a financial consultant under the Reservoir fisheries project. The consultant is looking into financial aspects of freshwater cage culture in Nam Ngum as part of a Mekong basin (MRC) study into selected aquaculture farming technologies.

			<p>participants, at \$4/day = \$48 Khammouane– 3 days for 3 participants, at \$15/day = \$135 Savvannakhet – 3 days for 3 participants, at \$15/day = \$135 Champassak – 3 days for 3 participants, at \$15/day = \$135</p> <p>Per diem for provincial staff – 15 days for 2 staff @\$5/day = \$150</p> <p>Researcher bonus = \$200</p> <p><b>Total =\$1,013</b></p>
4. Analysis of results and drafting of survey report. (June)	4. Analysis of results, mainly involving computing work in LARReC and LFDD	4a. None 4b. None 4c	<p>4a. 4b. 4c. LARReC/LFDD staff for 2 weeks. Bonus \$250.</p> <p><b>Total =\$250</b></p>
5. Hold small workshop in LARReC to present and discuss findings. (July)	5. Invite participants, organise travel of resource speakers from Vietnam and Thailand. Develop agenda, prepare presentations and draft report for discussion (in Lao and English). Implement one day workshop.	5a. Misc workshop expenses 5b. 5c. Input from external adviser – 3 days +air fare 4 participants – 2 from Thailand and 2 from Vietnam, with air fare and DSA	<p>5a \$200 5b. 5c. External input \$750+\$150 air fare Air fares - \$1,000 Per diem for 3 days at \$50/day = \$600</p> <p><b>Total = 2,700</b></p>
6. Finalise report + disseminate and present results (August)	Finalise report	6a. Copying expenses 6b. None 6c. None	<p>6a. \$100 6b. None 6c. Staff bonus - \$105</p> <p><b>Total = \$205</b></p>
			<p><b>Grand total for study = 7,585.5</b></p> <p><b>With LARReC overhead at 18% = \$8,951</b></p> <p><b>With 10% contingency = \$9,846</b></p>

			Total estimated costs for study, including contingencies and LARReC overheads: = \$9,846
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**LARReC overhead:**

US\$ 1,365.3

## ***Project activity flow diagram year 2001***

### **1. YEAR 2000**

<b>Main activities</b>	<b>Jan</b>	<b>Feb</b>	<b>March</b>	<b>April</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
1. Study tour to Thailand			XX									
2. Three day meeting to finalise survey plan, train survey team, including one day field testing of survey techniques				XX								
Implement field survey					XX	XX						
Analysis of results and drafting of survey report.						X	X					
Hold small workshop in LARReC to present and discuss findings.							XX					
Finalise project report								XX				

## ***Annex B: Workshop program***

### **Wednesday, 29<sup>th</sup> August**

- 0900h: Opening ceremony (hosted by LARReC) and welcoming of guests  
1000h: Coffee break  
1030h: Presentations by LAAReC/DLF researchers:  
- objectives and expected outputs of the workshop  
- presentation of study findings (detailed program to be developed)  
1200h: Lunch break  
1330h: Presentation of study findings (continued)  
1500h: Coffee break  
1600h: Discussion session  
1700h: Finish for the day

### **Thursday, 30<sup>th</sup> August**

- 0900h: Presentation of resource speaker(s) from Thailand  
1000h: Coffee break  
1030h: Presentation on environmental aspects  
1200h: Lunch break  
1330h: Discussion session followed by small working groups to develop workshop conclusions and recommendations  
1500h: Coffee break  
1600h: Working group sessions continued  
1700h: Final remarks and closing ceremony

The workshop was held in the LARReC meeting room in Vientiane.

## **Annex C: Survey questionnaire**

### **I. General Information**

1. Province  1 Vientiane municipality  
 2 Vientiane province  
 3 Luang Phrabang  
 4 Borikhamxay  
 5 Khammouan  
 6 Savannakhet  
 7 Champasak

2. Date.....

3. Name of respondent.....

4. Sex  1 male  
 2 female

5. Age.....

6. Education  1 uneducated  
 2 primary school  
 3 secondary school  
 4 high school  
 5 College  
 6 University

7. Address.....District.....Village

8. Experience.....year

9. The purpose for cage culture practice  1 income  
 2 protein food  
 3 both

10. Other present activities and income

Activity	Income (kips/month)

11. The previous occupation.....

12. Number of family member.....

Member	Sex	Age	Education	Eng. in cc	Hr/w
	M, F				
	M, F				
	M, F				
	M, F				
	M, F				

13. The initial factor induced you to practice cage culture

.....  
 .....

14. Source of initial investment

- 1 Own saving
- 2 Borrowing
  - financial institution, interest rate.....
  - Personal interest rate.....

## II. Techniques

1. Culture species

- 1. Tilapia
- 2. *Channa striata*
- 3. *Pangasius sutchi*
- 4. *Pangasius larnaudii*
- 5. Silver barb
- 6. Common carp
- 7. Big head
- 8. Silver carp
- 9. other.....

2. Number of cage.....

Size (LxWxD in meter)	Number	Construction material	Note
		1 2 3	
		1 2 3	
		1 2 3	

Note 1 = bamboo  
 2 = wood  
 3 = nylon net

3. Seed

Species	Source		Hatchery		Imported from
	Nat.	Hatch.	Local	Import	

note.....  
 .....  
 .....  
 .....

Sp.	Size		Price (kips/fish)	Stocking Fish/cage	Availability		Quality		
	TL (cm)	Weight g/fish			all	seas	yes	no	No com.

4. Feed

Species	Type					Source or brand (particularly for 3)	Price (kips/kg or bag), .....kg/bag	Avail.		Quality		
								all	seas	y	n	nc
	1	2	3	4	5							

Note 1 = macrophyte  
 2 = plankton  
 3 = commercial feed  
 4 = canteen waste  
 5 = life feed

5. Feeding regime

- 1 time/day at..... (what time)
- 2 times/day at.....(what time)
- 3 times/day at.....(what time)
- 4times/day at.....(what time)
- 5times/day at.....(what time)

6. Feeding amount

Age of fish (month)	Kg/time/cage	Kg/day/cage	Kg/crop/cage
1			
2			
3			
4			

7. Production

Species	Cult. Period (month)	Harv. Size (gram/fish)	Price (kips/kg.)	Survival rate (%)	FCR	Prod. Kg/cg/crop

Cult. Period (month)	Harv. Size (gram/fish)	Price (kips/kg.)	Total harvest (kg)
2			
3			
4			

8. Culture practice
- 1. All year round, How many crop/year.....
  - 2. Stop during.....why.....  
How many crop/year.....

**III. Economic**

**1. Fixed cost**

Cage

Construction material	Cost (kips/cage)	Economic life (year)
Bamboo		
Wooden plank		
Nylon net		

**Equipment**

Items	Number	Cost/item (kips)	Economic life (year)
Boat			
Water pump			
House			
Container			
Scoop net			

**2. Variable cost**

- Seed (in technical part)
- Feed (in technical part)

**Labor**

Labor	Number	Cost (kips/day/labor)	Note
Permanent			
Casual			

- Gasoline..... kips/day
- Lubricant..... kips/month
- Antibiotic ..... kips/crop.....
- Vitamin..... kips/crop.....
- Chemical reagents..... kips/crop.....
- Electricity..... kips/month
- Boat and equipment repair..... kips/month

**IV. Marketing**

1. Sell to
  - 1. Cage fish farmer..... kips/kg
  - 2. Collector..... kips/kg
  - 3. Retailer ..... kips/kg
  - 4. Final Consumer ..... kips/kg
  
2. Variation in farm gate price                      Yes                      No  
 If yes, please give more detail.....  
 .....

3. Wild fish production

Species	Production (ton/year)	Price (kips/kg)

4. Common fish species found in market

Species	Dry season		Wet season	
	Size (TL in cm)	Price (kips/kg)	Size (TL in cm)	Price (kips/kg)

5. Alternative protein food
- pork .....kips/kg
  - duck .....kips/kg
  - chicken .....kips/kg

6. Popular fish for consumption
- wild fish..... price.....kips/kg
  - ..... price.....kips/kg
  - ..... price.....kips/kg
  
  - culture fish ..... price.....kips/kg
  - ..... price.....kips/kg
  - ..... price.....kips/kg

**V. Environmental issues**

1. Site       1. Running water  
 2. stagnant water
2. Hydrology
- |  |     |    |
|--|-----|----|
| Seasonal variation in water quantity   | Yes | No |
| Seasonal variation in water quality    | Yes | No |
| Seasonal variation in current velocity | Yes | No |
3. Land use (need to be identified)
4. Pollution
- |                               |     |    |
|-------------------------------|-----|----|
| Industrial plant              | Yes | No |
| If yes, please identify ..... |     |    |



## **Annex D: Environmental considerations in cage culture**

The following is the outline of the presentation on environmental aspects of cage culture, presented to the cage culture workshop, by Dr Michael Phillips (Network of Aquaculture Centres in Asia-Pacific Bangkok)

### **Background**

- Cage culture is growing in popularity in the Mekong basin, Asia and globally
- There are diverse systems and species from intensive systems (high feed/yields) – *Channa*, *Pangasius*,
- To extensive farms (no feed/variable yields) – such as silver carp.
- Systems involve nursing, grow out and holding for market

### **Advantages and disadvantages of cage culture**

- The advantages include no land required, may offer access to poor people *etc*
- But there are disadvantages
- Markets and environment are two major factors contributing to failure!!

### **Why environment?**

- Cage farms interact with environment
- They are “open” systems
- They can be risky and vulnerable to:
  - impacts on cage culture – water pollution, water flow, depth fluctuations, predators, poaching
  - “self-pollution” from release of nutrients and organic matter - sediments, water quality, disease
  - can create environmental problems for other users – loss of visual amenity, navigation, small fishers.
  - wild fish stocks, escapes, exotics, disease transmission, locating cages on spawning grounds
  - “draining” local resources - feed for carnivorous fish, grass for grass carp, construction materials (forests!)

### **Grass carp cage/pen culture in Vietnam**

- Some experiences in the central Highlands of Vietnam:
- 40 kg of grass for 1 kg of grass carp!
- This has labour and resource implications
- Grass carp diseases – “red spot” leading to economic losses
- Crowding of culture areas and water quality problems
- User conflicts in some open water areas between fishermen, cage/pen farmers

### **Indonesia**

- Intensive common carp culture in freshwater reservoirs – problems include
- Water quality (upwelling), disease/mortalities
- Social equity

### **Environmental management at the farm level – some considerations**

- Choice of species:
  - Low in food chain or high in food chain? Best based on local resources
- Manage risk – nursing, grow out (long, short), holding
- Environmental tolerance of species, disease problems
- Exotics and indigenous species
- Polyculture – mixing of intensive/extensive (*Pangasius* and *Barbodes*)
- But remember markets!
- Choice of feeds and feed management:
  - Efficient feeding practices
  - Appropriate diets, minimise wastage.
  - Use of locally available resources to reduce reliance on imported materials
- More environmental considerations
  - Choice of cage type and mooring
  - Robustness, low investment, good culture environment
  - Suitability of location (e.g. river cages not in reservoirs!)
- Choice of water body
  - Location/site (depth, current), seasonality (wet and dry seasons) – dispersal of wastes, DO, above “anoxic” zone in reservoirs
- Water quality (green water, turbid, anoxic areas)
- Other users and pollutant sources, thefts, security
- Managing other risks
  - Seasonal stocking, harvesting
  - Diversify species.
  - Don’t put “all eggs in one basket”
  - Balance risk by marketing frequently
- Community and governance considerations for cage culture
  - Other factors contributing to cage culture failures:
  - Lack of institutional support/extension service
  - Lack of zoning/permitting plans – haphazard development!
  - Narrow sectoral focus and lack of incorporation into local area planning/ reservoir co-management
  - Lack of consideration of social/poverty issues

### **What is needed?**

- Permitting/zoning systems – consider as part of local development initiatives/co-management scheme for the area
- Extension? Technical support (promote also self-reliance, local groups)
- Base development on local needs
- Support low risk options as a livelihood strategy

### **Where to next?**

- Is cage culture suitable? Identify strengths, weakness, opportunities and threats

- Address the comparative advantage of Laos PDR
- Does it/can it contribute to development objectives, and poverty alleviation?
- What type/system/species for cage culture?
- What should be the approach?
  - Small-scale systems and species, low investment, incremental, integrated within local development initiatives, based on livelihood objectives of people?
  - Large scale, high investment?
- What next? That is the job of this workshop!

LARReC Data and Information Unit

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