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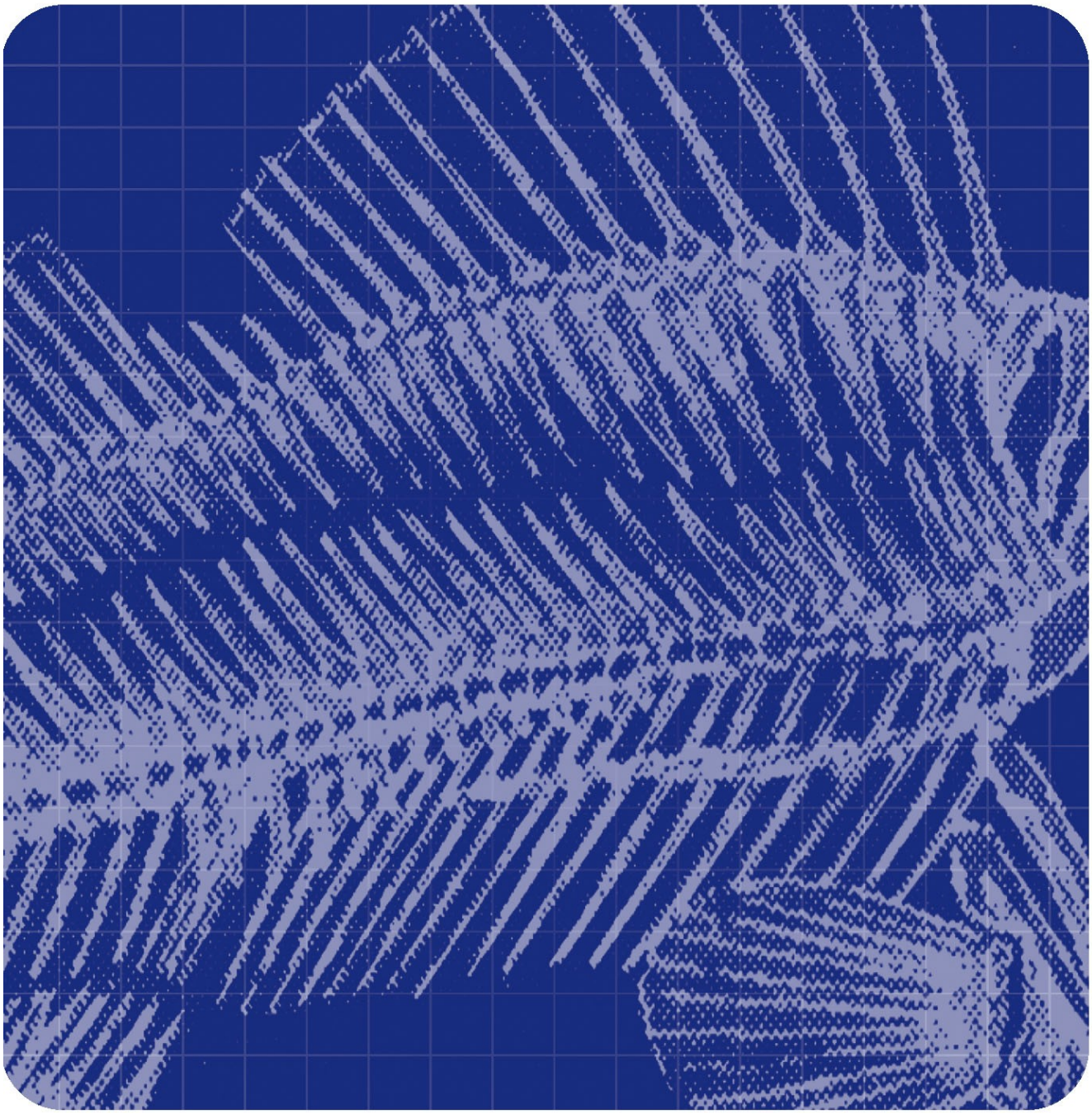
Slaughtering processes for farmed Pangasius in Vietnam

Consultancy surveying slaughter processes and by-products handling in the Vietnamese industry

Nils Kristian Sørensen



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Slaughtering processes for farmed Pangasius in Vietnam

Consultancy surveying Pangasius fillet quality and by-products handling in Vietnamese industry

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In a consultancy for the DANIDA project SEAQIP II, a survey of the slaughter processes for farmed Pangasius has been performed in the Mekong delta from April 16th to May 20th 2005. Five processing factories were visited for discussions and survey of the processes run at each factory. In principle the factories followed the same procedures in slaughter and production of the frozen fillets from Pangasius. The big success in several markets for the product, is a proof of the high quality. In addition the price is right. The factories have high capacity, receiving around 100 tons, (from 50 to 300 tons) of live fish every day.

The common method for transferring fish from the well boat to the factory is to transport in baskets without water, up to 20 minutes before the fish is killed. This is a stressful situation and should definitely be ended. Slaughter operation at the river bed or transport in water (containers or pumping) to factory should be considered as an improvement.

The colour of fillets is variable due to farming condition and season (feed and water quality?). It is no obvious explanation to why some fillets are very yellow, while others are white. The reason for this must be looked into, finding the component giving the discolouration. The pinkish colour must come from poor bleeding, and procedures can be improved, introducing new bleeding methods, type of cut, bleeding time, fish:water ratio, temperature.

It is advised to develop a colour card system, in order to objectively grade fillets from white towards yellow and red.

The variation in quality due to different farming conditions, is a challenge for factories that plan to process products with high and consistent quality.

It is advised that a pricing system may be developed in order to promote production of high quality Pangasius.

The utilization of by-products can be improved. It is proposed that the factories co-operate in this effort since the quantities are big and they are located in the same area. Possible use is as feed and special products. A feasibility study in this area should be discussed.

A general recommendation is to put even more effort into management of the health situation for the fish, in order to avoid development of diseases and focus more on welfare of fish. The quality of “home-made” feed is a variable that should be controlled in a better way.

Preface

Vietnam's production of farmed Pangasius species (catfish; Tra and Basa) in the Mekong River Delta has increased significantly, especially since the late 1990`ies. In 2004 the estimated production was around 300,000 tons, and further expansion is planned to reach 1.000.000 tons in 2010.

A Danish project organised by DANIDA, has for 10 years supported the Vietnamese fisheries industries. The project, SEAQIP II, wanted a consultancy to do a survey related to the quality of catfish production (Pangasius - Tra and Basa), with focus on the slaughtering process and the handling of waste material (blood and fat) in the Mekong delta, where most farming and processing of Pangasius are located.

I was as employee at Fiskeriforskning, asked to do the consultancy. This took place with field work in the Mekong delta from April 16th to May 20th , 2005. This report and two power point presentations at the industry seminar at Can Tho, May 13th, are the documentation from the consultancy.

The programme was well prepared by the SEAQIP-CA specialists on arrival, and five factories were visited for discussions and review of production. Some experiments were done to demonstrate different aspects related to slaughter quality of farmed fish. Although my experience is mainly with cold water species in the sea, it was interesting to see that many of the challenges in the efforts to obtain high quality products in freshwater at high temperatures in Vietnam, were the same as in Norway.

I will like to thank my co-workers in Vietnam, that followed me during the whole consultancy, for their good support and patience. They gave most valuable assistance throughout the days in planning and arranging meetings, discussions and practical set up for doing experiments, collecting and analysing data and for preparation of work-shop presentations and draft report. Invaluable were also the support when buying the many delicious dishes for lunch and dinner. They were good company, and definitely showed me that the Vietnamese people are kind and hard working from early morning to late evening, as we also could see at every factory visited.

Thank you very much, Tam, Bao and Thang for interesting and rewarding days in Vietnam.

I also would like to thank Finn Hamilton Heidemann for his kind support and for asking me to do this consultancy.

Nils Kristian Sørensen

Fiskeriforskning

Tromsø, Norway June 2005

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1 SUMMARY

In general the slaughtering and processing of Pangasius species in Viet Nam is done according to recommended Good Manufacturing Practices (GMP) and demands for quality assurance systems from authorities and markets, based on Hazard Analyses Critical Control Points (HACCP). The products are of high quality and have gained success in many markets, mainly in Asia, EU and Australia, both due to quality and price level. The potential for further increase is definitely at hand, but the development must be well planned, managed and monitored. This includes long term marketing of the products, building brands in order to raise the prices for the products from Pangasius.

The factories producing Pangasius were big, having capacities of around 100 tons of fish in for slaughter every day. This is generally handled in shifts of 10 - 12 hours, where certain personnel start early while other finishes late. One factory said capacity was 300 tons per 24 hours, in two 12 hour shifts, including two hours for breaks. The design of the factories is generally good and takes well care of demands for hygiene zones, dividing operations in clean and unclean areas.

Most companies had a group of managers that were young, well educated and enthusiastic, working long hours. Training programmes and information to the industry is promoted and arranged regularly by the Ministry of fisheries, industry organisations and donor countries.

The very rapid increase in volume of farmed fish and fillets produced, has to some extent resulted in lack of necessary control during the production chain. This consultancy deals with the slaughter process and processes in the factories. Other aspects of the farming of Pangasius, such as fingerling quality, type of farm, location of farm, feed quality, health management and regulations, will only be mentioned in short, when appropriate.

The main challenge in the processing industry is the variation in quality of the fish fillets. This variation is related to a share of the fillets being downgraded due to discolouration, i.e. the fillet flesh is not white, but rather pink or yellow. Such fillets fetch lower price in the market.

The degree of discolouration is correlated to the type of farm producing the fish, according to representatives of the industry. It is reported that the ponds with less water circulation gives the lowest quality, i.e. the highest percentage of downgrades due to discolouration. Less downgrading is found when water circulation is high.

The colour variation is also seasonal. Increased downgrading is related to part of the rainy season, during May to October. It is therefore reason to believe that the discolouration can have origin in the change of water quality in this period. A lower water quality, may be represented by increased number of particles and debris in the river water. Increased current will increase swimming activity and may make it more difficult for the fish to find the feed and then stress the fish. This is areas that should be looked into, if such information is not available already.

Feed quality is an important issue in all fish farming. Much of the feed used in the Mekong delta is made at the farms. It is based on recommended formulas, mainly consisting of the inner husk of rice, fresh sea fish and a mixture of nutrients. This feed may vary from farm to farm and if the quality of the raw materials is poor, e.g. the sea fish is old and/or rancid, the

result will be poor. Optimization and standardization of feed is always a challenge in fish farming.

Poor farming condition, that can be represented by the low water quality, and many other factors; e.g. stocking density and illness, may over time result in chronic stress to the fish. During the slaughter situation with crowding, handling, transport and time out of water, many fishes will experience acute stress. This can be observed by the immediate red discolouration of the mouth and belly area, as well as in the fins, when fish is heavily crowded or taken roughly out of water. Also the rapid decrease in muscle pH, from rested fish swimming in the well, to fish ready for slaughter, indicates high stress level. When farming other fish species, this is a focus area for controlling fish quality. Much effort is made in order to reduce the acute stress, by handling the fish carefully from the well boat and kill it quickly.

Table 1 Effects of resting fish on pH of Pangasius-Tra muscle.

	pH	**No of fish**
Resting fish measured **onboard** well-boat	7.2 ± 0.2	10
Resting fish (extra 1 day on well-boat) measured at **receiving area** of the factory		
Fish first out	6.8 ± 0.2	50
Fish last out	6.7 ± 0.1	50
Un-resting fish measured at **receiving area** of the factory		
Fish first out	6.7 ± 0.1	50
Fish last out	6.7 ± 0.1	50

The fish is taken from the well boat by scooping it into baskets, and then transporting it without water until the slaughter area. Dependent on factory location, the fish may stay out of water for up to 20 minutes. This must most probably lead to stress, and it was observed that a high percentage of fish had red mouth and belly, and at times they were dying before being killed by the bleeding cut. This handling operation should be looked into and improvements must be made.

Most of the operations before freezing the finished fillets, are done manually. Especially the trimming of fillets is an important manual operation that involves a lot of handling of the fillet. The fillets are in the pre-rigor state and have a firm texture. This is probably the reason why the fillets do not become more damaged; fall apart, increase degree of gaping, during the removal of skin, surface fat and red muscle. It is probable that fillet quality can be further improved by reducing handling, for example by introducing conveyors for internal transport.

It seems to be a trend towards introducing more mechanical equipment in the processing lines in the new factories. Some factories use skinning machines, conveyors and size grading machines, while filleting and trimming are strictly manual operations. Most fillet products are treated by a solution, often STPP (sodium tri-poly phosphate), for reduction of drip loss during packaging, freezing and thawing. Many customers do not accept this additive, and then

other blends may be used. Regulations in many countries demand declaration of additives. If the efforts in introducing organic fish products from Vietnam also include Pangasius, then additives can not be used.

Within the factory it is great possibilities for improving internal transport of fillets, by-products and offal. All fish is frozen, mainly as fillets. This is done using modern, efficient machinery, such as IQF (Individually Quick Frozen) freezers, plate freezers for blocks and blast freezers. Most of the packaging is done manually, also using small vacuum packaging machines. The cold storage seemed to be working well at around – 20 degrees C, most places. Increasing capacity was discussed in some factories.

Several of the factories have production of value added products in addition to the main product, the frozen fillets. These products are meant mainly for export, but they were also easily found in great numbers and variety, in supermarkets in Vietnam. These products are not only made from Pangasius raw material. By-products from filleting, i.e. dark muscle and trimmings are the basis for many minced products, often in combination with rice, potato etc. Even Norwegian farmed salmon was found as part of skewers produced for grilling.

The handling and treatment of the waste water and leftovers from filleting, (skin, head, bellies, and backbones) can be improved. The waste water treatment is already fully upgraded in the newest factories, where modern high capacity treatment plants have been built, based on microbial activity. To reduce the load of the treatment plants, fat and possibly blood should be removed before biological treatment, if possible. Fat can be skimmed off, being done partly manually or fully automatic. The blood is much more difficult to separate from the water. Dry-bleeding is an interesting idea, but so far it is not commercially introduced with success. Capacity is one issue and it is a challenge to obtain sufficiently acceptable bleeding of the fillet.

Collection of skin is organized, then it is cleaned and frozen, before being exported for gelatine production, e.g. in Spain. The fatty belly part can be collected for production of oil or fat, e.g. cooking fat at low price or developing processes for more high value products. Head and backbones can be raw material for a fish meal. A coordination of collection of by-products and transport to one central factory in the region may be a good solution. Transport is a challenge and the possibility should be looked into.

2 RECOMMENDATIONS

The recommendations given below have the main focus on areas described by the objectives and output expected by Seaqip for this consultancy. They are presented with the most important issue first, as it was understood after discussing with the industry representatives in each factory. Furthermore, some recommendations are given as general statements for other important areas, mainly related biological questions when farming fish.

2.1 Yellow fillets

All companies visited have focussed this area as priority one. The need for reducing the number of yellow fillets produced is most important. Although the product can be sold in certain markets, the price is reduced. It is not found any documentation of from where the yellow colour origins. This is an important question for all farmers and processors. The colour differences can be as clear, as can be seen from the pictures below.

Picture 1, to the left, represents three different grades of colour from white, via pink to red. Picture 2, to the right, shows the very intensely yellow colour that can appear in some fish.

2.1.1 Yellow colour component and origin of colour

It is recommended that a study is planned and performed, to:

Look into which component comprises the yellow colour, and

which factors can be the reason(s) for the seasonal variation in yellow colour of Pangasius.

As there seem to be many possible reasons for the colour variation, such a study should be connected to feed used and of water quality in the ponds and cages. Regular control of the feed by sampling for analyses of composition and rancidity is proposed. The RIA 2 may have more information.

2.1.2 Objective colour grading

It is recommended to:

> Develop a system for more objective grading of colour of the fillets. A possible tool can be a colour fan.

The fan will be made so as to show shades of colour in white, pink and yellow. The development of a colour fan must be done as a development project, as it is not a straight forward job. For the grading of Atlantic salmon such a colour fan was developed and is regularly used by the industry as an objective method for grading fillets according to red colour. The customers also accept that colour quality of the fillets is given with references to the fan.

2.1.3 Developing an industry standard for fillet quality, to be used in pricing

A more objective price difference between different qualities of farmed Pangasius, will probably improve the quality of the fish produced. It should therefore be of interest to discuss if a more strict price differentiating system could be developed, based on the experience that fish from different farms; pond, net, cage, give different quality of fillets, not only colour.

In order to differentiate in price between groups of fish quality, it is recommended to:

> Develop a system for grading the fish objectively according to quality. Then quality must be defined, probably according to fillet yield, size, appearance, texture (firmness) and gaping in addition to colour. This will then be an industry standard for Pangasius fish.

2.2 The slaughter process

The slaughter process involves many steps from crowding the fish in the pond/cages, via transport and handling to bleeding operation after killing. If the fish can be handled very carefully, avoiding any acute stress, it is possible to maintain a high energy level in the fish. This will reduce possibilities for early onset of rigor mortis, which would give a firm, hard flesh that is difficult to fillet.

2.2.1 Handling procedures during harvest

Time for starvation is usually two days at a temperature of around 30 degrees C. This seems to be an acceptable level obtained by experience by industry.

The need for further resting of fish before slaughter was addressed at one factory. According to the results, resting of fish for one extra day, did not improve the colour of the fillets. The amount of yellow fillets in the rested group increased more than in the red group, i.e. the quality became lower. But – this was one test only.

No effect on fillet colour or other quality traits was found. It is probable that the time in the well boat, while waiting to be unloaded may be enough for resting.

The farmers and the industry should be aware this point and observe possible seasonal changes.

2.2.2 Reduce stress during harvest and transport

A usual mortality was reported to be in the range of 2-8 % of the weight. If the higher figure is normal, the situation during transport should be looked into in detail, in order to reduce the mortality and economic loss.

It is recommended to:

Reduce stress before killing.

Improving the crowding, handling and transport procedures from farm, via well boat to factory will reduce stress. Factors like fish density, water quality in the well, transport time, resting may influence the level of stress to the fish.

Reduce the period of time when fish is out of water before killing.

Look into possibilities to do the killing operation on the river shore, and then transport the fish e.g. in containers or by pumping for further bleeding and processing in the factory.

Picture 3 (left) is an unstressed fish, while picture 4 shows stressed fish, red around mouth, next to fins and in the belly.

2.2.3 Killing quickly

The Pangasius fish is a very active and strong fish with vigorous movements when taken out of water. This activity stresses the fish, reduces energy level (can be recorded by measuring pH in muscle), reduce time before onset of rigor mortis and may lead to bruises and soft flesh due to damage from rough handling.

It is recommended that the fish should be killed as quickly as possible.

In order to be able to handle the fish efficiently, use of a machine for killing and/or use of anaesthesia should be considered. It may be necessary to do a study for finding the correct anaesthesia, and the machine will most probably need to be developed. Producers of machines for harvest and killing other species of farmed fish can be found.

It is recommended to do a study to find optimal conditions for killing Pangasius quickly, securing high quality and aspects of ethical quality.

2.2.4 Bleeding operation

The bleeding of Pangasius is done by cutting the main blood vessel from the heart to the gills. This cut leads to loss of pressure in the blood distribution, the heart pumps blood for a short period. Since the heart is no suction pump, the rest of the blood must be pressed out by muscle contractions coming from spasms of the fish when dying. These movements needs space, therefore the fish density in the bleeding tanks is important.

It is recommended that the following parameters should be investigated for optimization and control during slaughter:

Organize slaughter procedure to secure first fish in, first fish out

Investigate the possibility to introduce a new bleeding cut. This should cut the throat and the two blood vessels coming from the gills, one each side of the backbone.

Secure optimal ratio between fish and water during bleeding

Secure enough time for bleeding

Find optimal temperature of water during bleeding

The results should be evaluated by grading the fillets for quality; e.g. colour, gaping, texture, blood spots.

It is further recommended that:

Studies in this area can be done as projects related to MSc and PhD programs at university levels.

Co-operation to universities must then be organized. It is probably possible to do such university studies as joint projects with universities in donor countries.

2.3 Processing lines in factories

Inside the factories visited, it was quite crowded due to many people and a lot of tables, baskets and boxes. Internal transport can and should be improved, both to improve efficiency, but also to avoid mixing of batches.

The manual filleting of Pangasius was impressive. The workers were very skilled and worked very rapidly with expert results. It was observed that when cutting the fillets from the backbone, fresh blood appeared along the back bone and was easily transferred to the fillet. Fillets were dipped in water for washing afterwards, but this was not always good enough. It is advised to:

Introduce a spray of running water towards the newly cut fillet, to remove fresh blood

The use of machines for skinning fillets is introduced in all factories visited. During skinning the fillets are handled very rough, pushing them via the rotating knives. This could easily be improved, probably also without loss of capacity. It is also a possibility that the use of deep-skinning for removal of surface fat and part of the red muscle should be tested. Then the trimming operation would be easier.

The increased use of machines during processing seems to be a trend.

Machines and equipment used for freezing and packaging seemed to working well.

It is recommended that:

> Use of skinning machines for deep-skinning of fillets are tested out

2.4 Filleting yield - new product opportunities

As fillets of Pangasius are the main product, it is of importance to obtain a high filleting yield. It was reported that the filleting yield varies according to which type of farm the fish comes from. It is also a big difference in yield between Tra and Basa. Basa is growing more slowly and gives less filleting yield. The RIA 2 institute informed that they are running projects that focus on breeding Pangasius with the goal to increase fillet yield.

According to information given by the factories, fish from cage and net give a higher yield. 2,8 kg whole fish from cages and nets give 1 kg. fillet, fillet yield ca 35 %; while 3,2 kg whole fish from ponds is needed to give 1 kg. fillet, fillet yield 31 %. When looking at the work done by the workers doing filleting, it is doubtful that much increase can be obtained by changing the filleting procedure.

The fish is filleted without having been gutted, and sometimes a wrong cut may cut gall bladder or intestines. The result is discolouration of the fillet, rejection and much reduced yield.

The trimmings are used for value added products. Separation and grading of the red and white muscle, as well as the fat, may increase the utilisation of these by-products. They should immediately be chilled in order to retain freshness and quality.

Part of the trimmings cannot be used for value added products, but they can then be raw material for fish oil products or other components, proteins, enzymes, of value.

2.5 Improve utilization of by-products from filleting (head, backbone and intestines)

The following important information must be noted regarding utilization of by-products:

> By-products from Pangasius can not be used as raw material for feed products to give to Pangasius. This is not accepted for the EU markets because of fear for spreading diseases.

By-products can be used for other type of feed, i.e. other fish or farm animals.

It is recommended to:

Recover fat from the belly and process this for human consumption under hygienic conditions.

Look into possibilities to sort and grade other parts of the fish leftovers, e.g. swim bladder, heart etc.

Many of the interesting and valuable components may demand sophisticated and expensive equipment to be collected, purified and concentrated, before being marketable. Skin is today collected, frozen and exported for production of gelatine. It may be a possibility to this in Vietnam if factories are working together in utilization of this by-product.

2.6 Blood and waste water treatment

Waste water treatment is a very important area in a fish slaughter and processing factory, and seems to be given increased priority by the companies. Probably have several companies been built with a lower capacity than they run at today. It is understood that this area must be working according to regulations and standards, and therefore improvements are being made. New and modern waste water treatment plants with sufficient capacity have been built or are being planned. These plants are integrated with early steps skimming and removing fat, and with final step disinfecting the treated water before outlet into the recipient, the Mekong delta.

At the factories, information regarding the possibilities of collecting the blood directly from the fish, was much appreciated. This is a new idea that is being tested out for possible commercialisation. Still capacity is low and it is uncertain if the bleeding is good enough, compared to bleeding fish in water.

2.7 Factors to consider during farming

In this area, only brief comments are given as this is not my specialist area and it is not part of the consultancy.

In relation to fish farming, the area of health management should be considered very carefully. In Norway, the introduction of regular veterinary controls in the on-growing phase of farming, has proven very beneficial. We have also good experience with increasing focus on disease prevention, which resulted in reduced use of antibiotics.

Type of pond used for farming is definitely important both for growth and quality of Pangasius. The influence of water quality was reported to be:

Lowest quality fish - low water circulation, pond on land

Higher quality fish - acceptable water circulation, pond near bank

Highest quality fish - good water circulation, house cage in river

During well boat transport is has been reported high mortality, from 2 to 8 % of the fish. 8% is high values and efforts should be organized to control mortality during well boat transport.

The quality of feed is very important for having success in fish farming. The type of feed given to fish is both commercially formulated dry feed and “homemade” feed. The dry feed is standardized and produced in certified factories. The semi-dry “home made” feed is less standardised, which is probably an area of possible improvements for feed quality.

It is recommended to:

The use of Malachite green, (mainly to prevent fungus in eggs), and use of antibiotics should be reduced and carefully controlled

Work related to the further development of regulations for the design, operation and health management of ponds on land is expected to improve quality of fish produced.

The quality of feed should be optimized

Efforts should be organized to reduce and control mortality during well boat transport.

3 FARMING OF PANGASIUS IN VIETNAM

In recent years, Vietnam's production of Pangasius species (catfish; Tra and Basa) in the Mekong River Delta has increased significantly, especially since the late 1990`ies. In 2004 the estimated production was around 300,000 tons, and further expansion is planned to reach 1.000.000 tons in 2010. The most important market is EU. The main product is frozen fish fillets, but also value added products are exported in increasing quantities. Challenges in the market are acceptance for consistent quality and safe product, and the anti-dumping ban that was concluded in the important USA market in 2003.

The farming and processing of Pangasius is a work intensive industry, employing a great number of people. The low wages are one important reason why the production has been successful. In the near future important decisions must be made, related to mechanization of the industry and the number of employees. Political decisions will certainly have to be made.

In order to achieve the target of developing the production of Pangasius into a major competitive and sustainable industry, it is of outmost importance to understand all aspects of the production. At SEAQIP, it was therefore recommended to put a focus on the slaughtering process. In relation to quality, it is known that the correct slaughtering procedures at harvest of farmed fish, are very important. The normal procedure today is to transport fish out of water, in baskets from the farm to the well boat and to the receiving area of the factory, often up to several hundred meters away from the landing area. Slaughtering is done batch wise and results in fish that in many cases are almost dead before cutting and bleeding. Results are also that some fish are bleeding too short time in water before further processing, and some others can stay in the bleeding tanks too long. The principle of first fish in, is first fish out, should always be adopted.

Waste water from the catfish production can be an environmental problem due to the high amount of blood and fat from the processing. The treatment of this waste water has not been given sufficient focus, and several factories have too small capacity. At present, an increasing number of factories are building modern waste water treatment plants with sufficient capacity. These plants will also disinfect the water, usually with chlorine, before deposit in the recipient, the many rivers of the Mekong Delta.

Today, in too many factories, the fat and blood are still considered as waste and are running out with the drain water, without being treated. The saturated fat released during processing, solidifies in the drain and is only to some extent skimmed off in flotation tanks. A collection and use of this waste e.g. for animal feed could be a help to solve some of the environmental problems. Utilization of blood is much more challenging, and solutions for collection and use as a raw material will need considerable effort in development work. With a more intensive production, many factories could risk overloading the waste water treatment plants, which may result in serious pollution of the environment. The blood is not treated in a special way, which may be a problem, as blood may transfer agens of disease, if such an outbreak should happen. The new plants can handle this challenge, if properly designed for disinfection.

The handling procedures vary from factory to factory, and it was therefore important to involve 5 factories in the survey done during this consultancy.

3.1 Objectives and output for consultancy

- SEAQIP assisted, in a survey related to the quality of catfish production (Pangasius - Tra and Basa), with focus on the slaughtering process and the related handling of waste material (blood and fat)
- SEAQIP assisted, coming up with better handling procedures for the factories.

The output expected is:

- A survey report related to the present handling procedures
- Recommendation for needed changes of the slaughter process
    - In order to optimize the fish quality
    - Requirement for minimizing waste water use
    - Collecting of blood (fat) for further use

3.1.1 Scope of Work and important issues for the consultancy

The scope of work will include, but not necessarily be limited to the following:

- Study of the slaughter process in at least 5 catfish processing enterprises (2-4 days at each factory)
- Report containing description of the present procedures and recommendations for changes in order to optimize the production.

In a letter from SEAQIP to the involved factories, the consultancy and the aims of the visit were presented. These were focussed on the slaughtering process and a proposal for doing small experiments in the factories, as summarized in the following five points:

- To follow influence of resting and starving of quality of farmed Pangasius fish
- To follow influence of bleeding methods on quality of Pangasius fish fillets
- To do trials on *rigor mortis* and follow the influence of *rigor mortis* in fish
- To discuss with the companies, possible methods for improving the quality of Pangasius fish fillets. Special focus should be on colour, gaping and *rigor mortis*.
- To discuss with the companies, the utilization of blood and by-products from slaughtering of Pangasius fish.

4 FACTORIES VISITED

4.1 General aspects

All factories receive the fish from ponds (on land), nets along the river bank (caves) and/or cages in the river. The ponds are of very different design regarding size, depth, water quality and the way they are operated, e.g. with exchange of water. Fish from the closed ponds are considered producing the lowest quality fish and up to 10% fish die during transport. Ponds with circulation of water, is regarded to have a quality close to caves and nets with 1-2% dead fish during transportation. Since water quality, stocking density and type of feed can be very different, all these aspects can be the reason for the lower quality, higher share of discoloured, yellow fillets, of pond raised fish, that is reported. These aspects are therefore important to look into in more detail, in order to reduce the problems and obtain a more consistent quality of the fish produced. Quality of the feed is especially important. A survey analysing the feed for rancidity could give interesting information related to fillet quality, colour and flavour.

Work related to the further development of regulations for the design, operation and health management of ponds on land is expected to improve quality of fish produced. The river cages are fenced with steel wiring that are not “grown over” during the grow out period of 6 months. The strength of the wire mesh also secures that there is no escapes of fish to the river.

The farms are most often owned separately from the factories, although some companies also own some farms. Usually the factories buy fish from a group, or a club, of farmers. These farmers are usually responsible for transporting the fish to the factory. They sell fish alive to the factory and take care of the fish that die during transport. This fish is sold in the local market. Since the quality of farmed fish differs between types of production, the price is also different. 1 kg fish from a pond with still water is 5,000 VND and for the others it is 10,000-12,500 VND. These figures are varying greatly, we experienced, according to the factory buying, and related to supply and demand. A price difference between different qualities of farmed Pangasius, will probably improve the quality of the fish.

Before harvest, the fish is starved for 2 days, after which the crowding takes place, using a special harvest group of people. This is an independent group that may work for several companies. The company supplies 8 boats for transport of the fish from farm to factory. Each well boat transports 10-15 tons. The boats are equipped with underwater doors along the side of the boat. These are closed during transport so that the fish are exhausted as little as possible. Another reason may be that, when doors are open, the speed of the boat is reduced, which may influence the number of trips the boat can take during e.g. a week. Especially Basa are sensible to transport, it was reported. The transport takes from 1-3 hours and up to 10 hours, depending on where the farms are located. The information about closing doors during transport, is uncertain as it is also claimed that doors are kept open, in order to secure good circulation of water.

The fish at slaughter has a weight at around 0.8 - 1.5 kg. Dead fish is rejected at the factory. Well boats come during the night and wait near the factory for unloading; starting 04.30 a.m. Fish is weighed at farm, by counting number of full baskets when loading the well boat. Exact weight is registered at receipt at the factory. The weight loss due to mortality can be around 2 - 8%. The latter figure seems to be high. When such figures are registered, a close discussion should be taken with the boat crew, in order to understand the reason for such high figures.

In order to differentiate in price between groups of fish quality, it will be necessary to develop a system for grading the fish according to quality. Then quality must be defined, probably according to fillet yield, colour, texture (firmness) and gaping.

According to information given by the factories, fish from cage and net give a higher yield. 3,2 kg fish from ponds fish give 1 kg. fillet, while fish from nets and cages 2.8 kg fish give 1 kg. fillet.

In most factories, the main concern in relation to quality, is the colour of the fillet (white as the highest over red and pink to dark yellow as the lowest. The harvest takes place all year round. The dry season October to April/May give the best white quality. The rainy season May-October gives a lower quality with more yellow fillets. Especially the flooding season August-September gives a low quality product.

All factories are concerned about malachite green which up till recently has been widely used.

The fish from the river, both from ponds along the river bank and from the cages were better, the cages being best. However, during part of the rainy season when the water quality was reduced due to sand and debris in the river, the quality of fish from these ponds and cages were also reduced. The number of yellow fillets increased. It is not done any documentation of from where the yellow colour origins. This is an important question for all farmers and processors, and it is recommended that a study of what can be the reasons for the seasonal variation in yellow colour of Pangasius is planned and performed.

All factories focus on satisfying demands from markets, HACCP based quality assurance systems, ISO certification, approval for export to important markets; EU, Japan,

All factories also have challenges related to anti dumping from USA

All factories buy fish from different farms, cages in river, pond along river bank, pond on land. As this fish has varying quality, the raw material to the factories is not enough consistent.

All factories are seriously concerned by the use of antibiotics for avoiding diseases.

It is much focus on BASA as the highest quality fish, but the main production is of Tra which is easier to farm. The production of fingerlings of Tra is well controlled and the fish grows quickly and can be slaughtered after 6 months, having a size of 0.8 – 1.2 kg on average. During this period, no sexual maturation of the fish will happen.

Basa takes much longer to produce due to slower growth. This fish store much more fat in the intestines, which reduces the filleting yield substantially, increasing the production costs. The fat can be utilized for human consumption, but only at low prices. The look of the Basa fish is nice, compared to Tra, but prices that can be fetched are not much higher.

All factories are dependent on dry vs. wet season, in relation to fish and fillet quality. Tide is also important, changing water levels in the Mekong delta. The effects of water quality, mud and silt are not fully understood, I was told.

All factories transport fish in baskets from landing site to receiving area in factory. The time the fish is out of water before killing is related to distance between river bed and factory.

In general the processing steps are: Unloading. Carriage to receiving area. Weighing. Washing/intermediate storage. Cutting. Bleeding for 10 min (ambient water 30-35 C). Transport to manual filleting. Filleting and quick wash of fillets to remove excess blood, appearing immediately along the backbone area. Skinning by machine. Trimming manually, removing red muscle and fat (includes very much handling of fillets). Control of quality. Grading by size. Grading by colour. Polyphosphate treatment (STPP) or other, dependent on markets. Packaging in different ways, individually, shatter pack in blocks. Freezing as IQF, or in contact freezer, blast freezer. Glazing and refreezing. Final packaging in cartons. Frozen storage. Transport by trucks or containers by boat. Export to markets.

All factories used TSPP as an additive, except one that uses an other additive that is phosphate free. According to other information, the important EU market is the main market and does not accept TSPP. During our visit to the factories, none of the factories could then be producing for EU these days. We did not have this observation confirmed.

Quality aspects focussed were mainly related to fillet colour. In some factories, also the gaping of fillets were mention as a problem, then related to certain lots of the production and/or in certain shorter periods of the year. When this happens, usually during autumn to winter in the rainy season, the farmers have noted that the fish does reduce the feed intake and seem to stop growing. Especially the small fish, while the bigger fish starts eating after a shorter period. The bigger fish also have much gaping and also red spots in the fillets, when processed. A correlation between fish welfare and fillet gaping, may then be indicated. An easy answer to explain this seasonal effects can not be given, but it may be related to water quality as it happens during the season when water levels are high and the concentration of mud and sand in the water have increased substantially. These observations should be documented by collecting data related to percentages of fillets with gaping and amounts of discoloured fillets in production during these periods. Water quality should also be monitored and evaluated by competent laboratories.

The fillets that have gaping, are usually sorted out and used for further processing of value added products in companies that have such production. Other companies can usually find other markets for coloured fillets, e. g. markets in Asia, where the yellow colour in general can be masked when used in curry type products.

The muddy taste of fillets is not reported as a problem when growing Pangasius, as it is a major problem in many Tilapia farms and also Catfish farms in USA.

4.2 Vinh Hoan Co., Ltd

25 km and 30 minutes by car from Cao Lahn (Song Tra Hotel).

4.2.1 General background

Vinh Hoan is a limited Vietnamese private company, located in Cao Lanh city, Dong Thap province. It was established late December 1997 as a producer and exporter of both freshwater and sea products. The factory in Cao Lanh focus on producing Pangasius. It is mainly frozen products based on Tra fish fillet, in different grades of quality (colour), sizes and packages. A wide range of value added products, based on both freshwater and seawater raw material, are also produced by a sister company, located in Ho Chi Minh City. The factory has production in high quality modern buildings, located close to the Tien River, which gives short distance from delivery of fish to the receiving area, only meters away.

Daily production is around 100 tons raw material, which will be increased further to 120 tons/day during summer 2005. The factory utilizes around 28.000 tonnes of raw material, whole fish, mainly Tra, each year. Daily working time is divided in 2 shifts with alternative weekend, 1st shift from 5.00 – 15.00 and 2nd shift from 16.00 – 24.00.

The fish is mainly bought from the farmers and paid according to quantity delivered alive to the factory. Raw material supply is organized by a co-operative that have 32 ha land with 16 ha water surface. Some farms are also owned by the company. There is a small difference in price paid to the farmer based on from which type of farm the fish is harvested. The cages in the river fetch around 500 Dong more per kilo fish. The prices vary according to market situation, but is usually around 10 – 12.000 Dong per kilo.

Time for starving is usually two days, but it is not very well controlled since some times fish come from far away farms, taking 8 hrs during well boat transport. When receiving the fish, the quality control department do sensory check, size check and estimate the fat content of the fish. The time spent during processing is around two hours, i.e. from arrival for killing/ bleeding, until loaded in the freezers.

The filleting yield for Tra is around 3,2 kg raw material consumed for each kilo of fillet produced. The final yield of fillets is very dependent on the use of polyphosphate as an additive, because this substance binds water and easily can increase the weight of the product, dependent on the concentration used.

The exported volume from the company has increased from approximately 3000 metric tonnes in 1999, to 7074 in 2001 and 9000 tonnes in 2003. The value of exported goods was in 2003 around 25 million US$ and in 2004 32 mill US$. Main markets are in Asia and Europe.

In the processing area, use of conveyors has been introduced for moving fully trimmed fillets from workers to weighing and further processing. Also use of automated grading by weight, is introduced for accurate portioning and packaging. In the freezing process, both air blast freezer, contact freezer and steel belt freezer for IQF (Individually Quick Frozen) products, are installed. Other necessary supplies for the production is available; i.e. sufficient fresh sterilized water, flake ice machine, cold store (being extended from 350MT to 800MT), vacuum packaging machines and a fleet of 7 refrigerated trucks.

It is a strong focus on quality management systems such as ISO 9001 and HACCP-based systems like BRC (British retail Consortium) certification. The Vinh Hoan factory has a laboratory for microbiological control of samples. They send samples for special analyses to NAFICAVED, i.e. analyses for Nitrofuran, Chloramphenicol and Malachite green. The farmers are informed about the results of analyses two days before harvest. Recently also traceability systems are given priority as markets now are increasingly requesting such systems.

4.2.2 Discussions and experiments at Vinh Hoan Ltd

During the visit at Vinh Hoan factory we discussed with vice director Huynh Duc Trung and the quality manager.

After introductory presentations of the Seaqip project and purpose of the visit, aspects of quality related to the slaughter and processing of Pangasius were discussed in quite some detail. By using power point presentations from the computer, the different questions were illustrated and commented. It was focus on the need for and length of starving before slaughter, which also might cover a period of resting the fish, e.g. in the well boat, before unloading. An extra day of resting in the boat, will of course result in extra cost and reduce the capacity of the well boat. This is not so interesting for the fish farmer, who in this case, also owns the well boat. In addition the mortality rate most probably will increase, it was argued. A usual mortality was reported to be in the range of 2-8 % of the weight. If the higher figure is normal, the situation during transport should be looked into in detail, in order to reduce the mortality.

All new experience from harvesting farmed Atlantic salmon, and also other species, indicates that a rested fish, that have a higher level of energy deposits in muscle, gives a higher quality of the product produced. Based on the company's interest, we decided to make a slaughter experiment comparing normal slaughter procedure with one day extra starving/resting in the boat. The experiment also involved immediate killing of the fish by a blow to the head by a hammer and measurement of pH in the flesh. Two groups were involved each day. The fish were taken from the same pond, one well boat rested for one extra day at factory. The two groups were,

Batch 1) 50 fish killed by blow to head and cutting throat. This fish was prepared for the experiment early, and was not very active and alive at time of killing. Therefore half of the group was replaced with more active fish, and not so stressed, i.e. not red around mouth and belly. The fish was kept separate during processing and grading so as to calculate yield.

Batch 2) 50 fish killed by cutting throat before bleeding and follow normal production process. The fish was kept separate during processing and grading so as to calculate yield.

For the afternoon two new groups of each 50 fish, were selected for grading of colour and quality of fillets. The colour of the fillets in all four groups, were as a demonstration, also measured by an instrument, Minolta colorimeter.

Batch 4) 50 fish taken from the last part of the quantity in same well boat as in batch 1). pH was measured

Batch 5) 50 fish taken in afternoon from the regular production

Results from manual grading of colour in the factory:

Batch 1) 50 fish weighed 36 kg, giving 11,7 kg trimmed fillets before polyphosphate. Yield:

White colour	11,2 kg fillets	76,0 % of the batch
Red colour	3,- kg fillets	20,4 % - " –
Yellow colour	0,4 kg fillets	1,3 % - " –

Batch 2) 50 fish weighed 42 kg, giving 13,1 kg trimmed fillets before polyphosphate

White colour	13.7 kg fillets	84,6 % of the batch
Red colour	2,2 kg fillets	13.6 % - " –
Yellow colour	0,3 kg fillets	1,8 % - " –

Batch 4) 50 fish weighed 37 kg, giving 12,7 kg trimmed fillets before polyphosphate

White colour	14,0 kg fillets	92,4 % of the batch
Red colour	0,65 kg fillets	4,3 % - " –
Yellow colour	0,5 kg fillets	3,3 % - " –

Batch 5) Weight not registered

White colour	11,65 kg fillets	97,1 % of the batch
Red colour	0,35 kg fillets	2,9 % - " –
Yellow colour	0,0 kg fillets	- % - " –

The highest output of white fillets was obtained in the afternoon batches. These fish were more alive when slaughtered, which may have resulted in the higher output of white fillets in the batches 4 and 5.

As the experiment was set up and run in the factory at the same time as production was running, it was difficult to have full detailed control over the experiment. We must regard this as a demonstration of a possible way to run experiments and measure colour by instrumental method. The different batches were based on different killing methods, one being blow to the head of Pangasius. As this had not been tested before, we experienced that the very compact and strong bony structure covering the brain of Pangasius, left us with very variable results in obtaining immediate death of the fish. We did the experiment as planned and decided to do a study of the anatomy of the fish head in order to find the location of the brain.

The next day, early morning at 05.00 am at the factory, we made a new experiment, this time with the fish that had nearly one more day starvation and resting. Again, the workers had taken up the fish for the experiment, and in reality already started.

Rested fish from boat having 10 tons of live Pangasius, Tra fish:

Batch 1) Killed by blow to head, then normal production, colour assessed by manual and instrumental grading.

Batch 2) Normal production, colour assessed by manual and instrumental grading.

The company did calculate the yields for the different grades of fillets during the processing of the 10 tonnes of fish, Friday 22 of April and Saturday 23 of April. After addition of phosphate, the results were as follows, based on production of 2 x 10 tonnes of whole fish:

Table 2 Effects of resting for one day on colour grading of Pangasius fillets.

Colour of fillets	Non-resting	Resting
White	94.6 %	89.5%
Pink	4.5 %	6,0 %
Yellow	0.9 %	4.5 %

According to these results, resting of fish for one extra day, did not improve the colour of the fillets. The amount of yellow fillets in the rested group increased more than in the red group. In total the white share in the rested fish decreased 5,1 % by weight, which is a quite substantial difference that indicates that resting does not improve the colour o f the fillets.

It is important to notice that these experiments were done after short planning and preparation and in a situation were full commercial production took place. During the experiments different killing methods, pH measurements directly in fish muscle and instrumental colour assessment were tested and demonstrated for the workers and representatives of the staff. This was much appreciated by the company whose support and enthusiasm were important.

4.3 AGIFISH

15 min. by car from Long Xuyen (Dong Xuyen Hotel).

4.3.1 General background, AGIFISH, joint stock company

The factory visited lies in the outskirts of Long Xuyen in An Giang province, and is named Processing plant No 7. It is located near the river, but still so far away that the live fish is transported without water in barrels in trucks. The fish stays out of water for approximately 15 minutes before they again are brought into tanks for washing and further processing. This is not an optimal handling of the fish, as it is stressed during this operation.

The company has two more factories. The two processing companies have a capacity together at around 120 tons raw material per day. The fillets produced are graded at around 80 % white, 15% pink/red fillets and 5% yellow. A value added products factory (Factory No. 9) is located in Long Xuyen. A variety of products from this plant is found in the supermarkets in Vietnam

They are also involved in fish farming, owning floating fish cages in Chau Doc. The company started up in 1997 and has been one of the leading companies in the Pangasius industry and has a specific focus on contributing to the local economic and social development. Training of the workforce and the fish farmers are given priority. The company has been awarded the highly esteemed prize named "Hero of Labour" of the Government. More than 2000 people work for the company.

AGIFISH was a leading part in the co-operation with CIRAD of France, in the research for reproduction of Basa and Tra. This work in mid 1990`s led to the considerable success in producing fingerlings for the now rapidly developing Pangasius fish farming and processing industry.

The company is giving priority to quality, and is keeping up with the new demands from customers. From the start, quality assurance systems have been given priority and a HACCP based system is in operation. The company is certified according to ISO 9001. Now they focus on including traceability in the quality assurance system, which will be necessary for export to EU and other important markets.

The laboratory of the company is well equipped for analyses of antibiotics. Sampling is done from each pond before harvest of fish is accepted. Approximately 100 samples are taken each month. 80% of samples taken at the farms in January contained malachite green, but now it is much lower, the company mentioned. There are rarely parasites.

The main markets are EU, Australia, Singapore and Hong Kong. The value added products have important markets in Belgium and Holland, and they are also readily found in the Vietnamese supermarkets, offering more than 40 different products. Besides the farmed Basa and Tra of the Pangasius species, they also produce and sell a variety of seafood based on local supply and also some imports.

AGIFISH has secured the supply of raw material by establishing a club of farmers that produces 20.000 tons of Pangasius from floating cages in the rivers of the Mekong delta. Approximately 8.000 tons of finished products are exported and the turnover and income have been increasing year by year. Shares can be bought in the stock market.

Fish is harvested from ponds on land which have varying degree of water circulation and from ponds located along the river banks. These have sufficient water circulation, but they are big and the fish can also feed on the bottom. The company prefers the fish from cages in the river, from where they receive the most fish.

The slaughtering takes place from 5.30 am until 19.00 pm in two shifts. The process is the normal procedure as described in chapter 4.1. The process from slaughtering to freezing is done within 90 min, while the fish is still pre-rigor.

A new waste water treatment plant has recently been built. It has filtering systems, flotation for fat and an aerobic, biological treatment before disinfection by alumina and outlet to the recipient. There is no utilization of blood and neither the fat in the factory.

Supply of fresh water comes from two wells. These two wells are used for both factory no.7 and no. 9 (value added products).

4.3.2 Discussions and experiments at AGIFISH

Mr le Duc Trung, Director for Biological Technology Center RIA 2 joined our group during 2 and half days.

When arriving the company in the morning, we met with the Deputy Director of Company, Deputy Chief of Technical Board of Company and Deputy Director of factory No. 7. A presentation of our tasks were given. After that, we visited the factory for better planning for the next day's experiments. According to company request, after lunch, all of technical staff (12 persons) from the company did attend a mini- workshop. At that mini- workshop, the power point presentation regarding Norwegian fish farming and the reasons for the success, were given and a further presentation on aspects of slaughtering quality. The audience were very interested and including questions and comments we spent almost four hours.

The company was interested in trying the Iki-jime method for rapid killing and cutting the blood veins of Pangasius for improving the bleeding. So we agreed to do some anatomy in the next day to see tra's brain and blood veins. Then a plan for next day's experiments has been made during evening time for some alternative solutions.

After discussing with the staff, it was decided to do demonstrations of the anatomy of the Pangasius head. Brain and blood veins were found by anatomy in 20 fish. The Tra brain is protected by a strong skull. It was not easy to kill the fish by a blow to the head (brain). We showed how to kill the fish by Iki-jime (knife to hit the brain) and how to cut the two blood vessels coming from the gills. Such a cut will be in addition to cutting the main vessel from heart to the gill, as it is done now.

The experiments were done by four batches of fish, every batch in the trials was with 100 fish. See also table below describing method and presenting the results. The fish were kept separate during processing in order to calculate yield and the colour grading of fillets was done both by visual and mechanical method.

The first day of experiments:

- Trial with bleeding method, for 20 minutes in water of temperature, 32 C
  - Normal cut. Group of 100 fish
  - New cut (deeper). Group of 100 fish

- Trial with bleeding method, for 20 minutes in water of temperature, 0 C
  - Normal cut. Group of 100 fish
  - New cut (deeper). Group of 100 fish

The results are summarized in the table below

Batch	Method	Filleting yield (%)	Colour grade of yield	
			(1) %	(2) %
1	New cut Bleed 31°C ; 20 min	30.3	92.0	8.0
2	Normal cut Bleed 31°C; 20 min	31.6	85.8	14.2
3	New cut Bleed 0°C; 20 min	30.1	87.7	12.3
4	Normal cut Bleed 0°C; 20 min	30.2	80.6	19.4

The results indicate the following:

- New cut:
  - Total yield OK (see batch 1 and 3)
  - Colour grading – much improved compared to normal cut, batches 2 and 4.

- Bleeding at very low temperature, 0°C:
  - Total yield OK
  - Colour grading – lower % of grade 1, than bleeding at 31°C

Summing up:

- New cut:
  - Is possibly an improvement
  - Cold bleed – not promising (fat solidified)
  - Can bleeding at medium temperature be an improvement? Test out this idea.
  - The cold fish was difficult to fillet because it was very stiff.

pH was measured in 20 fish killed by hitting the brain by a knife. The plan was to see the development of *rigor mortis* at 30°C and 0°C in the fillets. The fish was not easy to kill quickly and therefore the pH was much lower than expected, varying from 6,4 to 7,1 - while the average was 6,75. The experiment did not work out well since the fillets did stick to the table and did not contract. Fillets at zero degree became frozen and no rigor was observed.

Based on the results from the first day, we decided to carry out some more experiments to find out optimal temperature. Bleeding at zero degrees resulted in a fish that became stiff, probably both due to onset of *rigor mortis* and because the saturated fat became solid at low temperature. The goal of the new experiment was to see effect of medium temperature during bleeding. We then used medium temperature (around 12 - 17°C) during bleeding.

See the results in the next table.

Batch	Method	Filleting yield (%)	Colour grade of yield	
			(1) %	(2) %
1	Normal cut Bleed water 12→17 °C Fish 31→25 °C 20 min	27.6	91.0	9.0
2	New cut Bleed water 12→17 °C Fish 31→25 °C 20 min	31.3	92.0	8.0

Result: New bleeding cut gives higher yield and a slightly higher share of fillets in colour grade 1.

It is unclear why the yield from the normal cut is so low. It may be mistake during weighing.

The group also visited a farm for observation of the harvesting procedure. The farm was located along the river bank, and had around 200 tons of fish. A group of around 25 persons was responsible for collecting the fish and crowding it in a net that was brought next to the well boat for loading. The fish were scooped into bamboo baskets and lifted into the well of the transport boat. The fish was collected and crowded carefully by the experienced workers. The boat loaded 20 tons of fish that was transported to the factory during a 30-45 minutes trip. Some of the other farms are located much further away, and a transport time of up to 6-7 hours may happen.

From the experiments we could conclude and propose:

Good result in finding *Pangasius* brain and to kill fish by Iki-jime

Tried new killing and bleeding method

New cut method and Iki-jime seem to be an improvement

Yield of trimmed fish were around 30 % of whole fish. Unclear why it once was 27 %

Chilled water during bleeding, i.e. 12 – 17 °C is promising. Acceptable bleeding and chilling effect.

Proposal for further trials:

➔ Increase bleeding time to further improve?

4.4 Afiex

30 minutes by car from Chau Doc, (Hang Chao Hotel). Sales office in Long Xuyen.

4.4.1 General background, AFIEX

The company is located in the An Giang province, between Long Xuyen and Chau Doc.

AFIEX started to slaughter fish 5 years ago. They buy fish from farmers, but has also own farms in the delta. The yearly supply of raw material is from 10 – 15.000 tonnes per year, and the volume of fillets produced is 4 – 5.000 tons. The capacity of the factory is 40-50 tons per day. Normally they run only one shift, starting to slaughter 4.30 in the morning, have lunch 9.30-11.30 and work until 15.00. 600 workers are employed in the AFIEX Company. The company also produces value added fish products, and whole Tilapia and Spanish mackerel chunks.

7-10 days before buying from the farmers, samples are taken for malachite green. These are checked by NAFIQAVED branch 6. In Jan 2005, 8 out of 10 samples contained Malachite green. In February 7 out of 10 contained malachite, but in March it was down to 2 out of 12 samples. The company have around 64 samples per month and they pay 3000 VND per sample for the analyses. They detect for chloramphenicol and nitrofurane in own laboratory but find it very seldom. RIA II look for parasites. The reason for sending samples to Naficaved for analyses is that these measurements demands highly specialized personnel and equipment, HPLC (High Pressure Liquid Cromatography).

Fish is starved for 2 days (at least 1 day), before transport from farm to the well boat for live transport to the factory. This procedure is the same as for most processors

Before, fish was killed by icing while now they follow the most common way of killing by cutting the throat of the fish, which also secures bleeding of the Pangasius. The received fish are washed in a tank before slaughtering by cutting the throat. After slaughtering the fish are bled in water in a container for only 5 min. It is then washed 5 -15 min (further bleeding), before they are filleted. During filleting, water is running directly onto the newly cut fillets along the backbone, removing a lot of the fresh blood appearing during filleting. This seems to be a very effective method for removing blood from the fillet.

It is very positive that the temperature in the trimming area is chilled to around 18 C in the air.

Then the fillets are skinned by machine. After skinning the fillets are trimmed and a cryoprotectant is added in order to reduce loss of quality, water and liquid during freezing, frozen storage and thawing before use. The cryoprotectant does not contain polyphosphate, as this is not accepted in the European markets. The products are then IQF or block frozen as layer packed fillets. Before 2001, when USA was an important market, they accepted use of Sodium tripolyphosphate (STPP) added to the fillets.

Time from slaughtering to freezing takes 4.5 hours. Freezing starts around 9.00 a.m. Equipment for freezing is IQF (Torry double belt freezer, contact freezers and air blast freezer.

The main markets are EU, taking 40% of the products, mainly white fillets. Some pink fillets are also sold to Germany at around 2.8 US$/kg. The yellow fillets are sold to Asia. White fillets fetch around 3 to 3.2 US$, while the yellow are 2.0 to 2.2 US$ per kilo, FOB Ho Chi

Minh City. The AFIEX Company has a slightly different way of grading into colour than the other factories visited.

The company has ISO 9001 - 2000, Halal certification and a manufacturing system based on GMP (Good Manufacturing Practices) and HACCP principles. It is independently inspected by Surefish.

There is no use of blood/fat

4.4.2 Discussions and experiments at AFIEX

When arriving the company in the morning, we met with the director and six of the leaders of the different departments, including the laboratory. A presentation of our tasks was given. Then the power point presentation regarding Norwegian fish farming and the reasons for the success was given and a further presentation on aspects of slaughtering quality. The audience were very interested and including questions and comments we spent almost four hours.

The company regarded the supply of fish as the most difficult area, because it involved such a big number of small fish farmers. Therefore the quality of the fish to the factory could have variable quality, due to type of farm, season and feed quality.

Mainly, they regarded the type of pond to be the critical issue. The land based ponds with little water circulation, give the lowest quality and has the highest percentage of yellow fillets.

The fish from the river, both from ponds along the river bank and from the cages were better, the cages being best. However, during part of the rainy season when the water quality was reduced due to sand and debris in the river, the quality of fish from these ponds and cages were also reduced. The number of yellow fillets increased.

It is possible that also the feed quality can have influence on the fillet colour. Small farms often produce feed from rice inner shells, local fish or fish from the sea and some additives, at least salt.

It is not done any documentation of from where the yellow colour origins. This is an important question for all farmers and processors, and it is recommended that a study of what can be the reasons for the seasonal variation in yellow colour of Pangasius is planned and performed.

When asking about any muddy taste or flavour from the Pangasius fillets as it often is observed with Tilapia, the director commented that this is no problem. This was later confirmed by several of the other factories. Asking about the USA market and competition from US catfish industry, the director referred to several visits to USA and meant that the Pangasius have much higher quality, especially regarding the white colour and no muddy taste. The US catfish production is mainly in inland ponds with low water circulation, resulting in the lower quality, was the opinion.

After discussing with the staff, it was decided to do demonstrations of the anatomy of the Pangasius head, and showing how to kill the fish by Iki Jime (knife to hit the brain) and how to cut the two blood vessels coming from the gills. Such a cut will be in addition to cutting the main vessel from heart to the gill, as it is done now.

An experiment was performed with two groups of fish (2x100 fish), comparing the normal cut method and the newly demonstrated method, after killing the fish by Iki Jime. Bleeding times were increased to 30 minutes for both groups and a start temperature in the bleeding water was set at 12 C in order to see if using the new method would result in a different percentage of white fillets than the usual method. The grading was to be done manually and by Minolta instrument, after adding cryoprotectant. The workers found the demonstration interesting and after a short practice also did cut quite effectively, using the new method. The trials were not fully realistic, since we had to do the bleeding in small baskets in order not to stop the commercial production for too long.

The results from the experiments were:

Good result in finding *Pangasius* brain and to kill fish by Iki-jime

Tried new killing and bleeding method

Yield of trimmed fish very high (figures probably not reliable???)

New cut method and Iki-jime seem to be best

Not possible to evaluate yield from colour grading, due to mistake

Big share of fillet are regarded as yellow

Afiex do different colour grading than other companies, all are white, then divide in white, pink or yellow

4.5 NFHH Basa www.basaco.com.vn

20 min by car from Long Xuyen (Dong Xuyen Hotel).

4.5.1 General background, BASA

The Basa Co., LTD was established at the end of 2002 and the new plant started up production in August 2004. The main shareholder has experience from other food processing, i.e. beer production and sea bass farming. A close contact is developed to the Australian market via a consultant.

BASA is a new company, recently started up production. The factory had high standards in the processing areas. A special design was that both walls and ceilings were fully covered by stainless steel plates in order to secure easy maintenance and cleaning procedures. I have not seen a design like that before, and it is of interest to have documentation later on how the company are experiencing this design. In the receiving area, several big tanks are used for intermediate storage of fish before slaughter. This is because the time from unloading to receipt in the factory is quite long, and this operation reduces the number of fish that die before bleeding. In the slaughter operation a system with four tanks, secures first fish in are the first fish out. This is very important and a good solution. It is even better because the water used during bleeding is chilled. Then the fish are chilled and also the blood

The company has around 500 workers of which 30 have university level education. These work within all departments: farming, processing, laboratory, marketing and economy.

The laboratory is well equipped and runs analyses of water quality, microbiology and chemistry of fish. Samplings from the farms are done before harvest and analyses for antibiotics (nitrofuran, chloramphenicol) and Malachite green. The latter is the main problem and is also most demanding regarding analyses. NAFICAVED in Can Tho do the analyses of Malachite green.

The fish is bought from a group of farmers, of which many have small farms. A few bigger farms, producing 1 to 200 tons, are also in the group. The use of antibiotics and Malachite green is as a preventative action to avoid development of diseases. The farmers are paid 10.000 to 11.000 dong per kilo of fish, dependent on the type of farm. Fish from land based ponds are paid less (around 500 dong/kilo) than river- raised fish. This difference is not very big and may be a bigger difference may increase the quality from land based farms, or that these farms may be reduced in number since they produce lower quality fish and hence gives less profit. The company mentioned that the price difference could not be bigger, because the factories have big capacities and the demand for fish results in big competition among buyers.

When the fish arrive the factory by well boats, these are unloaded the usual way by filling boxes or baskets with fish, and then transport these to the receiving area in the factory. As the distance is a few hundred meters, a truck is used for this. Then it takes time to load the truck and the fish may stay out of water for 15 – 20 minutes. During this period, the fish will be stressed and red bruises are seen in the mouth and belly region as well as the fins. Some of the fish will be dying, which again may influence the quality, colour and texture, of the fish fillets. The conditions for unloading the well boat at BASA Company should be improved, as it involves a lot of moving and lifting the boxes up to the truck. This situation is also found in all the other factories, although the distance from river to factory is different.

The Basa Company has introduced the necessary systems for securing quality in the production, i.e. HACCP, SSOP and has an ISO 9001 certification. Focus is these days towards traceability, which is more and more often demanded from customers in Europe. During the introduction and development of these quality assurance systems, cooperation has been good between the Basa- quality department and the NAFICAVED no 6 in Can Tho.

The managers of the quality department and laboratory were very busy during the days we were visiting, because they were preparing the application to submit to NAFICAVED for approval to export to the EU market.

4.5.2 Discussions and experiments at BASA

When arriving at the Basa Company, we had a full day meeting, presenting the Seaqip project, the aims of the visit and referred to results from visits at the other factories. Then the power point presentation regarding Norwegian fish farming and the reasons for the success was given and a further presentation on aspects of slaughtering quality. The people were very interested and including questions and comments we spent most of the day.

The discussion regarding quality and possible challenges in improving fillet quality from Pangasius were discussed in much detail.

We visited the receiving area and saw the different departments in the factory. A challenge in the slaughter process is to reduce the long time from unloading fish until it is ready for cutting/killing in the factory. The use of big tanks with water for intermediate storage before slaughter, intend to secure that the fish do not die before cutting. This does not seem to be an

optimal solution. It is advised that the company improves the unloading facilities and reduces the time when fish stays out of water. This will reduce stress and probably improve bleeding.

During the filleting operation, fresh blood appears along the backbone. This blood should immediately be washed away. This can be done by applying a water stream directly onto the fillet during cutting operation.

The next day, we demonstrated

- Finding *Pangasius's* brain and how to kill fish by Iki-jime and stunning
- Tried new killing and bleeding method, letting workers try the methods.
- Assessing pH related to immediate killing and dying in air
- Development of *rigor mortis* related to pH at killing

The new killing and bleeding methods were tried out with two groups, each of 100 fish. The normal cut resulted in a yield of 32,8 % while the new cut was approximately the same, at 31,9% of whole weight. This calculation is done for fillets after being treated with polyphosohate. Yield before polyphosphate were 26.6 and 26.2 % respectively. The manual colour grading gave as result that the normal and new cut gave same amount of white fillets, while the percentage of pink was higher in the normal cut group. Since pink colour gives a higher price than the yellow, normal cut would be preferred.

Again, it is important to comment that the experiment is an indication only, and the company should go on testing the new method further before a decision on changing the process.

An other experiment was done, trying to assess the development of rigor mortis in fish killing in three different ways; cutting throat, die in air, Iki-jime, and at different temperatures; 15 °C and 30°C. The experiment took time and the fish was left in the factory until next morning. Unfortunately the fish had been removed and the experiment was difficult to assess. Some results were obtained and these are presented in the figure below.

The group of normal cut fish at 15 °C went into *rigor mortis* first, after 2 hours, while the differences between the other groups were small, rigor after 6-8 hours. We can also see that the individual variation between fish in each group is big. It is important to note that we did not measure during the night, i.e. between 11 hours and 22 hours after killing.

In order to understand the slaughter processes, further experiments like these should be performed under full control.

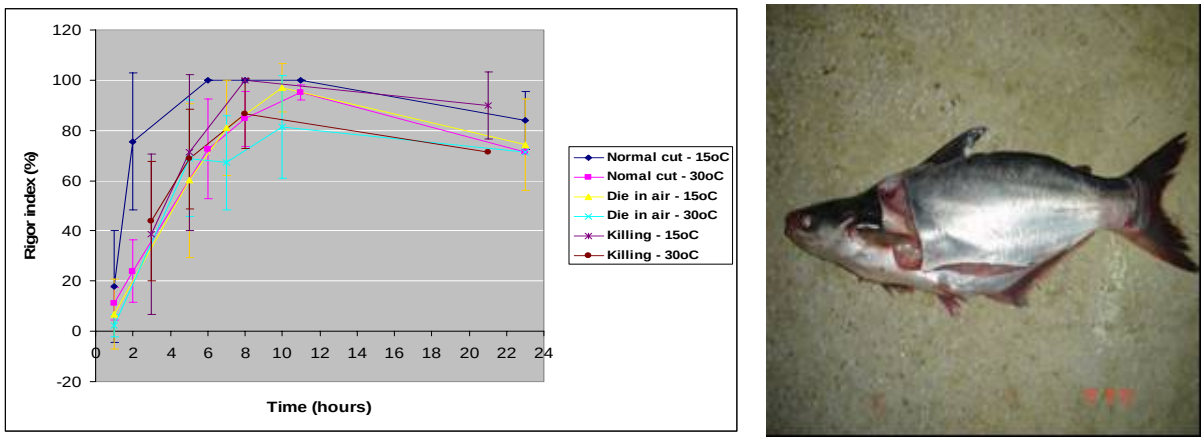

Figure 1 Presents the development of rigor, measured as rigor index at different temperatures (15 and 30°C), for three groups of fish, killed by cut to brain, killed by bleeding cut and die in air. Picture 5 shows that the fillet has contracted during rigor mortis. Data from BASA.

4.6 NAM VIET(NAVICO)

10 min by car from Long Xuyen (Dong Xuyen Hotel).

4.6.1 General background, NamViet

The company Nam Viet started up in 2000, and are now producing at the capacity of 300 tons with two shifts, from 04.00 am to 15.00 pm and 15.00 pm to 04.00 am. The shifts are divided in 2x10 hours work and 2x2 hours lunch break with work 7 days a week. The shifts, night and day are for all personnel. Sometimes it is closed on Sunday. 4400 are working in the factory, of which approximately 80 are educated at university level. Around 60 of these are working in the production and technology group.

Nam Viet is the biggest producer in Vietnam, according to information from the director, Doan Toi. The annual turn over was less than 15 million US$ in 2000, 40-50 million in 2002 and they hope to be around 100 million US$ in 2005. The company makes a reasonable profit, according to the director, who owns the factory. They have started building a new factory in March 2005, not far from the present one. It will be finished within 7 months and be named Atlantic Seafood Products. And will in addition to frozen fillets be producing a choice of value added products. They are going to expand at the present factory, by using the site where today is a factory for production of packaging material, cardboard and plastic bags and sheets. The factory producing packaging material is going to be moved to new buildings, now under construction. In the empty building, a new factory will be set up to produce frozen fillets. It is named Pacific Seafood Products Ltd. Then they will change to one shift in both factories. The total capacity will then be up to 700 tons per day for all three factories.

The company has the necessary quality assurance systems, based on the HACCP principles. No traceability is in place, but they are aware that this must come. The laboratory is working very well.

The director and his staff are much focussed on improving the logistics in production. Processing lines are planned to be using more conveyors for internal transport and in the receiving area for washing and distributing fish to the filleting and trimming lines. A new construction from a producer of processing equipment, were seen tested at the factory. The director was also very interested in solutions related to quick an efficient transport of live fish

from the well boat to the factory's receiving area. Vacuum pumps can be one possible solution.

The waste water treatment plant in the present factory can only take 50% of the total waste water today. This situation will be improved when the extension with Pacific Seafood will be done. The by-products are taken care of in a separate factory producing fish meal and oil, it was said. This factory has very simple equipment and by no means up to standard with the other parts of the company. The fish meal is of low quality and is used as fertilizer only. The fat is extracted by cooking and separation in small centrifuges. The oil has low quality and is sold as inexpensive cooking fat. This production absolutely needs upgrading by introduction of new methods and new equipment.

Workers do the cleaning at the end of the shift.

The factory has their own 12 well boats for live transport, with a capacity up to 30 tons. Sometimes additional boats are required. The boats arrive all around the clock and may wait some time before unloading.

The company has a club of 200 farmers. The farmers' chairman acts as a middleman and organizes the sale of fish from the farmers. He has functioned for three years, and no change is wanted. The size of the farms is on average producing 200 tons per year, while the biggest produce 17.000 tons a year. 90 to 95 % of the fish produced is Tra, while only 5 – 10 % then is Basa. During farming, feed supply is a challenge, and optimizing the feed is necessary according to the Nam Viet staff. The farmers have support from extension centres, but still need more assistance to improve. No information about starvation time could be given.

Before buying fish, samples are taken from the farms for testing of antibiotics and malachite green. These samples are analysed at the laboratory in the factory, which is well equipped for this. In January 50% of the samples are positive. The situation is the same now, in May 50 % are still positive for Malachite green. Before they sent 200 samples per month to NAFIQAVED. The laboratory personnel have now been trained by Naficaved and the company runs these analyses on HPLC in own laboratory. The laboratory is very nice.

It was mentioned that the Asian markets did not bother much regarding fish having positive analyses of malachite green.

Fish are briefly cleaned before slaughtering. Bleeding take 10 min. followed by a rinsing for about 10 min. The process follows the same lines as in the other factories. The factory is very busy, and crowded with people. A big variety of frozen products are produced and being packaged in cartons according to customers demand. The frozen products are stored in a cold room for shorter periods before they are shipped in freezer containers on a boat to HCMC for further export.

The process from bleeding to freezing is 2 hours.

Up to the anti dumping law suite 80% of the products were sold in US, now it is zero. The biggest markets to day are EU, Asia and Australia. The company is not so much concerned about white/red/yellow fillets, as long as the raw material has the right price compared with the price for the final product. They treat all products with polyphosphate unless the costumer will not allow. How this can happen at the same time as it is stated that most important market EU, do not accept TSPP, was not discussed

Water is supplied from 9 wells pumping all the time.

A Vietnamese university has looked at use of blood/fat, but it did not seem to be feasible.

4.6.2 Discussions and experiments at NamViet

A full presentation regarding quality, killing methods and waste water handling, was made also at the NamViet factory to interested staff. Their primary concern is related to the use of antibiotics at the farms and the use of feed of very different quality. Another concern was the change of colour in fillets after freezing. Some fillets even became blue, the reason being unknown. That situation has not been observed lately.

They were very interested in being informed about waste water treatment, disinfection methods and possible new ways of utilizing by-products. Therefore an afternoon was spent discussing these questions both in general and in more detail, e.g. regarding disinfection methods. These can be several, depending on the probability of which bacteria and/or viruses should be killed. The use of low pH or high pH to specific levels, combined with certain holding times is possible, as well as heating (big volumes, high cost) and use of chloride. The latter is chosen as a method for the new waste water plant to be built at the new factory.

The company was not very interested in doing experiments in the factory. We did discuss the possibilities for changing to a new cut when killing, and also to demonstrate Iki Jime killing, but the staff would themselves do this demonstration for the workers.

We had the support to do a small experiment with assessing development of *rigor mortis* of unstressed fish. It was performed onboard a well boat, waiting to be unloaded. This fish was rested and we picked fish one by one from the well, before killing by a cut into the brain, and immediately measure pH in the fish muscle. The results were as hoped and expected, quite higher, 7.2, than measured before, 6.7, in fish that had been transported from a well boat to the receiving area of the factory, and therefore stressed.

Appendices

Terms of reference

Ministry of Fisheries, Vietnam

Danida
J.Nr. 104.Vietnam.803-4

FISHERIES SECTOR PROGRAMME SUPPORT

Component: SEAQIP II

Terms of References

Consultancy on

Assistance to a survey on slaughtering processes of Pangasius included the waste handling, in order to come up with recommendation for better procedures.

Background

In 1994 it was agreed between the Ministry of Fisheries (MOFI) and the Danish Ministry of Foreign Affairs (DANIDA) to support the development of the fisheries sector in Vietnam, applying the adopted Sector Programme Support (SPS) approach. A Fisheries Master Plan was supported by DANIDA and completed in 1997. The Export and Quality Improvement Project (SEAQIP I) was supported from mid-1996 to the end of 1999. The SEAQIP Component, which forms a part of the SPS to the Vietnamese Fisheries Sector started in January 2000. The SPS includes the following 5 components:

Component 1:	**Strengthening of the Fisheries Administration (STOFA)**
Component 2:	**Support to Fresh Water Aquaculture (SUFA)**
Component 3:	**Support to Brackish Water and Marine Water Aquaculture (SUMA)**
Component 4:	**Seafood Export and Quality Improvement Programme (SEAQIP II)**
Component 5:	**Support to Industry Restructuring & Enterprise Development (SIRED)**

Activities supported by SEAQIP II are focusing on 5 areas in relation to the fish-processing sector:

1. Training within marketing and management;
2. Awareness raising on environmental performance and improvements;
3. Awareness raising on occupational health aspects and improvements;
4. Awareness raising on improved handling of raw materials in the chain from farm/vessel to factory;
5. Awareness rising on efficient implementation of HACCP systems.

This Terms of Reference aims to assign assistance to make a survey report of the present slaughtering procedures for catfish (Pangasius) and the collection/use of waste. The report

will also include recommendations for better handling procedures. This TOR is as such within the scope for SEAQIP and especially related to the above mentioned area 2 and 4

In recent years, Vietnam's catfish (Tra and Basa) production in the Mekong River Delta has increased significantly. The production for 2004 is estimated to be about 300,000 tons. In order to achieve the target of developing the catfish production into a major competitive and sustainable industry, it is of outmost importance to look at all aspects of the production. It is therefore recommended, among others, to put a focus on the slaughtering process. In relation to quality it is known the right slaughtering procedures are very important. The normal procedure to day is batch slaughtering resulting in some fish are bleeding too short a time before further processing and some others can stay in the bleeding jar too long.

Compared with many other seafood products (e.g. shrimps and cephalopods) waste water from the catfish production can be an environmental problem due to the high amount of blood and fat from the processing. For the present the blood and fat is just considered as waste and is running out with the drain water. A collection and use of this waste e.g. for animal feed could be a help to solve some of the environmental problems which could come with a more intensive production, where there in many factories could be a risk overloading the waste water treatment plants, which may result in serious pollution of the environment.

The handling procedures will vary from factory to factory, it is therefore important to involve at least 5 factories in the survey.

Objective
The objectives are:

- SEAQIP assisted in a survey related to the quality of catfish (Pangasius - Tra and Basa) production with focus on the slaughtering process and the related handling of waste material (blood and fat)
- SEAQIP assisted coming up with better handling procedures for the factories.

Output
- A survey report related to the present handling procedures
- Recommendation for needed changes of the slaughter process
    - In order to optimize the fish quality
    - Requirement for minimizing waste water use
    - Collecting of blood (fat) for further use

Scope of Work
The scope of work will include, but not necessarily be limited to the following:

- Study of the slaughter process in at least 5 catfish processing enterprises (2-4 days at each factory)
- Report containing description of the present procedures and recommendations for changes in order to optimize the production.

Methodology
The consultant will work in close cooperation with local SEAQIP staff.

The work will be carried out in Vietnam and to the extent needed from home base in Norway, within the frames given in advance in the contract.

Input and Timing
The consultancy will be carried out by:

Nils-Kristian Sorensen (nils-kristian.sorensen@fiskeriforskning.no) is a Senior Scientist in the Norwegian Institute of Fisheries and Aquaculture Research, Department of Seafood and Industrial Processing. The Department has a particular focus on handling raw material and optimization of seafood processes, contributing to enhanced productivity and increased profit. Main areas of research: Basic and functional properties of seafood, raw material quality and seafood processing, and process automation and efficiency.

Tentative Work Schedule:

Main Activities	Input from Home base		Input in Vn	
	Number	*Time Schedule*	*Number of days*	*Time Schedule*
Preparation for the study: literature check, contact to companies etc.	5 days	April 2005		
Study regarding quality of Catfish especially in relation to the slaughter process			25 days	April-May 2005
Report/workshop preparation			5 days	May 2005
Workshop			1 day	May 2005
Final report	5 days	May-June 2005		
Travel	2 x 1 day			

Reporting

Before departure from Vietnam the consultants will submit to the Component Management a short debriefing report, summarizing the activities carried out with focus on major achievements and bottlenecks to overcome.

A Draft Final Report, in 5 hard copies and one electronic version, shall be submitted to DANIDA/the Royal Danish Embassy in Hanoi not later than 3 weeks after returning from the stay in Vietnam. Five days after receiving comments from DANIDA a final report in 8 hard copies and one soft copy in MS-Word or a compatible software shall be submitted to DANIDA/the Royal Danish Embassy in Hanoi unless otherwise agreed in advance with Danida.

Embassy of Denmark in Hanoi

Itinerary

16.04.2005 Leave Tromsø, Norway for Ho Chi Minh City, (HCMC), via Copenhagen and Bangkok

17.04.2005 SUNDAY

Arrive in HCMC. Meet Finn H. Heidemann at airport . To hotel Palace.

18.04.2005 Meeting at H Palace, Finn H Heidemann, Huynh Le Tam, Seaqip; Huynh Nguyen Duy Bao, Seaqip; Cao Duc Thang, RIA 2. Discussed detailed plans for consultancy and work at the factories.

19.04.2005 Travel to Cao Lanh. Visit at a shrimp processing factory, outskirts of HCMC

20.04.2005 Visit Vinh Hoan factory: Discuss aspects of fish quality with manager and quality assurance manager.

21.04.2005 Discussions, work and experiments regarding resting of fish at Vinh Hoan factory.

22.04.2005 Further experiments at factory

23.04.2005 Further experiment and discussions, summing up. Evening, leave for Long Xuyen, Dong Xuyen hotel.

24.4.2005 SUNDAY

Reporting. Free time. Bao leaves for HCMC in morning. Tam arrives in evening from HCMC.

25.04.2005 Visit AGIFISH. Introduction, presentation of mission and power point presentation on aquaculture and harvesting methods, the effect on quality of farmed fish. Discussion for selection of experiments.

26.04.2005 AGIFISH. Experiments and demonstrations

27.04.2005 AGIFISH. Experiments. Discussion and presentation of findings. Concluding remarks. Travel further to Chau Doc in the evening.

28.04.2005 Visit AFIEX. Introduction, presentation of mission and power point presentation on aquaculture and harvesting methods, the effect on quality of farmed fish. Experiments in afternoon and concluding discussion and remarks.

29.04.2005 AFIEX Company closed due to holidays and celebration of April 30th. Go back to HCMC via Sam Mountains. Overnight HCMC, Hotel Oscar

30.04.2005 Working with Tam regarding work done during the week. Prepare outline of PP presentation for workshop for industry, planned for May 13th, Can Tho.

01.05.2005 SUNDAY. Free time. Dalat.

02.05.2005 Free time. Prepare reporting. Overnight HCMC, Hotel Oscar

03.05.2005 Travel to Long Xuyen. Overnight at Hotel Dong Xuyen for next 8 nights.

04.05.2005 Visit TNHH BASA Company and factory. Introduction, presentation of mission and power point presentation on aquaculture and harvesting methods, the effect on quality of farmed fish. Plan and prepare for experiments next day.

05.05.2005 BASA, experiments related to slaughtering of Tra fish. Introduction to killing methods, demonstration of anatomy (head and brain) of Tra. New proposal for bleeding and experiments with bleeding cut, temperature and time for bleeding in water.

06.05.2005 BASA, further experiments. Killing methods and the effect on onset and resolution of rigor mortis in Tra fish.

07.05.2005 BASA, finalisation of experiments. Summing up and concluding remarks with company representatives. Reporting.

08.05.2005 SUNDAY. Reporting. Free time.

09.05.2005 Visit Nam Viet Company, Long Xuyen. Introduction, presentation of mission and power point presentation on aquaculture and harvesting methods, the effect on quality of farmed fish.

10.05.2005 Nam Viet, experiments

11.05.2005 Nam Viet, experiments and hotel for reporting. Leave for Can Tho and seminar.

12.05.2005 Can Tho. Prepare presentations for workshop 13.05.2005 with Tam and Bao.

13.05.2005 Work shop for Pangasius industry. Effects of harvesting and slaughter of Tra and Basa fish on the quality of the fish fillets. Late afternoon leave for HCMC. Overnight at Grand Hotel.

14.05.2005 Meeting with RIA 2, (Research Institute for Aquaculture 2). Finn, Bao, Thang, Nils K. Evening, leave for Hanoi with Bao. Overnight at hotel Horison.

15.05.2005 SUNDAY. Work with final draft report to SEAQIP and DANIDA.

16.05.2005 Debriefing at SEAQIP office in Hanoi, with Finn H. Heidemann., Mr. Nguyen Huu Dung- SEAQIP National Director, Huynh Le Tam – SEAQIP Quality Assurance Specialist, Huynh Nguyen Duy Bao – SEAQIP Quality Assurance Specialist

17.05.2005 Final draft report. Free time

18.05.2005 Final draft report. Free time

19.05.2005 Leave for Copenhagen, Norway and Tromsø

20.05.2005 Arrive in Tromsø. End of trip. Finalization of draft report to be done.

SEAQIP Working Program on Slaughtering Pangasius

No.	Companies	Time	Participants
1.	Vinh Hoan Company Tran Quoc Toan Industrial Zone National Way 30, Ward 11, Cao Lanh Town, Đong Thap Province Tel: 067.891166-891663 Fax: 067.891062 Mr: Huynh Duc Trung, Deputy Director Mobile: 091300025	20 - 23/4/2005	1. Nils Kristian, Norwaygian Expert 2. Huynh Nguyen Duy Bao, SEAQIP-QA Specialist 3. Cao Duc Thang, RIA 2 Trainee
2.	Agifish 1234 Tran Hung Dao, My Quy Ward Long Xuyen City, An Giang province Tel: 076.852368-857724 Fax: 076.852202 Mr Nguyen Dinh Huan, Deputy GeneralDirector	25 -28/4/2005	1. Nils Kristian, Norwaygian Expert 2. Huynh Le Tam, SEAQIP-QA Specialist 3. Cao Duc Thang, RIA 2 Trainee
3.	Afiex National Way 91, Vinh Thanh Trung Ward, Chau Phu District, An Giang Province Tel:076.687690 Fax: 076.688597 Mr Buu Huy Mobile: 0913971791	29/4 - 3/5/2005	1. Nils Kristian, Norwaygian Expert 2. Huynh Le Tam, SEAQIP-QA Specialist 3. Cao Duc Thang, RIA 2 Trainee
4.	Basa Ltd.Co. Thoi Thuan Ward, Thot Not District, Can Tho City Fax: 071.833533 Mr. Vo Tan Minh, General Director Mobile: 0913975073	4-7/5/2005	1. Nils Kristian, Norwaygian Expert 2. Huynh Nguyen Duy Bao, SEAQIP-QA Specialist 3. Cao Duc Thang, RIA 2 Trainee
5.	Nam Viet Company 19D Tran Hung Dao, Long Xuyen City, An Giang Province Tel: 076.834060-834065 Fax: 076.834054 Mr Doan Toi, General Director Mobile: 0913877005	9-12//5/2005	1. Nils Kristian, Norwaygian Expert 2. Huynh Nguyen Duy Bao, SEAQIP-QA Specialist 3. Cao Duc Thang, RIA 2 Trainee

Agenda of the Workshop

Title of the Workshop:

Improvement of Handling and Processing of *Pangasius* in Vietnam

Date: **13 May 2005**

Place: **Cuu Long Hotel in Can Tho**

Time	Subject	Speaker
7.30 – 8.00	Reception	SEAQIP
8.00 – 8,15	Opening Speech	Finn Heiderman
8.15 – 9.45	Introduction of Norwegian Research Studies on Aquaculture, and Handling and Processing of Atlantic Salmon	Nils Kristian Sorensen
9.45 – 10.15	Tea break	
10.15 – 11.00	Questions and Answers to handling of Salmon	
11.00 – 12.00	Summary of some trails on Pangasius handling in Vietnam. Proposal for further researching	Nils Kristian Sorensen Huynh Le Tam Huynh Nguyen Duy Bao
12.00 – 13.30	Lunch	
13.30 – 16.00	Summary of some trails on Pangasius handling in Vietnam.Proposal for further researching (Continue)	Nils Kristian Sorensen Huynh Le Tam Huynh Nguyen Duy Bao
16.00 – 16.30	Discussion – Questions and Answers	

The target groups should be:

- Factories dealing with Salmon (in HCMC), Pangasius (in An Giang, Can Tho, Vinh Long, Tra Vinh, Dong Thap)
- Teachers in BFT groups (both from Can Tho and Nha Trang)
- NAFIQAVED Head Office and Branches
- RIA II

List of Participants

Workshop on pangasius slaughtering in viet nam

Can Tho City, 13/5/2005

No.	**Names**	***Company***
1.	Le Hong Diep	***INCOMFISH***
2.	Truong Trong Hong Hanh	
3.	Vo Thi Thuy Loan	
4.	La Huu §uc	***Duyen Hai Food Processing***
5.	Nguyen Thai Bao	
6.	NguyÔn Minh TrÝ	
7.	Le Thi Thuy Trang	
8.	Nguyen Thi Hong	
9.	Vo Kim Phuong	
10.	Tong Hoang Liem	***Tuan Anh Ltd. Co.***
11.	Nguyen Minh Dung	
12.	Nguyen Thanh Long	
13.	Bui §uc Quy	***QVD Food Ltd. Co.***
14.	Bïi V¨n Dòng	
15.	Nguyen Tri Uyen	
16.	Vo Dong Duc	***CATACO***
17.	Lam Van Minh	
18.	Huynh Duc Trung	***Vinh Hoan***
19.	§o Thi Anh Dao	
20.	Ho Thanh Hue	
21.	Buu Huy	***AFIEX Co.***
22.	Nguyen Van Trung	
23.	Vo Thi Thanh Huyen	***Thuan Hung Ltd. Co.***
24.	Le Thi Le Tuyen	
25.	Tran Ngoc Hoa	
26.	Dang Kiet Tuong	***AQUATEX Ben Tre***
27.	Nguyen Van Kiet	
28.	Vo Thi Thuy Nga	
29.	Le Van Diep	***AGIFISH***
30.	Nguyen Thi Lien	
31.	Phan Cong Bang	

32.	Phan Thanh Mong Hoang	
33.	Huynh Thi Dung	
34.	Luu Phuoc Dinh	
35.	Nguyen Thi Chinh	***Mekong Seafood Co.***
36.	Le Yen Nhi	
37.	Nguyen Minh D¹t	
38.	Doan Thanh Phuong	***FARQIMEX Ben Tre***
39.	Phan Ngoc Hau	***SEAPRODEX Mien Trung***
40.	Le Huu Tho	***SEASPIMEX***
41.	§o Trong Vinh	
42.	Le Duc Duy	
43.	Vo Phong Thuong	***Sa Dec Seafood Export Import Processing Factory***
44.	Vo Thanh Danh	
45.	Nguyen Anh Tuan	
46.	Le Minh Lam	***An Giang Fisheries Association (AFA)***
47.	Vo Quoc Van	***NAFIQAVED Br. 6***
48.	Pham Van Hung	
49.	Le Xuan Nhat	***VASEP***
50.	Chu Duc Xuan	***NAFIQAVED Br. 5***
51.	Hoang Thi Nghia	***NAFIQAVED Br. 2***
52.	Pham Van Thai	***NAFIQAVED Br. 1***
53.	Nguyen Van Muoi	***Can Tho University***
54.	Ho Thanh Toan	
55.	Phan Thi Thanh Que	
56.	Nhan Minh Tri	
57.	Nguyen Van Hieu	***Ben Tre DOFI***
58.	Nguyen Thuan Anh	***Nha Trang University***
59.	Nguyen Hong Quang	
60.	Ngo Thi Hoai Duong	
61.	Pham Van Tuan	

People met

VINH HOAN

Huynh Duc Trung,	Deputy director
Nguyen Thi Thu Hue	Quality staff

AGIFISH

Nguyen Dinh Huan	Deputy director of Company
Phan Cong Bang	Deputy chief of Technology Division of company
Nguyen Thi Lien	Deputy Director of Factory No. 7 ---- ” ----- ” ----
Luu Phuoc Dinh	Deputy Production Manager of Factory No. 7
Luu Thi Yen Nhi	Quality staff Factory No. 8

AFIEX

Buu Huy	Director
Nguyen Van Trung	Quality manager
Phan Thi Ngoc Tuyen	Laboratory leader
Tran Thi Thanh Thuy	Production manager

BASA

Vo Tan Minh	Chairman of the board and owner
Hien Huu Dang	Consultant and sales agent, minority owner
Lê Van Diep	Advisor to the chairman of the board (owner)
Nguyen Thi Due Linh	Head of quality management department
Pham Van Thai	Quality management department
Le Diem Thuy	Manager, Microbiology laboratory

NAM VIET

Doan Toi	General Director
Nguyen Thua Buu	Chief of technical department
Le Ngoc Anh	Production manager

Company visited by Tam and Finn, not included in survey

TUAN ANH Company *(near by Nam Viet)*
Daily working time: 6.00 – 15.00
Daily Production: 70 – 80 tons of Raw Materials. (Nam Viet claims they produce 30 tons/day)
5 Well boats with 10 – 25 tons/boat capacity

Fish have been starved 2 days before receiving into the factories. Transportation boats arrive to factory early in the morning, and unloading until 13.00.

There are 5 wells pumping water.
Processing time from bleeding to freezing: 1.5 – 2 hours
Treatment with Phosphate/ Non-phosphate depend on customers requirements.
900 workers, and 20 graduated from Universities as technical staff.
Antibiotics testing and microbiological testing at NAFIQAVED 6
Basic HACCP training has been given by NAFIQAVED 6 to 30 persons (technical, supervisors).

There are 5 contact freezers and 2 IQF freezers.
Company did not show interest to improvement of product quality, that why SEAQIP will not chose them in the list of pilot factories for trials.

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