# The Commercial Use of Chicken Processing Wastes to Raise Hybrid Catfish *(Clarias gariepinus x Clarias macrocephalus)* in Thailand

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## Background

Production of the hybrid catfish *(Clarias macrocephalus x Clarias gariepinus)* and broiler chickens has increased substantially over the last decade in Thailand, with an unreported but important level of integration. Excreta from broiler and layer chickens is used as a fertilizer for catfish and other freshwater fishponds (Edwards et al. 1983; Engle and Skladany 1992). Broiler chicken production has now expanded, to take advantage of increased domestic and export markets. The by-products from chicken processing are assuming an important role in feeding catfish.

Catfish production in Thailand increased dramatically after the widespread adoption of hybrid fish and reached about 30,000 t/year by 1990 (DOF 1993). Most is sold in domestic markets. The hybrid is easier and quicker to raise than *Clarias macrocephalus* and, at first, commanded better prices than the previously more widely cultured *Clarias batrachus*. However, soaring production and a slow growing market have slimmed profit margins and fish farmers have attempted to reduce feed costs and increase unit size.

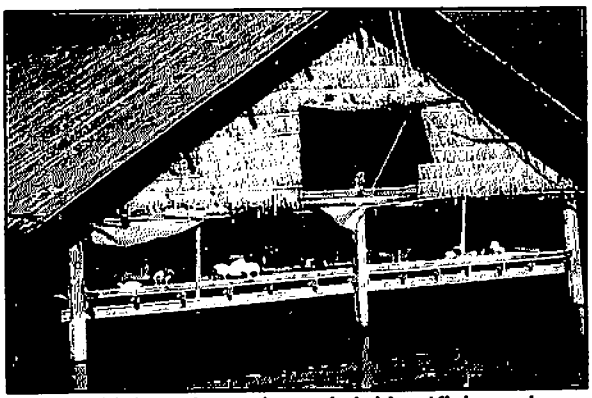
Catfish culture from the 1960s was based mainly on feeding with marine trash fish. Floating pelleted feeds, although available for over a decade (Edwards et al. 1983) have only recently become popular, as the hybrid has become the dominant cultured catfish. Chicken processing wastes, principally heads, intestines and leg bones have become important catfish feed resources.

We conducted in-depth interviews and made frequent visits to an intensive catfish farm in Pathum Thani province owned by Mrs. Luan Wasanagamol and a catfish/snakehead (*Channa striata*) farm owned by Mr. Chokchai Aukulwatana in Supanburi province.

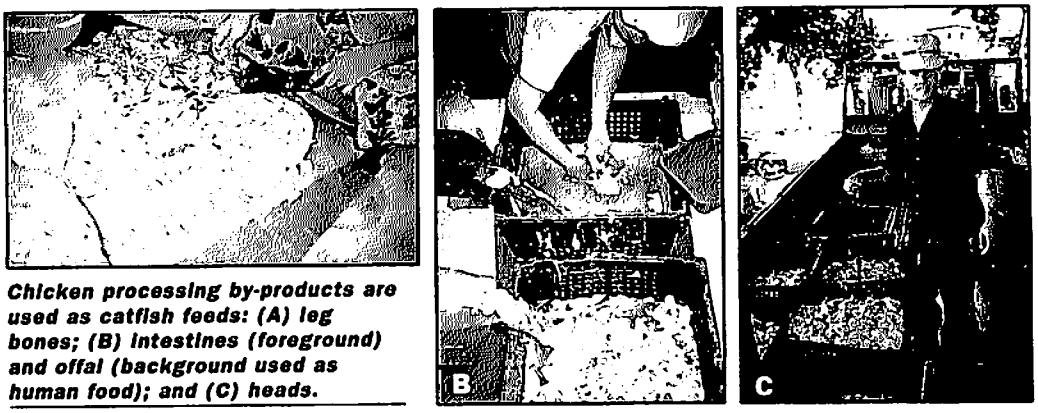
Mrs. Luan's farm began as a pig-fish integrated farm in 1980, raising a polyculture of silver-striped catfish (*Pangasius sutchi*), Nile tilapia (*Oreochromis niloticus*) and rohu (*Labeo rohita*). Initially the farm covered 5 ha, with nine 0.1-0.5-ha ponds. From 1991, a second 17-ha site has been used for nursery and growout. Utilization of chicken bones as a fish feed began in 1986; the first instance of this in the area, although other by-products such as dried blood and live male day-old chicks had been tried before. Initially the bones were ground and mixed with water hyacinth (*Eichhornia crassipes*) and fed to the polyculture pond. The pig growing enterprise was gradually reduced as it became less profitable. Intensive catfish production began in 1987 with *C. batrachus*. The hybrid was tried a year later and completely replaced *C. batrachus* by 1989. A polyculture of silver-striped catfish, Nile tilapia and various carps is still raised using surplus ground chicken bones as feed.

The Chokchai farm was established in 1965 on a 5-ha site with 10 ponds but by 1989 had expanded to a total of 55 ha, including 72 0.05-1.1-ha ponds and 5-ha reservoir. The farm produced *C. batrachus* and snakehead until 1991 when the catfish hybrid replaced these.

The following account of nursery and growout operations derives from information gathered at this typical farm.



*Broiler chickens housed over hybrid catfish ponds are a common sight in Central Thailand, often on high value land in peri-urban areas.*




*Chicken processing by-products are used as catfish feeds: (A) leg bones; (B) intestines (foreground) and offal (background used as human food); and (C) heads.*

## Nursery Operations

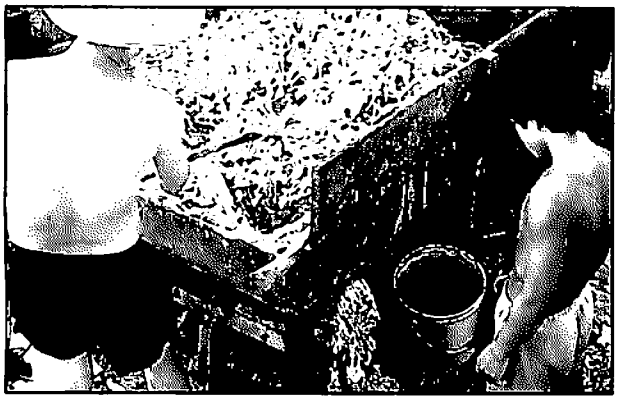
After yolk-sac absorption, the fry are nursed up to at least 2.5 cm to ensure good survival prior to stocking in growout ponds. Another method used is nursing in a separate pond, for 1-2 months, to advanced fingerlings (6 g). Survival to harvest for fry stocked just after yolk-sac absorption is around 50%, but this increases to 75-90% for 6-g fingerlings. Sodium

cyanide (4.2 kg/ha) and quicklime (63 kg/ha) are used to prepare nursery ponds prior to filling with canal water and stocking the next day. Nursing lasts a minimum of one month. The fry are fed cladocerans (*Moina* spp.) at 40 kg/ha for the first three days, before changing to a diet of finely minced and sieved chicken bones fortified with a vitamin premix (6-14 kg/ha/day).

During the nursing period to 2.5 cm, the fry are susceptible to diseases, especially white patch disease caused by the bacterium *Flexibacter columnaris*. This is treated by broadcasting potassium permanganate ($KMnO_4$) dissolved in water or formalin at 3 ppm at a rate of 6.25 kg/ha. Occasionally, oxytetracycline is added to the ground chicken bones.

## Growout

Small fry (2.5 cm; US$3.6/1,000 fry) are stocked at 125 fish/m² or larger, nursed fry at around 40 fish/m². The culture period ranges from 4-5 months, depending upon the stocking strategy and the required size at harvest. The latter depends largely on whether the fish are to be marketed in North or Northeast regions, where the demand is for small fish (8-11 fish/kg), or locally in Central Thailand (3-6 fish/kg).



***Chicken leg bones, processed on-farm by fine mincing together with a binder such as rice bran or waste noodles, before feeding fresh to catfish.***

This typical farm requires large quantities of chicken processing wastes to prepare sufficient feed. For example, 12 ha of production ponds require approximately 6 t of chicken leg bones daily to give a gross yield of 100 t/ha/year of harvested catfish. The farmer needs good personal relationships with chicken processors as chicken by-products are highly sought after. Typically, a successful procurer acts as wholesaler of by-products to other farms. The chicken leg bones, heads and intestines are finely minced and are combined with materials such as fine rice bran or noodle waste as binders. Different by-products have different prices and this is related to their value as catfish feed ingredients, as well as the extra benefits that can be gained by removing remaining meat scraps. Typically, leg bones that contain significant meat residues cost more than finely cleaned bones (US$160/t and US$120/t, respectively). Extra costs are recovered by subcontracting casual laborers to remove the meat, which is sold for human consumption before mincing the bones for fish food.

Up to 10 t of chicken bones are purchased daily at this farm from four processing plants. Any excess to the farm's requirements is sold to other farms, either ready minced (+US$32/t) or whole (+US$20/t). Whole, cleaned chicken carcasses are also obtained intermittently for as little as US$40-80/t although these are normally purchased by other individuals for processing into human food.

Feeds are prepared daily by passing through an industrial extruder (20-cm diameter die, with 0.375-cm diameter holes) attached to a 100-hp diesel engine. Prior to mincing, chicken bones are mixed at a ratio of approximately 5:1 weight with dry noodle waste (US$70/t) or fine rice bran (US$120/t). Proximate analysis of ground chicken bones (Table 1) indicates their high nutritional quality.

Bones and other chicken by-products leave the processing plant in plastic bags on ice and are refrigerated at the farm before mincing and feeding to fish. Processing plants are closed on Sundays and fresh materials are unavailable but refrigerated storage allows daily use of chicken by-products. The feed is broadcast from a boat twice daily at 250-3,000 kg/ha/day, increasing gradually the amount fed through the culture period. The fish are not fed on Mondays.

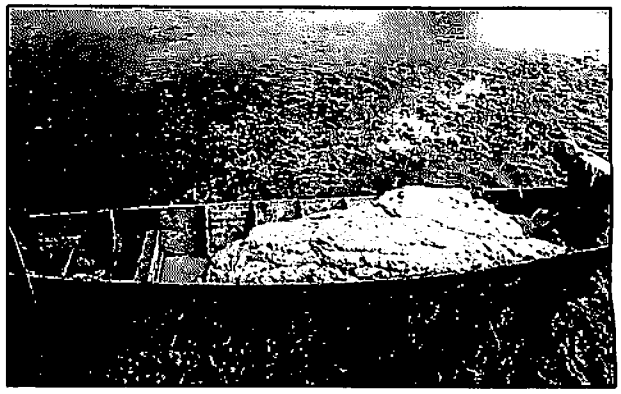
**Table 1. Proximate composition of ground broiler chicken bones (%DM) mean values (± SD), n = 3.**

| | |
|---|---|
| Moisture | 58.35 ± 2.29 |
| Crude protein | 39.46 ± 0.78 |
| Crude lipid | 21.72 ± 4.21 |
| Crude fiber | 0.31 |
| Ash | 30.48 ± 7.04 |
| NFE | 4.62[a] |

[a] n = 1

The high feed inputs necessitate some water exchange in the last three months of growout; generally 50% of the pond water is changed monthly. Farms change to locally available floating catfish pellets (crude protein 25-30%) if chicken processing by-products are unavailable or in short supply. Chicken processing by-products cause greater deterioration in water quality than floating pellets. If the supply of irrigation water is temporarily limited, pellets are substituted to facilitate water quality management. Increasingly, the drainage from catfish pond is directed into neighboring ponds for producing Nile tilapia and carps (e.g., *Cirrhinus mrigala, Cyprinus carpio, Labeo rohita,* and *Puntius gonionotus*) (Little and Griffiths 1992). Ponds are dried and re-excavated regularly as fish growth is significantly slower in older ponds. Fish might reach market size in as little as 3 to 4 months in a newly excavated pond compared to 5 months in older ponds with more organic sediment.

Low catfish prices (US$0.9/kg) have stimulated some farmers to switch to



***Twice daily feeding of minced chicken bones to hybrid catfish at rates of between 250 and 3,000 kg/ha/day, from a boat.***

snakehead production. Chicken bones and breads are used as partial ingredient in snakehead rations and do not normally exceed 25% of the wet weight of snakehead feeds, which are mainly composed of 75% trash marine fish. Catfish production can also be reduced by seasonal shortages of seed or the use of $F_2$ hybrid seed which, despite good early survival, grow poorly compared to the progeny of pure Thai and African catfish, according to the farmers interviewed.

## Overview

Thailand is currently the biggest exporter of chicken meat in the world: 120,000-150,000 t over the last few years. This represents, however, only a small proportion of domestic production. Only 38% of the live weight of the chickens is exported. The rest is sold locally as specific products (e.g., chicken wings) or as by-products.

Fig. 1 indicates the products derived from 1.75-kg live weight broiler chickens. Small quantities of chicken leg bones, heads and intestines are used as feeds for livestock, but this is compensated for by consequent use of livestock by-products, such as carcass bones and blood, as catfish feeds. By-products are also available from chickens produced for the domestic market since only 33% of the total chicken meat produced is exported (Keeratipipatpong 1994) but these by-products are not included in the analysis as they are only available in small quantities and availability is more dispersed, which makes them less useful for large-scale catfish producers. Use of poultry by-products, at an assumed feed conversion ratio (FCR) of 4.0, supports the production of over 10,000 t of catfish annually, or around one-third of total fish production. The other principal feeds used by catfish producers in Thailand are floating pellets. One company produces 2,000 t/month.

The chicken processors and catfish farmers have mutual interests in continuing this linkage. Income from by-product sales is important in the chicken industry with its small profit margins and competition with lower-cost producers such as those in China. The value of by-products sold for catfish feed can be equivalent to 90% of labor costs or 40% of transport costs of broiler production. Conversely, chicken by-products reduce to some extent the demand for pelletized catfish feeds which are produced by the same companies processing chickens.

*Processing broiler chickens is labor-intensive; this plant near Bangkok slaughters 60,000 birds per day, mostly for export.* ALL PHOTOS BY DAVID LITTLE.

This use of chicken processing wastes for catfish culture has implications for individual catfish farmers and for the use of resources on a national scale. Chicken by-products are used here efficiently and profitably and support a large percentage of catfish produced in Thailand. Thai aquaculture uses the wastes from the chicken industry during the raising of chickens through the use of chicken excreta in catfish and other foodfish ponds, and through the use of processing wastes as described here. This relationship, between an export-based food industry and fish culture producing food for the domestic market, increases employment opportunities whilst reducing the environmental impact of these potentially polluting activities that are often located on the urban fringe.

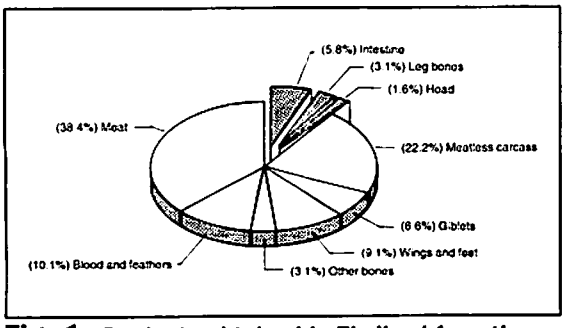



**Fig. 1.** ***Products obtained in Thailand from the processing of broiler chickens of average weight 1.75 kg. The total live weight of such chickens processed annually is about 395,000 t.***

## References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Field trips to observe aquaculture activities as described in this paper are an integral part of a new short course to be offered at the Asian Institute of Technology in 1995, entitled 'Catfish in Thailand: a tradition and a future'. For further details and an application form, please contact Aquaculture Short Course Unit, AIT, P.O Box 2754, Bangkok, Thailand.


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