7.2 Freshwater fish seed resources in Brazil

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ABSTRACT

With 13.7 percent of the freshwater available in the planet, Brazil has an enormous variety of fish in its river basins and this is reflected in the large number of fish species being farmed in the country. A telephone survey of 175 seed producers in 22 states was made to collect data for this report. Hatcheries vary from small installations producing few thousands of seed to bigger installations with a capacity to produce over 20 million seed per annum. The sum of the seed production of all freshwater fish species was 617 million seed in 2005. Tilapia is the main fish produced in Brazil with a production volume of 304.5 million in 2005, followed by tambaqui with a volume of 52 million seed in the same year. The remaining 261 million seed are spread among 35 other species, of which 26 are indigenous to Brazil. This document describes the seed production technology for the main freshwater fish species farmed in Brazil, with information about broodstock maturation, spawning, egg fertilization and larviculture. Some general aspects of Brazilian freshwater seed industry like seed management, quality, marketing and certification are described for the main cultured species. A brief analysis of the legal framework describes the main constraints that hinder aquaculture development, statistical data collection, law enforcement and sanitary programs for aquatic organisms. Finally, future prospects and recommendations on actions to realize the great potential of aquaculture development in Brazil are provided.

INTRODUCTION

With 13.7 percent of the freshwater available in the planet, Brazil has an enormous variety of fish in its river basins and this is reflected in the large number of fish species being farmed in the country. Besides the exotic species introduced for aquaculture purposes like tilapia (*Oreochromis sp.*), carps (*Cyprinus carpio, Hypopthalmichthys molitrix, Aristichthys nobilis* and *Ctenopharyngodon idella*), catfish (*Ictalurus punctatus*) and trout (*Oncorhynchus mykiss*), there are a number of Amazon and Pantanal fish that are farmed all over the country with seed producers installed in almost every state. The so-called "round" fishes like pacu (*Piaractus mesopotamicus*), tambaqui (*Colossoma macropomum*), pirapitinga (*Piaractus brachypomus*) and their hybrids tambacu (F^1 tambaqui x M^1 pacu), tambatinga (F^1 tambaqui x M^1 pirapitinga), paqui (F^1 pacu x M[1] tambaqui) and patinga (F[1] pacu x M[1] pirapitinga) are well accepted by the local markets and aquaculture of these species has contributed substantially to increase fish consumption in Brazil. Many native fish that were available only in big fish markets in the Amazon and Pantanal regions are now encountered in almost every supermarket in all parts of the country. It is estimated that national fish consumption has increased in the last two years based on the information given by the Brazilian Supermarket Association (ABRAS) who reported an increase of 30 percent in the supermarket commercialization of fish. Freshwater fish farming is responsible for 67 percent of the national aquaculture production in 2004, with an estimated volume of 180 730 tonnes (Instituto Brasileiro de Meio Ambiente e dos Recursos Naturais Renováveis - IBAMA, 2005).

SEED RESOURCES AND SUPPLY

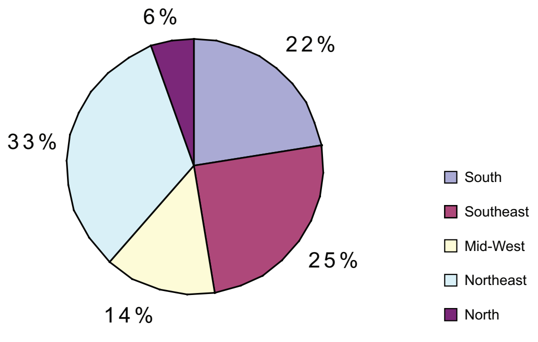
All fish seed comes from hatcheries. Pirarucu (*Araipama gigas*) is an exception as this species is collected from the wild as described in the section "Seed management". The great majority of hatcheries are privately-owned. Many government institutions and hatcheries were created in the 1970s to provide seed supply for stock enhancement in federal rivers and reservoirs. The two main government institutions are CODEVASF (Company for the Development of the São Franscisco Valley) and DNOCS (National Department of Engineering Against Droughts). These institutions are still very important in the northeast region where they supply seed for restocking and for small-scale aquaculture. The production of freshwater fish seed from government hatcheries was 75.1 million which represented 12.2 percent of the national seed production in 2005.

SEED PRODUCTION FACILITIES AND SEED TECHNOLOGY

The continental dimensions of Brazil and the informal situation of many aquaculturists that are not registered by local or federal authorities made it is very difficult to identify and contact all freshwater fish seed producers in the country. However, an exhaustive attempt to contact each seed producer either through reference from fish farmers or through advertisement in specialized magazines, allowed the identification of 175 hatcheries installed in 22 states.

Hatcheries vary from small installations producing few thousands of seed to bigger installations with capacity to produce over 20 million seed per annum. The sum of the seed production of all freshwater fish species was 617.5 million seed in 2005. Tilapia is the main fish produced in Brazil with a seed production of 304.5 million seed in 2005, followed by tambaqui (*Colossoma macropomum*) with a volume of 52 million seed in the same year. The remaining 261 million seed are spread among other 35 species, of which 26 are indigenous to Brazil.

FIGURE 7.2.1
Regional distribution of the freshwater fish seed production in Brazil in 2005



Source: Interview with 175 seed producers

Seed producers are present in all Brazilian regions and the northeast region leads the national production with 203.5 million seed in 2005 (Figure 7.2.1). This is due in part to the presence of 21 governmental hatcheries in the region that produce 57 million, not only for aquaculture purposes, but also for restocking programs in federal rivers and reservoirs.

Available technologies for production of freshwater fish seed include the following: (i) gonad maturation and spawning induction with hormones, (ii) hatching, (iii) breeding and (iv) rearing to fingerling and juvenile stages. A sperm bank of wild tambaqui was created in 2001 in the north region to avoid the increasing inbreeding among the progenies produced in other Brazilian regions. Broodstock improvement is not always easy considering that many seed producers are very distant from the natural banks of wild tambaqui. In this sperm bank, sterile test tubes are used to collect 6 to 12 ml of tambaqui semen per fish. The semen is then analyzed for its viscosity, motility and spermatozoid concentration before dilution in a cryopreservation solution for freezing and stocking in liquid nitrogen at -196 ^{O}C. Tests with frozen semen has obtained fertilization rates of 88 percent, followed by normal incubation and larviculture with survival rates of up to 70 percent (Panorama de Aqüicultura, 2003). Tilapia broodstock which originated from the Genetically Improved Farmed Tilapia (GIFT) population are available in Brazil through one of the biggest private tilapia seed producer, who supplies 20 million seed of "GenoMar Supreme Tilapia" annually.

TABLE 7.2.1
Scientific name, common name, regional distribution, volume and percentage of freshwater fish seeds in Brazil during 2005

	Species	Common name	Farmed in the Region[2]	Volume	%
1	*Oreochromis* sp.	Tilapia[3]	S, SE, CW, NE, N	304 481 275	49.31
2	*Colossoma macropomum*	Tambaqui	SE, NE, CW, N	51 981 654	8.42
3	*Piaractus mesopotamicus*	Pacu	S, SE, CW, NE, N	41 625 723	6.74
4	Hybrid (F[1] tambaqui x M[1] pacu)	Tambacu	SE, CW, NE, N	29 786 030	4.82
5	*Leporinus macrocephalus*	Piauvuçu, piauçu	S, SE, CW, NE, N	27 815 170	4.50
6	*Cyprinus carpio*	Common carp[3]	S, SE, CW, NE	18 878 848	3.06
7	*Ctenopharyngodon idella*	Grass carp[3]	S, SE, CW, NE	16 792 495	2.72
8	*Prochilodus lineatus*	Curimbatá, curimba	S, SE, CW, NE, N	13 552 110	2.19
9	*Brycon amazonicus*	Matrinxã	S, SE, CW, NE, N	13 405 230	2.17
10	*Astyanax altiparanae*	Lambari	S, SE, CW	10 935 450	1.77
11	*Prochilodus* sp.	Curimatã	S, SE, CW, NE, N	10 859 240	1.76
12	*Aristichthys nobilis*	Big head carp[3]	S, SE, CW, NE	10 036 125	1.63
13	*Ictalurus punctatus*	Channel catfish[3]	S, SE, CW	9 926 600	1.61
14	*Rhandia spp.*	Jundiá	S, SE, CW	9 803 610	1.59
15	Hybrid (F[1] tambaqui x M[1] pirapitinga)	Tambatinga	SE, CW, NE, N	5 782 000	0.94
16	*Piaractus brachypomus*	Pirapitinga	SE, CW, NE, N	5 362 450	0.87
17	*Brycon hilarii*	Piraputanga	S, SE, CW, N	5 254 400	0.85
18	*Leporinus friderici*	Piau	SE, CW, NE, N	5 241 360	0.85
19	*Hypopthalmichthys molitrix*	Silver carp[3]	S, SE, NE, CW	4 268 000	0.69
20	Hybrid (F[1] pacu x M[1] pirapitinga)	Patinga	SE, CW, N	4 244 600	0.69
21	*Oncorhynchus mykiss*	Rainbow trout[3]	S, SE	4 205 000	0.63
22	*Pseudoplatystoma* spp.	Pintado, surubim, cachara	S, SE, CW, NE, N	4 027 980	0.65
23	*Brycon orbignyanus*	Piracanjuba	S, SE, CW	2 048 735	0.33
24	*Clarias gariepinus*	African catfish[3]	S, SE	1 996 500	0.32
25	*Salminus maxillosus*	Dourado	S, SE, CW, NE	1 602 813	0.26
26	*Leporinus obtusidens*	Piava	S	565 000	0.09
27	*Leporinus elogantus*	Piapara	S, SE	563 925	0.09
28	*Hoplias lacerdae*	Trairão	SE	553 350	0.09
29	*Semaprochilodus* sp.	Jaraqui	N	500 000	0.08
30	*Hoplias malabaricus*	Traíra	S, SE	453 000	0.07
31	*Leporinus amblyrhynchus*	Chimboré	CW	400 000	0.06
32	*Cichla ocellaris*	Tucunaré	SE	183 705	0.03
33	*Hemisorubim platyrhynchos*	Juropoca	CW	120 000	0.02
34	*Micropterus salmoides*	Black bass[3]	SE	70 000	0.01
35	*Araipama gigas*	Pirarucu	SE, CW, NE, N	62 200	0.01
36	*Phractocephalus hemioliopterus*	Pirarara	SE, CW, NE, N	62 200	< 0.01
37	*Sorubim lima*	Jurupensen	CW	10 000	< 0.01

[1] F = Female and M = Male.
[2] N = North, NE = Northeast, CW = Center-West, SE = Southeast and S = South
[3] Exotic species

FIGURE 7.2.2
Freshwater fish seed hatcheries in Brazil (February 2006)

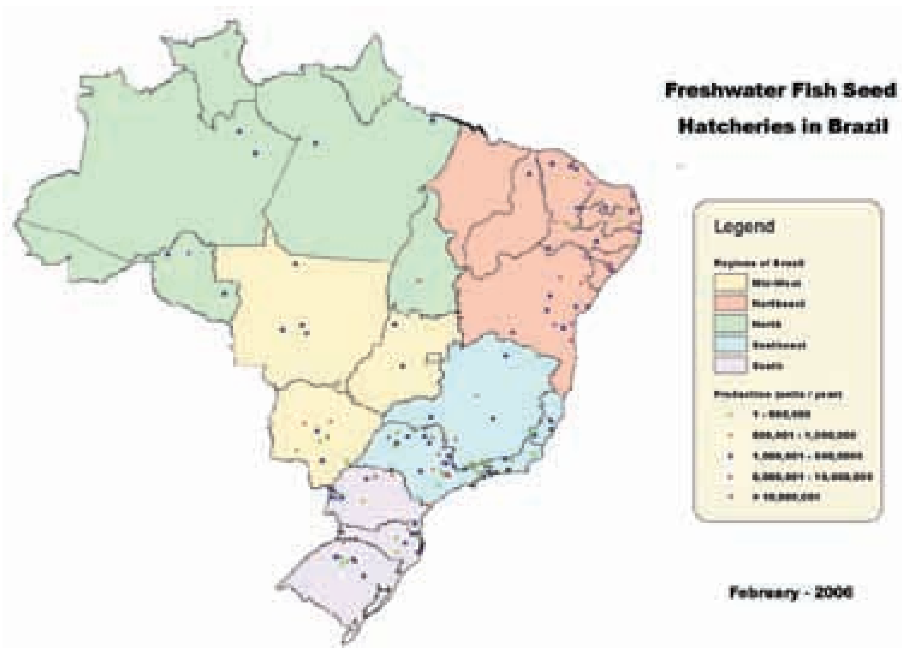


FIGURE 7.2.3
Freshwater fish seed hatcheries in Brazil (South Region, February 2006)

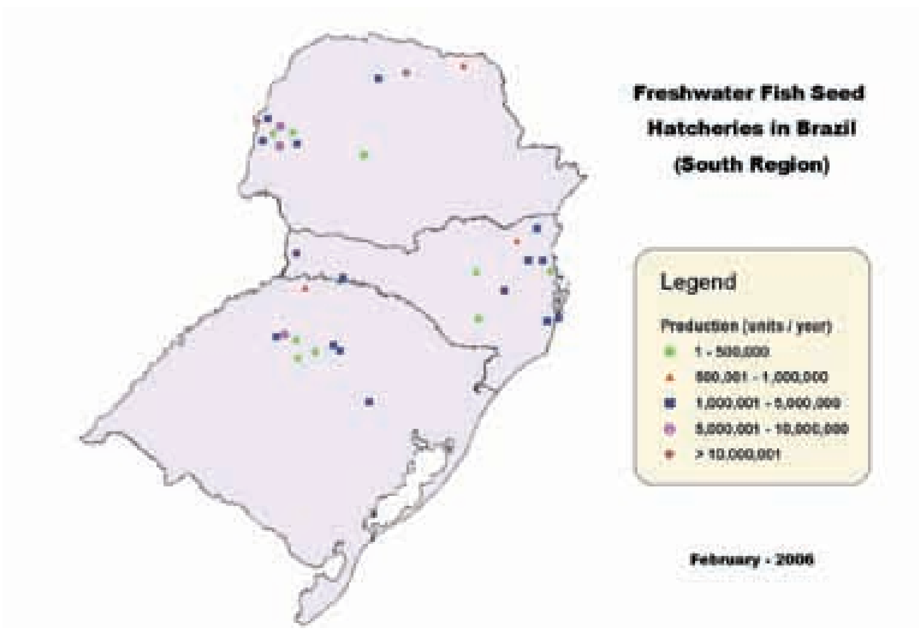


FIGURE 7.2.4
Freshwater fish seed hatcheries in Brazil (Southeast Region, February 2006)

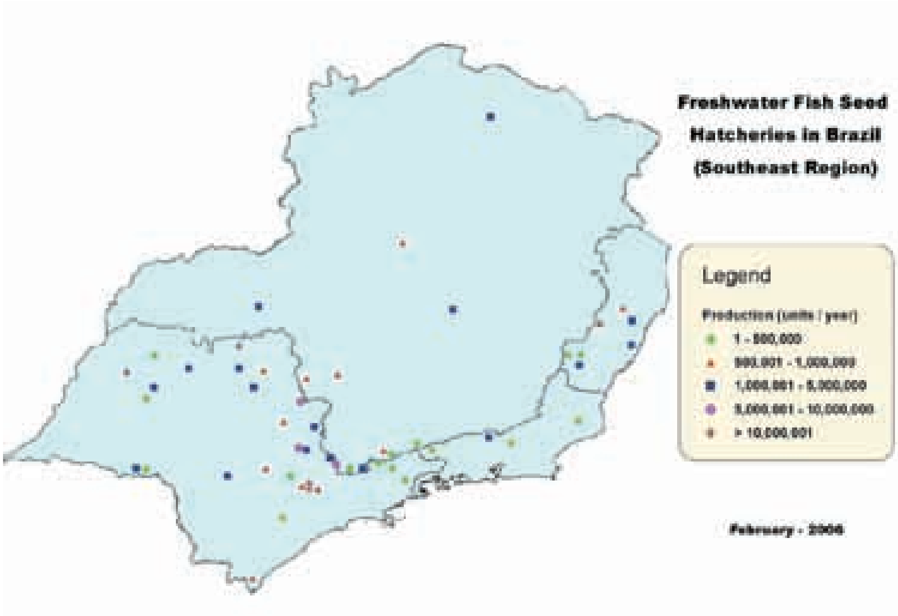


FIGURE 7.2.5
Freshwater fish seed hatcheries in Brazil (Mid-West Region, February 2006)

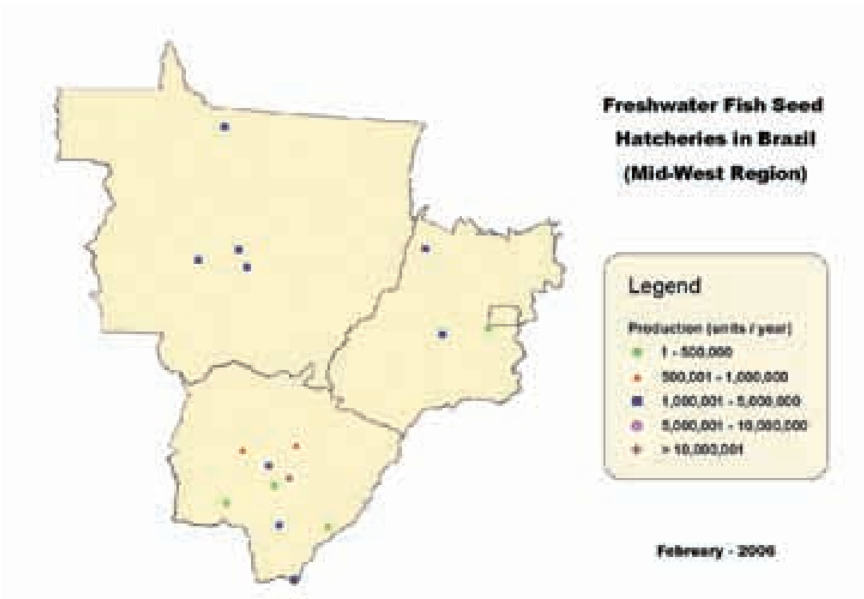


FIGURE 7.2.6
Freshwater fish seed hatcheries in Brazil (Northeast Region, February 2006)

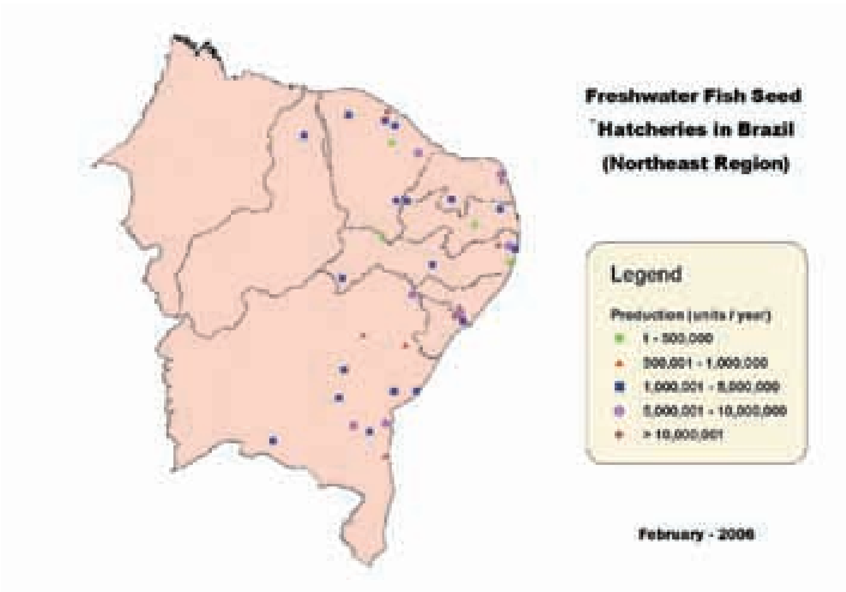
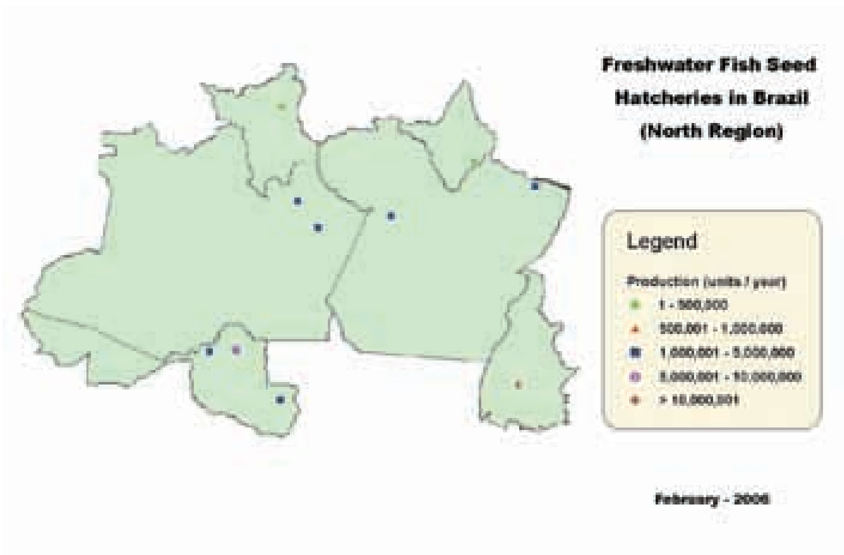


FIGURE 7.2.7
Freshwater fish seed hatcheries in Brazil (North Region, February 2006)



SEED MANAGEMENT

In pacu, tambaqui and pirapitinga, eggs and sperm are obtained through extrusion and fertilized in a container without water followed by incubation with continuous water movement. In some regions of Brazil, it is possible to obtain natural maturation of the broodstock with year-round spawns. Larvae start to feed five days after hatching when the water temperature is kept between 24 °C and 27 °C. First feed can be phytoplankton and zooplankton although these fish seems to prefer copepods (Zaniboni Filho, 2004).

Piau (*Leporinus friderici*), piapara (*L. elogantus*), piava (*L. obtusidens*) and chimboré (*L. amblyrhynchus*) show natural maturation in captivity and need hormonal induction for final maturation, ovulation and spawning. Spawn can occur in the tanks or through manual extrusion with dry fertilization. The latter is favoured by seed producers because it improves egg survival rate. Incubation is made in conventional incubators with continuous water movement. Larvae start feeding after five days and the main feed are *Cladocera* spp. and other zooplankton. Between ten and 20 days after first feeding, larvae accepts artificial feed (Zaniboni Filho, 2004).

Matrinxã (*Brycon lundii*), piracanjuba (*B. orbignyanus*), jatuarana (*B. cephalus*) and piraputanga (*B. cephalus*) reach their first maturation after one year for males and after two years for females. In captivity, final maturation and spawning can be obtained with hormones. For matrinxã, some producers utilize curimbatá hypophysis extract in doses of 4.4-5.5 mg/kg for females and 1.0-1.5 mg/kg for males (Gomes and Urbinati, 2005). Eggs are dry fertilized and kept in incubators with good water movement. Hatching occurs 16 hrs after fertilization when eggs are kept at 26 °C. First feed offered is zooplankton, mainly *Cladocera* spp., *Artemia* spp. and post-larvae of other fish. Great care with feeding is needed as these species show cannibalistic behavior when not fed to satiety. Best results with a survival rate of 72 percent are obtained during the 21 days larviculture from a density of 120 post-larvae/m^2. Post-larvae have to be fed three times per day using balanced feed with 35 percent of protein. Four days after hatching, the critical cannibal phase finishes and the larvae can be fed with pulverized commercial feed (Zaniboni Filho, 2004).

For the reproduction of the pintado (*Pseudoplatystoma corruscans*) and the cachara (*P. fasciatum*), seed producers use the same procedures as with gonad and hypophysis hormones. In captivity, males have their first maturation on the first year and females on the second year of life. The hormone treatment uses 5.5 mg of hypophysis extract per kg in females and 2 mg per kg in males. Production of eggs in the pintado and cachara is about 10 percent of the female weight and a 5-kg female can produce 1.1 million eggs. The hatched larvae measures about 3 mm and after three or four days, when they reach 4.5 mm, they start to feed on *Artemia spp*. The best density on the larviculture phase is 15 larvae/l and they need to be fed between 7 and 10 times per day with 500 nauplius/larvae. Survival rate in this phase is high, varying between 75 and 90 percent. Ten days after hatching, larvae can be fed with *Cladocera* spp. and copepods. In this phase, which normally takes 15-20 days, stocking density is reduced to 3-4 fish/l and survival rate varies between 50 and 80 percent. Balanced feed is offered after 60 days with 40 percent of crude protein. Juveniles are sold at 120-80 mm length and survival rate in the last phase is about 30 percent (Inoue *et al.*, 2003).

The dourado (*Salminus brasiliensis*), a fish greatly accepted by consumers especially by those practicing sports fishing, was first spawned under laboratory conditions in 2000. The fertilization rate that was initially at 10-20 percent is, nowadays, at 85 percent. This fish shows severe cannibalistic behavior, as soon as the yolk bag is absorbed, if not well fed. Excellent results have been obtained using curimbatá (*Prochilodus lineatus*) larvae as first live feed. Therefore it is common to schedule curimbatá spawns simultaneously with dourado spawns. Experiments have shown that 20 larvae of curimbatá for each dourado larvae is an appropriate feeding rate. The

PLATE 7.2.1

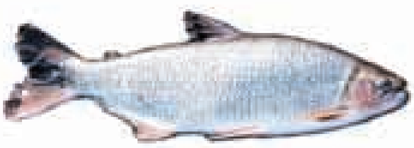
Illustration of some indigenous and exotic freshwater fish species (common names) of Brazilian aquaculture

Piauçu

Tucunaré

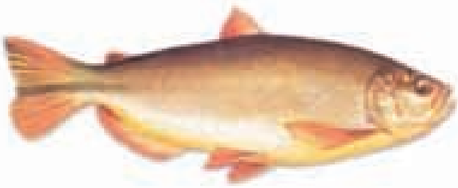
Pintado

Jurupensen



Piracanjuba

Juropoca



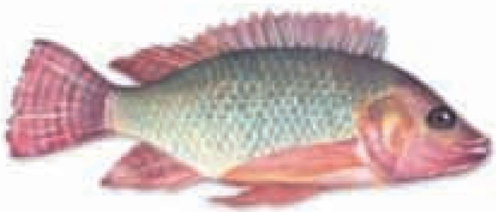
Piraputanga

Piau

Pirarara

Pirarucu

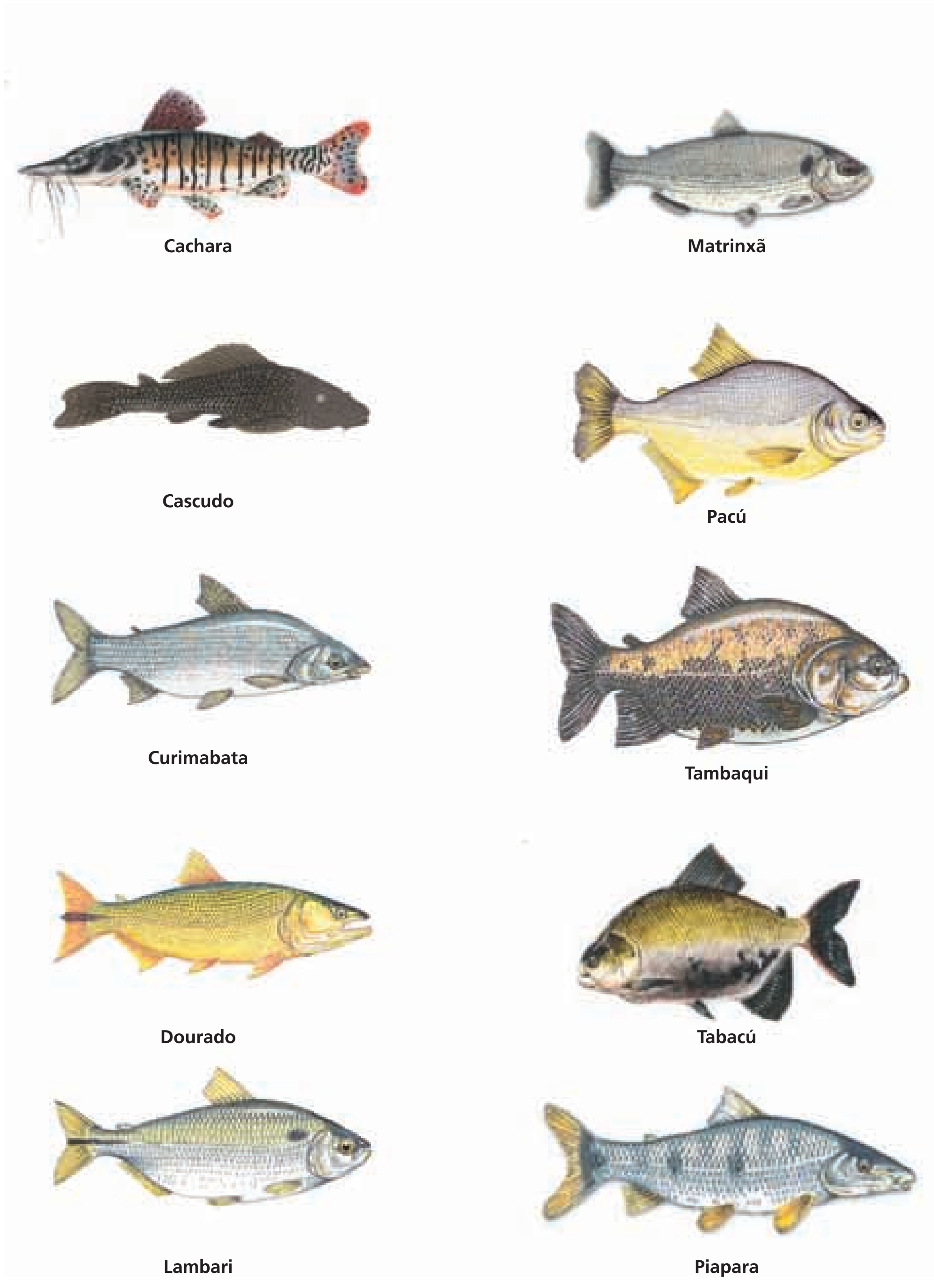
Trairão



Tilápia

PLATE 7.2.1 (CONTINUED)

Illustration of some indigenous and exotic freshwater fish species (common names) of Brazilian aquaculture



larvae accept balanced feed five days after hatching. Best survival rate was observed with 24 hrs/day of light exposure while best growth rate was observed with 24 hrs/day of darkness. This fish grows fast until they reach 100 g and growth is reduced after this weight. More research are now underway to investigate the best timing for the feeding transition (from live feed to artificial feed), farming densities and practices, as well as nutritional demands for this species (Fracalossi, Zaniboni Filho and Meurer, 2002). The curimbatá, also known as curimatã, in some regions of Brazil, is easy to reproduce and handle. Their eggs are 2.9 mm in diameter and larvae hatch about 14 hr and 30 min after fertilization, with an average length of 3.5 mm when incubated at 28 °C (Fracalossi, Zaniboni Filho and Meurer, 2002).

The jundiá (*Rhamdia spp.*) is found in black, yellow, gray and albino colors. This fish matures and spawns naturally in captivity, but seed producers use hypophysis extract to induce maturation and spawning to enhance the efficiency of the process. A first dose of 0.5 mg/kg is applied in females kept at 25 °C and a second dose of 5.0 mg/kg is applied after 12-15 hrs. Males receive a single dose of 0.5 mg/kg simultaneously with the second dose applied in the females. Eggs are expelled 7-9 hrs after the application of the second dose, if the fish are maintained at 25 °C, or after 220-240 hrs at temperatures between 22 °C to 27 °C). Fertilization rate is around 70 percent and eggs hatch after 20 hrs at 25 °C. First feed offered is a balanced feed powder with 40-45 percent of crude protein together with *Artemia* spp. Fingerlings are kept at densities of 30 to 60 fingerlings/m^2 with good homogeneity until 30 days, but great heterogeneity (3.5-16 cm) is observed if these densities are maintained until 60 days (Carneiro *et al*., 2002).

Production of apaiari (*Astronotus ocellatus*) is based on natural maturation when couples are conditioned in reproduction tanks. Spawning is also natural and incubation is made by the fish in the same tank. Each couple makes an average of 3.5 spawns per year and they have a reproductive life between three and four years. Larvae start to feed on plankton four days after hatching; 20-day old fingerlings are fed with minced fish fillet, pure or mixed with balanced feed powder. After 50-60 days, when fingerlings reach 50 mm, they are separated from their parents, counted and stocked in 40 m^2 nursery tanks with a density of 50 fingerling/m^2. In general, it is common to obtain 600 fingerlings per spawn per couple, with a maximum of 2 100. In the nursery tanks, the apaiari are fed with minced fish fillet and/or minced shrimp twice a day with 5 percent of their biomass. The nursery phase takes about 40 days (Bezerra and Silva, 2005).

The major obstacle for the consolidation of pirarucu farming is the lack of methodology to develop controlled reproduction to satisfy the increasing demand for juveniles of this species. At this stage, all seed are obtained from fish collected in the wild that have spawned in captivity. Pirarucu has a complex mating behavior before spawning. The traditional techniques of hormone induction have not being observed with success and farmers do not have control on the mating behavior. Therefore, there are difficulties to produce fingerlings on a continuous and scheduled base. Research on pirarucu husbandry and reproduction is scarce, one of the reasons being the difficulty in handling the animal because of its size. Fish gonad maturation usually starts in between 40 to 60 kg body weight. Many pirarucu farms maintain a certain number of adult males and females (although the method to differentiate sexes are still under controversy) under captivity and their mating behaviors (e.g. nest construction, matting, egg deposition and fish hatch) are followed closely in order to collect the larvae as soon as possible. It is reported an average around 3000 fish per cycle, with 3 cycles/yr. Information about their need for space, water quality, nutritional demand and reproductive physiology is very limited and this limitation of knowledge hinders the control of reproduction of pirarucu. In captivity, the pirarucu can spawn thrice a year with an average of 2 000 juveniles/spawn (Cerri, 1995). Recent studies of induced reproduction of pirarucu have been faced with great difficulties particularly in handling the fish due to its size, reaching maturity at 40 to 60 kg and final weight of 120 kg. Moreover, the quantity and costs of hormone applications are enormous when compared to the quantity normally used for other commercial species. Pirarucu larvae absorbs its yolk sac eight to nine days after hatching and the fingerlings take between 3-4 months to reach the juvenile stage (5-7 cm), when they are collected and separated from their parents. Juveniles are fed at least six times a day with zooplankton until they are transferred to grow-out tanks (Pereira-Filho and Roubach, 2005).

SEED QUALITY

Only a small percentage of seed producers have appropriate means to evaluate the quality of their product. One aspect that is observed by most hatcheries is the mechanical classification of seed sizes in order to deliver seed batches that are homogeneous in this aspect. Tilapia seed producers have great care with sexual reversion efficiency and most of them reports that rates of 99 percent are attained. Some producers have reported that there are bad quality tilapia seed being offered at lower prices in the market, particularly in the aspect of lower rates of sexual reversion. Most producers also informed that their seed attain survival rates of 95 percent if well handled by fish farmers. Some large hatcheries maintain constant contact with their customers to get feedback on survival and feed conversion rates. Information about seed health management is very limited and there is no sanitary control to avoid the spread of diseases through the commercialization of seed within different regions of the country.

SEED MARKETING

Freshwater fish culture in Brazil is divided in two complementary sectors: seed production and fish farming. Only a minority of fish farmers produce their own seed. Therefore, the commerce between seed suppliers and fish farmers is a critical point in the productive chain, where there is a need to standardize seed size classes. The seed is currently sold as fingerling I or fingerling II or juvenile, accordingly to its size or weight. This variety in terms of sizes and prices leads to great confusion in the seed market and causes a big heterogeneity in the product. An analysis of the problem was made in 2003 and it was recommended that all seed should be called 'juveniles' and divided in four standard size classes to allow product and price comparisons by fish farmers (Gomes, Araujo-Lima and Roubach, 2003).

A number of seed distributors buy larvae from hatcheries and raise them until commercial size. The commercial size varies between species and the normal size range for the first sale to grow-out tanks is between 3-5 cm. Some distributors are specialized in producing juveniles of 6-8 cm or 8-10 cm that are used by those fish farmers who utilize cages for farming in lakes and reservoirs.

In general, each seed producer makes the commercialization of his own product and some of them may drive more than 500 km to deliver goods to distant customers. With some local exceptions, the fish farming sector is not organized in associations, thus, there is no systematic mechanism or networking for seed distribution and sharing of information concerning supply and demand for fish seed. Large- and medium-seed producers deliver to any location in the country where their products are requested, either by air or by road, charging the freight costs to the buyer. A high airfreight cost is one problem that hinders the efficient distribution by small producers. Some seed producers program their hatchery activities according to previous orders.

SEED INDUSTRY

The seed industry was strongly focused on the supply of seed for recreational fishing parks in the 1980s and commercial fish farming to supply restaurants, supermarkets and processing factories were only established in the 1990s. Nowadays, it is possible to find small-, medium- and large-scale seed production companies in almost every part of the country, although the exact number of producers is hard to determine due to poor statistical service by the government and non-registration of hatchery producers. Production scale varies from 5 000 to more than 50 million seed/yr and the distribution of hatcheries according to the production scales are shown in Figures 7.2.2-7.2.7.

Tilapia is by far the most produced species in Brazil and large companies are now increasing the participation of Brazilian tilapia in the international market. Tilapia seed production is also more technically developed than seed production of native or other introduced species. However, as this is the main species farmed in Brazil, prices are not very high, averaging US$29.50/thousand seed (price ranging from a minimum of US$13.6 to a maximum of US$59). Cyprinids and most native species are commercialized with an average price of US$30/thousand seed. Production of leading fish like pintado, cachara, surubim (*Pseuplatystoma* spp.) and jurupensem (*Sorubim lima)* are relatively difficult in comparison with the production of other native species which explains the lower production levels and very elevated prices which can be more than ten times, averaging at US$ 1/unit. Pirarucu is by far the most expensive fish; seed price is dependent on its length. The average price of a pirarucu juvenile with length of 15 cm is US$8.3/unit with maximum prices reaching US$13.6/unit. Non-payment among seed buyers was not identified as a problem based on interviews with seed suppliers.

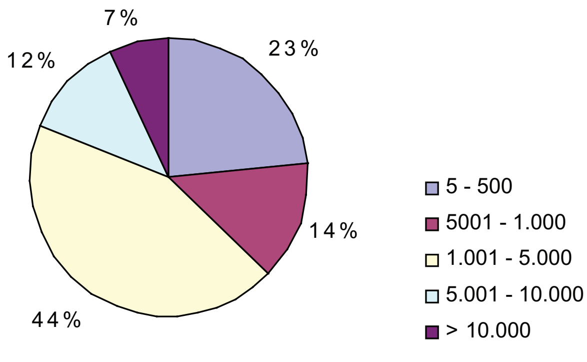
The number of employees in this industry sector was not determined, but some large hatcheries informed that up to 30 people are involved in seed production. If an average number of 15 employees per hatchery are assumed, it can be estimated that the sector generates 2 625 direct jobs. As many hatcheries are family-based business, women are therefore very much involved in this industry in Brazil. The number of indirect jobs is difficult to determine or estimate as there are numerous seed distributors and hatchery equipment suppliers in the country.

SUPPORT SERVICES

In general, the support services for seed producers are provided by universities and federal research institutions that are involved with aquaculture. Among the main institutions, it can be mentioned that the following are service providers, namely: (i) Aquaculture Research and Training Center – CEPTA in Pirassununga, São Paulo, (ii) Aquaculture Center of the São Paulo State University (CAUNESP - UNESP) in Jaboticabal, (iii) Freshwater Fish Aquaculture Laboratory from the Federal University of Santa Catarina (LAPAD – UFSC), the São Paulo Fisheries Institute, (iv) Superior School of Agriculture Luis de Queiroz from the University of São Paulo in Piracicaba (ESALQ – USP) and (v) Animal Reproduction Laboratory from the State University of Maringá in Paraná (UEM).

These institutions are responsible for the development of the fish reproduction technology of most indigenous species. The reproduction technology of some species like pintado *(Pseudoplatystoma* spp.) and patinga (hybrid of female *Piaractus mesopotamicus* with male *Piaractus brachypomus*) were developed by private hatcheries and are now available at the national level. A major deficiency in Brazilian aquaculture that also impacts on the seed production industry is the absence of efficient extension programs and services. Many seed producers have

FIGURE 7.2.8
Frequency of freshwater fish seed producers based on production volume in 2005 (x 1 000)



Source: Interview with 175 seed producers reported that they do not have access to the latest technology achievements made by the universities and aquaculture research institutions.

SEED CERTIFICATION

To date, there is no seed certification processes or organizations involved in certification in Brazil. There is only one organic tilapia producer in the Paraná State and he produces his own seed without sexual reversion. To avoid reproduction in the farm ponds, farmers separate females from males when they reach a bigger juvenile stage. The Brazilian Association for the Culture of Aquatic Organisms (ABRACOA) has recently launched a traceability program and they are now promoting training courses and making efforts to involve seed producers, fish farmers and fish processors/ distributors.

LEGAL AND POLICY FRAMEWORK

There are few legal regulations regarding aquaculture seed production in Brazil. According to the law, every hatchery and fish producer need to have an Aquaculturist Registration document issued by the Special Secretariat of Aquaculture and Fisheries from the Presidency of the Republic of Brazil (SEAP/PR). However, the Aquaculturist Registration is preceded by the emission of environmental license and, as the majority of aquaculture establishments are not licensed yet, the number of registered producers are also very low. This situation leads to a lack of good statistical information, which could contribute towards better governance and management of the national aquaculture sector.

Similarly, the lack of registration makes the implementation of sanitary control or health programs for aquatic animals difficult. The federal government structure to implement efficient sanitary control programs is very poor and the Ministry of Agriculture, Supply and Cattle (MAPA), who is responsible for this role, has only one technician to undertake this job.

At the moment, the National Council for Environmental Affairs (CONAMA) is discussing the elaboration of a federal regulation regarding the issuance of an environmental license for aquaculture establishments. Although some of the 24 States of the Federation have their own regulation to aquaculture environmental licensing, the majority does not have any legal framework in this aspect. It is expected that with the publication of the CONAMA regulation for the environmental licensing of aquaculture, this procedure will become less bureaucratic and more accessible for aquaculturists. In Brazil, it is very clear that all fish producers wants to be registered and licensed but the inexistence of an appropriate legal framework is hindering that.

Fish farming in Brazil is entirely based on hatchery production of seed and the use of seed from wild sources is not allowed by the government if the fish is to be stocked in cages. There is no mention in the law of such prohibition if the fish seed is collected in the wild to be stocked in aquaculture ponds.

ECONOMICS

As mentioned in the section on ‘seed industry’, the production of fish seed flourished in the 1980s to satisfy the increased demand for recreational fishing parks. The transition from recreational fishing parks to fish farms as main seed market brought considerable changes in the customer demand. Some fish that were preferred for sports or recreational fishing were substituted by other species more suitable for farming, processing and filleting. Factors that determine the price of seed are: (i) preference by local farmers and final consumers, (ii) demand and supply and (iii) size of the seed. The last factor is very hard to standardize as there is no common agreement within the industry of a clear way to classify the seed by weight or size classes, as mentioned before. For this reason, it is common to find price fluctuations of even ten times among different regions, but prices tend to be more homogeneous within one particular region. In general, seed production is concentrated during the period between October and April and seed are offered at lower prices during this part of the year. After April, as seed become bigger, prices get higher accordingly. Most of the seed producers interviewed in the preparation of this report informed that aquaculture was their main or single occupation and the great majority informed that they intend to increase their production next year, indicating that seed production is a profitable business.

FUTURE PROSPECTS AND RECOMMENDATIONS

With the recent establishment of the Special Secretariat of Aquaculture and Fisheries (SEAP) at the federal level, Brazil has formulated, for the first time, an aquaculture development policy. This demonstrates that aquaculture is now recognized by the Federal Government as an important industry that can contribute significantly to job and income generation and food production. Many things that should have been done in the past, including the establishment of an appropriate legal framework for aquaculture with clear rules that can attract investments, are now underway. Federal investments in the aquaculture sector that were almost inexistent in the last decade are now substantial. In 2005, SEAP invested US$12 million to the whole sector (both marine and continental aquaculture).

Freshwater aquaculture has increased at an average rate of 10.8 percent per year in the last decade and this occurred under a very negative scenario. Although the country has 3.5 million ha of reservoirs, access to public water areas is virtually impossible due to the lack of a good legal and regulatory framework to aquaculture development. This is one major aspect that, together with the access to environmental license, had hindered the development of Brazilian aquaculture at a faster pace. It is expected that these two factors will finally be resolved in 2006 and many investors that are waiting for such resolution will feel strongly encouraged to take up the aquaculture industry.

To maintain sustainable and healthy aquaculture, it is vital that the government puts more emphasis in monitoring aquaculture production practices, particularly on aspects concerning seed, feed and the use of therapeutic substances (i.e. drugs and chemicals). The attention currently given to these factors is inappropriate and the government should formulate other mechanisms to address such issues.

The contribution from capture fisheries have been relatively stable in the last years and it is unlikely to increase in the near future. Aquaculture products, that already represents 26.5 percent of the national fish supply, is expected to increase continuously in the years to come. It is important, however, that the productive sector becomes more organized and that a strong Brazilian Aquaculture Association (ABRAQ) assumes its responsibilities and roles. Although ABRAQ was created more than ten years ago, it was never active as a representative of the industry interests.

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