Aquaculture 414–415 (2013) 127–134

Contents lists available at ScienceDirect

Aquaculture

journal homepage: www.elsevier.com/locate/aqua-online

Feed and fishmeal use in the production of carp and tilapia in China

Alice Chiu [a], Luping Li [b], Shujing Guo [b], Junfei Bai [b], Chris Fedor [a], Rosamond Lee Naylor [a,*]

[a] Center on Food Security and the Environment, Stanford University, Encina Hall 406E, Stanford, CA 94305, USA
[b] Center for Chinese Agricultural Policy, Chinese Academy of Sciences, Institute of Geographical Sciences and Natural Resources Research, Jia 11, Datun Road, Anwai, Beijing 100101, China

ARTICLE INFO

Article history:
Received 19 April 2013
Received in revised form 14 July 2013
Accepted 28 July 2013
Available online 3 August 2013

Keywords:
Carp
Tilapia
Fishmeal
Aquaculture feeds
Fish consumption
China

ABSTRACT

China dominates the global aquaculture industry, most clearly with its massive production and consumption of low trophic-level carp species and its rapidly rising output and exports of tilapia. Although these fish do not require a high percentage of fishmeal in their diets, their large production volumes contribute to China's leading role in global fishmeal consumption. The magnitude of China's dependence on fishmeal supplies – and hence the pressure it places on wild forage fisheries – remains a contentious issue. In this study, we use primary survey data from three provinces in China to examine the current use of aquafeeds in the carp and tilapia sectors and to assess how future demand for fishmeal will likely be affected by the country's shifting patterns of seafood consumption and production. Our results indicate that virtually all carp and tilapia farmers in our survey regions use manufactured feeds containing fishmeal and that median feed conversion ratios (FCRs) are in the range of 1.4 to 1.9. Feeds are poorly targeted on many farms due to widespread polyculture practices, especially the integration of higher-value species into carp ponds to improve farm-level profitability. Our study also suggests that government statistics underestimate household demand for fish by 20–35% because they do not account for out-of-home consumption. As China's demand for fish continues to rise in the future with per capita incomes and urbanization, the co-culture of high-valued species and the use of aquaculture feeds containing fishmeal are also expected to expand.

© 2013 Elsevier B.V. All rights reserved.

1. Introduction

China plays a dominant role in the global fisheries sector: it is the largest aquaculture producer and exporter, and the biggest consumer of seafood, aquafeeds, and fishmeal worldwide (FAO, 2012). Seafood production and consumption are both predicted to increase as the country's middle class prospers and demands larger quantities of seafood (*ibid.*). The latest available statistics show that, in 2010, China produced 63% of global aquaculture output in volume and over 61% of global farmed finfish output (FAO, 2013). The volume of freshwater aquaculture (excluding mollusks) more than quadrupled in China between 1990 and 2010; the top six finfish species currently farmed, by volume, include grass carp (*Ctenopharyngodon idella*), silver carp (*Hypophthalmichthys molitrix*), common carp (*Cyprinus carpio*), bighead carp (*Hypophthalmichthys nobilis*), crucian carp (*Carassius carassius*), and tilapia (*Oreochromis* spp.) (Fig. 1). In 2010, China produced over 15 million metric tons (mmt) of carps and around 1 mmt of tilapia, accounting for about 90% of global carp production and 40% of global tilapia production (FAO, 2013). A little over half of the tilapia produced are exported as processed products, amounting to about 250,000 metric tons (mts) of processed tilapia (Hanson et al., 2011). Meanwhile, nearly all carps are consumed domestically (UN Comtrade, 2013).

Although tilapia and most carps have relatively low protein requirements and can survive well on plant-based diets,[1] small amounts of fishmeal are routinely incorporated into manufactured feeds to enhance the growth of these species. China's typical inclusion rates (share of individual dietary components in feeds), as reported by Tacon and Metian (2008), are 2–5% fishmeal in tilapia feeds and 0–12% fishmeal in carp feeds. The International Fishmeal and Fish Oil Organization (IFFO) previously estimated 2–4% fishmeal inclusion in carp feeds (Tacon et al., 2006). However, because these fish are cultured in such large volumes, even low inclusion rates add up to a substantial portion of global fishmeal demand. Earlier estimates show that global carp production consumes about 15% of total fishmeal supplies, and tilapia production consumes about 3% of total fishmeal (Tacon et al., 2006). China's overall consumption of fishmeal has grown from an estimated 5% of global supply in 1990 to 45% in 2009, although this share varies from year to year (FAO, 2013).

Consumption patterns for fish within China are also changing as per capita incomes rise. The middle class already consists of more than 300 million people and is predicted to reach 600 to 800 million by 2025 (Wang, 2010). China consumed almost 60% of global aquaculture production in 2010, and the United Nations Food and Agriculture Organization (FAO) predicts that the country's average seafood

* Corresponding author. Tel.: +1 650 723 5697; fax: +1 650 725 1992.
E-mail address: roz@stanford.edu (R.L. Naylor).

[1] There is a difference among carps; for example, silver and bighead carp species are generally not fed (unless in polyculture where the feed is directed toward other species in the system) while crucian carp are typically given compound feeds.

0044-8486/$ – see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.aquaculture.2013.07.049

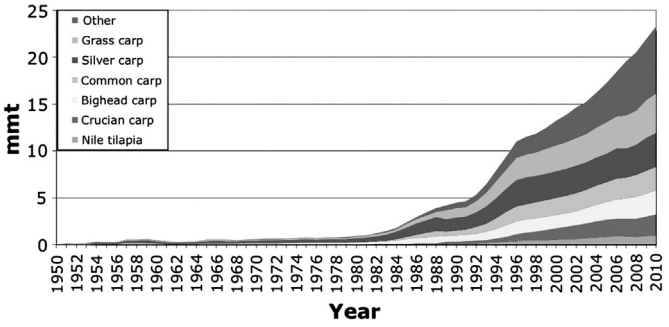

Fig. 1. Chinese freshwater aquaculture production (mmt), 1950–2010. Carp and tilapia species comprise the top six finfish species produced in China, totaling >16 mmt of production in 2010 (~70% of total Chinese freshwater aquaculture production, excluding mollusks). While the traditional carp species continue to make up the majority of aquaculture production, the culture of other freshwater finfish species is growing rapidly.
Source: FAO (2013).

consumption will jump by one-third from 26.7 kg/capita in 2007 to 35.9 kg/capita in 2020 (FAO, 2012, 2013).[2] In addition to eating more fish and shellfish per capita, the Chinese middle and upper classes are also eating more high-valued fish. Observers expect that China's growing demand for fish will be met largely by domestic production, and that its aquaculture exports will weaken (Sævarsson, 2007).

Despite China's dominant role in the global aquaculture sector, it remains a black box to many analysts in terms of production practices, feed inputs, and dependence on wild fish supplies for feed. In this paper, we attempt to crack open this box by revealing field-based evidence on China's carp and tilapia feed practices, fishmeal production, and sourcing of wild fish for feeds. Our data come from field surveys in three provinces of China where we interviewed rural fish farmers growing tilapia and/or carps, feed companies, fishmeal manufacturers, and rural and urban households (for their seafood consumption habits). Our focus on tilapia and carps allowed us to examine the consumption of fishmeal by lower-value, lower-trophic-level fish species, and to compare production practices for fish destined for export versus fish destined for domestic consumption.

Our farm surveys included four broad types of aquaculture systems: polyculture of mixed carp species in ponds, polyculture of carps with other higher-value species in ponds, floating cage systems containing carps and other finfish in lakes, and tilapia monoculture (with minimal polyculture for bio-control) in ponds. A primary goal of our study was to investigate feed practices in these culture systems, including the ingredients used, feed efficiencies, and sourcing of feeds and fishmeal. Interviews with domestic fishmeal manufacturers revealed information on species used for fishmeal production, feed yields, and the relationship between domestic and imported fishmeal. We also collected household data on fish consumption in rural and urban areas in order to measure seafood consumed both within and outside of the home. Through our analysis of primary field data, we could begin to tell a story about fish consumers, low-valued finfish producers, and fishmeal use in China.

2. A field-based approach

Our study draws on four separate surveys of fish production, rural fish consumption, urban consumption, and feed and fishmeal manufacturing. In all cases, survey teams organized by the Center for Chinese Agricultural Policy (CCAP) in Beijing conducted the interviews. The surveys on fish production, rural fish consumption, and feed and fishmeal manufacturing were conducted in the provinces of Hainan, Shandong, and Zhejiang (Jiashan and Qiandaohu[3]). These provinces were chosen because of their prevalent production of tilapia (in the case of Hainan) and carps (in the cases of Zhejiang and Shandong). Zhejiang is a highly developed area of China, whereas Shandong is more mixed; our survey region of Shandong was characterized by small-scale agriculture and aquaculture (predominantly mixed carp) production. A more detailed listing of the survey contents can be found in Appendix Table 1.

The fish production survey targeted a sample of small, household aquaculture operations and sought to gain a better understanding of feed use and production patterns of carps and tilapia. From August to November 2010, survey teams visited two to three regions in each province and interviewed a total of 351 fish farmers. The sample included farmers who grew mainly tilapia, mainly carps, or some combination of carps and other fish. Survey sites were selected to capture a diversity of aquaculture systems, from the temperate North to the tropical South, from pond systems to suspended cage systems. As is typical of research in China, where access to information tends to be difficult, survey respondents were identified through networks of contacts, and thus they may not represent unbiased cross-sections of the regions. In most cases, the survey team established a few key contacts in each location, who then introduced the team to other locals who provided further connections (i.e., snowball sampling).

In addition, the survey team collected consumption data from 410 households in rural Hainan, Zhejiang, and Shandong selected opportunistically (based on local contacts). Household members were asked to recall their fish consumption over the past year, including all aquatic products eaten both at home and away from home. Fish consumption fluctuates seasonally in China (with a large peak during the Chinese New Year), so a longer recall period better captures intra-annual variations. While in-home consumption was specific by fish type (e.g., tilapia, grass carp, oyster), out-of-home consumption data only specified the general class of aquatic product (e.g., fish, shrimp, crab, algae). When eating out, it is often impossible to know the exact type of fish being consumed; even in the U.S., 25–70% of seafood consumed in restaurants is mislabeled (Oceana, 2012).

At the time of our rural study, a separate consumption survey project was in progress at CCAP, and we were fortunate to gain access to their seafood consumption data for urban areas. Urban participants were given diaries in which to record all their food consumption for one week, both at home and away from home. The diaries gathered data from 769 urban households in Beijing (July 2007), Nanjing (September 2009), and Chengdu (September 2010) and asked about overall seafood consumption (not about consumption of different seafood types). The data collected on urban fish consumption reflect a conservative estimate because they did not cover consumption during the Chinese New Year. Both recall and record surveys are commonly used in social science research; however, each method has its strengths and weaknesses. In this case, the rural surveys yielded more detailed data (i.e., consumption of specific fish types) while the urban survey results were less specific but more accurate (i.e., consumption recorded as it occurred rather than estimated after the fact).

In addition to the production and consumption surveys, we interviewed fifteen feed and fishmeal manufacturers in Hainan, Zhejiang, and Shandong in October–December 2011. Our sample targeted large feed companies in each area; these companies were the ones used most frequently by the farmers in our producer survey. Fishmeal manufacturers, concentrated in the coastal areas of Shandong and Zhejiang, were selected opportunistically based on contacts at local fisheries bureaus. Although the sample size for these companies was

[2] The FAO data on per capita fish consumption are based on total fish and shellfish supplies available for consumption (accounting for trade), which depict live weight and not edible weight. As a result, the numbers are significantly higher than the official Chinese statistics, as discussed later in the paper.

[3] Jiashan and Qiandaohu townships in Zhejiang are treated as separate survey regions in this paper because the aquaculture production practices in these townships are quite distinct from each other, while the numerous townships surveyed in the other provinces were more homogeneous.

Download English Version:

https://daneshyari.com/en/article/8495449

Download Persian Version:

https://daneshyari.com/article/8495449

Daneshyari.com