Mariculture issues in the live reef food fish trade

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Introduction

The international live reef food fish trade (LRFFT) is conducted throughout much of the Indo-Pacific region. Major source countries that supply species of reef fish for the live food trade are Indonesia, Malaysia, Philippines, Australia and several within the western Pacific. Most fish species in trade are members of the family Serranidae (groupers), with smaller numbers provided by the Lutjanidae (snappers) and Labridae (wrasses), amongst others. The majority of fish in the LRFFT are caught in the wild, although an increasing number of species, especially of grouper, are being produced by hatcheries.

The species of fish targeted for the LRFFT include several medium to large size reef-associated species, many with life-history characteristics poorly suited to heavy fishing pressure. Indeed, in many places some of these species have declined in numbers, mean size and CPUE, in some cases following introduction of the LRFFT into the area. Although cause and effect cannot be established, evidence is growing that the additional pressure on reef resources from the high value export LRFFT is unsustainable. If so, the extra pressure of the LRFFT could potentially threaten economies, food security and livelihoods in areas where these species are targeted.

As one means of relieving pressure on wild populations of reef species sought by the LRFFT, mariculture is proposed as an option. The manner in which mariculture is currently practiced, however, is probably unsustainable. This paper examines current mariculture practices in Southeast Asia in terms of seed supply, fish feed, threatened species, and public acceptability of maricultured species and draws conclusions on the role of mariculture in resource sustainable use in the LRFFT.

Definitions

I use the term **mariculture** to refer to the aquaculture of marine species, where aquaculture is defined as: "…the farming of aquatic organisms, including fish…(where)……. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated…." (Food and Agriculture Organization of the United Nations, FAO). Mariculture therefore includes the grow-out of

fish produced by hatcheries as well as fish that have been wild-caught. The importance of distinguishing between these two activities will be apparent.

Culture or **grow-out** are terms used interchangeably and refer to the protection and feeding of fish under private ownership, through part, or all (if hatchery produced), of their life cycle, until they reach marketable size. The term culturist refers to someone who practices mariculture

In referring to fish grown-out in pens, ponds or cages until they reach marketable size I use the term **seed**. Seed is a general term that refers to fry, fingerlings or juveniles used for mariculture grow-out and is used when a more precise description is unnecessary. Wild seed refers to seed (of any kind) fished from the wild (as opposed to produced in a hatchery). Fry is a term commonly used for advanced larvae or early juveniles of fishes, generally 1-2 cm in total length. Fingerlings range from 2.5-5 cm total length, while juveniles generally refer to fish greater than about 5 cm, and smaller than sexual maturation.

During grow-out fish are often fed mixed fish feed. **Mixed fish** refers to the non-target fishes formerly discarded as valueless bycatch. More typically the term 'trash fish' is used for this category of fish. Use of the term 'trash' (meaning rubbish) for mixed fish feed is misleading since many species are the juveniles, or food, of commercially important marine species and cannot be considered as rubbish fish.

Mariculture in the live reef food fish trade – current practices

Mariculture production of fish for the live reef food fish trade is increasing, although the relative proportions of grow-out of wild-caught fish to hatchery-produced fish is unknown. The current role of mariculture in reducing pressures on wild populations of species preferred in the LRFFT, therefore, is not yet clear because of continued heavy reliance on wild-caught seed for many species, and extensive use of mixed fish feed for grow-out. Moreover, few of the total species targeted for the trade can be hatchery-produced at commercially viable levels.

While the proportion of hatchery-produced versus wild-caught fish in the LRFFT cannot be determined, it is clear that there is a vigorous and substantial international trade in wild-caught seed for several species of grouper Southeast Asia. It is estimated that tens of millions of grouper seed are traded annually, most imported by Taiwan and China (including Hong Kong). Since current capture, transport and handling practices result in high levels of mortality in the international grouper seed trade, the actual volume of seed removed from the wild each year could be substantially higher. Given the high demand for seed by the mariculture industry for grow-out, the wide range of source countries, and the complexity of the seed trade, it is not surprising that a vigorous seed market has developed. This market is somewhat buffered from seed shortages arising in source countries. In Hong Kong, for example, interviewed traders and culturists were unaware of shortages in areas of the Philippines and Thailand because the international fry trade relies on a wide

range of alternative source countries. Given the declines in seed noted in some places, there is concern that the international fry trade may not be sustainable.

It is widely assumed that fish seed may be taken from the wild with little or no impact on adult populations of the same species and, for this reason, little attention has been paid to the high volumes of grouper seed in trade. It is assumed that very high levels of natural mortality early in the life of fish mean that seed can be removed in vast numbers without impacting adult populations. While this might be true of seed taken in the first few weeks or months of life post-settlement, grouper seed is removed from the wild throughout the first 12 months of life, and beyond in many cases. Since the highest levels of natural mortality in reef fishes occurs during or before the first few months of settlement, fish older than a few months probably have a high probability of surviving to reproduce. Their removal in large numbers for culture, therefore, could substantially reduce adult populations. Heavy seed removals cannot be ignored when considering the links between seed and adult fisheries in establishing sustainable levels of harvest of both.

Mixed fish feed is the most common type of fish feed used for fish in the LRFFT, and is implicated as contributing to overfishing and pollution. Although few data are available on the species of fish involved in mixed fish feed, studies in Hong Kong show that a range of species of nemipterids, sciaenids, clupeids, leiognathids, and others, are involved and can represent a significant proportion of the annual catch of inshore waters. The practice of taking large volumes of fish that, if allowed to grow bigger could contribute to fish for human consumption, to culture captive fish is an inefficient use of natural resources. Moreover, the excess feeding common when using mixed fish feed often contributes to pollution in inshore waters.

Mariculture and threatened species

For mariculture to contribute towards the protection of vulnerable species, pressure must be reduced on wild populations. The FAO definition of the term ‘mariculture’ refers to the grow-out of fish that are both hatchery-produced or taken directly from the wild. However, for culture to remove pressure from wild populations it would need to involve hatchery-production.

The hatchery-production of any fish species popular in the LRFFT that is, or could be, threatened with overfishing holds promise for taking pressure off wild stocks. The humphead wrasse, *Cheilinus undulatus*, is classified as vulnerable on the IUCN Red List and could be threatened with extirpation in some parts of its geographic range if its fishery is not managed. While this species is not currently hatchery-produced, hatchery production could potentially reduce pressure on wild stocks as long as: 1) hatchery-produced fish are clearly distinguishable from wild-caught fish; 2) hatchery production is economically viable; 3) hatchery-produced fish are acceptable to consumers as a substitute for wild-caught fish, and 4) hatchery-production effectively replaces or reduces wild capture for the LRFFT.

To what extent are these conditions likely to be met? There is currently no method for marking the place of origin for hatchery-produced reef fishes and research will be needed to develop appropriate methodology to do so. For many species, and especially for those traded in small volumes like the humphead wrasse, hatchery-production may not be possible or economically viable. To date, for example, few fish species in the LRFFT are hatchery-produced in large quantities despite almost 2 decades of research. There is no reason to believe that hatchery-produced and threatened species will not be acceptable to the public (but see below). Hatchery-production does not necessarily entirely replace wild capture; the case of the giant grouper, *Epinephelus lanceolatus*, a species that is generally uncommon and for which there is conservation concern is a good example. Although it has now been hatchery-produced for several years very large individuals are still occasionally imported to Hong Kong from wild sources. In general, therefore, the apparent scope of mariculture to contribute towards the conservation of threatened species appears to be limited.

For hatchery-production to play a significant role in reducing pressure on wild animals, clarity in the use of the term 'mariculture' is essential. In Indonesia, for example, current law (HK330/S3.6631/96) prohibits the capture of fish <1 kg and >3 kg unless taken for mariculture. Mariculture of the humphead wrasse does not involve any hatchery-production of seed, but relies instead on a juvenile fishery (i.e., < 1kg) for a species of conservation concern. In this case, therefore, mariculture is adding to the fishing pressure of the species, not reducing pressure.

Public acceptance of cultured fish in the live reef food fish trade

In general there is a consumer preference for fish that come directly from the wild rather than for maricultured fish, at least in the Hong Kong-based LRFFT. This is reflected in higher prices for cultured versus wild fish and also in responses given during consumer surveys in retail markets and supermarkets in Hong Kong. However, there is some indication that younger consumers would select fish to avoid threatened species, if sufficiently informed about possible choices. This indicates that consumer-awareness and advertising could increase demand for cultured fish relative to those that enter the live fish market directly from the wild.

Conclusions

As currently practiced, mariculture does not appear to be significantly alleviating pressure from wild populations of reef fishes preferred in the LRFFT. Links and interactions between mariculture practices for live marine fish in southeastern Asia and wild fish populations are strong because grow-out operations still rely heavily on wild populations to supply both seed and mixed fish feed.

Mariculture has the potential to enhance world seafood supplies and generate livelihoods and income. It can only do this, however, if sustainably practiced in relation to the natural resources on which it continues to depend. There is, therefore, a need to understand the links between inputs from wild sources, such as fish seed and mixed fish feed, and

mariculture practices. Such links are often not considered, with mariculture typically viewed in complete isolation from the status of its natural resource inputs.

To move towards a more sustainable approach to the mariculture of fish species favoured in the LRFFT, several measures are recommended: 1) prohibit all export of wild-caught seed and promote local seed for local need (i.e., local grow-out) so that source countries gain the economic benefit of their resources from grow-out and fishing pressure on fish seed is reduced; 2) reduce mortality of seed through poor harvest, transport and culture practices; 3) develop marking or other methods for distinguishing hatchery-produced from wild-caught seed, and 4) adopt the precautionary principle for the exploitation of reef fish resources under the FAO Code of Conduct For Responsible Fisheries.

There is currently an initiative under APEC to develop a voluntary code of good conduct for mariculture. It is hoped that this code will recognize the links between wild capture and mariculture to ensure sustainable mariculture practices in the LRFFT.

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