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Feeding for Fertility: Nutritional Strategies to Improve Seabass Broodstock Spawning

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Broodstock nutrition is a critical determinant of reproductive success in Asian seabass (*Lates calcarifer*) aquaculture. This article highlights the role of balanced feeding strategies in enhancing gonadal development, spawning performance, egg quality, and larval survival. Successful broodstock management requires diets rich in protein, essential fatty acids, vitamins, and minerals—nutrients that underpin gametogenesis and overall reproductive efficiency. The paper reviews commonly used feed types, including formulated broodstock pellets, fresh/trash fish, and mixed diets, while emphasizing the importance of consistent feeding regimens, pre-spawning conditioning, and careful water-quality management. Practical guidelines for feed formulation, supplementation, feeding rates, and health considerations are discussed alongside common mistakes encountered in hatchery operations. By integrating nutritionally balanced diets with sound husbandry practices, hatcheries can significantly improve seabass broodstock fertility, resulting in higher-quality eggs, improved larval viability, and enhanced overall productivity.

Keywords: Asian seabass; *Lates calcarifer*; broodstock nutrition; reproductive performance; gametogenesis; essential fatty acids; EPA/DHA; formulated feed; trash fish; broodstock conditioning; spawning management; egg quality; larval survival; hatchery practices; aquaculture nutrition; vitamin supplementation; HUFA; broodstock feeding strategies.

Introduction

Asian seabass (*Lates calcarifer*) are opportunistic carnivores in the wild, feeding on small fishes, crustaceans, and molluscs. Broodstock in captivity retain this preference, and their reproductive performance hinges on meeting the same nutritional requirements they encounter in nature (Glencross *et al*., 2023). Protein deposition drives gametogenesis, while essential fatty acids, vitamins, and minerals regulate fecundity, egg quality, and larval viability **(**Pandey Abhed., 2024).

Why Nutrition Matters for Broodstock

Good feeding makes broodstock strong breeders. Well-fed broodstock develop mature gonads and spawn on time, producing many healthy eggs and fry. In contrast, underfed broodstock may spawn late and make smaller eggs. Studies show that balanced diets boost egg size, fertilization and larval survival. In practical terms, healthy broodstock = more babies and higher farm yields.

- **Better spawning and egg quality:** Adequate food leads to bigger, more fertile eggs.
- **Higher fry survival:** Eggs from well-nourished broodstock hatch into stronger larvae that survive better.
- **More farm profits:** More eggs and healthier fry mean more marketable juveniles, boosting income.

- **Risks of poor feeding:** Skimping on feed slows growth and delays spawn time, reducing production.

Broodstock feeding management

Broodstock feeding management is an important concept in Asian seabass broodstock management because these parent fish play a crucial role in producing healthy eggs and sperm for the next generation. By providing them with diets that is complete with the nutrients they need, their overall health and appetite are significantly improved (Glencross *et al*., 2023). Proper feeding approach not only enhances egg quality and hatch rates but also helps in reducing stress and lowering the risk of disease. Moreover, it offers a sustainable advantage by reducing reliance on costly water management techniques which will ultimately support the fish welfare and the farm economics.

Broodstock Feeds and Formulations

In commercial hatcheries, broodstock diets are provided either as **formulated pellets** or as **fresh (trash) fish and molluscs**, often in combination. Some best practices:

- **Commercial brood pellets:** If available, use a large-size broodstock pellet formulated for marine carnivores (~45–50% protein, 15–20% lipid). Pellet-based feeds (extruded or steamed) ensure consistent nutrient levels and lower pathogen risk compared to raw feeds. In ponds, extruded pellets are preferred (so fish feed naturally); in cages, sinking/slow-sinking pellets work well. Always verify the pellet's analysed composition; a batch with a vitamin/mineral premix and marine oil ensures broodstock needs are met.
- **Fresh/trash fish and squid:** Many hatcheries feed high-quality raw fish (sardines, mackerel, milkfish) or cephalopods (squid, cuttlefish) because these are palatable and rich in protein, lipids and natural micronutrients. Typical practice is to feed 3–5% body weight per day of chopped or minced fish prior to spawning. Oily fish and squid provide innate DHA/EPA and vitamins A/E. However, "trash fish" must be varied and fresh (avoid spoiled fish) to prevent nutrient imbalances. Also note the disease risk: unprocessed fish can introduce parasites or toxins.
- **Mixed diets:** A balanced approach is to combine both: e.g. feed formulated pellets as the staple (ensuring known nutrient specs) and add a portion of fresh squid or squid liver oil during conditioning. For example, a Vietnamese program fed broodstock mostly on farm-made pellets, supplementing with squid oil and a vitamin/mineral premix during the 3 months before spawn. Such conditioning feeds "flush" the fish with extra EFA and vitamins.

Feeding Regimen and Conditioning

Feeding Rate and Frequency: Broodstock (large, >2–3 kg each) consume relatively less feed per body mass than juveniles, but still need consistent daily rations. Hatchery experience suggests feeding at ~2–3% body weight per day during conditioning, then reducing to ~1–1.5% at spawning time. For example, the Lampung centre fed >3-year-old brooders at 2–3% BW/day, then cut back to ~1% during the actual spawn.

Daily routine checklist:

- **Morning**: give the first portion of the ration (pellet or mix). Remove uneaten feed after an hour if possible.
- **Midday/Afternoon**: offer fresh feeds (if used), or second pellet meal. Chop fresh feed into small pieces and sprinkle evenly.
- **Evening (if needed)**: a small top-up feeding.
- **Routine tasks**: clean tanks daily, record feed given and broodstock weight/condition, and observe any spawning behaviour.

Stocking and conditioning: Maintain a sex ratio of ~1:1 in brood tanks. Begin conditioning at least 2–3 months before the expected spawning season. During this period, feed the full ration (2–3% BW/day) *daily*. A twice-daily schedule (morning and midday) ensures fresh

feed and high intake; large adult brooders often consume a day's ration in one feeding, but two small meals can improve uptake.

Pre-spawn conditioning: In the 4–8 weeks before spawning, maximize dietary quality. Increase fish/squid oil or algae oil in feed to ensure high EPA/DHA, and double-check vitamin levels. Supplementary feeding of squid, krill or mussel meat (rich in HUFA and minerals) 2–3 times/week can boost brood condition. Lampung practice: add oil-rich squid liver (or krill oil) and a vitamin/mineral premix *daily* during this period. The goal is to build fatty energy reserves and yolk precursors.

Spawning period: Do **not** starve broodstock at spawn – poor nutrition markedly reduces egg viability. Continue light feeding up to ovulation. However, it is common to reduce total feed to ~1% BW/day to keep water clean. **Note:** fish may lose appetite just before spawn, brooders often refuse feed 1–2 days after transfer to spawning tanks. Fine-tune rations by observing feeding behaviour – do not overfeed.

Practical Tips: Feed broodstock separately from juveniles to avoid competition. Use hand broadcasting or slow automatic or demand feeders if needed (brooders tend to eat slowly). Maintain excellent water quality, as uneaten rich feeds can foul tanks. Because broodstock can generate dense waste (high protein diet), frequent siphoning or moderate aeration/circulation is advised.

Implementation in Hatchery Operations

- **Broodstock Diet Selection:** Use a dedicated broodstock feed or high-grade grower feed with similar formulation. Check that it contains marine lipids (fish or squid oil) and a complete vitamin/mineral premix. If switching feeds, do so gradually over weeks.
- **Supplementation:** Even with commercial feed, consider targeted supplements: e.g. add liquid fish oil or premix vitamins to wet feeds once weekly. This is illustrated by the FAO report where weekly Vitamin E at 30 mg/kg (body weight) improved outcomes Some hatcheries also give a weekly "vitamin slurry" (vit C + E dissolved in oil) via gavage or in feed.
- **Monitoring:** Track broodstock condition via weight, gonad palpation and fat reserves. Good broodstock should have plump bellies (females full of eggs) and firm muscle. Immediately correct any sign of emaciation or anaemia by adjusting feed quality/quantity.
- **Health Considerations:** Rotate trash-fish sources and store it frozen to prevent spoilage. As noted, reliance on fresh feed carries pathogen risk – screen or quarantine new fresh feeds when possible. Maintain optimal water parameters (28–32 °C, salinity ~30 ppt) during conditioning; low oxygen or high ammonia can blunt feeding and gonad development.

Common Mistakes & How to Avoid Them

- **Overfeeding:** It's tempting to feed broodstock a lot, but too much feed leads to excess fat and poor water quality. Overweight broodstock often spawn poorly. Feed measured portions and remove leftovers promptly.
- **Using poor-quality fresh feed:** Old, low-grade or polluted trash fish can introduce pathogens and toxins. Farmers have reported disease outbreaks from spoiled feed. Always buy or catch feed carefully, and consider freezing/thawing or removing skins if possible. Alternatively, rely more on clean pellets.
- **Skipping supplements:** Neglecting vitamins and oils leaves gaps in the diet. Missing vitamin C/E or essential fats can reduce egg viability. Follow mixing instructions for premixes.
- **Changing diet too quickly:** A sudden switch to a new feed can cause broodstock to reject it. Transition gradually: mix a new feed into the old diet at increasing ratios over a week.
- **Ignoring water quality:** Poor water (low oxygen, high waste) stresses broodstock. Clean tanks often and monitor parameters. Remember that uneaten fresh feed decays fast and can foul water. Using pellets can cut down on tank pollution.

- **No variety:** Feeding only one feed type (all pellet or all trash) misses out on benefits. A balanced rotation or mix is best to cover all nutrient needs.

By avoiding these errors, farmers can keep broodstock healthy and ready to spawn.

Summary of Recommendations

- **Diet composition:** Aim for ~45–50% protein and ~15–20% lipid in the brood diet. Ensure at least 1–2% of diet as EPA+DHA (fish/oil/krill sources).
- **Vitamin/mineral premix:** Use a comprehensive premix. In particular, include Vitamin E (≥100–200 mg/kg feed) and Vitamin C (several hundred mg/kg). Include selenium (0.5–1 mg/kg) and other trace elements.
- **Feed regimen:** Feed 2–3% body weight daily during conditioning (multiple small meals). Transition to ~1% just as spawning approaches. Feed high in HUFA and vitamins for at least 6–8 weeks pre-spawn. Maintain 1–2 feedings/day (once feeding is often enough for large brooders).
- **Feed type:** Use high-quality pellets whenever possible. Supplement with fresh feeds like squid, mussel or krill at least weekly for variety and HUFA boost. Add squid or cuttlefish meals (or oils) in the diet to enhance egg quality.
- **Handling:** Transfer broodstock to spawning tanks ~4 weeks before expected spawn, minimizing stress. They often fast briefly after transfer. Keep feeding consistent up to hormone injection or natural spawn, then stop feeding ~24 h before collection to ensure clean eggs.

By following these guidelines—providing a nutrient-rich, balanced diet and careful conditioning—farmers can maximize seabass broodstock fertility. Well-nourished broodfish will yield larger egg batches, higher fertilization and hatch rates, and more robust larvae.

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