ARCTIC FOOD ARENA

Aquaculture – Warm water species

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Type: Desktop summary

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Exploring Warm-Water Aquaculture in Arctic Conditions

How heat, water, and circular thinking can unlock new food production in Norrbotten County

As part of Arctic Food Arena's ongoing work to identify circular food production opportunities in Northern Sweden, this report explores the potential for warm-water aquaculture—including species such as barramundi, tilapia, African catfish, and kingfish.

The desktop summary examines biological requirements, system performance, and industrial symbiosis potential, showing how waste heat and water from existing industries can support new, sustainable food production systems in Arctic environments.

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Barramundi (*Lates Calcifer*)

Rearing temperature:
- Commercial/optimal: ~25–30°C (optimum often cited ≈28-29°C). Below ~20°C growth slows and stress increases; mortalities occur at much lower temperatures ~13°C.

Production / stocking density (kg/m³)
- Reported grow-out stocking biomasses in tanks commonly ~15–45 kg/m³ in commercial practice – the range depends on the system used (lower in extensive systems, higher in RAS with good oxygen/water exchange).

Water quality / husbandry notes
- Tolerates a wide salinity range (fresh to marine/estuarine), but water temperature and dissolved oxygen are critical. The system needs to maintain high levels of dissolved oxygen, stable temperature near optimum, good biosecurity and disease management.

Background / current situation
- Native to Indo-Pacific (including northern Australia, southeast Asia). Aquaculture has expanded strongly in Asia and Australia; production comes from both cages and land-based systems including RAS and pond systems. There is growing innovation (feeds, RAS) and some commercial entrants to EU markets.

Potential producers
- MainStream Aquaculture – Australia

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Tilapia (*Oreochromis niloticus*)

Rearing temperature:
- Commercial/optimal: ~24–29°C (optimum often cited ≈26°C). Below ~20°C both growth and feeding is reduced; mortalities occur at much lower temperatures ~10-12°C.

Production / stocking density (kg/m³)
- Reported grow-out stocking biomasses in tanks commonly ~60–185 kg/m³ in commercial practice – the range depends on the system used (lower in extensive systems, higher in RAS with good oxygen/water exchange). Biomass/productivity can be higher in specialized systems utilizing hybrid biofloc/RAS.

Water quality / husbandry notes
- Tilapia are hardy and tolerant of variable water quality, but dissolved oxygen, ammonia and temperature control remain limiting factors at high densities — aeration and water exchange or biofloc/RAS technology are commonly used. Tilapia are primarily a freshwater species, but they can thrive in brackish water.

Background / current situation
- One of the world's most widely farmed freshwater species; major global production centers are Asia, Latin America and Africa. Production in intensive systems (ponds, cages, tanks, RAS) is widespread. Tilapia is present in European markets (imports and niche EU production). Market growth in Europe is tied to consumer acceptance, sustainability credentials, and competition with other affordable proteins.

Potential producers
- Gårdsfisk – Sweden

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ARCTIC FOOD ARENA

Clarias (*Clarias gariepinus*)

Rearing temperature:
- Commercial/optimal: ~25–33°C (optimum often cited ≈30°C). Below ~10-18°C both growth and feeding is reduced.

Production / stocking density (kg/m³)
- Reported grow-out stocking biomasses in tanks commonly ~100-400 kg/m³ in commercial practice – the range depends on the system used (lower in extensive systems, higher in RAS with good oxygen/water exchange). Biomass/productivity can be higher in specialized systems utilizing hybrid biofloc/RAS.

Water quality / husbandry notes
- High tolerance to low oxygen levels – compared to many other finfish species (Clarias have an air-breathing ability), but at commercial densities dissolved oxygen, ammonia control, and biosecurity remain critical. Unlike many other species, Clarias do not require clear water – they are adapted to thrive in muddy water with relatively poor conditions.

Background / current situation
- Widely farmed across Africa and parts of Europe (small scale), popular for fast growth and adaptability. Increasing interest in intensive tank/RAS production for controllability and year-round supply.

Potential producers
- Gårdsfisk – Sweden

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Kingfish / Yellowtail (*Seriola lalandi*)

Rearing temperature:
- Commercial/optimal: ~23°C.

Production / stocking density (kg/m³)
- Kingfish are grown intensively in cages and increasingly in marine RAS. Reported grow-out stocking biomasses in tanks commonly ~75-100 kg/m³ in commercial practice – the range depends on the system used (lower in extensive systems, higher in RAS with good oxygen/water exchange).

Water quality / husbandry notes
- Marine salinity required; dissolved oxygen, ammonia, nitrite and tank/cage water flow (current) are critical. Kingfish are high-value species so feed quality, grading, and health management (parasites, bacterial/viral agents) are important. High system recirculation rate is needed (99.6% of flow).

Background / current situation
- Kingfish are important cultured marine finfish in several producing countries; interest in on-land and RAS production has increased to meet demand and reduce disease/escape risks from sea cages. Kingfish is not native to most of Europe; however, there is commercial interest (particularly land-based RAS) to supply European consumers with a high-value warm-water marine product. High market acceptance – e.g., very similar to tuna.

Potential producers
- The Kingfish Company – Netherlands

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Other important factors to include for future investigations

FCR comparison:
- How much feed is needed to grow 1kg of biomass?

Feed composition comparison:
- What type of input material is needed to produce the feed?

Growth comparison:
- How long does it take to grow 1kg of biomass (e.g., production cycle and mortality rate; productivity kg growth/m3/day)?

Other species:
- Do a similar summary for coldwater species

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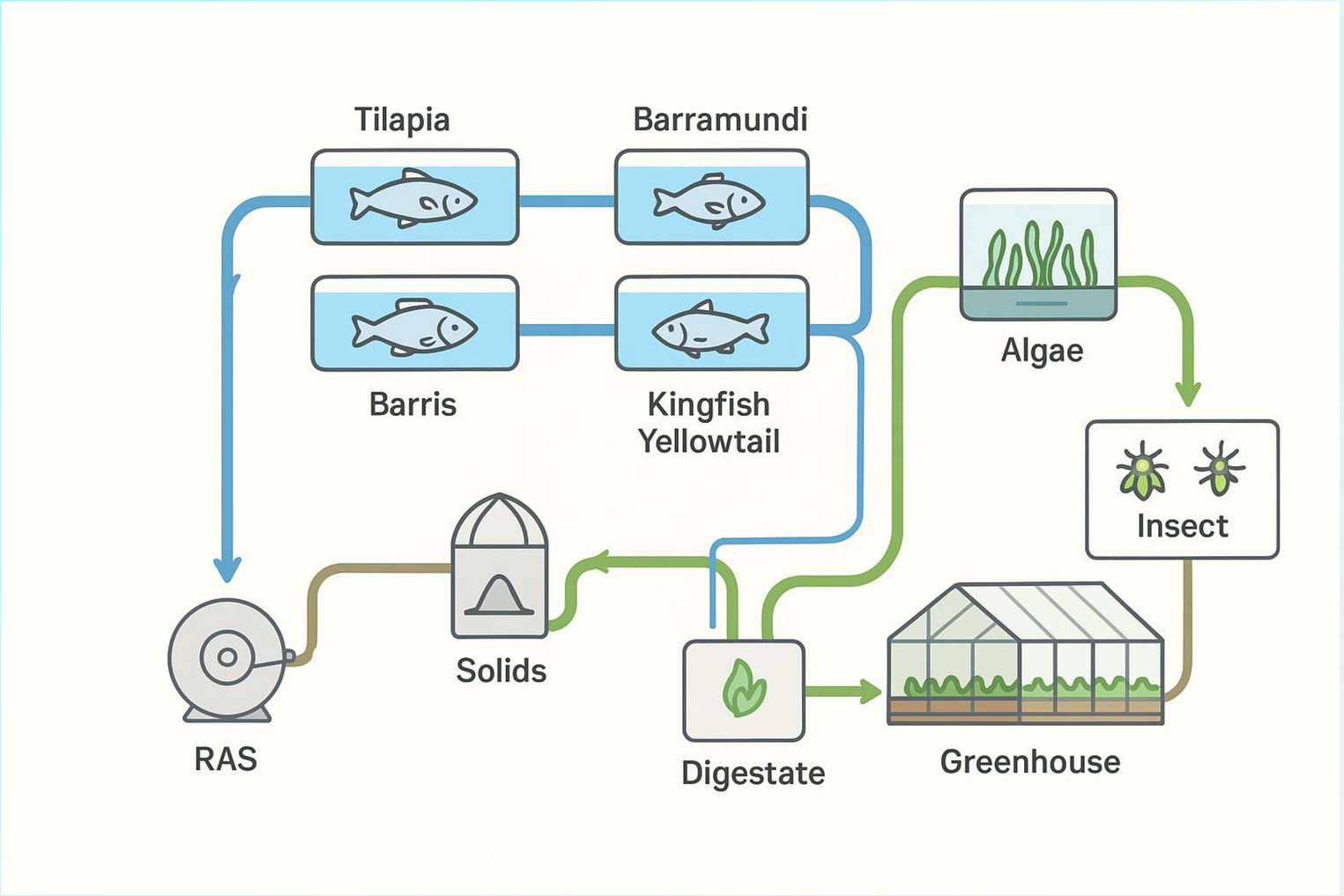
Symbiosis potential



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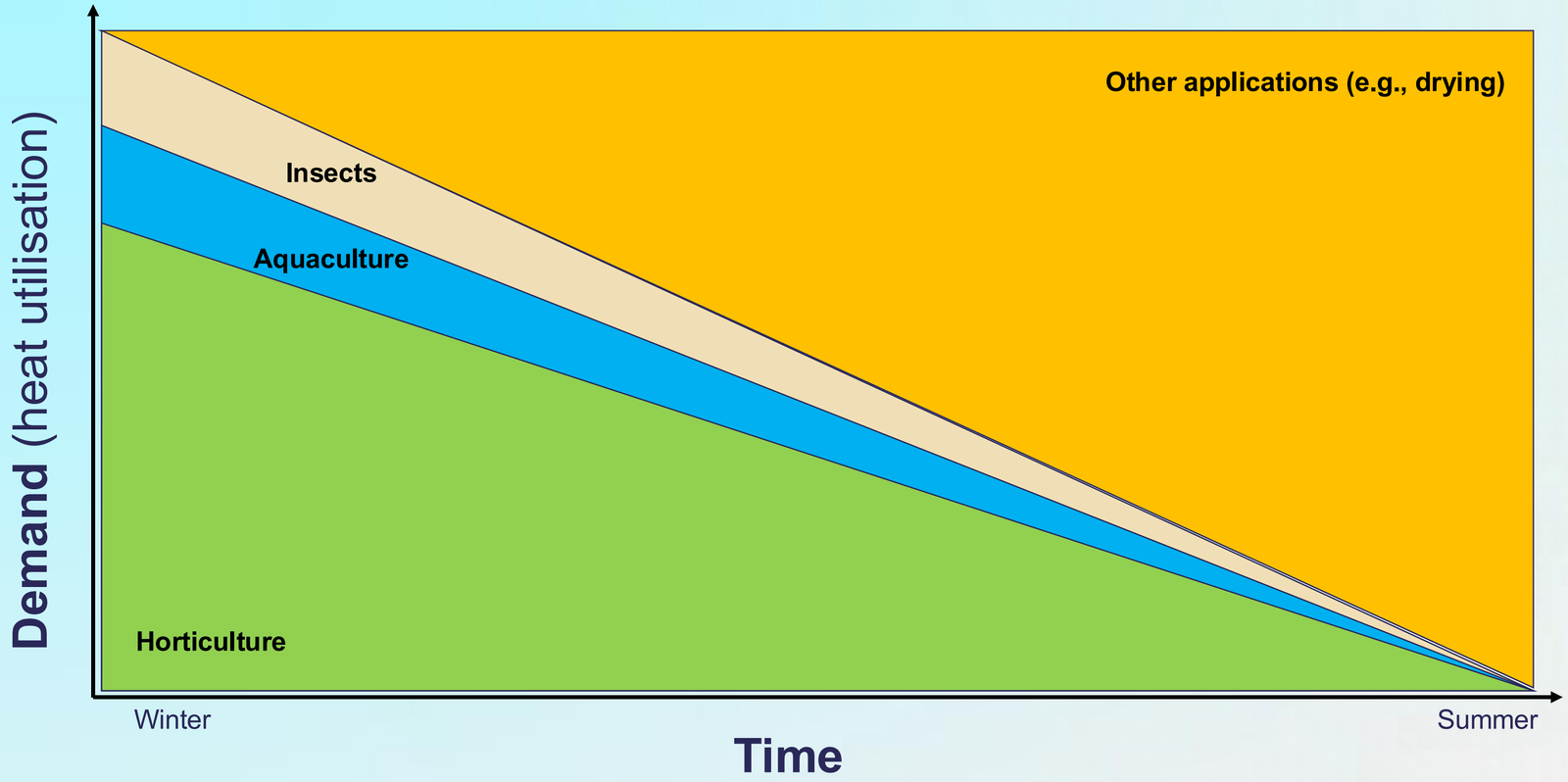
Heat utilisation illustration – general



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