

## Species Concept in Fisheries for Conservation Related Decision

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### Introduction

The concept of species is fundamental to fisheries management and conservation efforts. In an era when biodiversity is increasingly threatened by overfishing, habitat loss, and climate change, a clear understanding of species boundaries and their ecological roles is essential for developing effective conservation strategies. Beyond the traditional identification and classification of species, nuanced concepts such as unique species, flagship species, umbrella species, and keystone species add layers of ecological and cultural significance to decision-making processes. By examining the biological, ecological, and socio-economic dimensions of species identification and classification, we aim to underscore the critical interplay between species concepts and sustainable fisheries management.

#### A) Unique Species

Unique species are those with distinct evolutionary traits, ecological roles, or genetic characteristics that differentiate them from other species. They often represent ancient lineages or are highly adapted to specific environmental niches.

**Examples:** Examples include the Coelacanth (*Latimeria chalumnae*), considered a "living fossil," and the Chinese paddlefish (*Psephurus gladius*), an iconic species from the Yangtze River that is thought to be extinct.



Coelacanth (*Latimeria chalumnae*)



Paddlefish (*Psephurus gladius*)

**Conservation Challenges:** Unique species often have small populations and restricted ranges, making them particularly vulnerable to habitat loss, climate change, and overexploitation. For instance, the narrow habitat requirements of many unique freshwater fish make them especially susceptible to threats such as river damming and pollution.

**Conservation Implications:** Protecting unique species helps preserve evolutionary history and biodiversity. Conservation efforts often include habitat restoration, captive breeding, and strict regulatory measures. These species also serve as biological indicators, reflecting the health of their ecosystems (Roff, 2013).

#### B) Umbrella species

Umbrella species are species whose conservation indirectly benefits other species sharing the same habitat. By focusing on protecting umbrella species, conservationists can safeguard entire ecosystems (Wilson *et al.*, 2023).

**Examples:** The Atlantic salmon (*Salmo salar*) and Beluga sturgeon (*Huso huso*) are classic examples of umbrella species.



Atlantic Salmon (*Salmo salar*)



Sturgeon (Beluga Sturgeon)

**Conservation Challenges:** The conservation of umbrella species in fisheries presents significant challenges due to their complex habitat requirements, slow reproductive rates, and vulnerability to human activities. These species often require vast and interconnected ecosystems, which are threatened by habitat destruction, overfishing, climate change, and pollution. Migratory species like salmon and sturgeon face obstacles such as dams and water pollution, while overfishing of high-value species like bluefin tuna exacerbates population declines (Caro, 2010).

**Conservation Implications:** Umbrella species are instrumental in ecosystem-based management approaches. Their conservation drives habitat restoration and protection, benefiting biodiversity at multiple levels. However, the umbrella effect is not always guaranteed; species with specialized needs may not benefit from the protection of an umbrella species.

#### C) Flagship species

Flagship species are charismatic or culturally significant species that serve as symbols for conservation

campaigns. These species are used to raise awareness and garner public and political support for broader conservation efforts.

**Examples:** In fisheries, the Atlantic bluefin tuna (*Thunnus thynnus*), manta rays (*Manta birostris*), and seahorses (*Hippocampus* spp.) are notable examples of flagship species.



Atlantic bluefin tuna



Seahorses



Manta rays

**Conservation Challenges:** Flagship species in fisheries often face significant conservation challenges due to their high-profile status, which can attract attention and funding. However, this focus on flagship species may lead to the neglect of less charismatic but ecologically important species, causing an imbalance in conservation priorities. Additionally, flagship species often have specific habitat or ecological requirements that may not benefit other species within the same ecosystem (Jepson & Barua, 2015). Overexploitation, climate change, and habitat destruction continue to threaten these species. Furthermore, conservation efforts targeted at flagship species may not always translate into broader ecosystem protection. Balancing public interest with the overarching goal of maintaining ecosystem health remains a critical challenge in flagship species conservation.

**Conservation Implications:** The conservation of flagship species in fisheries has significant implications for broader ecosystem management. By focusing on high-profile species, conservation efforts can attract public attention, funding, and political support, leading to the implementation of protective measures such as habitat restoration and sustainable fishing practices. However, these efforts may inadvertently overshadow the needs of other less charismatic species that also play vital ecological roles. While flagship species can serve as a rallying point for conservation, their protection alone may not ensure the overall health of the ecosystem. This highlights the necessity of adopting a holistic, ecosystem-based management approach that addresses the needs of all species within the ecosystem.

#### D) Keystone species

Keystone species have a disproportionately large impact on the structure and function of their ecosystems. Their presence or absence can significantly alter ecosystem dynamics.

**Example:** In marine ecosystems, sharks are a quintessential example. As apex predators, sharks regulate prey populations and maintain the balance of marine food webs. Another example is the parrotfish, which grazes on algae, helping to maintain the health of coral reefs.



Shark



Parrotfish

**Conservation Challenges:** Conserving keystone species in fisheries presents significant challenges due to their critical role in maintaining ecosystem balance. These species often perform unique ecological functions that influence the abundance and diversity of other species within the ecosystem. However, their conservation is complicated by habitat degradation, overfishing, climate change, and pollution, all of which can disrupt the delicate balance they maintain. Protecting keystone species requires not only safeguarding their populations but also addressing broader ecosystem health, as their decline can lead to cascading effects that harm the entire food web.

**Conservation Implications:** The conservation of keystone species often involves measures such as regulating fisheries to prevent overexploitation, establishing marine protected areas, and promoting sustainable fishing practices. Challenges include the identification of keystone species in complex ecosystems and balancing conservation goals with economic interests.

#### Conclusion

The concepts of unique, umbrella, flagship, and keystone species provide a comprehensive framework for making informed conservation decisions in fisheries. These species concepts are integral to effective conservation and fisheries management. Unique species, with their distinctive ecological or evolutionary traits, require focused conservation efforts to prevent extinction and preserve biodiversity. Unique species, with their distinctive ecological or evolutionary traits, require focused conservation efforts to prevent extinction and preserve biodiversity. Umbrella species help protect broader ecosystems by ensuring the health of entire habitats, benefiting many other species in the process. Flagship species, often charismatic and economically important, draw attention and resources to conservation initiatives, although they may inadvertently overshadow other critical species. Finally, keystone species, which play a crucial role in maintaining ecological balance, demand

targeted protection to prevent cascading disruptions in the ecosystem. Together, these species concepts emphasize the need for holistic, ecosystem-based approaches that consider both the direct and indirect benefits of conservation for biodiversity and ecosystem health. By understanding the ecological roles, cultural significance, and socio-economic value of species, conservationists can prioritize actions that maximize biodiversity protection and ecosystem sustainability. Integrating these concepts into policy and practice will be critical for addressing the challenges of aquatic conservation in a rapidly changing world.

### References

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