Impact of Climate Change on China and New Zealand's Marine Biodiversity

Winds of Change 2022

Climate change can result in decline of species. One species can also change interactions in food chain, harming the biodiversity in the ecological system. This brochure provides an introduction on the impact of climate change on marine biodiversity and counter-measures that have been taken by China and New Zealand through the lens of Snapper. It also brings inspiration from other countries and communities on the management of marine ecosystem.

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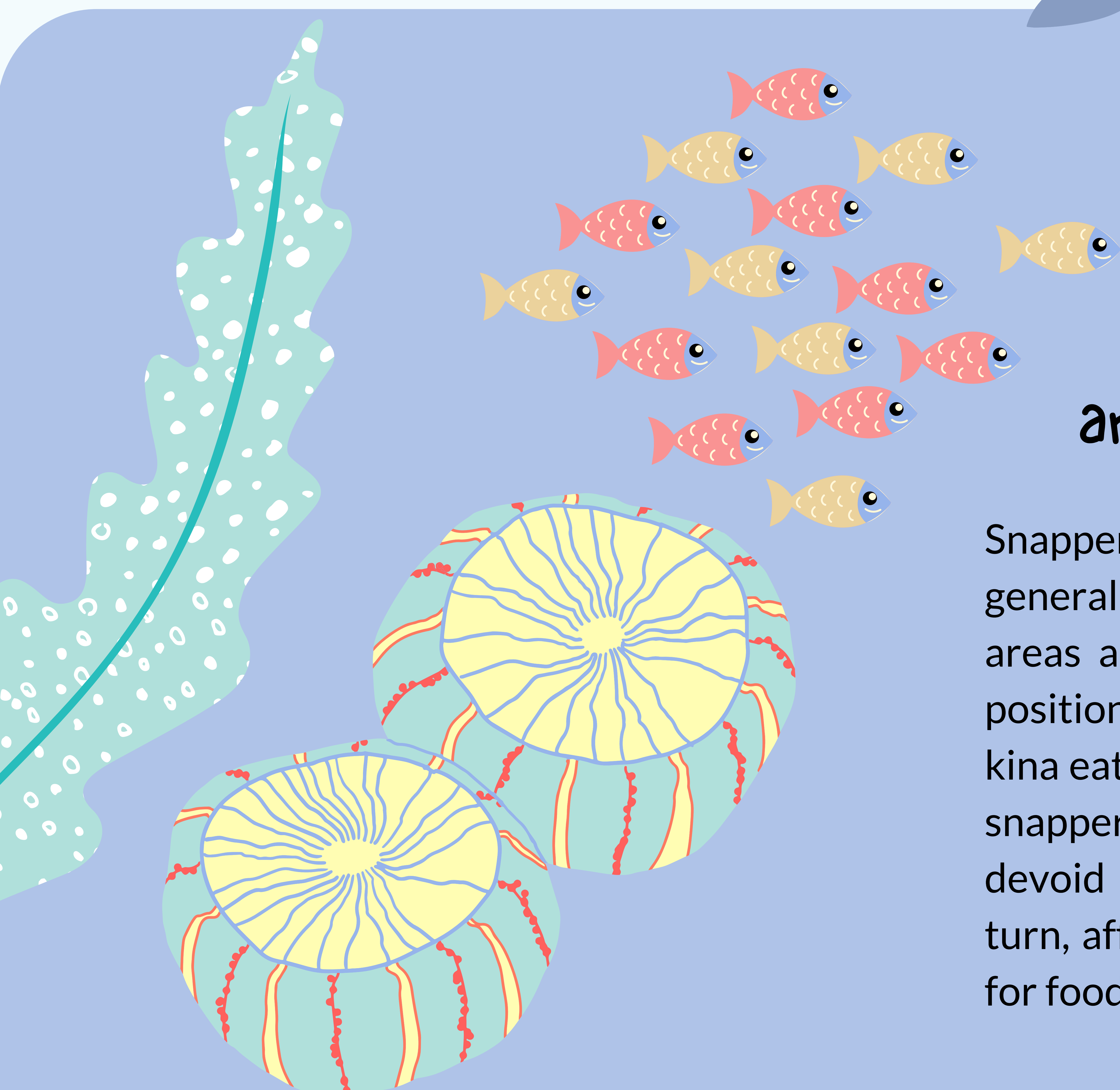


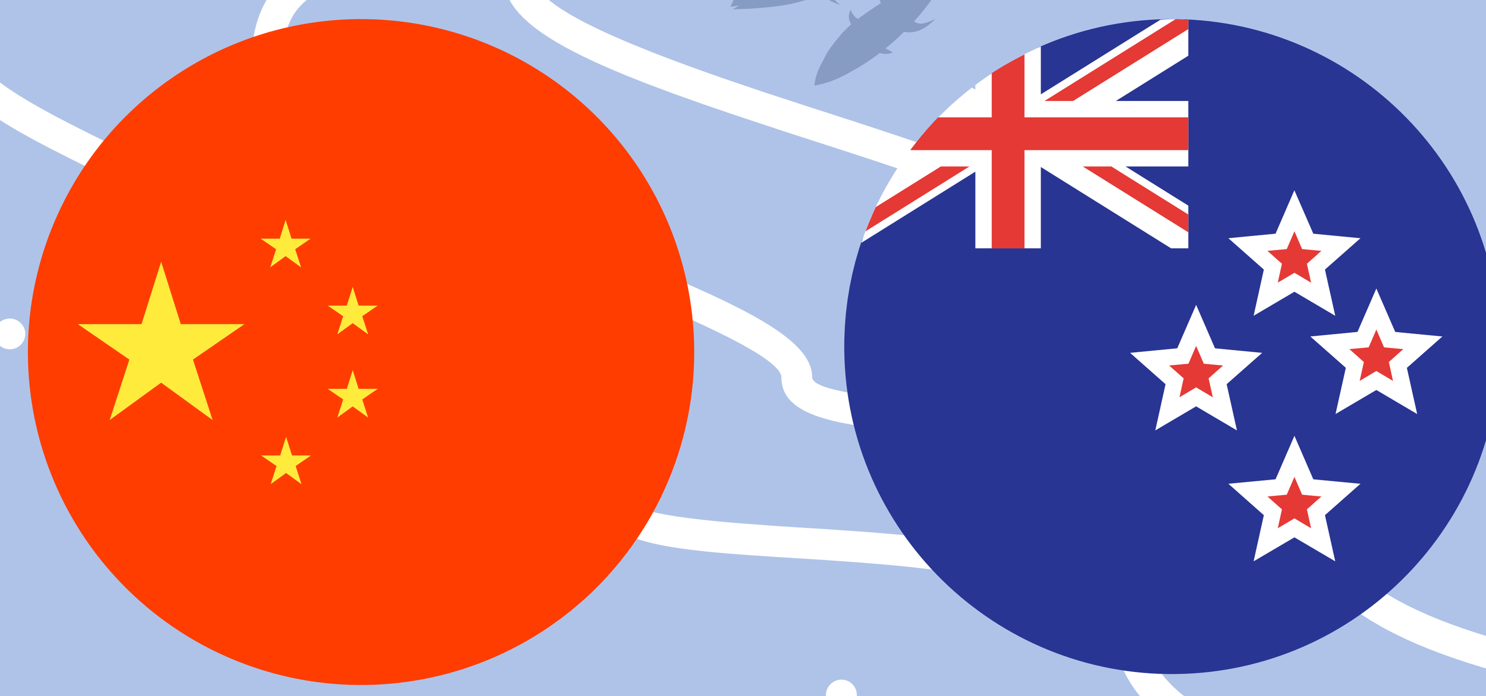
Kelp, Kina, and Snapper: an interconnected ecosystem

Snappers stay together in large schools, and generally stay close to the sea floor, inhabiting reef areas and even shipwrecks. They have important position in their ecosystem. Snapper eat kina, and kina eat kelp. Therefore, areas with low numbers of snapper can have more kina and less kelp, or be devoid of kelp (Shears & Babcock, 2002). This, in turn, affects the many species that depend on kelp for food and habitat (Shears & Babcock, 2002).

Environmental Change

Climate change can lead to elevated sea temperature and ocean acidification. This affects the distribution, timing and intensity of spawning of fish species, affecting their reproduction. As a result, this would change the balance of the ecosystem, altering the structure of the pelagic food web.

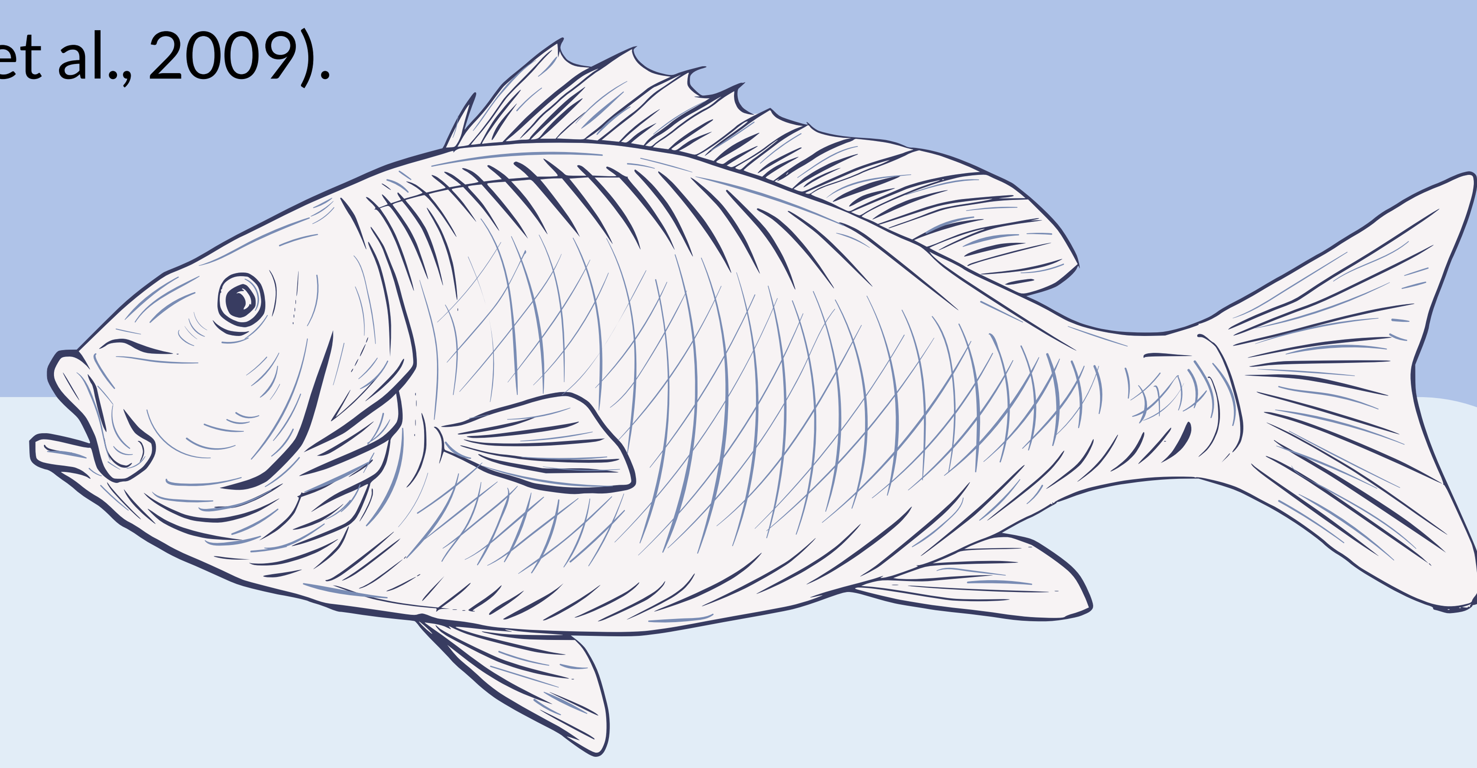
Snapper in China and New zealand



Both China and New Zealand have large territorial sea areas and lengthy coastline. Both countries make significant contribution to global fisheries production. Snapper (i.e. Pagrus Auratus), a common reef-associated fish with a distribution range from 44°N - 47°S, 90°E - 175°W, is one of the most economically-important fish in the market for both countries (Capuli, 2009).

Climate Change and Snapper

Snapper is highly vulnerable to climate change. Increased temperature and acidification may have short-term positive effect on Snapper's swimming ability, growth, and larval survival rate. However, temperature and acidification cannot exceed the thermal and ph optimum (Parsons et al., 2021). After the thermal and ph optimum is exceeded, the growth will decline (Parsons et al., 2021). As assessed by the IUCN Red List of Threatened Species, there is already a trend towards decline amongst mature snapper individuals across their native habitats (Carpenter et al., 2009).



Policy in action

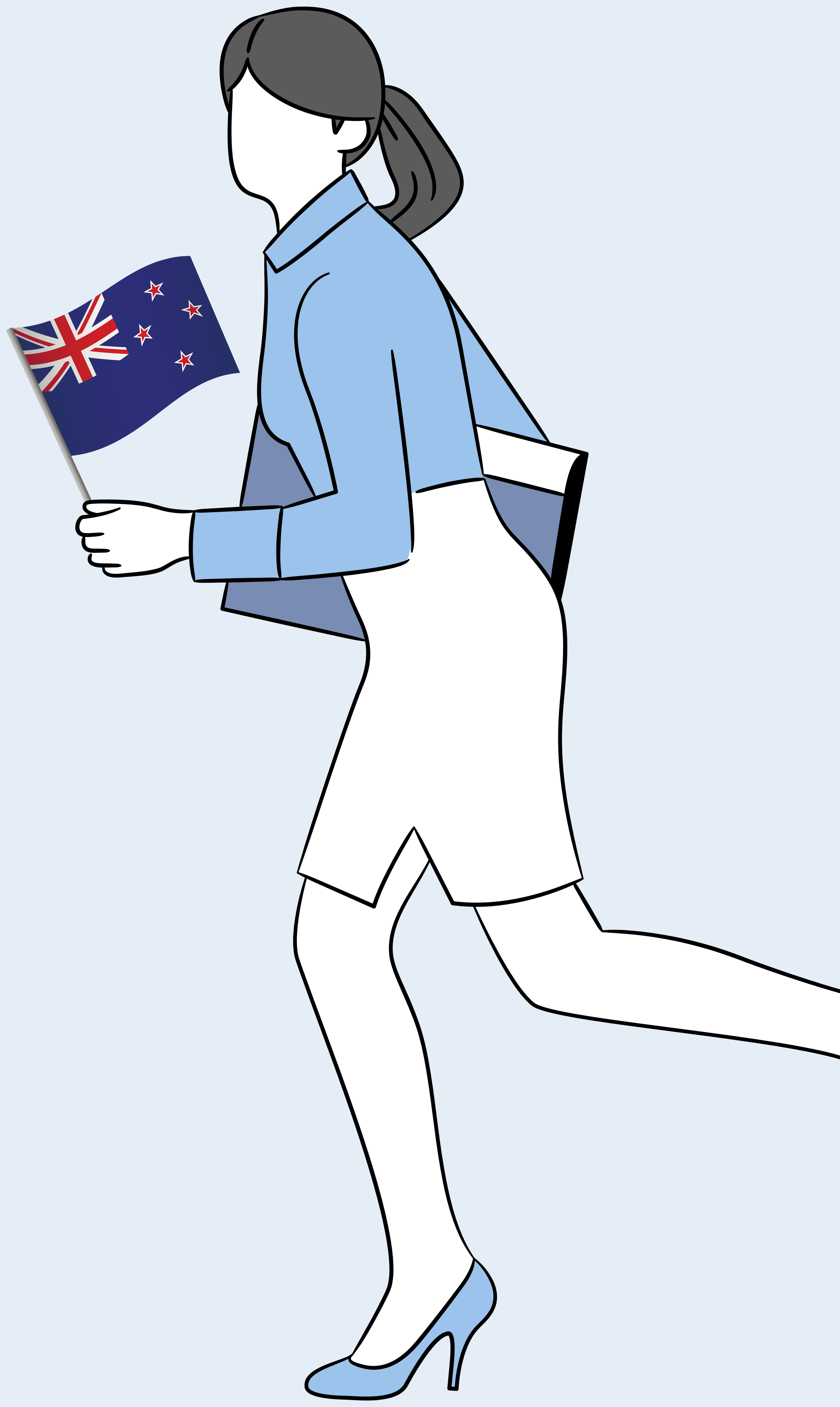
China

According to the press release from the State Council of the People's Republic of China (2013), two major approaches are taken:

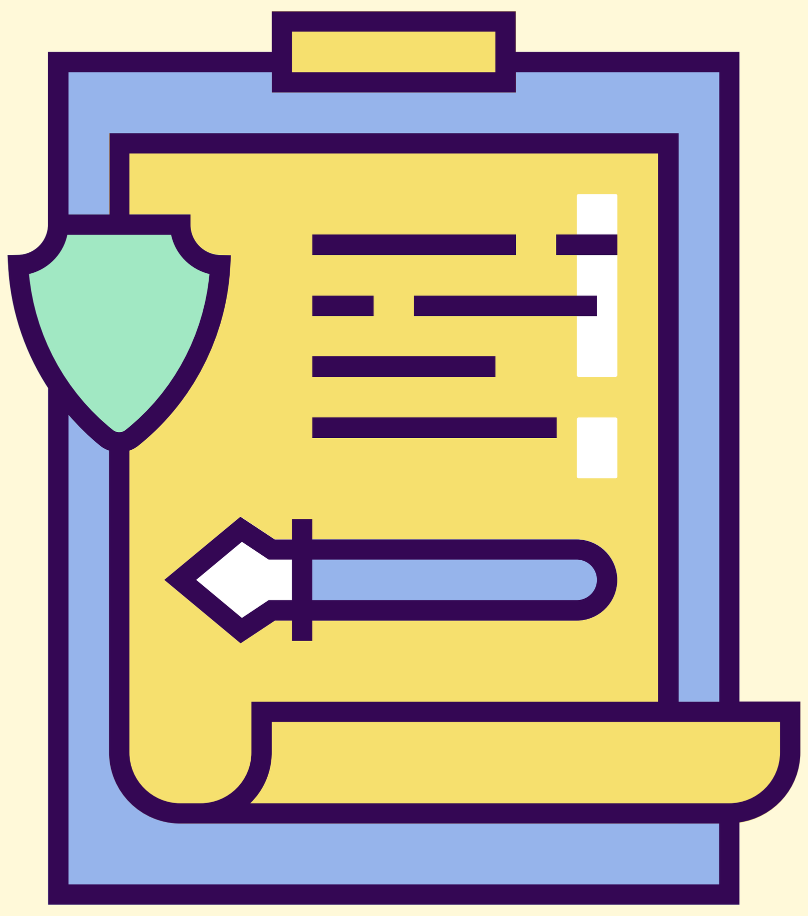
1. **Reduce Human Intervention**
    a. China established a centralised fishery evaluation system which constantly monitors and assesses fishery resources to scientifically determine the allowable amount of fishery resources and formulate plans for the utilisation of fishery resources.
    b. China planned to reduce the reliance on offshore fishery (wild capture) by
        i. gradually reducing the number and total power of fishing vessels.
        ii. developing Marine pastures, increasing the release of artificial reefs, increasing the proliferation and release of fishery resources.
        iii. promoting sustainable and healthy aquaculture models, such as introducing the standardisation of aquaculture ponds, the standardisation of cages for offshore aquaculture, and recycling of aquaculture equipment.
2. **Reduce Pollution into the Ocean**
    a. Marine pollution contributes to climate change both through direct Greenhouse Gas emissions and indirectly by negatively affecting ocean organisms. China established Marine ecological and environmental monitoring system which aims to strictly control the emission of land-based pollutants into water bodies and the total amount of pollutants emitted in key ocean areas.

New Zealand:
According to the Marine Conservation Report (Gibbs, 2019) and Maritime New Zealand (n.d.), two major approaches are taken:

1. **Reduce Human Intervention**
    a. Under The Resource Management Act 1991, Fishery NZ conduct or co-found research with local stakeholders to adverse sustainable catch limits for harvested species.
    b. Fishery methods are to comply with the protection standard. Methods that require bottom-disturbing fishing methods such as bottom-trawling, dredging and Danish seining to be prohibited.
    c. Regional councils have the responsibility to manage the adverse effects of terrestrial and marine activities on marine biodiversity. In practice, councils implement this responsibility by including rules in their regional coastal plans (e.g., to prohibit particular activities in areas with high biodiversity values).
2. **Reduce Pollution into the Ocean**
    a. All vessels, from the smallest recreational boat to the largest containership must comply with the environmental regulations that protect New Zealand's seas for everybody.
        i. Ministry of Transport has responsibility to stop or control discharges of waste, including oil, chemicals and garbage.
        ii. Maritime New Zealand share a responsibility to prevent marine pollution caused by the dumping and disposal of waste from New Zealand flagged ships on the high seas.



How effective are these Policies?



China
According to the governmental report, the enforcement of sustainable harvest limit directly maintained the sustainability of local marine ecological system. The agenda of reducing the reliance on offshore fishery significantly reduced the human interference on the local marine ecology. On the one hand, it has contributed to the development in the material and equipment standard of boat and capturing methods. Therefore, the number of boats and fishing intensity matches the general renewability of fishery resources. On the other hand, there has been advancement in infrastructure conditions for the flourishing of aquaculture. The area of aquaculture remained stable at about 2.2 million hectares. Aquaculture now can supply a variety of seafood products with good quality. The conservation and restoration capacity of wild aquatic living resources has been effectively improved.

New Zealand
No policy review is available to provide an evaluation or update on the outcome of marine protection policies. However, based on witness report, there has been improvement on the conservation of marine biodiversity. For instance, Conan Young , a Fisheries Reporter, indicated a change in the area from North Cape to Kāpiti. In 2005, these areas were largely closed to commercial fishers after the collapse of snapper stocks. Consequently, the ecosystem also underwent significantly challenge. After 16 years of conservation, the Snapper stock has gradually recovered. This created a chain-reaction in the local ecological system. The seaweed regenerate. The crabs, the crustaceans, the food sources for these fin fish also returned in abundance. The local ecosystem has grown stronger.

Alternative solutions from other countries that could be used in New Zealand and China

Building Trust

Ensuring common goals and agreed objectives to provide clarity among stakeholders, manage expectations and improve the outcomes from Snapper stock management.

Some NGOs, such as the Marine Biodiversity Hub, are committed to improving the capacity of the marine research community to engage Australia's Aboriginal and Torres Strait Islander people in coastal and marine research.

Getting the Right Information

• Basic biology

While basic biological information of Snapper is known (distribution, stock structure, growth, longevity, age structures, reproductive biology, early life history) some changes may occur as a result of climate-change driven effects.

• Comprehensive data on removals from each sector of the fishery (estimates of fishing mortality). These are considered a bare minimum requirement to manage any fishery.

Commercial – mandatory logbooks of catch and effort, noting Information from industry needs to be respected and a level of trust

Charter boats – mandatory logbooks of catch and effort

Recreational – robust estimates of total recreational catch

Indigenous – robust estimates of total Indigenous catch

•Recreational surveys

Need to be undertaken regularly (in time and space), using a systematic approach and cover, where appropriate, the entire recreational fishing population .

They need to be extrapolated to estimate entire recreational catch and be granular enough to be useful at the stock level.

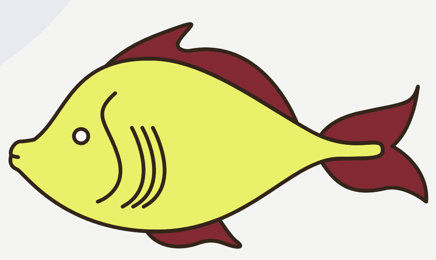
https://www.frdc.com.au/project/2019-046

Resource Evaluation

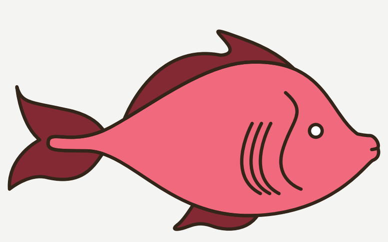
Snapper evaluation is conducted on the basis of surveys and an evaluation method and management method are introduced with a management aim to realise that the catch reaches maximum sustainable yield (MSY).

For this evaluation, 1) information of snapper generation situation, 2) estimation of the number of snapper for different ages, the natural decrease rate, and the rate of death due to catch, and 3) influence of recent marine environmental change on the natural decrease rate are examined and a survey system to collect necessary information for the examination is strengthened.

Clear Objectives and Pathways



There is a need to develop and implement a well-defined harvest strategy with sectoral objectives, incorporating a decision-making process with appropriate limits and targets and control rules.



Most Snapper stocks are below targets and need rebuilding so there is a need to specify rebuilding objectives and strategies to achieve them Need to be clear on timeframes and some estimation of when the targets should be reached. To achieve this, fishing mortality must be reduced.

Reductions and rebuild timeframes (pathways to stock rebuilding) should be set in consultation with stakeholders and defined in harvest strategies.

Target levels and rebuilding pathway(s) should consider Snapper biology as well as the social and economic values of the different sectors.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9352237/

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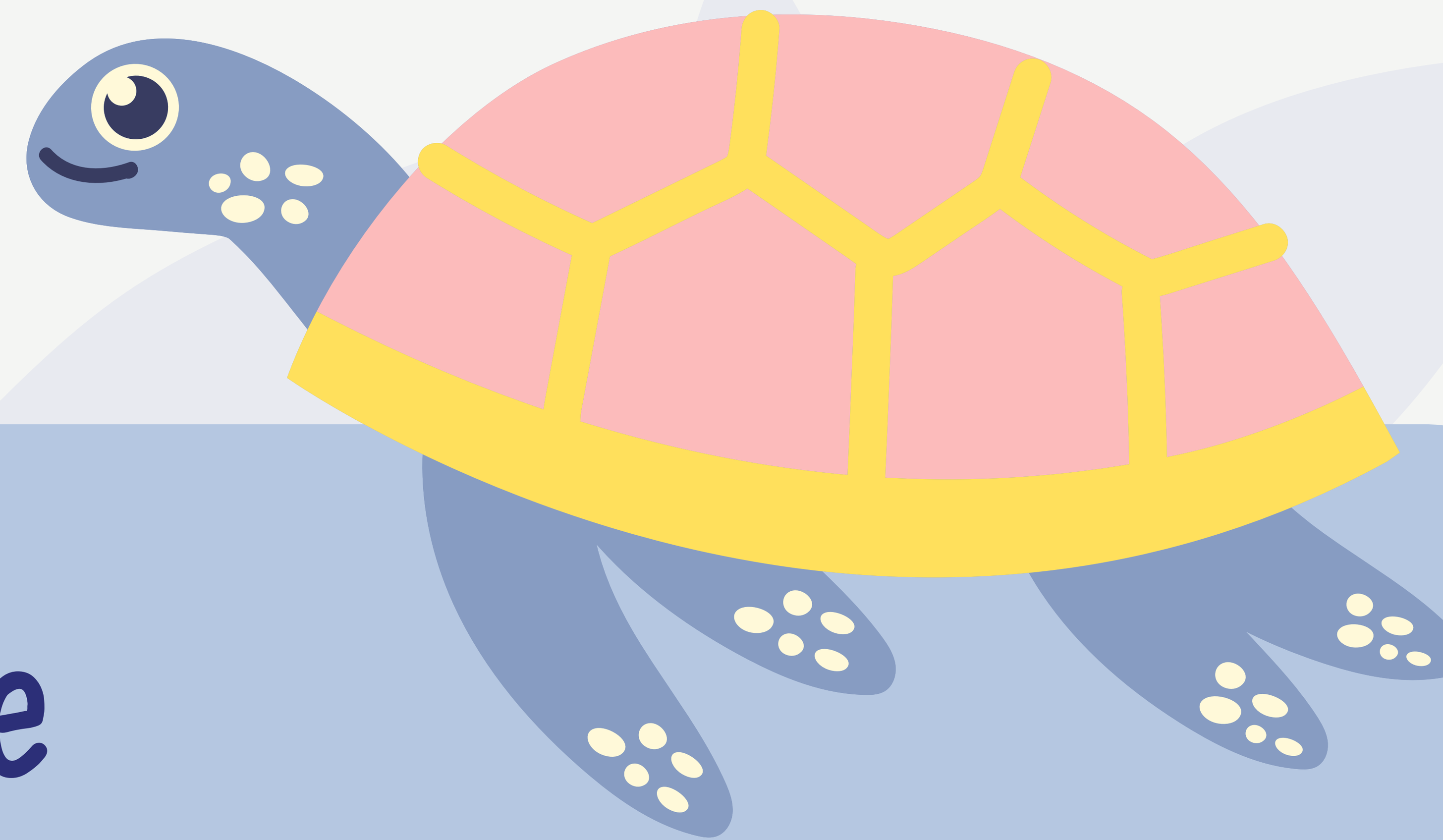

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