# AN OCEAN LIKE NO OTHER

## 7.2 CHOKKA SQUID AND ITS ENVIRONMENT: AT THE MERCY OF ERRATIC UPWELLING SYSTEMS

**VIDEO DURATION– 06:44**

In this lecture you will learn about the spawning and recruitment of Chokka Squid and how these processes influence the catch. We will look at the key environmental factors influencing squid catches and at the potential impact of climate change on the marine environment of the Agulhas Bank.

We will start with a closer examination of the spawning process, which is important not only for the success of the population, but also for catches. It's a complicated procedure.

Male and female chokka squid are normally dispersed over the Agulhas Bank, and to some degree, over the west coast of South Africa — forming separate shoals. Males are larger than the females being typically 40 cm in length.

In October-November each year, both sexes migrate to the coastal waters of the eastern Agulhas Bank — between Port Alfred and Plettenberg Bay, to take advantage of the warmer coastal environment. When environmental conditions are favourable, they form large spawning aggregations at depths between 20 and 40 meters.

These can be as large as a football field. Here they perform what has become known as the 'nuptial' or mating dance. Thousands of males and females perform a ritual of pairing up, copulating, and then laying the egg capsules on the seabed where they then stay for 3 weeks until the embryo is ready to hatch. They form huge, orange, egg masses, or eggbeds, that sway to-and-fro under the effects of surface waves. During the nuptial dance, there is an aggressive phase between males fighting for possession of a female.

The key to successful spawning is communication. Squid are able to communicate with one another using a myriad of different visual colour patterns on their skin — known as ethograms. These patterns are produced by thousands of ink-filled sacs called chromatophores distributed over their skin. By expanding or contracting these, the animal can display a myriad of different patterns signalling a communique.

For example, this male squid shows a series of spots across the fins, which we believe is an aggressive display, used to warn other males, especially when fighting for possession of a female.

Squid can also use these chromophores to blend into their surroundings, making themselves difficult to see by their enemies. Importantly, squid have excellent eyesight, so the water clarity is important for their communication.

However, turbid water can prevent this visual communication system. It is common for a **Bottom Nephaloid Layer** to be found on the inshore regions of the Eastern Agulhas Bank where the squid spawn. This is a high density 3-5 meter layer of decaying organic particles above the seabed, which cuts out the light. As experienced by divers, it can be pitch black down near the seabed. Under these conditions, the chromatographic communication used by squid fails, so spawning aggregations either do not form, or the squid disperse until conditions improve.

Chokka can only be economically caught when spawning aggregations are formed. The spawning aggregation can last for weeks with new squid moving in and spent ones emigrating. These spawning aggregations are easy to detect using echosounders, and hence the fishing boats are continuously hunting for them. It is very difficult to catch squid if they are not spawning because they are too dispersed.

Now we will have a look at recruitment. In ecology, recruitment describes how much of the new entrants to the squid population can occur through egg hatching. Recruitment is about the squid paralarvae having enough food to survive.

Ship and satellite observations show the Agulhas Bank to have two important areas of planktonic production — coastal upwelling off Port Alfred and the region of the Cold Ridge. The latter is seen as the most important as it appears the tiny squid paralarvae hatched in the coastal zone are swept westward towards Cold Ridge.

Here, they have the greatest opportunity to capture zooplankton, usually associated with high levels of phytoplankton.

The formation of the Cold Ridge is linked to the summer coastal wind-driven upwelling, and varies in intensity from year to year. This means paralarval food varies between years, with less food during periods where the Cold Ridge is weak.

Squid paralarvae are born with a small yolk sac that only lasts, at the most, 3 days. It is likely then that many do not find sufficient food in time and perish, resulting in poor recruitment and a lower adult biomass in the forthcoming year.

So, the environment has a very real impact on the behaviour of spawning squid and also its food, lack of which can lead to starvation and reduction of the stock size in the following fishing seasons.

Of course, the squid life cycle is impacted in other ways than just ocean productivity and Benthic Nepheloid Layer events. For instance, imbalances of predators that prey on the minute squid paralarvae, juveniles and adults, can similarly affect the squid biomass on the Agulhas Bank.

The problem is, almost all of the upper levels of the food web love to eat squid! Squid maintain a position mid-way in the trophic structure. That's why it is the favourite bait for fishermen wishing to catch fish on hook and line. Whales, dolphins and seals eat large amounts of squid too. We know very little about the predators of the paralarvae, but a large biomass of small pelagic fish such as anchovy and pilchard, which feed on plankton, will no doubt limit the recruitment in the squid fishery. So the squid biomass and catches are maintained by a balance between physical drivers and the ecosystem in its entirety. Too much, or too little, of one component will send rippling effects throughout the ecosystem on the Agulhas Bank.

In addition to these complex factors we are beginning to see the signs of anthropogenic climate change on the Agulhas Bank. The climate model projections show that in addition to increased temperature, the Agulhas Bank is likely to see increased ocean stratification, reduced primary production, and, alarmingly, a changing behaviour of the powerful Agulhas current.

The models show increasingly frequent events of Agulhas meanders sweeping the Bank, leading to increased losses of the paralarvae. Understanding how a combined impact of these factors, in addition to ocean acidification, may impact the squid population and the fishery reliant on it, remains a major challenge for marine science.

In this lecture, we have discussed spawning and recruitment of the Chokka squid and the importance of these processes to the commercial success of the fishery. We have learned about the key environmental factors controlling spawning and recruitment, and made the first steps in trying to understand potential impacts of climate change on the squid population.