Jellyfish Effects on Food Web Production in the Bering Sea

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In recent years, gelatinous plankton, including large jellyfish, have been shown to have a substantial impact upon fish populations by preying on eggs and yolk-sac larvae. In the Bering Sea, there has been a tenfold growth in the biomass of the large jellyfish *Chrysaora melanaster* over the past decade (Brodeur et al. 1999). Other than a small, one-time snapshot in late summer (Hamner 1982), their feeding habits have not been examined and nothing is known about diets in spring; when with other species, predation rates as high as 60% of the ambient fish eggs per day have been recorded (Purcell et al. 1994). In some systems, growth in jellyfish biomass has been accompanied by failure in recruitment of fish stocks. This study tests the hypothesis that *Chrysaora melanaster* significantly depresses the annual production and biomass of other members of the pelagic food web of the Bering Sea, including walleye pollock *(Theragra chalcogramma)* and other forage fishes. The hypothesized mechanisms operate through trophodynamic processes, including competition with fishes for common prey, and predation on fish eggs and larvae.

Several species of jellyfish actively select for fish eggs among the plankton (Fancett 1988, Purcell et al. 1994). When sufficient high-quality food is available, medusae often experience exponential growth and can quickly become the dominant species in an ecosystem. In nonintroduced species, this is often limited by predation from other medusae. In the Bering Sea there is only one documented case of this occurring (Hamner 1982), where the large jellyfish *Cyanea capillata* preyed upon *Chrysaora melanaster. Cyanea capillata,* however, tend to be located in the outer shelf and oceanic regions. Thus there may be little predation pressure upon *Chrysaora* in the middle and inner-shelf regions of the eastern Bering Sea.

The study encompassed a two-month period from early April through early June 2000, the period of peak spawning of pollock on the southeastern shelf as well as the suspected period of maximum growth for the medusae. It was conducted from a relatively inexpensive 9.8 m Bristol Bay gillnetting vessel. The vessel size necessitated working out of a safe harbor, such as False Pass, where shelter could be taken whenever weather conditions were too severe for the boat or for diving. The chosen sampling site was the north shore of Unimak Island near the entrance to False Pass in depths less than 20 m. This is an area of historic high jellyfish biomass and near the center of distribution of spawning pollock. The 20 m depth was chosen because it provides a floor that can be utilized for equipment as well as for safety concerns.

For the process studies, collection via diving was chosen. Due to the fragile nature of jellyfish, trawling often produces unusable specimens, since they are damaged and net contamination makes stomach content analysis dubious. Much of the feeding takes place on the oral lobes, which hang below the animals and may be three meters long in Bering Sea *Chrysaora*. These are often torn off in plankton trawls. Due to the vertical composition of the population (Brodeur 1998), dip-nets are also likely to collect specimens nonrepresentative of the population and damage the oral lobes in small waves and choppy conditions. This leaves diving as an alternative to collect samples.

Since there are no diving facilities in the region, a compressor was needed at the site. A low-pressure, surface-supply system was chosen because it is a small portable system weighing about 250 kg and can be placed aboard a small vessel and run on diesel. This system also allows for ease of communication and cooperation with the support vessel through the tether. One advantage of this system is that divers are not time-limited by tanks and are thus more able to complete tasks. The tether is needed due to the currents, low visibility, and lack of spatial references for the divers. This system is widely used by commercial abalone, sea cucumber, and geoduck divers in Alaska waters and is suitable for many of the remote diving conditions encountered here.

Although the project was designed to test different methods of collection for *Chrysaora melanaster* via diving, the jellyfish distribution in 2000 proved to be too deep, and specimens had to be collected with an otter trawl. In future studies modifications (such as a completely ship-based study and incorporation of ROV use) will need to be made in order to follow swarms of jellyfish away from safe harbors.

References

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