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FOOD OF *Kyphosus elegans* (PERCIFORMES: KHYPOSIDAE) IN LORETO, BAJA CALIFORNIA SUR, MÉXICO

Espectro alimentario de *Kyphosus elegans* (Perciformes: Khyposidae) en Loreto, Baja California Sur, México

RESUMEN. En este estudio se describe la dieta de la Chopa del Mar de Cortés *Kyphosus elegans* (Peters, 1869) en el área de Loreto, Baja California Sur, México. Los peces (N=55) fueron capturados en abril y julio de 1997. La chopa del Mar de Cortés es considerada como un herbívoro generalista, sin embargo no hay suficientes datos que apoyen esta conclusión. Del contenido estomacal se identificaron un total de 13 géneros de algas y uno de pasto marino. El alga parda *Sargassum* spp. fue el alimento más frecuente y con mayor contribución en peso. Se concluyó que *K. elegans* es un consumidor primario con una marcada preferencia por *Sargassum* spp.

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Reef ecosystems are characterized by having high species diversity and high primary productivity. Although algae constitute one of the most diverse groups with the highest cover, their biomass is frequently low due to the influence of grazers (Hay & Taylor, 1985). Studies on the diet and feeding habits of fish yield information on the predator-prey relations and competition between species (Clements & Choat, 1997; Ferreira *et al*., 2001). The family Kyphosidae is one of the dominant taxa in the fish community structure of Bahía de Loreto, Baja California Sur, México (Campos-Dávila *et al*., 2005). They have been described mainly as grazers that occasionally consume small crustaceans and mollusks (Randall, 1967; Clements & Choat, 1997). In this study the feeding spectrum of Sea of Cortez seabram *K. elegans* is described within the Loreto Marine Reserve at Loreto bay, B.C.S., through the analysis of their stomach contents.

Specimens used in this study were collected during April and July, 1997 in Loreto bay, located in front of the town of Loreto, B.C.S., México (25° 43'N 13'' N, 111° 13' 09'' W and 26° 07' N, 49'' N 111° 21' 08'' W) (Diario Oficial de la Federación, 1996). Two gill nets (120 m length, 3 m height, and 9 cm mesh) were set perpendicular to the coastline at sunset (18:00 h –19:00 h) and retrieved at sunrise (05:30 h–07:30 h). Nets were set in water 5 m – 14 m in depth and we recorded surface water temperature, substrate type, and rock coverage. The stomach fullness degree was estimated. Fullness degree of fish stomachs was categorized to empty, ¼ full, ½ full, ¾ full, full for each month.. The stomach contents were homogenized and identified to the lowest possible taxon following Setchell & Gardner (1924) and Abbott & Hollenberg (1976). Wet weight (% W: percentage of each food type from the total food weight) and frequency of occurrence (% FO: percentage of the frequency of occurrence of each food category in the total number of full stomachs) were used to quantify each component contribution to the trophic spectrum. Percentage values of these indices were plotted in a scattergram in order to measure the feeding strategy of the consumer (Amundsen *et al*., 1996). The monthly diet breadth was estimated using Levin´s (B*i*) standardized index, which varies from 0 to 1. Low values (< 0.6) indicate a diet dominant by few components and high values (> 0.6) indicate a generalist diet (Krebs, 1989; Labropolou *et al*., 1999).

A total of 55 stomachs were examined (April, n= 27; July, n= 28). The percentage values of fish with stomachs fullness in April were e 3, 53.6%; 2, 25%; and 4, 21.4%, and in July the most frequent values were 3 and 4, up to 50% and 42.8%, respectively. A total of fourteen components were identified, 10 in April

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Table 1. Diet composition of *K. elegans* during April and July 1997 in Loreto, B.C.S., Mexico, expressed in percentage by weight (% W) and frequency of occurrence (%FO).

Food component	April		July	
	%W	%FO	%W	%FO
RHODOPHYTA				
Gigartinaceae				
Gigartina spp.	2.452	3.703	5.944	3.571
Cystocloniaceae				
Hypnea spp.			0.016	3.571
Gracilariaceae				
Gracilaria spp.			1.220	21.428
Rhodomelaceae				
Laurencia spp.	0.278	3.703	0.032	3.571
Polysiphonia sp.	5.406	14.814	0.610	17.857
Halymeniaceae				
Prionitis spp.	0.055	3.703	0.025	3.571
Gelidiaceae				
Pterocladiella spp.			0.224	14.285
PHAEOPHYTA				
Dictyotaceae				
Dictyota spp.	1.895	7.407	1.767	21.428
Padina spp.			0.032	3.571
Sargassaceae				
Sargassum spp.	77.257	96.296	59.377	78.571
CHLOROPHYTA				
Caulerpaceae				
Caulerpa spp.	0.390	7.407		
Ulvaceae				
Enteromorpha spp.	9.643	29.629	3.052	7.142
Ulva spp.	2.341	11.111	13.719	39.285
MAGNOLIOPHYTA				
Zosteraceae				
Zostera spp.	0.278	3.703	13.976	3.571

samples and 13 in July, thirteen macroalgae and one seagrass (Table 1).

The scattergrams of frequency of occurrence vs. weight percentage show a marked dominance of *Sargassum* spp. during the examined months (Fig. 1) while the rest of the components contributed little. The diet of the Sea of Cortez seabream showed low values of diet width for both months (B*i* April = 0.070 and B*i* July = 0.127).

Many authors have relied on stomach content analysis as a tool for determining dietary components, estimating trophic position and energy flux, as well as a plataform for defining trophic structure and partitioning of food resources in a community (Gerking, 1994). Describing the diet of *K. elegans* is important because it is one of the most common species in the ichtyofauna of the Gulf of California (Aburto-Oropeza & Balart, 1991; Campos-Dávila *et al*., 2005) and little is known about its ecology, particularly about its feeding preferences. Moreover, this type of information is frequently used in the construction of trophic flux models (Pauly & Christensen, 1993; Livingston, 2002).

In general, herbivorus fish feed mainly on algae that cover reefs and on filamentous algae, consumption can be greater than 50% to 100% of the total algal production (Hay & Taylor, 1985). In spite of the occurrence of various food components in the Sea of Cortez seabream diet the proportion of *Sargassum* spp. is outstanding.

No differences were observed in the feeding preferences of *K. elegans* in spite of the more than three month separation between sampling periods (Figure 1). The availability of food resources is one of the main factors determining the presence and abundance of fish in marine environments. *Sargassum* spp. commonly form extensive beds that grow up to several meters from the bottom (Zertuche-González *et al*., 2006). These *Sargassum* beds represent both a food source for herbivorous as well as a critical habitat for numerous species of fish and invertebrates that they use as nurseries and refuge against predators (Rivera & Scrosati, 2006; Aburto-Oropeza *et al*., 2007).

Our results on the diet of *K. elegans* agree with those for other species of the Khyposidae (*v.gr*., Randall, 1967; Sazima, 1986; Zahorcsak *et al*., 2000; Silvano, 2001; Silvano & Ziggiatti, 2006). Randall (1967) and Topp (1970) describe the seabream as diurnal fish occurring in tropical and temperate rocky reefs. Similarly, Rimmer (1986), Clements & Choat (1997) and Moran & Clements (2002) describe them as fish showing morphological and physiological adaptations for feeding on algae,

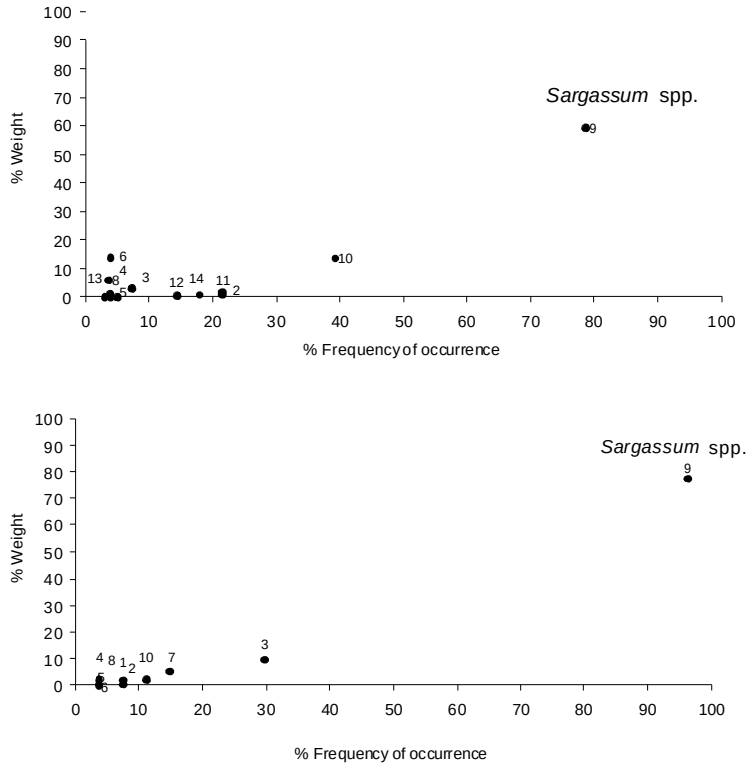

Figure 1. Food preference of *K. elegans* based on the frequency of occurrence (%) vs. gravimetric percentage of each food type. a) April y b) July. Numbers represent food types: 1 *Caulerpa* spp., 2 *Dictyota* spp., 3 *Enteromorpha* spp., 4 *Gigartina* spp., 5 *Laurencia* spp., 6 *Zostera* spp., 7 *Polysiphonia* sp., 8 *Prionitis* sp., 9 *Sargassum* sp., 10 *Ulva* sp., 11 *Gracilaria* sp., 12 *Hypnea* sp., 13 *Padina* sp., 14 *Pterocladiella* sp.

such as bacterial fermentation in stomach. Based on our results we conclude that *K. elegans* is a primary consumer with a relatively narrow feeding spectrum and a marked preference for *Sargassum* sp. However, increasing the sample size should support a more precise description of their diet.

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