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Estimates of length at first sexual maturity in *Cynoscion* spp. (Pisces: Sciaenidae) from the Gulf of Nicoya, Costa Rica

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Resumen: De enero 1987 hasta julio de 1988 se recolectó 820 *Cynoscion* con algún desarrollo en las gónadas en el Golfo de Nicoya. En *C. squamipinnis* y *C. phoxocephalus* el 50% de los peces maduros fueron de 36 a 45 cm, por lo que su talla a la primera madurez sexual se estimó en 40 cm. Se calculó una mortalidad por captura de peces juveniles de 32% para *C. squamipinnis* (16-35 cm). En *C. phoxocephalus* 38% de la captura se concentró sobre juveniles. La talla a la primera madurez sexual de *C. albus* se estimó en 75 cm (4.5 años de edad). Se encontró que el reclutamiento a la pesquería sucede antes que el biológico, por lo que se recomiendan regulaciones en el uso de las artes de pesca.

Key words: *Cynoscion,* corvina, sexual maturity, Golfo de Nicoya, gonads.

Fisheries exploitation in the Pacific of Costa Rica account for approximately 98% of landings; the fishing fleet is represented by artisanal and semi-industrial fishing boats, where the artisanal yields 68.8% of total fish production (CCT-WRI 1991). First Commercial Class Fish is formed by six species, four of which are *Cynoscion* spp. (corvinas), with one of the highest ex-vessel prices for the artisanal fleet.

There are few studies of the fisheries in Golfo de Nicoya. Madrigal (1985) stated that *Cynoscion squamipinnis* and *Micropogonias altipinnis* were already overexploited. Campos *et al.* (1984) concluded that shrimp trawlers discarded massive numbers of juvenile *Cynoscion spp,* thus affecting recruitment to the fishery. The latest available assessment indicates that Maximum Sustainable Yield has already been surpassed for the Gulf fishery (CCT-WRI 1991).

An analysis of the length at first sexual maturity for *Cynoscion* from the Gulf of Nicoya is presented here in an effort to add basic knowledge for the management of these species.

A total of 820 *Cynoscion* spp with some gonadal development, from 122 samples from artisanal boats in the upper Gulf of Nicoya (10'00 N, 85'00 W), were used for this study. Fish were measured (total length in cm) and dissected to record sex and gonadal development using an scale from I= inmature to VII=spawned (Laevastu 1974). Monthly frequencies of stages V and VI were pooled (V-VI) and interpreted as the frequency of mature fish. Column "%" that appears next to "TOTAL" in Table 1 is the accumulated percentage of mature individuals for each class interval. The point where 50% of the fish at a particular length interval were mature was taken as the length at first sexual maturity (LFSM).

Frequencies of gonadal development of *C. squamipinnis* and *C. phoxocephalus* are presented in Table 1. For both species 50% of mature fish were between 36 and 45 cm, achieving first sexual maturity around 40 cm. The most commonly used 89 mm gillnet has an

TABLE 1

Frequencies of stages of gonadal development by length class interval (cm) for C. squamipinnis, C. phoxocephalus *and C.* albus *in the Gulf of Nicoya, Costa Rica*

C. Squamipinnis

	stages of gonadal development						
	I	II	III	IV	V-VI	TOTAL	%
class interval							
16-20		1				1	-
21-25	3	1	1	1		6	-
26-30	21	18	8	5	3	55	5.4
31-35	13	25	24	17	27	106	25.4
36-40	3	13	18	25	53	112	47.3
41-45	-	3	21	22	77	123	62.6
46-50	-	1	7	12	83	103	80.6
51-55	-	2	-	4	18	24	75
56-60	-	-	-	1	3	4	75
> 61	1	-	-	1	1	3	33.3
TOTAL	41	64	79	88	265	537	

C. phoxocephalus

	I	II	III	IV	V-VI	TOTAL	%
10-15			1			1	-
16-20	2					2	-
21-25	6	1				7	-
26-30	9	1	1	2		13	-
31-35	4	8	9	1	2	24	8.3
36-40	2	7	13	6	12	40	30.O
41-45	-	4	17	37	62	120	62.0
46-50	-	-	2	2	15	19	78.9
51-55	-	-	-	-	1	1	100.0
TOTAL	23	21	43	48	92	227	

C. albus

	I	II	III	IV	V-VI	TOTAL	%
36-45	3	-	-	-	-	3	
46-55	-	-	-	-	3	3	
56-65	-	-	-	-	1	1	
66-75	2	-	2	2	4	10	40
76-85	-	1	2	-	8	11	72
86-95	-	1	-	1	14	16	77
96-105	1	-	1	-	8	10	57
>106	-	-	-	-	2	2	
TOTAL	6	2	5	3	40	56	

average capture at length of 44 cm and 51 cm for *C. squamipinnis* and *C. phoxocephalus*, respectively (Conquest *et al.* 1990). However, from 32% to 50% of total catch on *C. squamipinnis* goes to individuals with lengths between 16 and 40 cm (1-2 years in age, Conquest *et al.* 1990). In *C. phoxocephalus*, up to 38% of total catch goes to immature fish. Thus, for both species, a considerable amount of fishing mortality pressure goes to pre-recruits.

In *C. albus*, immature fish occur up to 65 cm (roughly age 4, Conquest *et al.* 1990); few individuals in stage V-VI are found in the 46-55 length interval (Table 1). Thus, first sexual maturity takes place at sizes larger than 65 cm.

The 89 mm gillnet shows an average length at capture of 51 and 53 cm, while the 127 mm gillnet has one of 60-66 cm respectively for *C. albus* and *C. stolzmanni*. At these lengths a considerable capture of pre-recruits is also taking place for these species.

This results indicate that commercial fishing is curtailing an important contribution to biomass (through growth) and to the genetic pool of the standing stock of these species, both natural processes needed to preserve population stability. That is, recruitment to the fishery is taking place before biological recruitment, which can lead to growth overfishing (Gulland 1983), specially in light of the reduced catch levels in recent years (Campos 1991).

A fishery closure for the inner Gulf of Nicoya enacted since 1987 prohibits use of gillnets between May and July. However maximum spawning in *C. squamipinnis* and *C. phoxocephalus* takes place from July to September (Campos 1991), and based on the growth rate of the former (Lai and Campos 1989), it is estimated that juveniles of this species will be around 10-20 cm between January and April. Thus, gear regulations should be modified to cover the first trimester of each year in order to protect juveniles and not only the pre-adults (20-40 cm) of the actual closure. No ageing data is available for *C. phoxocephalus*, but since average maximum length and spawning peaks are similar to *C. squamipinnis*, any management measure good for one should also benefit the other.

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