ICES CM 2010/E:29

# Spiny dogfish, *Squalus acanthias*, caught as bycatch in salmon driftnet fishery in the Pacific off the Kuril Islands and Kamchatka

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## INTRODUCTION

Spiny dogfish *Squalus acanthias* is widely distributed in temperate and warm waters of the Northern and Southern hemispheres from the Arctic to Sub Antarctic. The southern edge of its range in the North Pacific extends to the northern part of the East China Sea, Hawaii, and the southern tip of Baja California. Along the Asian coast, spiny dogfish is distributed as far north as Olyutorsky Cape in the western Bering Sea and in North American waters as far as Kotzebue Sound in the Chukchi Sea. During seasonal feeding migrations, dogfish move north along the coasts of Primoriye, Japan, and along the Kuril Islands, penetrating as far as Kamchatka waters of the Pacific and the southwestern Bering Sea. Since this shark occurs off Kamchatka in summer and autumn only and is considered a rare species, information on its occurrence and life history in this area is scarce.

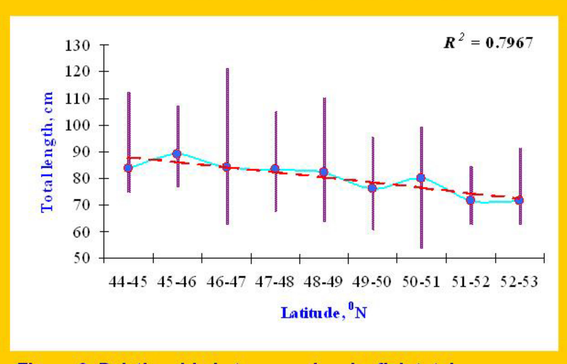


**Figure 2. Relationship between spiny dogfish total length and latitude (bars = variations, circles = means)**

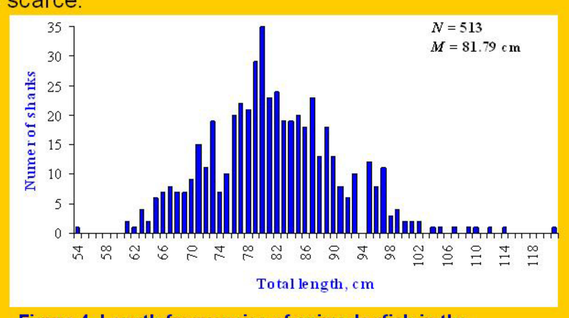


**Figure 4. Length frequencies of spiny dogfish in the Pacific waters off the Kurils and SE Kamchatka**

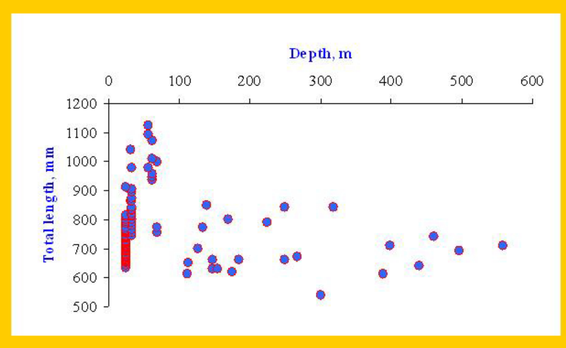


**Figure 3. Total length of spiny dogfish at various depths**

## MATERIALS

This presentation summarizes data on 1361 captures of spiny dogfish obtained in the Pacific waters off the Kuril Islands and Kamchatka taken by different fishing gears (salmon drift nets, bottom trawls and stationary nets) in 1993-2008.
Totally data on 512 specimens were sampled.

## OBJECTIVE

Here we provide the data on some external morphological characters, distribution, length and weight, physiological condition, diet composition and feeding habits, and reproduction of spiny dogfish in the Pacific waters off the Kuril Islands and Kamchatka.

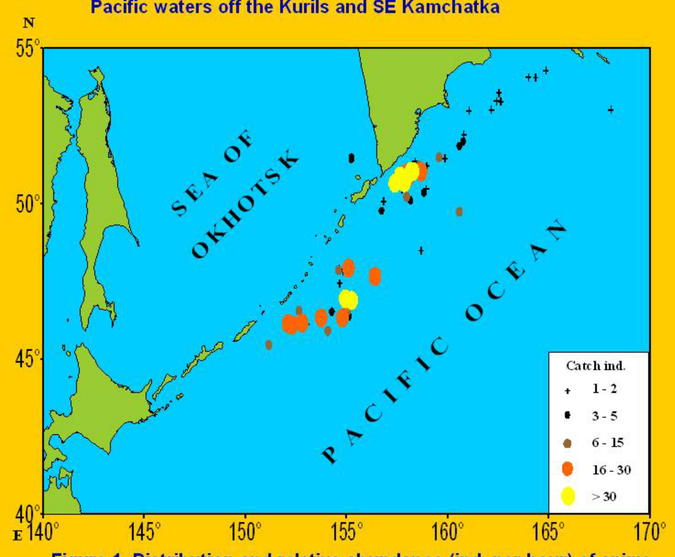


**Figure 1. Distribution and relative abundance (ind. per hour) of spiny dogfish in the Pacific off the Kuril Islands and Kamchatka**

**MAIN RESULTS 1.** The highest catch rates of spiny dogfish were observed off the southeastern Kamchatka and opposite the First Kuril Strait (Fig. 1). In these areas spiny dogfish occurred in May-December but most frequently in July-August and October-November during its northward feeding migrations. **2.** There were latitudinal changes of spiny dogfish total length (Fig. 2). In southernmost area (44º-45ºN) its TL varied 75 to 112 cm (mean 83.8 cm) while in northernmost area (52º-53ºN) it was 63 to 91 cm with mean 71.7 cm. **3.** No relation between TL and capture depth was observed (Fig. 3). However, largest individuals (>95 cm) were caught at depths < 100 m. **4.** Catches were represented by individuals of 54-121 cm total length with mean 81.79 cm (Fig. 4). Sharks with total length of 76-90 cm were most numerous (62.3%) in catches. **5.** There were no relationships between TL and condition factor (Fig. 7) and TL and gonado-somatic index (Fig. 8). **6.** The bulk of spiny dogfish diet off the southern Kuril Islands consisted of fish, cephalopods and worms (Fig.9). **7.** Diet compositions of male and female spiny dogfish differed notably (Fig. 10). **8.** Spiny dogfish increase in size is accompanied by changes of diet composition (Fig. 11). **9.** No relationships between TL and number of eggs and TL and maximum egg diameter (Fig. 12) were observed. **10.** Catches were represented mostly by immature individuals (97.6% of females and 83.7% of males). Maximum total length of immature female was 109 cm, while minimum mature female total length was 91 cm. **11.** Male and female spiny dogfishes statistically differed by five characters: standard length, length of first dorsal fin, distance between dorsal fins, distance between shout and orbit, and mouth width (Table 1). **12.** The northwest Pacific spiny dogfish has smaller pectoral fins as compared to the Black Sea, specimens, smaller distance between dorsal fins versus fish from NW and SE Atlantic and Black Sea; longer shout as compared to SE Atlantic, Black Sea and New Zealand specimens, larger orbit versus NW and SE Atlantic specimens and smaller orbit versus subantarctic individual, smaller mouth as compared to New Zealand fish (Table 2).

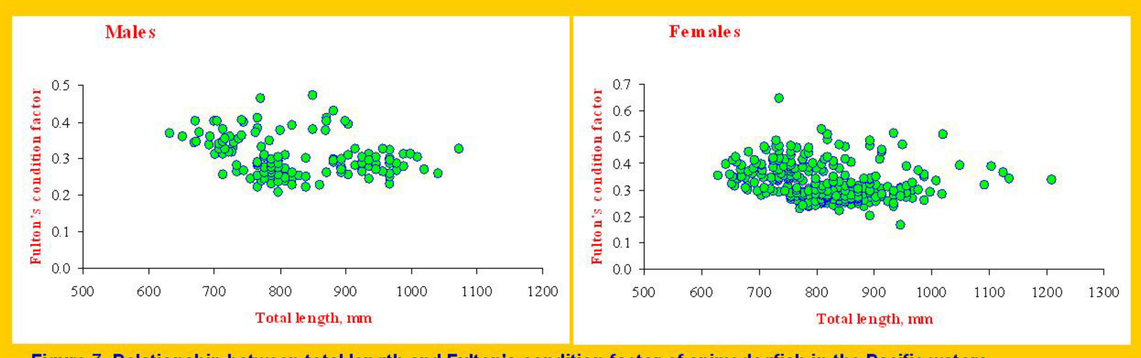


**Figure 7. Relationship between total length and Fulton's condition factor of spiny dogfish in the Pacific waters of the Kuril Islands and southeastern Kamchatka: females (left) and males (right)**

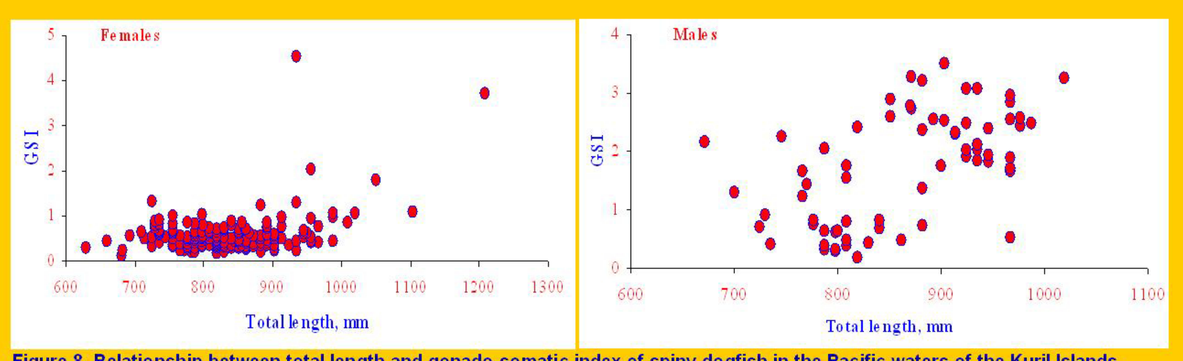


**Figure 8. Relationship between total length and gonado-somatic index of spiny dogfish in the Pacific waters of the Kuril Islands and southeastern Kamchatka: females (left) and males (right)**

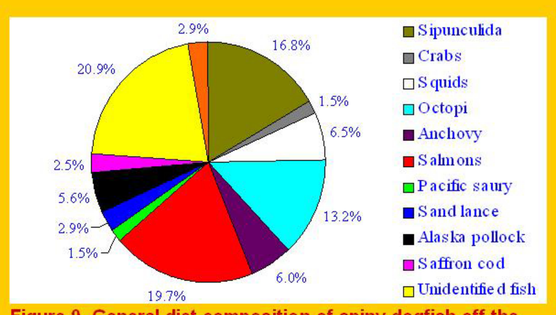


**Figure 9. General diet composition of spiny dogfish off the southern Kuril Islands, bottom trawl, October-November 2005**

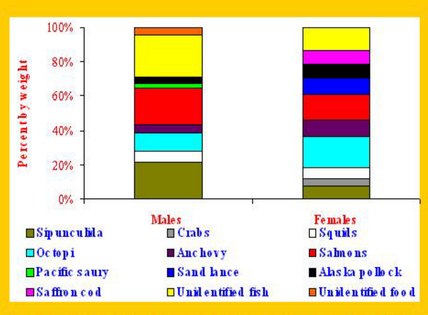


**Figure 10. Diet composition of male and female spiny dogfish off the southern Kuril Islands**

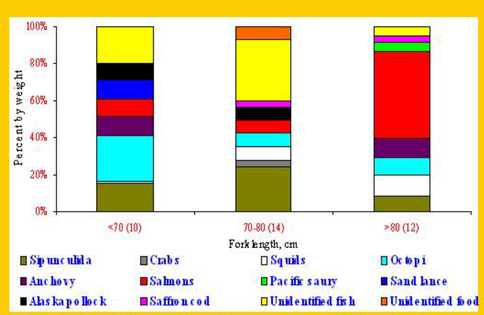


**Figure 11. Diet composition of spiny dogfish of various length classes off the southern Kuril Islands**

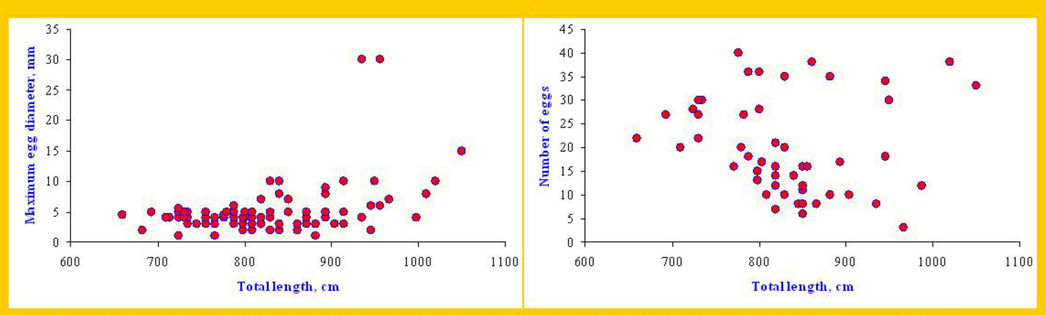


**Figure 12. Relationships between female spiny dogfish total length and maximum egg diameter (left) and total length and number of eggs (right) in the Pacific waters off the Kuril Islands and southeastern Kamchatka**

**Table 1. Some external morphological characters of spiny dogfish *Squalus acanthias* from Avacha Bay, southeastern Kamchatka**

| Character | Females | | Males | | Both sexes | |
|---|---|---|---|---|---|---|
| | Min-Max | Mean | Min-Max | Mean | Min-Max | Mean |
| Total length, cm (*TL*) | 65.3-80.1 | 73.0 | 67.0-76.3 | 71.5 | 65.3-80.1 | 72.6 |
| in % TL | | | | | | |
| Fork length (*FL*) | 86.2-89.4 | 88.1 | 87.5-89.6 | 88.6 | 86.2-89.6 | 88.3 |
| **Standard length** (*SL*) | 78.3-81.0 | 79.6 | 79.0-81.6 | 80.2 | 78.3-81.6 | 79.8 |
| Body height at origin of 1st dorsal fin (*H*) | 11.0-15.1 | 12.8 | 11.7-14.9 | 13.0 | 11.0-15.1 | 12.9 |
| Distance between snout and anal vent (*aA*) | 52.7-56.9 | 54.6 | 51.6-57.0 | 54.1 | 51.6-57.0 | 54.4 |
| Distance between snout and origin of 1st dorsal fin (*aID*) | 32.6-37.4 | 35.2 | 33.3-36.1 | 34.9 | 32.6-37.4 | 35.1 |
| **Length of 1st dorsal fin base** (*ID*) | 5.5-7.2 | 6.4 | 5.2-6.7 | 6.0 | 5.2-7.2 | 6.3 |
| Length of pectoral fin (*IP*) | 12.7-16.5 | 14.4 | 13.9-15.2 | 14.6 | 12.7-16.5 | 14.4 |
| **Distance between dorsal fins** (*DD*) | 21.7-24.0 | 23.0 | 22.1-25.5 | 23.7 | 21.7-25.5 | 23.2 |
| **Distance between snout and orbit** (*aO*) | 6.8-8.0 | 7.5 | 6.9-7.6 | 7.3 | 6.8-8.0 | 7.5 |
| Orbit diameter (*O*) | 3.1-3.8 | 3.5 | 3.3-3.6 | 3.4 | 3.1-3.8 | 3.5 |
| **Mouth width** (*B*) | 5.8-7.6 | 6.9 | 5.9-7.4 | 6.6 | 5.8-7.6 | 6.9 |
| Number of specimens measured (*n*) | 18 | | 7 | | 25 | |

**Note: statistically significant differences between males and females are in bold (p < 0.1)**

**Table 2. Comparison of some external morphological characters of spiny dogfish *Squalus acanthias* from different areas (specifications of morphological characters are given in Table 1; 1 – Myagkov and Kondyurin 1986; 2 – Kondyurin and Myagkov 1982; 3 – Pshenichnov 1997; na – not available).**

| Character | NW Pacific (our data) | | NE Atlantic[1] | NW Atlantic[1] | | SE Atlantic[1,2] | | Black Sea[1] | New Zealand[1] | Sub Antarctic[3] |
|---|---|---|---|---|---|---|---|---|---|---|
| | ♀ | ♂ | ♂ | ♀ | ♂ | ♀ | ♂ | ♀+♂ | ♀ | ♀ |
| *TL*, cm | 65.3-80.1 | 67.0-76.3 | 56.2-77.8 | >80 | 32.2-40.0 | 67.1-78.0 | 48.8-64.0 | 104.0-148.2 | 74.2-93.5 | 71.9 |
| In % TL | | | | | | | | | | |
| *FL* | 86.2-89.4 | 87.5-89.6 | na | na | na | 90.3 | 90.4 | na | na | 88.9 |
| *SL* | 78.3-81.0 | 79.0-81.6 | na | na | na | na | na | na | na | 80.1 |
| *aID* | 32.6-37.4 | 33.3-36.1 | 34.2-35.6 | 35.0 | 36.0 | 33.8 | 33.7 | 32.5-34.4 | 34.7-35.4 | 32.9 |
| *ID* | 5.5-7.2 | 5.2-6.7 | 6.8-7.2 | 5.6 | 4.9 | 7.1 | 6.8 | 6.1-6.3 | 5.3-5.7 | 7.1 |
| *IP* | 12.7-16.5 | 13.9-15.2 | 12.9-14.0 | 14.4 | 12.7 | 15.0 | 14.4 | 12.1-12.2 | 14.6-15.1 | 13.3 |
| *DD* | 21.7-24.0 | 22.1-25.5 | 25.2-27.5 | 30.2 | 29.0 | 29.3 | 29.9 | 26.7-27.0 | 25.3-26.2 | 23.8 |
| *aO* | 6.8-8.0 | 6.9-7.6 | 6.0-6.6 | na | 7.4 | 6.4 | 6.3 | 5.8-6.6 | 5.7-5.8 | 6.8 |
| *O* | 3.1-3.8 | 3.3-3.6 | 2.8-3.3 | na | 4.0 | 4.3 | 4.2 | 2.6-3.7 | 3.0-3.7 | 2.4 |
| *B* | 5.8-7.6 | 5.9-7.4 | 6.4-7.4 | na | 6 | 6.9 | 6.4 | 5.8-6.2 | 5.4-5.6 | 7.4 |
| *n* | 18 | 7 | 4 | 25 | 16 | 20 | 20 | 20 | 2 | 1 |