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# Bycatch of the pelagic ray *Dasyatis violacea* in Uruguayan longline fisheries and aspects of distribution in the southwestern Atlantic*

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SUMMARY: The presence of the pelagic ray *Dasyatis violacea* (Bonaparte, 1832) in Uruguayan waters has been monitored since April 1998, the beginning of the National Observer Programme on board the Uruguayan tuna fleet (PNOFA). These are the first records of these species for the South Atlantic off Uruguay. Its distribution within the area is analysed, based on 13 trips made from April 1998 to September 2001 from 26 to 37ºS. Five hundred and twenty five specimens were caught during this period. The presence of the species appears to be closely associated with the highest values of surface water temperature, with CPUE being relatively low below 20ºC. The southern border of its distribution is around 36ºS. *Dasyatis violacea* is part of a well-defined warm water fauna that reaches Uruguayan and northern Argentinean waters following warm subtropical waters. The incidental capture of *D. violacea* in the area reaches significant levels; the species is always discarded. We suggest that this bycatch is important and should be monitored from a conservation point of view.

*Key words*: longline fisheries, bycatch, *Dasyatis violacea*, southwestern Atlantic.

RESUMEN: CAPTURA INCIDENTAL DE LA RAYA PELÁGICA *DASYATIS VIOLACEA* POR LA FLOTA PALANGRERA URUGUAYA Y ASPECTOS DE SU DISTRIBUCIÒN EN EL ATLÀNTICO SUDOCCIDENTAL. – La presencia de la raya pelágica *Dasyatis violacea* (Bonaparte, 1832) en aguas uruguayas ha sido detectada desde el comienzo del Programa Nacional de Observadores a bordo de la Flota Atunera Uruguaya (PNOFA) en abril de 1998. Este es el primer informe sobre esta especie para el Atlántico Sur, frente a las costas de Uruguay. Se analiza su distribución dentro del área, sobre la base de 13 viajes realizados entre abril de 1998 y septiembre de 2001, entre los 26º y 37º S. Durante dicho período se capturaron quinientos veinticinco ejemplares. La presencia de esta especie parecería estar estrechamente relacionada con los valores más altos de temperatura superficial del agua, con una CPUE relativamente baja por debajo de los 20º C. La frontera sur de distribución de la especie estaría alrededor de los 36º S. *Dasyatis violacea* integra una fauna de agua templada bien determinada, que alcanza las aguas uruguayas y del norte de Argentina, siguiendo corrientes subtropicales templadas. La captura incidental de *D. violacea* en dicha área alcanza cifras significativas. Esta especie es siempre descartada. Sugerimos que esta captura fortuita es importante y debería ser analizada, a efectos de generar medidas que permitan su conservación.

*Palabras clave*: pesquería de palangre, captura fortuita, *Dasyatis violacea*, Atlántico sudoccidental.

## INTRODUCTION

*Dasyatis violacea* is widely distributed in the tropical and subtropical areas of the Pacific, Atlantic and Indian Oceans. It is the only currently known pelagic species in the family Dasyatidae. Knowledge about its distribution has improved with the increase in longline fisheries in several areas (Scott and Tibbo, 1968; Wilson and Becket, 1970; Nishida and Nakaya, 1990; Menni

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TABLE 1. – Dates of capture of *Dasyatis violacea*. Effort is number of hooks and CPUE is number of individuals per 1000 hooks. Mean temperature (ºC) refers to surface water.

| | Date | Nº of sets | Effort | Mean tem. (ºC) | Number of individuals | Cpue |
|---|---|---|---|---|---|---|
| 1998 | 9-27/APR | 15 | 14,850 | 21.94 | 91 | 6.13 |
| | 13/JUL-14/AUG | 26 | 25,045 | 18.73 | 19 | 0.76 |
| | 18-27/OCT | 7 | 6,160 | 19.4 | 5 | 0.81 |
| | 30/OCT-10/NOV | 11 | 12,000 | 18.97 | 22 | 1.83 |
| 1999 | 2-13/APR | 11 | 12,470 | 23.18 | 143 | 11.47 |
| | 2-14/JUL | 11 | 11,530 | 19.13 | 1 | 0.09 |
| | 21/AUG-29/OCT | 49 | 42,390 | 19.14 | 228 | 5.38 |
| 2000 | 17/SEPT-1/OCT | 10 | 8,300 | 18.5 | 3 | 0.36 |
| | 17-29/SEPT | 7 | 6,450 | 19.43 | 2 | 0.31 |
| | 18-23/NOV | 5 | 4,100 | 19.1 | 3 | 0.73 |
| 2001 | 4-16/JUN | 12 | 10,220 | 21.18 | 5 | 0.49 |
| | 23/JUL-6/AUG | 9 | 10,160 | 19.57 | 2 | 0.20 |
| | 8-25/SEPT | 12 | 12,910 | 20.89 | 1 | 0.08 |

*et al*., 1995; Menni and Stehmann, 2000; Mollet, 2002).

In Uruguay the tuna longline fishery started in 1969 with a single vessel which operated until 1974 (Nion, 1999). In 1981, the fishery was reactivated with a tuna fleet (Ríos *et al*., 1986) operating through to the present time. Two different fishing operations occurred during this period. From 1981 to 1992, vessels with Japanese skippers and gear targeted mainly swordfish (*Xiphias gladius*), bigeye tuna (*Thunnus obesus*) and yellowfin tuna (*Thunnus albacares*) that were landed frozen (Ríos *et al*., 1986). From 1992 to the present, vessels with American-type monofilament longline gear targeted mainly swordfish that was landed fresh (Domingo *et al*., 2001). During the latter period, fishing permits for experimental fishing were granted to two foreign vessels which operated from 1993 to 1996, capturing swordfish with a monofilament gear different from that used by the fleet (Marín *et al*., 1998).

The *D. violacea,* was reported from the Atlantic by Bigelow and Schroeder (1962), and from the Gulf of Mexico by Branstetter and McEachran (1983). Off Brazil, *D. violacea* has been recorded from between 20º53´ and 21º36´S and between 37º16´ and 46º44´W (Sadowsky and Amorim, 1977; Sadowsky *et al*, 1986). Menni *et al*. (1995) reported a female from 8º24´S and 31º33´W off northeastern Brazil. Subsequently, many individuals of *D. violacea* were captured off northeastern Brazil within the area from 2º30´ to 8º30´S and from 30º30´to 32º30´W, over bottom depths well below 4000 m. Temperatures at the surface for these capture locations ranged between 26.5 and 28.5ºC (mean 27.75ºC, N= 14), but the calculated temperatures at the hook depth where *D. violacea* was caught ranged from 13.4 to 27.0ºC (mean 17.34ºC, N= 8) (Menni and Stehmann, 2000).

This work reports the presence of *D. violacea* in Uruguayan waters and analyses its distribution and share in the total and discarded capture.

## MATERIAL AND METHODS

Specimens and data were obtained from 13 trips carried out from April 1998 to September 2001 (Table 1) by the National Observer Programme on board the Uruguayan Tuna Fleet of the Dirección Nacional de Recursos Acuáticos (formerly Instituto Nacional de Pesca). This programme was implemented in 1998, and one of its main objectives is to record the composition and quantity of the capture. Sampling was carried out on longliners targeting swordfish, which operate within the Uruguayan Economic Exclusive Zone (EEZ) and adjacent international waters, between 26 and 37ºS and 36 and 55ºW (Fig. 1). The fleet used an American-type

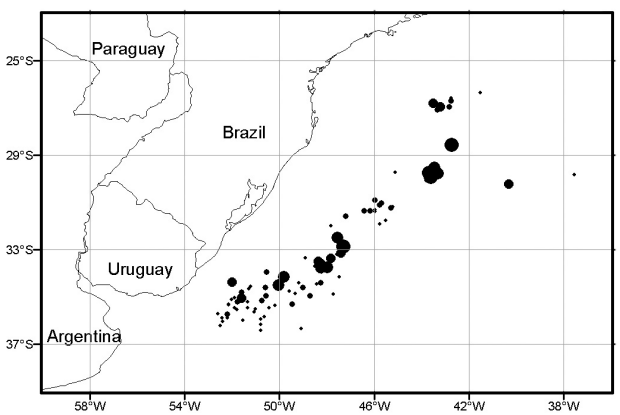


FIG. 1. – *Dasyatis. violacea* capture areas.

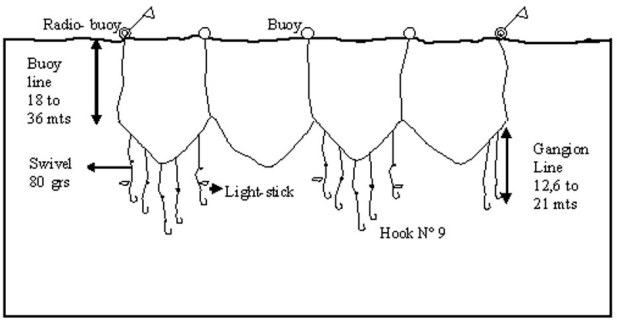


FIG. 2. – Gear used by Uruguayan long line vessels

monofilament longline (Fig. 2). The total captures were classified as capture, catch, discard (bycatch and release) (Hall, 1996) and lost catch (Domingo, 2002). The capture per unit effort (CPUE) was calculated as the number of individuals per 1000 hooks. The discard modality makes sex determination rather difficult and data in this connection may be biased. Therefore, sex-ratio was not included in this study. Eight specimens were measured (Table 2) and deposited with the fish collection of the Facultad de Ciencias de la Universidad de la República Oriental del Uruguay (ZVC-P No. 4566 to ZVC-P 4573). Measurements were taken according to Bigelow and Schroeder (1962), Hubbs and Ishiyama (1968) and Stehmann (1995). No morphometrics were taken for the rest of the specimens captured.

## RESULTS

A total of 525 individuals of *D. violacea* were captured during the analysed period: 137 in 1998, 372 in 1999, 8 in 2000 and 8 in 2001 (Table 1).

The morphometrics of the 8 specimens collected agree with the available information provided by Scott and Tibo (1968), Wilson and Beckett (1970), Nakaya (1982), Lamilla and Melendez (1989), Nishida and Nakaya (1990) and Menni *et al*. (1995) (Table 2).

TABLE 2. – Morphometrics of specimens of *Dasyatis violacea* deposited with the fish collection of the Facultad de Ciencias, Uruguay. Measurements as percent of disc width.

| Measurement | Male 1 | Male 2 | Male 3 | Male 4 | Male 5 | Female 6 | Male 7 | Male 8 |
|---|---|---|---|---|---|---|---|---|
| Total length (mm) | 940 | 970 | 920 | 994 | 1146 | 956 | 990 | 860 |
| Disc width (mm) | 450 | 240 | 458 | 434 | 460 | 568 | 446 | 378 |
| Disc length | 75.56 | 133.34 | 78.6 | 75.58 | 78.69 | 78.52 | 81.61 | 76.19 |
| Anterior Projection | 34.23 | 62.92 | 38.65 | 35.71 | 38.04 | 36.44 | 30.94 | 33.07 |
| Snout tip to origin cloaca | 62.89 | 111.67 | 68.56 | 63.82 | 67.39 | 72.18 | 68.61 | – |
| Snout tip to pelvic fin | 63.12 | 108.34 | 67.25 | 61.75 | 64.78 | 69.37 | 66.59 | 64.55 |
| Preorbital length | 11.23 | 20.83 | 13.75 | 12.79 | 12.39 | 13.2 | 14.12 | 13.76 |
| Prenasal length | 10.23 | 17.5 | 11.35 | 9.91 | 10.22 | 10.03 | 9.64 | 9.79 |
| Preoral length | 14.45 | 22.08 | 14.52 | 13.71 | 14.56 | 13.53 | 14.12 | 13.76 |
| Prespiracular length | 16.89 | 30.42 | 19 | 17.28 | 17.39 | 16.55 | 18.83 | 16.67 |
| Eye diameter | 4 | 6.46 | 3.6 | 3.34 | 3.26 | 3.08 | 3.47 | 3.31 |
| Interorbital width | 15.12 | 25.21 | 14.3 | 14.17 | 15.33 | 14.26 | 17.71 | 13.89 |
| Spiracle length | 6.12 | 8.54 | 5.24 | 5.41 | 5.33 | 6.16 | 5.83 | 4.76 |
| Interspiracular width | 18 | 32.5 | 18.56 | 17.28 | 17.39 | 16.2 | 19.17 | 16.14 |
| Nasal curtain width | 12.23 | 20.42 | 11.57 | 11.75 | 12.39 | 10.74 | 12.11 | 10.98 |
| Nasal curtain length | 4.78 | 9.37 | 3.71 | 3.92 | 4.13 | 3.17 | 4.26 | 3.44 |
| Internarial width | 9.89 | 17.92 | 9.5 | 10.14 | 9.78 | 8.8 | 10.2 | 8.73 |
| Mouth width | 13.12 | 22.08 | 12.66 | 12.9 | 13.48 | 12.76 | 13.45 | 13.09 |
| Snout tip to first gill opening | 24.67 | 41.67 | 24.89 | 23.04 | 24.56 | 23.06 | 25.34 | 21.43 |
| Snout to fifth gill opening | 36 | 62.92 | 35.81 | 32.95 | 35.22 | 34.68 | 37.22 | 32.54 |
| Interspace first gill slits | 19.34 | 33.54 | 18.12 | 18.89 | 19.02 | 19.01 | 19.17 | 18.52 |
| Interspace fifth gill slits | 12.67 | 21.25 | 13.1 | 12.21 | 12.39 | 12.67 | 13.45 | 13.49 |
| Branchial basket length | 11.78 | 20 | 11.13 | 10.83 | 11.3 | 12.15 | 12.56 | 10.85 |
| Pectoral fin inner margin | 11.34 | 24.17 | 10.15 | 11.29 | 11.3 | 11.09 | 11.21 | 8.46 |
| Pectoral fin anterior margin | 14.23 | 24.17 | 13.32 | 14.86 | 12.28 | 10.21 | 11.55 | 10.85 |
| Posterior margin of pectoral fin | 7.89 | 15.62 | 8.84 | 8.98 | 8.26 | 10.39 | 8.74 | 8.2 |
| Pelvic fin base | 7.23 | 14.58 | 8.08 | 5.99 | 8.15 | 8.27 | 8.74 | – |
| Pelvic fin Inner margin. | 4.23 | 5.84 | 4.58 | 4.6 | 4.56 | 10.56 | 4.48 | 3.17 |
| Tail width | 6.56 | 11.67 | 6 | 5.99 | 5.43 | 5.98 | 5.83 | 5.82 |
| Tail height | 4 | 7.5 | 4.15 | 3.69 | 4.13 | 4.05 | 3.59 | 3.97 |
| Distance from origin of cloaca to spine origin | 34 | 60.42 | 33.84 | 30.64 | 35.22 | 32.75 | 35.87 | – |
| Spine length | 27.56 | 54.17 | – | 28.11 | – | 25.18 | 24.66 | 29.1 |
| Clasper length | 24 | 45.84 | 24.45 | 23.96 | 24.35 | – | 25.11 | – |
| Clasper external length | 10.45 | 19.58 | 12.88 | 11.4 | 10.87 | – | 10.76 | 13.76 |
| Number of oral papillae | 4-6 | 6-8 | 5-5 | 5-6 | 4-5 | 6-7 | 5-6 | 7-5 |
| Supracaudal membrane | Absent | | | | | | | |
| Infracaudal membrane | Weakly developed, continues along the spine, 1.5 mm width | | | | | | | |

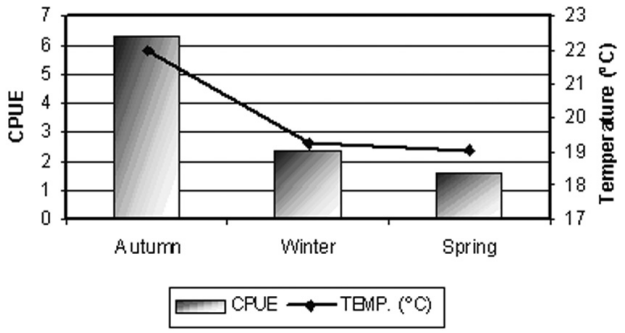


FIG. 3. – *Dasyatis violacea*. Seasonal variation in capture.

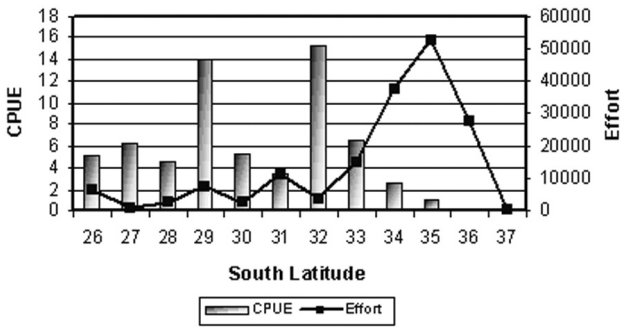


FIG. 4. – *Dasyatis violacea*. CPUE and effort according increasing South latitude

Longline sets were made at depths ranging from 40 to 60 m, over bottom depths ranging from 750 to 5000 m. *D. violacea* were captured in 51% of the sets, of which 2% were made at depths below 1000 m, 10% between 1000 and 2000 m, 15% between 2000 and 3000 m, and 73% below 3000 m.

CPUE values reached maximum levels (6.1 and 11.5 individuals/1000 hooks) in April 1998 and 1999 respectively, and minimum levels (0.09 and 0.08 individuals/1000 hooks) in July 1999 and September 2001 (Table 1). The highest seasonal accumulated CPUE values were observed in fall, with 6.4 specimens/1000 hooks, and the lowest were recorded in spring, with 1.6 specimens/1000 hooks. Likewise, the maximum (22.1ºC) and minimum (19.1ºC) mean water temperatures were observed in fall and spring respectively (Fig. 3). The highest CPUE values by latitude were observed between 29 and 32ºS, while the lower values were observed between 34 and 37ºS, in spite of increasing effort (Fig. 4).

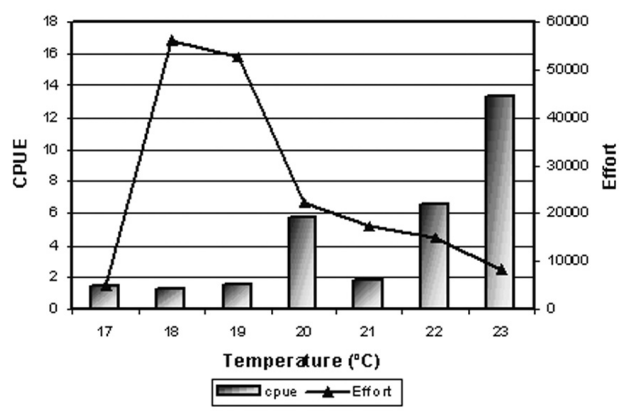


FIG. 5. – *Dasyatis violacea*. CPUE and effort as related to Temperature

Considering the range of mean surface water temperature, values of CPUE were higher between 20 and 23ºC and lower between 17 and 19ºC (Fig. 5).

For the period 1998-2001, the *D. violacea* represented 3.1% of the observed capture, 9.3% of the discarded capture and 0.1% of the lost capture.

## DISCUSSION

This is the first record of *D. violacea* in Uruguay ocean waters. *Dasyatis violacea* occurs almost worldwide at tropical, subtropical and temperate latitudes. Its migratory patterns and reproduction cycles are not known. However, it has been suggested that in the eastern Pacific females give birth in winter in the warmer waters off the coast of Central America and then migrate to higher latitudes (Mollet, 2002). Mollet *et al*., 2002, suggest that the gestation period is short and there may be up to two litters per year.

*Dasyatis violacea* is captured off southeastern and southern Brazil between 20 and 33ºS and between 40 and 50ºW, together with a typical pelagic longline fauna at about 200 m depth (Sadowsky and Amorim, 1977; Sadowsky *et al*., 1986).

Menni and Stehmann (2000) reported numerous specimens obtained off northeastern Brazil from 2º30´ to 8º30´S and from 30º30´ to 32º30´W. Bottom depths at all these stations were well below 4000 m. In contrast, *D. violacea* was not captured towards the northwest, where there are large submarine banks and the waters are more shallow.

Marín *et al*. (1998) reported the presence of *Dasyatis sp*. in the Atlantic Ocean. From the data available with regard to the fishing area, gear, target species and accompanying fauna, it may be assumed that the species reported was *D. violacea*. In the area under study *D. violacea* apparently forms part of the epipelagic fauna. Off Uruguay from 26 to 37ºS, with hooks set between 40 and 60 m, *D. violacea* was captured in 51% of the sets.

Marín *et al*.(1998) reported that the highest proportion of captures (10.1% of the total) were in

oceanic waters over 200 miles from the coast. The lowest proportion (0.4 to 0.7%) was reported from the Uruguayan EEZ over bottoms less than 600 m deep.

Considering the distribution of *D. violacea* according to latitude, our results show that an sharp decrease in CPUE is observed below 33ºS in spite of increasing effort. However, there are CPUE peaks at 29ºS and 32ºS which are apparently not related to latitude but to local variations in surface water temperature.

In our study, an increase in the CPUE was observed with increasing surface water temperature, with CPUE being relatively low below 20ºC (Fig. 5). Captures of *D. violacea* were higher with increased autumn temperatures, and decreased in winter and spring with lower temperatures (Fig. 3). This trend was supported by the fact that captures increased with higher surface water temperatures despite lower fishing effort. This pattern, also observed in sharks of the genus *Sphyrna*, is relatively common in subtropical chondrichthyan and osteichthyan species. Briggs (1974) suggested that the latitude of the Rio de la Plata mouth was the probable southern limit of the warm temperate fauna. Three chondrichthyan families and twenty teleostean families (tropical and subtropical) do not occur beyond this border (Menni 1981).

*Dasyatis violacea* has a wide distribution in the south western Atlantic, being more abundant at latitudes below 34ºS. Data collected by Mollet (2002), together with information from this study suggests that this species occurs throughout the Atlantic Ocean.

Though wholly discarded, the species is part of the bycatch of the Uruguayan pelagic fishery. The hooks are removed by smashing the fish against the rail because the crew are concerned about injury from the ray's spine, which can result in them being off work for a few days. Consequently, most individuals are discarded with serious mouth and/or jaw damage and probably have a low chance of survival.

CPUE values decrease from autumn to spring, following decreasing mean surface water temperatures. Considering the CPUE values obtained and a 100% discard with low survival, it is obvious that more attention should be given to the capture of this species by the longline fleets.

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## REFERENCES

Bigelow, H.B. and W.C. Schroeder. – 1962. Fishes of the Western North Atlantic. *Sears Found. Mar. Res*., 1(1): i-xvii, 1-576.

Branstetter, S. and J.D. McEachran. – 1983. A first record of the bigeye tresher, *Alopias superciliosus*, the blue shark, *Prionace glauca*, and the pelagic stingray, *Dasyatis violacea*, from the Gulf of Mexico.*Northeast Gulf Sci*. Vol. 6 Nº 1. pp. 59-61

Briggs, J.C. – 1974. *Marine Zoogeography*. McGraw Hill Book Company, New York, 475 pp.

Domingo, A. – 2002. Bycatch and lost catch in the Uruguayan longline fishery. *Shark News*, 14: 3.

Domingo, A., O. Mora and M. Cornes. – 2001. Evolución de las capturas de elasmobranquios pelágicos en la pesquería de atunes de Uruguay, con énfasis en los tiburones azul (*Prionace glauca*), moro (*Isurus oxyrinchus*) y porbeagle (*Lamna nasus*). *Col. Vol. Sci. Pap. ICCAT*, 54(4): 1406-1420.

Hall, M.A. – 1996. On bycatches. *Rev. Fish Biol. Fish.,* 6: 319-352.

Hubbs, C. and R. Ishiyama. – 1968. Methods for the taxonomic study and description of skates (Rajidae). *Copeia,* 3: 483-491.

Lamilla J. and R. Melendez. – 1989. Primer registro de *Dasyatis violacea* (Bonaparte, 1832) (Myliobatiformes: Dasyatidae) en las cercanias de la Isla de Pascua. *Estud. Oceanol*., 8: 45-50

Marín Y.H., F. Brum, L.C. Barea and J.F. Chocca. – 1998. Incidental catch associated with swordfish longline fisheries in the south-west Atlantic Ocean. *Mar. Freshwater Res*., 49:633-699

Menni, R.C. – 1981. Sobre la distribución de los peces marinos de la Argentina. In: *Symposia*, *VI Jornadas Arg. Zool*., pp. 57-73. Ramos Americana, La Plata.

Menni, R.C. and M.F.W. Stehmann. – 2000. Distribution, environment and biology of batoid fishes off Argentina, Uruguay and Brasil. A review. *Rev. Mus. Arg. Cienc. Nat., n.s.,* 2(1): 61-109.

Menni, R.C., F.H.V. Hazin and R.D.T. Lessa. – 1995. Occurrence of the night shark *Carcharhinus signatus* and the pelagic stingray *Dasyatis violacea* off northeastern Brazil. *Neotropica*, 41(105-106):105-110.

Mollet, H.F. – 2002. Distribution of the pelagic stingray, *Dasyatis violacea* (Bonaparte, 1832), off California, Central America, and worldwide. *Mar. Freshwater Res*., 53: 525-530.

Mollet, H.F., Escurra, J.M. and O'Sullivan, J.B. – 2002. Captive biology of the pelagic stingray, *Dasyatis violacea* (Bonaparte, 1832), *Mar. Freshwater Res*., 53: 531-541.

Nakaya K. – 1982. *Dasyatis violacea*. In: O. Okamura *et al*. (eds.), *Fishes of the Kyushu-Palau Ridge and Tosa Bay* pp. 54, 55 and 315. JAMARC. Tosho Printing Co, Tokyo.

Nion, H. – 1999. La pesquería de Tiburones en el Uruguay, con especial referencia al cazón (*Galeorhinus galeus* Linnaeus, 1758). In: R. Shotton (ed.) *Case studies of the management of elasmobranch fisheries*, pp. 218-267. FAO F.T. Papers Nº 378, part 1. Roma, FAO. 199.

Nishida, K. and Nakaya K. – 1990. Taxonomy of the genus *Dasyatis* (Elasmobranchii, Dasyatidae) from the North Pacific. In: H.L. Pratt Jr., S.H. Gruber and T. Taniuchi (eds.), *Elasmobranchs as living resources advances in the biology, ecology, systematics and the status of fisheries*, pp. 327-346. NOAA Technical Report NMFS 90.

Ríos C.R. Leta, O. Mora and J. Rodríguez. – 1986. La pesca de atunes y especies afines por parte de la flota de altura palangrera uruguaya. *1er Simp. Cient. CTMFM* 1 (II): p. 483-54

Sadowsky, V. and A.F. de Amorim. – 1977. Primeiro registro de

ocorrência da arraia pelágica *Dasyatis violacea* (Bonaparte, 1832) nas águas do Atlántico Sul Occidental. *Ciencia e Cultura*, Supl. Resumos, 29(7): 792.
Sadowsky, V., A.F. de Amorim, C.A. Arfelli and O.B.F. Gadig. – 1986. Composicâo da fauna de peixes cartilaginosos pelágicos do Sudeste e Sul do Brasil. Res. II Reuniâo Grupo de Trabalho Pesca e Pesquisa de Tubarôes e Arraias no Brasil, Maranhâo (without page number).
Scott, W.B. and S.N. Tibbo. – 1968. An occurrence of the pelagic stingray, *Dasyatis violacea*, in the northwest Atlantic. *J. Fish. Res. Bd. Can.*, 25: 1075-1076.
Stehmann, M. – 1995. A record of *Raja clavata*, the eastern Atlantic thornback skate, from the southern Madagascar Ridge at Walters Shoal (Elasmobranchii, Rajidae). *J. Ichthyol.*, 35(5): 63-73.
Wilson, D.B. and J.S. Beckett. – 1970. Atlantic Ocean distribution of the pelagic stingray, *Dasyatis violacea*. *Copeia,* 4: 696-707.

Scient. ed.: W. Norbis