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THE OCCURRENCE OF IMPOSEX IN THE GASTROPOD NUCELLA LAPILLUS AT SITIES IN SPAIN AND PORTUGAL

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RESUMEN:

En el presente trabajo se han establecido los valores del Imposex de la especie **Nucella lapillus** en 22 localidades a lo largo de la costa atlántica de la Península Ibérica desde la Costa Vasca hasta Portugal.

Los valores más altos, correlacionados con la contaminación producida por la pintura anti-incrustante, se observan en el NW de la península Ibérica con valores superiores al 30%.

Palabras Clave: Nucella lapillus, contaminación por TBT, Imposex, España, Portugal.

SUMMARY: The occurrence of imposex in the gastropod Nucella lapillus at sites in Spain and Portugal.

In this work, the value of the **Nucella lapillus** species in 22 localities along the Atlantic Coast of the Iberian Peninsula, from the Basque Coast to Portugal, are established.

The highest values, correlated with the contamination produced by the anti-incrustation paint, are observed in the NW of the Iberian Peninsula with values higher than 30%.

Key Words: Nucella lapillus, contamination by TBT, Imposex, Spain, Portugal.

LABURPENA:

Lan honetan **Nucella lapillus** itsas-kurkuiluaren "Imposex" neurriak kalkulatu dira. Euskokostaldetik Portugaleko kostalderaino 22 muestra hartu dira.

Hartu diren muestretan oso "Imposex" altua ikusi da, Galizia kostaldean hartutakoetan handienetakoak azaltzen direlarik (handiena Bayonan-Galizia-%32).

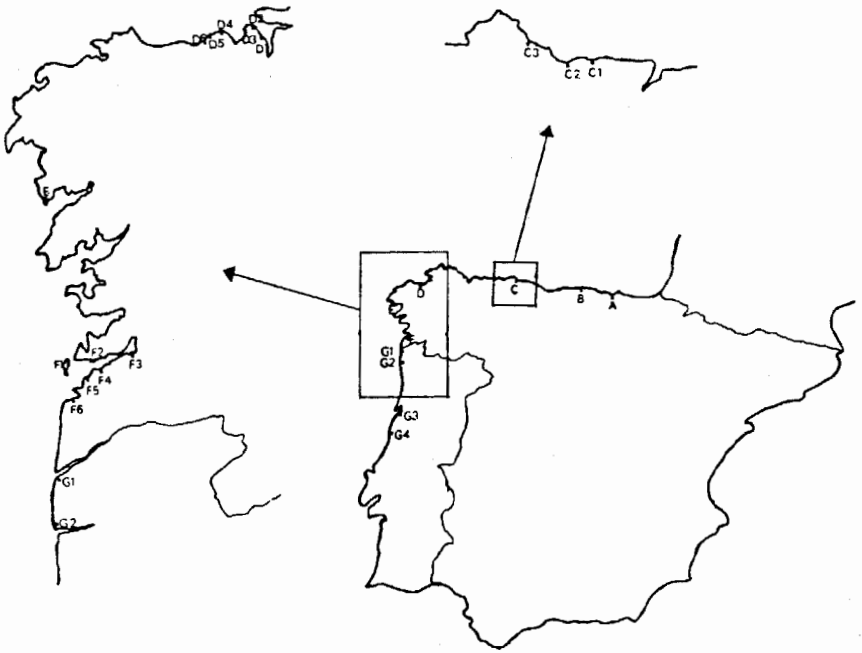

Fig.1-Localities of sampling

1. INTRODUCCION.

In recent years a marked decline has been noted in populations of the gastropod **Nucella lapillus** at a number of sites around the British Isles. Normally this species is an abundant and conspicuous component of the fauna of the rocky sea-shore where in many instances it may be considered the dominant carnivore (Lewis 1964). A series of studies carried out in south west England (Bryan et al 1986, 1987; Gibbs et al 1987 & Gibbs and Bryan 1986) have shown that **Nucella** populations have declined as a result of the use of tributyl tin (TBT) as a bio-toxic agent in the anti-fouling paints which are used on the hulls of boats and the cages of fish-farms.

On exposure to concentrations of TBT as low as 3ng/l female **Nucella** begin to develop male characteristics. A similar process has been observed in **Nassarius obsoletus** by Smith (1980) and has been referred to as "imposex". In this species female snails develop a penis which is linked by a vas defferens to the capsule gland. Similar symptoms may also occur in **Nucella**; Gibbs and Bryan (1986) have shown that in extreme cases, nodular tissue associated with the development of the vas defferens may occlude the pallial oviduct and so render the affected individual sterile. Such individuals continue to produce eggs and capsules; these become impacted in the capsule gland which may then rupture and so cause death. A combination of the lack of juvenile recruitment and the death of female animals leads to an overall decline in numbers and a population structure dominated by large old males. (Fig. 2).

The toxic effects of TBT are not limited to **Nucella.** The maximum concentration recorded in U.K. waters is a little in excess of 2μg/l (Wood 1986) and below this level severe effects have been noted on the oysters **Crassostrea gigas** and **Ostrea edulis** (Waldock & Thain 1983; Thain & Waldock, 1986), the mussel **Mytilus edulis** (Beaumont & Budd 1984; Thain & Waldock, 1985) and the brown shrimp **Crangon crangon** (Thain 1983) in addition to a number of non-commercial species. Clearly the use of TBT based paints poses a severe threat to the marine environment and this has been recognised by a number of countries placeing severe restrictions on their use. To asses the current extent of TBT pollution by chemical methods, however, is particularly difficult as the most sensitive technique based on graphite furnace atomic absorption does not appear to be widely available.

Fig. 2- Nucella lapillus

Fortunately, Bryan et al (1987) have shown that **Nucella** can be used to identify contamination by the use of a simple technique based on the relative volumes of the male and famale penes. This technique has now been widely used around the coast of the United Kingdom where it shows that very few sites are totally unaffected by TBT pollution. In the present study comparable data has been obtained for a range of sites on the coasts of northern Spain & Portugal.

2. MATERIAL & METHODS.

A minimum of 50 adult **Nucella** were collected from each site during the period between May and July 1987 and for each population the relative penis size index (RPS) was calculated by the methods described by Bryan et al (1986). RPS is defined as the mean bulk of the female penis expressed as a percentage of the mean bulk of the male penis, bulk being calculated as the cube of length (Gibbs et al 1987).

The location of the sampling sites is shown in Fig. 1. By the careful choice of these sites it was hoped to show a contrast between those close to harbours, where it was expected that TBT pollution would be most severe, and those on the open coast.

3. RESULTS.

The principal results are presented in Table 1.

At each site studied a small number of juvenile animals were examined in addition to the adults and on all occasions females were found which had some penis development. As Gibbs et al (1987) point out, this suggests that there is ongoing TBT pollution.

4. DISCUSSION.

In the absence of chemical analysis, the development of a penis and the extent of the associated vas defferens development in female **Nucella** have been shown to be reliable indicators of the extent of pollution by very low levels of tri-butyl tin. Of the two methods the former is the simpler and more rapid and can if necessary be performed on preserved material. Gibbs et al (1987) have shown that as the concentration of TBT is sea-water rises, there is a sharp increase in RPS until 4ng/l is reached but thereafter increasing levels of the pollutant have only small effects. As such, the method cannot be considered as a broad bio-assay. The existance of imposex in the **Nucella** population at any given site however demonstrates that TBT is present locally and act as a warning that other species are at risk.

If the relationship between RPS and the sea water concentration of TBT is the same in Spanish and Portuguese animals as in that in animals from S.W. England (Gibbs et al 1987) then the data presented above show that although all the populations examined were affected none were exposed to levels higher than 4ng/l.

Currently available data suggest that at such low levels other species are unaffected (Wood 1986) but as most are from laboratory toxicity tests, which do not detect sub-lethal effects, this is not necessarily the case.

A number of the samples analysed in this study were taken close to commercial harbours, fishing ports or other areas where there is a high level of boating activity. When studies have been carried out at similar sites in U.K. waters (Davies et al 1987; Gibbs et al, 1987; Hutton pers comm.) the RPS of **Nucella** populations has frequently exceeded 40%, a level at which their reproductive capacity would be strongly impaired (Bryan et al 1986). In such populations there is a clear dominance of old male animals. This is certainly not the case in Spain & Portugal, juveniles were generally present and in most cases the larger size classes were dominated by females. For these reasons it would appear that although there is evidence for TBT pollution in the coastal waters of both countries it is at a lower level than in the British Isles.

SPAIN	Male Penis	SD	Female Penis	SD	Imposex percent
Playa de las Arenas(A)	3.24	.91	1.16	.34	4.62
Santander(B)	2.91	.3	.91	.41	3.03
Ensenada de España(C-1)	3.89	1.14	2.03	.31	14.32
Gijon(C-2)	2.62	.35	1.29	.86	12.02
Candas(C-3)	2.84	.53	1.28	.3	9.15
Laurido(D-1)	4.13	.43	2.03	.85	11.95
Lorbe(D-2)	4.37	.89	2	1.39	9.57
Punta de Mera(D-3)	3.71	.67	2.27	1	22.74
Torre de Hercules(D-4)	4.22	.83	1.94	.75	9.7
Ensenada de Orzan(D-5)	4.69	.58	1.94	.44	7.13
Punta de Langostera(D-6)	3.8	.39	1.32	.34	4.19
Punta de Louro(E)	3.77	.58	1.44	.9	5.56
Isalas Cies(F-1)	4.35	.71	2.92	.54	30.29
Cangas (F-2)	3.49	.56	1.59	.88	9.48
Rande(F-3)	3.22	.39	1.69	1.19	14.56
Bouza(F-4)	3.45	.51	2.44	.85	30.06
Canido(F-5)	3.07	.64	1.84	.44	21.69
Bayona(F-6)	3.89	.57	2.67	.54	32.23
PORTUGAL					
Moledo(G-1)	3.77	.65	.56	.63	.33
Viana do Castelo(G-2)	3.48	.76	.88	.49	1.64
Aveiro(G-3)	3.61	.85	2.06	.67	18.06
Figuera da Foz(G-4)	3.5	1.02	.03	.52	.06

Table 1.- Imposex values.

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