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GIREPAM

PORTOFERRAIO, 8 NOVEMBRE 2018

BERTA MAGGIORE E MINORE (*CALONECTRIS DIOMEDEA, PUFFINUS YELKOUAN*) DEL BACINO LIGURE-TIRRENICO, CONSERVAZIONE E MONITORAGGIO

CONSERVAZIONE DI UCCELLI MARINI A RISCHIO: TECNICHE DI CAMPIONAMENTO NON LETALI PER INDAGINI ECOTOSSICOLOGICHE

LETIZIA MARSILI
UNIVERSITÀ DI SIENA

UNIVERSITÀ DI SIENA 1240

One of the main characteristics of the Mediterranean marine avifauna is the high number of endemic taxa, despite the low diversity and small population densities; this is consistent with a low productivity ecosystem compared to open oceans (Coll et al. 2010).


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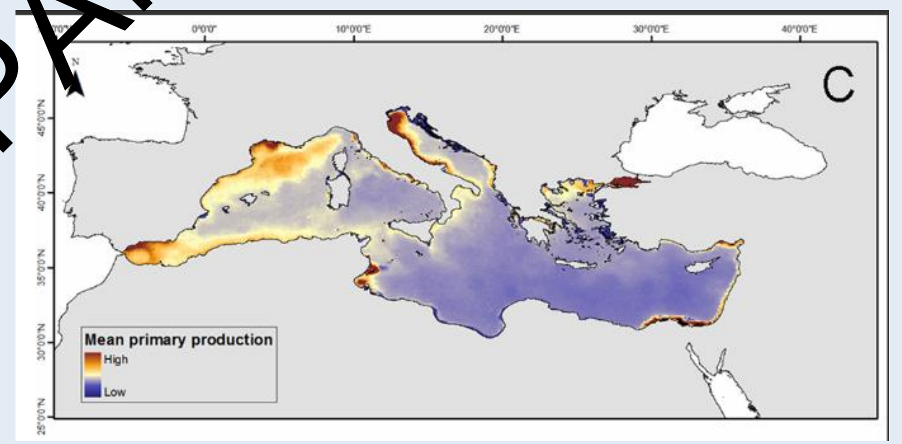
PLoS one

Review

The Biodiversity of the Mediterranean Sea: Estimates, Patterns, and Threats

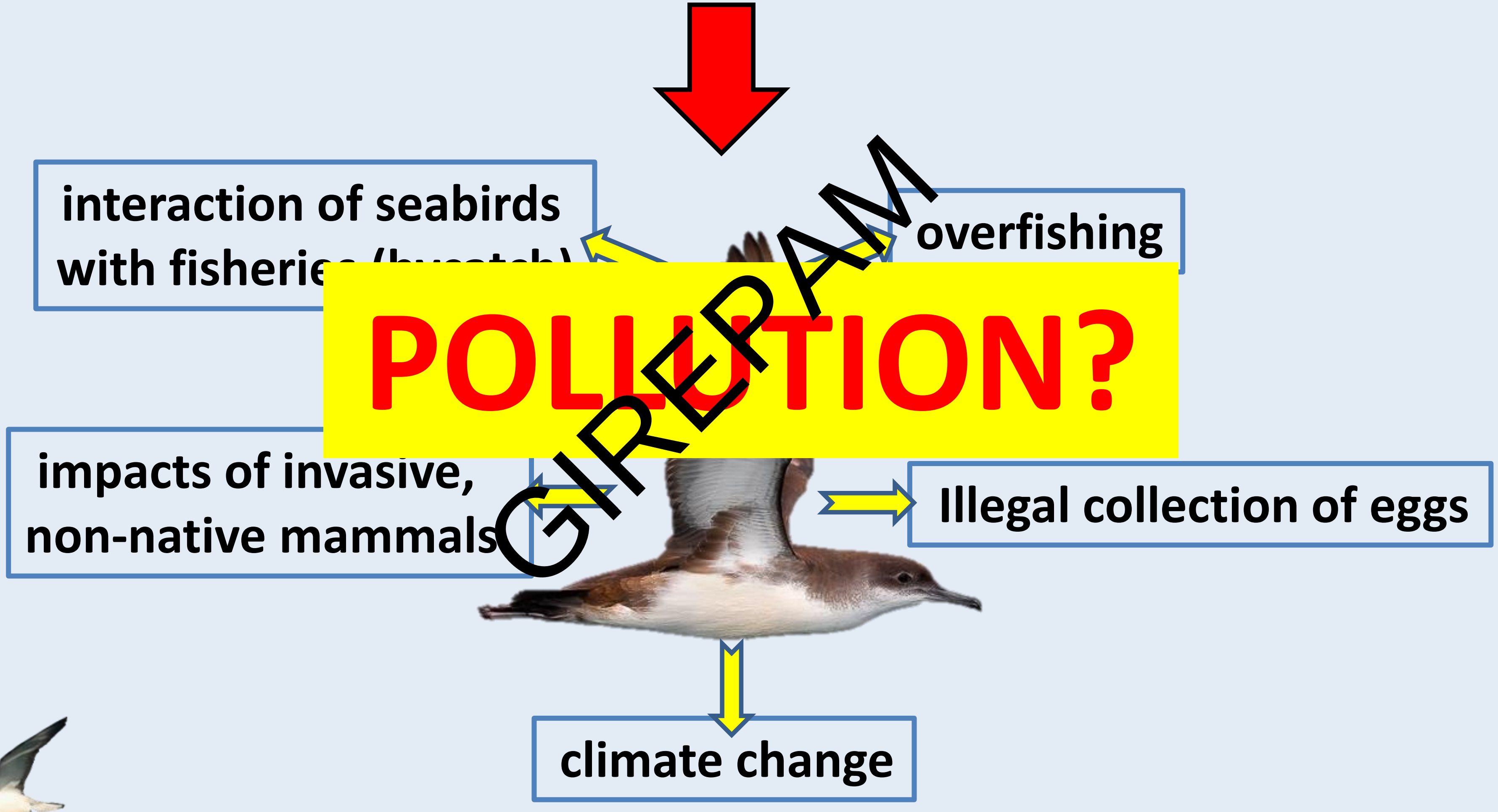
Marta Coll[1,2]*, Chiara Piroddi[3], Jeroen Steenbeek[3], Kristin Kaschner[4], Frida Ben Rais Lasram[5,6], Jacopo Aguzzi[1], Enric Ballesteros[7], Carlo Nike Bianchi[8], Jordi Corbera[9], Thanos Dailianis[10,11], Roberto Danovaro[12], Marta Estrada[1], Carlo Froglia[13], Bella S. Galil[14], Josep M. Gasol[1], Ruthy Gertwagen[15], João Gil[7], François Guilhaumon[5], Kathleen Kesner-Reyes[16], Miltiadis-Spyridon Kitsos[10], Athanasios Koukouras[10], Nikolaos Lampadariou[17], Elijah Laxamana[16], Carlos M. López-Fé de la Cuadra[18], Heike K. Lotze[2], Daniel Martin[7], David Mouillot[5], Daniel Oro[19], Saša Raicevich[20], Josephine Rius-Barile[16], Jose Ignacio Saiz-Salinas[21], Carles San Vicente[22], Samuel Somot[23], José Templado[24], Xavier Turon[7], Dimitris Vafidis[25], Roger Villanueva[1], Eleni Voultsiadou[10]

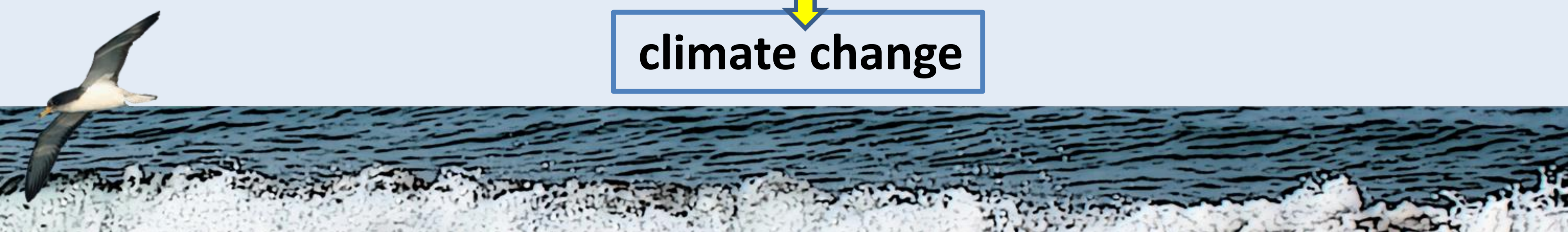
PLoS ONE | www.plosone.org 1 August 2010 | Volume 5 | Issue 8 | e11842

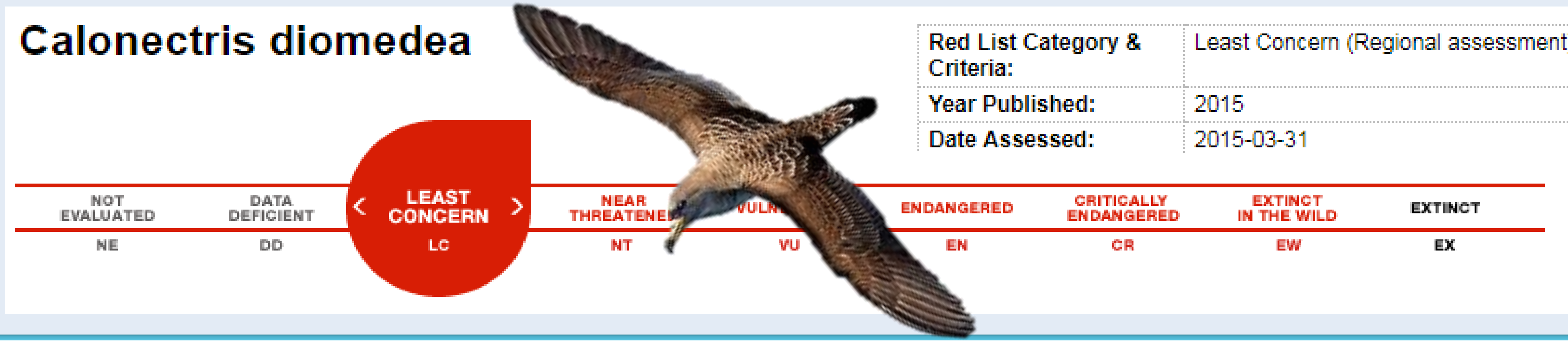


All four Procellariiforms (petrels and shearwaters) present in the Mediterranean constitute endemic taxa: two at species level (*Puffinus mauretanicus* and *Puffinus yelkouan*) and two at subspecies level (*Calonectris diomedea diomedea*, *Hydrobates pelagicus melitensis*).

SEVERAL THREATS IMPERIL THE FUTURE OF THIS UNIQUE SEABIRD COMMUNITY….. THEN CURRENT POPULATION TREND IS DECREASING






Calonectris diomedea
Red List Category & Criteria: Least Concern (Regional assessment)
Year Published: 2015
Date Assessed: 2015-03-31
NOT EVALUATED NE
DATA DEFICIENT DD
LEAST CONCERN LC
NEAR THREATENED NT
VU
ENDANGERED EN
CRITICALLY ENDANGERED CR
EXTINCT IN THE WILD EW
EXTINCT EX

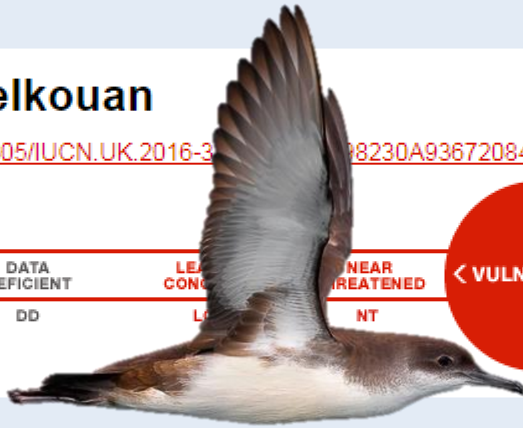
POLLUTION

?

Puffinus yelkouan

http://dx.doi.org/10.2305/IUCN.UK.2016-3 … 98230A93672084.en

Red List Category & Criteria:	Vulnerable A4bcde
Year Published:	2016
Date Assessed:	2016-10-01



The gregarious behaviour of this species makes it particularly vulnerable to oil spills and the intense maritime traffic in the Mediterranean and Bosporus increases the risk of oil spills. Light pollution at sea from bunkering areas, oil platforms and other at sea structures may be an important threat for some colonies. Less prominent threats include competition for nest sites with Cory's Shearwater, collisions with wind turbines, pollution and contaminants (e.g. plastic [R. Crnkovic *in litt.* 2012, Codina *et al*. 2013])…

Codina-García, M., Militão, T., Moreno, J., González-Solís, J. 2013. Plastic debris in Mediterranean seabirds. *Marine pollution bulletin* 77(1): 220-226.
Crnković, R. 2012. Present situation of the population of seabirds (Calonectris diomedea, Puffinus yelkouan, Phalacrocorax asistotelis desmarestii, Larus audouinii, Larus michahellis and Sterna hirundo) breeding at Lastovsko otočje nature park, Croatia. (pp. 221-222). In Yésou, P., Baccetti, N. & Sultana, J. (Eds.), Ecology and Conservation of Mediterranean Seabirds and other bird species under the Barcelona Convention - Proceedings of the 13th Medmaravis Pan-Mediterranean Symposium. Alghero (Sardinia) 14-17 Oct. 2011. Medmaravis, Alghero.

WHAT IS POLLUTION?

Heavy metals and metalloids (e.g. cadmium, lead, mercury)

Persistent Organic Pollutants (POPs) (e.g. PCBs, DDTs, Dioxins, PAHs)

Emerging Persistent Organic Pollutants (EPOPs) (e.g. EPBDEs, PFCs) and Emerging Pollutants of Concern (EPOCs) (e.g. Pharmaceutical Active Compounds, drugs, detergents, deodorants)

Petroleum Hydrocarbons

Marine Litter (e.g. plastic litter)

ENVIRONMENTAL CONTAMINANTS

Always remember that we only know the top of the iceberg!

MARINE LITTER and PLASTIC AGE

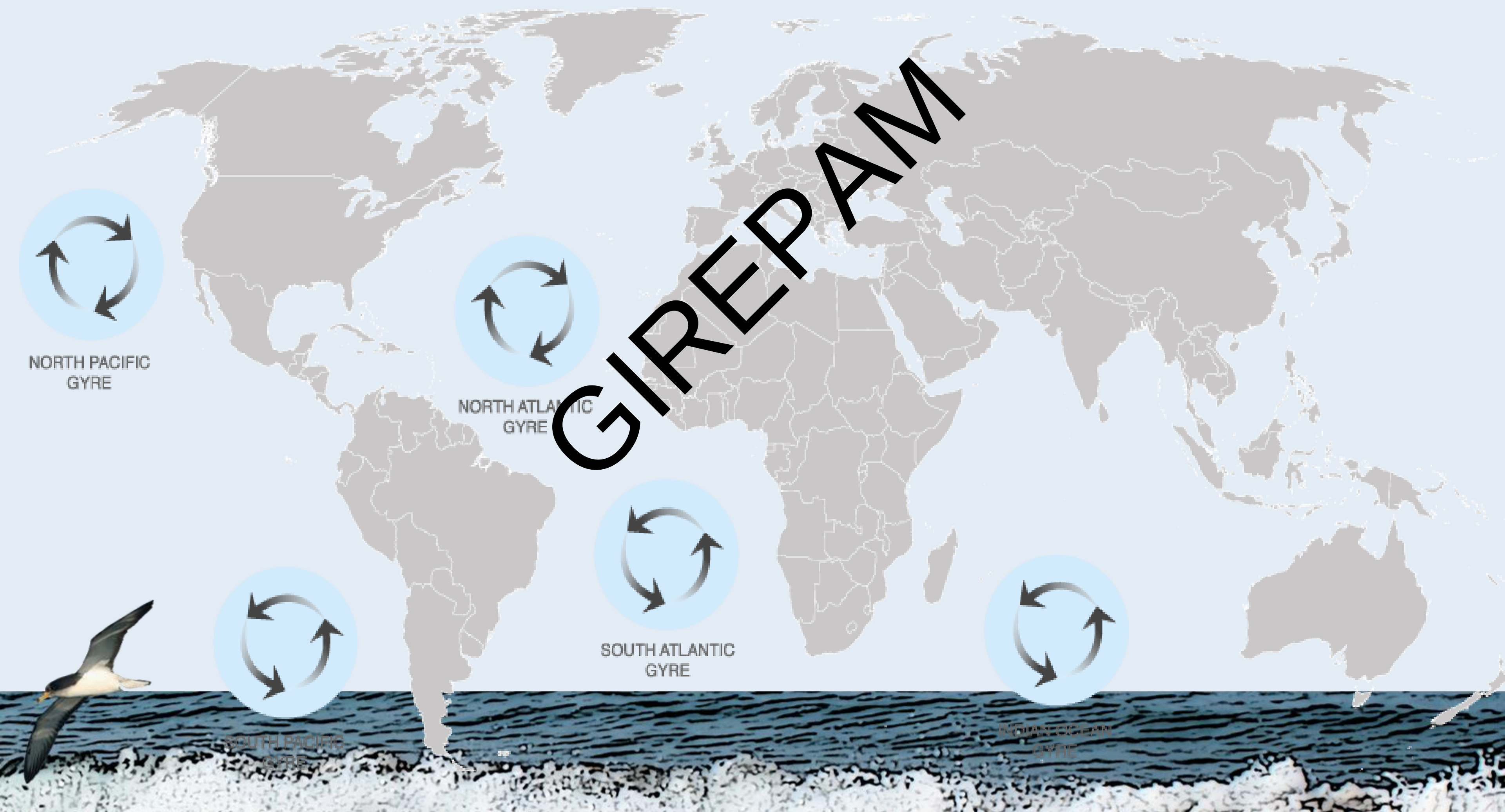

EMERGENCY
MARINE
LITTER!


ALUMINUM CANS OVER 100 YEARS
CANNISTER OVER 400 YEARS
SHOPPERS OVER 800 YEARS
GLASS BOTTLES IN SEA OVER 1000 YEARS
TIN CAN OVER 50 YEARS
PLASTIC BOTTLE OVER 500 YEARS
FISHNETS OVER 600 YEARS

MICROPLASTICS

Microplastics are small fragments of plastic debris (< 5 mm) that have accumulated in the environment on a global scale. They originate from the direct release of particles of plastic and as a consequence of the fragmentation of larger items.

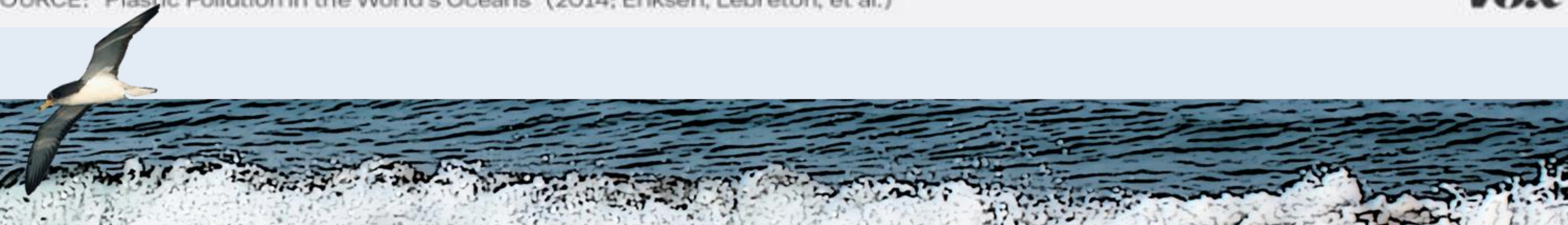
Five oceanic gyres (North Atlantic, South Atlantic, South Indian, North Pacific and South Pacific)



Oceans ranked by estimated surface plastic (pieces and weight)

OTE: individual ocean estimates were converted from metric tons, and deviate slightly from overall estimates
OURCE: "Plastic Pollution in the World's Oceans" (2014; Eriksen, Lebreton, et al.)

Vox



Are microplastics a danger to the Mediterranean Sea?

The “**micro-debris**” floating in the Mediterranean Sea have reached a maximum number of 892,000 particles per Km^2.

The average estimated microplastic abundance is of the same order of magnitude as measured in the North Pacific Gyre (**0.334 particelle/m^2)**.

ARE SEABIRDS EXPOSED TO THE RISK OF MACRO- AND MICRO-PLASTICS?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EFFECTS?

Sci Adv. 2016 Nov 9;2(11):e1600395. doi: 10.1126/sciadv.1600395. eCollection 2016 Nov.

Marine plastic debris emits a keystone infochemical for olfactory foraging seabirds.

Savoca MS[1,2], Wohlfeil ME[1,2], Ebeler SE[3], Nevitt GA[1,2].

Author information

1 Department of Neurobiology, Physiology, and Behavior, University of California, Davis, Davis, CA 95616, USA.
2 Graduate Group in Ecology, University of California, Davis, Davis, CA 95616, USA.
3 Department of Viticulture and Enology, University of California, Davis, Davis, CA 95616, USA.

Abstract

Plastic debris is ingested by hundreds of species of organisms, from zooplankton to baleen whales, but how such a diversity of consumers can mistake plastic for their natural prey is largely unknown. The sensory mechanisms underlying plastic detection and consumption have rarely been examined within the context of sensory signals driving marine food web dynamics. We demonstrate experimentally that marine-seasoned microplastics produce a dimethyl sulfide (DMS) signature that is also a keystone odorant for natural trophic interactions. We further demonstrate a positive relationship between DMS responsiveness and plastic ingestion frequency using procellariiform seabirds as a model taxonomic group. Together, these results suggest that plastic debris emits the scent of a marine infochemical, creating an olfactory trap for susceptible marine wildlife.

Issue 9, 2017

Previous Article | Next Article

From the journal:
Analytical Methods

Quantifying ingested debris in marine megafauna: a review and recommendations for standardization

Check for updates

Jennifer F. Provencher,*[ab] Alexander L. Bond,[c] Stephanie Avery-Gomm,[d] Stephanie B. Borrelle,[e] Elisa L. Bravo Rebolledo,[f] Sjúrður Hammer,[g] Susanne Kühn,[f] Jennifer L. Lavers,[h] Mark L. Mallory,[b] Alice Trevail[i] and Jan A. van Franeker[f]

Mar Pollut Bull. 2018 Oct;135:852-861. doi: 10.1016/j.marpolbul.2018.08.016. Epub 2018 Aug 13.

Seabirds and plastics don't mix: Examining the differences in marine plastic ingestion in wedge-tailed shearwater chicks at near-shore and offshore locations.

Verlis KM[1], Campbell ML[2], Wilson SP[3].

Author information

Abstract

Plastic ingestion by wedge-tailed shearwaters (WTS) nesting at near-shore and offshore sites along the east coast of Australia were investigated. Ingestion rates were at 20% in near-shore lavaged WTS, where the beaches were significantly more polluted, compared to 8% in birds at offshore sites. The material and colour of recovered plastics at offshore sites differed significantly between beach surveys and that ingested by seabirds in the same area. This pattern was not evident near-shore. Hence, in near-shore environments birds may feed locally and are influenced by nearby plastics, compared to birds offshore. The origins of marine debris between near-shore and offshore beaches differed; with land-based sources unsurprisingly having more influence on near-shore sites. The findings of this study indicate the need for localised data to address and m...
ecological quality objective for W...

ELSEVIER

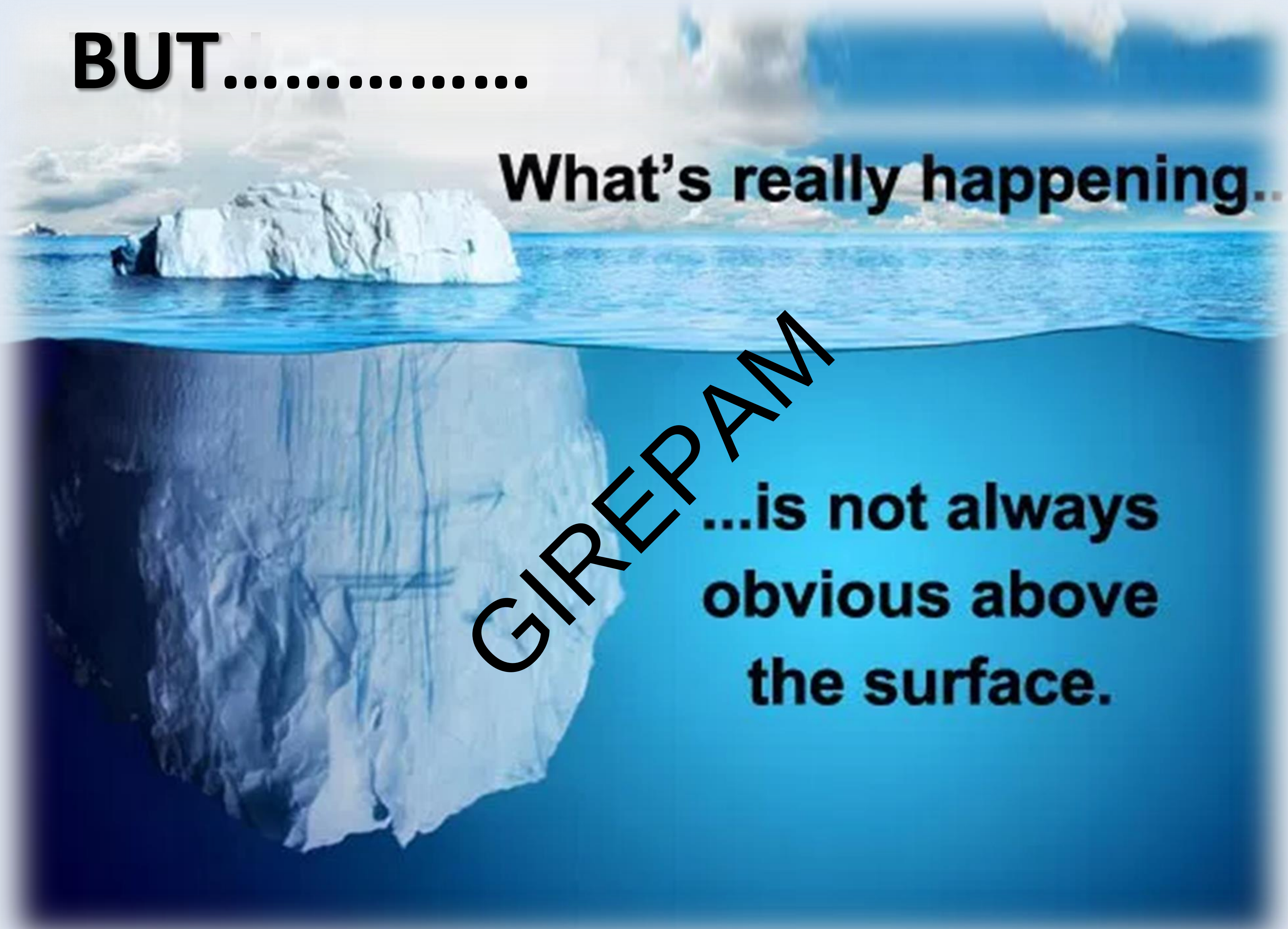
Environmental Pollution

Volume 243, Part B, December 2018, Pages 1750-1757

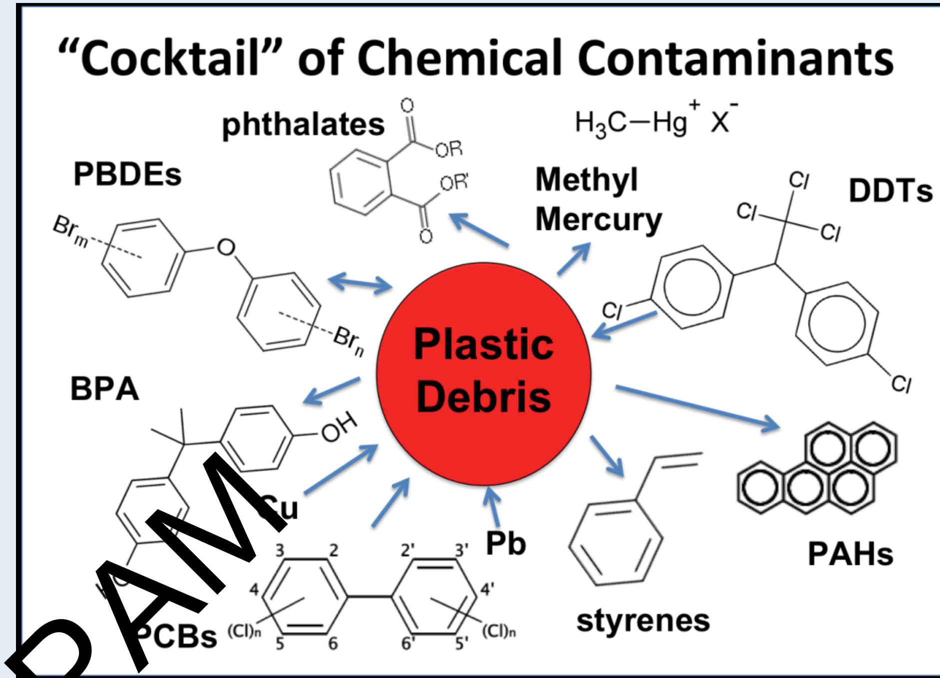
Seabird plastic ingestion differs among collection methods: Examples from the short-tailed shearwater ☆

Airam Rodríguez[a, b, c], Francisco Ramírez[d], M. Nazaret Carrasco[c], André Chiaradia[a]

BUT……………


What's really happening…
…is not always obvious above the surface.

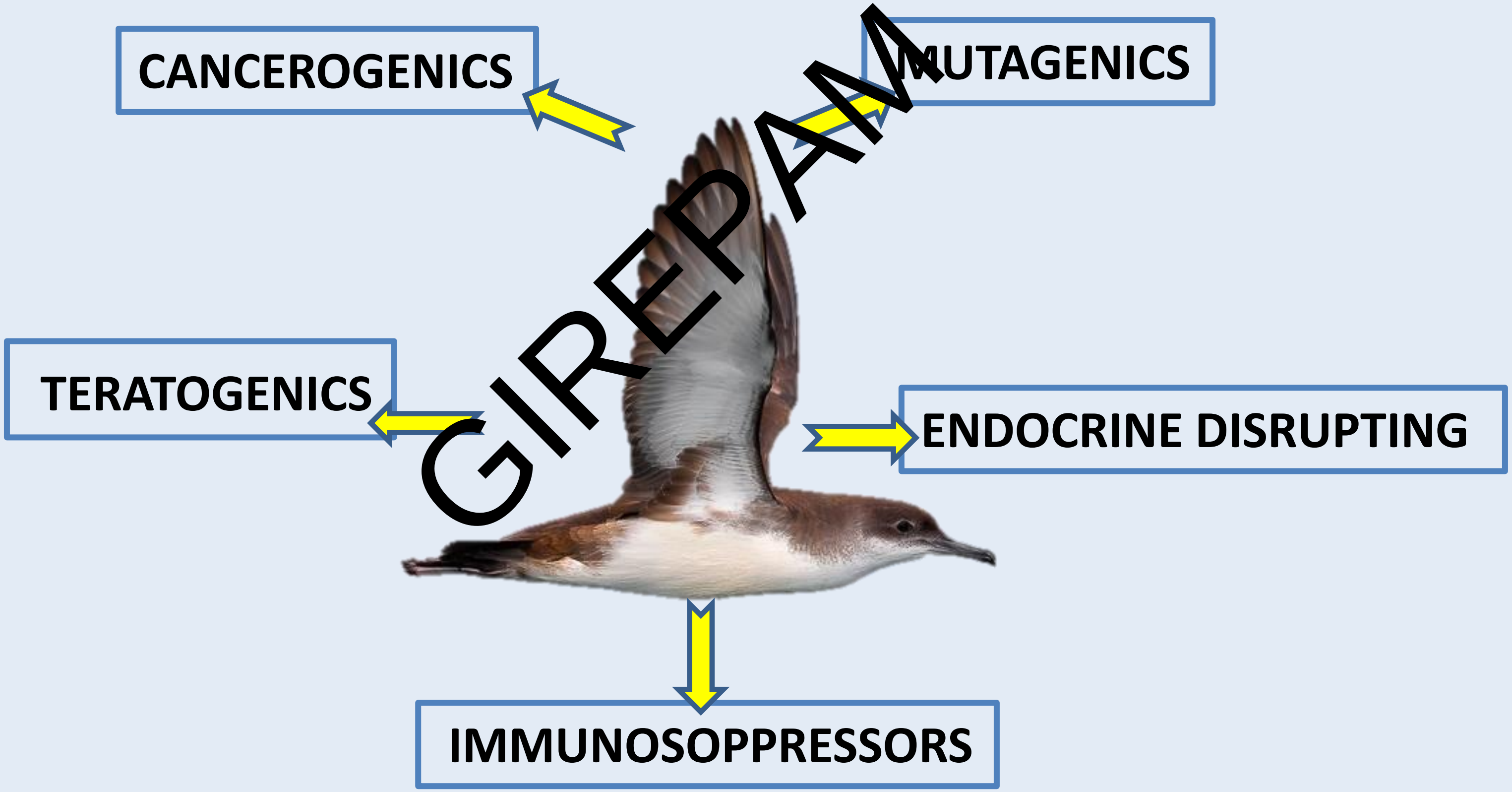
Microplastics and Contaminants



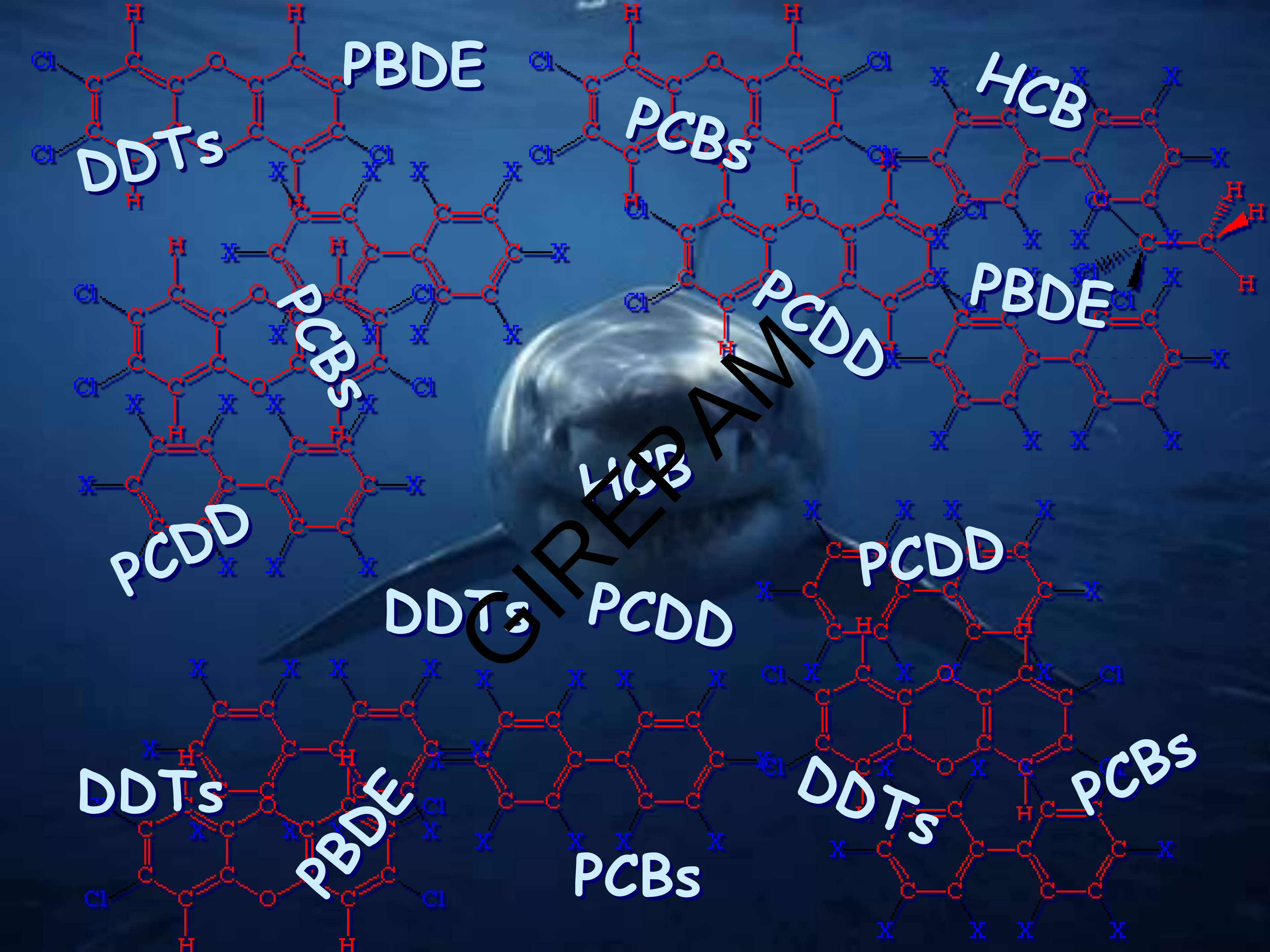
The microparticles can be **"carriers" of lipophilic chemical compounds** (mainly POPs) and **source of contaminants** such as polyethylene, polypropylene and in particular **phthalates** that can potentially interfere with the health of organisms (Teuten *et al.*, 2007).

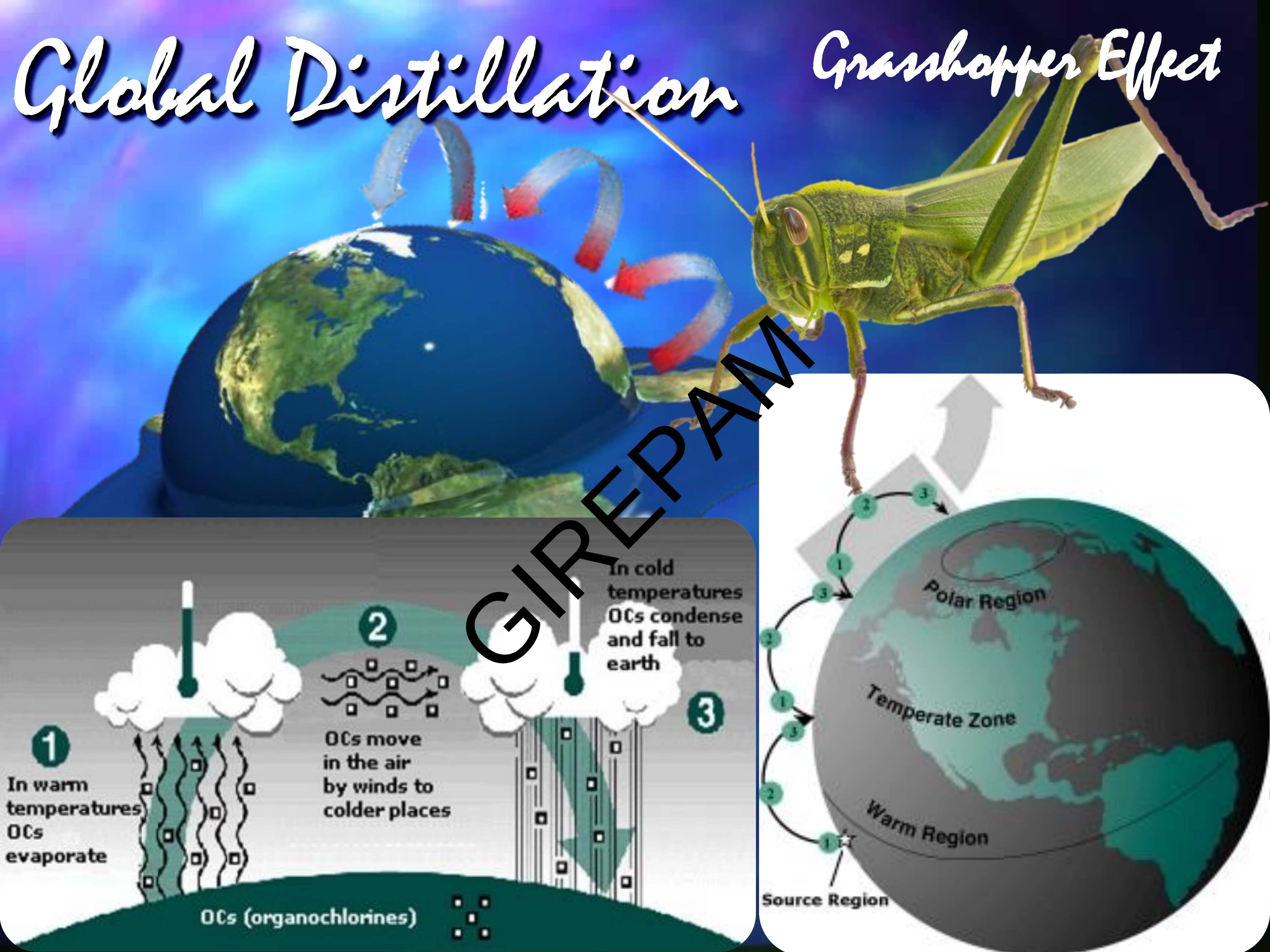
EFFECTS?

TOXICOLOGICAL PROPERTIES

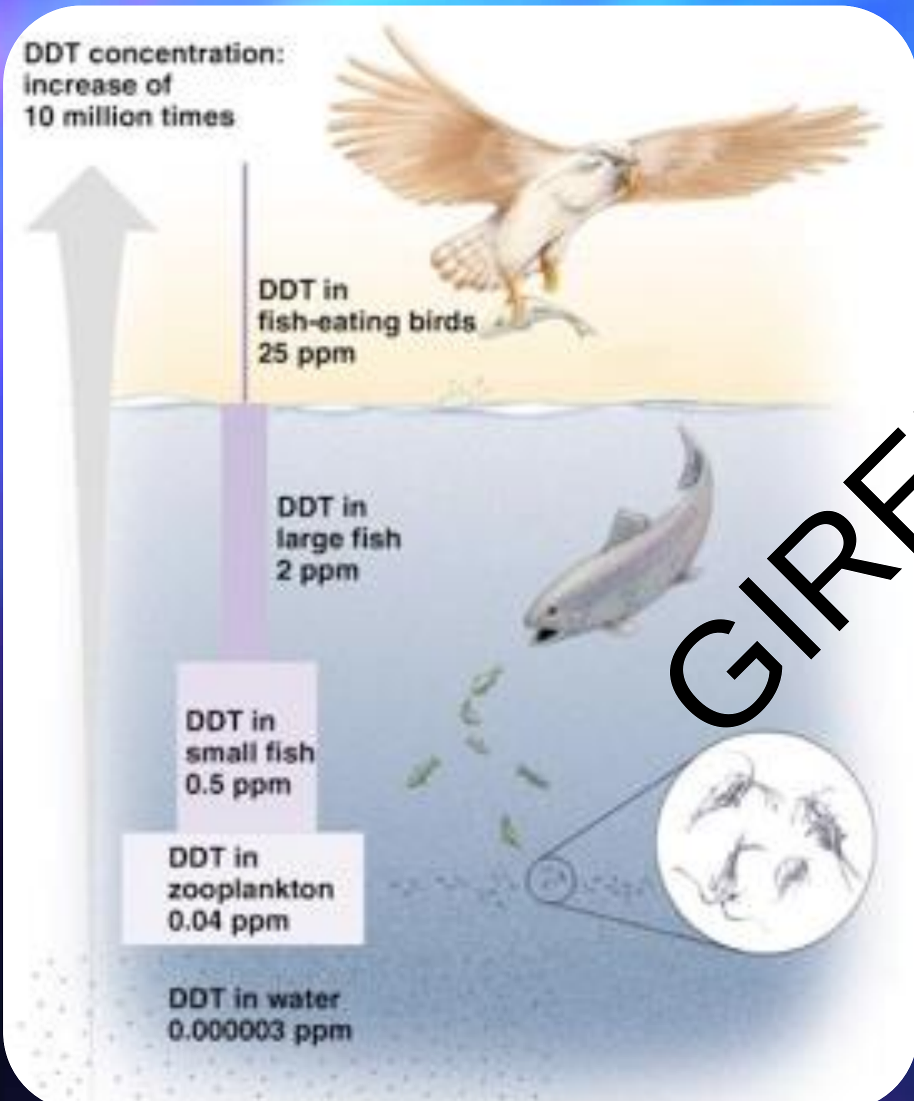


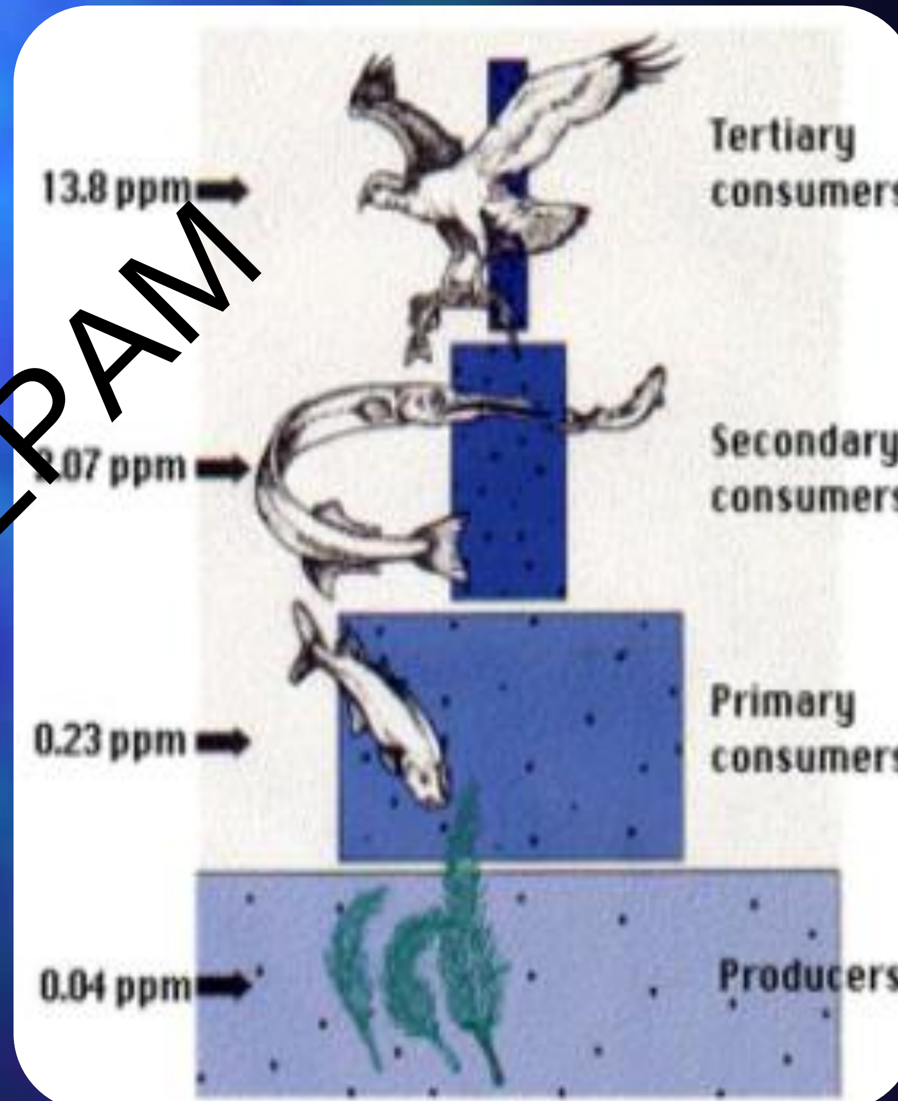
THE INVISIBLE CONTAMINATION OF THE OCEANS


PBDE
PCBs
HCB
DDTs
PCBs
PCDD
PBDE
HCB
PCDD
DDTs
PCDD
PCDD
DDTs
PBDE
PCBs
DDTs
PCBs
GIREPAM

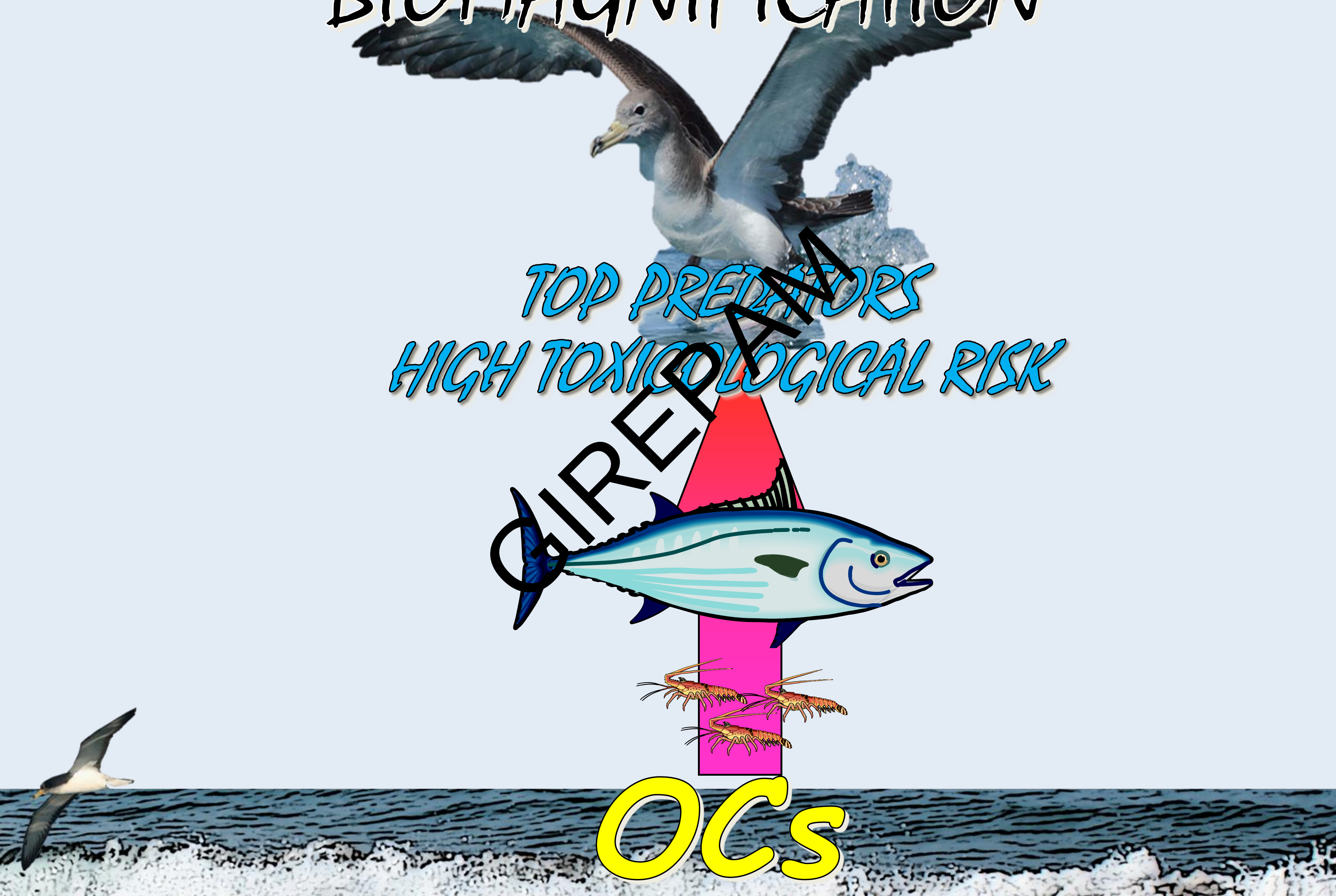

Global Distillation
Grasshopper Effect
GIREPAM
1
In warm temperatures OCs evaporate
2
OCs move in the air by winds to colder places
In cold temperatures OCs condense and fall to earth
3
OCs (organochlorines)
Polar Region
Temperate Zone
Warm Region
Source Region

IS DILUTION THE SOLUTION TO POLLUTION?





BIOMAGNIFICATION



A review of the literature about contaminants in Mediterranean seabirds: a work in progress

Fabrizio Borghesi

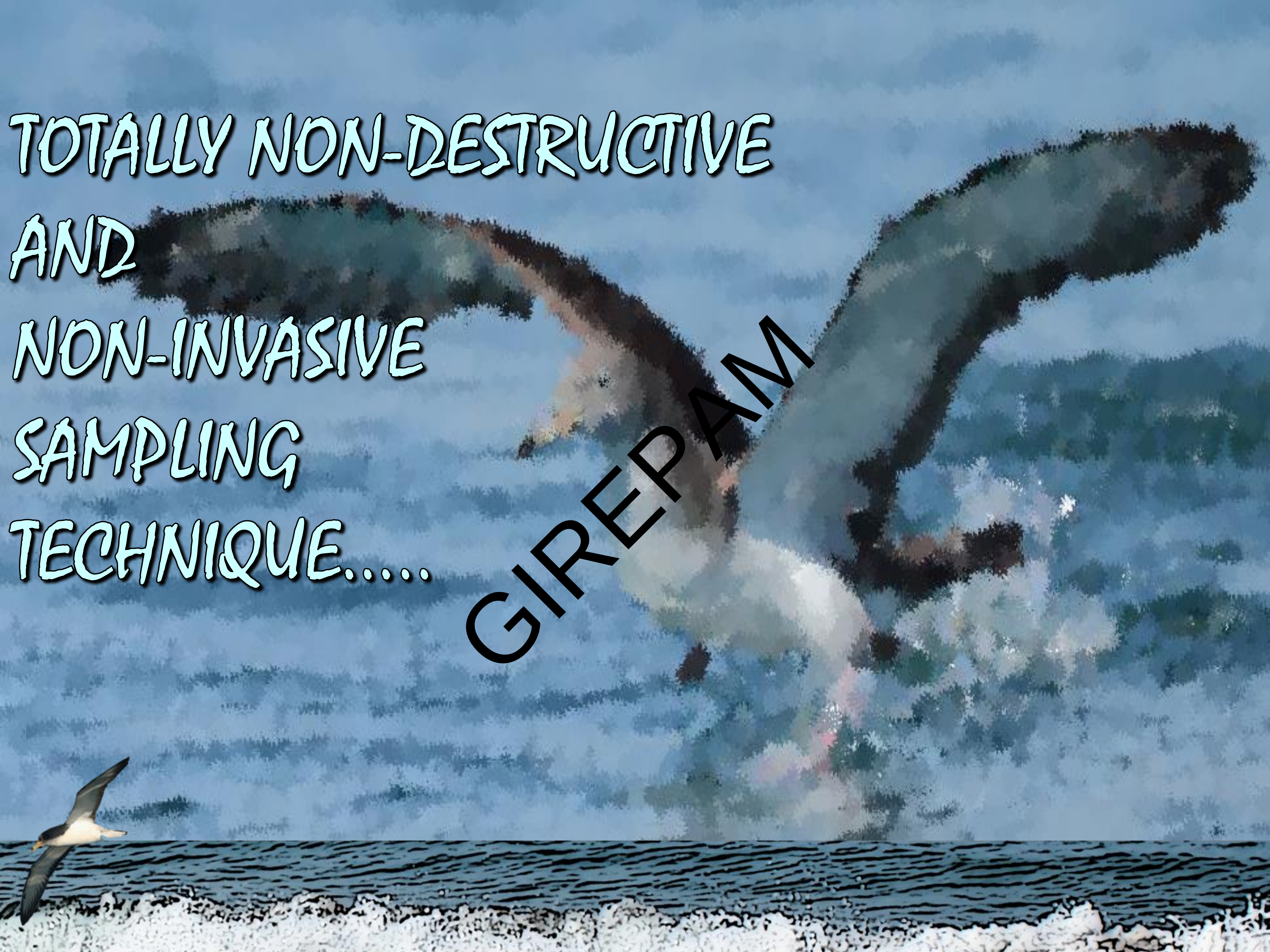
Medmaravis, Italy.
E-mail: fab.borghesi@gmail.com

Subject	Sub-topic	Number of papers for subject	Number of papers for sub-topic
CO & SB & MED		24	
	Organic pollutants (OP)		14
	Metals (ME)		9
	Plastics (PLA)		2
	Oil spills (OIL)		0

CO= Contaminants; SB= Sea Birds; MED= Mediterranean Sea

BUT HOW CAN WE CONTRIBUTE TO PRESERVING THE SEABIRDS BIODIVERSITY BY STUDYING THE EFFECTS OF ENVIRONMENTAL CONTAMINATION?

NON-DESTRUCTIVE RESEARCH


TOTALLY NON-DESTRUCTIVE
AND
NON-INVASIVE
SAMPLING
TECHNIQUE.....
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Collection of tissues and organs for contaminant analysis:

- Feathers
- Fat
- Muscle
- Liver
- Stomach
- Intestine

OCs
PAHs
Trace elements
Plastic debris

DEAD SPECIMENS

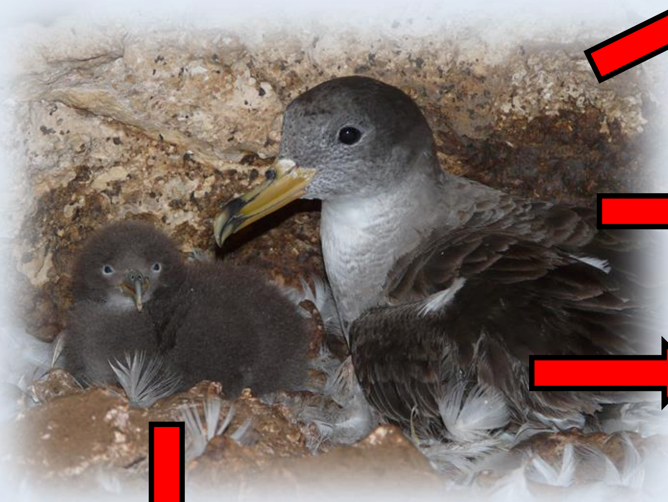
OC levels in fat, liver, and muscle of *Calonectris diomedea* sampled in Pianosa

High levels of DDTs and PCBs

Berta di Pianosa	Adipe (ng/g p.s.)	Fegato (ng/g p.s.)	Muscolo (ng/g p.s.)
HCB	**50,08**	**24,69**	**10,38**
95	46,63	21,06	12,98
op'DDE	5,13	3,04	2,39
101	52,68	26,35	12,33
99	n.d.	n.d.	n.d.
pp'DDE	1261,87	667,36	260,28
op'DDD	55,13	28,24	11,71
151	45,64	[illegible]	9,28
144+135	32,28	[illegible]	6,40
149+118	[illegible]	155,17	62,78
pp'DDD	[illegible]	35,76	13,67
op'DDT	8,46	6,11	2,31
146	210,22	98,71	39,00
153	1177,59	564,73	227,51
141	23,04	10,50	15,05
pp'DDT	78,50	34,74	14,21
138	570,83	277,73	110,78
178	50,38	23,04	11,04
187	268,76	122,33	47,83
183	138,15	62,75	24,39
128	41,32	18,05	6,23
174	71,72	29,99	14,38
177	46,46	20,53	8,26
156+171+202	110,24	50,50	21,02
172	55,54	24,20	9,25
180	775,89	334,67	132,67
199	1,91	n.d.	1,23
170	442,88	187,83	71,14
196	73,40	29,04	12,47
201	119,87	46,36	18,56
195	52,37	21,82	5,76
194	93,25	38,31	14,19
206	19,61	8,35	4,47
DDT Tot	**1478,39**	**775,24**	**304,56**
PCB TOT	**4838,51**	**2208,13**	**899,00**
OC totali	**6366,98**	**3008,06**	**1213,94**
MOE%	**87,6**	**55,9**	**22,9**

NESTS

Nests



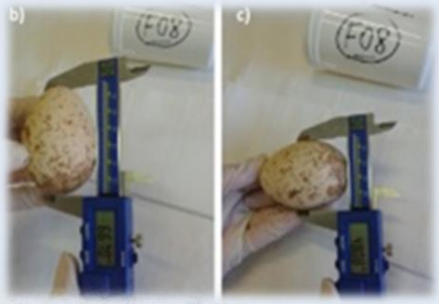
FEATHERS AND PLUMAGE  Trace elements

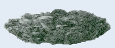
EXCRETA 

OCs
PAHs
Trace elements

UNHATCHED EGGS 

OCs
PAHs
Trace elements
Egg shell



GASTRIC BOLUS 

OCs
PAHs
Trace elements
Plastic debris

Environmental Pollution (Series A) 40 (1986) 17–35

Comparison Between Concentrations of Mercury and Other Contaminants in Eggs and Tissues of Cory's Shearwater *Calonectris diomedea* Collected on Atlantic and Mediterranean Islands

A. Renzoni, S. Focardi, C. Fossi, C. Leonzio & J. Mayol*

The Science of the Total Environment, 78 (1989) 13–22
Elsevier Science Publishers B.V., Amsterdam — Printed in The Netherlands

AN ASSESSMENT OF POLLUTANTS IN EGGS OF AUDOUIN'S GULL (*LARUS AUDOUINII*), A RARE SPECIES OF THE MEDITERRANEAN SEA

CLAUDIO LEONZIO[1], MARCO LAMBERTINI[2], ALBERTO MASSI[1], SILVANO FOCARDI[1] and CRISTINA FOSSI[1]

LONG TERM MONITORING OF POLLUTANTS IN EGGS OF YELLOW-LEGGED HERRING GULL FROM CAPRAIA ISLAND (TUSCAN ARCHIPELAGO)

S. FOCARDI, C. FOSSI, M. LAMBERTINI, C. LEONZIO, and A. MASSI

Dipartimento Biologia Ambientale, Università di Siena. Via delle Cerchia 3, 53100 SIENA, Italy

(Received August 1986)

Environmental Monitoring and Assessment 10 (1988) 43–50.
© 1988 by Kluwer Academic Publishers.

CHEMISTRY AND ECOLOGY
2018, VOL. 34, NO. 7, 595–609
https://doi.org/10.1080/02757540.2018.1482885

RESEARCH ARTICLE

Taylor & Francis
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Temporal and geographical variations of mercury and selenium in eggs of *Larus michahellis* and *Larus audouinii* from central Mediterranean islands

Nicola Bianchi[a], Nicola Baccetti[b], Claudio Leonzio[a], Pietro Giovacchini[c*] and Stefania Ancora[a]

[a]Department of Physics, Earth and Environmental Sciences, University of Siena, Siena, Italy; [b]ISPRA, Italian Institute for Environmental Protection and Research, Ozzano dell'Emilia, Italy; [c]Museo di Storia Naturale della Maremma, Grosseto, Italy

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Environmental Toxicology and Chemistry, Vol. 27, No. 10, pp. 2064–2070, 2008
© 2008 SETAC
Printed in the USA
0730-7268/08 $12.00 + .00

CADMIUM, LEAD, AND MERCURY LEVELS IN FEATHERS OF SMALL PASSERINE BIRDS: NONINVASIVE SAMPLING STRATEGY

Nicola Bianchi,* Stefania Ancora, Noemi di Fazio, and Claudio Leonzio
Dipartimento di Scienze Ambientali, Università degli Studi di Siena, Via Mattioli 4, Siena 53100, Italy


INFORMATION RELATING TO "STRESSED" SPECIMENS AND TO "NOT FRESH" BIOLOGICAL MATERIAL.....
..... THE ALTERNATIVE IS THE FREE SPECIMENS!
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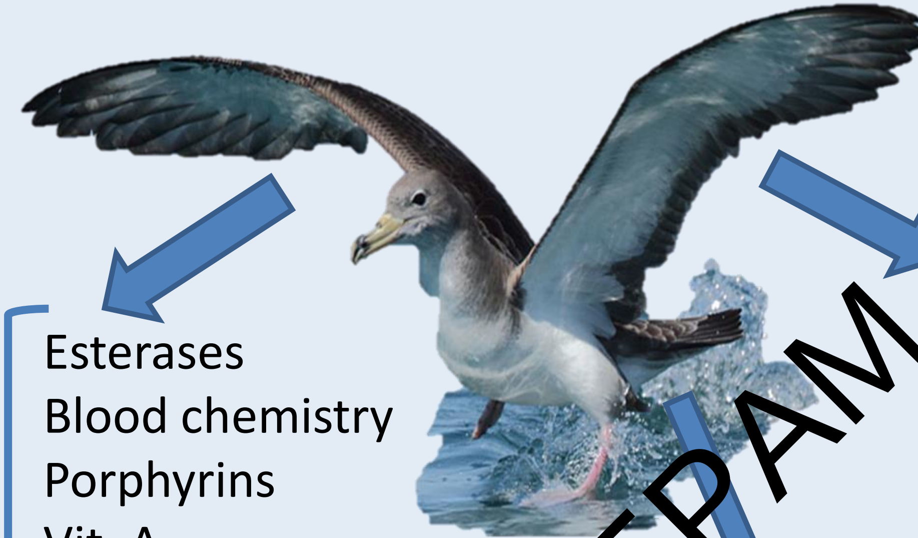
WHICH TECHNIQUES IN FREE SPECIMENS?

FREE SPECIMENS

BLOOD SAMPLES

WHICH BIOLOGICAL MATERIALS ARE SUITABLE FOR NONDESTRUCTIVE BIOMARKER STUDIES IN SEABIRDS?



FEATHERS
- Porphyrins
- Hg

BLOOD
- Esterases
- Blood chemistry
- Porphyrins
- Vit. A
- Y-GT
- ALAD
- MFO
- Hb adducts
- DNA Strand breaks
- Toxic metals
- OCs

EXCRETA
- Porphyrins
- Toxic metals
- OCs

Ecotoxicology. 1994 Mar;3(1):11-20. doi: 10.1007/BF00121385.

Blood esterase inhibition in birds as an index of organophosphorus contamination: field and laboratory studies.

Fossi MC[1], Massi A, Leonzio C.

Author information

Abstract

: With the aim of developing a nondestructive biomarker (serum 'B' esterases) for monitoring bird populations …
chloro-2-oxooxazolo(4,5-b)pyridin-3(2H)-yl)methyl) 0,0-dimethyl phosphorothioate (9CI), paral…
In japanese quail (Coturnix coturnix japonica) treated with azamethiphos at 10 …
carboxylesterase (CE) activities were inhibited by 88% and 35…
With a higher dose (50 mg kg(-1)), the birds di…
birds that were sampled at 3 h, w…
was a statistically significant corre…
rustica) nesting in a stable treated …
stable.

Arch Environ Contam Toxicol. 1992 Jul;23(1):99-104.

Serum esterase inhibition in birds: a nondestructive biomarker to assess organophosphorus and carbamate contamination.

Fossi MC[1], Leonzio C, Massi A, Lari L, Casini S.

Author information

Abstract

With the aim of proposing a nondestructive biomarker for monitoring the toxicological risk to birds of exposure to the organophosphorus insecticide azamethiphos and the carbamate insecticide methomyl, laboratory studies were performed on serum "B" esterases in Japanese quail (Coturnix coturnix japonica). The birds received two single dos… of each compound (azamethiphos and methomyl), i.e., 50 mg/kg and 250 mg/kg respectively. In the first treatment, serum but… carboxylesterase (CbE) were drastically inhibited in the azamethiphos-treated group, 24 h after the dose. N… activities in the methomyl-treated group, 24 h after the dose. In the second treatment, the bi… brain acetylcholinesterase (AChE) were strongly inhibited after treatme… ethoxyresorufin dealkylation activities were also inhibited. A stati… found at lethal and sublethal doses of these xenobiotics. The ex… an early qualitative and semi-quantitative warning of the toxic e…

Ecotoxicology. 2003 Feb-Aug;12(1-4):297-…

Review: porphyrins as biomarkers for hazard assessment of bird populations: destructive and non-destructive use…

Casini S[1], Fossi MC, Leonzio C, Renzoni A.

Author information

Abstract

In this review the biochemical, metabolic and toxicological significance of porphyrins in birds is examined, and their use as biomarkers of exposure to xenobiotics and heavy metals is explored. Laboratory studies pinpointing the main classes of compounds that alter porphyrin profiles are described, as well as those which defined the resulting porphyrin profiles and target organs. Field studies in which the biomarker was validated in natural p… several species of birds are then reviewed. We finally illustrate their potential as a nondestructive biomarker suitable for sit… …ctive sampling of natural populations must be avoided, suggesting the implementation of this approach.

GIREPAM

Chemosphere. 1999 Oct;39(8):1273-85.

Nondestructive biomarkers of exposure to endocrine disrupting chemicals in endangered species of wildlife.

Fossi MC[1], Casini S, Marsili L.

Author information

Abstract

This paper explores the problem of endocrine disrupting chemicals (EDCs) from the ecotoxicological point of view, focusing on nondestructive biomarkers of exposure to EDCs for risk assessment of endangered species of wildlife. Several EDCs, such as polyhalogenated aromatic hydrocarbons and toxic metals, tend to be biomagnified in the terrestrial and particularly the marine food chains. Top predators tend to accumulate high concentrations of these contaminants which places them in a situation of high toxicological risk. Hence, there is a need to develop nondestructive techniques, such as nondestructive biomarkers, for hazard assessment, protection, and conservation of endangered species exposed to EDCs. The biological materials proposed for this approach (for example blood, faeces, fur, skin biopsy specimens) are easily obtained with minimal stress for individuals and populations. Some validation data are reported on porphyrins in sea bird excreta (Larus dominicanus, Phalacrocorax olivaceus, Pelecanus occidentalis thagus), as nondestructive biomarkers of exposure to organochlorines, and on benzopyrene monooxygenase activities in marine mammal skin biopsy specimens (Stenella coeruleoalba, Balaenoptera physalus), as early indicators of exposure to p,p'-DDE and other endocrine disrupting organochlorines.

Bull Environ Contam Toxicol. 1996 Feb;56(2):244-50.

Porphyrins as biomarkers of methylmercury and PCB exposure in experimental quail.

Leonzio C[1], Fossi MC, Casini S.

Author information

Abstract

Chemicals such as heavy metals and polyhalogenated hydrocarbons have a high capacity to interfere with the enzymatic processes responsible for haem biosynthesis. These compounds can produce accumulation in tissues and organs and increased elimination of porphyrins in excreta (Andrew et al, 1990). The development of fast and easy analytical methods and the wide variety of biological media in which porphyrins can be detected have suggested their use as biomarkers of environmental pollution (Akins et al, 1993; De Matteis and Lim 1994). The analysis of porphyrins in the excreta is of special interest because it enables nondestructive monitoring of wild animals in the assessment of threatened or endangered species (Fossi et al, 1994). Methylmercury and PCBs are ubiquitous global pollutants and there is evidence they accumulate in terminal consumers, particularly those belonging to marine trophic chain (Renzoni et al, 1986; Yamashita et al, 1993). There have been some reports on methylmercury-induced (e.g. Woods et al, 1991; Bowers et al, 1992; Miller and Woods 1993) and PCB-induced porphyria (e.g. Vos and Pennings, 1971; Miranda et al, 1987; Elliot et al, 1990; Miranda et al, 1992) but little data on their combined effect. In order to investigate the quality of porphyrins as biomarkers we performed an experiment in which Japanese quail were fed a diet containing methylmercury and polychlorobyphenyls (PCBs as Arochlor 1260) individually or combined in different ratios. The present study aims to provide preliminary data on liver and fecal levels of porphyrins in response to methylmercury and PCB administration, and on whether the indicator is sensitive to synergism or antagonism between the two compounds, administered simultaneously.

Sci Total Environ. 2017 Nov 15;598:179-187. doi: 10.1016/j.scitotenv.2017.04.014. Epub 2017 Apr 22.

Individual variation of persistent organic pollutants in relation to stable isotope ratios, sex, reproductive phase and oxidative status in Scopoli's shearwaters (Calonectris diomedea) from the Southern Mediterranean.

Costantini D[1], Sebastiano M[2], Müller MS[3], Eulaers I[4], Ambus P[5], Malarvannan G[6], Covaci A[6], Massa B[7], Dell'Omo G[8].

⊕ Author information

Abstract

Little is known about the accumulation of persistent organic pollutants (POPs) and its consequences for seabirds in the Mediterranean basin. We characterised the plasma contaminant profile (polychlorinated biphenyls ΣPCBs; organochlorine pesticides ΣOCPs; polybrominated diphenyl ethers ΣPBDEs) of a population of the seabird Scopoli's shearwater (Calonectris diomedea) that breeds in the southern Mediterranean (Linosa Island) and investigated (i) whether sex, stable isotope ratios (related to diet), reproductive phase (early incubation vs. late breeding season) and body mass explained variation in contaminant burden and (ii) whether they predict health-related variables. The predominant category of POPs was ΣPCBs contributing between 53.0 and 92.4% of the total POPs in each shearwater. The percentage contribution of ΣOCPs to total POPs ranged between 7.6 and 47.0%, while that of ΣPBDEs ranged between <1% and 22.1%. Near the end of the breeding season, concentrations of ΣPCBs, ΣOCPs and ΣPOPs were significantly higher than at the beginning of the incubation period. ΣPBDEs were higher in males than females near the end of the breeding season, while they were higher in females than males at the beginning of the egg incubation period. Carbon- and nitrogen isotope ratios and individual body mass were not significantly associated with any contaminant class. Mates differed in the concentration of POPs, but they had similar stable isotope values. There was little evidence for a connection between contaminants and blood-based markers of oxidative balance. None of the contaminants predicted the probability of a bird being resighted as a breeder the following year. Thus, although POPs were present at high concentrations in some individuals, our study suggests little concern regarding POP exposure for this shearwater population.

KEYWORDS: Antioxidants; Contaminants; Isotopes; Oxidative stress; POPs; Seabirds

POPs WERE WEAKLY ASSOCIATED WITH MARKERS OF ANTIOXIDANT PROTECTION.

GIREPAM

ANNEX A – PRELIMINARY RESULTS FROM SAMPLES TAKEN IN 2015

TECHNICAL REPORT

Ilaria Caliani*, Nicola Bianchi*, Matteo Baini*

***Department of Physical, Hearth and Environmental Sciences, University of Siena, Siena, Italy**

Preliminary analysis of mercury in feather's samples and analysis of frequency of abnormalities in peripheral erythrocytes in blood samples from three different species of seabirds sampled in different areas of the Mediterranean Sea.

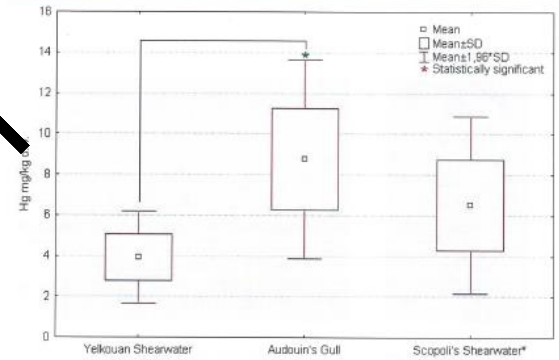


Figure 2A. Mercury levels (mg/kg dry matter) in down of yelkouan shearwater (n = 9), audouin's gull (n = 3) and in feathers scopoli's shearwater (n = 3) sampled in Tunisia. (* feathers of adults).

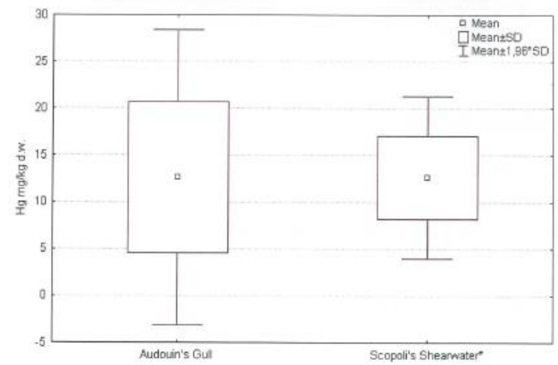


Figure 3A. Mercury levels (mg/kg dry matter) in down of audouin's gull (n = 3) and feathers of scopoli's shearwater (n = 3) sampled in Italy. (* feathers of adults).

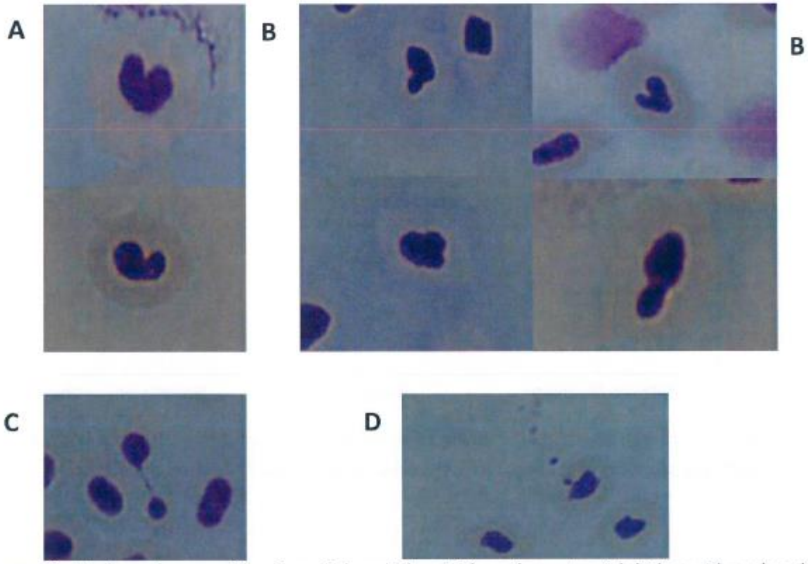


Figure 1A. Nuclear abnormalities in peripheral blood: A) erythrocyte with kidney, B) nuclear bud, C) fragmented erythrocyte, D) erythrocyte with micronucleus.

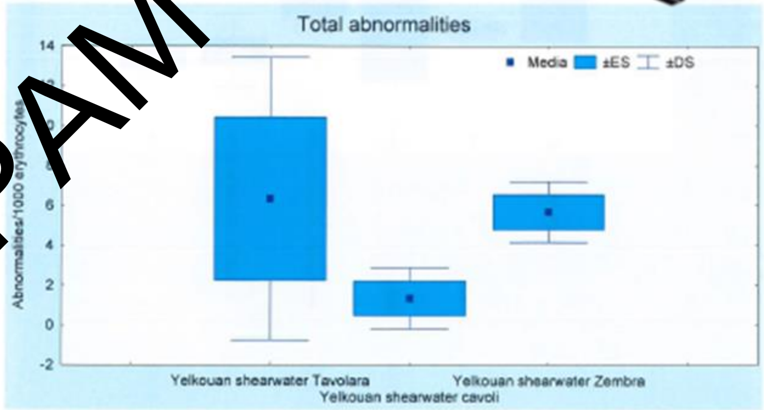
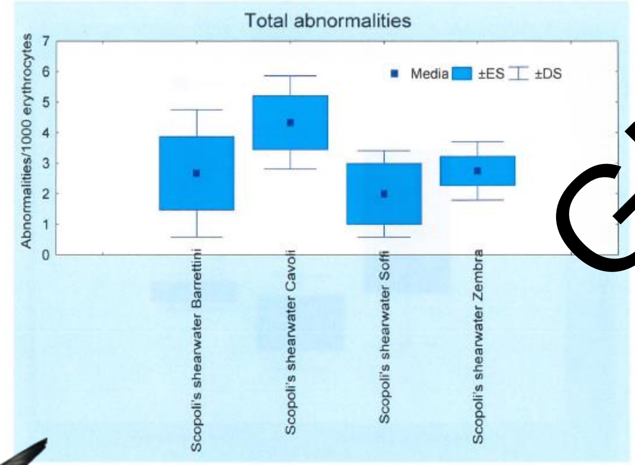


Figure 11A. Frequencies of total abnormalities (mean, deviation standard and error standard) in peripheral blood of Yelkouan shearwater collected from different sampling areas in Italy (Tavolara in Sardinia north and Cavoli in Sardinia south) and in Tunisia (Zembra island).



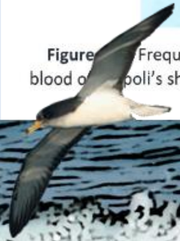
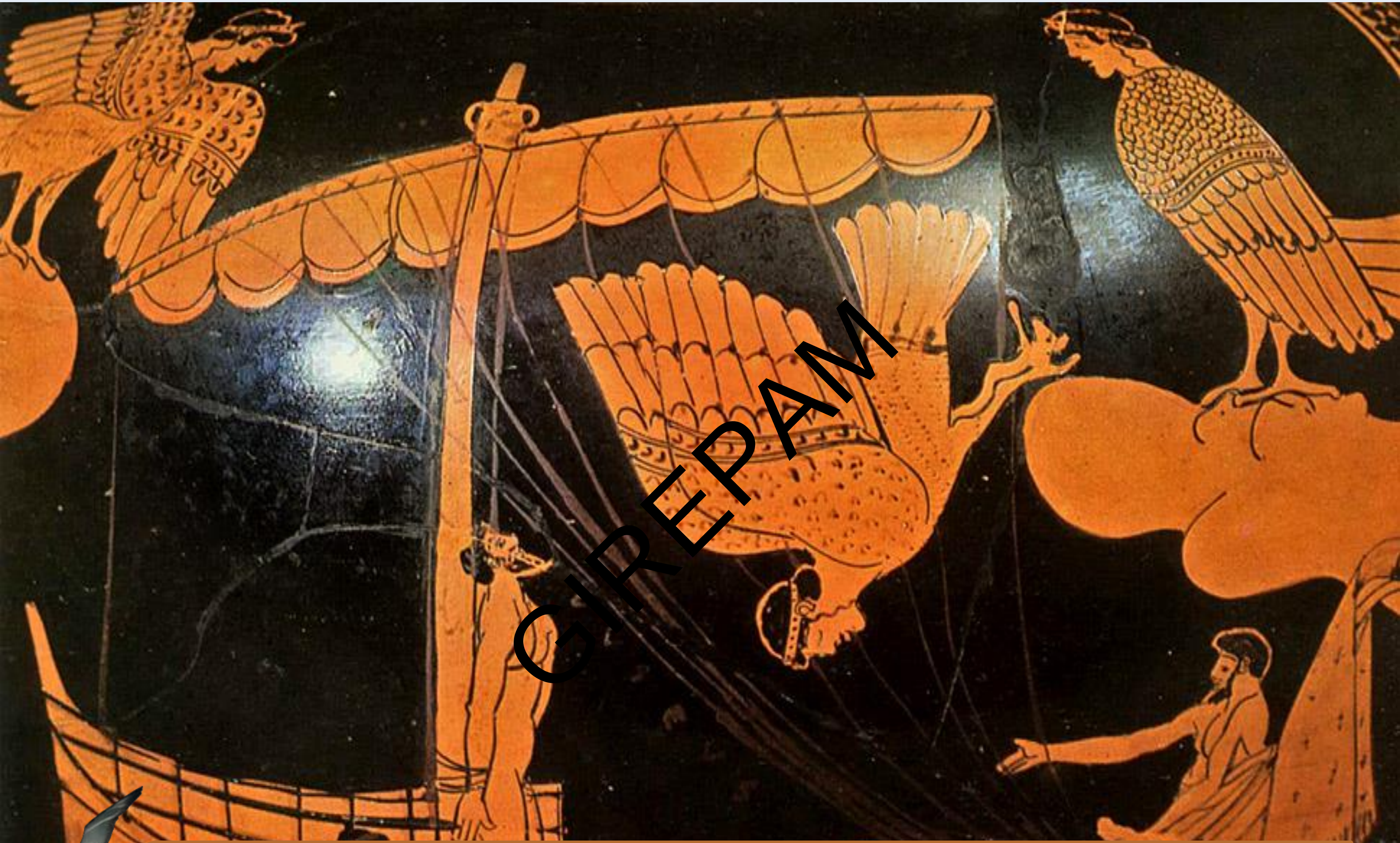


Figure Frequencies of total abnormalities (mean, deviation standard and error standard) in peripheral blood o poli's shearwater collected from different sampling areas in Italy (Cavoli in Sardinia south; Soffi and Barrettini in Sardinia north) and in Tunisia (Zembra island).



Thanks for your attention!