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ORIGINAL ARTICLE

Chlordecone levels in green turtles from Martinique 30 years after the national ban of this insecticide

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Abstract
Chlordecone, banned in 1993, is a persistent toxic insecticide that is presently monitored in humans and food-producing animals in the French West Indies, yet marine wildlife impregnation is poorly known. Here, we measured chlordecone concentrations in the plasma of 77 green turtles, sampled in 2022 and 2023 in two bays of the Martinique island, using gas chromatography coupled to tandem mass spectrometry. Chlordecone was quantified in 58.4% of the turtles samples. We did not observe year- nor site-effects. Interestingly, we compared the concentrations with human plasma toxicity threshold. Results show that 17.8% of individuals displayed chlordecone levels exceeding the toxicity threshold levels for humans. These results are of concern for human and wildlife health because turtles were sampled in fishing and swimming zones, 30 years after the ban of chlordecone.

Keywords Chlordecone · Conservation · Contamination · Ecotoxicology · Green turtle · West Indies

Introduction

The controversial and massive use of chlordecone in the French Martinique island is among the biggest environmental scandals of the last five decades [1]. This pesticide was extensively spread in the French West Indies to fight against the banana weevils from 1972 to 1993, the year of its national ban. However, this organochlorine insecticide has been recognized as neurotoxic and reprotoxic [2], banned in the United States since 1976, classified as a potential carcinogen since 1979 by the International Agency for Research on Cancer, and included in the Stockholm Convention Annex A on Persistent Organic Pollutants, which lists chemicals to eliminate, in 2009. Notably, it has been associated with increasing risk of prostate cancer in the French West Indies human population, and hepatic tumors in laboratory rats and mice (see [2] for further details).

This two-decade-long heavy and widespread use of chlordecone resulted in extended contamination of soils, rivers, sediments, food-producing animals and plants [3], as well as of the human population itself [4] because of its high degree of bioaccumulation and biomagnification [5]. In 2013–2014, over 90% of Martinique inhabitants were found to be contaminated with chlordecone [4], mainly due to the fact that the Martinique population largely relies on local resources which are contaminated. Concerningly, because of its physicochemical properties, this endocrine disruptor is highly persistent in the environment, i.e., from several decades to centuries [6].

Controversially, apart from terrestrial and aquatic food-producing vertebrates and invertebrates, which are used as

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bioindicator in toxicological monitoring studies, local wildlife contamination has been seldom considered, especially in the marine and coastal environments [7]. Yet, Martinique is a well-known key place for green sea turtles (*Chelonia mydas*), an emblematic long-lived marine species. It was listed as "endangered" in the International Union for Conservation of Nature red list until October 2025 and is now classified as "Least concern" at the global scale, but is still highly locally threatened by multiple biotic and abiotic factors [8]. Due to their global distribution, their long life span, their high fidelity to coastal foraging grounds, their various trophic levels throughout life and their capacity to accumulate contaminants, green turtles are key bioindicators for monitoring marine ecosystem pollution [9, 10]. Specifically, the West coast of the Martinique island hosts an important population of immature green turtles, characterized by their strong site-fidelity to a given bay for approximately 10–15 years before migrating to their adult foraging grounds in the Caribbeans and Atlantic Ocean [11].

Here, we report the first baseline concentrations of chlordecone in immature green turtles from Martinique, sampled 30 years after the ban of this pesticide, using plasma as a biological matrix, which allows for a minimally invasive and non-lethal sampling in the context of ecotoxicological biomonitoring. We compare these concentrations across sampling years and sites, as well as to the known toxicity levels for humans, that is the only reference value currently available in the literature for vertebrates so far.

Experimental

We sampled 77 wild immature green turtles, in two bays, i.e., Anse du Bourg/Chaudière and Grande Anse ([12], Fig. 1A). Importantly, they have first been selected because of their high turtle densities [12].

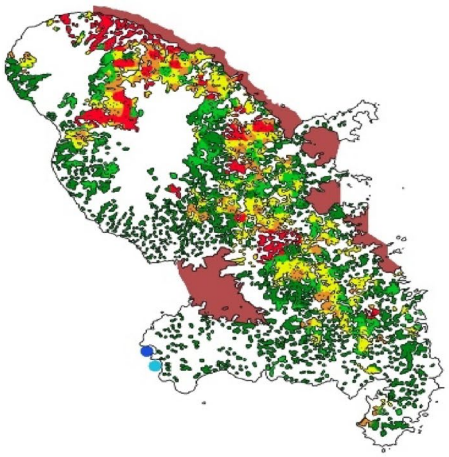
Moreover, both sites are located within the authorized fishing zones (Fig. 1B), and far from areas with high chlordecone soil contamination (Fig. 1B), which means that water quality is considered as satisfactory by the French government.

This ecotoxicological monitoring was carried out during two consecutive fieldwork sessions, in February 2022 and 2023, including 37 and 40 individuals sampled respectively. In brief, turtles were captured by free drivers at depths of up to 15 m and brought back to the surface (see [13] for more details). Blood samples of approximately 2 mL were collected from the jugular artery in the dorsal cervical sinus using a heparinized syringe with a 21-gauge needle. All blood samples were centrifuged for 2 min at 4,000 rpm to separate plasma and red blood cells, which were subsequently stored at -20 °C until ecotoxicological analyses.

The assessment of plasma contamination by chlordecone was achieved with a Perkin Elmer automated thermal desorber pre-concentrator coupled to a Thermo gas chromatography equipped with a ITQ 900 tandem mass spectrometer, following the sample preparation and chemical analysis methods described in [14]. In brief, each plasma



A



B

Fig. 1 **A** Picture of an immature green turtle grazing on algae and phanerogam grass meadows in a Martinican bay. Picture taken by Fabien Lefebvre and Damien Chevallier. **B** Map of Martinique presenting soil contamination by chlordecone in 2016, unauthorized fishing areas defined by the French government due to concerning chlordecone levels measured in the water, and the two turtle sampling spots for this ecotoxicological study. Chlordecone contamination is represented according to 4 levels: red – concerningly high; orange – high; yellow – medium; light green – low. Dark green corresponds to area with chlordecone levels below the limit of detection. Restricted fishing areas are highlighted in brown. Turtle sampling areas are representing with blue circles: dark and light blue circles correspond to Grande Anse and Anse du Bourg/Chaudière respectively. Figure adapted from the French water development and management master plan (SDAGE) – Guillaume Raimbaud (Observatoire de l'Eau de la Martinique)

sample was pre-concentrated and analyzed in duplicate using automated thermal desorption gas chromatography coupled to tandem mass spectrometry (ATD-GC-MS/MS). Prior to the analytical sequence, clean automated thermal desorption (ATD) tubes were injected to verify the absence of contamination. The solvent used for chlordecone extraction from plasma was also injected into the gas chromatography coupled to tandem mass spectrometry (GC/MS-MS) system to avoid potential contamination. Quantification was performed twice for each plasma sample with GC/MS-MS, allowing for the selection of specific daughter ions for the chlordecone molecule, thereby minimizing the risk of misidentification. Calibration was achieved by injecting a spiked ATD tube with increasing concentrations of chlordecone standards, each analyzed in triplicate. Standard variation was below 15% for all solutions injected. The chlordecone levels are expressed in ng *per* wet weight (ww) gram of plasma, hereafter written ng/g ww plasma. The application of such mass-correction resulted in final chlordecone concentrations below the limit of detection for 29 samples, which were therefore excluded from subsequent quantitative analyses ($N_{final} = 48$). The limit of detection and the limit of quantification were 0.027 and 0.051 ng/g ww plasma, respectively. For samples with chlordecone concentrations below the limit of detection, a substituted value corresponding to one-sixth of the limit of detection, i.e., 0.0045 ng/g ww plasma, was assigned for statistical analyses.

Statistics were performed using R software v4.3.0 ([15], see Text S1 for the entire script used). We determined year- and site-effect on chlordecone levels using the t.test function from the *stats* package, with Welch approximation used for the calculation of the degree of freedom. Normality was assessed visually with a Quantile-Quantile plot. We measured the site-effect on the proportion of individuals with chlordecone levels above the limit of detection using the chisq.test function from the *stats* package, with Pearson's approach applied to perform the goodness-of-fit.

Results and discussion

Turtles impregnation by chlordecone

Chlordecone plasma concentrations were between the limits of detection and quantification for 3 and above the limit of quantification for 45 out of the 77 sampled turtles respectively.

This work represents the first study of local chlordecone contamination in a long-lived marine vertebrate. It highlights that 62.3% and 58.4% of the sampled turtles in Martinique showed detectable and quantifiable concentrations of chlordecone respectively, 30 years after its ban. Importantly, we measured the circulating plasma chlordecone concentrations, reflecting the short-term exposure and impregnation to this insecticide.

Here, we emphasize the prevalent chlordecone impregnation in Martinican immature green turtles, whilst corroborating the findings on chlordecone quantification in the skin and eggs of female green and hawksbill turtles transiently nesting on Guadeloupe beaches [16]. Our results are raising concerns as immature sea turtles are essentially herbivorous, i.e., grazing on algae and phanerogam grass meadows ([17], Fig. 1A). In other words, they are at the lowest levels of the marine trophic chain, and thus expected to be the least exposed and impregnated. Yet, given the capacity of native seagrass beds to retain chlordecone [18] and the recent demonstration of a biomagnification mechanism of this substance within the soil ecosystem [19], the frequent turtle contamination observed in our study could be due to chlordecone absorption, i.e., through food consumption. Moreover, as immature sea turtles spend their entire time in the Martinican coastal waters, they may also be exposed to chlordecone through adsorption, i.e., passive transfer through the skin. While our correlative approach cannot definitely identify the main route of exposure, the diluted chlordecone levels are locally slightly lower at seagrasses meadows [18], suggesting that turtle chlordecone impregnation may probably be explained by absorption rather than adsorption, although both hypotheses remain plausible and non-exclusive. Further research is urgently needed to differentiate between these two routes of contamination, with local concomitant chlordecone studies in coastal water column, substrate, seagrasses, and turtles, for example (Fig 2).

To conclude, this finding then suggests that non-negligible residual chlordecone levels are still circulating in the coastal environment of Martinique inhabited by immature turtles with chlordecone contamination and diffusion occurring early in the local marine food web.

Potential year- and site-effect on turtle chlordecone impregnation

Chlordecone concentrations for the 48 individuals with chlordecone levels above the limit of detection were not significantly different between the two years ($t_{1,46} = 1.52$, $p = 0.140$, Table 1) nor the proportion of contaminated individuals, i.e., above the limit of detection ($\chi^2_{1,75} = 3.73$, $p = 0.053$). Moreover, both the chlordecone concentrations *per se* and the proportion of contaminated individuals were not different between the two sampling sites, i.e., Anse du Bourg/Chaudière and Grande Anse ($t_{1,46} = -0.310$, $p = 0.759$ and $\chi^2_{1,75} = 1.12$, $p = 0.289$, Table 2). When considering only the 45 individuals with chlordecone levels above the limit of quantification, chlordecone levels were again not

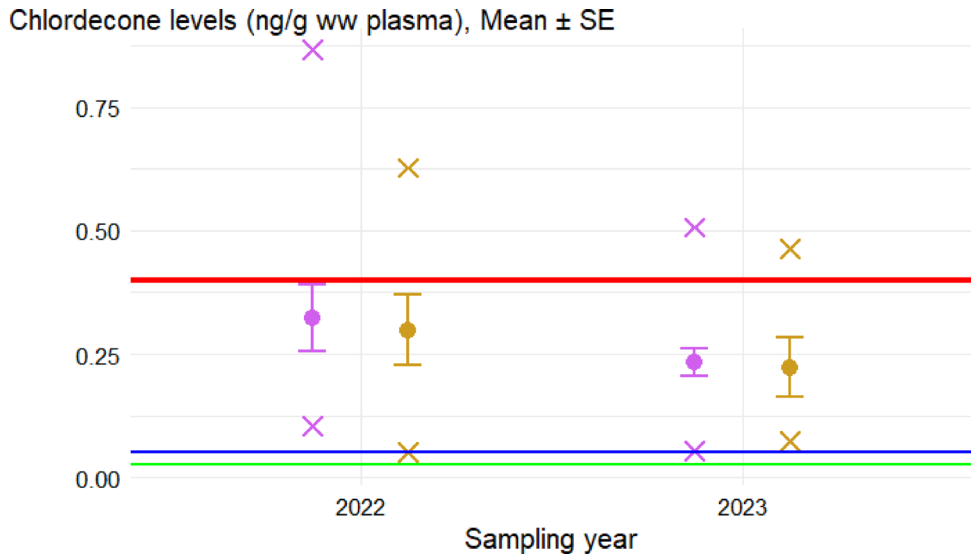


Fig. 2 Quantified chlordecone levels (ng/g ww plasma) for the 19 and 26 sampled turtles in 2022 (left) and 2023 (right) respectively. The purple and golden yellow figure elements (dots, bars, and crosses respectively) correspond to data from turtles sampled in the Anse du Bourg/Chaudière and Grande Anse bays, respectively. Specifically, the dots correspond to the average chlordecone levels, the bars to the average chlordecone levels plus or minus the standard error (SE) and crosses to the minimum and maximum values respectively. The horizontal green line corresponds to the limit of chlordecone detection, defined as 0.027 ng/g ww plasma. The horizontal blue line corresponds to the limit of chlordecone quantification, stated at 0.051 ng/g ww plasma. The horizontal red line corresponds to the human internal chronic toxicological reference value estimated at 0.400 ng/g ww plasma

Table 1 Description of chlordecone quantification (ng/g ww plasma) in plasma of immature green turtles from Martinique sampled during the capture sessions conducted in February 2022 and 2023

	Year	
	2022. $N=37$	2023. $N=40$
Quantification proportion (%)	51.4 ($N=19$)	65.0 ($N=26$)
Mean ± SE	0.314 ± 0.048	0.230 ± 0.025
Median	0.256	0.189
Min - Max	0.052–0.866	0.054–0.506
	Year	
	2022. $N=19$	2023. $N=26$
Proportion of individuals above the human toxicity reference value (%)	26.3 ($N=5$)	11.5 ($N=3$)

We indicated the number of turtles sampled each year (sample number, N) and provided the mean ± standard error (SE), as well as the minimum (Min) and maximum (Max) values recorded for each monitored year

Table 2 Description of chlordecone quantification (ng/g ww plasma) in plasma of immature green turtles from Martinique sampled during the capture sessions conducted in Anse du Bourg/Chaudière and Grande Anse

	Sampling site	
	Anse du Bourg/Chaudière. $N=52$	Grande Anse. $N=25$
Quantification proportion (%)	61.5 ($N=32$)	52.0 ($N=13$)
Mean ± SE	0.266 ± 0.031	0.264 ± 0.047
Median	0.211	0.228
Min - Max	0.054–0.866	0.052–0.627
	Sampling site	
	Anse du Bourg/Chaudière. $N=32$	Grande Anse. $N=13$
Proportion of individuals above the human toxicity reference value (%)	15.6 ($N=5$)	23.1 ($N=3$)

We indicated the number of turtles sampled each year (sample number, N) and provided the mean ± standard error (SE), as well as the minimum (Min) and maximum (Max) values recorded for each monitored year

significantly different between years ($t_{1,43} = 1.53$, $p=0.137$) or between sampling sites ($t_{1,43} = 0.035$, $p=0.972$).

We demonstrated here the widespread and recent contamination of turtles by chlordecone around the Martinique island. Specifically, we reported comparable levels of chlordecone across years and sites of interest in this study.

Importantly, individuals in this study were sampled on the Caribbean coast and inside the authorized fishing zones defined by the French government in both 2022 and 2023. Fishing is not permitted along the entire coastline of the Martinique island due to high chlordecone levels measured locally in sea water (brown areas in Fig. 1B). Considering that seafood products represent the main food protein source for the local population [4], our results are of concern for human health and suggest an ongoing chlordecone contamination of human Martinican populations through their diet. Furthermore, while Anse du Bourg/Chaudière and Grande Anse, the two sampling sites of our study, are not

considered by the French agency for food, environmental and occupational health & safety (ANSES) as contaminated areas, this study should encourage the French environmental and health authorities to reinforce chlordecone monitoring all along the Caribbean coast – in swimming areas notably, and outside port areas.

Overall, the current presence of chlordecone in coastal systems, suggested by the findings of this study, may be promoted by soil erosion [20, 21], which is possibly increased by the use of glyphosate-containing herbicides as part of agricultural practices in the island [22]. Future investigations looking at concentrations in internal tissues of dead stranded or accidentally captured turtles would help to assess the long-term contamination and accumulation of chlordecone in the tissues of green turtles, while avoiding ethical concerns regarding sampling of healthy free-ranging individuals. Moreover, sampling other life stages, e.g., hatchlings and adults, in French West Indies, but outside Martinique which only hosts immature individuals, will provide a more comprehensive understanding of geographical, temporal and chronic patterns of chlordecone exposure.

To conclude, these results suggest the frequent and recent chlordecone contamination of turtles inhabiting the Martinique island in fishing areas, questioning the human contamination.

Potential chlordecone risk

Among the 45 individuals sampled with chlordecone plasma concentrations above the limit of quantification over the two years, eight of them (i.e., 17.8%, see Tables 1 and 2 for distribution and proportion patterns across years of interest and sampling sites respectively) presented values above 0.400 ng/g ww plasma, the human chronic internal toxicity reference value defined by ANSES in 2021 [23].

While green sea turtles already suffer from various abiotic and biotic environmental pressures, such as bycatch, vessel strikes, loss of nesting and foraging habitat, climate change and fibropapillomatosis, i.e., a debilitating tumoral disease, our results suggest that at the immature stage, this species may also be threatened locally by chlordecone contamination, a pollutant describes as carcinogenic and neurotoxic in several vertebrate species.

The threshold used in this study has been recently determined by the ANSES, based on epidemiological data [24]. It refers to the concentration of chlordecone in blood below which the long-term risk of adverse effects in the human population is considered negligible. In other words, if this threshold is exceeded for an extended period, the possibility of adverse effects in the population cannot be excluded. Here, since no toxicity reference value has been determined for any reptilian species, we considered the only reference value for a vertebrate available in the literature, i.e. human. While the extrapolation of toxicology data from mammals to reptiles is questionable, due to evident metabolic, physiological, and toxicological differences between these two animal groups, our results remain concerning. Indeed, green turtles stay in Martinican bays for several years during their growth/maturation phase which may then expose them to this pollutant on a chronic basis and thus, potentially increase the toxic risk. To go further, local longitudinal turtles monitoring, i.e., concomitant measurement of chlordecone levels and health status throughout time to given individuals, would be one of the next crucial steps to conduct in order to provide appropriate research outputs. Specifically, studying chlordecone short- and long-term effects on turtles' health, reproduction and survival and associated impact on populations dynamics should be a priority for the conservation of this locally endangered species, especially given that the French West Indies host important populations of sea turtles, at different stages of their life cycle, i.e., hatchlings, immatures, and adults.

All other available toxicological references are estimates of the acute median lethal dose (LD_{50}) in fishes, mammals, and birds, i.e., the substance dose required to kill 50% of a test population, which may not reflect the exposure experienced by green turtles in their natural habitat (for example in fish: [25]). Because our study was not designed to evaluate the adverse outcomes on any physiological, biochemical, or pathological endpoints due to chlordecone contamination, our results have to be considered cautiously when interpreting potential health implications for turtles. Yet, deleterious effects on aquatic organisms, i.e., the cichlid fish notably, are already documented [26, 27]. Thus, future studies are urgently needed to investigate impacts on turtle liver function, immune response, reproductive maturation, growth rates, and incidence of fibropapillomatosis notably.

To conclude, immature green turtles may be under the threat of chlordecone during their stay in the Martinican bays.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10311-026-01923-1.

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Author contributions SMD, PB, JF, GLL, MatG and DC designed research; SMD, MM, MatG and DC performed research ; PB, GLL, MA, NA, OB, CD, PF, CF-C, CF, CH, GH, AL, EL, ALL, YLM, NL, NL, FL, PL, ML, LL-J, JM, SM, EP, FP, SR, and DC performed data collection; SMD, AG, SM, MG, KM and JM analyzed data ; DC acquired funding; and SMD, MatG and DC wrote the paper. All authors commented on the paper drafts.

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Data availability All data generated during this study can be found in Table S1 of the Supplementary Material attached to this published article.

Code availability Code used can be found in Text S1 of the Supplementary Material attached to this published article.

Declarations

Competing interests The authors declare no competing interest.

Ethical approval Fieldwork was performed in accordance with the French legal and ethical requirements. Specifically, the protocol was approved by the conseil national de la protection de la nature (CNPN) and the French Ministry for Ecology (permit number: R02-2020-08-10-006) and followed the recommendations of the police prefecture of Martinique. Fieldwork was carried out under the certification of Damien Chevallier (prefectural authorizations' owner) under strict compliance of the police of Martinique's recommendations to minimize animal disturbance.

Consent to participate All authors consent to participate to this study.

Consent for publication All authors consent for publication.

References

1. Resiere D, Florentin J, Kallel H et al (2023) Chlordecone (Kepone) poisoning in the French territories in the Americas. Lancet 401:916. https://doi.org/10.1016/S0140-6736(23)00180-0
2. Inserm (2021) Pesticides et effets sur la santé: Nouvelles données. Collection Expertise collective. EDP Sciences, Montrouge, pp 437–491
3. Mottes C, Deffontaines L, Charlier JB et al (2020) Spatio-temporal variability of water pollution by chlordecone at the watershed scale: what insights for the management of polluted territories? Environ Sci Pollut Res 27:40999–41013. https://doi.org/10.1007/s11356-019-06247-y
4. Dereumeaux C, Saoudi A, Guldner L et al (2020) Chlordecone and organochlorine compound levels in the French West Indies population in 2013–2014. Environ Sci Pollut Res 27:41033–41045. https://doi.org/10.1007/s11356-019-07181-9
5. Coat S, Monti D, Legendre P, Bouchon C, Massat F, Lepoint G (2011) Organochlorine pollution in tropical rivers (Guadeloupe): role of ecological factors in food web bioaccumulation. Environ Pollut 159:1692–1701. https://doi.org/10.1016/j.envpol.2011.02.036
6. Cabidoche Y-M, Achard R, Cattan P, Clermont-Dauphin C, Massat F, Sansoulet J (2009) Long-term pollution by chlordecone of tropical volcanic soils in the French West Indies: a simple leaching model accounts for current residue. Environ Pollut 157:1697–1705. https://doi.org/10.1016/j.envpol.2008.12.015
7. Dromard CR, Bodiguel X, Lemoine S, Bouchon-Navaro Y, Reynal L, Thouard E, Bouchon C (2016) Assessment of the contamination of marine fauna by chlordecone in Guadeloupe and Martinique (Lesser Antilles). Environ Sci Pollut Res 23:73–80. https://doi.org/10.1007/s11356-015-4732-z
8. Lelong P, Besnard A, Girondot M et al (2024) Demography of endangered juvenile green turtles in face of environmental changes: 10 years of capture-mark-recapture efforts in Martinique. Biol Conserv 291:110471. https://doi.org/10.1016/j.biocon.2024.110471
9. Dsikowitzky L, Schwarzbauer J (2014) Industrial organic contaminants: identification, toxicity and fate in the environment. Environ Chem Lett 12:371–386. https://doi.org/10.1007/s10311-014-0467-113
10. Beauvieux A, Bourjea J, Fromentin JM et al (2024) Tracing troubles: Unveiling the hidden impact of inorganic contamination on juvenile green sea turtle. Mar Pollut Bull 208:117048. https://doi.org/10.1016/j.marpolbul.2024.117048
11. Chambault P, de Thoisy B, Huguin M et al (2018) Connecting paths between juvenile and adult habitats in the Atlantic green turtle using genetics and satellite tracking. Eco Evo 8:12790–12802. https://doi.org/10.1002/ece3.4708
12. Roost T, Schies J-A, Girondot M et al (2022) Fibropapillomatosis prevalence and distribution in immature green turtles (*Chelonia mydas*) in Martinique Island (Lesser Antilles). EcoHealth 19:190–202. https://doi.org/10.1007/s10393-022-01601-y
13. Bonola M, Girondot M, Robin J-P et al (2019) Fine scale geographic residence and annual primary production drive body condition of wild immature green turtles (*Chelonia mydas*) in Martinique Island (Lesser Antilles). Biol Open 8:bio048058. https://doi.org/10.1242/bio.048058
14. Rodrigues A, Gaffard A, Moreau J, Monceau K, Delhomme O, Millet M (2023) Analytical development for the assessment of pesticide contaminations in blood and plasma of wild birds: the case of grey partridges (*Perdix perdix*). J Chromatogr A 1687:463681. https://doi.org/10.1016/j.chroma.2022.463681
15. R Core Team (2015) R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna. https://www.R-project.org23
16. Dyc C, Covaci A, Debier C, Leroy C, Delcroix E, Thomé J-P, Das K (2015) Pollutant exposure in green and hawksbill marine turtles from the Caribbean region. Reg Stud Mar Sci 2:158–170. https://doi.org/10.1016/j.rsma.2015.09.004
17. Siegwalt F, Jeantet L, Lelong P et al (2022) Food selection and habitat use patterns of immature green turtles (*Chelonia mydas*) on Caribbean seagrass beds dominated by the alien species *Halophila stipulacea*. Glob Ecol Conserv 37:e02169. https://doi.org/10.1016/j.gecco.2022.e02169
18. Dromard CR, Bouchon-Navaro Y, Cordonnier S, Guéné M, Harmelin-Vivien M, Bouchon C (2018) Different transfer pathways of an organochlorine pesticide across marine tropical food webs assessed with stable isotope analysis. PLoS ONE 13:e0191335. https://doi.org/10.1371/journal.pone.0191335
19. Coulis M, Senecal J, Devriendt-Renault Y, Guerin T, Parinet J, Pak LT (2024) Fate of chlordecone in soil food webs in a banana agroecosystem in Martinique. Environ Pollut 362:124874. https://doi.org/10.1016/j.envpol.2024.124874
20. Höhener P, Guers D, Malleret L et al (2022) Multi-elemental compound-specific isotope analysis of pesticides for source identification and monitoring of degradation in soil: a review. Environ Chem Lett 20:3927–3942. https://doi.org/10.1007/s10311-022-01489-8
21. Mottes C, Sabatier P, Evrard O et al (2022) Pesticide resurrection. Environ Chem Lett 20:3357–3362. https://doi.org/10.1007/s10311-021-01347-z

22. Sabatier P, Mottes C, Cottin N et al (2021) Evidence of chlordecone resurrection by glyphosate in French West Indies. Environ Sci Technol 55:2296–2306. https://doi.org/10.1021/acs.est.0c05207
23. ANSES, Saisine n° « 2018-SA-0166 » - revision from 29/11/2021. https://www.anses.fr/fr/system/files/ERCA2018SA0166.pdf
24. Emond C, Multigner L (2022) Chlordecone: development of a physiologically based pharmacokinetic tool to support human health risks assessments. Arch Toxicol 96:1009–1019. https://doi.org/10.1007/s00204-022-03231-3
25. Asifa KP, Chitra KC (2015) Determination of median lethal concentration (LC50) and behavioral effects of chlordecone in the cichlid fish, *Etroplus maculatus*. Int J Sci Res 4:1473–1475. https://doi.org/10.21275/SUB152402
26. Asifa KP, Vidya Balakrishnan PV, Chitra KC (2014) Toxicity evaluation of chlordecone and its effect on oxidative imbalance in the cichlid fish, *Etroplus maculatus* (Bloch). Int J Zool Res 4:1–20
27. Asifa KP, Chitra KC (2019) Effect of chlordecone on the reproductive potential of the cichlid fish, *Pseudetroplus maculatus* (Bloch, 1795). Mar Sci 2:163–177 Doi: 10.29199/2639- 4618/ARMS- 202033

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