Chemical Pollution and the Population Crisis of Hector's and Māui Dolphins.

A CRITICAL RESEARCH BIBLIOGRAPHY, 1970–2026

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CONTENT

Abstract

Background and objective. The decline of Hector's dolphin (Cephalorhynchus hectori hectori) and the critically endangered Māui dolphin (C. h. maui) has generated an extensive literature on bycatch, abundance, habitat, disease, and conservation management. Chemical pollution has also been documented, but its evidentiary status and its treatment in threat assessment remain fragmented. This study completes the bibliographic-reconstruction phase of a broader project examining whether chemical exposure has been under-recognised as a causal, contributory, or synergistic factor in the population crisis.

Methods. A bounded maximum-coverage bibliography was assembled for 1970–22 June 2026. It integrates the official Department of Conservation bibliographies of 2003, 2012, and 2018; the 2024 NOAA/NMFS five-year review; primary and grey literature on Hector's and Māui dolphins; New Zealand monitoring of organochlorines and dioxins; the Paritutu/New Plymouth historical-exposure corpus; comparative marine-mammal toxicology; disease and pathology studies; demographic and bycatch research; and literature on risk governance, uncertainty, and scientific recognition. Records were deduplicated and classified into five thematic layers. Fifty sources were selected for analytical annotation against a source-to-outcome chain: source → environmental transport → prey → internal dose → immune or reproductive effect → population outcome.

Results. The final corpus contains 388 unique records, including 19 direct dolphin toxicology, disease, and pathology sources; 55 New Zealand source and exposure-pathway sources; 45 comparative or mechanistic toxicology sources; 239 demographic, habitat, bycatch, and competing-threat sources; and 30 sources on risk governance and the history of knowledge. The literature establishes that Hector's and Māui dolphins have been exposed to persistent organic pollutants and, more recently, PFAS; it also supports trophic biomagnification, maternal transfer, and biologically plausible immunotoxic and reproductive mechanisms. However, Māui-specific toxicological samples are very small, contemporary PCDD/F coverage is limited, and no study closes the full causal chain from a defined New Zealand source to an individual health effect and a quantified population consequence. Bycatch and some infectious-disease pathways are represented by more direct mortality data and by models that are easier to parameterise.

Conclusions. Chemical pollution cannot be treated as an unobserved or purely speculative exposure, but the available literature does not yet quantify its contribution to population decline or demonstrate that it was the primary driver. The central finding of this bibliographic stage is an asymmetry of evidence production: directly countable mortality has been integrated into population-risk models more readily than chronic, mixture-based, and potentially synergistic effects on immunity, reproduction, and disease susceptibility. This bibliography therefore closes a distinct research phase by providing an auditable corpus, an explicit classification, a set of analytical priorities, and a reproducible starting point for the next phase of source attribution, integrated toxicology-pathology analysis, and population modelling.

Keywords

Hector's dolphin; Māui dolphin; Cephalorhynchus hectori; chemical pollution; persistent organic pollutants; dioxins and furans; PCDD/F; polychlorinated biphenyls; organochlorine pesticides; PFAS; Paritutu; New Plymouth; biomagnification; maternal transfer; immunotoxicity; reproductive toxicity; toxoplasmosis; brucellosis; bycatch; population viability; risk assessment; scientific non-recognition; critical reconstruction; New Zealand.

Key points

- The corpus contains 388 unique records published or issued between 1970 and 22 June 2026; 50 are analytically annotated.
- The search integrates direct dolphin evidence, New Zealand pollution sources and exposure pathways, comparative toxicology, competing population threats, and the governance of uncertainty.
- Persistent organic pollutants have been measured directly in Hector's and Māui dolphins; PFAS have now also entered the species-specific evidence base.
- Published evidence supports trophic biomagnification and maternal transfer, so exposure cannot be dismissed as merely environmental background.
- Comparative marine-mammal research provides credible mechanisms for immune impairment, reproductive dysfunction, and interaction with infectious disease.
- The species-specific literature rarely links an individual contaminant burden to pathology, fertility, calf survival, or subsequent demographic performance.
- Māui-dolphin toxicology remains particularly underpowered because only very small numbers of animals have been analysed.
- The historical existence of a TCDD-related source and human exposure at Paritutu/New Plymouth is documented; attribution of dolphin burdens to that source is not.
- No modern study combines congener fingerprinting across source materials, sediments, prey, dolphin tissues, pathology, and population modelling.
- Toxoplasmosis and brucellosis create plausible pathways for contaminant–disease interaction, but paired individual-level tests are lacking.
- Bycatch has stronger direct and quasi-experimental evidence, including observed entanglement mortality and improved survival after spatial protection.
- Official risk frameworks more readily quantify acute deaths than chronic, sublethal, mixture-based, or synergistic effects, producing an evidentiary asymmetry.
- The literature does not establish chemical pollution as the sole or principal cause of decline, but it also does not justify treating pollution as negligible.
- The most defensible current interpretation is that pollution is a documented exposure and a plausible contributory or synergistic threat whose population effect remains unquantified.
- Absence of a complete causal chain is a research gap; it is not evidence that a population-level effect is absent.
- This document completes the bibliographic-reconstruction phase and defines the evidence package and research design required for the next phase.

Introduction

The present study proceeds from the working hypothesis that chemical exposure may have played an important, potentially synergistic role in the rapid decline and impaired recovery of Hector's and Māui dolphin populations (1, 2). This is not presented as an established causal conclusion. Rather, it is the hypothesis against which the published and grey-literature record is critically reconstructed.

In this document, the term chemical factor is used provisionally as an umbrella category. It includes legacy organochlorine pesticides, polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/F), phenoxy-herbicide production contaminants and co-contaminants, PFAS, and other substances capable of acting through direct toxicity, endocrine or reproductive effects, immune modulation, altered disease susceptibility, or mixture effects. The existing evidence is too uneven to collapse these pathways into a single quantified exposure variable; the umbrella term is therefore descriptive, not mechanistically final.

A second premise concerns the three regimes of scientific recognition developed elsewhere in this project (3, 4). The present work follows the standard of critical reconstruction. It asks not only what conclusions appear in the literature, but also what was measured, which causal links were operationalised, which data entered formal models, which uncertainties remained unquantified, and how the organisation of research shaped the relative visibility of competing hypotheses. Analysis of the scientific community and its evidentiary practices is therefore part of the object of study rather than an external commentary on it.

This bibliography constitutes a completed research stage within a continuing programme. Its deliverables are: (i) a dated and deduplicated corpus; (ii) a five-layer thematic classification; (iii) analytical annotations for the most consequential sources; (iv) an explicit map of evidentiary strengths, discontinuities, and missing links; and (v) a defined reading and research pathway for subsequent source-attribution, toxicological, pathological, demographic, and science-studies analyses.

The document was prepared in advance of the conference to be held in Prague on 15–17 October 2026 (5). Later project outputs may revise interpretations or add newly released sources, but they will build on—not reopen—the completed bibliographic reconstruction reported here.

Questions addressed in this stage

- What direct evidence exists for chemical exposure, disease, and pathology in Hector's and Māui dolphins?
- Which New Zealand pollution sources and environmental pathways are documented, and where does source attribution remain incomplete?
- Which mechanisms established in other marine mammals are relevant to immunity, reproduction, maternal transfer, and susceptibility to infection?
- Why have bycatch and other directly lethal threats been more readily incorporated into quantitative risk models?
- How have official reviews and management documents classified, prioritised, or omitted chemical pollution?

- Which empirical studies are required to close the chain from source to dose, health effect, and population outcome?

1. Scope of the corpus and method

Here, maximally complete means maximum coverage within a defined research contour, not every publication worldwide on marine chemical pollution. The corpus was designed to reconstruct the evidence relevant to a specific causal question and to permit comparison among competing explanations. Coverage was built across five connected layers:

- [A] direct evidence from Hector's and Māui dolphins: contaminants, disease, and pathology
- [B] New Zealand sources and exposure pathways: Paritutu, 2,4,5-T/TCDD, and environmental monitoring
- [C] comparative and mechanistic toxicology of marine mammals
- [D] demography, bycatch, habitat, and competing explanations of decline
- [E] risk governance, the history of knowledge, scientific recognition, and uncertainty

The main bibliography is arranged chronologically from 1970, with entries alphabetised within each year. A star (★) marks a key source. The letter code identifies the thematic layer, and the code in braces records the source corpus from which the entry was recovered.

Sources used to construct the bibliography

- The official annotated bibliographies of the Department of Conservation: Martinez and Slooten (2003), du Fresne, Burns and Gates (2012), and Miller (2018).
- The 2024 NOAA/NMFS five-year review and its bibliography; official pages and reports from the Department of Conservation, Fisheries New Zealand, the Ministry for the Environment, the Ministry of Health/Health New Zealand, and Taranaki Regional Council.
- Primary journal publications and DOI records for the principal toxicological, pathological, and demographic studies; the theses of Casano-Bally (2023) and Wildblood-Crawford (2008).
- The Paritutu historical corpus assembled by Monod de Froideville and Gibbs (2023), supplemented by primary government documents and peer-reviewed publications.

Corpus construction and record handling

Records recovered from the source corpora were consolidated, normalised where possible, and manually deduplicated. DOI, publisher, or institutional metadata took precedence over shortened citations and apparent OCR errors in earlier bibliographies. Grey literature was retained when it contained primary historical, monitoring, autopsy, policy, or methodological evidence unavailable in journal articles. The result is a critical maximum-coverage research bibliography rather than a PRISMA-style systematic review or a formal meta-analysis.

Limitations

- Some early archival items survive only as letters, departmental reports, or committee papers; they are included as historical primary sources.
- The official DOC bibliographies are selective and contain gaps between editions. The 2012–2014 interval and the period after 2018 were supplemented by separate searching and citation tracing.
- The comparative-toxicology section is broad but does not claim exhaustive coverage of every publication on POPs or PFAS in every marine-mammal species.
- Entries retaining "et al." are those for which open metadata did not permit reliable reconstruction of the complete author list without introducing error.
- A bibliography can reconstruct patterns of evidence production and identify missing causal links, but it cannot by itself establish the magnitude of a population-level causal effect.

Corpus structure

Code	Content	Records
A	direct evidence from Hector's and Māui dolphins: contaminants, disease, and pathology	19
B	New Zealand sources and exposure pathways: Paritutu, 2,4,5-T/TCDD, and monitoring	55
C	comparative and mechanistic toxicology of marine mammals	45
D	demography, bycatch, habitat, and competing explanations of decline	239
E	risk governance, the history of knowledge, scientific recognition, and uncertainty	30
Total	**unique records**	**388**

2. Key sources with analytical annotations

The works below are the most consequential for testing the chain "source → environmental transport → prey → internal dose → immune or reproductive effect → population outcome" and for comparing the chemical-pollution hypothesis with the bycatch hypothesis.

1. [B] Agricultural Chemicals Board. 1972. Report of the Subcommittee on 2,4,5-T. Wellington, New Zealand.

   Analytical relevance: An early official New Zealand document that establishes the contemporary framework used to assess the risks of 2,4,5-T.

2. [B] Firestone, D.; Ress, J.; Brown, N.L.; Barron, R.P.; Damico, J.N. 1972. Determination of polychlorodibenzo-p-dioxins and related compounds in

commercial chlorophenols. Journal of AOAC International 55: 85–92. doi:10.1093/jaoac/55.1.85.

Analytical relevance: A methodological foundation for the early detection of dioxin impurities in commercial chlorophenols.

3. [B] Baughman, R.; Meselson, M. 1973. An analytical method for detecting TCDD (dioxin): levels of TCDD in samples from Vietnam. Environmental Health Perspectives 5: 27–35.

Analytical relevance: A classic early analytical study of TCDD and the chemical legacy of wartime herbicide use.

4. [C] Holden, A.V. 1975. The accumulation of oceanic contaminants in marine mammals. Rapports et Procès-Verbaux des Réunions du Conseil International pour l'Exploration de la Mer 169: 353–361.

Analytical relevance: One of the earliest conceptual accounts of the accumulation of persistent contaminants in marine mammals.

5. [C] Helle, E.; Olsson, M.; Jensen, S. 1976. DDT and PCB levels and reproduction in ringed seal from the Bothnian Bay. Ambio 5: 188–189.

Analytical relevance: Early evidence linking POP burdens with reproductive condition in a marine mammal.

6. [B] Department of Health. 1977. 2,4,5-T and Human Birth Defects. Department of Health, Wellington.

Analytical relevance: An official position from the production era; important for reconstructing which health outcomes were treated as demonstrated, uncertain, or unproven.

7. [D] Baker, A. N. 1978. The status of Hector's Dolphin, Cephalorhynchus hectori (van Beneden), in New Zealand waters. Reports of the International Whaling Commission 28: 331–334.

Analytical relevance: An early status review that provides a baseline preceding much of the modern monitoring programme.

8. [B] Brinkman, G.L.; Matthews, R.E.F.; Earl, W.B. 1986. Possible Health Effects of Manufacture of 2,4,5-T in New Plymouth: Report of the Ministerial Committee of Inquiry. New Zealand Government, Wellington.

Analytical relevance: The central official inquiry into human health around 2,4,5-T manufacture in New Plymouth.

9. [C] Reijnders, P.J.H. 1986. Reproductive failure in common seals feeding on fish from polluted coastal waters. Nature 324: 456–457.

Analytical relevance: A landmark feeding experiment demonstrating reproductive effects from contaminated fish.

10. [A] Hutton, J.; Blair, D.; Slooten, E.; Dawson, S. M. 1987. Case studies of fluke induced lesions in the mesenteric lymph node of Hector's Dolphins (Cephalorhynchus hectori). Diseases of Aquatic Organisms 2: 83–86.

Analytical relevance: Early documentation of pathology in Hector's dolphins, showing that disease was investigated well before contemporary threat models.

11. [A] Buckland, S.J.; Hannah, D.J.; Taucher, J.A.; Slooten, E.; Dawson, S.M. 1990. Polychlorinated dibenzo-p-dioxins and dibenzofurans in New Zealand's Hector's dolphin. Chemosphere 20: 1035–1042. doi:10.1016/0045-6535(90)90217-H.

Analytical relevance: The first direct publication on PCDD/F in Hector's dolphin tissues and a foundational source for the chemical-pollution hypothesis.

12. [A] McCutchen, D. 1993. Comparison of PCB and DDT levels found in Hector's dolphin (Cephalorhynchus hectori) with an international literature review of organochlorines in marine mammals. Diploma in Wildlife Management thesis, University of Otago, Dunedin. 59 p.

Analytical relevance: An early thesis on PCB and DDT burdens; important for reconstructing the measurement history and international comparisons.

13. [C] Aguilar, A.; Borrell, A. 1994. Abnormally high polychlorinated biphenyl levels in striped dolphins affected by the 1990–92 Mediterranean epizootic. Science of the Total Environment 154: 237–247.

Analytical relevance: A principal comparative source for the pollution–immunity–epizootic hypothesis.

14. [C] de Swart, R.L.; Ross, P.S.; Vedder, L.J.; Timmerman, H.H.; Heisterkamp, S.; van Loveren, H.; Vos, J.G.; Reijnders, P.J.H.; Osterhaus, A.D.M.E. 1994. Impairment of immune function in harbour seals feeding on fish from polluted waters. Ambio 23: 155–159.

Analytical relevance: Experimental evidence of immune impairment associated with a contaminated diet.

15. [C] Tanabe, S.; Iwata, H.; Tatsukawa, R. 1994. Global contamination by persistent organochlorines and their ecotoxicological impact on marine mammals. Science of the Total Environment 154: 163–177. doi:10.1016/0048-9697(94)90086-8.

Analytical relevance: A classic global review of the distribution and ecotoxicological effects of persistent organochlorines in marine mammals.

16. [A] Jones, P.D.; Leathem, S.V.; Hannah, D.J.; Day, P.J.; Dye, E.A.; Hoffman, K.A.; Lister, A.R.; Porter, L.J.; van Maanen, T.; Symons, R.K.; van Helden, A.; Buckland, S.J.; Slooten, E.; Dawson, S.M.; Donoghue, M. 1996. Biomagnification of PCBs and 2,3,7,8-substituted polychlorinated dibenzo-p-dioxins and dibenzofurans in New Zealand's Hector's dolphin. Organohalogen Compounds 29: 108–113.

Analytical relevance: Demonstrates trophic biomagnification and moves the question from simple detection to food-web accumulation.

17. [D] Burkhart, S. 1998. Population Viability Analysis (PVA) of Hector's Dolphin (Cephalorhynchus hectori). MSc thesis, University of Otago, Dunedin. 182 p.

Analytical relevance: Formalises the demographic sensitivity of small populations and the implications of additional mortality.

18. [A] Jones, P.D. 1998. Analysis of organic contaminants in New Zealand marine mammals. Conservation Advisory Science Notes 184. Department of Conservation, Wellington. 8 p.

Analytical relevance: An official concise review of early New Zealand data on organic contaminants in marine mammals.

19. [C] Aguilar, A.; Borrell, A.; Pastor, T. 1999. Biological factors affecting variability of persistent pollutant levels in cetaceans. Journal of Cetacean Research and Management, Special Issue 1: 83–116. doi:10.47536/jcrm.v1i1.264.

Analytical relevance: Essential for controlling for age, sex, lactation, and life-history effects when comparing contaminant concentrations.

20. [A] Jones, P.D.; Hannah, D.J.; Buckland, S.J.; van Maanen, T.; Leathem, S.V.; Dawson, S.M.; Slooten, E.; van Helden, A.; Donoghue, M. 1999. Polychlorinated dibenzo-p-dioxins, dibenzofurans and polychlorinated biphenyls in New Zealand cetaceans. Journal of Cetacean Research and Management, Special Issue 1: 157–167. doi:10.47536/jcrm.v1i1.263.

Analytical relevance: Compares PCDD/F and PCB profiles among New Zealand cetaceans and informs questions of source patterns and coastal exposure.

21. [C] Kannan, K.; Blankenship, A.L.; Jones, P.D.; Giesy, J.P. 2000. Toxicity reference values for the toxic effects of polychlorinated biphenyls to aquatic mammals. Human and Ecological Risk Assessment 6: 181–201.

Analytical relevance: A widely used source of toxicity reference values; extrapolation to Hector's dolphins requires caution.

22. [E] Slooten, E.; Fletcher, D.; Taylor, B. L. 2000. Accounting for uncertainty in risk assessment: case study of Hector's dolphin mortality due to gillnet entanglement. Conservation Biology 14(5): 1264–1270.

Analytical relevance: A key methodological analysis of uncertainty in bycatch risk assessment and conservation decision-making.

23. [B] Pattle Delamore Partners. 2002. Investigation of Dioxin Contamination in Soil in the Paritutu Area, New Plymouth. Report for Ministry of Health and Taranaki District Health Board.

Analytical relevance: The principal report mapping TCDD contamination in soil around the Paritutu facility and therefore central to establishing the existence and spatial extent of a local source.

24. [C] Ross, P.S. 2002. The role of immunotoxic environmental contaminants in facilitating the emergence of infectious diseases in marine mammals. Human and Ecological Risk Assessment 8: 277–292.

Analytical relevance: Directly articulates the mechanism most relevant to a possible interaction between pollution and toxoplasmosis.

25. [D] Burkhart, S.M.; Slooten, E. 2003: Population viability analysis for Hector's dolphin (Cephalorhynchus hectori): a stochastic population model for local populations. New Zealand Journal of Marine and Freshwater Research 37: 553–566.

Analytical relevance: Formalises the demographic sensitivity of small populations and the implications of additional mortality.

26. [B] Fowles, J.; Gallagher, L.; Baker, V.; Phillips, D.; Marriott, F.; Stevenson, C.; Noonan, M. 2005. A Study of 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) Exposures in Paritutu, New Zealand. ESR for Ministry of Health.

Analytical relevance: The main official reconstruction of historical exposure among Paritutu residents, including air-dispersion, soil, and serum modelling.

27. [C] Wells, R.S.; Tornero, V.; Borrell, A.; Aguilar, A.; Rowles, T.K.; Rhinehart, H.L.; Hofmann, S.; Jarman, W.M.; Hohn, A.A.; Sweeney, J.C. 2005. Integrating life-history and reproductive success data to examine potential relationships with organochlorine compounds for bottlenose dolphins in Sarasota Bay. Science of the Total Environment 349: 106–119. doi:10.1016/j.scitotenv.2005.01.010.

Analytical relevance: An example of the study design missing for Hector's and Māui dolphins: contaminant burdens are linked to individual life histories and reproductive success.

28. [E] Wildblood-Crawford, B. 2008. Environmental (In)justice and "Expert Knowledge": the discursive construction of dioxin contamination in New Plymouth. PhD thesis, Massey University.

Analytical relevance: A detailed social-science analysis of the conflict over expertise, evidence, and community participation.

29. [B] Fowles, J.; Noonan, M.; Stevenson, C.; Baker, V.; Gallagher, L.; Read, D.; Phillips, D. 2009. 2,3,7,8-Tetrachlorodibenzo-p-dioxin plasma concentrations in residents of Paritutu, New Zealand: evidence of historical exposure. Chemosphere 75: 1259–1265. doi:10.1016/j.chemosphere.2009.01.067.

Analytical relevance: A peer-reviewed study of serum TCDD in residents; it supports historical human exposure but does not establish exposure in dolphins.

30. [C] Castrillon, J.; Gomez-Campos, E.; Aguilar, A.; Berdié, L.; Borrell, A. 2010. PCB and DDT levels do not appear to have enhanced mortality of striped dolphins in the

2007 Mediterranean epizootic. Chemosphere 81: 459–463. doi:10.1016/j.chemosphere.2010.08.008.

Analytical relevance: An important negative result showing that a biologically plausible contaminant–disease interaction is not necessarily confirmed in a specific epizootic.

31. [A] Stockin, K.A.; Law, R.J.; Roe, W.D.; Meynier, L.; Martinez, E.; Duignan, P.J.; Bridgen, P.; Jones, B. 2010. PCBs and organochlorine pesticides in Hector's (Cephalorhynchus hectori hectori) and Māui's (C. h. maui) dolphins. Marine Pollution Bulletin 60: 834–842. doi:10.1016/j.marpolbul.2010.01.009.

Analytical relevance: The principal peer-reviewed study of PCBs and organochlorine pesticides in both subspecies; the very small Māui sample sharply limits causal inference.

32. [D] Gormley, A.M.; Slooten, E.; Dawson, S.; Barker, R.J.; Rayment, W.; du Fresne, S.; Brager, S. 2012: First evidence that marine protected areas can work for marine mammals. Journal of Applied Ecology 49: 474–480.

Analytical relevance: Quasi-experimental evidence of improved survival following spatial protection from gillnet fishing.

33. [D] Baker, C.S.; Hamner, R.M.; Cooke, J.G.; Heimeier, D.; Vant, M.; Steel, D.; Constantine, R. 2013. Low abundance and probable decline of the critically endangered Māui's dolphin estimated by genotype capture-recapture. Animal Conservation 16: 224–233.

Analytical relevance: A foundational abundance and decline estimate that provides the demographic context for testing any causal hypothesis.

34. [A] Roe, W.D.; Howe, L.; Baker, E.J.; Burrows, L.; Hunter, S.A. 2013. An atypical genotype of Toxoplasma gondii as a cause of mortality in Hector's dolphins (Cephalorhynchus hectori). Veterinary Parasitology 192: 67–74. doi:10.1016/j.vetpar.2012.11.001.

Analytical relevance: Direct evidence of fatal toxoplasmosis and therefore essential to evaluating possible interaction between infection and immunotoxicants.

35. [D] Slooten, E. 2013. Effectiveness of area-based management in reducing bycatch of the New Zealand dolphin. Endangered Species Research 20: 121–130.

Analytical relevance: Evaluates the effect of area-based protection on bycatch, the leading competing causal model.

36. [C] Murphy, S.; Barber, J.L.; Learmonth, J.A.; Read, F.L.; Deaville, R.; Perkins, M.W.; Brownlow, A.; Davison, N.; Penrose, R.; Pierce, G.J.; Law, R.J.; Jepson, P.D. 2015. Reproductive failure in UK harbour porpoises: legacy of pollutant exposure? PLoS ONE 10: e0131085. doi:10.1371/journal.pone.0131085.

Analytical relevance: An example of population-based assessment of reproductive pathology in relation to contaminant exposure.

37. [C] Desforges, J.-P.W.; Sonne, C.; Levin, M.; Siebert, U.; De Guise, S.; Dietz, R. 2016. Immunotoxic effects of environmental pollutants in marine mammals. Environment International 86: 126–139. doi:10.1016/j.envint.2015.10.007.

Analytical relevance: A modern review of immune mechanisms and biomarkers relevant to testing contaminant–infection interactions.

38. [C] Jepson, P.D.; Deaville, R.; Barber, J.L.; Aguilar, À.; Borrell, A.; Murphy, S.; Barry, J.; Brownlow, A.; Barnett, J.; Berrow, S.; Cunningham, A.A.; Davison, N.J.; ten Doeschate, M.; Esteban, R.; Ferreira, M.; Foote, A.D.; Genov, T.; Giménez, J.; Loveridge, J.; Llavona, Á.; Martin, V.; Maxwell, D.L.; Papachlimitzou, A.; Penrose, R.; Perkins, M.W.; Smith, B.; de Stephanis, R.; Tregenza, N.; Verborgh, P.; Fernandez, A.; Law, R.J. 2016. PCB pollution continues to impact populations of orcas and other dolphins in European waters. Scientific Reports 6: 18573. doi:10.1038/srep18573.

Analytical relevance: Demonstrates that PCB-related population risks can persist for decades after regulatory bans.

39. [A] Buckle, K.; Roe, W.D.; Howe, L.; Michael, S.; Duignan, P.J.; Burrows, E.; Ha, H.-J.; Humphrey, S.; McDonald, W.L. 2017. Brucellosis in endangered Hector's dolphins (Cephalorhynchus hectori). Veterinary Pathology 54: 838–845. doi:10.1177/0300985817707023.

Analytical relevance: Documents brucellosis and associated pathology, broadening the set of infectious outcomes potentially sensitive to immune status.

40. [E] Palliser, A.; Dodson, G. 2017. Uncertainty, complexity and controversy in dolphin threat management: a role for post-normal science? Environmental Science and Policy 78: 74–80.

Analytical relevance: The source most directly concerned with decision-making for these dolphins under uncertainty, complexity, and controversy.

41. [C] Desforges, J.-P.W.; Hall, A.; McConnell, B.; Rosing-Asvid, A.; Barber, J.L.; Brownlow, A.; De Guise, S.; Eulaers, I.; Jepson, P.D.; Letcher, R.J.; Levin, M.; Ross, P.S.; Samarra, F.; Víkingson, G.; Sonne, C.; Dietz, R. 2018. Predicting global killer whale population collapse from PCB pollution. Science 361: 1373–1376. doi:10.1126/science.aat1953.

Analytical relevance: A rare example of translating toxicological evidence into population projections and a methodological model for work on Hector's and Māui dolphins.

42. [D] Roberts, J.O.; Webber, D.N.; Edwards, C.T.T.; Roe, W.D.; Doonan, I.J. 2019. Population effects of fishery and non-fishery threats on Māui dolphin. New Zealand Aquatic Environment and Biodiversity Report 215. Fisheries New Zealand, Wellington.

Analytical relevance: Links threats to population outcomes and is essential for examining how chemical exposure was included, parameterised, or omitted.

43. [D] Roberts, J.O.; Webber, D.N.; Roe, W.D.; Edwards, C.T.T.; Doonan, I.J. 2019. Spatial risk assessment of threats to Hector's and Māui dolphins. New Zealand

Aquatic Environment and Biodiversity Report 214. Fisheries New Zealand, Wellington.

Analytical relevance: The key official spatial risk model; it shows which threats were converted into quantitative estimates and which remained qualitative.

44. [E] Department of Conservation; Fisheries New Zealand. 2020. Hector's and Māui Dolphin Threat Management Plan 2020. Wellington, New Zealand.

Analytical relevance: The principal management document for the period and an essential source for analysing threat prioritisation and research allocation.

45. [A] Casano-Bally, D. 2023. Temporal and spatial trends of organochlorine contaminants in Hector's and Māui dolphins (Cephalorhynchus hectori), 1997–2022. MSc thesis, Massey University, Palmerston North, New Zealand.

Analytical relevance: The broadest temporal dataset on organochlorines in the species; important for trends, threshold comparisons, and gap identification, although it remains a master's thesis.

46. [E] Monod de Froideville, S.; Gibbs, A. 2023. Silencing Paritutu: how the framing of science obscured environmental harm in New Plymouth, New Zealand. Crime, Law and Social Change. doi:10.1007/s10611-023-10083-0.

Analytical relevance: A key study of the scientific and institutional recognition of harm and directly relevant to the question of why a hypothesis may remain marginal.

47. [A] Parsons, E.C.M. 2024. Hector's Dolphin and Māui Dolphin (Cephalorhynchus hectori): Five-Year Review. NOAA Technical Memorandum NMFS-OPR-75. National Marine Fisheries Service, Office of Protected Resources. doi:10.25923/jw2s-y058.

Analytical relevance: The most comprehensive recent status review; it explicitly treats pollution as a potentially synergistic threat and records major data deficiencies.

48. [A] Stockin, K.A.; Peters, K.J.; Saltré, F.; Machovsky-Capuska, G.E.; Betty, E.L.; Tremblay, L.A.; Yi, S. 2025. No place to hide: Marine habitat does not determine per- and polyfluoroalkyl substances (PFAS) in odontocetes. Science of the Total Environment 1000: 180701. doi:10.1016/j.scitotenv.2025.180701.

Analytical relevance: The first PFAS assessment to include Hector's dolphin and an expansion of the chemical focus beyond legacy organochlorines.

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4. Legend for record-source codes

- {DOC03} — official 2003 DOC bibliography.
- {DOC12} — official 2012 DOC bibliography.
- {DOC18} — official 2018 DOC bibliography.
- {NOAA24} — the 2024 NOAA five-year review and its bibliography.
- {PRIMARY} — primary publication, publisher record, or DOI record.
- {NZOFF} — official New Zealand report or archival record.
- {CASANO23} — the bibliography and review in Casano-Bally (2023).
- {PARITUTU23} — the bibliography in Monod de Froideville and Gibbs (2023).

Combined codes indicate that the same record was recovered from more than one corpus. A manually verified record with a confirmed DOI took precedence over an OCR error or abbreviated form in an older bibliography.

5. The official Paritutu research corpus that should be read as a single evidence package

The Fowles et al. (2005) report should be analysed together with its appendices and external reviews because its conclusions depend on the atmospheric-transport model, soil geostatistics, participant selection, toxicokinetics, and interpretation of serum data.

- The final report and the two ESR interim reports (2004–2005).
- Appendices on study design, emission reconstruction, and atmospheric dispersion.
- The geospatial model of soil TCDD and the historical residential scenarios.
- The toxicokinetic model, control-group selection, laboratory QA/QC, and statistical evaluation.
- Individual serum-analysis results and the criteria used to include or exclude candidates.
- External reviews by Neil Pearce, Dale Hattis, Erik Dybing, Marie Haring Sweeney, Allan H. Smith, and C. Frampton, together with the ESR/Ministry of Health responses.
- The Pattle Delamore Partners (2002) soil report and subsequent Taranaki Regional Council monitoring reports.

6. Minimum reading sequence for testing the chemical-pollution hypothesis

- Buckland et al. (1990) → Jones et al. (1996, 1999) → Stockin et al. (2010) → Casano-Bally (2023) → Stockin et al. (2025).
- Pattle Delamore Partners (2002) → Fowles et al. (2005, 2009) → Collins et al. (2009) → Monod de Froideville & Gibbs (2023) → Gibbs (2026).
- Roe et al. (2013) → Buckle et al. (2017) → Roberts et al. (2019) → Roberts, Jones & Roe (2021) → Chen et al. (2025).
- Reijnders (1986) → de Swart et al. (1994) → Ross (2002) → Desforges et al. (2016) → Jepson et al. (2016) → Desforges et al. (2018).
- Gormley et al. and Slooten et al. on bycatch and spatial protection → the official 2019 risk models → NOAA 2024 → Bennington et al. (2026).

7. Key bibliographic reviews as independent records

Martinez, E.; Slooten, E. 2003. A selective, annotated bibliography for Hector's dolphin. DOC Science Internal Series 124.

du Fresne, S.; Burns, D.; Gates, E. 2012. An updated, annotated bibliography for Hector's and Māui dolphins. DOC Research and Development Series 332.

Miller, E.J. 2018. Updated, annotated bibliography for Hector's and Māui dolphins, 2018. Department of Conservation.

Parsons, E.C.M. 2024. Hector's Dolphin and Māui Dolphin: Five-Year Review. NOAA Technical Memorandum NMFS-OPR-75.

Casano-Bally, D. 2023. Temporal and spatial trends of organochlorine contaminants in Hector's and Māui dolphins, 1997–2022. MSc thesis.

8. Completeness, reproducibility, and updating

The corpus was closed on 22 June 2026. Government reports, theses, and journal articles may appear after that date. Companion RIS, BibTeX, and TSV files were prepared to support reproducibility; all records can be sorted, deduplicated, corrected, and extended in a reference manager. The fixed cut-off should be treated as a version boundary, not as a claim that future literature cannot modify the interpretation.

9. Conclusions of the completed bibliographic stage

This stage began with a question about the possible neglect of chemical pollution and ends with a bounded answer. The literature supports neither of two simple positions: that pollution has been absent from the scientific record, or that it has been established as the primary cause of the population crisis. It supports a more specific conclusion: exposure is documented, relevant biological mechanisms are credible, and the threat is acknowledged intermittently, but the studies needed to quantify its demographic contribution have not been completed.

- Evidence of exposure is established. PCDD/F, PCBs, organochlorine pesticides, and PFAS have been measured in the relevant species or subspecies, and food-web accumulation and maternal transfer are supported by the literature.
- Evidence of effect is discontinuous. Species-specific studies generally stop at concentration measurement and rarely connect internal dose with immune biomarkers, reproductive pathology, infection severity, fertility, calf survival, or lifetime reproductive success.
- The Māui-specific evidence base is insufficient for confident toxicological characterisation. Sample scarcity is itself a central result of the reconstruction, not a minor technical limitation.
- The Paritutu/New Plymouth literature establishes a historically important TCDD-related industrial source and human exposure, but it does not yet establish source-specific transfer into Māui dolphins or a resulting population effect.
- Interaction with disease is biologically plausible. Toxoplasmosis and brucellosis provide concrete health outcomes against which contaminant-associated immune impairment could be tested, but paired individual-level analyses are lacking.
- Bycatch has a stronger direct causal record because entanglement deaths can be observed, spatial overlap can be estimated, and survival changes can be assessed following protection. This does not disprove a chemical contribution; it explains why the bycatch hypothesis has been more readily quantified.
- The architecture of official risk assessment creates a structural evidentiary asymmetry: acute deaths are easier to express as annual mortality, whereas chronic, mixture-based, reproductive, immune, and synergistic effects often remain qualitative or are excluded from population models.
- Marginal treatment of pollution cannot, by itself, demonstrate intentional suppression. It may arise from fragmented disciplines, sample scarcity, model design, regulatory framing, and demand for immediately quantifiable management variables. Claims of deliberate silencing require a separate documentary analysis.

- The completed output of this stage is therefore not a verdict on a single cause. It is an auditable map of what is known, what has been assumed, what has been modelled, and what empirical work is still required.

Research priorities arising from this stage

- Reanalyse archived and newly available tissues for PCDD/F, dioxin-like and non-dioxin-like PCBs, organochlorine pesticides, PFAS, and other relevant co-contaminants using harmonised lipid-normalised reporting.
- Undertake congener and source-fingerprint comparisons across the former Paritutu source complex, other New Zealand sources, marine sediments, principal prey species, and dolphin tissues.
- Link individual contaminant burdens with full necropsy findings, infection status, immune and endocrine biomarkers, reproductive-organ pathology, age, sex, nutritional condition, and cause of death.
- Develop mixture-based and species-appropriate toxicological interpretation rather than relying only on thresholds transferred from other marine mammals.
- Integrate plausible effects on fecundity, calf survival, and disease mortality into population models alongside bycatch, with uncertainty propagated explicitly.
- Audit how chemical threats were included, excluded, or qualitatively downgraded in official assessments, research programmes, and funding decisions.
- Maintain the bibliography as a versioned research asset while preserving 22 June 2026 as the formal closure date of this completed stage.

Taken together, these outputs make the present document a completed phase of inquiry rather than a provisional note. The next phase begins from a defined evidence base and a specified programme of empirical and institutional analysis.

10. References cited in the framing text

1. Gibbs, Andrew, and Dmitry Nikolaenko. 2026. “Competing Hypotheses and Scientific Non-Recognition: Investigating the Hector’s and Māui Dolphin Decline in the Context of Wartime Chemical Legacies”. *Pollution and Diseases*, June. https://doi.org/10.66659/10csws50
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