



Rodenticides and Birds

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Presence of Second-Generation Anticoagulant Rodenticides (SGARs) in avian predators

- Most studies in U.S., Canada, Europe, Australia
- Brodifacoum most commonly found in livers
- Present in >80% of predatory birds
- 1/3 to 2/3 exposed to >1 compound - increases risk
- Effects vary among species



Modes of exposure

- Consuming target or non-target rodent species
- Spread outside of boxes or treatment areas, eg:
 - Dispersal of rodents
 - Scavenging
- Consuming invertebrates (slugs, snails, earthworms)



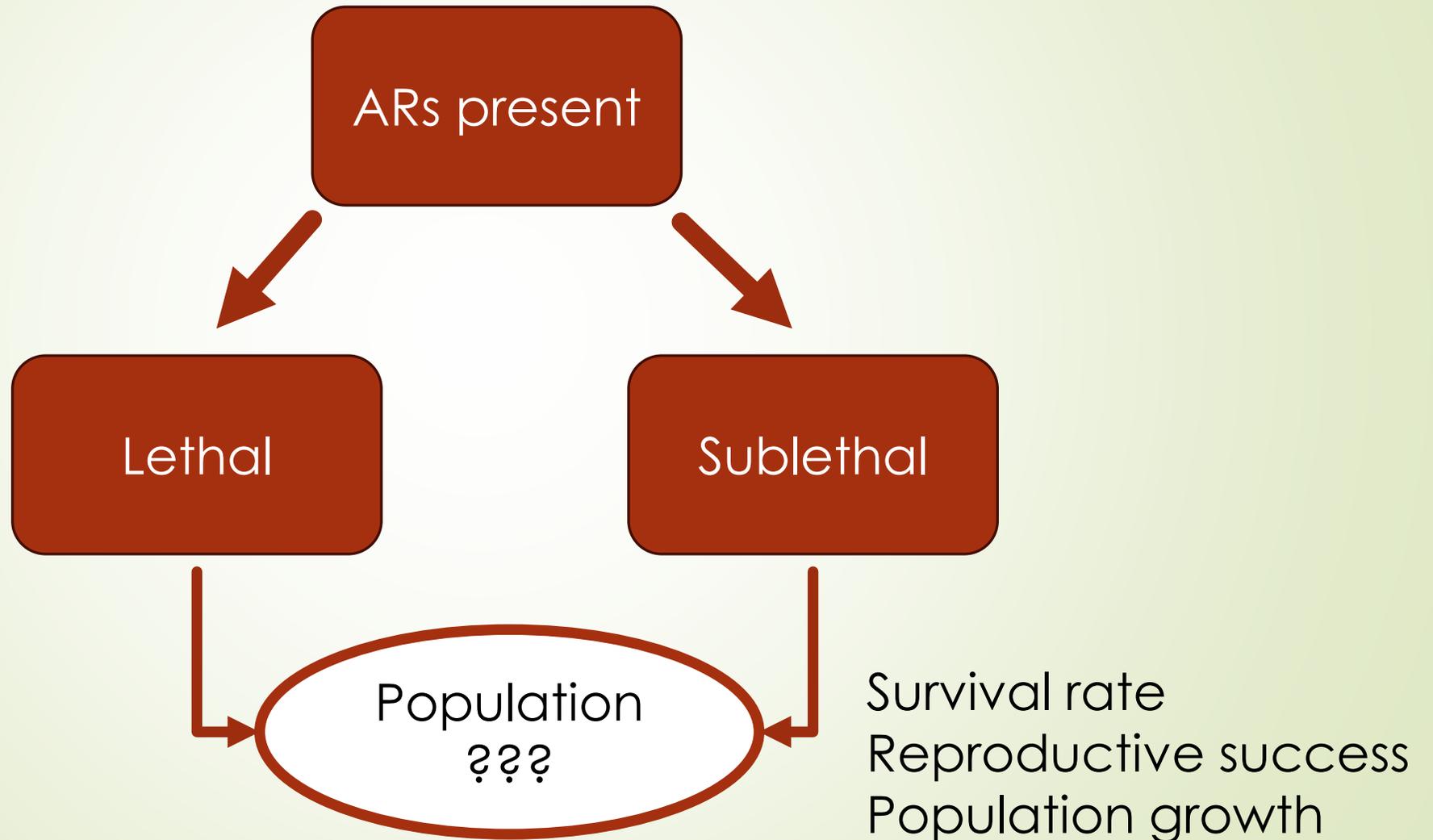
Presence of rodenticides in birds

Example studies using livers

	Australia	Canada
No. evaluated	60	741
Years	2020-2022	1988 - 2018
Percent exposed	92%	74%
Multiple compounds	38%	50%
Environments	Urban Agricultural Forest	Highest in suburban and intensive ag.
Change over time		Policy changes seen in owls*
Reference	Cooke <i>et al.</i> 2023	Elliott <i>et al.</i> 2022



What levels of SGARs result in impacts?



Evidence of lethal levels in birds

- Data on AR toxicity derived from controlled exposure lab studies with common surrogates (e.g. quail, mallard, chicken), and with captive hawks and owls.
- Captive owls and kestrels: 100-200 ng/g liver residue is potentially lethal
 - = Liver damage, but bird may be asymptomatic
- Toxicity:
 - Likely to be greater in free-living birds that are contending with other stressors
 - Varies depending on SGAR compound(s), timing and repeat of exposure, species, diet, age, behavior, nutrition...



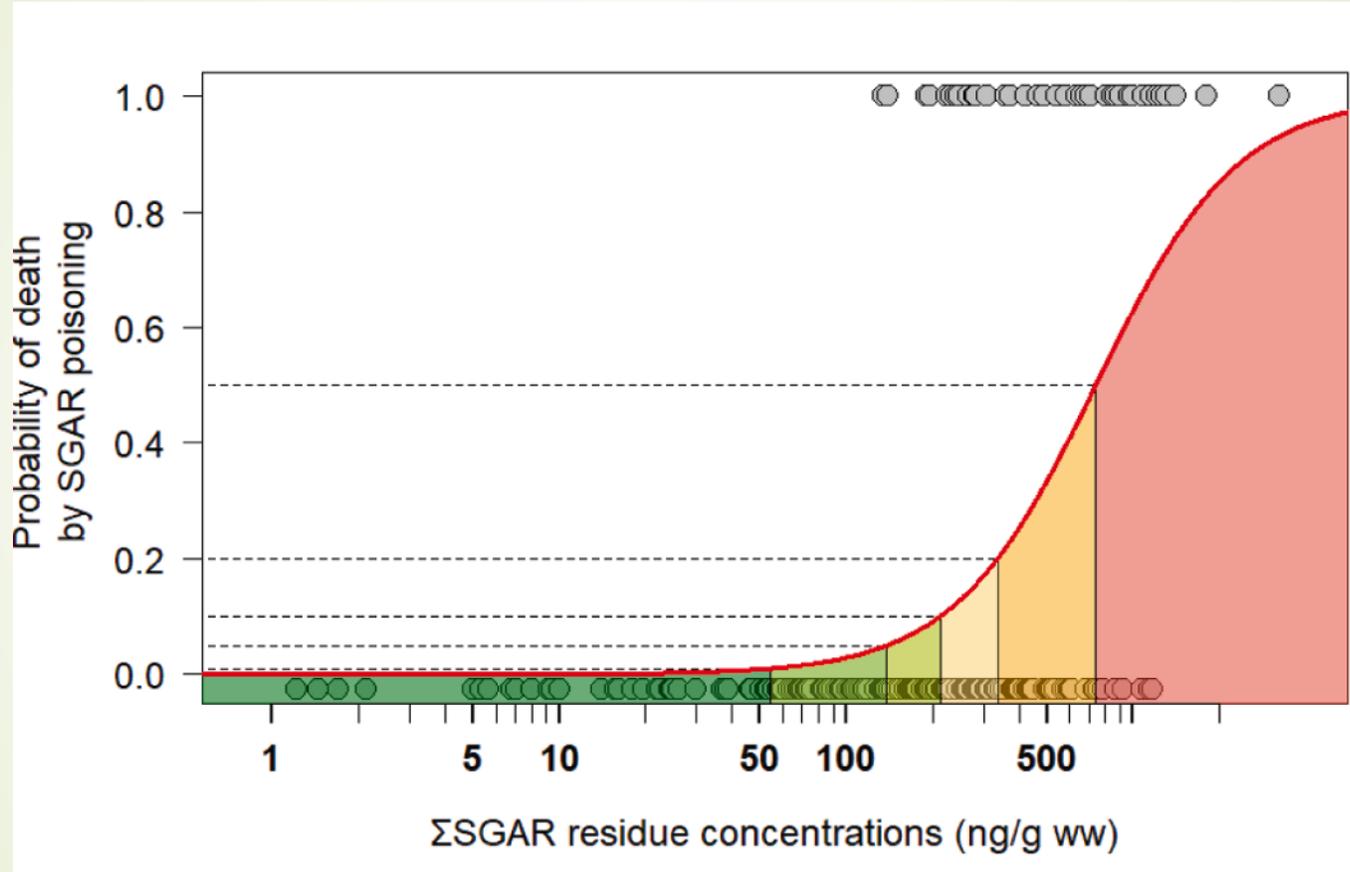
Evidence of lethal levels in birds

Example Studies

- ▶ Australia: potentially lethal levels in 50% of raptors
(Cooke *et al.* 2023)
- ▶ Texas: 53 owls admitted to rehab, 2020-21
51% exposed to AR, 26% of those at lethal levels
(Gomez *et al.* 2023)
- ▶ 259 Eurasian Sparrowhawks, 1995 - 2015
81% exposed, all below lethal levels
(Broughton *et al.* 2022)



Modeling exposure in free-living birds

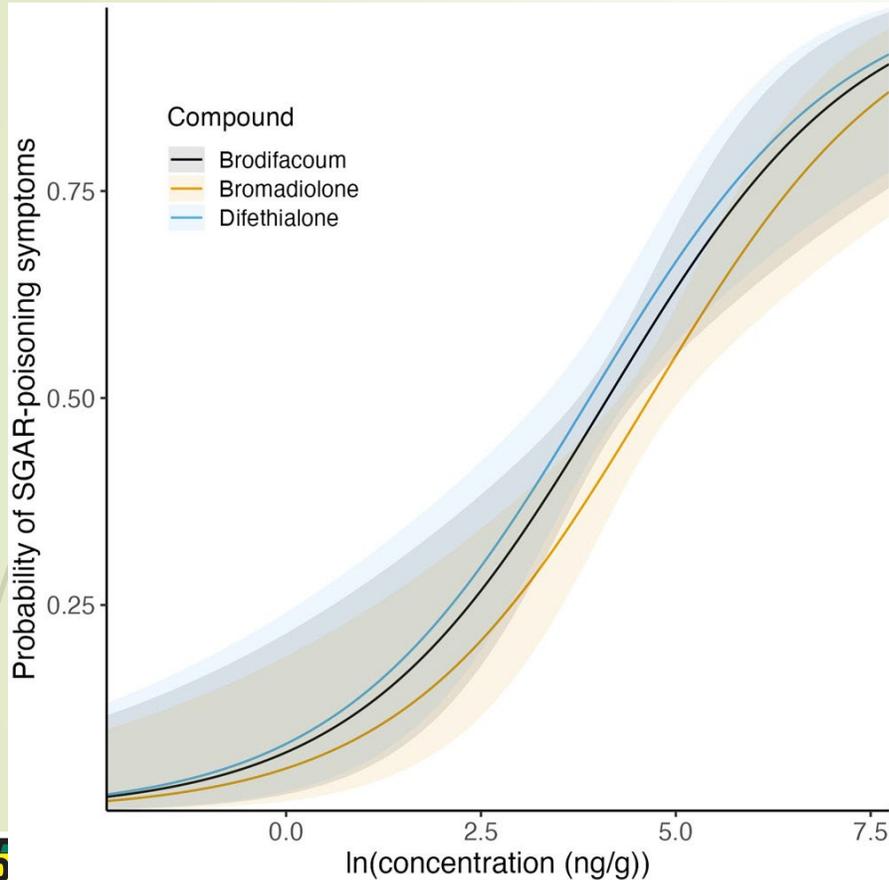


263 Red kites: 55 and 40 ng/g recommended
(**<100 – 200 ng/g threshold**)



Modeling exposure in free-living birds

Years: 1989 – 2021



Determined thresholds for groups of raptor species for 3 AR compounds:

- Randomly selected from 951 samples for 26 species that had postmortem exams by qualified vet before liver was tested (removing bias)
- Compared levels in liver for diagnosed with AR poisoning vs not diagnosed

TABLE 2: Expected toxicity thresholds for four families of raptors with exposure to second-generation anticoagulant rodenticide

Probability of SGAR poisoning	Accipiters (Σ SGAR; ng g^{-1})	Falcons (Σ SGAR; ng g^{-1})	True owls (Σ SGAR; ng g^{-1})	Barn owls (Σ SGAR; ng g^{-1})
0.05	0.6 ± 0.1	0.9 ± 0.1	1.5 ± 0.1	—
0.10	2.2 ± 0.1	2.6 ± 0.1	4.5 ± 0.2	—
0.15	4.6 ± 0.2	4.9 ± 0.2	8.8 ± 0.3	0.10 ± 0.006
0.20	8.2 ± 0.3	7.9 ± 0.2	14.5 ± 0.4	0.32 ± 0.02
0.50	78 ± 1	55 ± 1	107 ± 3	39 ± 2



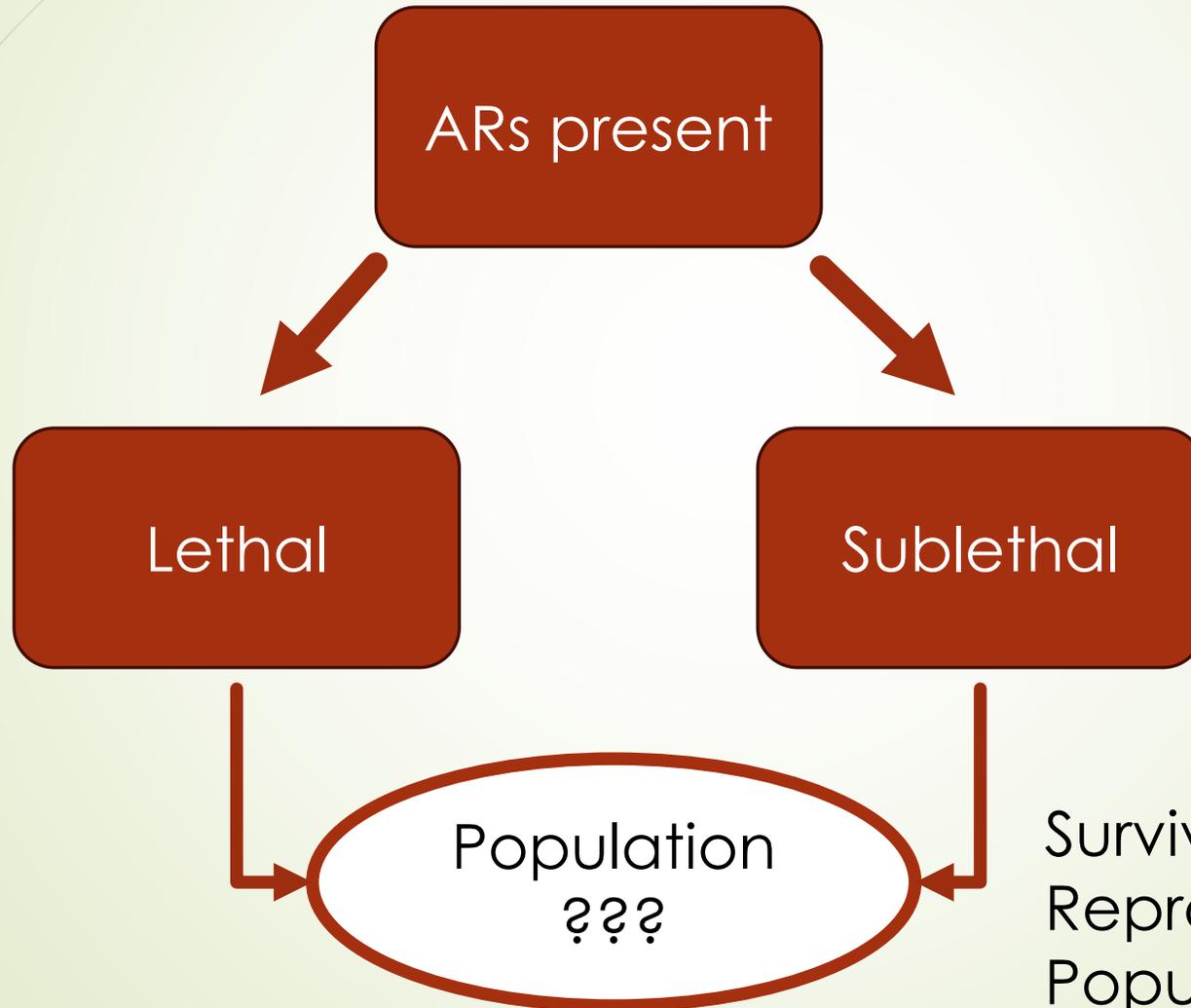
(Elliott et al. 2024)

Information Needs

- Studies in the Northeast on free-living birds
- Compare risk in different landscapes
- Ramifications of sublethal exposure
- Secondary AR exposure via invertebrates, birds that are preyed on, and aquatic ecosystems
- Species-specific exposure risk models for carnivorous and omnivorous fauna based on life history parameters
- Assess potential population-level impacts
- What use scenarios are most problematic?



What levels of SGARs result in impacts?



Survival rate
Reproductive success
Population growth

