

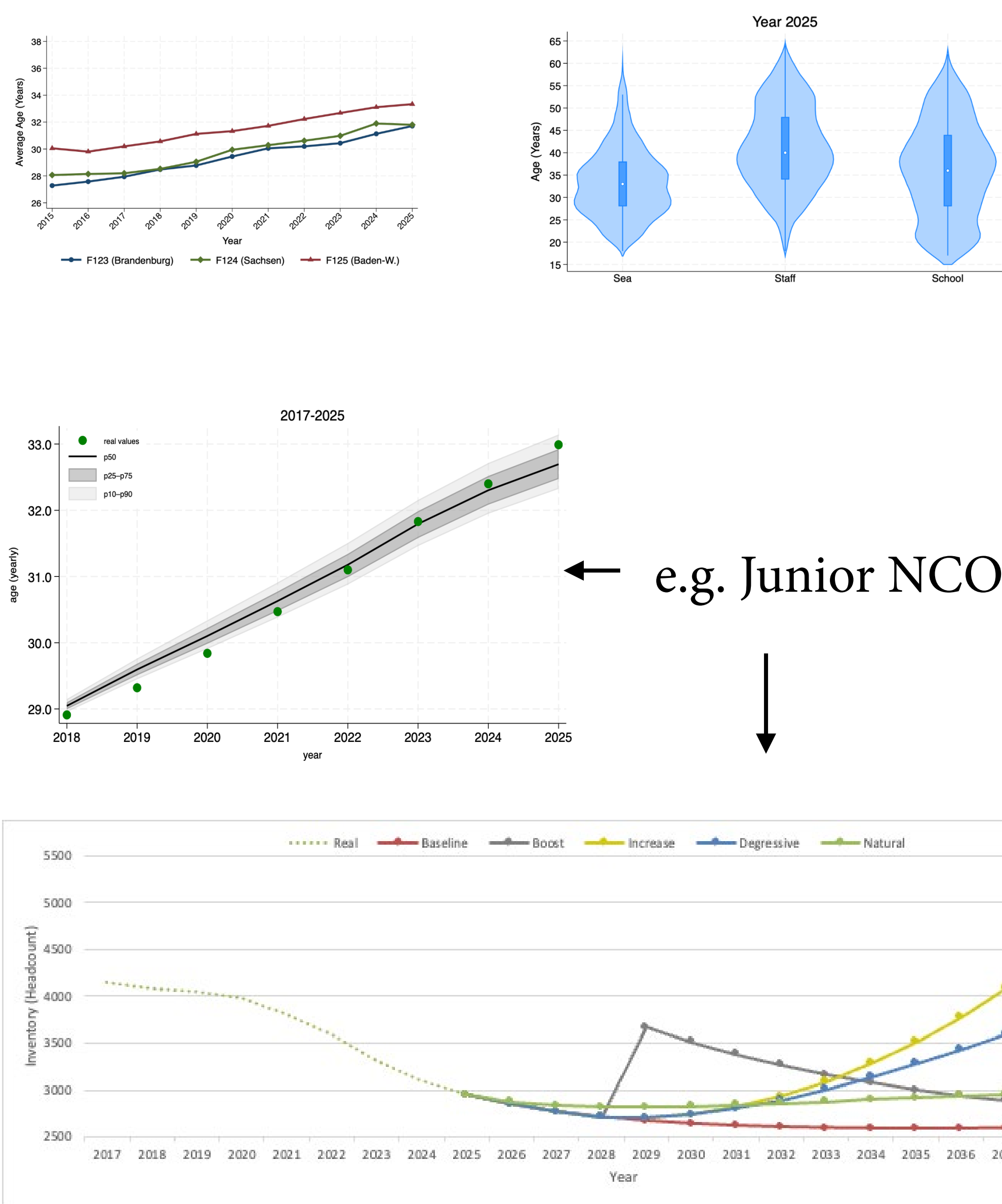
Abstract

Germany’s “turning point” and the goal to be “war-capable by 2029” make naval manpower structure and aging a readiness-critical issue.

The German Navy’s total strength fell only 3.7% from 2015–2025. Enlisted (–19.7%) and Junior NCOs (–30.1%) shrank while Senior NCOs and officers grew (+12–13%)

Making the force more top-heavy, Sea billets stayed younger than Staff billets but aged steadily, and ship types showed distinct crewing and aging patterns.

Methods



- 4- Discrete-time Markov chain models with up to 100 states = rank × age class per career track
- Forecasting to 2040
- Validation by backtesting (inventory, mean age) and Monte Carlo simulations
- Demographic Analysis
- Hypothetical and Real Policy Implications
- Uncertainty Testing over time

Results & Impact

- Markov Baseline 2040: Officers 4,129 (+14.1%), Senior NCOs stable, Junior NCOs 2,496 (–11.7%), Enlisted 2,271 (–7.4%).
- Uncertainty grows with horizon; Officers have lowest terminal spread, Junior NCOs and Enlisted the highest, limiting reliable planning horizons for junior ranks.

Future Research

- Recalibrate models with additional post-2022 data to capture new enlisted rank structure.
- Integrate explicit retention and promotion policy levers into the Markov framework.
- Link demographic constraints and readiness metrics directly to projected age and rank structures.