NOAA FISHERIES

... As Forage in the Ecosystem:

The Demand for Ecosystem Valuation

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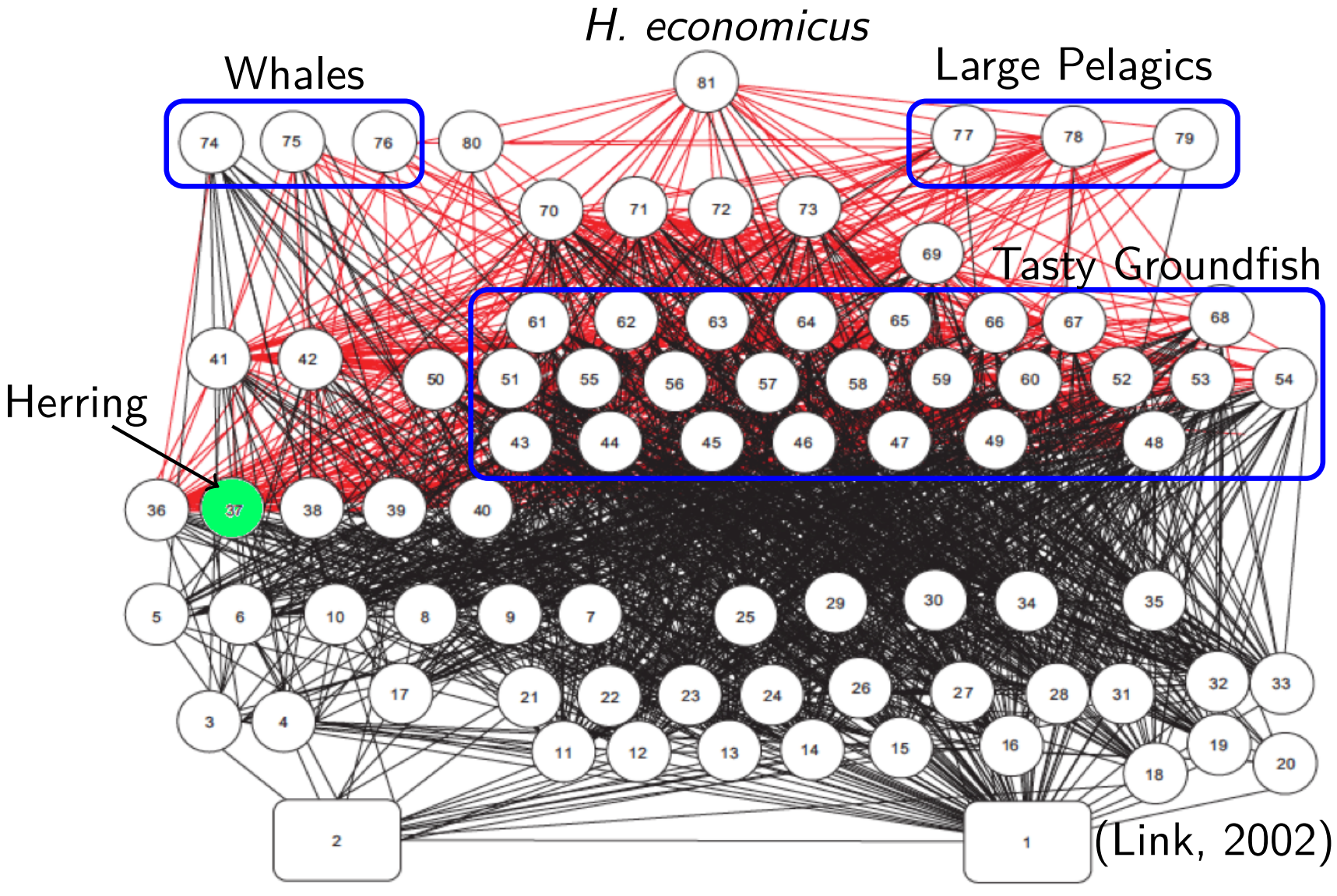
The Demand for Ecosystem Service Valuation

In 2015 Fisheries Managers in New England wanted:

- A Harvest Control Rule (HCR) that accounts for the role of Atlantic herring in the ecosystem, including its role as forage
- A HCR that stabilizes the fishery at a level that achieves optimum yield

The Complex Food Web in the Northeast US



(Link, 2002)

My Takeaway from the Herring Experience

Problem:
Difficult to do ESV in complex multispecies systems on the timeline expected by fishery managers.

Solutions:

- More, different human resources?
- Better expectations-setting and communication with partners?
- Settle for "good enough"?
- Others?

Herring

- Mostly used for bait in the lobster fishery
- Some catch of juvenile haddock and river herring
- Two gears (Trawl offshore and Purse Seine inshore)
- The herring industry is small in numbers and has few allies

New England Fishery Management Council Goals

- "...conserve and manage the living marine resources of the United States of America by carrying out the business of the Council for the **greatest overall benefit of the Nation**."

- "being careful to **balance competing private or regional interests**."

Competing Private Interests in Atlantic Herring Management

- "... **the whale watching industry has been significantly impacted** by the departure of whales ... due to the commercial removals of entire herring schools." (2000)
- "The herring fishery is eliminating forage that other species rely on... including **cod, haddock and bluefin tuna, are likely being negatively impacted."** (2005)
- **a healthy inshore herring stock is critically important to lobster fisherman** who use herring for bait (2007)
- "...enough herring in the ocean will improve the chances of **recovery for cod, tuna, whales, and seabirds**." (2015)

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The Dream

The herring harvest that produces the "greatest overall benefit" is the solution to this dynamic optimization problem[1]:

$$\max_{h_t} \sum_{t=1}^{N} \delta^t \Big(\overbrace{CS(h_t) + PS(h_t, X_t)}^{herring\ industry} + \overbrace{ESV_t(h_t, X_t)}^{everything\ else} \Big)$$

$h_t, X_t =$ harvest and biomass of herring

$ESV_t(h_t, X_t) =$ annual flow of value from herring as forage in the ecosystem

and some constraints, including a state-transition equation

[1] Ragozin and Brown Jr (1985); Crocker and Tschirhart (1992); Finnoff and Tschirhart (2003); Brown, Berger, and Ikiara (2005)

So Many Ecosystem Services Need to be Valued!

How do changes in herring biomass work though the ecosystem to affect humans activities, including:

- Eco-tourism
- Non-consumptive or Passive Use
- Recreational Predator Fisheries
- Commercial Predator Fisheries

You have 1 year to figure out CS, PS, and ESV. What do you do?

The Dream vs The Reality

The Dream:

$$\max_{h_t} \sum_{t=1}^{N} \delta^t \Big(\overbrace{CS(h_t) + PS(h_t, X_t)}^{herring\ industry} + \overbrace{ESV_t(h_t, X_t)}^{everything\ else} \Big)$$

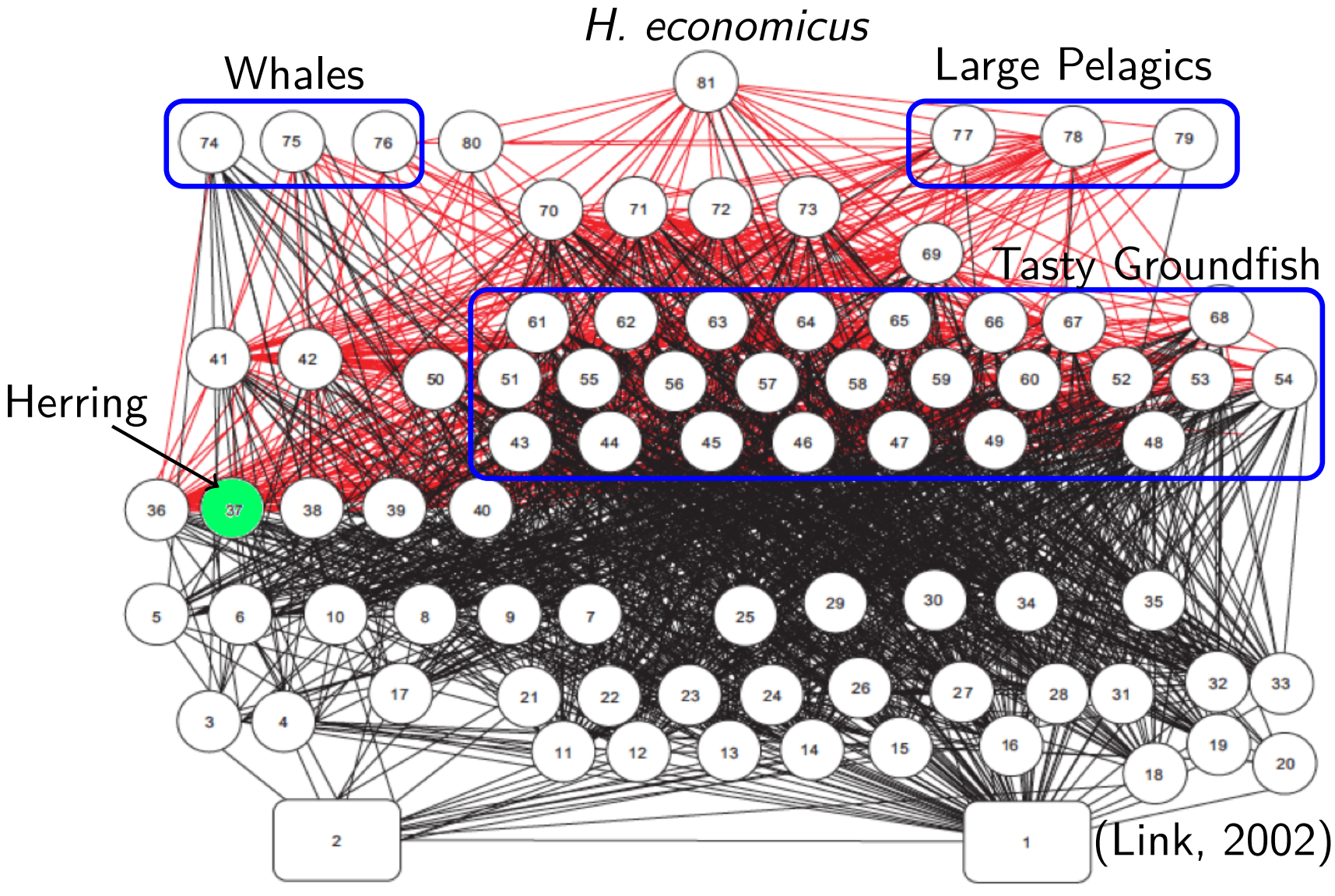
The Reality:

$$\max_{h_t} \sum_{t=1}^{N} \delta^t \Big(CS(h_t) + PS(h_t, X_t) + ??? \Big)$$

Why?

1. Complex ecosystem
2. Timelines
3. NMFS is a little stovepiped
4. Me (instead of Dan or Kristy)

The Complex Food Web in the Northeast US



(Link, 2002)

An Example: Recreational Fishing?

- Which predator fishery?
- What's the relevant metric?
- Wait until the ecosystem model is done? Or take your best guess?

- Benefit Transfer (quick)
- Travel Cost Method to ongoing MRIP data collection? (quick)
- Develop and deploy a valuation survey (slow)

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End Matter

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Deroba, J.J. *et al*. "The dream and the reality: meeting decision-making time frames while incorporating ecosystem and economic models into management strategy evaluation" *Canadian Journal of Fisheries and Aquatic Sciences*. In Press.

Thanks to: MSE participants

References

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