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Managing Water in the West

Quest for Durable Foul-Release Coatings

Bobbi Jo Merten, Ph.D.
David Tordonato, Ph.D., P.E.
Allen Skaja, Ph.D.

Funding: Reclamation Science & Technology Program

U.S. Department of the Interior
Bureau of Reclamation

Outline

- Prior Results
- Durable Materials Evaluation
- Demonstration Scale-ups

Reclamation Testing

- Interdisciplinary program to reduce impacts
- Coatings evaluation at Parker Dam
  - Commercial and experimental products
  - Static and dynamic exposures

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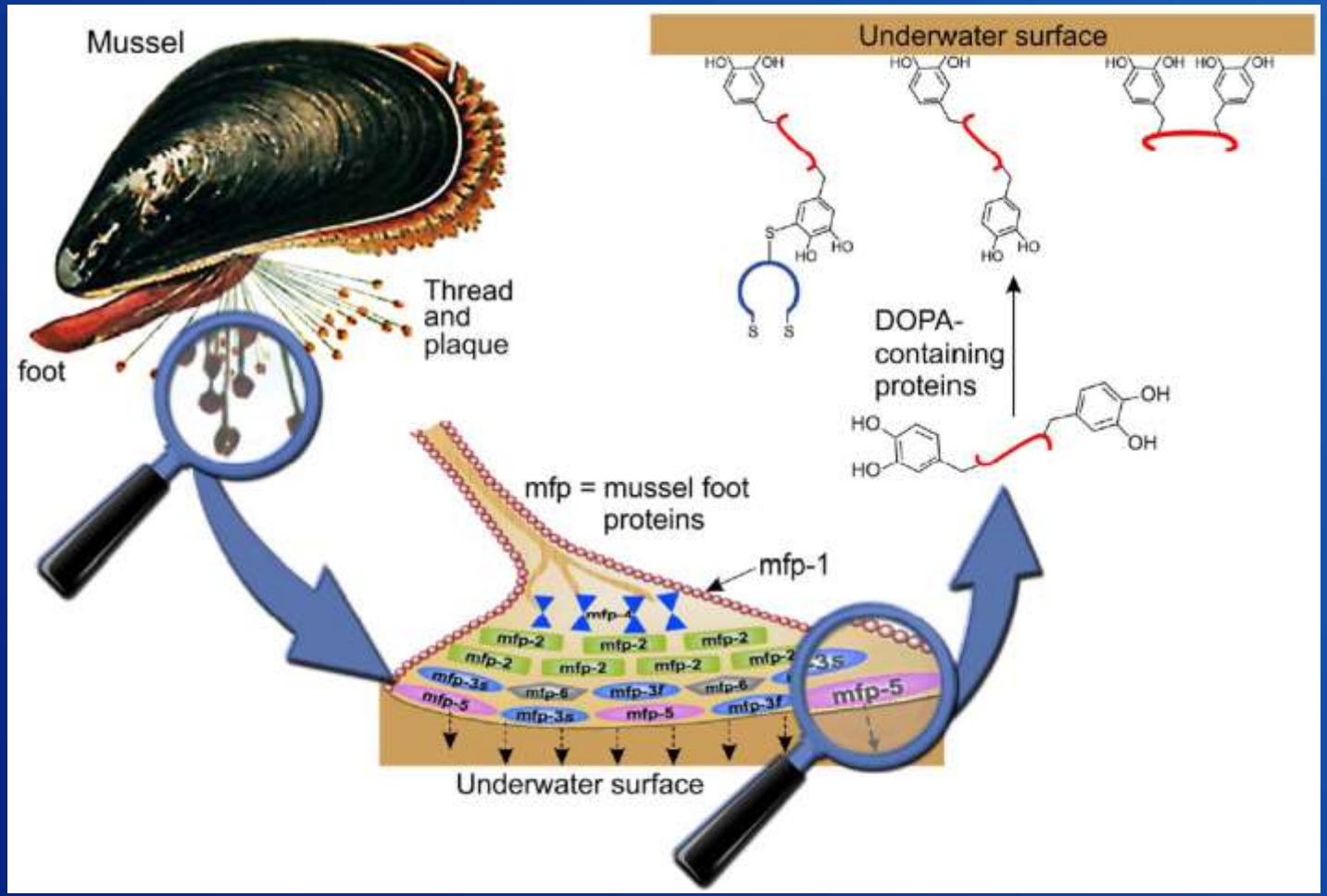
Mussel Adhesion



Complex underwater cure

Bidentate hydrogen bonding

Merten et al.

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Prior Results

- Silicone foul-release (FR) coatings prevent mussel attachment for many years

Commercial Systems

2 years

5 years

7 years

Control

2 years

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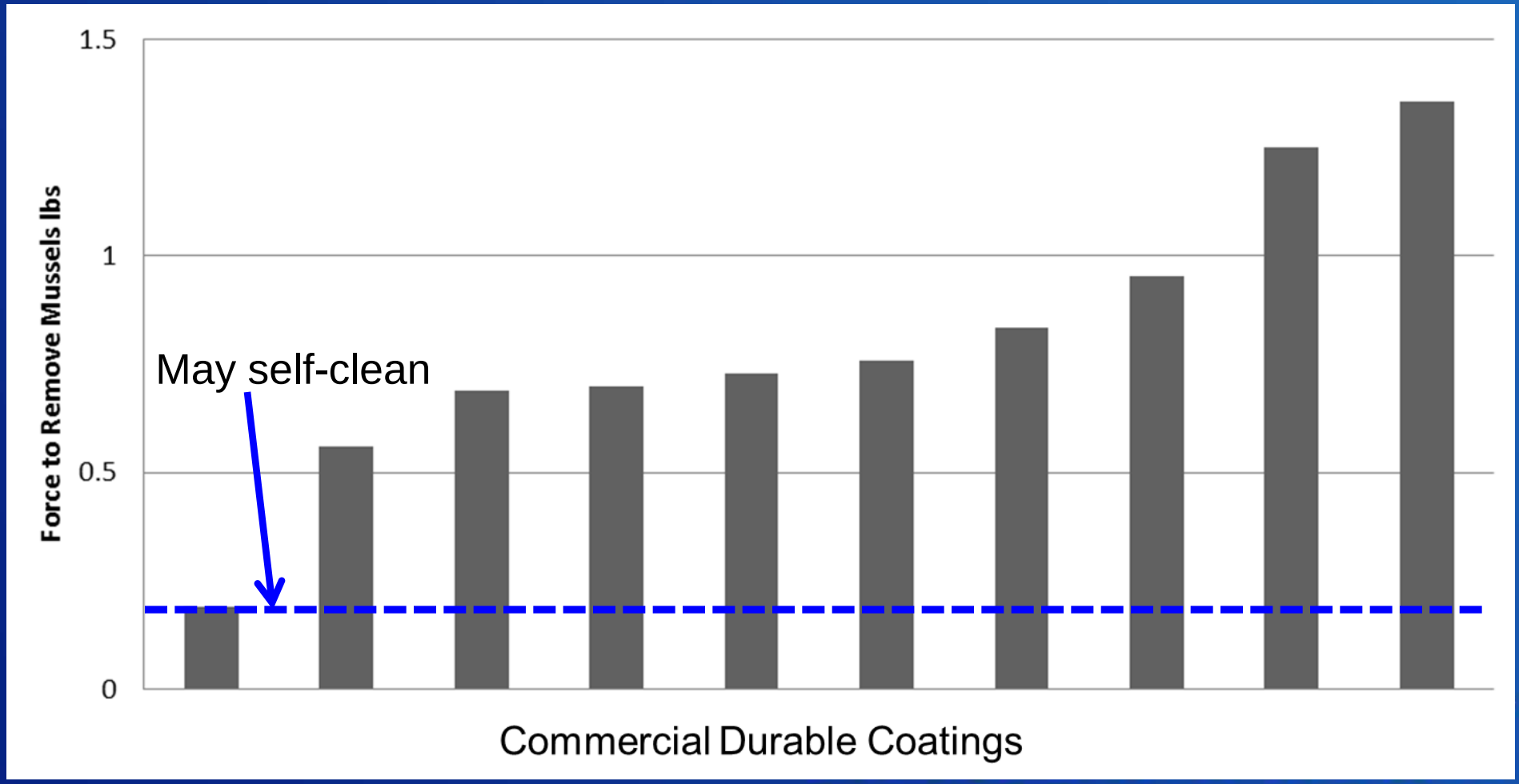
Evaluating Durable Materials

- Silicone materials with higher tear strength
  - Anti-icing coatings
  - Room temperature vulcanization gaskets
- Hybrid coatings, including silicone epoxy, fluorinated polyurethane, silicone polyurea

- Field Measurements
  - Shimpo model FGV-5XY force gauge
  - Modified ASTM D 5618-94 – barnacle strength

Durable Materials Results

- Some success for coatings



Durable Materials Results

- Anti-ice coatings as low as 0.0-0.4 lbs and easily cleaned
- Two of six gaskets prevent attachment

Before

After (cleaned)

Silicone gaskets (2)

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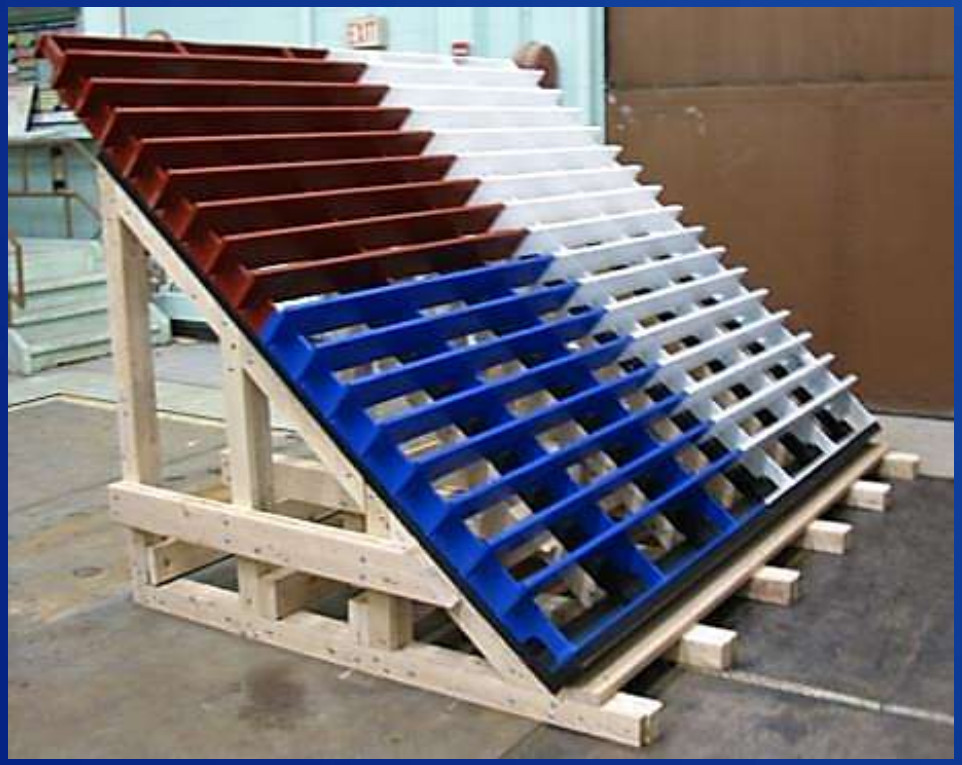
Demonstration Scale-ups

- Fish screens (brush cleaner)
- Trashrack (trash rake cleaning system)



Generic Coating Type	Location
Silicone FR	Top left
Fluorinated silicone FR	Top right
Silicone FR	Bottom right
Epoxy silicone hybrid	Bottom left

Fish Screen Results

Abrasion from the nylon brushes

Soft FR coatings damaged easily

Hard FR coating undamaged

Foul release (left) and durable (right)

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Trashrack Installation

- Trash rake cleaning system
- Out with the old…

Rake Head

Existing trashrack (left), new (right)

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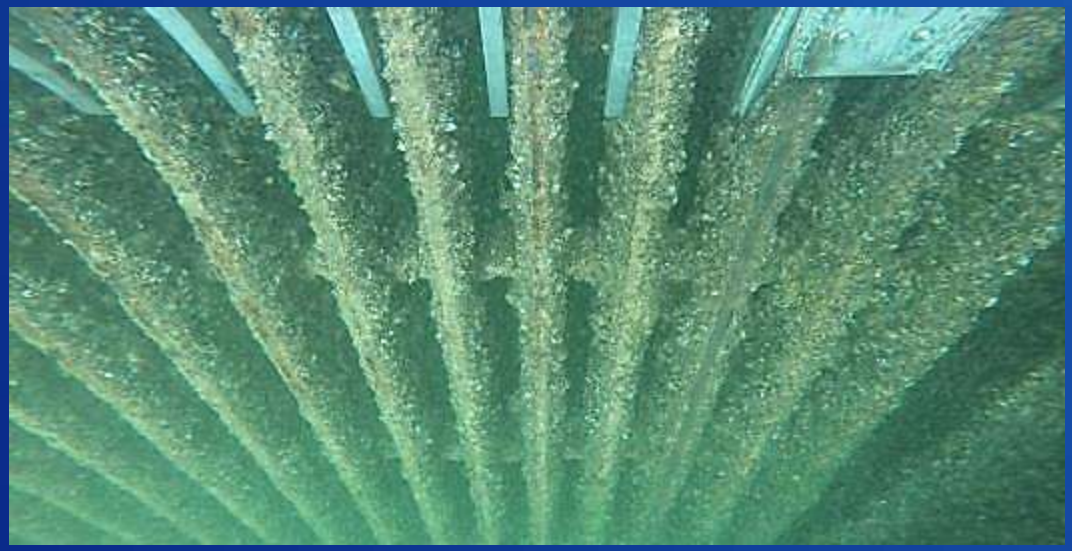
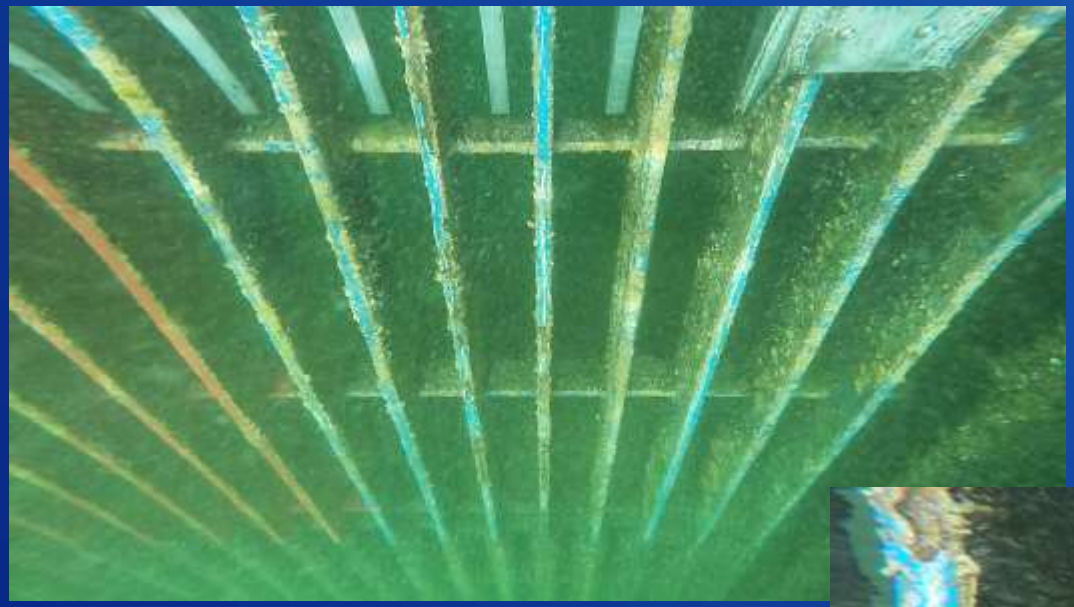
Trashrack Results



Silicone FR coatings had minimal damage

Trashrack Results



Hard FR coating most damaged

Future Work

- Continue to evaluate commercial products

- Working with partners to evaluate experimental systems – *result varied*
  - Allows for quicker screening
  - May help to expedite commercialization

Conclusions

- Scale-up studies showed that material success is dependent on service events
  - Nylon brush damaged soft foul release coatings
  - Galvanized trash rake damaged hard foul release coating
- Continued testing of durable materials
  - Good mechanical abrasion resistance
  - High tensile and tear strength
  - Low mussel attachment forces

Contact Information

Bobbi Jo Merten, Ph.D. Coatings Specialist
bmerten@usbr.gov
303-445-2380

David Tordonato, Ph.D. Coatings Specialist
dtordonato@usbr.gov
303-445-2394

Allen Skaja, Ph.D. Coatings Specialist
askaja@usbr.gov
303-445-2396

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References

B.E. Merten, A. Skaja, D. Tordonato, Chapter 28—Mussel Byssus and Adhesion Mechanism: Exploring Methods for Preventing Attachment, *Biology and Management of Invasive Quagga and Zebra Mussels in the Western United States*, CRC Press, Boca Raton, FL, 2015.